Chapter 5

The Economic and Social Benefits of GED Certification

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Contents

5.1 Introduction

This chapter evaluates the benefits of GED certification in the labor market and in postsecondary education. On the surface, GED recipients appear to perform better in the labor market than other high school dropouts. Figure 5.1 presents data for males and females from the 2009 American Community Survey, a large national sample.[1] The bars show mean annual earnings (including nonworkers), employment, and hours worked (excluding nonworkers) for high school dropouts, GED recipients, and high school graduates. The sample excludes people who attend college.

[Figure 5.1 here.]

The data show a clear pattern. GED recipients perform better than other dropouts but substantially worse than high school graduates who do not enroll in postsecondary education. Compared to male GED recipients, female recipients supply more labor than other dropouts. This chapter examines whether GED certification causes the relatively successful performance of GED recipients apparent in Figure 5.1, or whether it simply signals the greater cognitive ability of GED recipients present before they take the GED exam and if the signal is known by the market before certification.

Figure 5.1 may be very misleading because it does not account for differences in background, ability, and character skills present in early adolescence before dropping out is possible. As documented in Chapter 4, GED recipients are smarter, complete more grades of school, and come from better backgrounds than other dropouts but have the same or higher rates of adolescent criminal and risky behavior before they drop out. Although GED recipients are as smart as high school graduates who do not enroll in postsecondary education, they have much higher rates of adolescent criminal and risky behavior and come from more disadvantaged family backgrounds.

A substantial body of research establishes that the labor market values the skills that

[1] See Section W5.1.1 of the Web Appendix for more detail on the data sets used in this analysis. The Web Appendix mentioned in this note and subsequent notes is found at `http://jenni.uchicago.edu/Studies_of_GED`.

differ among GED recipients, other dropouts, and high school graduates.[2] Differences in skills that exist before GED certification might explain the evidence in Figure 5.1.

To address this issue, we analyze six data sets that span different time periods and have different measures of background and skills. Analyzing multiple data sets minimizes the danger of generalizing from quirks of any particular data set. Table 5.1 summarizes important features of each survey we use.[3]

[Table 5.1 here.]

The data sets differ in their information about GED certification, and measures of background, ability, and personality.[4] Three of the data sets that we use—American Community Survey (ACS), National Adult Literacy Survey (NALS), and National Assessment of Adult Literacy (NAAL)—report only the final education attained, and in these surveys we can only identify GED recipients who do not attend college. We cannot identify whether a college attendee had previously earned a GED. The ACS, NALS, and NAAL data contain few measures of background or ability.[5] The National Educational Longitudinal Survey (NELS), National Longitudinal Survey of Youth 1997 (NLSY97), and National Longitudinal Survey of Youth 1979 (NLSY79) contain information about the complete educational histories, backgrounds, and abilities of respondents. Of the three longitudinal sets, only the NLSY79 follows individuals through age 40.[6]

Using the NELS, NLSY97, and NLSY79 data, we can determine whether differences in background and ability account for the apparent benefits of GED certification visible in Figure 5.1. Figure 5.2 shows annual earnings by reported level of final education for people who do not attend college. The top panels show unadjusted income from all six data sources. The bottom panels show adjusted income for the data sets with measures of pre-GED ability

[2]See Borghans, Duckworth, Heckman, and ter Weel (2008) and Almlund, Duckworth, Heckman, and Kautz (2011).

[3]For a complete description of each data set, see Section W5.1.1 in the Web Appendix.

[4]Some major data sources like the U.S. Census do not report GED status.

[5]The NALS and NAAL contain measures of ability but do not release them for public use. The ACS contains only rudimentary measures of background.

[6]NLSY79 data past age 40 are subject to severe attrition problems. See Table W5.1.7 in Web Appendix W5.1.3.

and background (NLSY79, NLSY97, and NELS). We restrict the age range to be comparable across data sets.

[Figure 5.2 here.]

The top panels of Figure 5.2 show that for all six data sets, GED recipients have annual earnings that are intermediate between those of other dropouts and high school graduates, consistent with the pattern shown in Figure 5.1. The data sets that contain measures of background and ability show patterns that are qualitatively similar to the patterns found in the other data sets. The bottom panels show that differences in ability and background account for the differences in income between male GED recipients and other dropouts for all three data sets. Even after adjustment, female GED recipients perform slightly better than other dropouts, but the difference is no longer statistically significant. Even after adjusting for background and ability, both male and female high school graduates still have statistically significantly higher earnings than dropouts and GED recipients.

For several reasons, Figures 5.2 and 5.2 might be misleading. First, Figures 5.1 and 5.2 show outcomes for people who do not attend college. Using only these samples biases downward the estimated economic benefits of the GED because, as we show below, about 40% of the GED recipients—and among them relatively more women than men—enroll in some form of postsecondary education.

Three of the data sets displayed in Table 5.1 have information on educational histories. Using these data, we evaluate the benefits of GED certification for samples that include those who attend college. GED recipients who complete degrees benefit substantially. We find that at the same level of ability, GED recipients who complete college appear to have the same earnings as high school graduates who complete college. However, a body of literature starting with Cameron and Heckman (1993, 1994) and Cameron (1996) shows that very few GED recipients (3%–4%) complete bachelor's degrees. The analysis of this chapter confirms and extends these early findings.

The same traits that cause GED recipients to drop out of high school cause them to drop

out of college as well as the military, marriage, and jobs.[7] After accounting for preexisting traits, *on average*, GED recipients do no better than other dropouts. This finding holds even when GED recipients who complete degrees are included, because so few do.

The few GED recipients who earn degrees have lower discounted lifetime earnings than high school graduates who earn degrees because GED recipients earn their degrees later. On average, among those who earn degrees, male GED recipients earn associate's degrees three years later and bachelor's degrees seven years later than high school graduates. Female GED recipients earn associate's and bachelor's degrees six years later. This delay results in a roughly 30% reduction in the present value of lifetime earnings when compared to high school graduates who earn the same degrees in a more timely fashion.

Figures 5.1 and 5.2 combine all racial and ethnic groups. We find that when we disaggregate our analyses by race and ethnicity and condition on pre-GED traits for males and females, the GED provides few benefits for most demographic groups. A few groups benefit moderately. The primary beneficiaries are female GED recipients, who are more likely to participate in the labor force than other female dropouts. However, as we note below, female GED recipients do not earn higher hourly wages.

One potential criticism of the analysis summarized in Figure 5.2 is that it only captures early segments of the life cycle. The GED certificate might open doors to new opportunities that pay off later. To study this possibility, we follow recipients through age 40.

The literature summarized in the next section shows that the GED offers few benefits over the life cycle.[8] However, this conclusion is not universally accepted. Richard Murnane and a group of scholars affiliated with him claim that low-ability GED recipients benefit from exam certification and that the benefits increase with age.[9]

The evidence reported in this chapter shows few life-cycle benefits, if any, after adjusting for traits present before receipt of the GED. A few groups of GED recipients exhibit life-cycle

[7] Chapter 6 discusses the performance of the GED recipients in the military.

[8] See Web Appendix Section W5.2.

[9] See Murnane, Willett, and Boudett (1999), Murnane, Willett, and Tyler (2000), and Tyler, Murnane, and Willett (2003).

growth in earnings; most do not. Any evidence for life-cycle earnings growth is found for women, and even for them the evidence is quite weak.

Benefits are confined to increased labor supply. The GED does not impact their hourly wage rates.[10] The rate of increase of the earnings of GED recipients with age is well below that of high school graduates. For persons who do not attend college, GED recipients and dropouts have similar wage profiles. Even these apparent benefits for women might not be a direct causal effect of the GED. Any estimated labor supply benefits come primarily through increased labor force participation. The evidence is consistent with the hypothesis that women who choose to take the GED do so in anticipation of entering the workforce. The measured benefit might be a result of greater taste for work that was present before the GED was attempted.[11]

For those who benefit, what produces the benefits? Is it through the acquisition of skills in preparing for the GED? As discussed in Chapter 1, few GED recipients study more than 20 or 30 hours—far less than the thousand or so hours of time spent in school (never mind homework).[12] For most GED recipients, it is unlikely that they acquire much knowledge by studying for the exam.

Another mechanism of benefits, featured in a widely cited paper by Tyler, Murnane, and Willett (2000), is *signalling*.[13] As first noted by Heckman and Rubinstein (2001) and as supported by the analysis of Chapter 4, GED certification sends a mixed signal. GED recipients are smarter than other dropouts, but their character skills are as bad or worse than those of other dropouts. Both cognitive and character skills are valued in the market and in schools. Hence, the net signal sent by a GED certificate is inherently ambiguous.

We identify various groups that benefit from GED certification. The GED may also signal *changes* in skills, goals, and motivation. Figures 5.1 and 5.2 present average outcomes. We show that the primary beneficiaries are a group of women. They include high-ability women

[10]This finding accords with the analysis of Boudett, Murnane, and Willett (2000).
[11]Under this interpretation, such women would work whether or not the GED had a true causal effect.
[12]See Carroll (1990).
[13]See Spence (1974).

who become pregnant, drop out of high school, and later GED certify. They also include bright young girls who do not become pregnant and have low levels of character skills but appear to mature after they drop out of high school. As noted in Chapter 4, female GED recipients who drop out due to pregnancy have higher levels of pre-dropout character skills than other female GED recipients. For these groups, the GED may be a lifeline. Attaining a GED may also signal changes in their attitudes and traits. The birth of a child may change the motivations of a young woman, and the constraints she faces.

Even if traits do not change, exam certification might signal abilities that are not otherwise revealed in the labor market. We address this issue by using panel data to compare the wages of GED recipients before and after certification. On average, accounting for life-cycle wage growth that would occur in the absence of exam certification, we find little evidence of a signalling effect of GED certification. For most groups, what is signalled after certification is signalled before. The finding of no signalling effect is confirmed in a recent study by Jepsen, Mueser, and Troske (2011).

The rest of this chapter proceeds as follows. Section 5.2 reviews the previous literature on the GED. Section 5.3 presents cross-sectional comparisons by age for a variety of labor market and educational comparisons for dropouts, GED recipients, and high school graduates. We present results for all groups, including those who go on to achieve further levels of education, as well as for those who terminate their education with GED certification. On average, those who pursue higher education do better than those who do not, but there are few who attain postsecondary degrees. Section 5.4 presents a longitudinal analysis. Section 5.5 shows how the differences in skills between male and female GEDs explain the relatively superior performance of female GEDs over male GEDs in comparison with uncertified dropouts of the same gender. Section 5.6 summarizes our results. Finally, Appendix Section 5.7 presents a brief sketch of our methodology.

5.2 The Previous Literature

In order to place the analysis of this chapter in context, we briefly review the previous literature.[14] The Web Appendix presents a more extensive literature review.[15]

5.2.1 Overview

The literature is unanimous in establishing that GED recipients perform substantially below the level of high school graduates in the labor market, in higher education, and in the military. This conclusion survives a variety of adjustments for personal and family background characteristics that are present before the GED certificate is acquired. We affirm this finding in multiple data sets.

Adjusting for their pre-GED traits, we find that male GED recipients perform no better in the labor market than other dropouts. In this chapter, we present new evidence for women. We discover that the labor supply of female GED recipients is an apparent exception to the general rule that the GED has no benefits. Female GED recipients are more likely to be employed and work more hours than female dropouts who do not certify. They are more likely to participate in the labor force and actively seek work when they are not employed. However, their hourly wages are no higher than those of other female dropouts. They earn more than uncertified dropouts because they work more. Despite their greater work experience, female GED recipients do not have higher hourly wage rates than dropouts, suggesting that female GED recipients take dead-end jobs, possibly in response to the exigencies of supporting their families. Consistent with the previous literature, even under the most favorable interpretation of the benefits of GED certification, few female GED recipients escape the poverty associated with being a high school dropout.[16]

The first analytical papers on the effectiveness of GED certification are those of Cameron and Heckman (1993, 1994) and Cameron (1996). These papers frame much of the discussion

[14] See Boesel, Alsalam, and Smith (1998) for a survey of the evidence through 1998.
[15] See Web Appendix Table W5.2.1.
[16] See Boudett, Murnane, and Willett (2000).

in the academic and policy literatures. The subsequent literature builds on and sometimes contests the major conclusions of these authors.

For a sample of young males from the NLSY79 (age 25–28 in the late 1980s), Cameron and Heckman (CH) study the determinants of GED certification, as well as the post-GED training and educational choices of GED recipients. They examine the political economy behind the growth of GED certification over the post–World War II period.

Consistent with the analysis reported in Chapter 4, Cameron and Heckman show that male GED recipients are smarter (as measured by an achievement test) than other dropouts but are not as smart as the average high school graduate. They are, however, as smart as the average high school graduate who does not attempt any postsecondary schooling. GED recipients come from more advantaged backgrounds than other dropouts but have less advantaged backgrounds than high school graduates — even graduates who do not attend college. CH show that the mean preparation time is low for GED recipients. GED recipients drop out with more years of schooling attained than other dropouts.

Compared to dropouts, the authors show that male GED recipients are more likely to attempt further education and training, including (a) formal schooling, (b) vocational certificates, (c) company training, (d) off-the-job training (which for this group is largely government-sponsored job training), and (e) participation in the military. They are less likely to participate in all of these activities than are high school graduates except for off-the-job training programs and programs that offer vocational certificates.

Although many male recipients (around 40%) try some form of higher education, the vast majority drop out before they finish.[17] The same traits that cause GED recipients to drop out of high school explain their performance in further levels of education. Cameron and Heckman show that very few (2%) GED recipients get bachelor's degrees, compared to 35% of high school graduates. However, they show that the few GED recipients who attempt college at any level complete associate's degrees at about the same, or slightly higher, rate

[17] About 60% of high school graduates attempt college. See the discussion in Section 5.3.5.

as high school graduates. Most male GED recipients complete less than two years of college, and many do not last a semester. GED recipients who graduate from college with a bachelor's or an associate's degree have the same annual earnings and labor supply as ordinary high school graduates with the same ability. However, there are few of them. These findings are substantiated both in the subsequent literature and in this chapter. Here we show that because GED recipients earn postsecondary degrees later than high school graduates, their discounted lifetime benefits are substantially lower. The delay induced by dropping out of high school is costly.

CH show that, on average, the GED certificate offers few benefits unless recipients complete further education. Controlling for their greater ability, the authors find that GED recipients earn at the same rate as other dropouts.[18] GED recipients earn substantially less than high school graduates, even compared to those who do not attempt college. The economic benefit of an additional hour of work experience is the same for a dropout as it is for a GED recipient. It is somewhat below that of a high school graduate, but the difference is not precisely determined. The analysis in this chapter is consistent with the previous literature and finds the same rate of wage growth with work experience for GED recipients and other dropouts, but it is lower than that of high school graduates. CH state that any wage or labor supply benefits to the GED are present in the market before the GED certificate is obtained. They show that adjusting for greater work experience and job tenure closes the gap between GED recipients and high school graduates but does not eliminate the gap. Cameron and Heckman (1993) report before–after differences in GED certification and show that any traits present after certification were present before and were already signalled to the market. They find no signalling effect of GED certification.

Differences in cognitive ability and years of schooling attained explain the differences in the labor market experiences of GED recipients and other dropouts. For CH's sample of males, a substantial portion (60%–100%) of any economic return to the GED is indirect,

[18]CH report similar findings controlling for years of schooling attained at the time they drop out. We are unable to replicate this finding.

coming through the return to postsecondary schooling, training, and work experience. The estimates reported in this chapter are consistent with these findings.

In a companion paper, Cameron and Heckman (1994) study the schooling and training choices of young males, using a sequential life-cycle framework. They find substantial differences in educational attainment and training paths among racial and ethnic groups. Their evidence is in agreement with the analysis of Chapter 4 that GED recipients are more likely to come from broken homes and that labor market opportunities in unskilled labor markets encourage students to drop out and acquire GED certificates.

They also examine the determinants of postsecondary schooling and training, which are the principal contributors to any effect found for GED certification. They show that, controlling for ability, GED recipients enroll in a variety of postsecondary, nonacademic training programs at about the same rate as high school graduates.

In an unpublished Ph.D. thesis, Cameron (1996) extends Cameron and Heckman's analysis of males in the NLSY79 to study females. In addition, he analyzes (in a cursory fashion) two other longitudinal data sets on the performance of females age 34–44 in 1988 and age 52–65 in 1989. His findings for women generally support the conclusions for men presented in CH.

Cameron (1996) reports some interesting differences from CH, however, that resonate with the findings of this book. (1) Consistent with the evidence reported in Chapter 4, female GEDs, unlike male GEDs, come from better backgrounds than other dropouts. Female GEDs also perform less badly in school and drop out with more years of schooling than male GEDs. (2) Both Cameron (1996) and we find that female GED recipients are more likely to have dropped out of school due to pregnancy than other female dropouts and are more likely to have been married and divorced. (3) Both studies show that unlike male GED recipients, even after adjusting for differences in background traits, female GED recipients are more likely to be employed than other dropouts.

(4) In this chapter we show that the indirect effects of GED certification on wages and

earnings through post-GED work experience and schooling are a substantial component of any estimated GED effect. CH and Cameron use data for a limited segment of the life cycle. Their estimates for both men and women might not apply to longer segments of the life cycle. In this book, we find substantial direct and indirect effects of GED certification for women arising from (a) the greater labor supply of GED recipients (direct effect) and (b) post-GED educational attainment (indirect effect). (5) The evidence on the determinants and consequences of the GED for women age 34–44 reported by Cameron is consistent with that for younger women. Unlike the analysis for men reported in CH, for younger women, conditioning on tenure and work experience does not equate the wages of GED recipients with those of high school dropouts. (6) Cameron shows that there is some evidence that the GED has a marginally statistically significant effect on hourly wages for older women (age 52–65), but only after controlling for their greater tenure on the job and for work experience.

Open Questions from the Research of Cameron and Heckman

While the research of Cameron and Heckman (1993) and Cameron (1996) opened the door to understanding the GED, it left open many questions:

1. Cameron and Heckman (1994, 1993) and Cameron (1996) study the wages, earnings, and labor supply of young people. Do their results hold over the life cycle for certifiers who acquire work experience with the GED? The human capital investment model of Becker (1964) and Mincer (1962) suggests that initial payoffs to certification might be negative if GED recipients invest in further schooling, job training, and work experience and take lower starting wages to pay for their training. Payoffs would come later. The analysis of Cameron (1996) hints that, for older women, returns to the GED may be more substantial, and suggests that the early training of GED recipients might pay off later in life.

2. Cameron and Heckman (1993) and Cameron (1996) show that a substantial part of the return to the GED comes from investments made after GED certification. Does

this result hold up in longer run analyses?

3. Is the GED an effective signal? Even if preparing for the GED does not produce human capital, the credential may be an effective signal to the market about information that employers and academic institutions do not possess. Cameron and Heckman (1993) and Cameron (1996) show that the hourly wages earned by GED recipients before they certify are the same as their hourly wages after certification. This finding suggests that the information conveyed by the GED signal is known in the market before the signal was obtained. But their result is for young persons and for wages shortly after GED certification. The GED may have long-run signalling value that is not detected in the short stretches of the life cycle that they study.

4. Do immigrants who enter the United States having completed their education benefit from GED certification? The GED might be a more informative signal for this group, given the uncertainty surrounding the quality of schooling in many origin countries.

Many of these issues were addressed in the subsequent literature, which is reviewed in depth in the Web Appendix.[19] We summarize the major studies in the text.

5.2.2 The Analyses of the Murnane Group

Papers by Richard Murnane and various coauthors address many of the open questions surrounding the research of Cameron and Heckman, using a variety of data sources.[20] A tabular summary of this work appears in the Web Appendix.[21]

The cumulative body of work by the Murnane Group supports many of the conclusions of Cameron and Heckman (1993, 1994) and Cameron (1996) but contradicts or supplements others. Their main conclusions are as follows.

[19] See Web Appendix Table W5.2.1.

[20] See Murnane, Willett, and Boudett (1995, 1997, 1999), Murnane, Willett, and Tyler (2000), Boudett, Murnane, and Willett (2000), and Tyler, Murnane, and Willett (2000, 2003).

[21] See Web Appendix Table W5.2.1, which provides a comprehensive summary of the literature and has a separate block on their work (see "Murnane et al. Studies").

1. GED recipients are intermediate between dropouts and high school graduates in terms of ability, years of secondary schooling attained, and family background.

2. For both men and women, GED recipients perform below the level of high school graduates in the labor market. *On average*, adjusting for differences in pre-GED traits, GED recipients earn the same wages as dropouts.

3. GED recipients do not attain postsecondary educational credentials at the same rate as high school graduates. At the same level of educational attainment and ability, GED recipients earn at the same level of annual earnings as ordinary high school graduates.

4. Building on the work of Cameron and Heckman, but substantially extending it by using longer panels that sample later ages, Murnane, Willett, and Boudett (1995, 1997, 1999), Murnane, Willett, and Tyler (2000), and Tyler, Murnane, and Willett (2000, 2003) present evidence that shows wage and earnings growth due to GED certification that appears three to five years after receipt of the certificate. This evidence is consistent with an investment interpretation of the benefits of the GED. This effect was not found by CH, who studied shorter stretches of the life cycle. Growth effects appear to be stronger for women than for men but are present for both. Consistent with an investment story, one of their papers finds depressed earnings in the early periods following receipt of the GED with enhanced earnings at later ages as investments pay off (see Boudett, Murnane, and Willett, 2000).

5. In a series of papers beginning in 1999, the Murnane group reported that the benefits of the GED for both men and women are localized to *low-ability* recipients, although the definition of what constitutes low ability varies across studies. Different papers use different tests, and test scores are not equated across studies. In Murnane, Willett, and Boudett (1999), low ability is defined as being in the bottom quartile of the distribution of scores on an achievement test (the AFQT) for males. In Tyler, Murnane, and Willett

(2000), it is those at the margin of passing the GED.[22] In Tyler, Murnane, and Willett (2003), lower ability is the bottom half of a distribution of AFQT test scores for males. Estimated GED effects for low-ability groups range from 19% to 36%.[23] The authors interpret this finding as arising from the greater noncognitive skills of the low-ability GED certifiers who persist and pass the GED exam. This claim is contradicted by the analysis of Heckman, Humphries, Urzúa, and Veramendi (2011), which shows that the benefits of the GED are greatest for those with the greatest cognitive and noncognitive endowments.

6. A widely cited paper by Tyler, Murnane, and Willett (2000) claims that the GED is a successful signal of traits that were unknown to the market before receipt of the credential.

7. Many GEDs are obtained in prison. There is no payoff to prison-issued GEDs in terms of either wages or recidivism (Tyler and Kling, 2006).

8. The benefits of the GED are quite modest, and few recipients escape poverty. The exception occurs when GED recipients attain postsecondary credentials (Boudett, Murnane, and Willett, 2000).

9. Cameron and Heckman report that the wage and earnings returns to post-GED work experience for males are the same as the returns to the work experience of dropouts. Using a different measure of experience, Murnane, Willett, and Boudett (1999) and Tyler, Murnane, and Willett (2003) contest this conclusion. In Section 5.4, we confirm the analysis of Cameron and Heckman.

The models estimated, the variables used, and the samples analyzed differ greatly across papers from the Murnane group and those used by Cameron and Heckman and Cameron.

[22]Scores on GED tests are highly correlated with scores on AFQT tests (see Boesel, Alsalam, and Smith, 1998; Heckman and Kautz, 2012; Means and Laurence, 1984).

[23]See Table W5.2.1.

For example, in studies based on the NLSY, the Murnane group uses an oversample of poor families instead of the random sample. This practice runs the danger of making inferences from censored samples, and they do not correct for the biasing effects of censoring.[24] Measures of work experience vary across and within their studies. The Web Appendix highlights the variety of different assumptions made in their work.[25] This variety makes it difficult to summarize their research succinctly.

The most influential paper of the Murnane group is Tyler, Murnane, and Willett (2000), who use a modified version of a regression discontinuity estimator to identify the benefit of GED certification. Passing standards vary across states. Comparing the outcomes of GED recipients in low-standard states with the outcomes of GED exam failures in high-standard states, and adjusting for differences in labor market conditions across states, they report a 10%–19% earnings benefit *for whites only* to GED certification at the margin of passing.[26] They argue that these estimates are consistent with earlier studies by Cameron and Heckman (1993) and Cao, Stromsdorfer, and Weeks (1996), who find no effect of certification for the average test taker. They claim that for the margin they investigate—that of low-skilled exam takers—there are substantial "signalling" benefits to certification that are absent for the general population of test takers (i.e., the causal effect is positive for low-ability test takers). Averaging over all quartiles of ability, the white GED certifiers earn a 4% greater return.[27]

Jepsen, Mueser, and Troske (2011) explicitly address the issue of whether low-ability (marginal) GED test takers benefit from exam certification. They use a large sample of

[24]See, for example, the analysis of Heckman (1987) for the danger of using censored samples without correcting for censoring.

[25]See Web Appendix Table W5.2.1.

[26]They suggest that their lack of a significant GED effect for nonwhites 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 signalling value. See Chapter 3 for evidence of 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 W5.2.1 of the Web Appendix for a full account of study samples, treatment of race, and separate estimates by race. Other papers by this group report effects for blacks, and they do not discuss the discrepancy among the studies.

[27]For a more extensive discussion of their paper, see Web Appendix Section W5.2.

86,345 persons who first attempted the GED in Missouri in the period 1995–2005. Their sample also contains GED test scores for all attempts to pass the test. These scores are matched to unemployment insurance earnings data. They analyze earnings and employment outcomes for males and females of all demographic groups over the time period 1995–2005, using individual data on quarterly earnings up to 7.5 years after receipt of the GED and four quarters before the first attempt. For samples with long earnings histories pre- and postcertification, they compare GED passers with GED failers at the margin of passing on their first attempt of the GED exam.[28]

In contrast to the claims of Tyler, Murnane, and Willett (2000), Jepsen, Mueser, and Troske find that GED certification has *no* causal effect on the earnings of any demographic group, even 7.5 years after a person's first attempt. Certification increases the probability of *attempting* further education by 4 percentage points for males and by 8 percentage points for females. Earnings gaps between GED recipients and dropouts are the same before and after certification. Their analysis shows no evidence that GED recipients at the margin of passing (i.e., the "low-ability" GED recipients) receive any benefit from certification.

Jepsen, Mueser, and Troske (2011) note a fundamental flaw in the identification strategy of Murnane, Willett, and Tyler (2000). The GED exam has multiple component tests. Persons may attempt the GED on repeated occasions, and scores cumulate across the components that have been passed. Murnane, Willett, and Tyler (2000) do not account for this feature of GED certification, which Jepsen, Mueser, and Troske (2011) show produces violations of the identifying assumptions of their version of a regression discontinuity estimator. The research by Jepsen, Mueser, and Troske (2011) shows careful treatment of this issue critically affects the estimated effects of the GED.

The simplicity of their procedures, the cleanliness of their data, and the large sample sizes (which make it more likely to find GED effects using conventional significance levels)

[28]They develop and apply an innovative econometric extension of the regression discontinuity design estimator that accounts for the multiple thresholds and requirements that constitute the core standards for the GED.

speak powerfully against claims that low-ability GED recipients experience substantial wage growth as a consequence of GED certification.

Both the Tyler, Murnane, and Willett (2000) and Jepsen, Mueser, and Troske (2011) studies are for persons who *attempt* the GED. Arguably, those who attempt the test are more motivated individuals.[29] Before–after comparisons might eliminate this effect but only under strong assumptions.[30]

5.2.3 Studies of the Effect of the GED on Immigrant Assimilation and on the Effects of the Prison-Issued GED

Clark and Jaeger (2006) use Current Population Survey (CPS) data to examine the life-cycle consequences of GED certification and to investigate whether GED certification promotes immigrant assimilation by establishing that GED recipients have skills required to pass the GED test. The advantage of the CPS is that it provides large samples—typically, an order of magnitude larger than the samples used in much of the literature. They estimate GED effects across a wide array of age groups. They also provide information on the earnings of foreign-schooled immigrants who GED certify. The Web Appendix reviews their study and its central claims.[31]

One disadvantage of the CPS is that it only records terminal degrees. It is not possible to use CPS data to investigate the benefits of the GED for those who complete additional postsecondary schooling. Another disadvantage is that the CPS has no measures of ability or family background, which the previous literature shows to be important in explaining the performance of GED recipients compared to that of dropouts.

Clark and Jaeger (2006) report substantial effects on wages and earnings from receiving a

[29]Thus, taking the GED exam may distinguish GED test takers from those who do not try. Passing or failing may be irrelevant to any estimated effect of the GED. With their data, they cannot directly test this hypothesis.

[30]Sufficient assumptions are that skills are stable over time and age and, in particular, before and after GED certification, and that they enter outcome models in an additively separable fashion. Any combination of these assumptions that produces a fixed effect will also reduce bias.

[31]See Web Appendix Table W5.2.1.

terminal GED compared to not having the GED credential. They have data on outcomes at much later ages than are examined in most of the literature.[32] They report substantial growth in the returns to the GED credential with age, evidence that is in apparent agreement with the claims of the Murnane group. Like previous studies, they find little evidence that GED recipients are the equivalents of high school graduates who do not attain further education.

Heckman and LaFontaine (2006) use the CPS data to check the claims of Clark and Jaeger. They also study a sample of immigrants and natives using the National Adult Literacy Survey (NALS) data. They find that CPS imputation procedures produce an upward biased estimate of the GED effect.[33] When the bias is properly accounted for, estimated GED effects substantially weaken.

Heckman and LaFontaine (2006) also show that the life-cycle wage growth of GED recipients compared to dropouts that is reported by Clark and Jaeger is due to a cohort effect. The average years of schooling of high school dropouts has increased over time, while that of GED recipients has not.[34] This trend produces the statistical illusion of GED life-cycle wage growth in any cross section. Older cohorts of GED recipients are relatively better educated—and hence have higher earnings—than younger cohorts. Due to this cohort effect, older GED recipients (compared to dropouts) are more able and learn more than younger GED recipients, producing the appearance of life-cycle growth in cross-sectional analyses when none is present.

Heckman and LaFontaine (2006) also challenge the claim that the GED benefits immigrants. Using NALS data, Heckman and LaFontaine show that foreign-born dropouts have substantially lower ability than foreign-born GED recipients. After adjusting for these differences, immigrant GED recipients have the same earnings as immigrant dropouts.[35]

As noted in Chapter 1 and discussed further in Chapter 3, the GED testing program has

[32] An exception is Cameron (1996).

[33] Many GED recipients have missing data and are imputed to have the wages of high school graduates. See the discussion in Appendix Section W5.2.

[34] See Web Appendix Figure W5.2.2.

[35] For further discussion, see Appendix W5.2.

been introduced into prisons. Prison-issued GEDs account for a substantial portion of the growth of GED receipt among black males. Recent studies by Tyler and Kling (2006) and Zgoba, Haugebrook, and Jenkins (2008), reviewed in the Web Appendix, show no effect of prison-issued GEDs on either post-incarceration wages or recidivism.[36]

5.2.4 Summary of Previous Research and a Preview of the Analysis of This Chapter

While all studies agree that GED certification is not the same as high school graduation, they disagree as to whether dropouts benefit from earning a GED certificate. After accounting for preexisting ability and background, some studies find that GED recipients earn no more than other dropouts. Other studies find that the average GED recipient earns slightly more than the average dropout, while others claim that GED recipients in some groups earn much more.

This chapter reconciles the differences in the findings by providing comprehensive cross-sectional and panel analyses of the benefits to GED certification. We test a wide range of models across a variety of data sets for many subpopulations. In general, differences in ability and background account for many of the cross-sectional differences in labor market outcomes between GED recipients and other dropouts. For some groups, GED recipients are more likely to work and to work longer hours than other dropouts.

Differences in the estimated returns to the GED across studies stem from four primary methodological sources. First, studies account for preexisting ability in very different ways. The evidence in Chapter 4 shows that GED recipients are more able than other high school dropouts before they receive the GED. This finding suggests that it is important to account for differences in preexisting ability. Not all studies that use the NLSY79 treat or control for cognitive ability in the same way. Some control for cognitive ability and find that after doing so the GED has little benefit for dropouts (Heckman and LaFontaine, 2006). Some argue

[36] See Table W5.2.1.

that it is inappropriate to control for cognitive ability in the NLSY79 (Murnane, Willett, and Boudett, 1995; Murnane, Willett, and Tyler, 2000). Others allow for statistical interactions between the returns to the GED and cognitive ability in the NSLY79, and find that the GED benefits low-skilled recipients (Murnane, Willett, and Boudett, 1999).

This chapter considers a wide range of specifications. We report robust patterns and interpret the differences across specifications. We conduct statistical tests using over 100,000 different empirical models to avoid the arbitrariness of relying on one model — especially one arrived at through a battery of "specification tests." Our approach avoids the problem of "pretesting"—that the standard errors reported in the literature do not account for sifting and sorting across alternative models that is part of the standard practice of selecting a "final" empirical model.

A second source of differences across studies in estimated returns to the GED lies in the different measures of reported labor market outcomes used. For example, Murnane, Willett, and Boudett (1995) only study log wages, log earnings, or log hours worked, implicitly conditioning on employment. They compare the outcomes of *working* GED recipients with the outcomes of *working* dropouts. Since the GED might increase the probability of obtaining a job, this research does not address a potential source of selection bias.

Different labor market outcomes reflect conceptually different types of returns. Some studies only examine broad measures such as annual earnings. In this chapter, we consider six important economic outcomes: annual income, hourly wages conditional on employment, hours worked conditional on employment, the probability of employment, labor force participation, and unemployment conditional on labor force participation.

Annual income is an overall measure of economic success but obscures the source of any estimated success story. People could earn more because they have higher wages, because they work more hours when they are employed, or because they are more likely to be employed. We show that accounting for labor supply makes a difference in interpreting estimated GED effects.

Third, much of the literature focuses on male GED recipients or combines males and females in the same analysis. A large body of research in labor economics shows that female labor supply behavior is fundamentally different from male behavior.[37] We separate males and females for all analyses and show that estimated GED effects differ across genders. Some studies only analyze particular ethnic groups or control for ethnicity by including a dummy variable in regression analyses. We report pooled and separate analyses for each ethnic group and discuss differences across groups when they are found.

Fourth, different studies measure work experience in different ways. We systematically investigate a variety of measures of work experience. We study life-cycle wage growth attributable to GED certification. There is no evidence that the life-cycle wage growth of GEDs with work experience is greater than that of other dropouts. We now turn to our primary data analysis.

5.3 Cross-Sectional Analyses

In this section of the chapter, we present cross-sectional analyses. In Section 5.4 we exploit the panel features of our data.

5.3.1 Benefits Across Data Sets

In an appendix to this chapter (Section 5.7), we discuss the methodology used to control for unobserved differences in precertification characteristics between GED recipients and others. We control for unobservables using the rich set of measured variables at our disposal.

Figures 5.3 and 5.4 present the average benefits of GED certification between ages 23 and 27 compared to those of other dropouts. We remove observations on people currently

[37] See, for example, the essays in Smith and Cogan (1980) and Killingsworth (1983).

enrolled in school.[38] At each age, the raw estimates adjust only for age (within the reported category) and region or state of residence (to adjust for variations in market conditions). The ability-adjusted estimates also adjust for ability as measured by an achievement test with the effect of years of schooling removed from the adjusting test score using a procedure applied in Heckman, Humphries, and Mader (2011) that is discussed in detail in the Web Appendix.[39]

The background-adjusted estimates adjust for both ability and standard measures of family background at young ages that are used in the literature.[40] We use the same format introduced in Chapter 4. The bars attached to each column represent one-standard-deviation ranges of statistical variability in the estimates. The black dots on the tops of the bars indicate whether the estimate for GED recipients is statistically different from that of other high school dropouts at the 5% level; the white dots indicate whether the estimates for GED recipients and high school graduates are statistically different from each other; and the diamonds indicate whether the estimates for high school graduates are different from those of dropouts.

