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7 Determinants of Young Males' Schooling and Training Choices

Stephen V. Cameron and James J. Heckman

This paper examines the determinants of high school graduation, GED certification, and postsecondary participation in academic and vocational training programs. The three main avenues through which Americans attain high school graduate status are by attending traditional high schools, by attending adult high schools, or by passing the General Educational Development (GED) exam. A traditional high school graduate must complete 12 years of school as well as a number of academic requirements to earn his or her degree. An individual who drops out of the traditional track can still earn a "high school equivalence" degree by GED exam certification. No formal academic requirements need to be satisfied for GED certification, and an individual who has left school at any grade level may take the exam. A dropout need only demonstrate a certain level of academic competence on the GED exam to earn high school certification. GED certification has grown from only 3 percent of all high school degrees awarded in 1965 to 14 percent during the 1980s. One in three traditional high school dropouts now earns a GED certificate. It has been widely assumed that GED recipients are equivalent to traditional high school graduates. In previous work, (Cameron and Heckman 1993b) we demonstrated that exam-certified (GED) high school graduates make the same earnings as noncertified high school dropouts once we control for the number of years of high school completed. The only benefit to GED certification is the access it provides to a variety of federally subsidized postsecondary academic and

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vocational training programs that require a high school degree or its "equivalent" for admission.

This paper investigates the determinants of GED acquisition and high school graduation. We also consider the determinants of postsecondary training and schooling choices. We demonstrate two points: (1) The determinants of high school certification by exam are fundamentally different from the determinants of ordinary high school graduation. (2) In terms of their pursuit of postsecondary education or training, exam-certified (GED) high school graduates are fundamentally different from ordinary high school graduates. The former are more likely to take vocational and technical training; the latter are more likely to attend academic four-year colleges and complete the academic programs they begin. Exam-certified graduates are much more likely to take some form of training than are noncertified dropouts. Our previous work demonstrated that GED-certified ability is not the ability valued by employers. In this paper we demonstrate that the GED exam does not measure the ability or motivation that predicts successful completion of postsecondary schooling and training programs.

In establishing these points, we present new evidence on the determinants and consequences of the early schooling decisions of American white, Hispanic, and black males coming of age in the late 1970s and mid-1980s. We analyze school dropping-out and continuation decisions for these demographic groups.

This paper also examines the role of family background and local labor market opportunities on decisions to continue schooling and to take training. Unlike traditional studies in the economics of education that focus on college choices, we disaggregate post-high-school educational and training choices to account for the full array of academic and nonacademic schooling and training choices available to potential students. This disaggregation turns out to be essential in producing behaviorally interpretable models of postsecondary schooling choices for minority youth.

We find strong effects of family background on school continuation decisions. We also find that local labor market opportunities play an important role in explaining secondary schooling decisions and high school dropping-out behavior. The better are opportunities for unskilled labor, the lower are high school continuation rates. Participation in postsecondary nonacademic training is *positively* related to family resources. Participation in either academic or nonacademic training thus reinforces initial family earnings inequalities.

7.1 Background on the GED and the Recent Rise in GED Test Taking[1]

There are three main routes through which Americans achieve recognition as high school graduates: first, through traditional course attendance and grad-

1. Cameron and Heckman (1993b) present a more detailed overview of the history of the GED.

uation at the end of the twelfth grade; second, through night school, adult high school, and other formal programs oriented toward those who have dropped out of the traditional high school track but who still wish to achieve high school graduation; and third, through certification testing. Certification testing tries to validate knowledge gained through life experience, and not just that gained inside a classroom. Several exam-certification programs exist, but certification through programs other than the GED has been small—only 1–2 percent of all new high school graduates over the period 1974–87. The number of high school graduates from adult high school programs, too, has been small. The major change in the source of high school credentials has come from growth in GED certification.