Two conclusions emerge from these figures. (1) GED recipients perform much worse than high school graduates. (2) With the exception of employment and annual earnings for females in the NLSY surveys, on average, GED recipients perform at the level of dropouts. This pattern is found repeatedly throughout this chapter.

[Figure 5.3 here.]

[Figure 5.4 here.]

[38]When analyzing annual income, this restriction excludes 10.1% of males and 9.1% of females in the NLSY79 data, 8.5% of the male observations and 10.2% of the female observations in the NLSY97 data, and 22.5% of males and 23.0% of females in the NELS data. The figures in the NELS data are higher because the variable indicates whether the person was enrolled in postsecondary education at any point in the year, whereas the NLSY79 and NLSY97 variables are at the time of interview.

[39]See Web Appendix Sections W5.3.1 and W5.3.2. The estimates that adjust ability for schooling attained are very similar to the effects without adjusting for schooling attained.

[40]See, for example, Taubman (1977) or Cameron and Heckman (2001).

5.3.2 Benefits over the Life Cycle

The estimates just presented are for young people. How do these conclusions change if we follow GED recipients to later ages? It is possible that GED certification pays off with age, as some papers claim. The NLSY79 data is the only data set with information past age 27 contains rich detail on ability, background, and educational histories. As noted in our review of the literature, the NLSY79 has been the principal data set for examining the effects of GED certification. Relying solely on the NLSY79 for our life-cycle analysis could be problematic if the GED recipients in the NLSY are atypical. We now establish that they are not.

As noted in Table 5.1, other data besides the NLSY79 have information by age on the earnings of GED recipients who attain no postsecondary education. Figure 5.5 shows the annual income for GED recipients and high school graduates who do not attain any postsecondary education relative to dropouts for the NLSY79, ACS, and NALS. The estimates are comparable across data sets for each age, suggesting that the NLSY79 is not an anomalous sample of GED recipients. Heckman and LaFontaine (2006) establish the comparability of NLSY79 estimates of GED effects with CPS-based estimates after adjusting for imputation bias in the CPS. These comparisons give greater confidence in using the NLSY79 to study the effects of the GED over the life cycle.

[Figure 5.5 here.]

Figures 5.6 and 5.7 report the average estimated effects of GED certification and high school graduation across four age groups from the NLSY79 data.[41] Persons enrolled in school or in formal job training programs are not included because they are likely to work less and have lower wages when they work owing to competing demands on their time.

[Figure 5.6 here.]

[Figure 5.7 here.]

[41] See Web Appendix Section W5.3.5 for similar figures for race and postsecondary educational attainment groups.

Across all age groups, the pattern for labor market outcomes present in Figures 5.3–5.4 generally continues to hold. On average, GED recipients perform worse than high school graduates, usually statistically significantly so. Female GED recipients are more likely to be employed than other dropouts (see Figure 5.8). At some ages, the estimated effect is statistically significant. Their greater employment is not associated with greater hourly wages or hours worked even at later ages when their work experience cumulates and might be thought to produce higher hourly wages. Female GED recipients earn more than other dropouts, but the effect arises in large part from their greater employment.

Employment of male GED certifiers increases with age. At ages 35–39, it is borderline statistically significantly greater than that of dropouts. There is no corresponding GED effect on income, wages, and hours worked. In Section 5.3.7 we show that the employment effect is partly due to a decrease in the employment rate for a group of black high school dropouts starting around age 30. It is not found for any other male demographic groups.

5.3.3 Other Dimensions of Labor Supply

Thus far we have only considered labor supply in terms of whether or not someone is working and in terms of hours worked conditional on working. We have not considered labor force participation — whether people are employed or are actively searching for a job.

Figure 5.8 decomposes employment by separating labor force participation and unemployment, given labor force participation. At each age, from left to right, the pairs of bars show ability- and background-adjusted labor force participation (LFP), employment (Empl), and unemployment (conditional on labor force participation) (Unemp) for GED recipients and high school graduates relative to dropouts. The figure shows that most of the labor supply differences between GED recipients and dropouts arise because of their greater labor force participation. Among those actively seeking jobs, GED recipients and dropouts have similar levels of unemployment.

This finding sheds light on the observed labor supply differences between GED recipients

and dropouts. As discussed in Chapter 1, the GED certificate opens doors to employment. Motivated persons may work more and enter the labor force to obtain jobs. Women who are not planning to enter the labor force may never attempt to earn a GED certificate. The evidence in Figure 5.8 is consistent with these conjectures and with the results from Jepsen, Mueser, and Troske (2011), who find no labor market differences between GED recipients and dropouts who *attempt* to earn a GED certificate. Those who attempt the GED are more motivated than those who do not, but the motivation is signalled before the exam is taken, and it is also present for the dropouts who do not pass the exam.

[Figure 5.8 here.]

5.3.4 Benefits in Terms of Post-GED Schooling and Training

One possible objection to the preceding analysis is that it is too highly aggregated. It combines the outcomes of terminal GED recipients with those of more aspiring GED recipients who attain further education and training. How many GED recipients attempt further education? How many are successful in these attempts?

The GED Testing Service provides a partial answer to this question. A recent document by Zhang, Guison-Dowdy, Patterson, and Song (2011) studies the educational attainment of a large cohort of GED recipients six years after they certify. The study does not disaggregate by age, race, or gender. Figures 5.9–5.10 present estimates from that study.

Six years after certification, the study shows that 57% of GED recipients did not participate in any form of postsecondary education. It also shows that 37% have enrolled but have dropped out or have not yet earned a credential; 1.3% receive bachelor's degrees, 2% receive associate's degrees, and 1.6% receive vocational certificates; and less than 0.1% receive a master's degree. Figure 5.10 shows that few GED recipients enroll for more than two semesters of postsecondary education.

We find comparable rates of educational attainment in the NLSY79, NLSY97, and NELS data. These data sets allow us to analyze follow-up periods longer than six years. Figures

5.11 and 5.12 show final schooling for GED recipients and high school graduates through age 27 — the last age available for the NLSY97 and NELS data for males and females. We consider five categories of postsecondary attainment: any enrollment in college ("some college"), completion of at least a year of college ("some college, more than a year"), and earning a certificate, an associate's degree, or a bachelor's degree. The three data sets differ in their information on these categories. NELS does not allow us to identify the duration of time that people spend in college. We have limited information on vocational certificate-holders in the NLSY79.

Some features are common across all three data sets. More than half of GED recipients who enroll in college complete less than one year. GED recipients obtain certificates at higher or similar rates as high school graduates. However, they earn associate's degrees and bachelor's degrees at much lower rates. Less than 3% of all GED recipients earn a bachelor's degree by age 27, compared to over 20% for high school graduates.

GED recipients might not have had a chance to return to school by age 27. The NLSY79 data allow us to study their educational attainment through age 40. Figure 5.13 shows educational attainment through age 40 in the NLSY79. Although more GED recipients earn degrees by age 40, the general patterns are very similar to those found in other data sets. In terms of educational attainment, GED recipients do not catch up with high school graduates.

[Figure 5.9 here.]

[Figure 5.10 here.]

[Figure 5.11 here.]

[Figure 5.12 here.]

[Figure 5.13 here.]

We also consider enrollment in other forms of training. Figure 5.14 shows the rates of government training, on-the-job training, and technical/vocational training for high school dropouts, GED recipients, and high school graduates in the NLSY79 data. The data on government training are only available between 1979 and 1987, so the estimates do not reflect

all enrollment in training through age 40. As with other forms of educational attainment, male GED recipients are intermediate between dropouts who do not GED certify and high school graduates in their attainment of job training and vocational/technical training. Female GED recipients are as likely to obtain vocational/technical training as female high school graduates.

Both male and female GED recipients are more likely than dropouts or high school graduates to obtain government training. This finding is consistent with the observation in Chapter 3 that many government training programs encourage participants to earn GED certificates.[42] Figure 5.15 shows training rates before eventual GED recipients earn their GED certificates. The GED opens doors to training, just as it opens doors to schooling.

[Figure 5.14 here.]

[Figure 5.15 here.]

5.3.5 Indirect versus Direct Effects: The Returns to Postsecondary Education

Some of the GED recipients who attend college benefit compared to other GED recipients. Figures 5.16–5.17 present estimates in a format similar to that used in Figures 5.6 and 5.7. They separate GED recipients who attend college from those who never attend college.[43] The some-college category includes respondents who have attended any amount of college but do not necessarily receive a degree.

In general, female GED recipients who attend college perform better than other GED recipients, especially at older ages. Male GED recipients who attend some college do not perform much better than other GED recipients or dropouts. Although the point estimates

[42] Although Figure 5.14 shows training rates for eventual GED recipients, it does not distinguish between training received before or after GED certification.

[43] We estimate the benefits associated with various educational statuses relative to dropouts using the estimates from the following equation: $Y_{it} = \alpha + \beta_1[(GED_{it}) \times (NOCOLL_{it})] + \beta_2[(GED_{it}) \times (SMCOLL_{it})] + \beta_3[(HSG_{it}) \times (NOCOLL_{it})] + \beta_4[(HSG_{it}) \times (SMCOLL_{it})] + \gamma X_{it} + \varepsilon_{it}$, where $NOCOLL_{it}$ and $SMCOLL_{it}$ indicate whether individual i has obtained no college or some college by time t. GED_{it} and HSG_{it} indicate whether a person is a GED recipient or high school graduate. X_{it} is a vector of background controls.

of male post-GED benefits are generally positive, they are not statistically significantly different from those of GEDs who do not attain further education, or from dropouts. The higher returns to females who obtain post-GED education is consistent with the literature that finds that community college tends to provide higher returns to females, even when they do not earn degrees.[44]

[Figure 5.16 here.]

[Figure 5.17 here.]

Do the estimated GED effects arise because the GED has direct value in the labor market or because the GED opens the door to postsecondary education which in turn improves labor market outcomes? To answer this question, we decompose the effect of GED certification into a "direct effect" (the effect of GED certification for people who have no postsecondary education) and an "indirect effect" (the effect of GED certification on changing the probability of attending college multiplied by the gain from attending college).[45] As a benchmark we perform the same decomposition for high school graduates.

For GED recipients, the direct effect is the benefit of having a terminal GED with no postsecondary education. The indirect effect is the probability that a GED recipient attends college multiplied by the additional return to college beyond having a GED. The total effect is the sum of the indirect and direct effects.[46] The effects are defined analogously for high

[44] See Belfield and Bailey (2011) for a review of the benefits of attending community college.

[45] We present a brief formal description of this methodology in the Appendix to this Chapter (Section 5.7). See the discussion surrounding equation (5.3).

[46] For each age range, we estimate the benefit to various educational states relative to dropouts using the following equation: $Y_{it} = \alpha + \beta_1 (GED_{it}) + \beta_2 [(GED_{it}) \times (SMCOLL_{it})] + \beta_3 (HSG_{it}) + \beta_4 [(HSG_{it}) \times (SMCOLL_{it})] + \gamma X_{it} + \varepsilon_{it}$, where GED_{it} and HSG_{it} indicate whether individual i is a GED recipient or high school graduate at time t and $SMCOLL_{it}$ indicates whether individual i has obtained some college by time t. X_{it} is a vector of background controls. β_2 and β_4 are the additional returns to attending some college for GED recipients and high school graduates, respectively. At each age range, we also estimate the probability of having attended some college for GED recipients (p_{GED}) and high school graduates (p_{HSG}). The total effect of GED certification is decomposed as follows:

$$\text{Total Effect} = \underbrace{\beta_1}_{\text{Direct Effect}} + \underbrace{(p_{GED} \times \beta_2)}_{\text{Indirect Effect}},$$

where p_{GED} is the probability of attending college for a GED. Methodological Appendix 5.7 discusses this decomposition in greater detail.

school graduates. We allow for the returns to postsecondary education to differ between GED recipients and high school graduates.

Figure 5.18 shows the estimates of the indirect and direct effects of GED certification and high school graduation on annual earnings. The first bar shows the total effect. The second and third bars show the relative contributions of no college and some college to the total effect. The numbers on top of the direct effect bars indicate the fraction of people who have not attended postsecondary education and the numbers on the indirect effect bars indicate the fraction who have attended postsecondary education. The decomposition for the other outcomes is presented in the Web Appendix.[47]

Both the direct and indirect effects of receiving a GED are small for male recipients at all ages. The total effect for male high school graduates increases over the life cycle, primarily due to growing returns by age for those who attend college. Between ages 20 and 24, most of the total GED effect for women comes from the direct effect. As women enroll in college at later ages, the indirect effect increases so that it is about half of the total effect by ages 35–39.

[Figure 5.18 goes here.]

Tables 5.2 (men) and 5.3 (women) present the estimated benefits underlying Figure 5.18 and the analogous decomposition for hourly wage rates. They decompose the benefits of GED receipt and high school graduation into direct and indirect effects. They also show the probability of attending college and the benefit of attending college for GED recipients and high school graduates.

For males, there is little direct or indirect effect of GED certification on annual earnings or hourly wages. For female GED recipients, the effect of attending college on annual earnings is relatively high at young ages. The indirect effect is low because so few have attended

The standard errors are calculated using a bootstrap procedure that allows for arbitrary correlation of the error term within individuals over time but assumes that the error term is uncorrelated across individuals. We use 100 draws.

[47] See Section W5.3.4.

college. As more female GED recipients attend college, the indirect effect of GED receipt on annual earnings increases so that by ages 35–39, the indirect effect accounts for nearly half of the estimated total effect of GED certification. For female GED recipients, the benefit of attending college comes through increased labor supply and not through increased hourly wages.

The indirect effect accounts for most of the effect of high school graduation on hourly wages. High school graduation opens the door to college and college leads to higher paying jobs. In contrast, the direct effect accounts for most of the effect of high school graduation on annual earnings. Why is the indirect effect more important for hourly wages than annual earnings? Much of the total effect of high school graduation on annual earnings comes through increased labor supply, rather than through higher hourly wages. In addition, attending college after graduating from high school has little incremental effect on labor supply. These factors lead to a relatively small indirect effect on labor supply and therefore annual earnings.

[**Table 5.2 goes here.**]

[**Table 5.3 goes here.**]

5.3.6 Present Values

Our cross-sectional analysis suggests that some groups of GED recipients benefit compared to other dropouts, especially those who complete some postsecondary education. But what is their lifetime benefit? Dropping out of high school delays final college attainment.

Figure 5.19 presents the difference in average annual earnings between high school graduates and GED recipients in the first five years after receiving an associate's degree or a bachelor's degree. The earnings of GED recipients constitute the baseline. For each type of degree, the first bar presents the unadjusted difference, and the second presents the difference after adjusting for ability and background. We only estimate the returns for the first five years because many GED recipients earn their degrees later in life and few of them

have more than five years of experience with the degree in our sample. We cannot reject the hypothesis that GED recipients and high school graduates who obtain degrees have the same earnings. This finding differs from the results reported in Section 5.3.5 in which we combined all GED recipients who attended college, many of whom did not obtain degrees. However, many of the estimates used to generate Figure 5.19 are imprecisely determined because so few GED recipients receive degrees.

[Figure 5.19 here.]

The few GED recipients who earn degrees obtain them later in life than high school graduates. As discussed in Chapter 4, there is considerable delay in the time between dropping out and obtaining GED certification. It averages five years for men and seven years for women. There is additional delay between GED certification and completion for those who obtain any degree. As shown in Figure 5.20, GED recipients tend to enroll in college much later than high school graduates. They also earn their degrees later. Male GED recipients tend to earn associate's degrees three years after high school graduates and bachelor's degrees seven to eight years after high school graduates. Female GED recipients earn associate's degrees and bachelor's degrees six to seven years after high school graduates.

[Figure 5.20 here.]

The consequent delay in earnings produces a lower present value of earnings for GED recipients compared to high school graduates who obtain the same level of postsecondary education. Figure 5.21 shows estimates of the present value of earnings of GED recipients and high school graduates relative to that of dropouts for different educational paths.

The present value of earnings is constructed by estimating the returns to various educational states and forming streams of the returns discounted to age 16. We analyze returns to educational experiences for different educational attainment levels: being a high school enrollee, being a high school dropout with no college, being a GED recipient with no college, being a high school graduate with no college, being a college enrollee (combining GED recipients and high school graduates), being a GED recipient with some college, being a high

school graduate with some college, being a GED recipient with an associate's degree, being a high school graduate with an associate's degree, and being a bachelor's graduate (combining GED recipients and high school graduates). We allow the returns within a state to depend on the experience in the state, and then we form sample averages.

We combine the estimates for different post-GED outcomes to estimate the present value of earnings. We assume that GED recipients drop out at age 16 and begin earning at the level of GED recipients at that time. Assuming a later age of dropping out or GED receipt would delay earnings further, decreasing the present value of earnings. Thus, our estimates are upper bounds on the benefits obtained from a GED. We assume that GED recipients earn their degrees after high school graduates and experience the average delay that GEDs who attain degrees experience.[48]

Figure 5.21 shows that the GED recipients who earn degrees have higher present discounted value of earnings compared to dropouts. The GED recipients, however, earn much less than high school graduates, in part because they earn their degrees so much later in life. This analysis shows that even the few GED recipients who obtain postsecondary degrees fare much worse than their high school graduate counterparts.

[Figure 5.21 here.]

5.3.7 Differences across Races

With a few exceptions, the patterns of empirical results across races mirror those obtained from analyses of the combined sample. Figures 5.22–5.23 show labor market outcomes by race for GED recipients and high school graduates relative to high school dropouts.[49] For each age, the first pair of bars displays the estimate for whites, the second for blacks, and the third for Hispanics. The benefits of GED certification are estimated from regressions restricted to the indicated racial/ethnic group. Thus they are effects relative to the dropouts

[48]See Section W5.3.4 of the Web Appendix for a detailed description of the methodology and assumed educational paths underlying this calculation.

[49]Unadjusted estimates and estimates separating by postsecondary education level are available in Section W5.3.5 in the Web Appendix.

of that group.

After accounting for ability, white and Hispanic male GED recipients are nearly indistinguishable from other dropouts of the same ethnicity for all outcomes at all ages. Black male GED recipients have similar earnings, hourly wages, and hours worked conditional on employment as black male dropouts, but are slightly more likely to work than their dropout counterparts at older ages. Later in life, differences in employment lead to slightly higher earnings for black male GED recipients compared to their uncertified dropout counterparts.[50]

The regression coefficients plotted in Figure 5.22 do not show whether the probability of employment for black male GED recipients and high school graduates is increasing with age or whether the probability of employment for high school dropouts is decreasing. Figure 5.24 plots employment rates by age for dropouts, GED recipients, and high school graduates for different samples of black males who attain no postsecondary education. Panel (a) reveals that the increasing return to the GED with age to high school graduation and GED certification that is apparent in Figures 5.22–5.23 result from lower employment rates for high school dropouts starting around age 30.

Why did many black male dropouts leave employment around age 30? During the 1980s and 1990s, it became easier to qualify for social security. In a sample that pools across age groups, Autor and Duggan (2003) show how increases in unemployment coincided with changes in policies and the greater uptake of Social Security Disability Income (SSDI). Panel (b) of Figure 5.24 shows the employment rates for black males excluding people who are currently on Supplemental Security Income (SSI). SSI recipients account for around half of the gap in employment rates between GED recipients and dropouts. This evidence is suggestive, but the sample sizes are relatively small. Other programs, such as SSDI, might account for more of the gap. Unfortunately, the NLSY79 does not have good measures of SSDI participation.

We supplement this analysis using the Current Population Survey (CPS) data that con-

[50]See Web Appendix Section W5.3.5.

tains more information about disability. Figure 5.25 shows employment rates for black males including and excluding disabled populations. This data is for a cohort similar to that of the NLSY79 panel. The evidence is striking. In the full population, there is nearly a 30 percentage point gap between the employment rates of black male high school graduates and black male dropouts. Excluding the disabled, the gap is less than 5 percentage points. Unfortunately, the CPS does not distinguish between GED recipients and high school graduates, but our estimates in the NLSY79 suggest that GED recipients would follow trends similar to those for high school graduates. Why does welfare expansion not affect GED recipients and high school graduates as much as dropouts? SSDI eligibility depends on educational attainment. There are more restrictions for eligibility for people with high school equivalency degrees (including GED certificates) to obtain SSDI, because the Social Security Administration assumes that they are able to obtain jobs that would not be compromised by their disabilities.[51]

Male high school graduates of all races earn more, have higher hourly wages conditional on employment, work more hours conditional on employment, and are more likely to be employed than GEDs and dropouts. In general, white, black, and Hispanic female GED recipients have outcomes similar to those reported in the pooled group. GED recipients have higher earnings due to their greater labor supply but have the same wages.

[Figure 5.22 here.]

[Figure 5.23 here.]

[Figure 5.24 here.]

[Figure 5.25 here.]

[51]The Social Security Administration (2012) defines GED recipients as high school graduates for the purposes of determining SSDI eligibility. The Social Security Administration (2013) describes how high school education affects disability determination.

5.3.8 Distributions of Estimated Effects across Specifications

The cross-sectional estimates suggest that some groups might benefit from GED certification. As discussed in Section 5.2 and in greater detail in the Web Appendix,[52] different econometric specifications produce different estimates of GED effects. The conventional practice of using econometric specification tests to pick a "correct" model is fraught with danger. The conventional practice is to "test down" to a model and to report p-values that ignore all of the testing that led to the final empirical model. This practice leads to badly biased inferences.

Estimates can appear to be statistically significant simply due to sampling variation. Approximately 5% of all estimates of the GED effect would appear to be "statistically significantly different from zero" at the 5% level, even if in actuality the GED had no effect. In an attempt to avoid this problem and summarize the cross-sectional results across a variety of plausible specifications, we estimate the distribution of estimated returns for over 100,000 different statistical models, using a variety of controls for different subpopulations. All models control for AFQT but use different combinations of other controls. We specify a set of other possible control variables that include mother's highest grade completed, urban residence at age 14, family income, residence in the South at age 14, smoked at 15, had sex by 15, committed a major crime, and ninth-grade GPA. We estimate the GED and high school graduate effects using each possible combination of these controls (without interaction terms). We run the regressions separately for separate subpopulations. All the subpopulations are partitions of race, postsecondary education, and age (measured in five-year categories) for males and females. The density of estimates for each subpopulation is weighted so that the figures report a nationally representative distribution.[53]

Figures 5.26–5.31 plot the estimates of returns across this large variety of specifications for annual earnings, hourly wages, employment, hours worked, and labor force participation.

[52] See Web Appendix Section W5.3.6 for discussion of robustness analyses.

[53] The exact procedure and a formal justification for this procedure are presented in Section W5.3.6 of the Web Appendix.

Figures 5.26, 5.27, and 5.28 present the distribution of the estimated effect for males of GED certification (dashed line) and high school graduation (solid line) for annual income, hourly wages, employment, hours worked, labor force participation, and the associated distributions of p-values.

Figure 5.26(a) shows that for male GEDs, the estimated coefficients capturing the effects of the GED on earnings compared with dropouts are centered at zero. Beneath this, Figure 5.26(c) plots the cumulative distribution of the p-values associated with tests of the null hypothesis of no GED effect for each model whose estimated effects are plotted in Figure 5.26(a). p-values are the probabilities that the estimated GED effects could arise from chance even if there is no effect of the GED on the indicated measure (earnings in Figure 5.26(a)). A well-known fact from statistics is that under the null hypothesis of no GED effect, the density of p-values is uniform—all p-values are equally likely to occur.

Figure 5.26(c) plots the cumulative distribution of the p-values. It is in the format of a Lorenz curve used to summarize departures of a variable from perfect equality. (The dotted line in the bottom panels of these figures is the line of perfect equality.) Under the null hypothesis of no GED effect, the cumulative distribution of p-values should lie along a 45° line starting at the origin. The 45° degree line is the shape of the cumulative distribution of a uniform random variable. This would be the line of perfect equality for a Lorenz curve. Departure of a cumulative distribution from the 45° line indicates the strength of rejection of the null hypothesis. The evidence in Figure 5.26 across numerous models reveals that there is no GED effect.

In contrast, for high school graduation (compared to dropouts), the mean of the coefficients is shifted strongly upward and the cumulative distribution of the p-values departs strongly from the 45° line, suggesting large effects of high school graduates. The same pattern holds for estimated effects on hourly wages, hours worked, and employment.

For women, the pattern is different. (See Figures 5.29–5.31.) There is a strong estimated effect of GED certification and high school graduation on annual income (panels (a) and (c)

of Figure 5.29), but not on hourly wages (see panels (b) and (d) of Figure 5.29). This effect arises through greater GED female labor supply (see Figures 5.30 and 5.31). This confirms the finding, previously demonstrated, that GED women work more and earn more but do not have higher hourly wages than other dropouts. High school graduates perform better on all dimensions.

[Figure 5.26 here.]

[Figure 5.27 here.]

[Figure 5.28 here.]

[Figure 5.29 here.]

[Figure 5.30 here.]

[Figure 5.31 here.]

This analysis bolsters the findings from the cross-sectional analyses previously reported. After controlling for their scores on an achievement test—the AFQT—the male GED recipients do not benefit compared to other dropouts on any labor market measure, whereas high school graduates benefit substantially. Female GED recipients have higher annual earnings but not higher hourly wages compared to other dropouts. They simply supply more labor than other dropouts.

5.3.9 The Persistence of Behavior

Life presents many opportunities to drop out. High school is one of the first; later opportunities arise in the military, employment, marriage, and college. Most GED recipients do not benefit from GED certification and remain lifelong dropouts. Character skills in adult life are relatively stable, although we show in Chapter 9 that they can be changed by intervention throughout childhood and adolescence. Section 5.3.5 demonstrated that few GED recipients who enroll in college make it past the first year. Few receive two- or four-year degrees. Chapter 6 shows that GED recipients are much more likely to drop out of the military compared to high school graduates.

In this section, we consider the persistence of GEDs and dropouts in a variety of life situations beyond high school. We first consider the survival rate of dropouts, GED recipients, and high school graduates in a variety of activities (the fraction of people who remain in a state as a function of time). Figures 5.32 and 5.33 present, for males and females respectively, survival rates in employment, marriage, and nonincarceration for dropouts, high school graduates, and GED recipients.[54] The black dots and diamonds on the lines indicate whether the survivor functions are statistically significantly different from those of dropouts at the 5% level. The circles indicate whether or not GED survivor rates are statistically significantly different from those of high school graduates. GED recipients and dropouts leave jobs, marriage, and enter jail more frequently than high school graduates.[55] Male GED recipients are more likely to divorce than high school graduates. Although some GED recipients might change their ways, most continue throughout their lives dropping out of everything they start at much greater rates than high school graduates.[56]

[Figure 5.32 here.]

[Figure 5.33 here.]

Chapter 4 shows that during their adolescent years, children who eventually GED certify are as likely—or in some cases more likely—than other dropouts to engage in risky behaviors. Do GED recipients reform later in life? Figure 5.34 shows later-life rates of daily smoking, binge drinking, marijuana use, and self-reported depression for dropouts, GED recipients, and high school graduates. The measures of drug use are reported when respondents are between ages 29 and 37, and depression is reported when respondents are between ages 27 and 35. For all outcomes, GED recipients are similar to high school dropouts and much worse than high school graduates.

We supplement this analysis using the National Health Interview Study (NHIS), a large,

[54]For more information on the calculation of survival rates, see Section W5.3.7 of the Web Appendix.

[55]When we eliminate black males from the sample, the survival rates in employment are the same for GEDs and dropouts.

[56]Figure 5.33 settles an issue raised in Chapter 4. The higher employment rates of GED women compared to those of other dropouts reported there could have been due to the lower turnover rates or higher job-taking rates. Figure 5.33 shows that it is the latter reason.

nationally representative data set that contains measures of risky behavior and health. Like some of the other data sources we use, the NHIS data only report the highest level of education attained, so we cannot identify whether college attendees are GED recipients or high school graduates. For this reason, we restrict our analysis to people who do not attend college. Additionally, the NHIS data do not include the time when the GED was received and the time when the outcome studied occurred. We analyze outcomes after age 35. By that age, most GED recipients have certified.

The top panels of Figure 5.35 show several outcomes from the NHIS data related to family structure and receipt of welfare. The top two figures plot rates of being single and living with children and divorce rates for all three groups. GED recipients are more likely than other dropouts or high school graduates to be in these categories. The evidence on divorce rates is consistent with the findings presented in Figures 5.32 and 5.33. The NHIS data, however, do not allow us to distinguish whether divorce precedes or follows GED certification, so its interpretation is less clear. GED recipients are as likely to receive welfare as other dropouts.

The middle two panels of Figure 5.35 show that the pattern of differences in adolescent behavior among high school dropouts, GED recipients, and high school graduates persist into adulthood. Compared to high school graduates, GED recipients are more likely to report having poor or fair health (as opposed to good, very good, or excellent health), smoking daily, drinking heavily, being obese, or being depressed. Most of these differences are statistically significant. For most outcomes, GED recipients are similar to other dropouts, but GED recipients are about 10% more likely to smoke daily than other dropouts.

The NHIS data has some information on labor market outcomes. The bottom two panels of Figure 5.35 show the number of months worked in the past year and the number of years worked at the current job for dropouts, GED recipients, and high school graduates who attend college. Male GED recipients work similar hours as high school dropouts. They also spend fewer years at their current job, suggesting that they have higher turnover rates.[57]

[57]For their sample of young males, Cameron and Heckman (1993) report similar estimates.

This is consistent with the data from the NLSY79 displayed in Figure 5.32. In contrast, female GED recipients work more months than high school dropouts, but spend a similar number of years at their current job as other dropouts.

[Figure 5.34 here.]

[Figure 5.35 here.]

5.4 Panel Data Estimates of Life-Cycle Dynamics

Up to this point we have analyzed outcomes by educational attainment using cross sections of people at different ages. Connecting estimates across ages produces "synthetic" life-cycle profiles that are averages over many different life-cycle trajectories. Profiles constructed in this fashion may not represent the actual life-cycle profiles of any person.[58]

This concern is especially relevant for the study of the impact of GED certification. There are many routes to GED certification, and recipients certify at very different ages (see Figure 4.11). The work experience gained in the years after attaining the GED may have a higher payoff than work experience gained prior to certification. The primary benefit of GED certification may be that it opens doors to career advancement and enhances life-cycle wage growth.

Instead of averaging across different life-cycle trajectories, it would be better to estimate the effect of GED certification longitudinally. The trajectories before and after certification could in principle be compared to those for persons who never certify, who certify later, or both.[59] Many interesting counterfactual comparisons might be made. One could in principle compare persons with different ages of certification and different levels of pre- and post-GED work experience. Such a comparison could reveal how the age at which people attain the GED affects their payoff stream. Those receiving GEDs at younger ages might experience more rapid career advancement and hence more rapid wage growth than those receiving

[58] See Web Appendix Section W5.4 for a more formal description of the analysis presented in this section.

[59] The same people appear at different ages in our cross sections, but we do not observe full life cycles for anyone.

GEDs at older ages who have diminished post-GED working lives.

Making such comparisons presents two major problems. The first is that they place great demands on the data. Many possible profiles are associated with different ages of GED certification and levels of pre-GED and post-GED work experience. Even with the large samples at our disposal, we need to simplify the set of possible trajectories to obtain estimates with any precision. The second problem is that the timing of the receipt of a GED and the levels of work experience pre- and postcertification are choice variables. The variables at our disposal may not be sufficient to control for all of the attributes that shape these choices. This creates the potential for serious endogeneity problems.

This section uses the panel data at our disposal to analyze the life-cycle dynamics associated with GED certification. We find that cross-sectional analyses give a fairly reliable guide to the life cycle of men. They are much less accurate for women, who have more complex and diverse patterns of life-cycle dynamics.

We present two distinct analyses based on different measures of work experience. For each analysis, we distinguish the performance of different types of female GED recipients. Our analyses are motivated by the research of Jacob Mincer (1974), who made a fundamental contribution to understanding life-cycle wage dynamics by demonstrating how wages and earnings increase with work experience. He interpreted the growth in wages as arising from on-the-job investments. Another possible interpretation of the same phenomenon is that people are learning by doing.[60]

We follow Mincer and analyze the effect of work experience on labor market outcomes. Our two measures of work experience are (a) cumulative hours of actual work experience and (b) potential experience (age at survey minus the age at which the person left school). The latter measure is widely used in applied work and has the advantage that it only depends on one choice—the age at which a person leaves school. Cumulative "actual experience" is vulnerable to multiple sources of endogeneity. However, "potential experience" is vulnerable

[60]See Heckman, Lochner, and Cossa (2003) for an analysis distinguishing the sources of life cycle wage growth.

to mismeasurement of experience.

The major findings from our analyses are as follows. (1) For both men and women there is no evidence that GED certification boosts the rate of earnings growth with experience regardless of the measure of work experience analyzed. (2) Using potential work experience, we find estimates that are consistent with cross-sectional results established in previous sections of this chapter. (3) Using actual work experience, our panel estimates are consistent with the cross-sectional results for men, but not for women. With the exception of women at the lowest levels of actual experience, female GED recipients do not have higher earnings at each level of experience.

For each measure of experience, we conduct two analyses. The first builds on the work of Mincer and assumes that the rate of growth of earnings with work experience is the same for persons at all educational levels. The second estimates separate effects for pre-GED and post-GED work experience to determine whether certification boosts wage and earnings growth. We find no evidence of such a boost.

5.4.1 Analysis by Actual Work Experience

We first analyze labor market outcomes by educational attainment at different levels of *actual* work experience. Initially, we do not distinguish between pre- and post-GED work experience. Actual work experience is defined as cumulative hours worked since age 18 divided by 2000, making the units one full year of work experience.[61]

Figures 5.36 and 5.37 (for males and females, respectively) display labor market outcomes by educational attainment at different levels of actual work experience.[62,63] We use the NLSY79 histories up to age 40 to measure educational attainment and work histories. There are only four bins in each figure. The first bin is for persons with 0–4 years of work experience, pre- or post-GED. The icons denoting outcomes are shifted slightly at different levels of

[61] We assume that work experience below 18 has negligible effects on wages.
[62] Due to the sparsity of the data, we create bins of experience.
[63] See Web Appendix Section W5.4 for a more complete discussion of this analysis.

experience in the graph to improve the visual display. The lines connecting the bins are drawn to enhance the reader's perception of the graphs. We do not plot outcomes for each year of experience.[64]

Outcomes are reported for all people with the indicated levels of education and work experience. The same person may show up in multiple bins. Thus a person with 4–8 years of actual experience would show up in at least two bins and possibly more if followed further over the life cycle. The level of education reported in each bin is the highest level attained by the person, although the work experience is aggregated across all educational attainment levels for each person (at the time the experience level was achieved) for each person. Everyone appears at least once in the category 0–4 years of actual experience.[65]

[Figure 5.36 here.]

[Figure 5.37 here.]

These graphs are to be compared with their age counterparts in Figures 5.6 and 5.7. In Figures 5.6 and 5.7, persons age 20–24 can have very different years of actual work experience. For males, the estimates based on actual work experience show a very similar pattern to what is obtained from the cross-sectional analyses. Male GED recipients and high school dropouts have nearly identical outcome measures, whereas high school graduates outperform both.

For females, the two analyses tell different stories. In the cross-sectional analyses, female GED recipients have higher annual earnings than other dropouts at each age because they are more likely to be in the labor force and be employed (see Figure 5.7). In contrast, in the panel estimates based on actual experience, only at 0–4 years of actual experience do female GED recipients have higher annual earnings than other dropouts. At 12–16 years of actual experience, female GED recipients earn somewhat higher hourly wages than other dropouts,

[64]For each bin, the average years of actual work experience generally differs by educational status. It also varies across bins.

[65]Persons with no work experience are dropped. Very few observations are dropped for this reason. For women it is less than 1%; for men it is even smaller.

but the estimated effect of the GED on earnings is not statistically significant.[66]

For women, the difference between an analysis based on actual work experience and a cross-sectional analysis is due to a group of dropouts who are rarely employed. Figure 5.38 shows the fraction of women who never accrue more than four years (8,000 hours) of actual work experience between ages 18 and 40.[67] Permanent dropouts who do not GED certify are about 15 percentage points more likely to be in this category than GED recipients. These persistent nonworkers show up at every age in Figure 5.7 but appear only in the first experience category of Figure 5.37. Most of the women not working at ages 20–24 are not working at ages 35–39, producing a roughly constant estimated GED effect on labor supply in cross-sectional estimates. If persons with low lifetime hours supplied to the market do not GED certify (and few do), the presence of a group that does not acquire work experience makes the benefits of GED certification on labor supply and earnings appear to be larger in the cross section at each age. This finding explains why the employment rates and annual earnings of female GED recipients are only high in the interval 0–4 years of actual experience. This interval includes some women who will have many more years of work experience as well as those who will not. For women who work more than four years, there is no estimated effect of the GED on labor supply.

[Figure 5.38 here.]

5.4.2 Analyses Based on Potential Experience

Actual experience is endogenous. Our conditioning variables may not be sufficient to control for it. A commonly used alternative measure of work experience that circumvents the endogeneity problem is to use "potential experience" – the number of years since leaving

[66] This is a very small and select group of women.

[67] The analogous figure for males is in Section W5.4 of the Web Appendix. For males, there are no statistically significant differences between GED recipients and permanent dropouts.

school.[68] Figures 5.39 and 5.40 present estimates based on potential work experience analogous to those of Figures 5.36 and 5.37.[69] The estimates based on potential experience are very similar to the estimates obtained from cross sections. Age is a good approximation to potential experience. In this case, they are similar because GED recipients and dropouts leave school at roughly the same age (slightly less than a year apart on average) and most males work at each age.

Male high school graduates have higher levels of earnings, hours worked, and wages compared to those of GED recipients or dropouts. Adjusting for their greater ability, male GED recipients and other dropouts have virtually identical outcomes at each level of potential experience. As is found in the cross section, female GED recipients appear to have higher earnings at each age because they are more likely to work than other dropouts.[70]

[Figure 5.39 here.]

[Figure 5.40 here.]

5.4.3 Does Pre-GED Experience Have the Same Effect as Post-GED Experience?

The analyses reported in the previous two subsections do not distinguish between the effect of work experience pre-GED and the effect of post-GED work experience. It may be that the GED confers benefits to wage and earnings growth that accrue only gradually. The analysis in this section makes this distinction. We find no difference in levels or rates of growth of wages and earnings pre- and post-GED certification except for one group of women, but even for this group the effect comes through their labor supply. This section also provides an implicit test of the validity of our set of control variables.

Although the NLSY79 contains many measures of background and ability, it might not

[68] See Mincer (1974) where this measure is used.

[69] See Web Appendix Section W5.4 for a further description of the analysis.

[70] As previously discussed, this effect arises from the core group of persistent dropouts in the category 0–4 years of actual work experience.

include all relevant background characteristics that affect the decision to take the GED, to work, or the other outcomes studied. There might be unobserved differences among dropouts, GED recipients, and high school graduates that affect their labor market outcomes and their certification and labor supply choices for which we do not properly control. Differences could also arise if people change their behavior after the age at which our measures of their background and abilities are recorded. This change in behavior could be associated with receiving a GED or other life events.

To investigate these possibilities and to examine whether receipt of a GED boosts wage growth, we compare the labor market outcomes of eventual GED recipients before and after they receive their GED. We estimate a statistical model in which we allow persons who will eventually earn a GED but are currently dropouts to have different rates of growth of earnings (and other outcomes) with experience before and after they GED certify.[71] If we have properly controlled for unobservables, we should find no evidence of differences or differential growth rates.

Figures 5.41–5.42 present labor market outcomes by actual experience for dropouts who never earn a GED, dropouts who will eventually earn a GED but have not yet earned one, GED recipients, and high school graduates.[72] In these figures, persons can be in only one category, unlike the categories used to create Figures 5.36–5.37 and 5.39–5.40. In constructing these figures, we use histories up to age 40. The post-GED estimate in the interval 8–12 is for someone who has been in the labor market for a total of 8–12 years and has also had a GED for 8–12 years. The pre-GED estimate in this interval is for a person with 8–12 years of work experience who does not have a GED but will eventually obtain one.

At each experience level, we test the difference between the pre- and post-GED experience profiles. A "*" indicates that the difference between the pre-GED and post-GED estimate is statistically significant. We stop the analysis at 12 years of actual experience. Few GED

[71] We estimate a standard model of outcomes partitioned by mutually exclusive education and experience categories. We normalize the estimates against the category of permanent (through age 40) dropouts with 0–4 years of actual work experience.

[72] "Never" means through age 40. See Web Appendix Section W5.4 for a further description of the analysis.

recipients work for more than 12 years before earning a GED.

Using actual work experience, on average, GED recipients do not perform better than pre-GED recipients. There is no evidence that the GED produces greater wage growth with work experience. At 0–4 years of actual experience, male pre-GED recipients have higher annual earnings than post-GED recipients.[73]

For women, the only statistically significant differences between the outcomes of pre- and post-GED recipients arise from persons with 0–4 years of labor market experience. Post-GED females are more likely to be employed than pre-GED females. This estimated effect is closely related to the pattern previously discussed in our analysis of Figure 5.37. For women, receipt of the GED is associated with entry into the labor market. Figure 5.37 suggests that the GED may produce moderate boosts in hourly wages for females with high levels of actual experience. However, Figure 5.42 shows that in fact, female GED recipients do not perform any better than dropouts who later earn a GED.

Figures 5.43 and 5.44 show results parallel to the ones just discussed for estimates based on potential experience. For men at the same level of experience, there are no differences in labor market outcomes between pre- and post-GED recipients. In contrast, women at the same level of experience who have a GED supply more labor than women who will eventually earn one.

This finding is consistent with our previous discussion of the employment patterns surrounding receipt of a GED for women. Many women earn a GED as they are entering the labor market. There are no hourly wage benefits of certification for any groups. These analyses suggest little effect of the GED, except possibly on female labor supply. Even for labor supply, the estimates might not reflect a causal effect of the GED. The data are consistent with the interpretation that the women who chose to take the GED are also the ones who want to work more in the future. The estimated GED effect might be a selection effect,

[73]This is consistent with the phenomenon of Ashenfelter's dip associated with men's receipt of the GED noted in Chapter 4. Many men earn their GED when they are unemployed, and hence their pre-GED earnings are depressed.

where certification is a marker for tastes for work.[74,75]

[Figure 5.41 here.]

[Figure 5.42 here.]

[Figure 5.43 here.]

[Figure 5.44 here.]

5.4.4 Distinguishing among Different Female GED Recipients

Female GED recipients differ among themselves in their life experiences. Approximately 40% of female GED recipients drop out of high school to have a child. As shown in Chapter 4, these women have traits different from those of other GED recipients. On average they have the same AFQT scores, but they are less likely to commit crimes, smoke, or drink. They also complete more grades in school before they drop out.

Figure 5.45 shows annual earnings for four different types of female GED recipients compared to permanent (through age 40) dropouts: (1) GED recipients who are pregnant before dropping out and attend any postsecondary education, any time before age 40, (2) GED recipients who are pregnant before dropping out and do not attend postsecondary education before age 40, (3) GED recipients who are not pregnant before dropping out and attend college at some time before age 40, and (4) all other female GED recipients. The percentage of GED recipients in each group is displayed in the legend.

This graph shows that female GED recipients who eventually attend college and females who drop out of high school due to pregnancy benefit from GED certification. The remaining category of female GED recipients do about as well as other dropouts who do not certify.[76] The evidence for women who drop out due to pregnancy is consistent with two possible, and

[74] This selection effect could arise whether or not there is a causal effect of the GED. Selection could arise because some women anticipate a real benefit from certification or because the same tastes for future work drive the certification decision and the decision to work in the future.

[75] In all of these analyses, we compare people at fixed ages or levels of actual experience. A more complete analysis would condition simultaneously on both dimensions. Unfortunately, the small sizes of the samples at our disposal limit our capacity to do so.

[76] "College" is defined as ever attending any level of college, including vocational training programs—measured through age 40.

not mutually exclusive, explanations. First, as shown in Chapter 4, these women have higher levels of character skills compared to other female GEDs who drop out for other reasons. When we adjust for our measures of these skills, we do not eliminate the benefits received by pregnant dropouts. Second, these women might change their preferences or motivations due to the birth of their children.[77] Unfortunately, we do not have measures of their character skills over the life cycle, so we cannot identify whether they have experienced a change in their cognitive or character skills.[78]

[Figure 5.45 here.]

5.4.5 Is There a Causal Effect of the GED for Women?

We find no evidence of a causal effect of the GED for men. The evidence from our cross-sectional analysis suggests that the GED might have a causal effect for women that arises from their greater labor force participation and employment. The evidence from our panel analysis substantially qualifies our cross-sectional analysis for women. Any estimated female GED labor supply effects arise from a group of female dropouts who rarely work.

We cannot rule out the possibility that GED certification induces greater labor supply for women. A natural question is, why is there no effect for men? An alternative explanation of our evidence that we find more plausible is that women who have greater preferences for work, however arrived at, are more likely to GED certify as a way to facilitate employment and gain the educational credentials that improve employability.[79] GED certification signals their greater taste for work. The evidence in Chapter 4 shows that women who drop out of high school due to pregnancy are more likely to attain GEDs after their youngest children can

[77] Preferences and expectations may change. Constraints surely change when they have a child.

[78] A third explanation is that the women are subject to financial constraints because they need to support their children, and this induces changes in their behavior. We cannot distinguish between changes in constraints and changes in preferences or skills.

[79] Our study suggests that women who pass the GED are more motivated. Their decision to take the GED might also reflect motivation to enter the workforce. Jepsen, Mueser, and Troske (2011), using a sample of women who attempt the GED, find that those who pass and those who fail earn the same. They include nonworkers, so their analysis captures employment effects. Controlling for motivation in this fashion, they find no GED effect.

safely be placed in child care. Many go on to attend some form of postsecondary education. These more motivated female GEDs obtain their credentials earlier in life and work more than permanent dropouts or most other GEDs who eventually attain their certificates. Many have better character skills before they drop out of school. Our evidence of an estimated GED effect may be a consequence of the inadequacy of our measures of skills leading to selection bias or because of a change in skills that occurs after our measures are taken. In our view, the weight of the evidence favors a selection story.

5.5 The Female Advantage

A consistent finding of the analyses in this book is that female GED recipients generally have better social skills (relative to uncertified dropouts) than male GED recipients. This pattern shows up more generally in the sorting of males and females into occupations classified by their average skills (see Figures 5.46 and 5.47). O*NET[80] provides data on the average level of cognitive, character, and physical skills in the occupations selected by persons of different educational attainment and gender. Using the ACS data (which only reports final educational attainment and hence cannot distinguish between college graduates who earned a GED certificate from those who earned a high school degree), we plot the O*NET occupational scores of men and women classified by education. Observe that female GED scores on social traits are much higher than male GED scores—a pattern that holds true for other education levels as well.

Not surprisingly, more educated people sort into jobs requiring less physical strength and more cognitive and personality skills. For males, the occupations selected by GED recipients (as measured by average traits of workers in the occupation) are barely different from those selected by dropouts. For females, there is a much sharper difference, especially in personality (social skills) sorting. Females generally sort into more noncognitively demanding occupations than do their male counterparts.

[80]More information on O*NET is available at `http://www.doleta.gov/reports/DESA_skill.cfm`.

[Figure 5.46 here.]

[Figure 5.47 here.]

5.6 Summary and Conclusions

This chapter summarizes and extends the previous literature on the effects of GED certification. It estimates the social and economic benefits of GED certification for numerous adult outcomes using a variety of major data sets. Consistent with the previous literature, we find that GED certification is a poor substitute for high school graduation. After accounting for differences in their preexisting ability, GED recipients are virtually identical to other dropouts on almost all of the outcomes we study.

After controlling for their higher cognitive ability, male GED recipients are nearly indistinguishable from other male dropouts with regard to labor market outcomes, including annual earnings, hourly wages, employment, and hours worked. Female GED recipients have higher annual earnings than other dropouts because they are more likely to be employed, not because they earn higher hourly wages. Our analysis shows that female GED recipients are more likely to participate in the labor force compared to other dropouts, but are not more likely to be employed if they do participate in the labor force. This finding is consistent with the interpretation that women who do not plan to work in the future have no incentive to earn a GED. Estimated effects of certification on annual earnings are primarily for women who attend college or are pregnant before dropping out. Many in this group have high levels of measured cognitive and character skills prior to dropping out of school. Even for these groups, any differences between GEDs and dropouts are largely confined to their effects on labor supply and so the interpretation of the estimated female effects is ambiguous. It may be due to a selection effect, or it may reflect a causal effect of certification. We feel that the weight of the evidence supports the interpretation of the estimated GED effect as arising primarily from a selection effect.

Many GED recipients attend a two- or four-year college, but only around 4% complete a bachelor's degree. GED recipients who obtain bachelor's degrees have annual earnings similar to those of high school graduates with bachelor's degrees, but the GED recipients earn their degrees later, which reduces the present value of their earnings by over 30%.

We find little evidence that the economic benefits to GED certification increase with work experience. GED recipients and dropouts have very similar life cycle hourly wage profiles. The GED certificate does not send a positive signal in the labor market. With the exception of labor supply for women, GED recipients perform the same in the labor market before and after they obtain a GED. For women, obtaining a GED appears to coincide with their decision to enter the labor force.

GED recipients are very similar to other high school dropouts on a variety of nonlabor market outcomes, including divorce, incarceration, health, welfare receipt, and measures of later life personality. Although some GED recipients might change their skills and motivations as part of the process of obtaining a GED, for most the deficits in skills that led GED recipients to drop out of high school appear to persist over their life cycles. These conclusions survive across many different model specifications and demographic groups.

5.7 Methodological Appendix

In making valid inferences about the effect of the GED on outcomes, it is important to control for differences in characteristics between GED recipients and other dropouts that exist prior to the certification decision. Failure to do so could produce substantially biased estimates of the effect of GED certification. It would be ideal in studying the average benefits of GED certification to be able to randomly assign dropouts to GED status and compare their outcomes to those of dropouts randomly denied the opportunity to take the exam. Random assignment would, on average, equalize preexisting differences between treatments and controls.[81] Since we do not have access to experimental data on GED certification, we are forced to use nonexperimental or "quasi-experimental" methods that adjust for preexisting differences.

Quasi-experimental methods operate in the following fashion. Denote Y as an outcome studied. For specificity, let it be earnings. Let D denote receipt ($D = 1$) or nonreceipt ($D = 0$) of a GED. A standard econometric model writes

$$Y = \alpha_0 + \alpha_1 D + U, \tag{5.1}$$

where U represents unobserved (or uncontrolled) factors that help to determine Y and that might in part also determine D. "α_1" is the causal effect of the GED. A least-squares regression of Y on D estimates the mean difference between GED recipients and dropouts ($E(Y \mid D = 1) - E(Y \mid D = 0)$), which is not necessarily the same as the causal effect of D on Y holding U fixed (α_1). The problem is that the least-squares effect of D on Y includes α_1 and any effect of U on Y that is mediated through D.[82]

A standard procedure for constructing causal estimates is to control for the biasing effect of U on D using a variety of plausible exogenous determinants of Y and D, which we denote

[81] Random assignment, however, can only answer a limited set of policy-relevant questions. See, for example, Heckman (1992), Heckman and Smith (1998), Heckman, LaLonde, and Smith (1999), and Heckman and Vytlacil (2007).

[82] See, for example, Haavelmo (1943).

by X. For example, a standard procedure is to estimate a model where $U = \alpha_2 X + V$ and V is assumed to be uncorrelated with D and X. Substituting this expression for U, we can write the model of equation (5.1) as

$$Y = \alpha_0 + \alpha_1 D + \alpha_2 X + V. \tag{5.2}$$

Under the stated conditions, controlling for X, allows analysts to identify the *ceteris paribus* causal effect of D on Y.[83] Another procedure that is available if the analyst has access to panel data is to compute the difference in earnings before and after persons obtain the GED. This approach eliminates components of U that are present before and after certification is obtained, thereby eliminating this source of bias.

5.7.1 Robust Evidence

One problem with conventional analyses is that analysts may not agree on which variables to include in X. Such choices can critically affect the estimates of α_1. There is no purely statistical criterion for selecting X, although some pretend otherwise.[84] We use economic theory and previous research in empirical economics to guide the selection of X, but it is an inherently controversial exercise.

Equation (5.2) is a version of what economists call an hedonic model. It relates the outcome measure Y to market determinants of productivity, which in this instance are D and X. If Y is income, one can interpret α_1 and α_2 as prices — rewards per unit attributes of D and X respectively.

A large and well-established literature shows the benefits for earnings of human capital investments such as schooling and post-school training (see, e.g., Mincer, 1974; Rubinstein and Weiss, 2006). There is ample evidence that measures of both cognitive and noncognitive ability affect earnings (see, e.g., Almlund, Duckworth, Heckman, and Kautz, 2011; Borghans,

[83] The method of matching is a nonparametric version of this procedure. See Heckman (2008).
[84] Using all of the available X can produce substantial bias. See Heckman and Navarro (2004).

Duckworth, Heckman, and ter Weel, 2008; Heckman and Kautz, 2012).

In order to minimize any controversy surrounding the adjustments employed in the analysis of this chapter, we use a variety of samples and standard measures of productivity and motivation to adjust for preexisting differences among persons that should not be attributed to the GED. We also use a variety of econometric methods to adjust for differences among the different educational groups in their backgrounds. We avoid relying on any particular methodology or data set to shape our conclusions. We place our estimates in the context of the received literature.[85,86]

5.7.2 Avoiding Pretesting Bias

In the text and in the Web Appendix, we summarize literally thousands of estimates of GED effects using multiple data sets with a variety of specifications. In reporting statistically significant "effects" from any particular empirical specification, one must address the problem that arises from "fishing" the data, that is, searching among alternative models (with different X and different functional forms) to find a set of "statistically significant" outcomes. This is a standard practice in social science that is used in many of the studies reviewed in the Web Appendix.[87]

Even though many models are fit, the standard errors and significance levels of coefficients

[85]This methodology is used in all careful empirical research in economics. Nobel Laureates Simon Kuznets and his student, Robert Fogel, both preached and practiced this approach. See Fogel (1987).

[86]An additional problem that plagues any study of wages and hours worked is that analysts can only measure wages for working persons. See Heckman (2001). Prisoners do not report wages, nor do persons who choose not to work. The measured wages of workers may or may not overstate the potential wages of all persons of a given educational category. This gives rise to *selection bias*, a pervasive problem in the analysis of social science data. Those who work are likely to be those who have good wage offers from the market. Selection can also work the other way. For example, evidence presented in Heckman (1980), and, recently reconfirmed in Mulligan and Rubinstein (2008), shows that for educated women, it is more likely that high-wage women stay at home to raise their kids. Such selection reduces the level of the measured wages of female workers. But how this effect operates in distorting comparisons of the wages of GED recipients and dropouts is far from obvious, since there is selective nonparticipation in both educational categories. Low-wage men are more likely to be incarcerated, for example. Such selection inflates the measured wages of all men compared to what would be observed if it were possible to obtain market wages for the incarcerated, but how it affects the difference in measured wages between GED recipients and dropouts is far from obvious. Such selection problems also plague experiments. We use a variety of methods to correct for this fundamental problem in an effort to produce a robust analysis.

[87]See Web Appendix Section W5.2.

typically reported ignore the messy process that leads to their selection. Few studies conduct extensive sensitivity studies that examine how variations in sets of adjustment variables and specifications affect the reported outcomes and whether reported estimates hold up in other data sets. Choosing one model from a candidate set of models and ignoring the consequences of the search process that leads to the final choice of a model spuriously distorts true p-values and produces biased estimates (see Bancroft, 1944; Judge and Bock, 1978).

In truth, a lot of fishing goes on in most studies in empirical social science. Reported p-values are substantially downward biased. No simple procedure is available for addressing this problem since most analysts do not tabulate all of the preliminary models that are estimated prior to reporting a final specification. The standard errors and p-values assume that the reported model is the first and only empirical model that is estimated. We address this problem by estimating a large collection of possible models reporting the distributions of a variety of fitted models.

5.7.3 Direct and Indirect Effects

We estimate both direct and indirect effects of GED certification. The direct effect is the effect on an outcome of attaining a GED and stopping there. The indirect effect is the effect that arises from the options created by GED certification. It arises from two components that are multiplied to produce the indirect effect: (a) the effect if GED certification on attaining any subsequent education and (b) the effect of that education on the outcome studied above and beyond the direct effect. In principle we could compute indirect effects for a variety of post-GED educational decisions. Practical considerations force us to lump all post-GED educational decisions into one category.

More precisely,

Let $D_1 = 1$ if a person gets a GED,

$= 0$ otherwise.

Let $D_2 = 1$ if a person who gets a GED goes on to a higher level of schooling,

$= 0$ otherwise.

Let p_{GED} be the probability of getting some education beyond the GED. Keeping the other covariates implicit, write

$$Y = \beta_0 + \beta_1 D_1 + \beta_2 D_1 D_2 + V.$$

β_1 is the direct effect of the GED. It is what agents would receive if they stopped their education at the GED. β_2 is the effect of attaining further education on earnings above and beyond the direct effect. Assuming that V is uncorrelated with D_1 and $D_1 D_2$, and $E(V) = 0$,

$$\begin{aligned} E(Y|D_1 = 1) &= \beta_0 + \beta_1 + \beta_2 E(D_2|D_1 = 1) \\ &= \beta_1 + (p_{GED} \times \beta_2), \\ E(Y|D_1 = 0) &= \beta_0, \end{aligned}$$

The total effect of the GED $E(Y|D_1 = 1) = E(Y|D_1 = 0) = \beta_1 + (p_{GED} \times \beta_2)$ is broken down to the direct effect β_1 and the value of further education multiplied by the probability of attaining further levels of education $(p_{GED} \times \beta_2)$.

$$\text{Total effect} = \underbrace{\beta_1}_{\text{direct effect}} + \underbrace{(p_{GED} \times \beta_2)}_{\text{indirect effect}}. \tag{5.3}$$

Indirect effects are a substantial component of any estimated GED effect.

Bibliography

Almlund, Mathilde, Duckworth, Angela, Heckman, James J., and Kautz, Tim. 2011. "Personality Psychology and Economics." In *Handbook of the Economics of Education*, edited by E. A. Hanushek, S. Machin, and L. Wößmann, vol. 4, 1–181, Amsterdam: Elsevier.

Autor, David H. and Duggan, Mark G. 2003. "The Rise in the Disability Rolls and the Decline in Unemployment." *Quarterly Journal of Economics* 118(1):157–206.

Bancroft, T. A. 1944. "On Biases in Estimation Due to the Use of Preliminary Tests of Significance." *The Annals of Mathematical Statistics* 15(2):190–204.

Becker, Gary Stanley. 1964. *Human Capital: A Theoretical and Empirical Analysis, With Special Reference to Education*. New York: National Bureau of Economic Research.

Belfield, Clive R. and Bailey, Thomas. 2011. "The Benefits of Attending Community College: A Review of the Evidence." *Community College Review* 39(1):46–68.

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

Borghans, Lex, Duckworth, Angela L., Heckman, James J., and ter Weel, Bas. 2008. "The Economics and Psychology of Personality Traits." *Journal of Human Resources* 43(4):972–1059.

Boudett, Katheryn Parker, Murnane, Richard J., and Willett, John B. 2000. ""Second-Chance" Strategies for Women Who Drop Out of School." *Monthly Labor Review* 123(12):19–32.

Cameron, Stephen and Heckman, James J. 1994. "Determinants of Young Males' Schooling and Training Choices." In *Training and the Private Sector: International Comparisons*, edited by Lisa M. Lynch, chap. 7, 201–232, Chicago: University of Chicago Press.

Cameron, Stephen V. 1996. "Three Essays on the Economics of Education." Ph.D. thesis, University of Chicago.

Cameron, Stephen V. and Heckman, James J. 1993. "The Nonequivalence of High School Equivalents." *Journal of Labor Economics* 11(1, Part 1):1–47.

Cameron, Stephen V. and Heckman, James J. 2001. "The Dynamics of Educational Attainment for Black, Hispanic, and White Males." *Journal of Political Economy* 109(3):455–499.

Cao, Jian, Stromsdorfer, Ernst W., and Weeks, Gregory. 1996. "The Human Capital Effect of General Education Development Certificates on Low Income Women." *Journal of Human Resources* 31(1):206–228.

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

Clark, Melissa A. and Jaeger, David A. 2006. "Natives, the Foreign-Born, and High School Equivalents: New Evidence on the Returns to the GED." *Journal of Population Economics* 19(4):769–793.

Fogel, Robert. 1987. "Some Notes on the Scientific Methods of Simon Kuznets." Working Paper 2461, NBER.

Haavelmo, Trygve. 1943. "The Statistical Implications of a System of Simultaneous Equations." *Econometrica* 11(1):1–12.

Heckman, James J. 1980. "Sample Selection Bias as a Specification Error with an Application to the Estimation of Labor Supply Functions." In *Female Labor Supply: Theory and Estimation*, edited by James P. Smith and John F. Cogan, 206–248, Princeton University Press.

Heckman, James J. 1987. "Selection Bias and Self-Selection." In *The New Palgrave: A Dictionary of Economics*, edited by John Eatwell, Murray Milgate, and Peter Newman, 287–297, London: Palgrave Macmillan Press.

Heckman, James J. 1992. "Randomization and Social Policy Evaluation." In *Evaluating Welfare and Training Programs*, edited by C. Manski and I. Garfinkel, 201–230, Cambridge, MA: Harvard University Press.

Heckman, James J. 2001. "Micro Data, Heterogeneity, and the Evaluation of Public Policy: Nobel Lecture." *Journal of Political Economy* 109(4):673–748.

Heckman, James J. 2008. "The Principles Underlying Evaluation Estimators with an Application to Matching." *Annales d'Economie et de Statistiques* 91–92:9–73.

Heckman, James J., Humphries, John Eric, and Mader, Nicholas. 2011. "The GED." In *Handbook of the Economics of Education*, edited by Eric A. Hanushek, Stephen Machin, and Ludger Wößmann, vol. 3, chap. 9, 423–484, Amsterdam: North Holland, Elsevier.

Heckman, James J., Humphries, John Eric, Urzúa, Sergio, and Veramendi, Gregory. 2011. "The Effects of Educational Choices on Labor Market, Health, and Social Outcomes." Unpublished manuscript, University of Chicago, Department of Economics.

Heckman, James J. and Kautz, Tim. 2012. "Hard Evidence on Soft Skills." *Labour Economics* 19(4):451–464. Adam Smith Lecture.

Heckman, James J. and LaFontaine, Paul A. 2006. "Bias Corrected Estimates of GED Returns." *Journal of Labor Economics* 24(3):661–700.

Heckman, James J., LaLonde, Robert J., and Smith, Jeffrey A. 1999. "The Economics and Econometrics of Active Labor Market Programs." In *Handbook of Labor Economics*, edited by Orley Ashenfelter and David Card, vol. 3A, chap. 31, 1865–2097, New York: North-Holland.

Heckman, James J., Lochner, Lance J., and Cossa, Ricardo. 2003. "Learning-by-Doing versus On-the-Job Training: Using Variation Induced by the EITC to Distinguish between Models of Skill Formation." In *Designing Social Inclusion: Tools to Raise Low-End Pay and Employment in Private Enterprise*, edited by Edmund S. Phelps, Cambridge: Cambridge University Press.

Heckman, James J. and Navarro, Salvador. 2004. "Using Matching, Instrumental Variables, and Control Functions to Estimate Economic Choice Models." *Review of Economics and Statistics* 86(1):30–57.

Heckman, James J. and Rubinstein, Yona. 2001. "The Importance of Noncognitive Skills: Lessons from the GED Testing Program." *American Economic Review* 91(2):145–149.

Heckman, James J. and Smith, Jeffrey A. 1998. "The Sensitivity of Nonexperimental Evaluation Estimators: A Simulation Study." Unpublished working paper, University of Chicago, Department of Economics.

Heckman, James J. and Vytlacil, Edward J. 2007. "Econometric Evaluation of Social Programs, Part II: Using the Marginal Treatment Effect to Organize Alternative Economic Estimators to Evaluate Social Programs and to Forecast Their Effects in New Environments." In *Handbook of Econometrics*, edited by J. Heckman and E. Leamer, vol. 6B, chap. 71, 4875–5143, Amsterdam: Elsevier.

Jepsen, Christopher, Mueser, Peter, and Troske, Kenneth. 2011. "Labor Market Returns to the GED Using Regression Discontinuity Analysis." Working Paper 1014, Department of Economics, University of Missouri.

Judge, George G. and Bock, M.E. 1978. *The statistical implications of pre-test and Stein-rule estimators in econometrics*, vol. 25. Amsterdam: North-Holland.

Killingsworth, Mark R. 1983. *Labor Supply*. Cambridge: Cambridge University Press.

Means, B. and Laurence, Janice H. 1984. "Characteristics and Performance of Recruits Enlisted with General Educational Development (GED) Credentials." Tech. Rep. FR-PRD-84-6, Human Resources Research Organization, Alexandria, VA.

Mincer, Jacob. 1962. "On-the-Job Training: Costs, Returns, and Some Implications." *Journal of Political Economy* 70(5, Part 2: Investment in Human Beings):50–79.

Mincer, Jacob. 1974. *Schooling, Experience and Earnings*. New York: Columbia University Press for National Bureau of Economic Research.

Mulligan, Casey B. and Rubinstein, Yona. 2008. "Selection, Investment, and Women's Relative Wages Over Time." *Quarterly Journal of Economics* 123(3):1061–1110.

Murnane, Richard J., Willett, John B., and Boudett, Kathryn Parker. 1995. "Do High School Dropouts Benefit from Obtaining a GED?" *Educational Evaluation and Policy Analysis* 17(2):133–147.

Murnane, Richard J., Willett, John B., and Boudett, Kathryn Parker. 1997. "Does a GED lead to more training, post-secondary education, and military service for school dropouts?" *Industrial and Labor Relations Review* 51(1):100–116.

Murnane, Richard J., Willett, John B., and Boudett, Kathryn Parker. 1999. "Do Male Dropouts Benefit from Obtaining a GED, Postsecondary Education, and Training?" *Evaluation Review* 23(5):475–502.

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

Pearlin, Leonard I., Menaghan, Elizabeth G., Lieberman, Morton A., and Mullan, Joseph T. 1981. "The Stress Process." *Journal of Health and Social Behavior* 22(4):337–356.

Rosenberg, Morris. 1965. *Society and the Adolescent Self-Image*. Princeton, NJ: Princeton University Press.

Rubinstein, Yona and Weiss, Yoram. 2006. "Post Schooling Wage Growth: Investment, Search and Learning." In *Handbook of the Economics of Education*, edited by Eric Hanushek and Finis Welch, *Handbooks in Economics*, vol. 1, chap. 1, 1–67, Amsterdam: North-Holland.

Smith, James P. and Cogan, John F. 1980. *Female labor supply: theory and estimation*. Princeton, N.J.: Princeton University Press.

Social Security Administration. 2012. "DI 25001.001 Medical-Vocational Quick Reference Guide." Last accessed from `https://secure.ssa.gov/poms.nsf/lnx/0425001001` February 4, 2013.

Social Security Administration. 2013. "Evaluation Considering Age, Education, and Work Experience." In *Social Security Handbook*, chap. 609, Washington, DC: Social Security Administration.

Spence, A. Michael. 1974. *Market Signalling: The Informational Structure of Job Markets and Related Phenomena*. Cambridge, MA: Harvard University Press.

Taubman, Paul. 1977. *Kinometrics: Determinants of Socioeconomic Success Within and Between Families*. New York: North-Holland Publishing Company.

Tyler, John H., Murnane, Richard J., and Willett, John B. 2000. "Estimating the Labor Market Signaling Value of the GED." *Quarterly Journal of Economics* 115(2):431–468.

Tyler, John H., Murnane, Richard J., and Willett, John B. 2003. "Who benefits from a

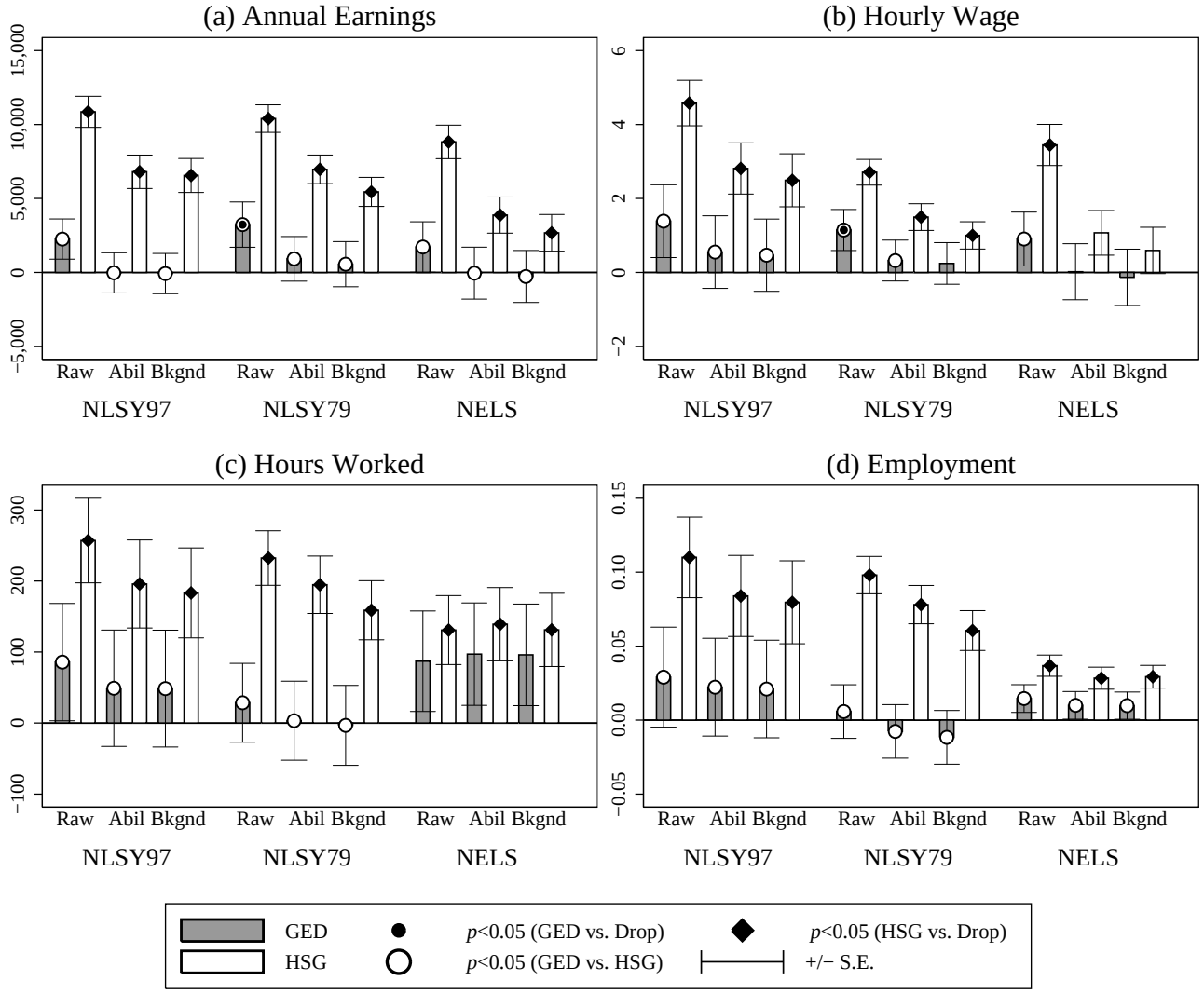
GED? Evidence for females from High School and Beyond." *Economics of Education Review* 22(3):237–247.

Tyler, John H. Tyler and Kling, Jeffrey R. 2006. "Prison-Based Education and Re-Entry into the Mainstream Labor Market." NBER Working Paper 12114.