Figure 7.1 documents the dramatic rise in GED certification. Cameron and Heckman (1993b) trace the growth of the GED, beginning from its birth during World War II as a certification device through which military personnel could signal skills acquired in the military. The GED first became available to civilians in 1952. Cameron and Heckman (1993b) also discuss the rapid increase in GED certification beginning in 1965, when only 3 percent of all new high school diplomas were GED certificates, to the 1980s, during which more than 14 percent of all new high school diplomas were GED certificates. They argue that the post-1965 growth began with direct subsidies from the Adult Basic Education Program—a program designed to teach basic reading skills to illiterate adults and to help adult high school dropouts graduate from high school—but continued growing in popularity as persons obtained GED certification to become eligible for a growing pool of state and federal subsidies to

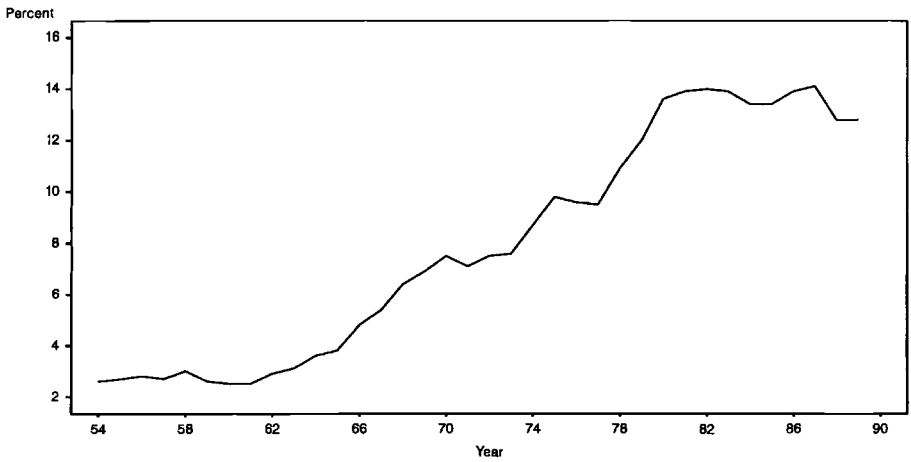

Fig. 7.1 New GED recipients as a percentage of total new recipients of high school credentials (GED + high school graduates)
Sources: U.S. Department of Education, National Center for Educational Statistics, *Digest of Education Statistics 1989*, Washington, D.C.: U.S. Government Printing Office [GPO], 1989); GED Testing Service (1989); U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-20 (Washington, D.C.: U.S. GPO, selected years).

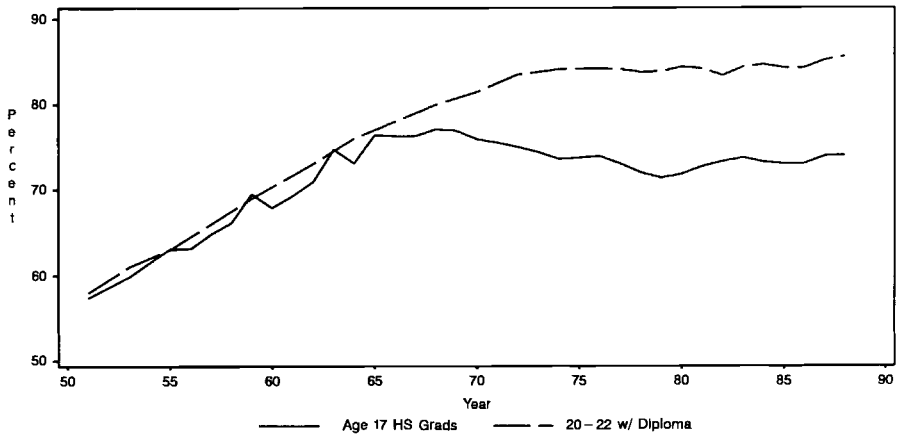

Fig. 7.2 Percentage of 17-year-olds who are high school graduates and percentage of 20–24-year-olds with at least a high school diploma
Sources: U.S. Department of Education, National Center for Education Statistics, *Digest of Education Statistics 1989;* (Washington, D.C.: U.S. GPO, 1989); U.S. Department of Commerce, Bureau of the Census, *Current Population Reports,* Series P-20 (Washington, D.C.: U.S. GPO, selected years).
Note: "High school graduates" includes graduates of regular day-school programs, excludes graduates of other programs, when separately reported, and high school equivalency recipients.

participants in postsecondary academic and vocational education. These subsidies include direct cash grants, subsidized student loans, and subsidized work-study programs.