Zgoba, K., Haugebrook, S., and Jenkins, K. 2008. "The Influence of GED Obtainment on Inmate Release Outcome." *Criminal Justice and Behavior: An International Journal* 35(3):375–387.

Zhang, Jizhi, Guison-Dowdy, Anne, Patterson, Margaret Becker, and Song, Wei. 2011. "Crossing the Bridge: GED Credentials and Postsecondary Educational Outcomes." Year two report, GED Testing Services.

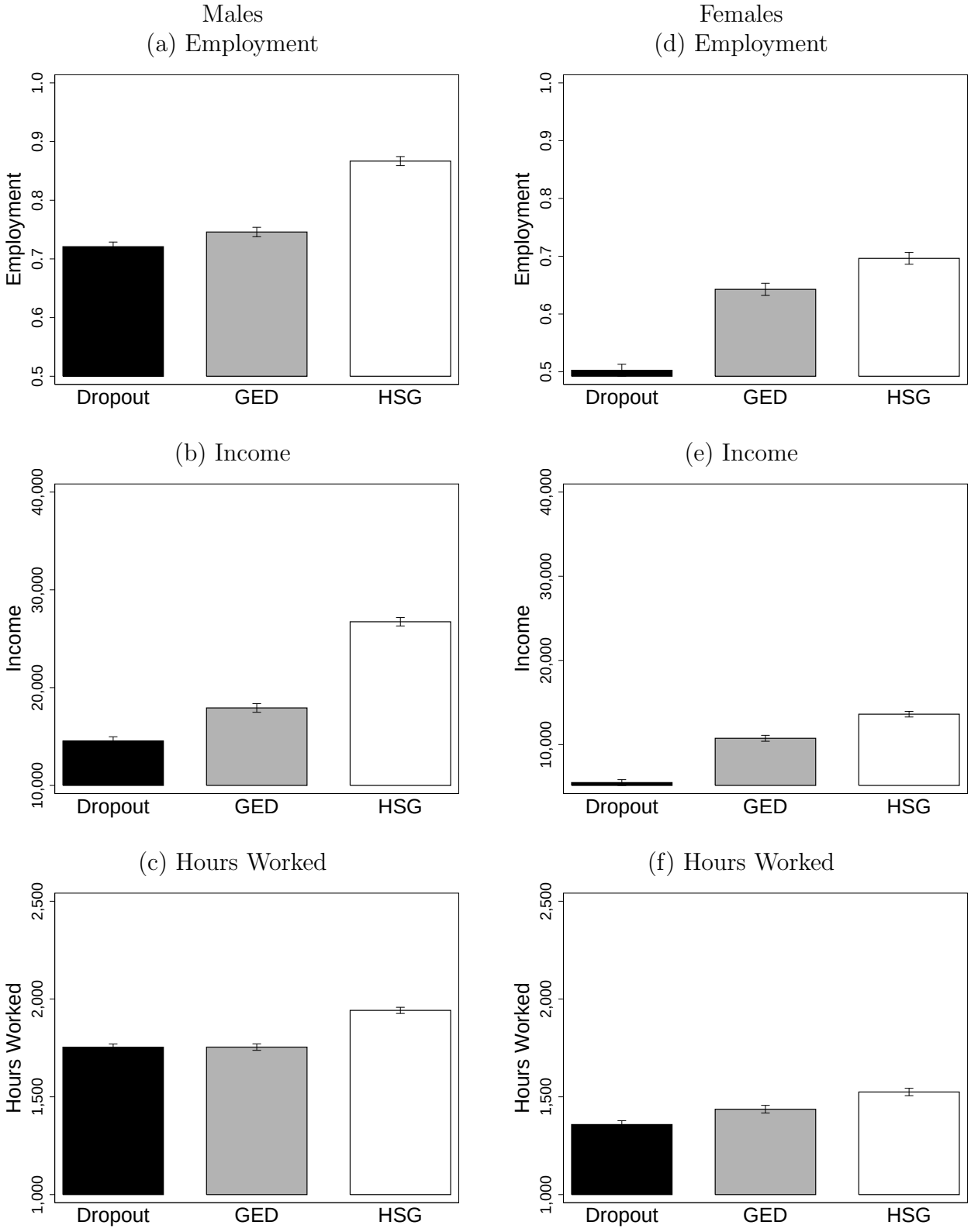
Figure 5.3 Labor Market Differences, Ages 23 to 27, across Data Sets (Males, All Levels of Postsecondary Education)



Sources: National Longitudinal Survey of Youth, 1979; National Longitudinal Survey of Youth, 1997; National Educational Longitudinal Survey, 1988.

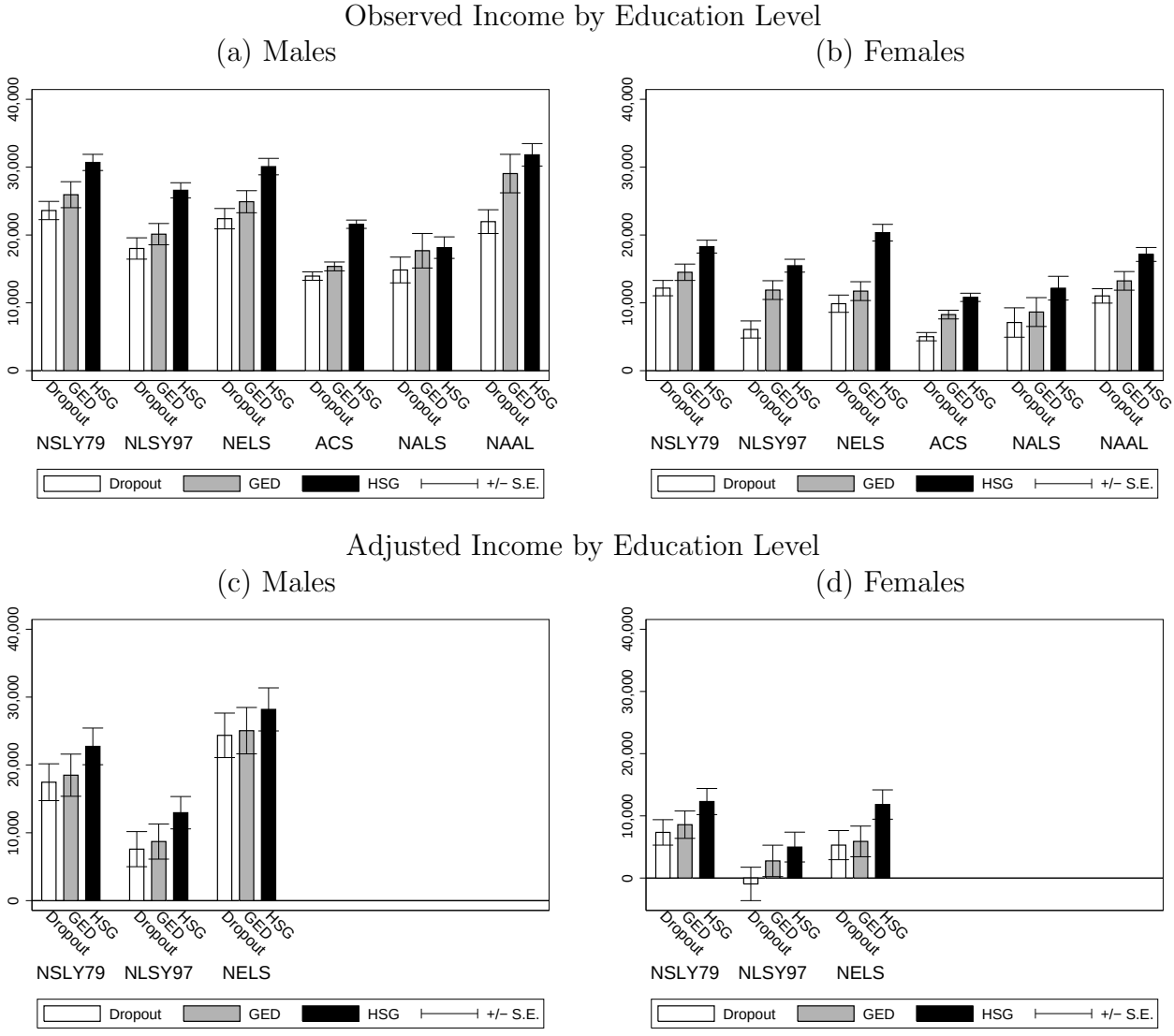
Notes: All NLSY79 and NLSY97 results are for individuals age 23 to 27. In NELS, individuals are age 24 to 27. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. "Raw" Controls: NLSY97—age, region of residence, year, and race; NELS—age, region of residence, and race; NLSY79—age, region of residence, year, and race. "Abil" Controls: NLSY97—raw controls and AFQT adjusted for schooling at time of test; NLSY79—raw controls and AFQT adjusted for schooling at time of test; NELS—raw controls and 8th grade subject test scores in reading, history, math, and science. "Bkgnd" Controls: NLSY97—ability controls, broken home status at age 6, family income in 1997, mother's highest grade completed, and urban residence; NLSY79—ability controls, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior; NELS— ability controls, 8th grade family socioeconomic status, urban residence in 8th grade, broken home in 8th grade, hybrid home in 8th grade, if the mother had a high school diploma, and if the mother had a college degree. Regressions exclude those who report earning more than $300,000 (2005$), working more than 4,000 hours, or earning hourly wages less than $3 (2005$) or more than $200 (2005$). For more information, please see Table W5.1.9 of the Web Appendix.

Figure 5.1 Unadjusted Differences in Economic Outcomes—Males and Females, Age 25 to 55



Source: American Community Survey, 2009.
Notes: Sample restricted to people age 25 to 55. Income includes nonworkers. Hours worked excludes nonworkers. Employment includes people both in and out of the labor force. Outcomes are adjusted by age, region, and race dummies. Error bars show one standard error. Tests of equality across groups strongly reject the hypothesis for all means (except those for the hours worked of male dropouts and GED recipients) at p-values below the 1% level. See Tables W5.1.3 and W5.1.4 in Web Appendix Section W5.1.2.

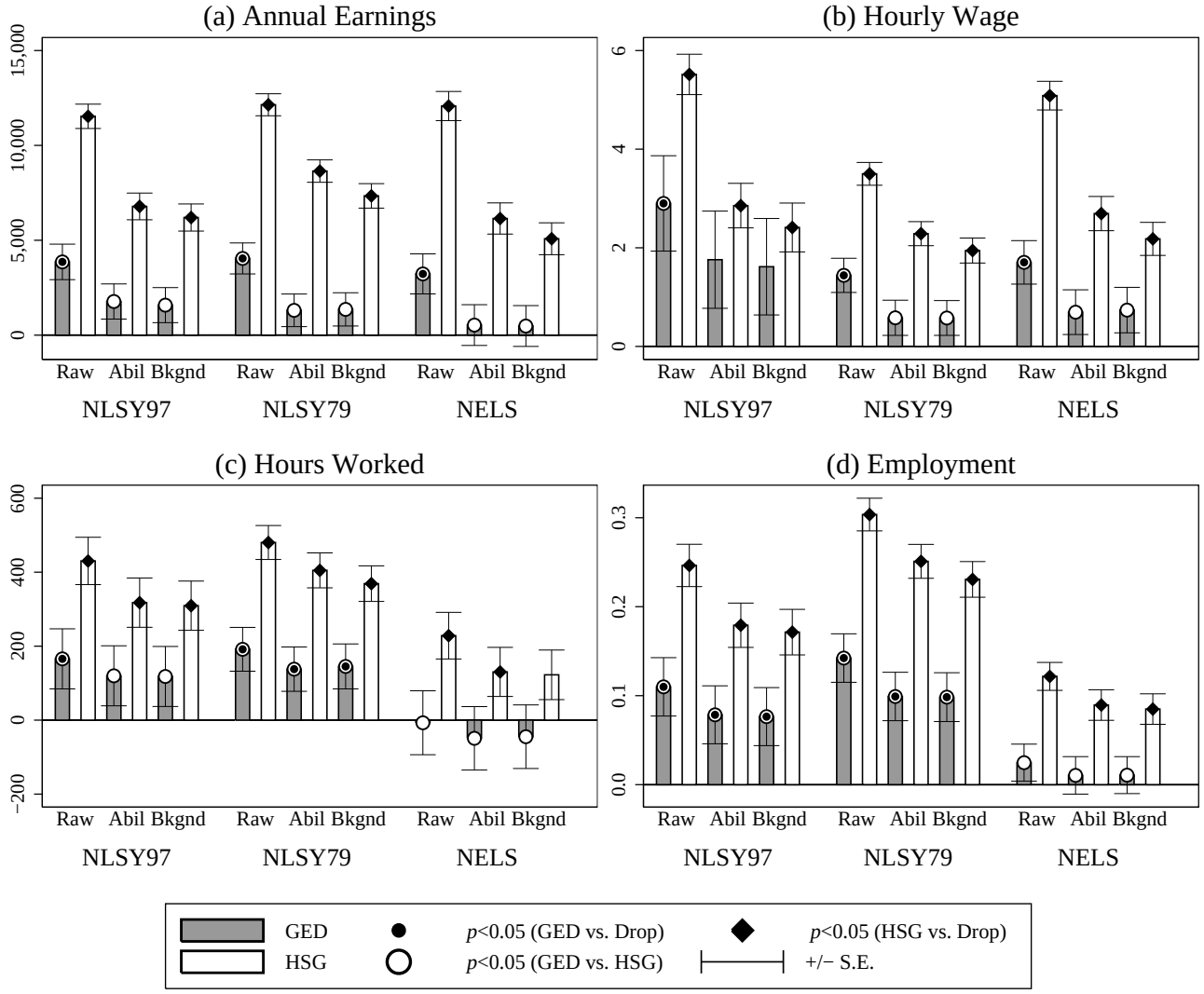
Figure 5.2 Raw and Ability-Adjusted Income—Males and Females, Age 23 to 27



Sources: National Longitudinal Survey of Youth, 1979; National Longitudinal Survey of Youth, 1997; National Educational Longitudinal Survey, 1988; American Community Survey, 2009; National Adult Literacy Survey, 1992; National Assessment of Adult Literacy, 2003.

Notes: Raw income is adjusted for region or state of residence and age and includes nonworkers. Adjusted income adjusts for schooling-adjusted AFQT scores, mother's education, and family income in 1979 or 1997 in the NLSY79 and NLSY97 and 8th grade reading and math scores, mother's education, and family income in 8th grade in NELS. Error bars show one standard error. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. All individuals are between the ages of 23 and 27. In NELS individuals are age 24 to 27, and in NAAL individuals are age 24 to 39 due to data limitations. Tests of equality between means for the unadjusted income levels are reported in Web Appendix W5.1.2. High school graduates tend to be statistically significantly different from GED recipients in the raw and adjusted regressions. We fail to reject equality of GED recipients and dropouts for males, and after adjusting for ability and background fail to reject equality even more strongly. For females, the difference between GED recipients and dropouts is statistically significant, but becomes insignificant after adjusting for ability and background. Adjustments are made for ability, mother's education, and family income before dropping out.

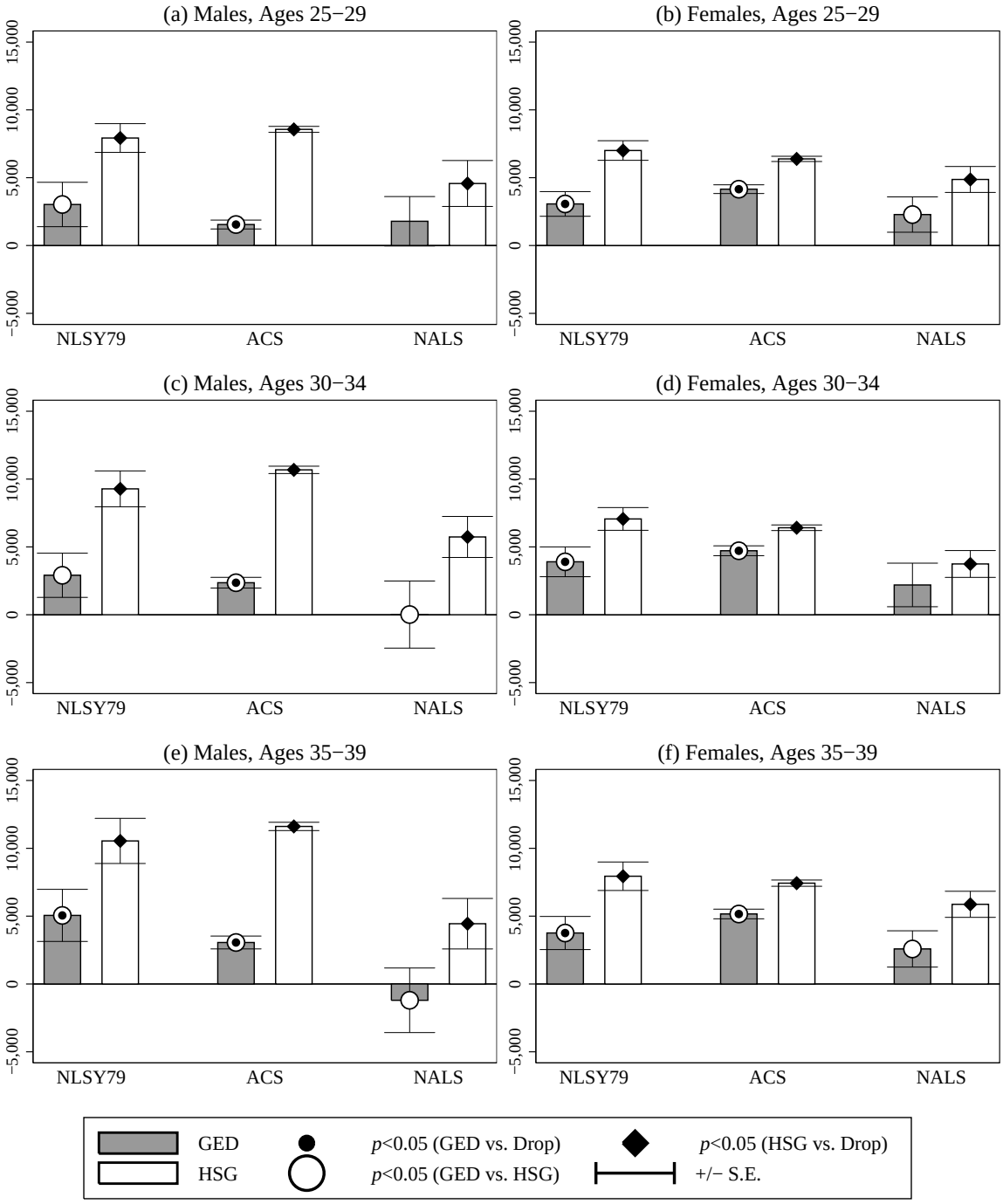
Figure 5.4 Labor Market Differences, Ages 23 to 27, across Data Sets (Females, All Levels of Postsecondary Education)



Sources: National Longitudinal Survey of Youth, 1979; National Longitudinal Survey of Youth, 1997; National Educational Longitudinal Survey, 1988.

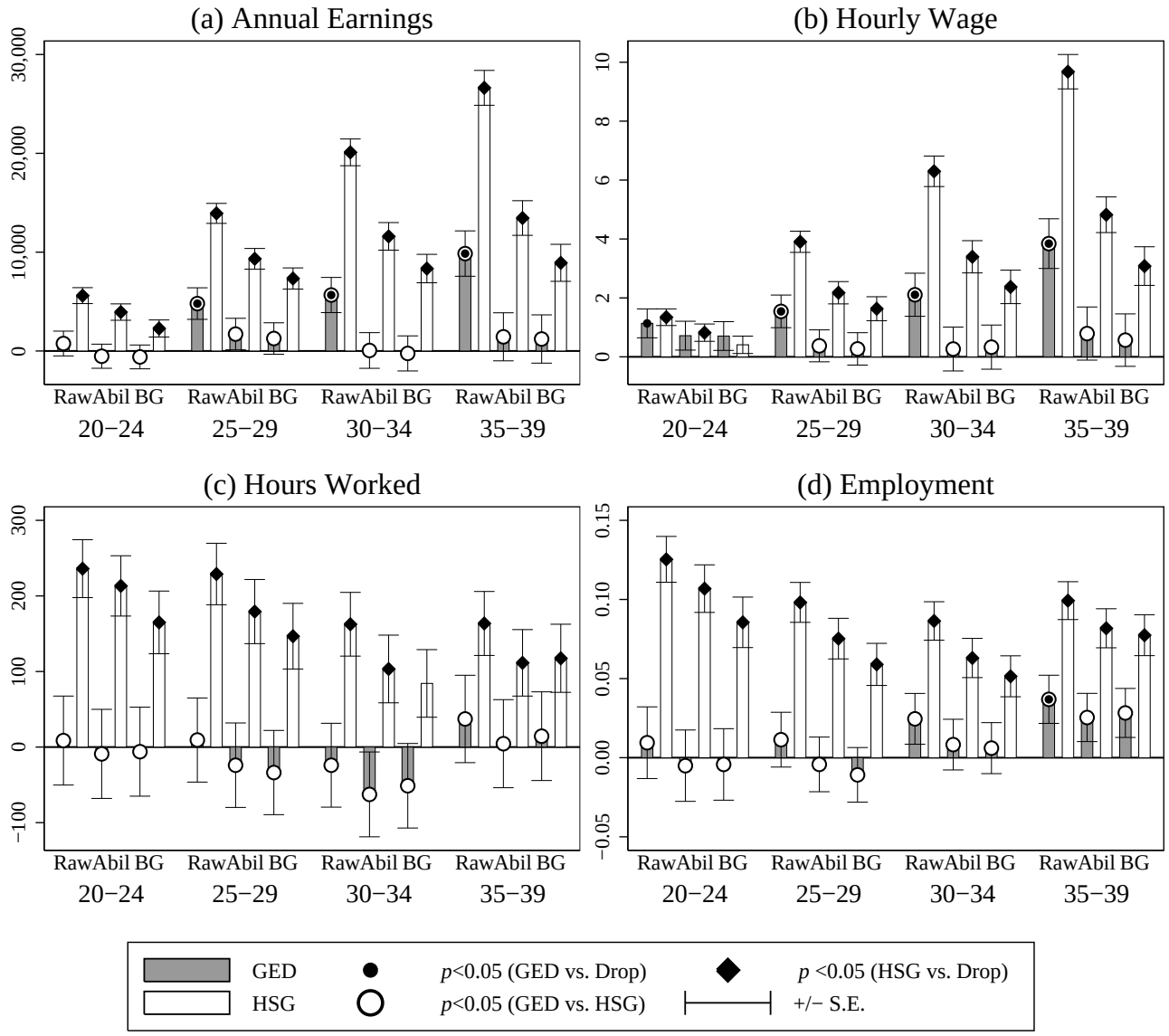
Notes: All NLSY79 and NLSY97 results are for individuals age 23 to 27. In NELS, individuals are age 24 to 27. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. "Raw" Controls: NLSY97—age, region of residence, year, and race; NELS—age, region of residence, and race; NLSY79—age, region of residence, year, and race. "Abil" Controls: NLSY97—raw controls and AFQT adjusted for schooling at time of test; NLSY79—raw controls and AFQT adjusted for schooling at time of test; NELS—raw controls and 8th grade subject test scores in reading, history, math, and science. "Bkgnd" Controls: NLSY97—ability controls, broken home status at age 6, family income in 1997, mother's highest grade completed, and urban residence; NLSY79—ability controls, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior; NELS— ability controls, 8th grade family socioeconomic status, urban residence in 8th grade, broken home in 8th grade, hybrid home in 8th grade, if the mother had a high school diploma, and if the mother had a college degree. Regressions exclude those who report earning more than $300,000 (2005$), working more than 4,000 hours, or earning hourly wages less than $3 (2005$) or more than $200 (2005$). For more information, please see Table W5.1.10 of the Web Appendix.

Figure 5.5 Annual Income Differences, Across Data Sets, No College



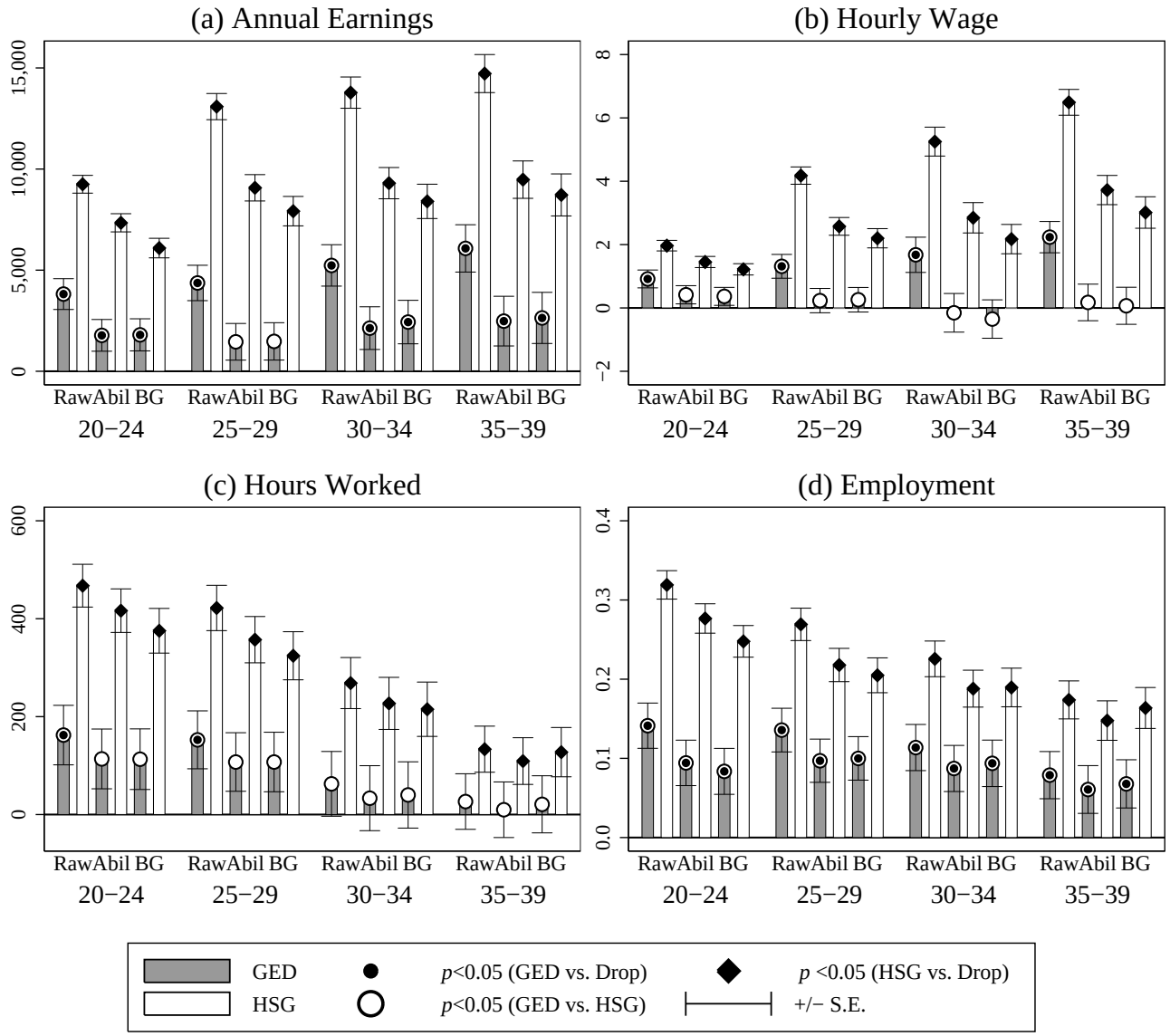
Sources: National Longitudinal Survey of Youth, 1979; American Community Survey Data, 2009; National Adult Literacy Survey, 1992.
Sample: Sample is restricted to those with no college. *Controls:* Estimates are adjusted for the age, race, and region or state of residence. Regressions exclude those reporting earning more than $300,000. For more information, please see Table W5.3.1 of the Web Appendix.

Figure 5.6 Labor Market Differences, Ages 20–39 (Males, All Levels of Postsecondary Education)



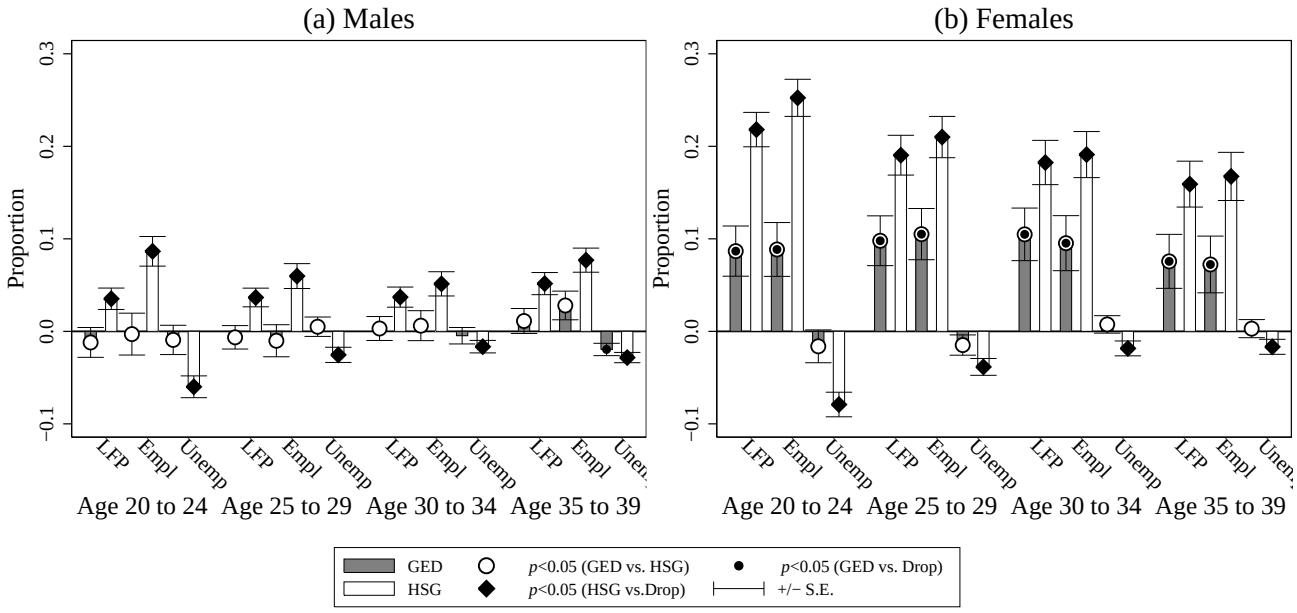
Source: National Longitudinal Survey of Youth, 1979.
Controls: "Raw"—age, region of residence, year, and race; "Abil"—raw controls and AFQT adjusted for schooling at time of test; "BG"—ability controls, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior. Regressions exclude those who report earning more than $300,000 (2005$), working more than 4,000 hours, or earning hourly wages less than $3 (2005$) or more than $200 (2005$).
Notes: All regressions allow for clustered standard errors at the individual level. For more information, please see Table W5.3.2 of the Web Appendix.

Figure 5.7 Labor Market Differences, Ages 20–39 (Females, All Levels of Postsecondary Education)



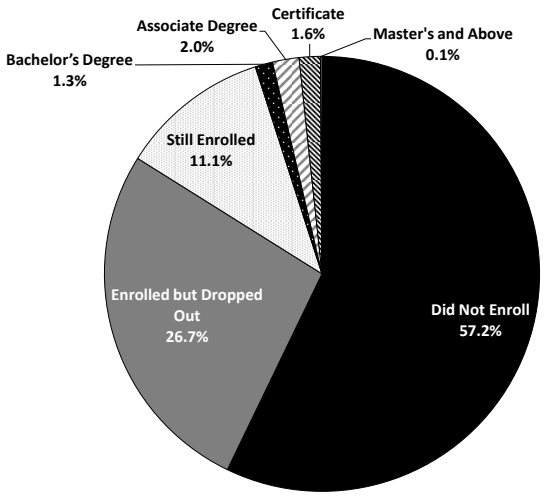
Source: National Longitudinal Survey of Youth, 1979.
Controls: "Raw"—age, region of residence, year, and race; "Abil"—raw controls and AFQT adjusted for schooling at time of test; "BG"—ability controls, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior. Regressions exclude those who report earning more than $300,000 (2005$), working more than 4,000 hours, or earning hourly wages less than $3 (2005$) or more than $200 (2005$).
Notes: All regressions allow for clustered standard errors at the individual level. For more information, please see Table W5.3.3 of the Web Appendix.

Figure 5.8 Ability- and Background-Adjusted Employment and Labor Force Participation (All Races, All Levels of Postsecondary Education)



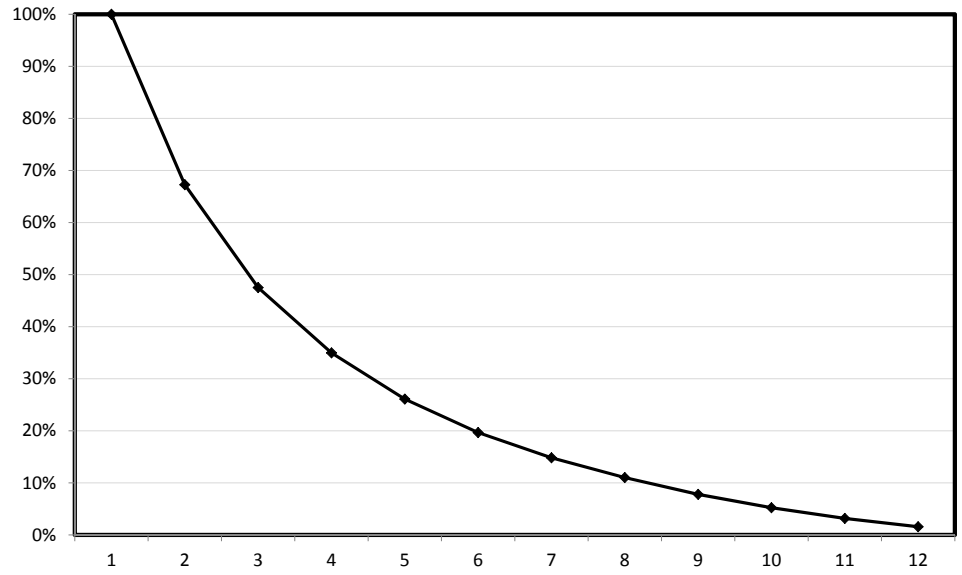
Sources: National Longitudinal Survey of Youth, 1979, Nationally Representative Sample.
Controls: Age, region of residence, year, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior.
Notes: Respondents are classified as GED recipients if they earn a GED before the age of 40. LFP, Empl, and Unemp signify the labor force participation rate, employment, and unemployment (conditional on labor force participation). All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. For more information, please see Table W5.3.4 of the Web Appendix.

Figure 5.9 Postgraduate Status of GED Passers in 2004, as of October 2010



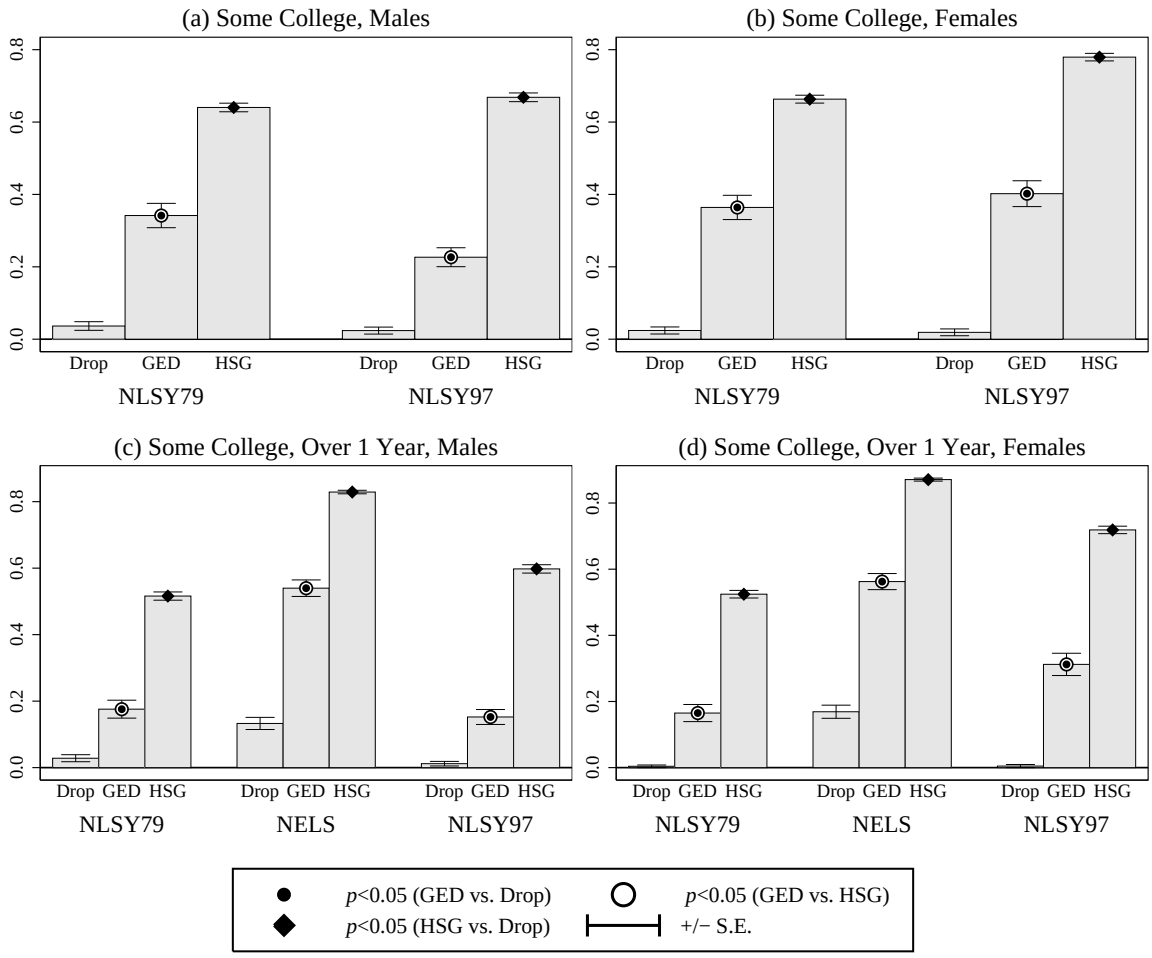
Source: Zhang, Guison-Dowdy, Patterson, and Song (2011).
Notes: Total number of 2004 cohort of GED passers who enrolled in postsecondary education between 2004 and 2010 was 175,382. The results presented in the graph exclude the type of degree earned for 5,146 individuals due to missing information.

Figure 5.10 Survival Rates of Enrollment in Postsecondary Education by Total Number of Semesters, 2004 Cohort of GED Tests Passers, as of October 2010



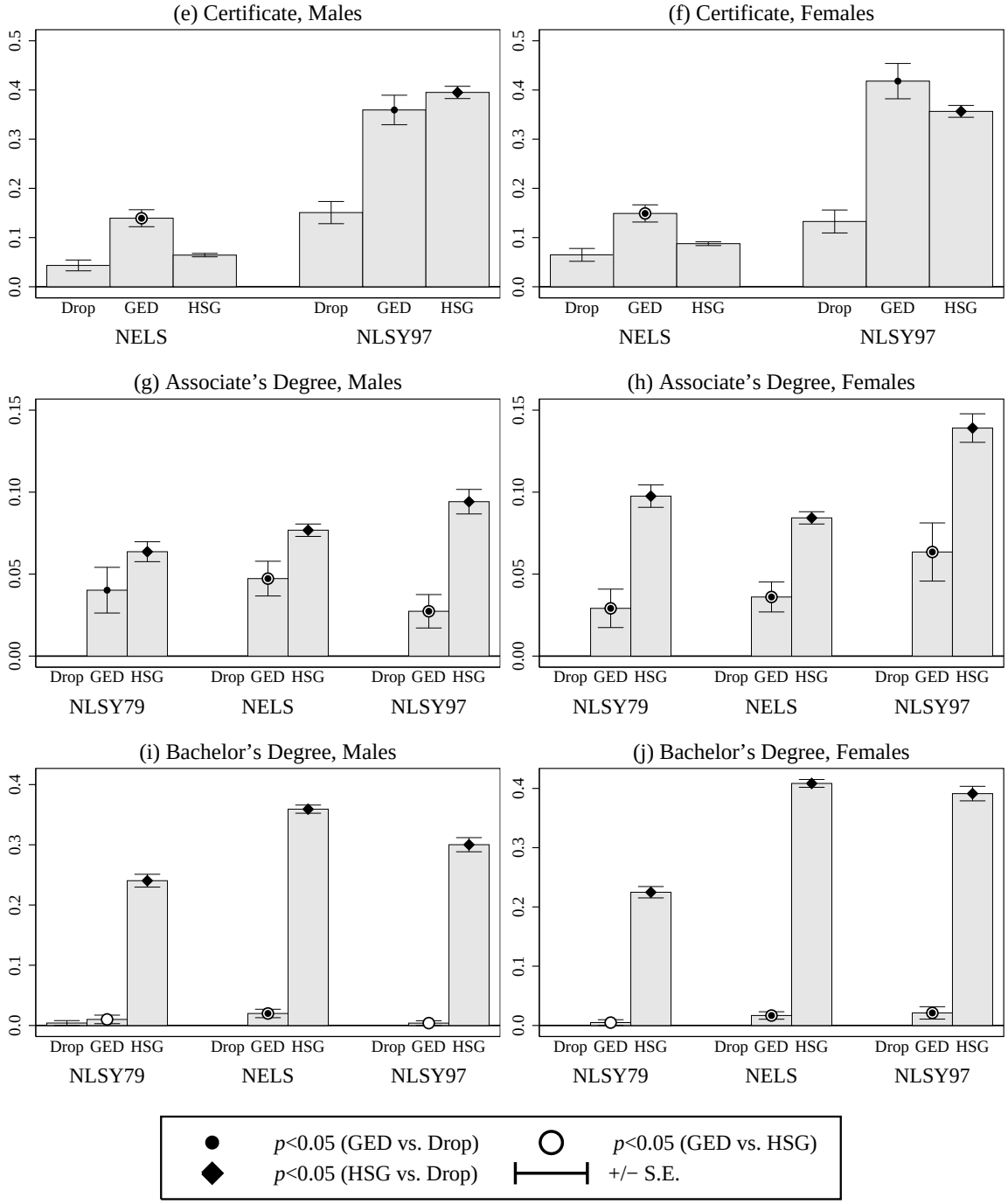
Source Zhang, Guison-Dowdy, Patterson, and Song (2011).
Notes: Total number of 2004 cohort of GED passers who enrolled in postsecondary education between 2004 and 2010 was 175,382. 13,646 individuals were excluded from the graph due to missing data. The survival rate represents the proportion of GED test passers who enrolled into postsecondary education for a given number of semesters. The survival rate changes with changes in both graduation and dropout rates.

Figure 5.11 Postsecondary Educational Attainment across Education Groups through Age 27, All Races



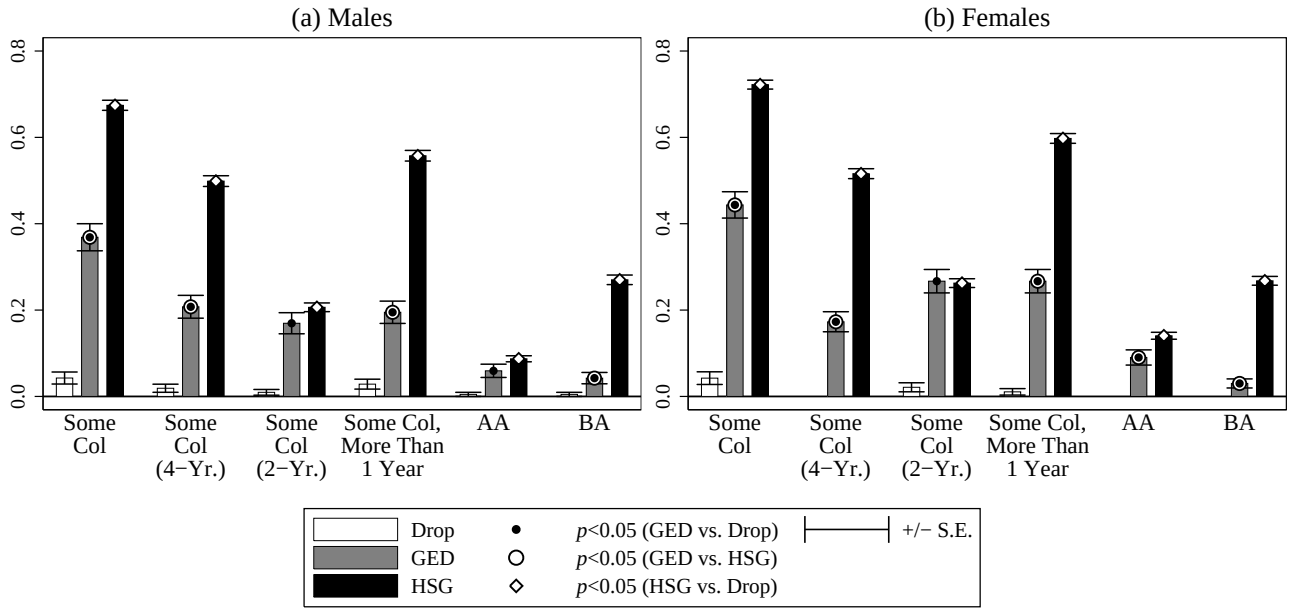
Sources: National Longitudinal Survey of Youth, 1979; National Longitudinal Survey of Youth, 1997; National Education Longitudinal Study.
Notes: The graph represents postsecondary educational attainment of dropouts, GED recipients, and high school graduates. *Variable Definitions:* "Some College" represents people who entered any postsecondary institution ever. "Some College, Over 1 Year" represents people who completed at least a year of some postsecondary education ever. For more information, please see Table W5.3.5 of the Web Appendix.

Figure 5.12 Postsecondary Educational Attainment across Education Groups through Age 27, All Races



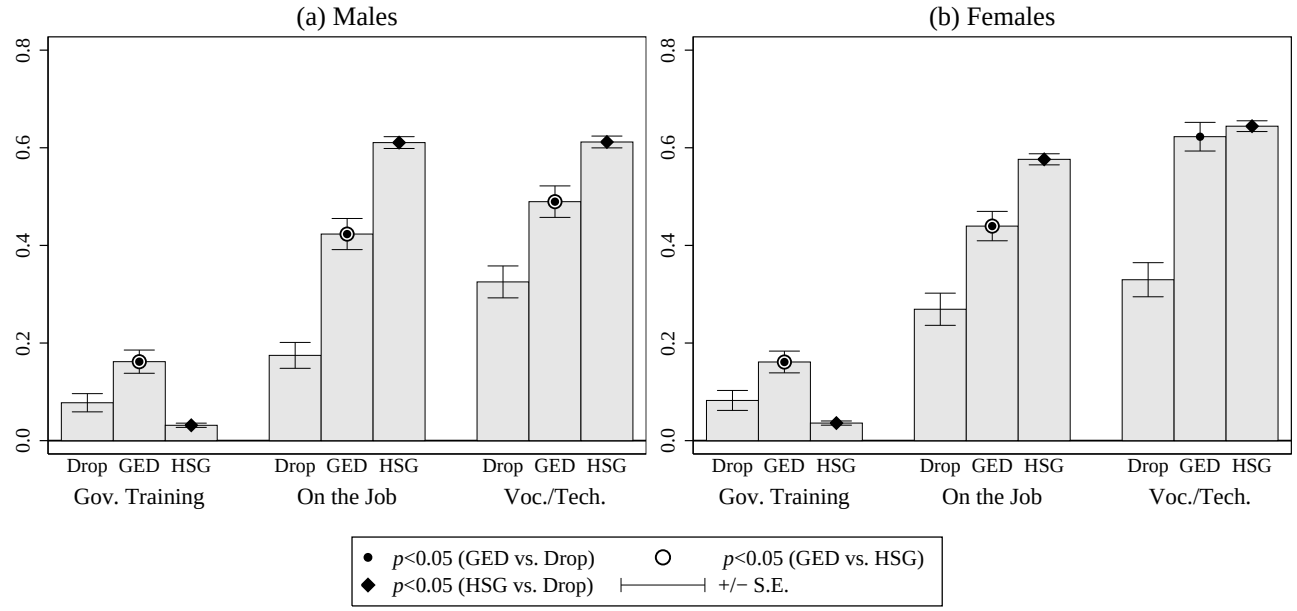
Sources: National Longitudinal Survey of Youth, 1979; National Longitudinal Survey of Youth, 1997; National Education Longitudinal Study.
Notes: The graph represents postsecondary educational attainment of dropouts, GED recipients, and high school graduates. *Variable Definitions:* "Certificate" represents people who obtained any certificate or license ever. "Associate's Degree" represents people who obtained associate's degrees ever. "Bachelor's Degree" represents people who obtained bachelor's degrees ever. "Bachelor's Degree" also includes people with higher education: master's, Ph.D., and professional degrees. For more information, please see Table W5.3.6 of the Web Appendix.

Figure 5.13 Postsecondary Educational Attainment across Education Groups through Age 40 (NLSY79), All Races



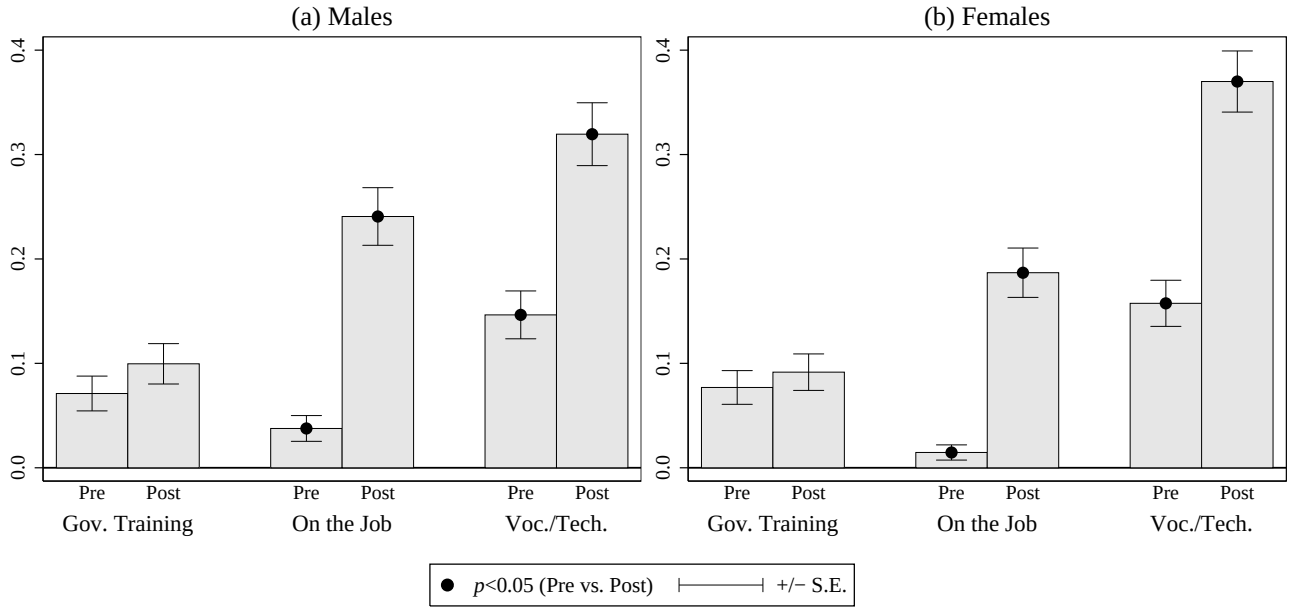
Source: National Longitudinal Survey of Youth, 1979.
Notes: The graph displays the postsecondary educational attainment of dropouts, GED recipients, and high school graduates through age 40. The bars indicate the standard errors, a measure of sampling uncertainty. *Variable Definitions:* "Some Col"—people who entered any postsecondary institution. "Some Col (4-Yr.)"—people who entered a 4-year college. "Some Col (2-Yr.)"—people who entered a 2-year college and never entered a 4-year college. "Some Col, More Than 1 Year"—people who completed at least a year of some postsecondary education. "AA"—people who obtained an associate's degree. "BA"—people who obtained a bachelor's degree. "BA" also includes people with higher education: master's, Ph.D., and professional degrees.

Figure 5.14 Rates of Government-Sponsored Training, On-the-job Training, and Vocational/Technical Training by Educational Status



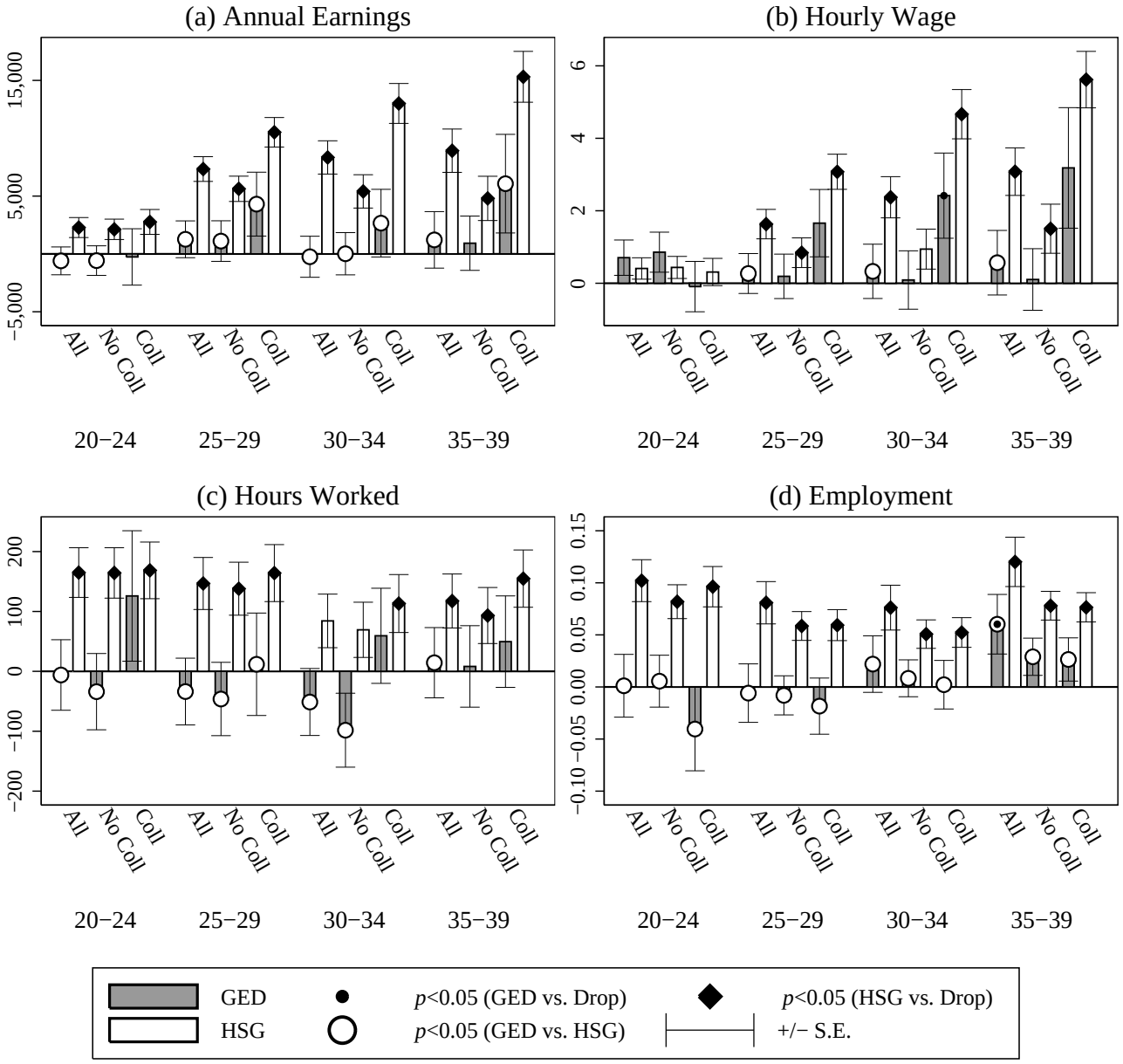
Source: National Longitudinal Survey of Youth, 1979, Nationally Representative Sample.
Notes: The government training category includes skills training from a government-sponsored program such as CETA, Job Corps, or other programs targeted to young individuals who are not attending regular school. Company training is training received directly from one's employer. Vocational and technical training includes apprenticeship, barber/beauty, business college, correspondence, company training, flight school, nursing program, vocational or technical institute. The government training variable is only available between 1979 and 1987, so the estimates do not reflect averages through age 40. For more information, please see Table W5.3.8 of the Web Appendix.

Figure 5.15 Rates of Government-Sponsored Training, On-the-job Training, and Vocational/Technical Training Before and After GED Receipt



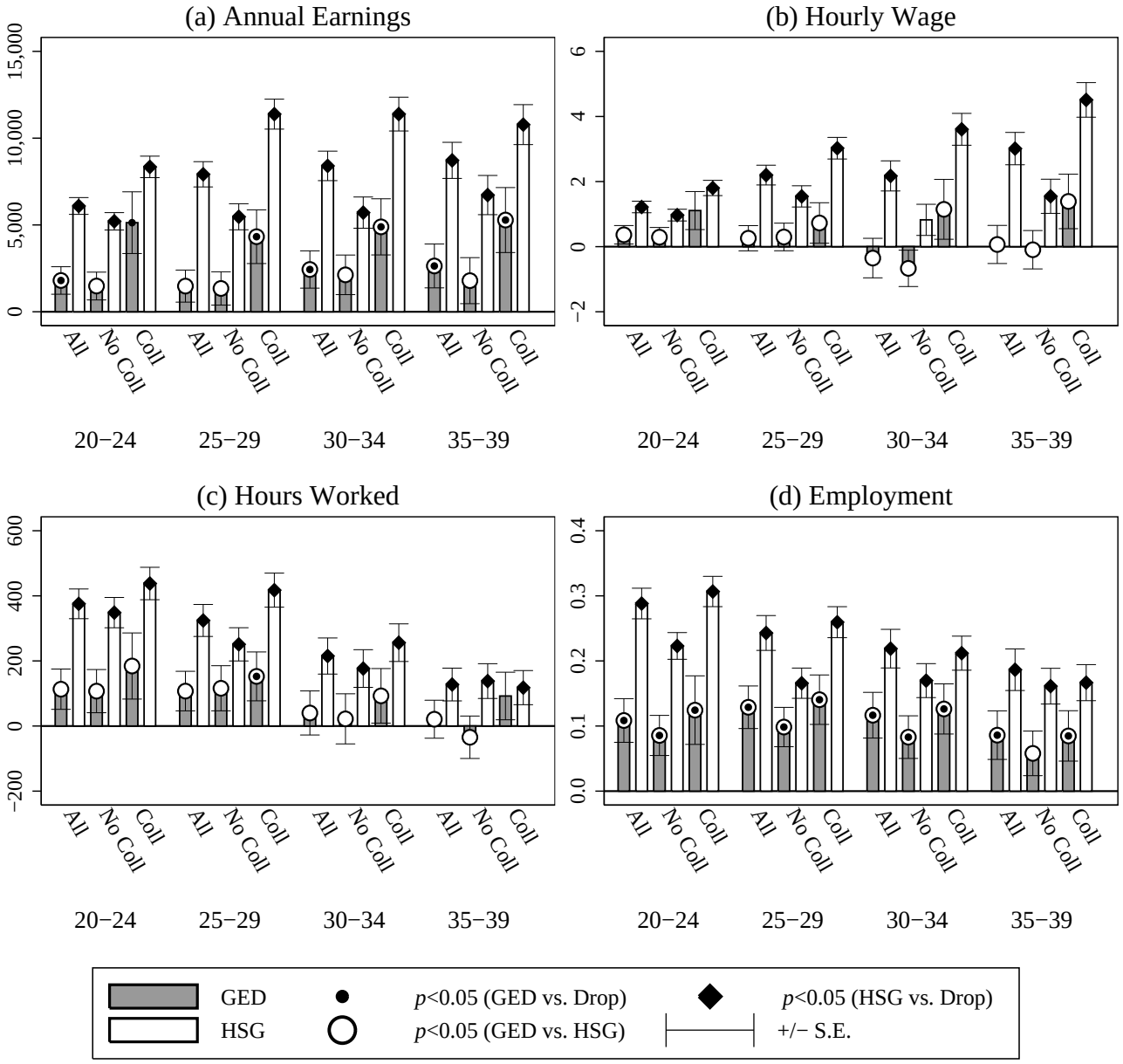
Source: National Longitudinal Survey of Youth, 1979, Nationally Representative Sample.
Notes: "Pre" and "Post" indicate periods before and after certification. The government training category includes skills training from a government-sponsored program such as CETA, Job Corps, or other programs targeted to young individuals who are not attending regular school. Company training is training received directly from one's employer. Vocational and technical training includes apprenticeship, barber/beauty, business college, correspondence, company training, flight school, nursing program, vocational or technical institute. The government training variable is only available between 1979 and 1987, so the estimates do not reflect averages through age 40. For more information, please see Table W5.3.9 of the Web Appendix.

Figure 5.16 Background- and Ability-Adjusted Labor Market Differences, by Age and Postsecondary Education (Males)



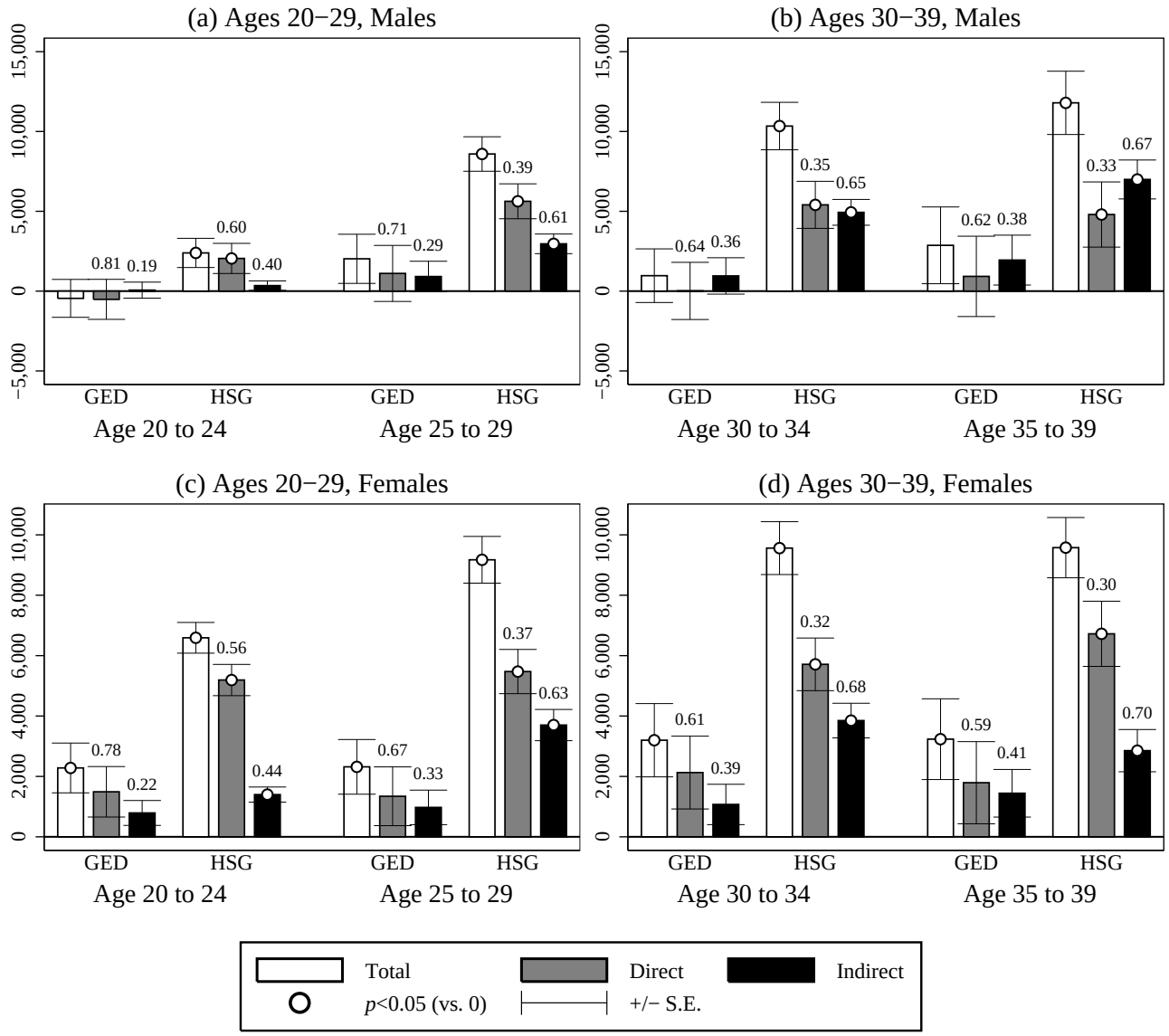
Source: National Longitudinal Survey of Youth, 1979.
Controls: Age, region of residence, year, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior. Regressions exclude those who report earning more than $300,000 (2005$), working more than 4,000 hours, or earning hourly wages less than $3 (2005$) or more than $200 (2005$).
Notes: "All" refers to the full sample. "No Coll" excludes people who ever attend a two- or four-year college. "Coll" includes only those who have attended a two- or four-year college. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. For more information, please see Table **??** of the Web Appendix.

Figure 5.17 Background- and Ability-Adjusted Labor Market Differences, by Age and Postsecondary Education (Females)



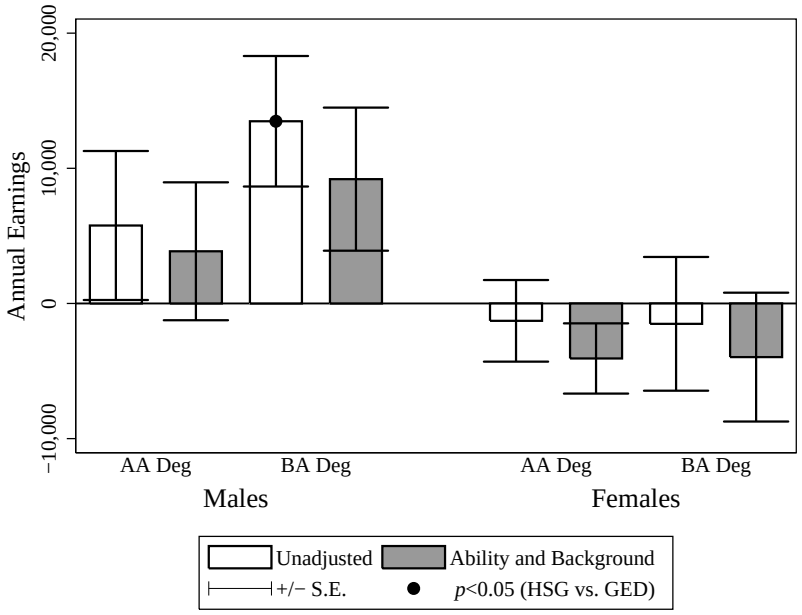
Source: National Longitudinal Survey of Youth, 1979.
Controls: Age, region of residence, year, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior. Regressions exclude those who report earning more than $300,000 (2005$), working more than 4,000 hours, or earning hourly wages less than $3 (2005$) or more than $200 (2005$).
Notes: "All" refers to the full sample. "No Coll" excludes people who ever attend a two- or four-year college. "Coll" includes only those who have attended a two- or four-year college. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. For more information, please see Table **??** of the Web Appendix.

Figure 5.18 Background- and Ability-Adjusted Indirect and Direct Annual Earnings Effects, by Age, NLSY79



Source: National Longitudinal Survey of Youth, 1979.
Controls: Age, region of residence, year, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, South at age 14, and factors based on adolescent risky behavior and criminal behavior.
Notes: Regressions exclude those who report earning more than $300,000 (2005$), working more than 4,000 hours, or earning hourly wages less than $3 (2005$) or more than $200 (2005$). The bars depict the total effect, the direct effect, the indirect effect through some college, and the indirect effect through having obtained an associates or bachelors degree. We estimate the returns to the educational states relative to dropouts using the following equation: $Y_{it} = \alpha + \beta_1[(GED_{it}) \times (NOCOLL_{it})] + \beta_2[(GED_{it}) \times (SMCOLL_{it})] + \beta_3[(HSG_{it}) \times (NOCOLL_{it})] + \beta_4[(HSG_{it}) \times (SMCOLL_{it})] + \gamma X_{it} + \varepsilon_{it}$, where $NOCOLL_{it}$ and $SMCOLL_{it}$ indicate whether individual i has obtained no college or some college by time t. GED_{it} and HSG_{it} indicate whether a person is a GED recipient or high school graduate. X_{it} is a vector of background controls. The probabilities of being in educational states are estimated at the average value for the age range. The total effect is the sum of the estimated returns, weighted by the probabilities of each state. The direct effect is the estimated return to the no college state multiplied by the probability of attending no college. The indirect effect is the estimated return to the some college state multiplied by the probability of attending some college. The standard errors are calculated using a bootstrap procedure with 100 draws that allows for arbitrary correlation of the error term within individuals over time but assumes that the error term is uncorrelated across individuals. For more information, see Table W5.3.12 of the Web Appendix.

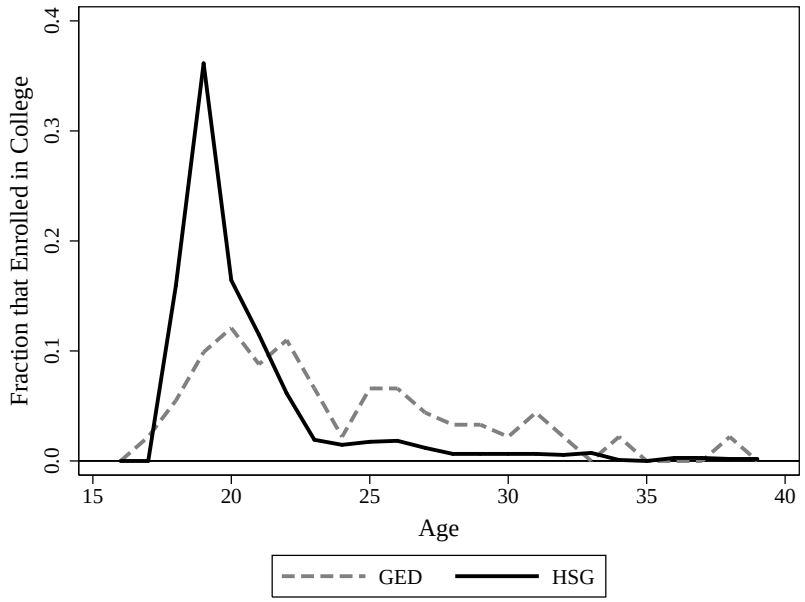
Figure 5.19 Annual Return to High School Graduate with Degree over GED Recipient with Degree



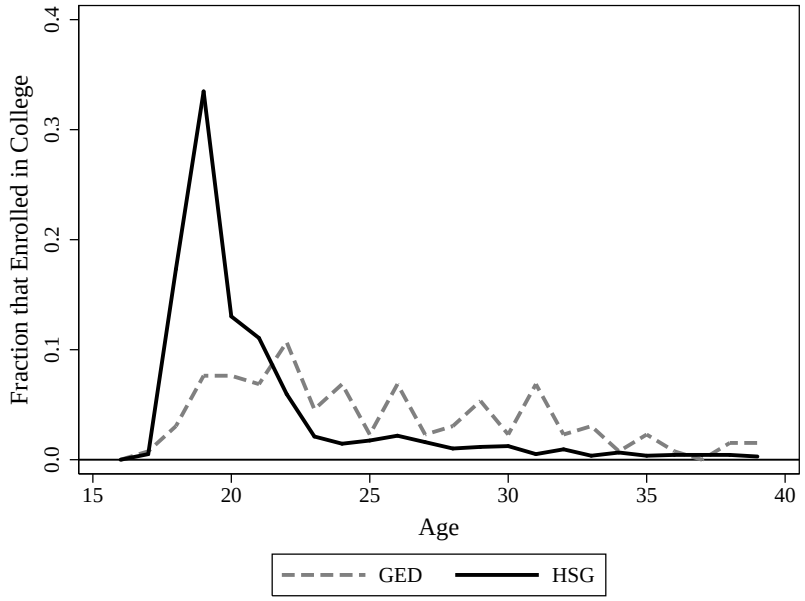
Source: National Longitudinal Survey of Youth, 1979, Cross-Sectional Sample.
Controls: Age, region of residence, year, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior.
Notes: The figure presents the difference in annual earnings between high school graduates and GED recipients for the five-year period after the degree is earned. The sample excludes people once they have been to jail. The p-values test the null hypothesis of equality of average annual income of GED recipients who graduate with the comparable returns of high school graduates. For more information, please see Table W5.3.13 of the Web Appendix.