Exam certification also explains an anomaly in the data on high school completions. Figure 7.2 plots the proportion of traditional high school graduates for the cohort of 17-year-olds over the period 1951–88. After a steady increase, the proportion declines after 1968 and then levels off through the late 1970s and 1980s. The pattern over the period 1971–86 for all high-school-certified persons never shows such a decline. The recent growth in exam certification explains the discrepancy. One in three high school dropouts now obtains a GED by age 25 (Cameron and Heckman 1993b).

Certification by GED acquisition requires no classroom training, only the demonstration of a certain level of competence on the GED exam. GED examinees are tested on a total of 290 items in five subject area tests: writing skills (80 items), social studies (60 items), science (60 items), reading skills (40 items), and mathematics (50 items).[2] The test focuses on general knowledge (Malizio and Whitney 1982). Most GED examinees spend little time in test preparation. A survey of GED test takers in 1980 revealed that the median examinee spent 20 hours preparing for the test and $10 in preparation costs. Seventy-five percent of the examinees spent 60 hours or less, and the upper 5

2. Since 1990 an essay section has been added to the GED battery.

percent reported more than 200 hours in preparation. Twenty-one percent did not prepare in any way. The upper quartile of the candidates spent $30 in direct out-of-pocket expenses and lost salary. The pass rate on any given sitting is usually around 70 percent. Candidates who fail one or more sections may retake sections of the exam until all five sections are passed, though a two-to-three-month waiting period is required by some states. Thus, most people sitting for the GED exam need little, if any, investment in new skills in order to pass. If the human capital investment required for GED certification is low, one might predict that the economic and educational returns to it are also be low.

7.2 Brief Description of the NLSY Data

In this section, we digress briefly to describe the National Longitudinal Survey of Youth (NLSY) data. The NLSY contains annual survey information on three separate samples of U.S. youths: a randomly chosen sample of 6,111 civilian youths; a supplemental sample of 5,296 randomly chosen black, Hispanic, and nonblack non-Hispanic economically disadvantaged youths; and a third sample of 1,279 youth participating in active military service. Sample respondents were aged 13–20 in January 1978 and were interviewed annually from 1979 through 1987. Thus, by the 1987 midyear interview, respondents' ages ranged from 22 to 30. This data set is especially rich in detail on family background, military participation, school and training histories, labor market histories and outcomes, as well as marriage and fertility histories.

Our sample consists of males who were in the random sample, the black supplemental sample, and the Hispanic supplemental sample. A total of 3,003 observations are available from the random sample, 1,105 from the black sample, and 729 from the Hispanic sample. Combining the blacks from the random sample and the blacks from the supplemental sample, we have a total of 1,461 randomly chosen blacks. Similarly, we have 939 randomly chosen Hispanics. Finally, from just the random sample we have a total of 2,437 randomly chosen nonblack, non-Hispanic youths.[3]

One advantage of the NLSY data is its rich variety of measures on family background, school quality, location, and ability. To measure family background we extract variables on the highest grades completed by the mother and by the father, income in 1978 of the respondent's parents, occupation of each parent, the number of living siblings, whether the respondent came from a broken home at age 14, whether the respondent was black, Hispanic, or white, and regional labor market characteristics at each age starting at age 14. Since we can identify the state and county of each respondent for each sample year (as well as the state in which the respondent lived at age 14), we merged supplementary measures of county and state labor market conditions with the NLSY (see the appendix). Finally, as a measure of ability, we use test scores

3. This sample includes a small number of men of Asian origin.

from the Armed Services Vocational Aptitude Battery (ASVAB), administered to all NLSY respondents in 1980. This test is described in the appendix. Precise definitions of the family background, local labor market, and school quality variables used in this analysis are listed in table 7.1.