Figure 5.20 Distribution of the Age of College Enrollment for GED Recipients and High School Graduates

(a) Males



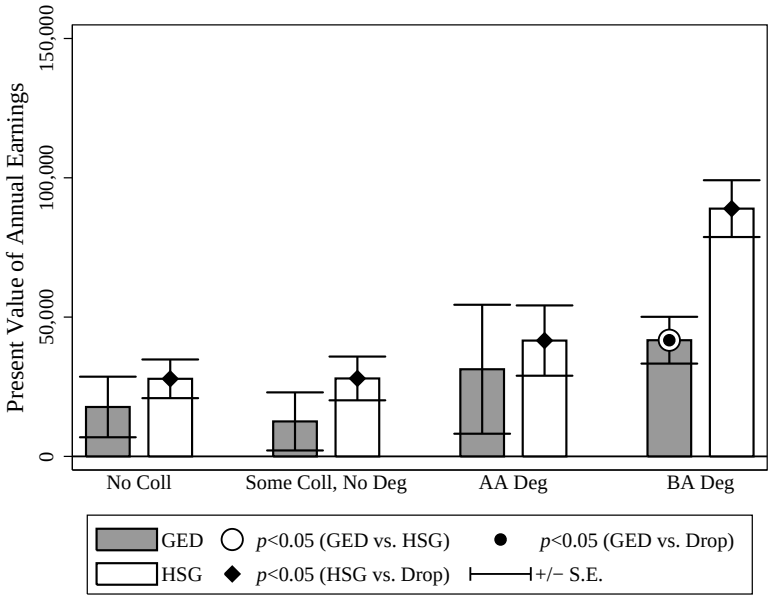
(b) Females



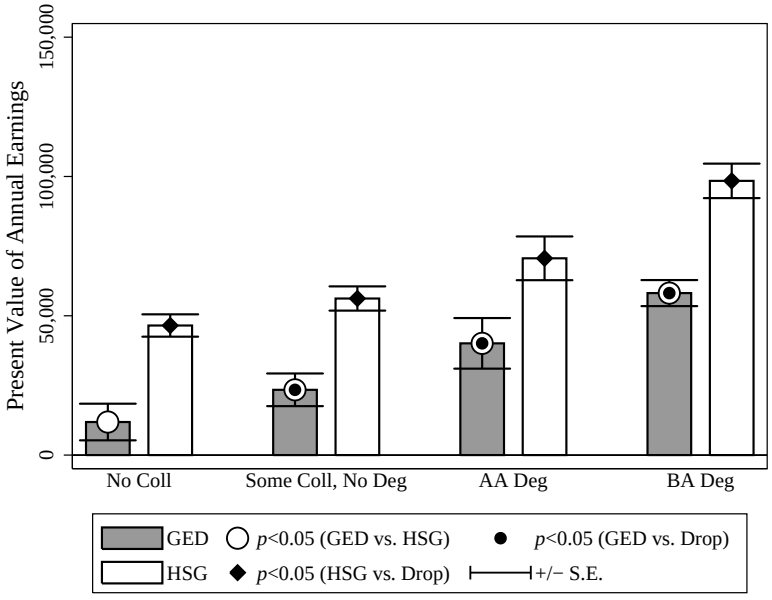
Source: National Longitudinal Survey of Youth, 1979, Nationally Representative Sample.
Notes: The figure displays the distribution in the age for enrollment in college for GED recipients and high school graduates who ever enrolled in college by age 40.

Figure 5.21 Present Value of Annual Earnings for Different Educational Paths, Discounted to Age 16 (All Races, 10% Discount Rate)

(a) Males

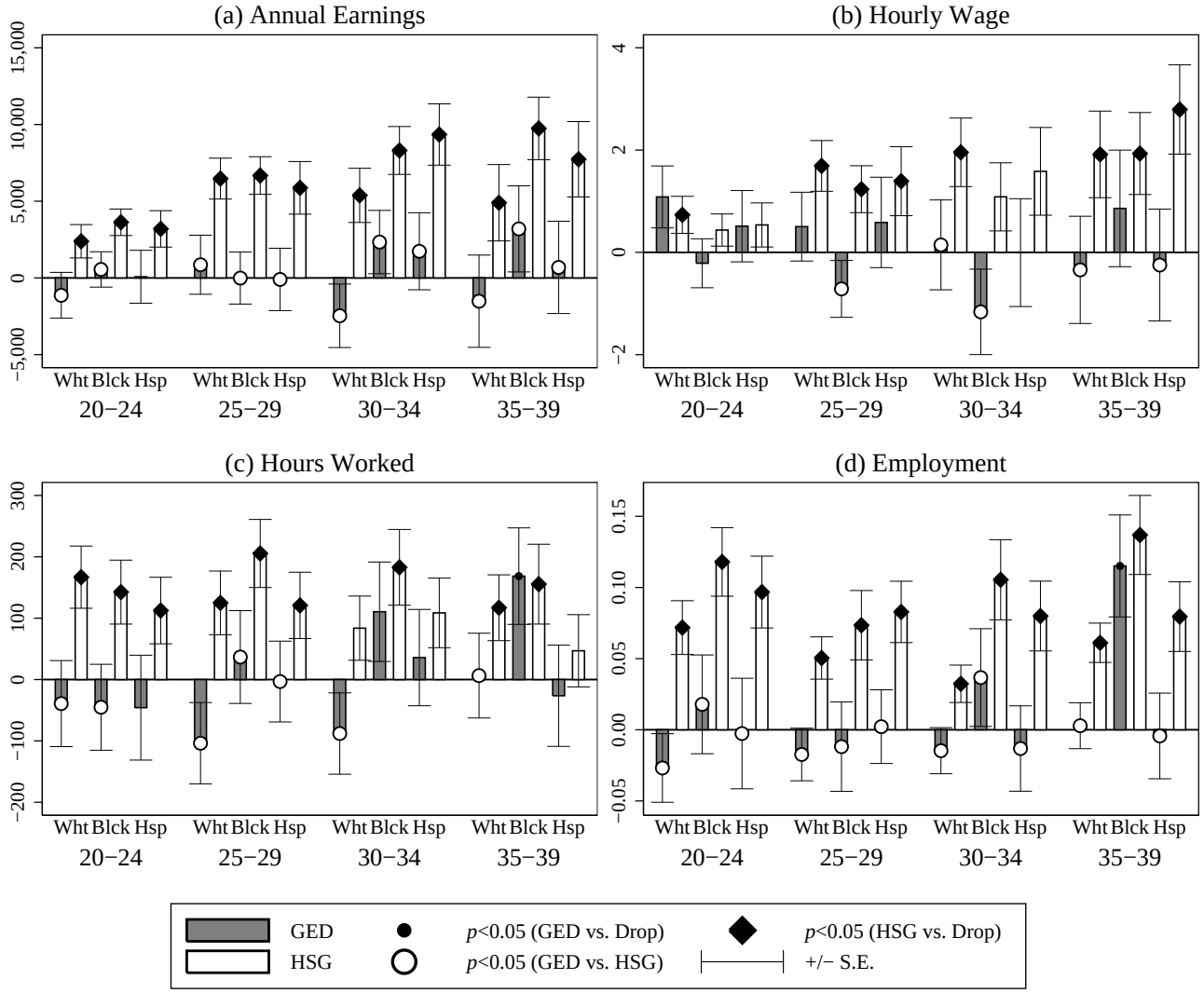


(b) Females



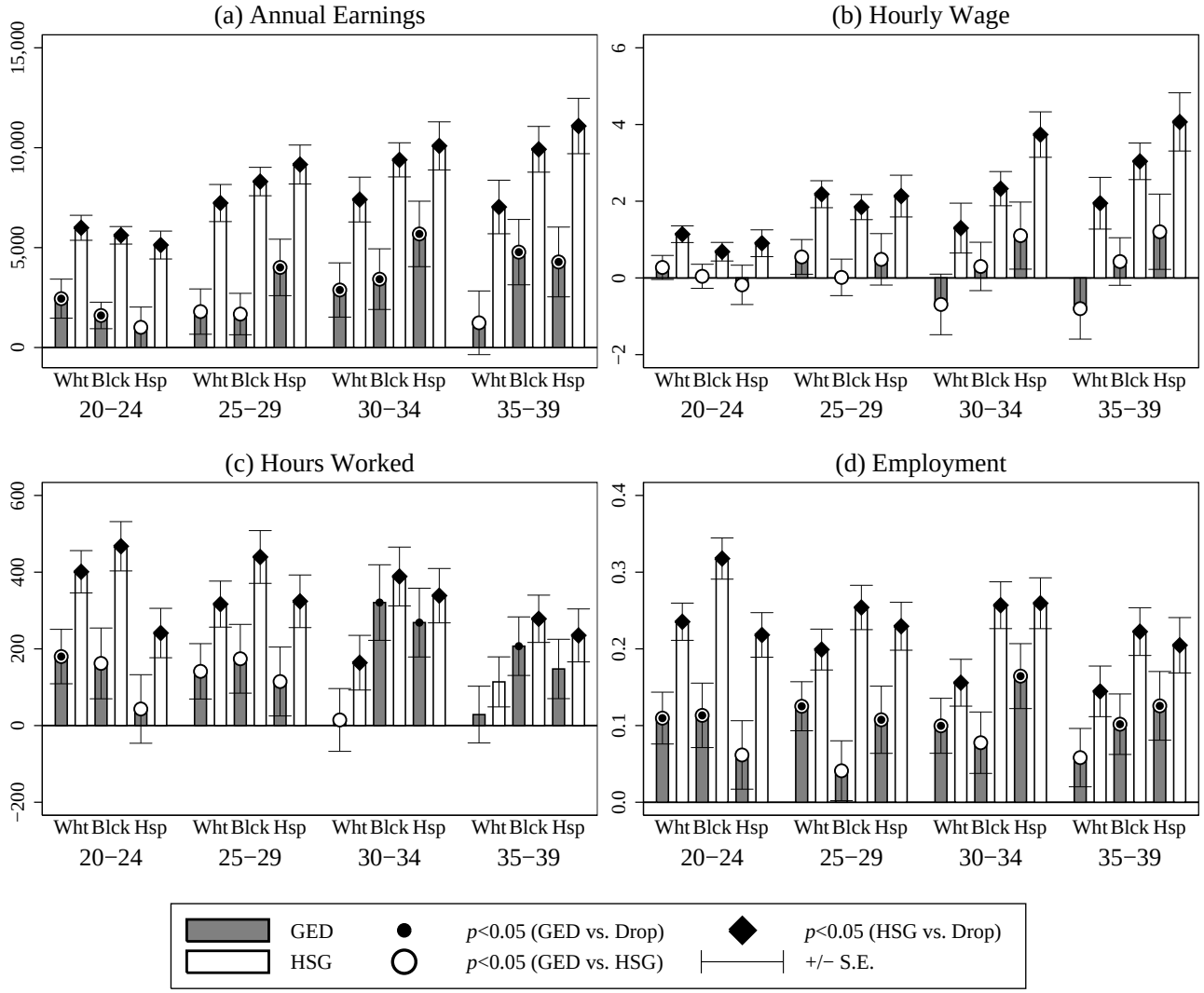
Source: National Longitudinal Survey of Youth, 1979.
Controls: Age, region of residence, year, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior.
Notes: The sample excludes people once they have been to jail. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. For more information about the methodology and estimates, please see Section W5.3.4 and Table W5.3.11 of the Web Appendix.

Figure 5.22 Background and Ability-Adjusted Labor Market Differences, by Age and Race, NLSY79 (Males, All Levels of Postsecondary Education)



Source: National Longitudinal Survey of Youth, 1979.
Controls: Age, region of residence, year, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior. Regressions exclude those reporting earning more than $300,000 or working more than 4,000 hours.
Notes: The figure reports background- and ability-adjusted estimates of the returns to the GED certificate and high school diploma by race. For each age, the first pair of bars is for whites, the second is for blacks, and the third is for Hispanics. The regressions are run separately for each race so that the baseline are estimates for that race. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. For additional information, see Table W5.3.12 of the Web Appendix.

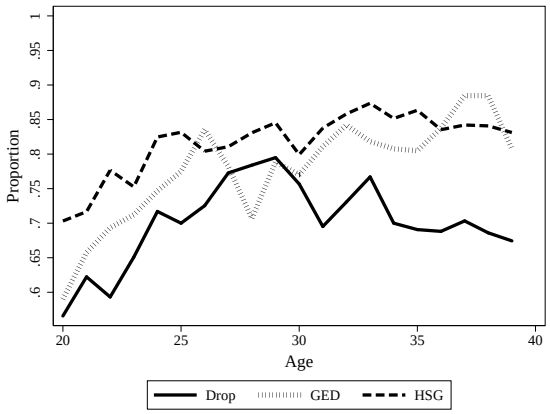
Figure 5.23 Background and Ability-Adjusted Labor Market Differences, by Age and Race, NLSY79 (Females, All Levels of Postsecondary Education)



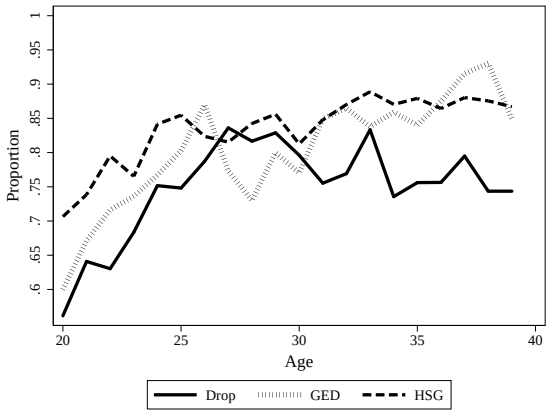
Source: National Longitudinal Survey of Youth, 1979.
Controls: Age, region of residence, year, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior. Regressions exclude those reporting earning more than $300,000 or working more than 4,000 hours.
Notes: The figure reports background- and ability-adjusted estimates of the returns to the GED certificate and high school diploma by race. For each age, the first pair of bars is for whites, the second is for blacks, and the third is for Hispanics. The regressions are run separately for each race so that the baseline are estimates for that race. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. For additional information, see Table W5.3.13 of the Web Appendix.

Figure 5.24 Black Male Employment and Supplemental Security Income (No Postsecondary Education)

(a) Full Sample

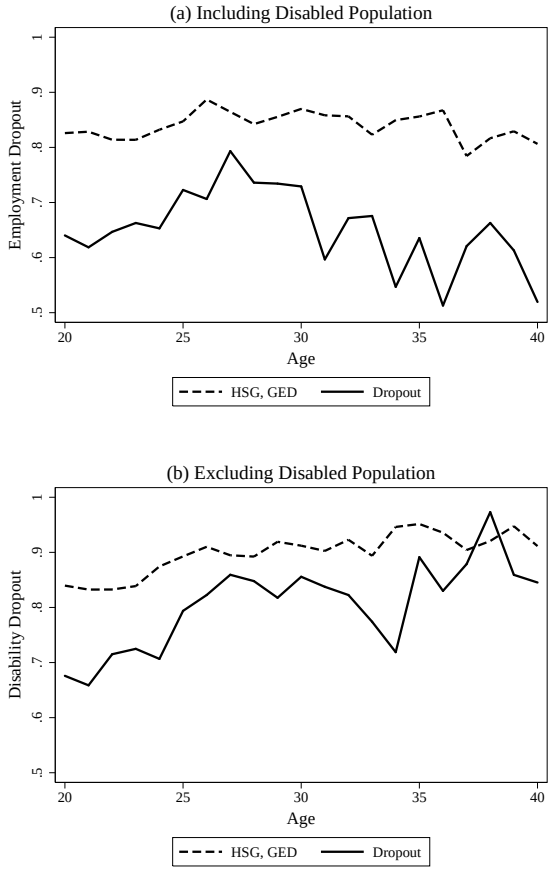


(b) Excluding Current SSI Recipients



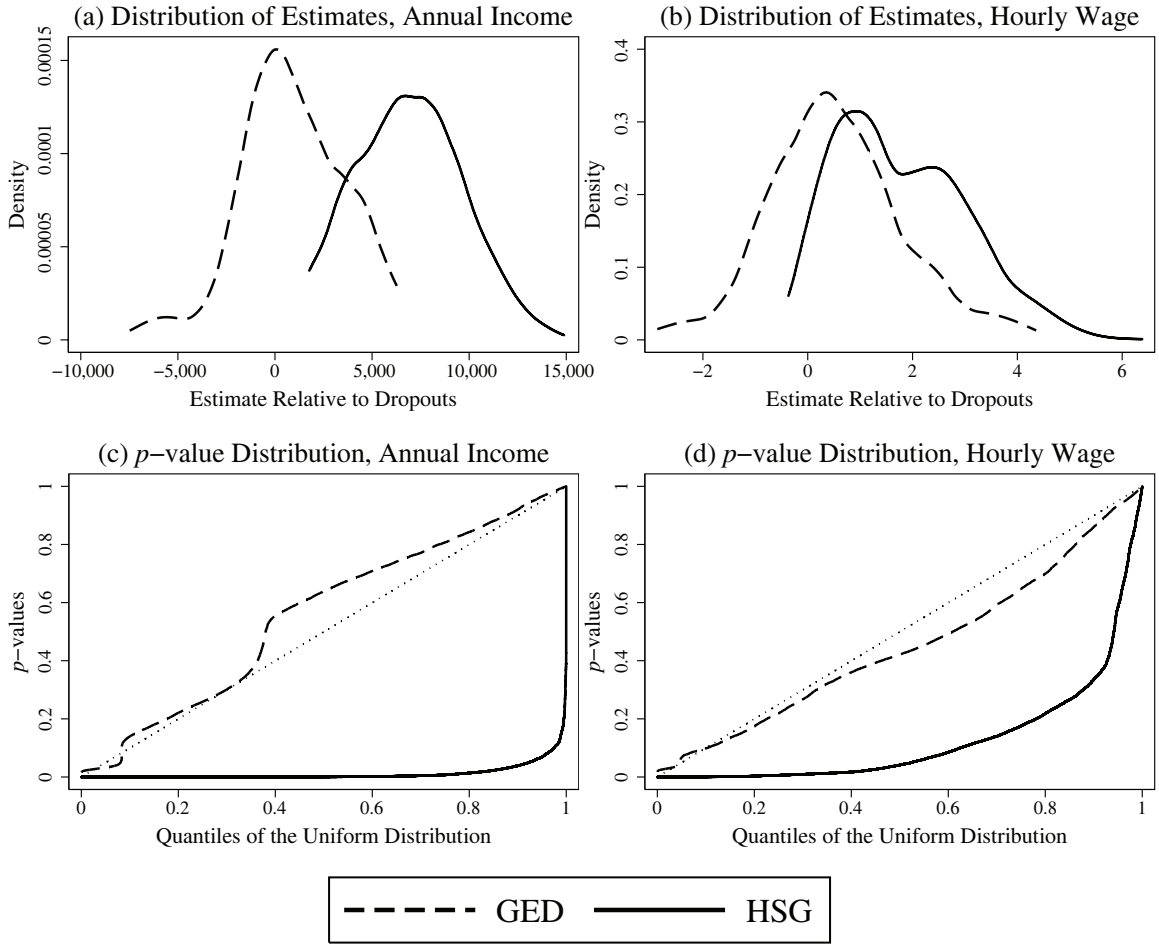
Source: National Longitudinal Survey of Youth, 1979.
Notes: Panel 5.24a includes the full sample of black males. Panel 5.24b excludes people currently on supplemental social security income. The sample excludes people once they have been to jail.

Figure 5.25 Employment Rate of Black Males Born 1957–1964 (Ages 20–40)



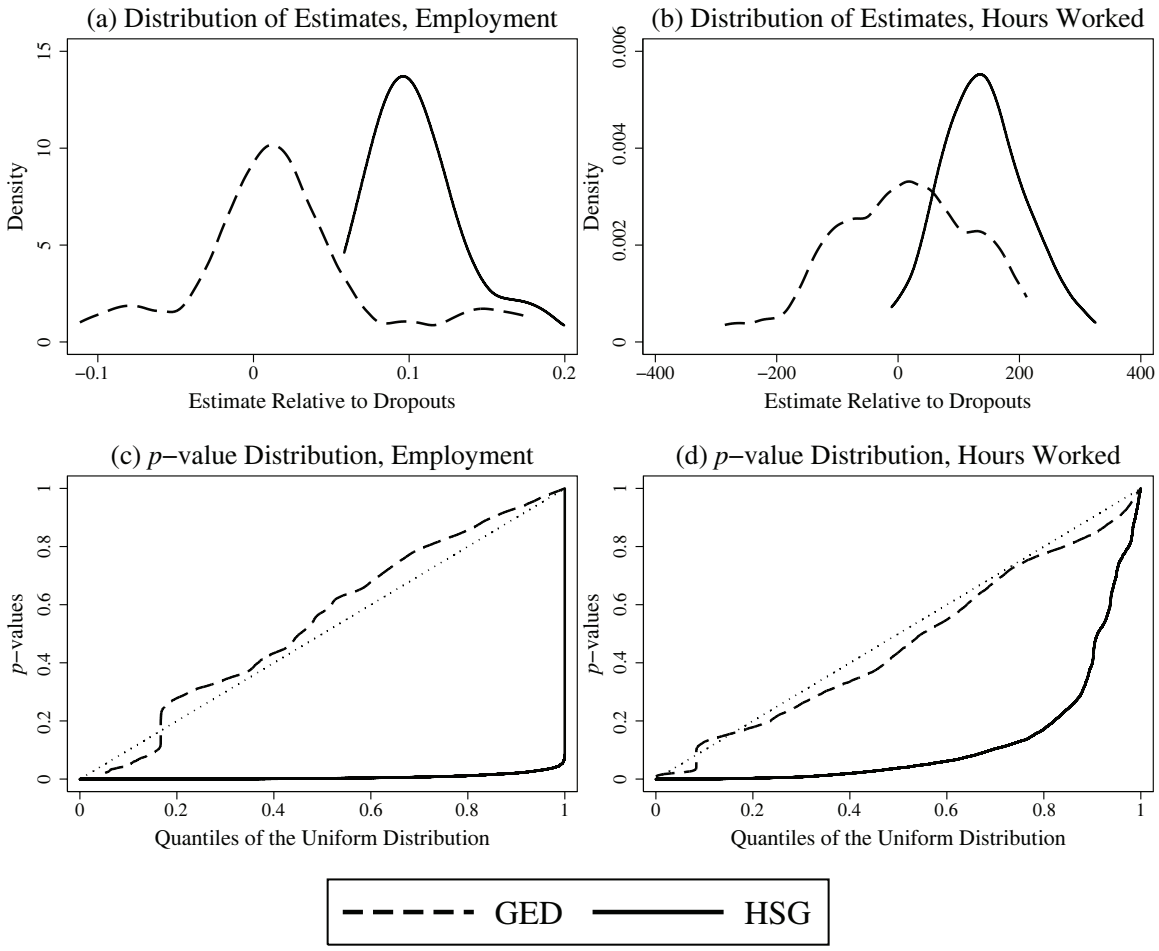
Source: March CPS, 1977–2005.
Notes: Employment rate is defined as the proportion of the population that has worked at least 80 hours in the previous year. A person is defined as disabled if their main reason for not working in the last year was "Disabled or Ill." Persons whose main reasons for not working in the last year were "Going to School" or "In the Armed Forces" are excluded from the analysis.

Figure 5.26 Distribution of the Estimated Effect of the GED Certificate and High School Graduation on Annual Earnings and Hourly Wage across Models for Males



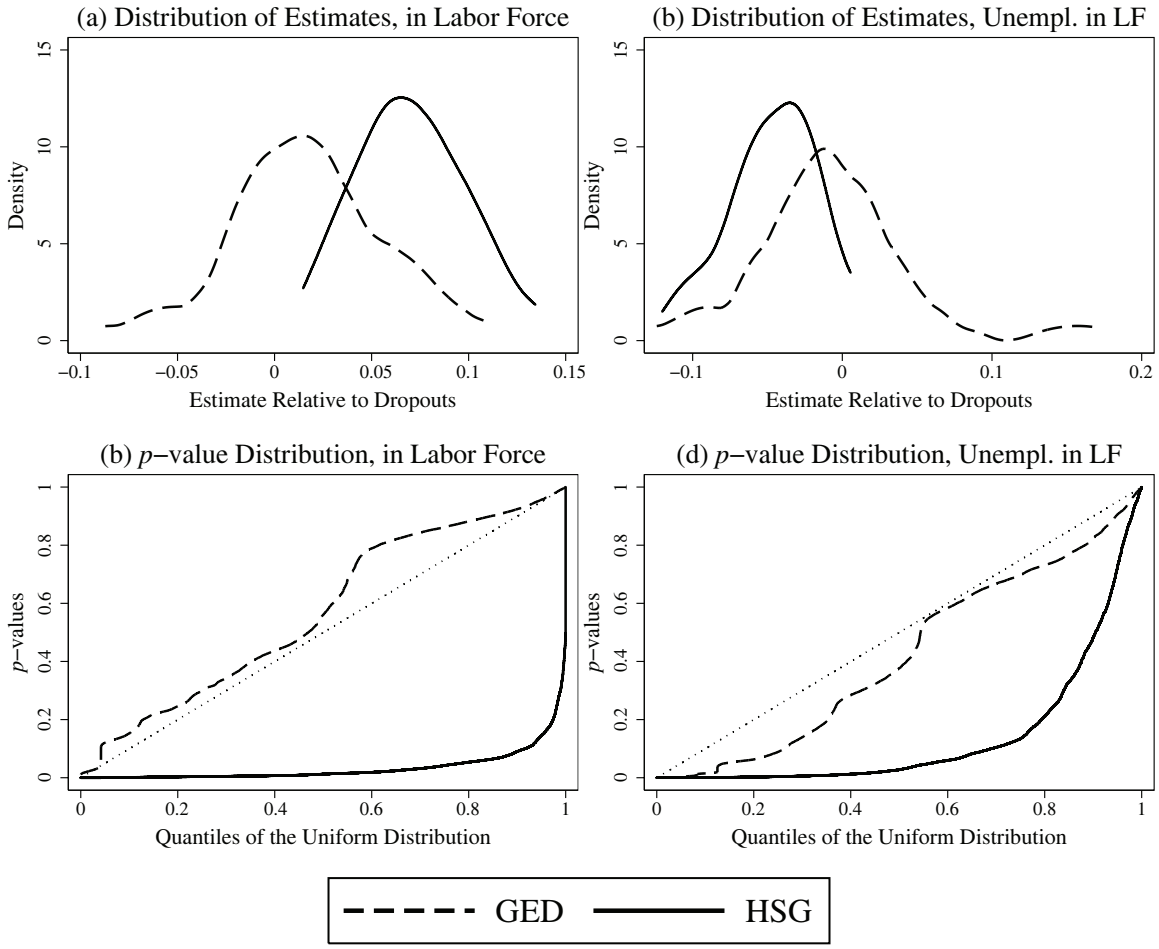
Source: National Longitudinal Survey of Youth, 1979.
Notes: The top panels plot the estimated coefficients from a series of linear regressions. The bottom panels plot the p-values from a series of estimates against quantiles of a uniform distribution with values between 0 and 1. For more information about the procedure, please see Section W5.3.6 of the Web Appendix. All models control for region, age, year, and AFQT score. The models differ in other controls and subpopulations of the data. The set of models includes all combinations of mother's highest grade completed, urban residence at age 14, family income, lives in the South at age 14, smoked at 15, has had sex by 15, has committed a major crime, and 9th grade GPA. The subpopulations are all partitions of race, postsecondary education (everyone, has some postsecondary education, no postsecondary education), and age (measured in 5-year categories from 20 to 39) for males and females. The p-values are calculated allowing for heteroskedastic errors and, when appropriate, clustering at the individual level.

Figure 5.27 Distribution of the Estimated Effect of the GED Certificate and High School Graduation on Employment and Hours Worked Across Models for Males



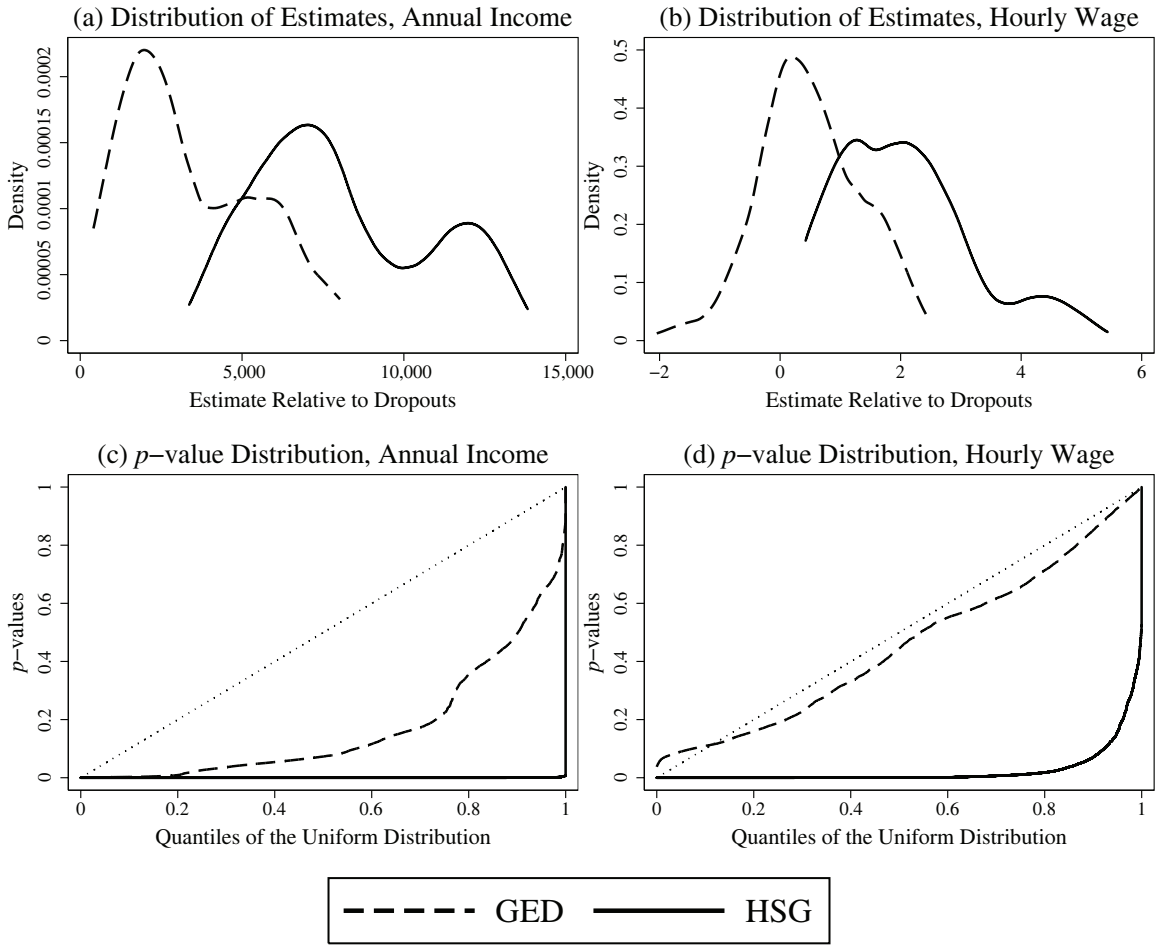
Source: National Longitudinal Survey of Youth, 1979.
Notes: The top panels plot the estimated coefficients from a series of linear regressions. The bottom panels plot the p-values from a series of estimates against quantiles of a uniform distribution with values between 0 and 1. For more information about the procedure, please see Section W5.3.6 of the Web Appendix. All models control for region, age, year, and AFQT score. The models differ in other controls and subpopulations of the data. The set of models includes all combinations of mother's highest grade completed, urban residence at age 14, family income, lives in the South at age 14, smoked at 15, has had sex by 15, has committed a major crime, and 9th grade GPA. The subpopulations are all partitions of race, postsecondary education (everyone, has some postsecondary education, no postsecondary education), and age (measured in 5-year categories from 20 to 39) for males and females. The p-values are calculated allowing for heteroskedastic errors and, when appropriate, clustering at the individual level.

Figure 5.28 Distribution of the Effect of the GED Certificate and High School Graduation on Labor Force Participation Across Models for Males



Source: National Longitudinal Survey of Youth, 1979.
Notes: The top panels plot the estimated coefficients from a series of linear regressions. The bottom panels plot the p-values from a series of estimates against quantiles of a uniform distribution with values between 0 and 1. For more information about the procedure, please see Section W5.3.6 of the Web Appendix. All models control for region, age, year, and AFQT score. The models differ in other controls and subpopulations of the data. The set of models includes all combinations of mother's highest grade completed, urban residence at age 14, family income, lives in the South at age 14, smoked at 15, has had sex by 15, has committed a major crime, and 9th grade GPA. The subpopulations are all partitions of race, postsecondary education (everyone, has some postsecondary education, no postsecondary education), and age (measured in 5-year categories from 20 to 39) for males and females. The p-values are calculated allowing for heteroskedastic errors and, when appropriate, clustering at the individual level.

Figure 5.29 Distribution of the Effect of the GED Certificate and High School Graduation on Annual Earnings and Hourly Wage Across Models for Females

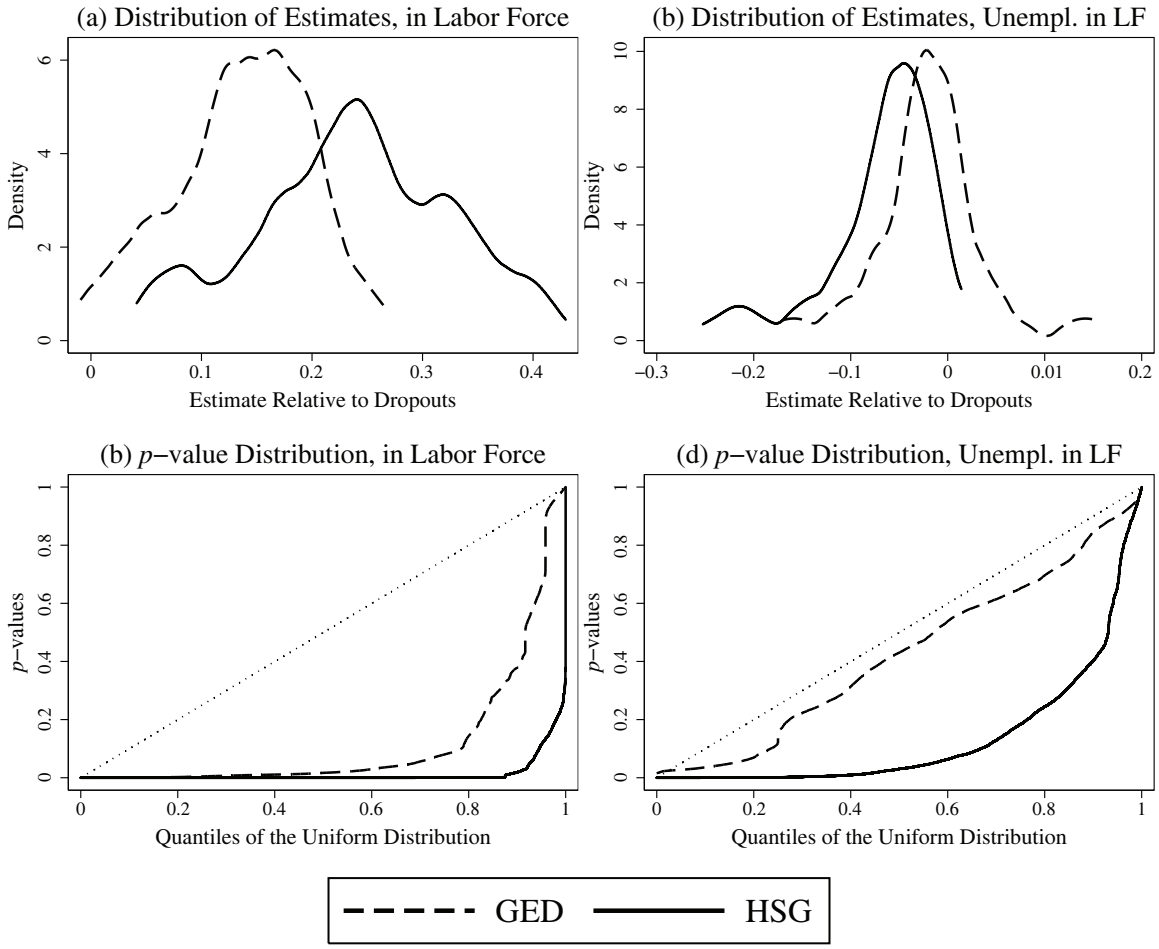


Source: National Longitudinal Survey of Youth, 1979.
Notes: The top panels plot the estimated coefficients from a series of linear regressions. The bottom panels plot the p-values from a series of estimates against quantiles of a uniform distribution with values between 0 and 1. For more information about the procedure, please see Section W5.3.6 of the Web Appendix. All models control for region, age, year, and AFQT score. The models differ in other controls and subpopulations of the data. The set of models includes all combinations of mother's highest grade completed, urban residence at age 14, family income, lives in the South at age 14, smoked at 15, has had sex by 15, has committed a major crime, and 9th grade GPA. The subpopulations are all partitions of race, postsecondary education (everyone, has some postsecondary education, no postsecondary education), and age (measured in 5-year categories from 20 to 39) for males and females. The p-values are calculated allowing for heteroskedastic errors and, when appropriate, clustering at the individual level.

Figure 5.30 Distribution of the Effect of the GED Certificate and High School Graduation on Employment and Hours Worked Across Models for Females

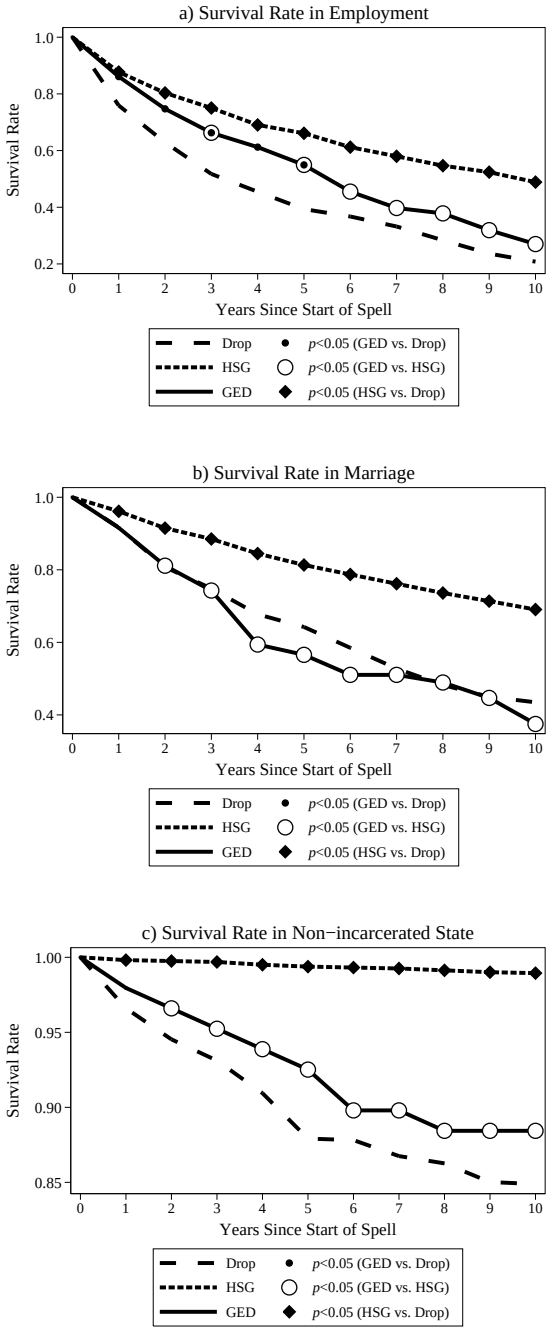
Source: National Longitudinal Survey of Youth, 1979.
Notes: The top panels plot the estimated coefficients from a series of linear regressions. The bottom panels plot the p-values from a series of estimates against quantiles of a uniform distribution with values between 0 and 1. For more information about the procedure, please see Section W5.3.6 of the Web Appendix. All models control for region, age, year, and AFQT score. The models differ in other controls and subpopulations of the data. The set of models includes all combinations of mother's highest grade completed, urban residence at age 14, family income, lives in the South at age 14, smoked at 15, has had sex by 15, has committed a major crime, and 9th grade GPA. The subpopulations are all partitions of race, postsecondary education (everyone, has some postsecondary education, no postsecondary education), and age (measured in 5-year categories from 20 to 39) for males and females. The p-values are calculated allowing for heteroskedastic errors and, when appropriate, clustering at the individual level.

Figure 5.31 Distribution of the Effect of the GED Certificate and High School Graduation on Labor Force Participation Across Models for Females



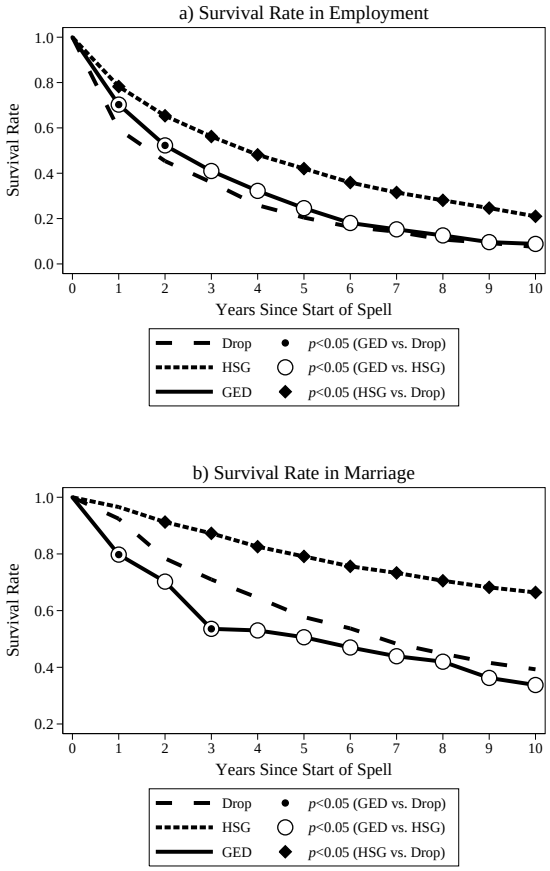
Source: National Longitudinal Survey of Youth, 1979.
Notes: The top panels plot the estimated coefficients from a series of linear regressions. The bottom panels plot the p-values from a series of estimates against quantiles of a uniform distribution with values between 0 and 1. For more information about the procedure, please see Section W5.3.6 of the Web Appendix. All models control for region, age, year, and AFQT score. The models differ in other controls and subpopulations of the data. The set of models includes all combinations of mother's highest grade completed, urban residence at age 14, family income, lives in the South at age 14, smoked at 15, has had sex by 15, has committed a major crime, and 9th grade GPA. The subpopulations are all partitions of race, postsecondary education (everyone, has some postsecondary education, no postsecondary education), and age (measured in 5-year categories from 20 to 39) for males and females. The p-values are calculated allowing for heteroskedastic errors and, when appropriate, clustering at the individual level.

Figure 5.32 Survival Rates (Males, All Races, All Levels of Postsecondary Education)



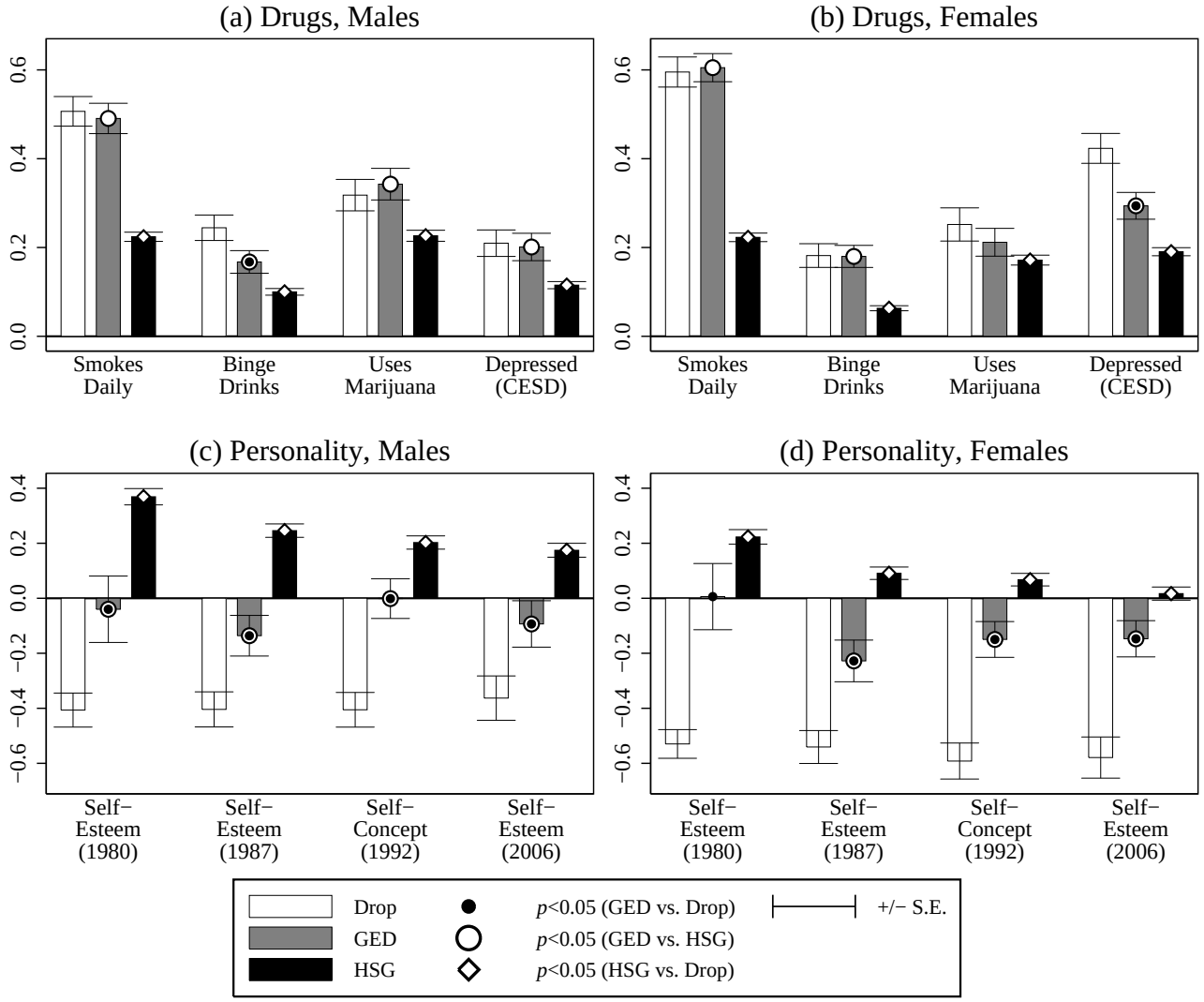
Source: National Longitudinal Survey of Youth, 1979 (NLSY79), nationally representative cross-sectional sample.
Note: For more information about the procedure, see Section W5.3.7 of the Web Appendix.

Figure 5.33 Survival Rates (Females, All Races, All Levels of Postsecondary Education)



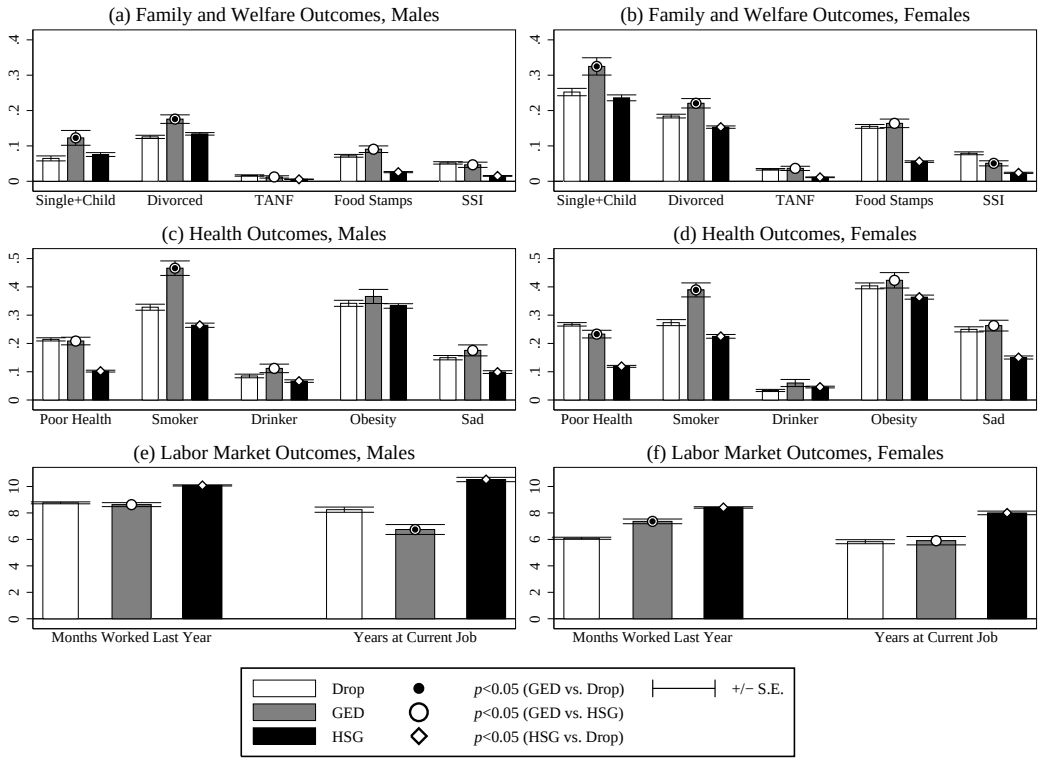
Source: National Longitudinal Survey of Youth, 1979 (NLSY79), nationally representative cross-sectional sample.
Note: For more information about the procedure, see Section W5.3.7 of the Web Appendix.

Figure 5.34 Health and Personality Outcomes — NLSY79 (All Races, All Levels of Post-secondary Education)



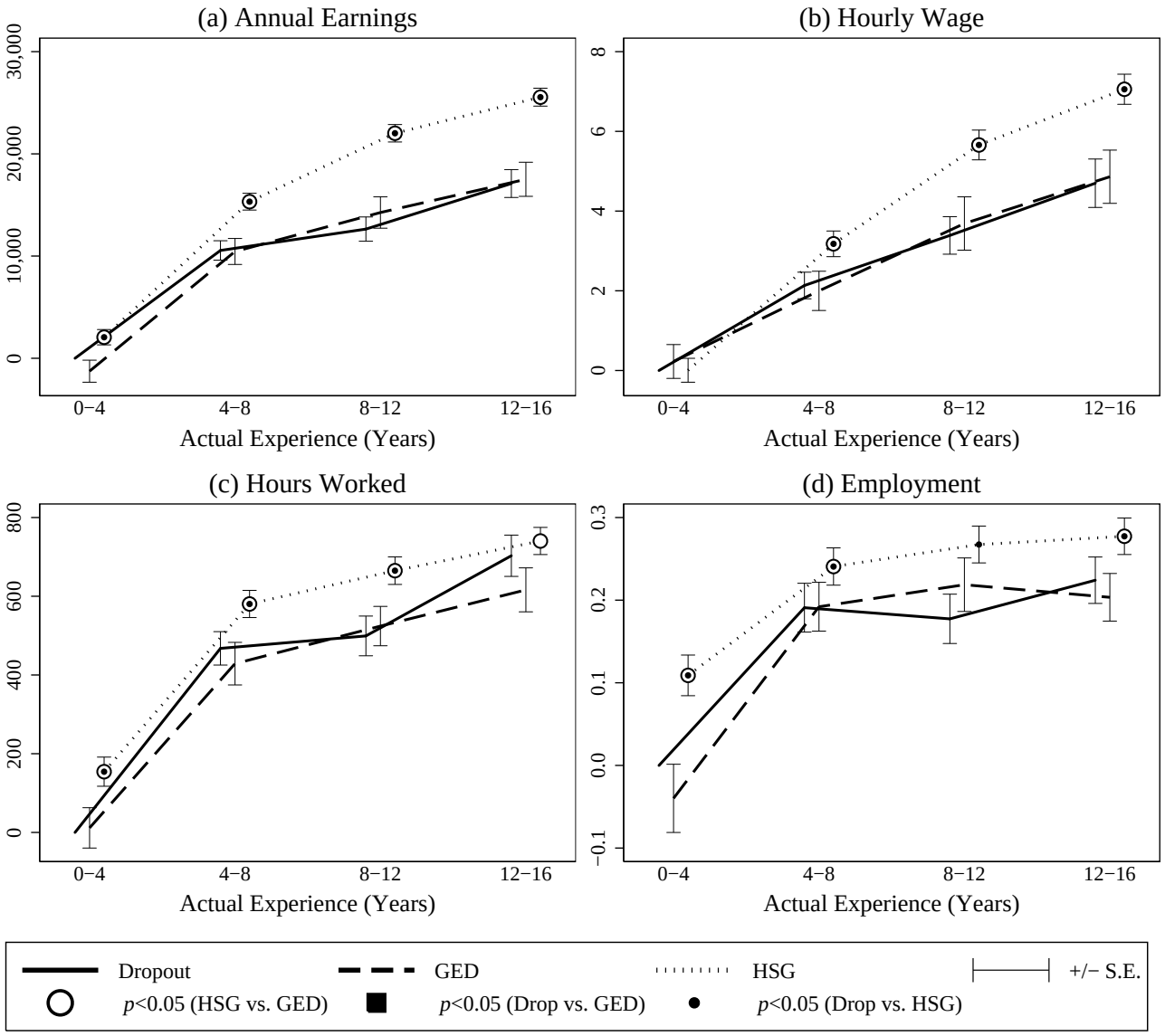
Source: National Longitudinal Survey of Youth, 1979 (NLSY79), nationally representative cross-sectional sample.
Notes: The estimates for daily smoking, binge drinking, and marijuana use are based on data from the 1992 and 1994 survey years when respondents are between 27 and 37. The estimate for depression are based on the 1992 survey when respondents are between 27 and 35. The sample excludes people who have been to jail.
Variable Definitions: Smokes Daily — reports smoking daily. Binge Drinks — drinks and typically drinks 5 or more drinks per day when drinking for males or 4 or more drinks per day when drinking for females. Marijuana Last Year — has used marijuana in the past year. Depressed — greater than or equal to 16 on the 20 question version of the Center for Epidemiologic Studies Depression Scale (CES-D) . Self-esteem is measured using the 10-item version of the Rosenberg Self-Esteem scale (Rosenberg, 1965). Self-concept is measured using the 7-item version of the Pearlin Mastery Scale (Pearlin, Menaghan, Lieberman, and Mullan, 1981). Higher scores represent higher levels of self-concept and self-esteem. The scores have been standardized over the whole population (combining males and females) for each year separately.

Figure 5.35 NHIS—Outcomes (All Races, Ages 35–55)



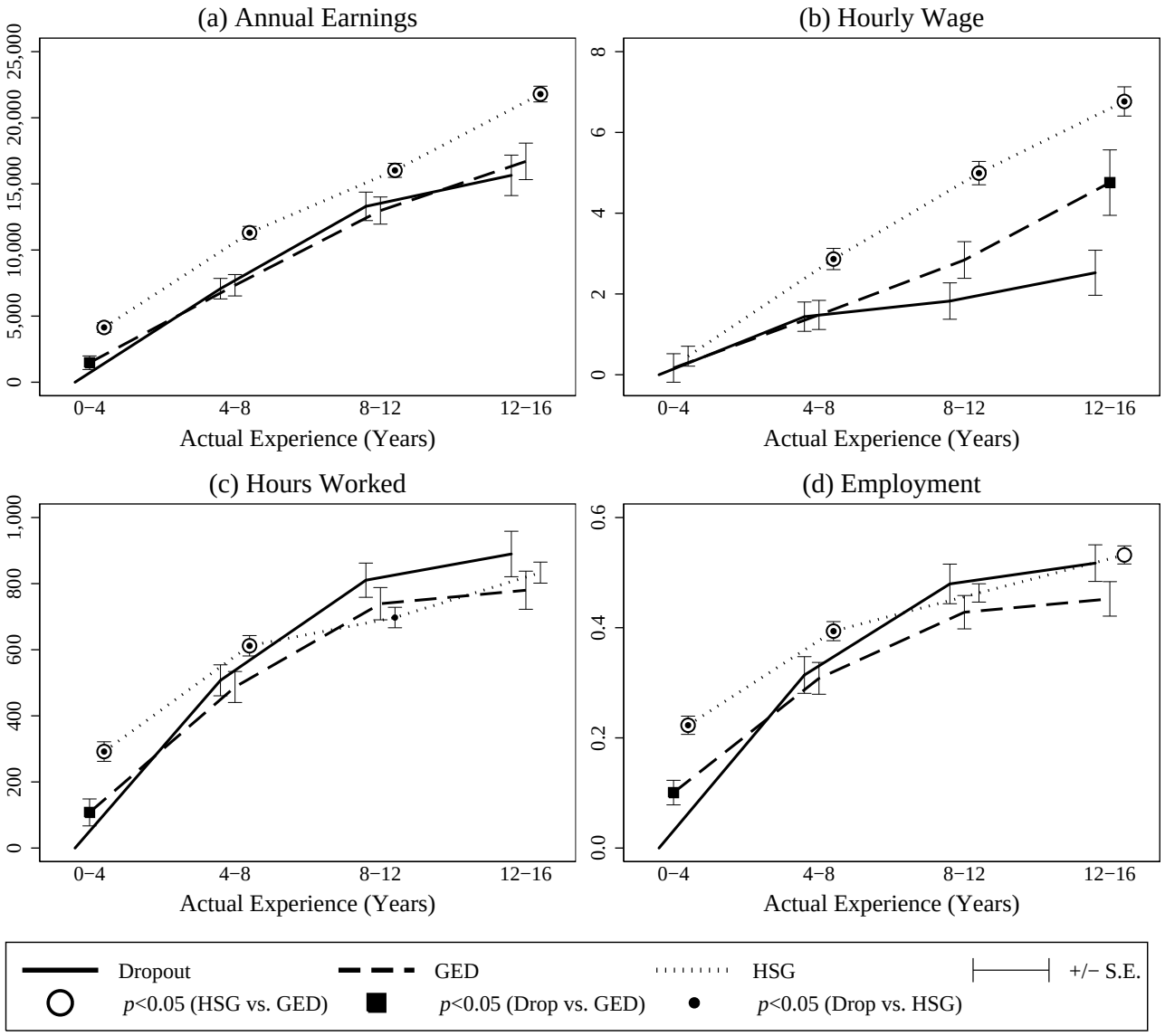
Source: National Health Interview Survey (NHIS), 2004–2007.
Notes: The data collected in the NHIS are obtained through a complex sample design involving stratification, clustering, and multistage sampling. For this reason weights were used in our analysis for means calculation. In addition, STRATUM and PSU were used to estimate variance correctly. For more information about the method, see NHIS user guide. Divorced and Separated were considered as the same category. Single+Child—Proportion of single families with children under age 18 out of all the families with children. TANF and Food Stamps—Proportion of individuals who received any income last year from these welfare programs. SSI—Proportion of individuals who receive Supplemental Security Income. Poor Health—Proportion of people with "Poor" and "Fair" self-reported health. Smoker—Percent of people who are current everyday smokers. Drinker—Proportion of heavy drinkers: for males >14 drinks per week in past year and females >7 drinks per week in past year. Obesity—Proportion of people with BMI $\geq$ 30. Sad—Percent of people who "felt so sad that nothing cheers them up" all/most/some of the time during the past 30 days.

Figure 5.36 Ability- and Background-Adjusted Labor Market Outcomes by Actual Experience (OLS) — (Males, All Levels of Postsecondary Education)



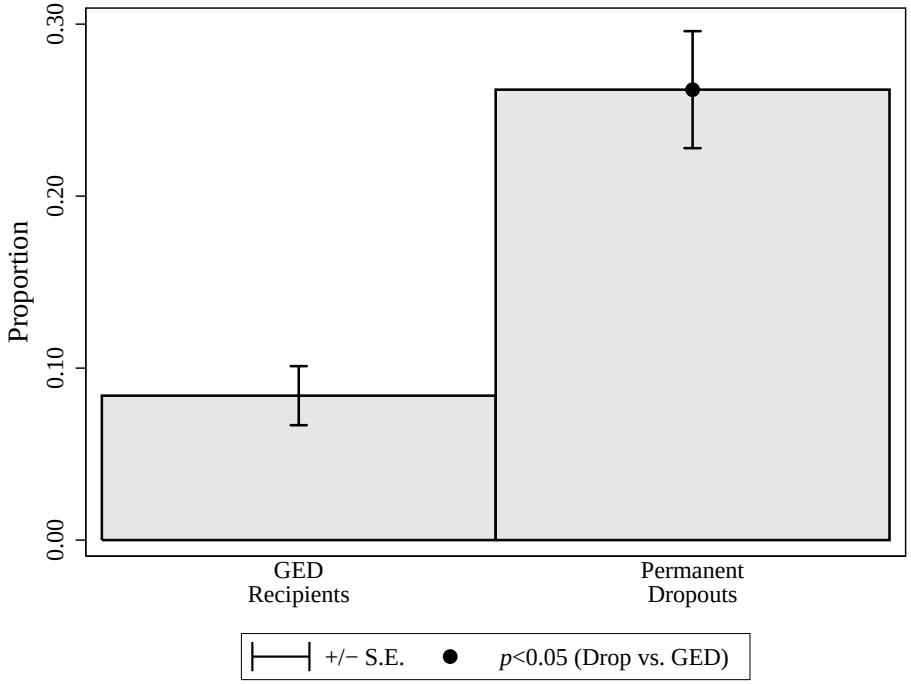
Source: National Longitudinal Survey of Youth, 1979, Nationally Representative Sample.
Controls: Region of residence, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, rseidence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior.
Notes: Respondents are classified as GED recipients if they earn a GED before the age of 40. The sample excludes people once they have been to jail. Actual experience is the cumulative hours worked divided by 2,000. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. For more information about the methodology, please see Web Appendix Section W5.4.

Figure 5.37 Ability- and Background-Adjusted Labor Market Outcomes by Actual Experience (OLS) (Females, All Levels of Postsecondary Education)



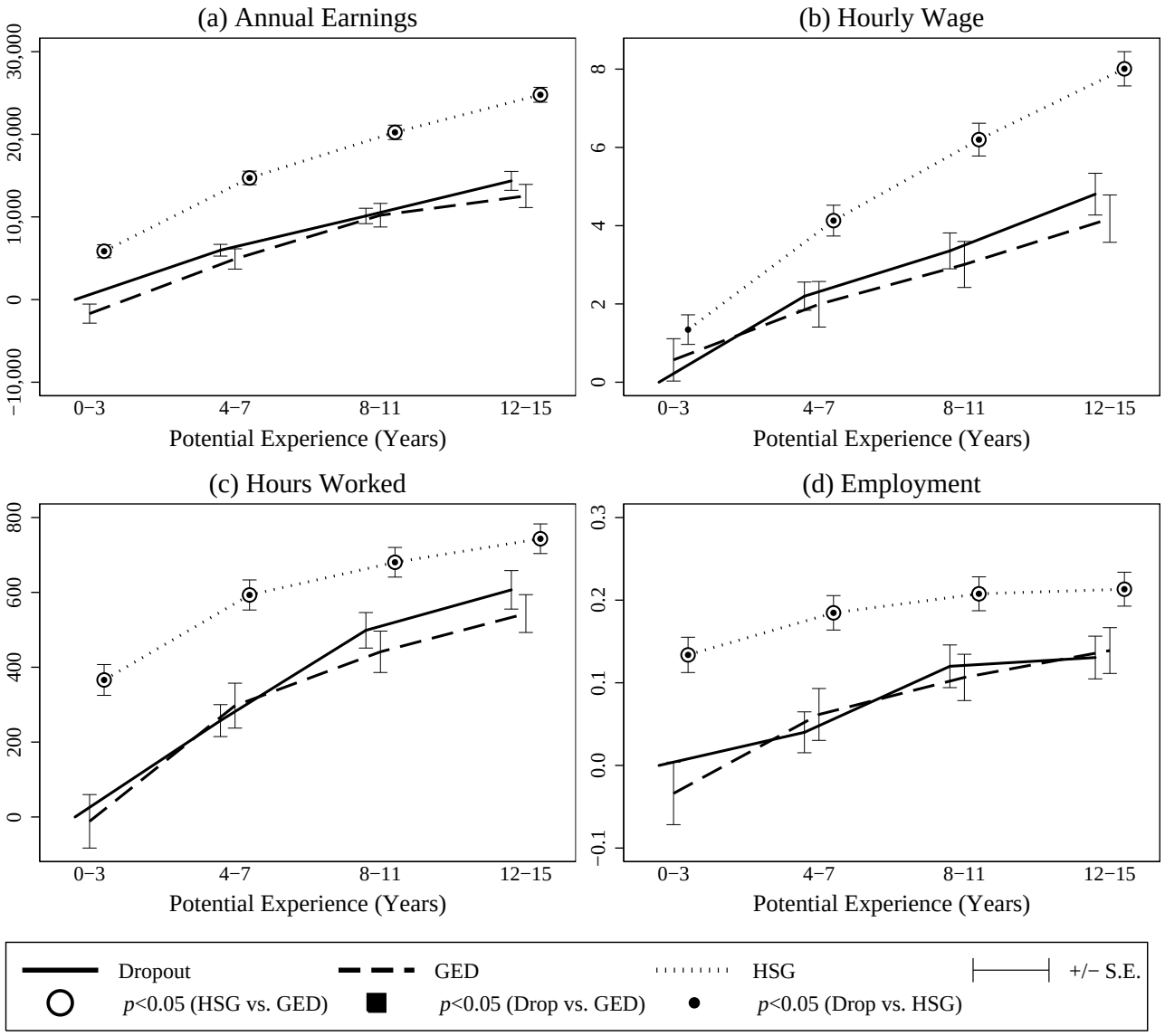
Source: National Longitudinal Survey of Youth, 1979, Nationally Representative Sample.
Controls: Region of residence, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, rseidence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior.
Notes: Respondents are classified as GED recipients if they earn a GED before the age of 40. The sample excludes people once they have been to jail. Actual experience is the cumulative hours worked divided by 2,000. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. For more information about the methodology, please see Web Appendix Section W5.4.

Figure 5.38 Fraction of Females with Less than 4 Years (8,000 Hours) of Actual Experience by Educational Status



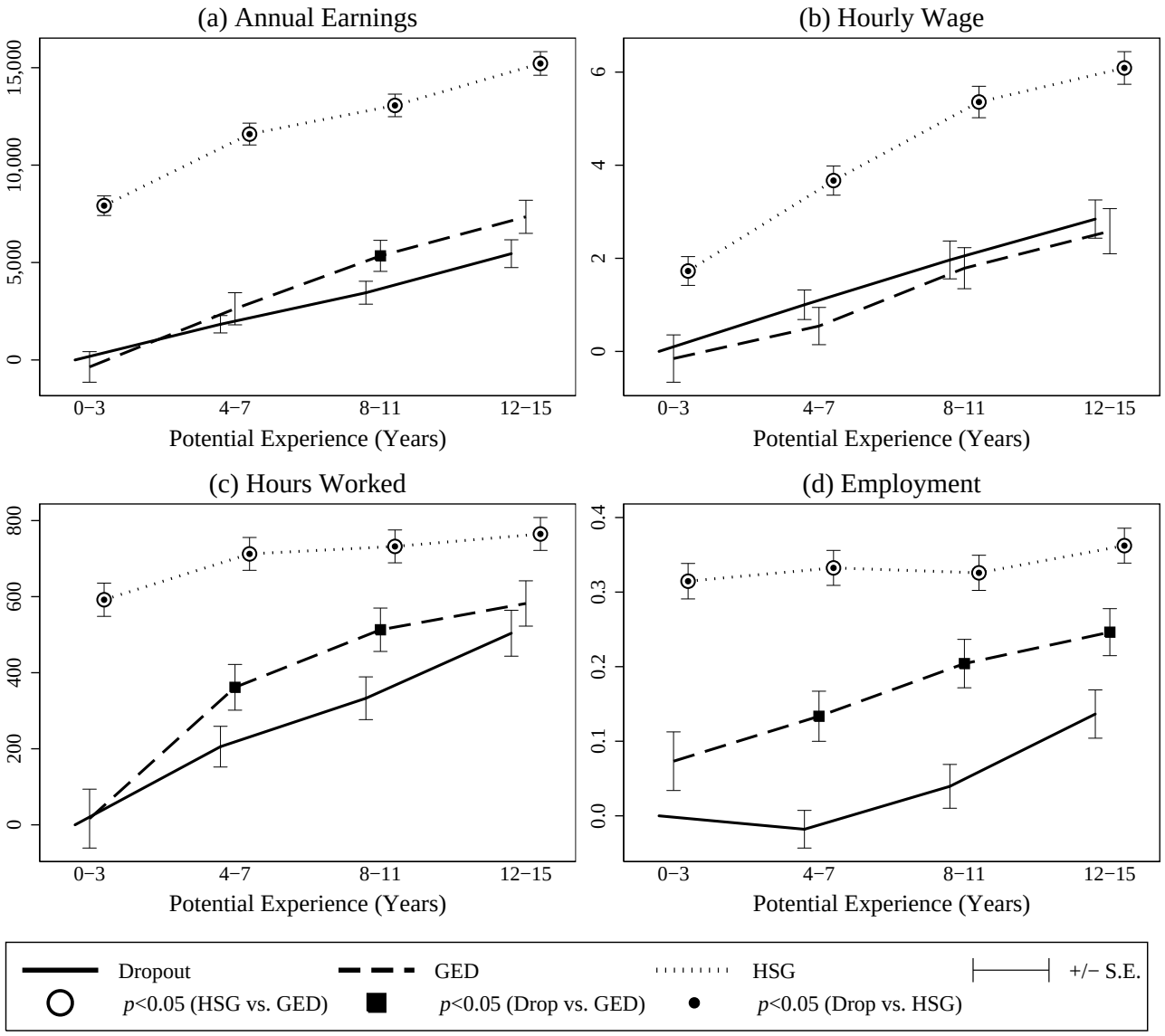
Source: National Longitudinal Survey of Youth, 1979, Nationally Representative Sample.
Notes: Respondents are classified as GED recipients if they earn a GED before the age of 40. The sample excludes people once they have been to jail.

Figure 5.39 Ability- and Background-Adjusted Labor Market Outcomes by Potential Experience (OLS) (Males, All Levels of Postsecondary Education)



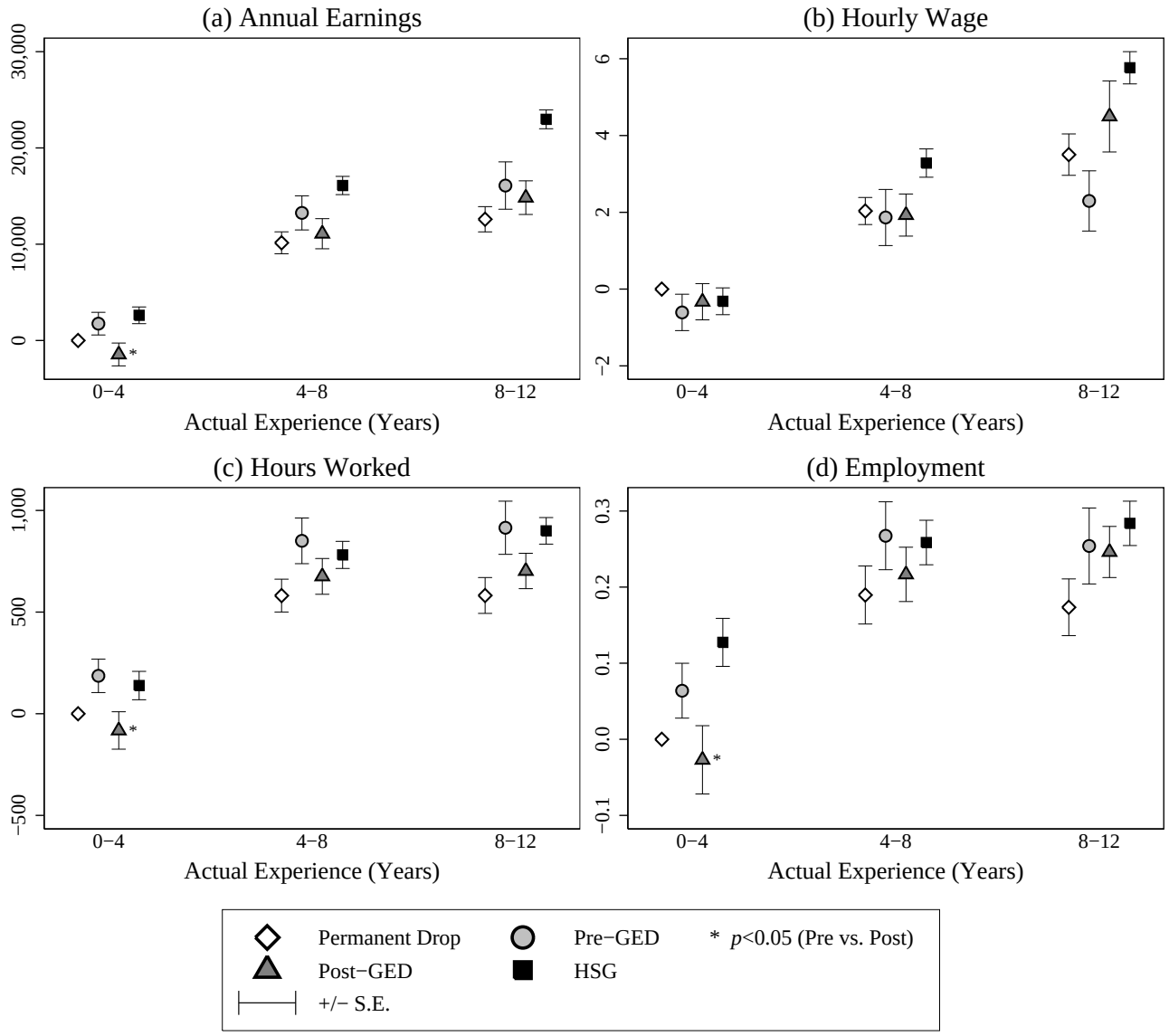
Source: National Longitudinal Survey of Youth, 1979, Nationally Representative Sample.
Controls: Region of residence, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior.
Notes: Respondents are classified as GED recipients if they earn a GED before the age of 40. The sample excludes people once they have been to jail. Potential experience is the number of years since exiting high school. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. For more information about the methodology, please see Web Appendix Section W5.4.

Figure 5.40 Ability- and Background-Adjusted Labor Market Outcomes by Potential Experience (OLS) (Females, All Levels of Postsecondary Education)



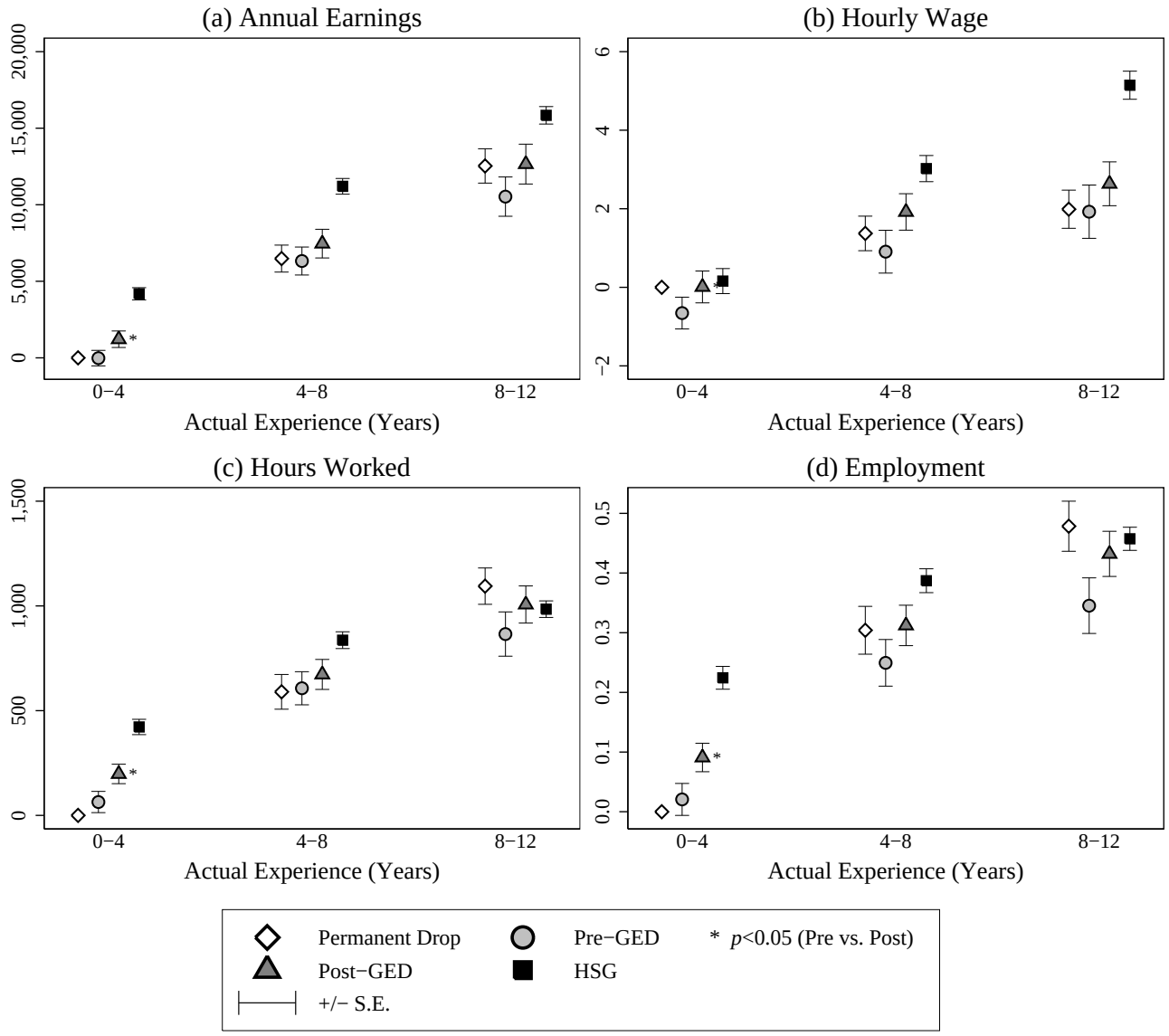
Source: National Longitudinal Survey of Youth, 1979, Nationally Representative Sample.
Controls: Region of residence, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior.
Notes: Respondents are classified as GED recipients if they earn a GED before the age of 40. The sample excludes people once they have been to jail. Potential experience is the number of years since exiting high school. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. For more information about the methodology, please see Web Appendix Section W5.4.

Figure 5.41 Ability- and Background-Adjusted Labor Market Outcomes by Actual Experience (OLS) (Males, All Levels of Postsecondary Education)



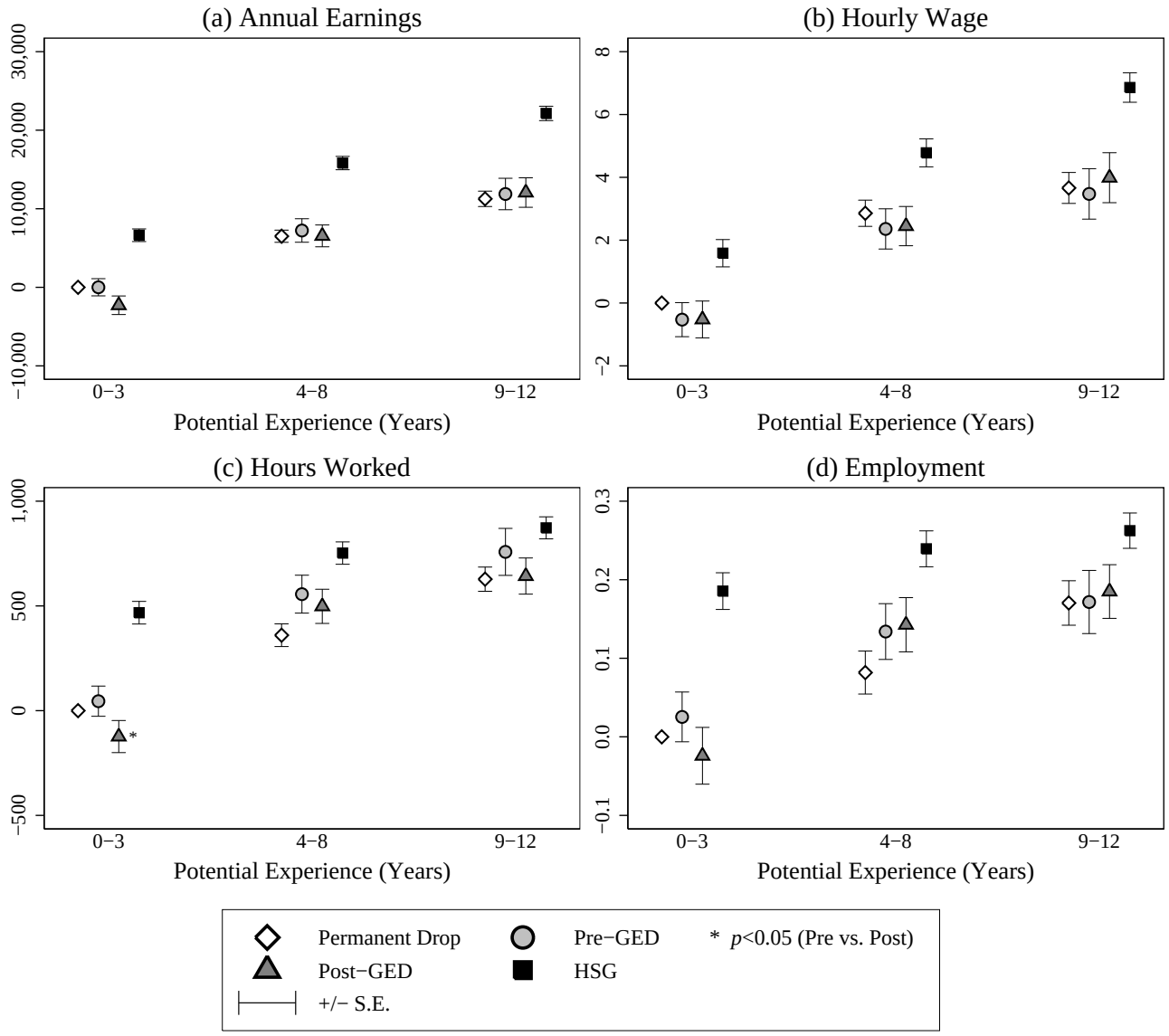
Source: National Longitudinal Survey of Youth, 1979, Nationally Representative Sample.
Controls: Region of residence, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior.
Notes: Respondents are classified as GED recipients if they earn a GED before the age of 40. The sample excludes people once they have been to jail. Actual experience is the cumulative hours worked divided by 2,000. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. For more information about the methodology, please see Web Appendix Section W5.4.

Figure 5.42 Ability- and Background-Adjusted Labor Market Outcomes by Actual Experience (OLS) (Females, All Levels of Postsecondary Education)



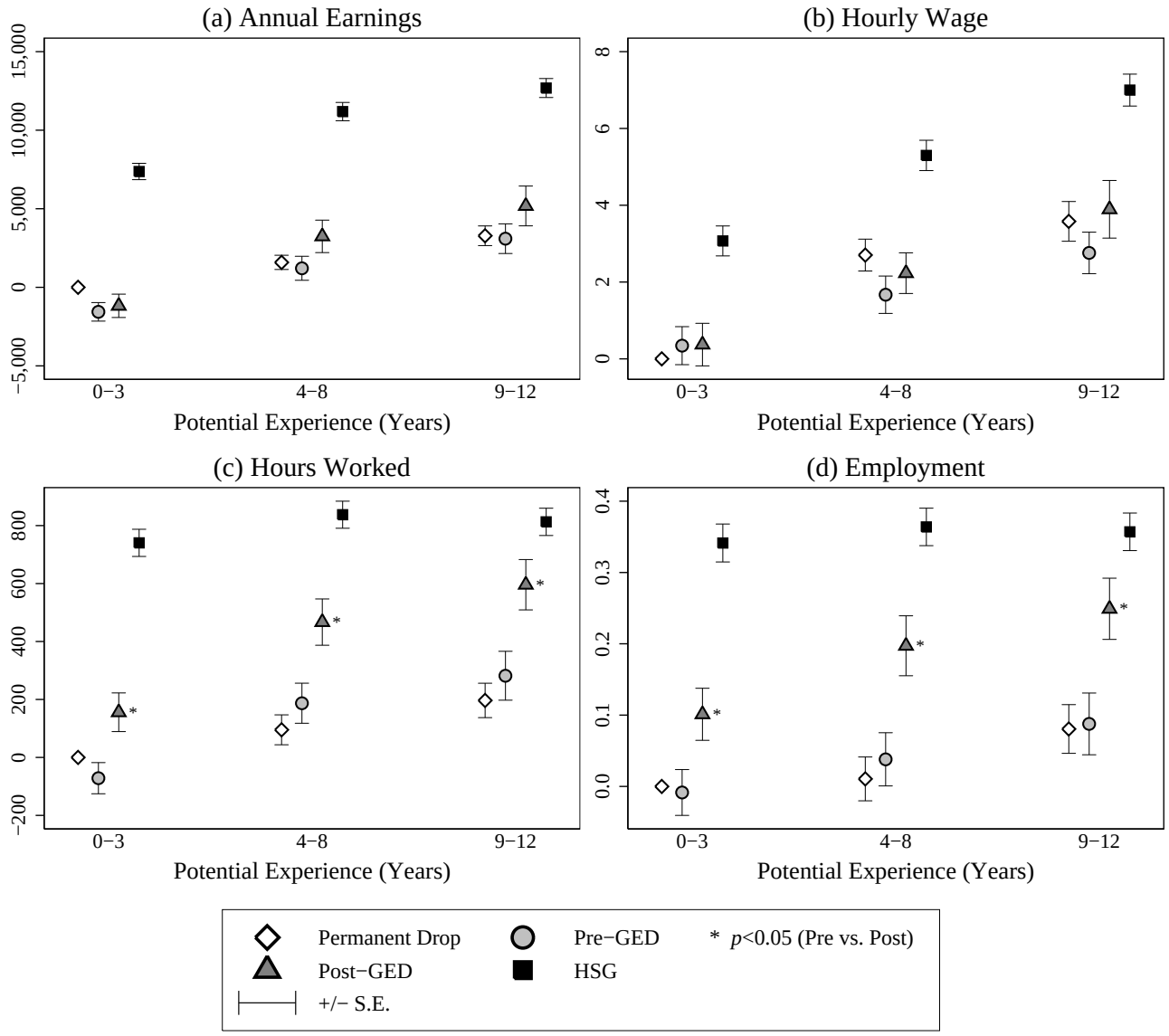
Source: National Longitudinal Survey of Youth, 1979, Nationally Representative Sample.
Controls: Region of residence, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior.
Notes: Respondents are classified as GED recipients if they earn a GED before the age of 40. The sample excludes people once they have been to jail. Actual experience is the cumulative hours worked divided by 2,000. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. For more information about the methodology, please see Web Appendix Section W5.4.

Figure 5.43 Ability- and Background-Adjusted Labor Market Outcomes by Potential Experience (OLS) (Males, All Levels of Postsecondary Education)



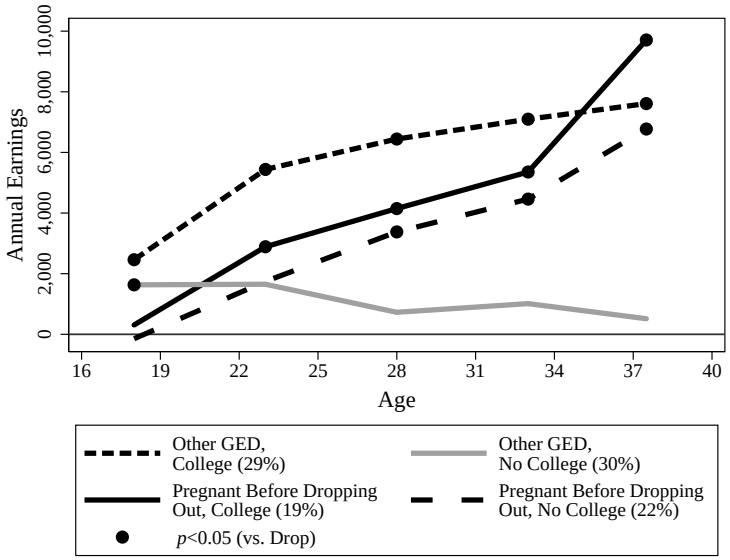
Source: National Longitudinal Survey of Youth, 1979, Nationally Representative Sample.
Controls: Region of residence, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior.
Notes: Respondents are classified as GED recipients if they earn a GED before the age of 40. The sample excludes people once they have been to jail. Potential experience is the number of years since exiting high school. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. For more information, please see Web Appendix Section W5.4.

Figure 5.44 Ability- and Background-Adjusted Labor Market Outcomes by Potential Experience (OLS) (Females, All Levels of Postsecondary Education)



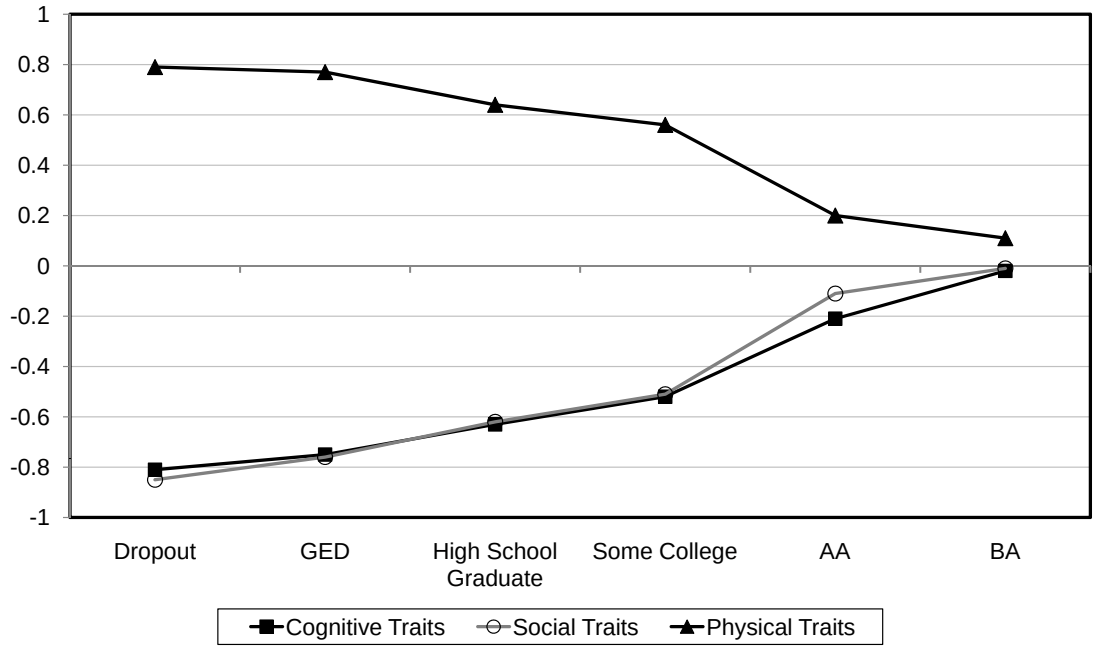
Source: National Longitudinal Survey of Youth, 1979, Nationally Representative Sample.
Controls: Region of residence, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior.
Notes: Respondents are classified as GED recipients if they earn a GED before the age of 40. The sample excludes people once they have been to jail. Potential experience is the number of years since exiting high school. All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level. For more information, please see Web Appendix Section W5.4.

Figure 5.45 Annual Earnings by Type of Female GED Recipient (All Races, Background- and Ability-Adjusted)



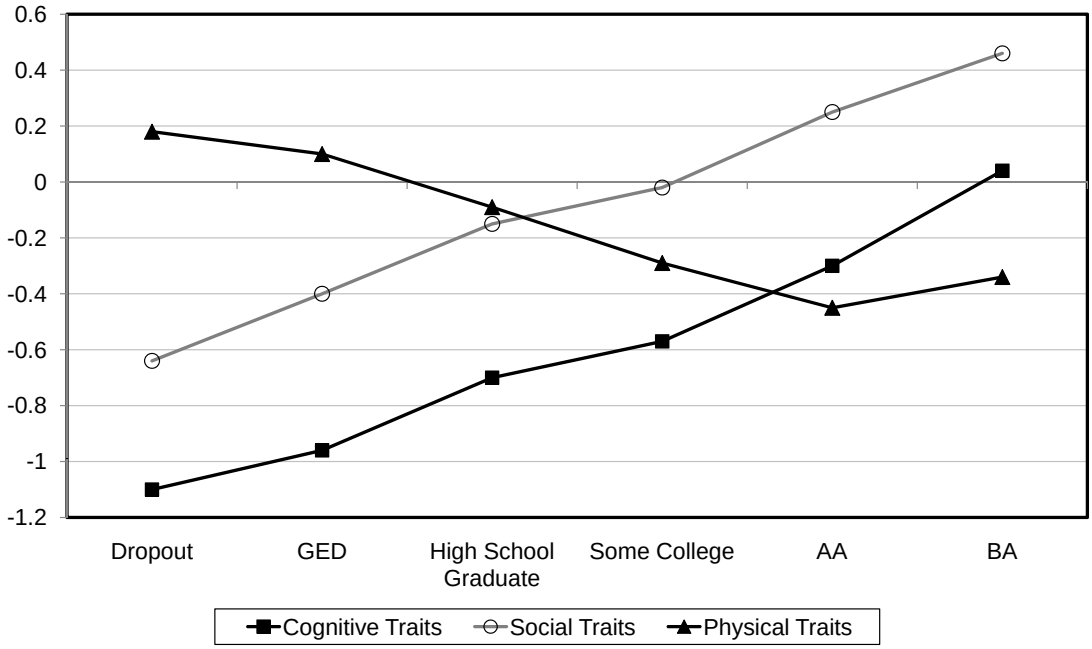
Source: National Longitudinal Survey of Youth, 1979, Nationally Representative Sample.
Controls: Age, region of residence, year, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior.
Notes: Respondents are classified as GED recipients if they earn a GED before the age of 40. The sample excludes people once they have been to jail. Regressions exclude those who report earning more than $300,000 (2005$). All regressions allow for heteroskedastic errors and, when appropriate, clustering at the individual level.

Figure 5.46 Average Occupational Factor Scores by Final Education — Males



Source: The American Community Survey, 2009, and O*NET. (More information on O*NET is available at `http://www.doleta.gov/reports/DESA_skill.cfm`.)
Notes: All educational categories are final education at time of interview. Each factor is based on the following O-Net occupational importance scores: *Cognitive* — active learning, analytical thinking, complex problem solving, critical thinking, deductive reasoning, inductive reasoning, interpretation of meaning, math reasoning, mathematics, processing information, reading comprehension, creative thinking, updating knowledge, and visualization. *Social* — communicate to outside organizations, concern for others, customer or personal service, establish relationships, leadership, oral expression, persuasion, social perceptiveness, speaking, writing, written expression, active listening, and cooperation. *Physical Traits* — arm and hand steadiness, control and precision, coordination, depth perception, explosive strength, finger dexterity, gross body coordination, gross body equilibrium, manual dexterity, multi-limb coordination, reaction time, spatial orientation, stamina, static strength, stress tolerance, trunk strength, and wrist and finger speed.

Figure 5.47 Average Occupational Factor Scores by Final Education — Females



Source: The American Community Survey, 2009, and O*NET. (More information on O*NET is available at `http://www.doleta.gov/reports/DESA_skill.cfm`.)
Notes: All educational categories are final education at time of interview. Each factor is based on the following O-Net occupational importance scores: *Cognitive* — active learning, analytical thinking, complex problem solving, critical thinking, deductive reasoning, inductive reasoning, interpretation of meaning, math reasoning, mathematics, processing information, reading comprehension, creative thinking, updating knowledge, and visualization. *Social* — communicate to outside organizations, concern for others, customer or personal service, establish relationships, leadership, oral expression, persuasion, social perceptiveness, speaking, writing, written expression, active listening, and cooperation. *Physical Traits* — arm and hand steadiness, control and precision, coordination, depth perception, explosive strength, finger dexterity, gross body coordination, gross body equilibrium, manual dexterity, multi-limb coordination, reaction time, spatial orientation, stamina, static strength, stress tolerance, trunk strength, and wrist and finger speed.

Table 5.1 The Data Sets Analyzed in this Chapter

Data Set	Birth Cohorts	Age Ranges Across All Survey Years	Survey Years	Measures of Cognitive Ability?	Measures of Early Adolescent Behavior?	Information on Family Background?	Information on GEDs Who Get Higher Levels of Schooling	Longitudinal	Sample Size
American Community Survey (ACS)	all ages	0 - 95	2009	no	no	no	no**	no	N = 3,030,728 GEDs = 94,262
National Adult Literacy Survey (NALS)	all ages	16 - 99	1992	yes*	no	no	no**	no	N = 9,620 GEDs = 868
National Assessment of Adult Literacy (NAAL)	all ages	16 - 65+	2003	no***	no	no	no**	no	N = 8,363 GEDs = 811
National Educational Longitudinal Survey of 1988 (NELS88)	1973-1975	12 - 30	1988, 1990 1994, 2000	yes	yes	yes	yes	yes	N = 12,144 GEDs = 826
National Longitudinal Survey of Youth 1979 (NLSY79)	1957-1964	14 - 52	annually 1979-1993, biannually 1994-2003	yes	yes	yes	yes	yes	N = 9,763 GEDs = 1,155
National Longitudinal Survey of Youth 1997 (NLSY97)	1980-1984	12 - 27	annually 1997-2008	yes	yes	yes	yes	yes	N = 8,984 GEDs = 967

Notes: All data sets are nationally representative. The two National Longitudinal Survey of Youth data sets include minority oversamples, which we use when analyzing races separately. NAAL reports age ranges rather than individual ages. Thus, the highest age specified is "65+". For full descriptions of the data sets used, see Web Appendix W5.1.1. *Measured in adulthood. **Only education at time of survey is measured. ***Cognitive ability is available at group but not individual level.

Table 5.2 Direct and Indirect Effects and Their Components for Men

	Direct Effect	Effect of College	Probability of College	Indirect Effect	Total Effect
Annual Earnings					
GED (20–24)	−514	332	0.19	62	−453
	(1,254)	(2,634)	(0.03)	(503)	(1,187)
GED (25–29)	1,109	3,194	0.29	916	2,025
	(1,754)	(3,278)	(0.03)	(957)	(1,539)
GED (30–34)	14	2,646	0.36	953	968
	(1,790)	(3,138)	(0.04)	(1,140)	(1,681)
GED (35–39)	924	5,148	0.38	1,944	2,869
	(2,516)	(4,097)	(0.04)	(1,561)	(2,403)
HSG (20–24)	2,048	863	0.40	346	2,394
	(944)	(733)	(0.01)	(295)	(914)
HSG (25–29)	5,627	4,887	0.61	2,963	8,590
	(1,094)	(1,007)	(0.01)	(614)	(1,079)
HSG (30–34)	5,405	7,601	0.65	4,935	10,340
	(1,473)	(1,246)	(0.01)	(808)	(1,486)
HSG (35–39)	4,798	10,512	0.67	6,995	11,793
	(2,041)	(1,839)	(0.01)	(1,219)	(1,982)
Hourly Wages					
GED (20–24)	0.87	−0.94	0.18	−0.17	0.70
	(0.54)	(0.82)	(0.03)	(0.16)	(0.48)
GED (25–29)	0.19	1.47	0.29	0.42	0.62
	(0.60)	(1.07)	(0.04)	(0.32)	(0.54)
GED (30–34)	0.09	2.33	0.35	0.80	0.89
	(0.83)	(1.27)	(0.04)	(0.44)	(0.75)
GED (35–39)	0.10	3.08	0.37	1.12	1.23
	(0.83)	(1.82)	(0.04)	(0.70)	(0.89)
HSG (20–24)	0.42	−0.07	0.41	−0.03	0.39
	(0.31)	(0.31)	(0.01)	(0.13)	(0.32)
HSG (25–29)	0.84	2.23	0.60	1.35	2.19
	(0.42)	(0.41)	(0.01)	(0.25)	(0.39)
HSG (30–34)	0.94	3.72	0.64	2.40	3.34
	(0.57)	(0.51)	(0.01)	(0.33)	(0.60)
HSG (35–39)	1.50	4.11	0.67	2.72	4.22
	(0.68)	(0.71)	(0.01)	(0.47)	(0.62)

Source: National Longitudinal Survey of Youth, 1979. *Controls:* Age, region of residence, year, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior. *Notes:* Regressions exclude those who report earning more than $300,000 (2005$), working more than 4,000 hours, or earning hourly wages less than $3 (2005$) or more than $200 (2005$). We estimate the returns to educational states relative to dropouts using the following equation: $Y_{it} = \alpha + \beta_1 (GED_{it}) + \beta_2 [(GED_{it}) \times (SMCOLL_{it})] + \beta_3 (HSG_{it}) + \beta_4 [(HSG_{it}) \times (SMCOLL_{it})] + \gamma X_{it} + \varepsilon_{it}$, where GED_{it} and HSG_{it} indicate whether individual i is a GED recipient or high school graduate at time t and $SMCOLL_{it}$ indicates whether individual i has obtained some college by time t. X_{it} is a vector of background controls. At each age range, we also estimate the probability of having attended some college for GED recipients (p_{GED}) and high school graduates (p_{HSG}). β_1 and β_3 are the direct effects of GED receipt and high school graduation. β_2 and β_4 are the additional returns to attending some college for GED recipients and high school graduates. $p_{GED} \times \beta_2$ and $p_{HSG} \times \beta_4$ are the indirect effects of GED receipt and high school graduation. The standard errors are listed in parentheses and are calculated using a bootstrap procedure that allows for arbitrary correlation of the error term within individuals over time but assumes that the error term is uncorrelated across individuals. We use 100 draws.

Table 5.3 Direct and Indirect Effects and Their Components for Women

	Direct Effect	Effect of College	Probability of College	Indirect Effect	Total Effect
Annual Earnings					
GED (20–24)	1,490	3,652	0.22	790	2,280
	(836)	(1,861)	(0.03)	(412)	(825)
GED (25–29)	1,343	2,982	0.33	974	2,317
	(973)	(1,689)	(0.03)	(572)	(906)
GED (30–34)	2,127	2,762	0.39	1,071	3,199
	(1,206)	(1,698)	(0.03)	(668)	(1,214)
GED (35–39)	1,791	3,491	0.41	1,442	3,234
	(1,360)	(1,896)	(0.03)	(788)	(1,337)
HSG (20–24)	5,192	3,174	0.44	1,399	6,590
	(518)	(569)	(0.01)	(251)	(508)
HSG (25–29)	5,473	5,912	0.63	3,701	9,173
	(732)	(824)	(0.01)	(517)	(774)
HSG (30–34)	5,712	5,676	0.68	3,849	9,561
	(872)	(852)	(0.01)	(574)	(875)
HSG (35–39)	6,723	4,058	0.70	2,853	9,576
	(1,080)	(998)	(0.01)	(700)	(998)
Hourly Wages					
GED (20–24)	0.29	0.82	0.23	0.19	0.48
	(0.32)	(0.64)	(0.03)	(0.16)	(0.30)
GED (25–29)	0.30	0.43	0.35	0.15	0.45
	(0.45)	(0.69)	(0.04)	(0.24)	(0.40)
GED (30–34)	−0.67	1.81	0.39	0.71	0.04
	(0.51)	(0.87)	(0.04)	(0.35)	(0.57)
GED (35–39)	−0.09	1.48	0.42	0.62	0.53
	(0.59)	(0.88)	(0.03)	(0.37)	(0.57)
HSG (20–24)	0.97	0.83	0.47	0.39	1.36
	(0.18)	(0.20)	(0.01)	(0.09)	(0.17)
HSG (25–29)	1.54	1.48	0.66	0.98	2.52
	(0.34)	(0.28)	(0.01)	(0.19)	(0.30)
HSG (30–34)	0.82	2.78	0.69	1.91	2.74
	(0.43)	(0.38)	(0.01)	(0.26)	(0.44)
HSG (35–39)	1.55	2.96	0.70	2.07	3.62
	(0.52)	(0.44)	(0.01)	(0.31)	(0.46)

Source: National Longitudinal Survey of Youth 1979. *Controls:* Age, region of residence, year, race, AFQT adjusted for schooling at time of test, broken home status at age 14, family income in 1979, mother's highest grade completed, urban residence at age 14, residence in the South at age 14, and factors based on adolescent risky behavior and criminal behavior. *Notes:* Regressions exclude those who report earning more than $300,000 (2005$), working more than 4,000 hours, or earning hourly wages less than $3 (2005$) or more than $200 (2005$). We estimate the returns to educational states relative to dropouts using the following equation: $Y_{it} = \alpha + \beta_1 (GED_{it}) + \beta_2 [(GED_{it}) \times (SMCOLL_{it})] + \beta_3 (HSG_{it}) + \beta_4 [(HSG_{it}) \times (SMCOLL_{it})] + \gamma X_{it} + \varepsilon_{it}$, where GED_{it} and HSG_{it} indicate whether individual i is a GED recipient or high school graduate at time t and $SMCOLL_{it}$ indicates whether individual i has obtained some college by time t. X_{it} is a vector of background controls. At each age range, we also estimate the probability of having attended some college for GED recipients (p_{GED}) and high school graduates (p_{HSG}). β_1 and β_3 are the direct effects of GED receipt and high school graduation. β_2 and β_4 are the additional returns to attending some college for GED recipients and high school graduates. $p_{GED} \times \beta_2$ and $p_{HSG} \times \beta_4$ are the indirect effects of GED receipt and high school graduation. The standard errors are listed in parentheses and are calculated using a bootstrap procedure that allows for arbitrary correlation of the error term within individuals over time but assumes that the error term is uncorrelated across individuals. We use 100 draws.