7.3 Basic Features of the Data

This section presents simple mean-difference and univariate distributional comparisons among high school dropouts, GED recipients, and high school graduates. Using the NLSY data described above, we compare the determi-

Table 7.1 **Variables Used in School Transition Analysis**

Variable	Definition
Number of siblings	Number of living siblings
Family income	Total family income of members of the parents family living in the household at the time of the first interview. Includes salary, interest and dividends, social security and retirement, alimony and child support, rental income, pension and annuities, unemployment compensation, veterans' benefits, public assistance and welfare, business income, farm income, educational benefits, food stamps, AFDC, and gift income (denominated in thousands of 1990 dollars).
Highest grade father and highest grade mother	Highest grades completed in years by the respondent's father and mother when respondent was age 14.
Broken home	Absence of at least one parent from the respondent's household at age 14.
South, age 14	Whether the respondent lived in the Southern census region at age 14.
Farm, age 14	Whether the respondent lived on a farm at age 14.
County average earnings	The average earnings per job (thousands of 1990 dollars) in skilled or unskilled industries in the county of residence, measured at the time the individual first became at-risk for the next transition. For example, for the transition complete ninth grade to attend high school, county average earnings is unskilled average earnings measured in the year the individual completed ninth grade. For whether the individual completes ninth grade, the initial state, county average earnings is unskilled average earnings measured in the year the individual first attends ninth grade or the year they dropout if they never attend ninth grade. As education level improves, so does the imputed opportunity wage. See the appendix for more details.
AFQT score	Score on the Armed Forces Qualification Test (see the appendix).
Company training/ apprenticeship	Any on-the-job, company-sponsored vocational or technical training program or formal apprenticeship that lasted at least one month.
Vocational training	Any off-the-job vocational or technical training program (may or may not be paid for by an employer) taken at a vocational school, nursing school, flight school, business or secretarial college, barber school, or beauty college. The program must have lasted at least one month.
Military	Enlistment and active duty for at least one month in any full-time branch of the armed forces.
Two-year college	Full-time enrollment for at least one full month in a junior or community college.
Four-year college	Full-time enrollment for at least one month in a four-year college or university.

nants and labor market and educational consequences of the three types of high school certification status.

Table 7.2 reveals that family background and labor market opportunity variables are ordered in the expected direction. High school dropouts are more likely to be minority group members and to come from larger families with lower incomes and less educated parents than are GED recipients, who, in turn, have more adverse background characteristics than high school graduates.[4] Dropouts are more likely to take unskilled jobs than are GED recipients and traditional high school graduates. The Wilcoxon test (see Bickel and Doksum 1977) reported in the right two columns of table 7.2, reveals that the family income distribution of traditional high school graduates stochastically dominates that of GED recipients and dropouts.

Evidence on postsecondary schooling choices is presented in tables 7.3 and 7.4, which look at postcertification educational choices for both high school graduates (diploma recipients) and GED recipients. Table 7.3 shows first choices after completing certification. GED-certified persons are much less likely to attend four-year colleges and are more likely to enter the military or to not undertake any postsecondary education (in 1992, however, the military stopped accepting GED recipients). Table 7.4 reveals that GED graduates are less likely than high school graduates to attend four-year colleges, or to graduate from them if they attend them. Completion rates at two-year colleges are much higher for high school graduates.

The evidence from the NLSY and the other studies reviewed in Cameron and Heckman (1993b) indicates that GED recipients are not the equivalent of high school graduates. Their labor market outcomes and performance in the military suggest that GED recipients are similar to high school dropouts. GED recipients are less likely to pursue postsecondary academic education and are less likely to finish an education or training program if they begin it. The balance of the paper presents a more refined statistical analysis of the NLSY that supports these basic conclusions concerning postsecondary education.

7.4 The Determinants of Secondary School Graduation, Dropping-Out Decisions, and GED Certification

This section presents an analysis of secondary schooling decisions through high school certification. Section 7.5 considers the determinants of postsecondary educational decisions. We establish the following results:

1. The determinants of the decision to take the GED exam are not the same as the determinants of high school graduation; accordingly, it is inappropriate

4. The anomalously high number of siblings is a consequence of size-biased sampling in the NLSY. If one child is included in a unit, so are all siblings—provided they share common family characteristics. This sampling induces a stochastic dependence among sibling observations, which we have analyzed elsewhere (Cameron and Heckman 1992b), where we show it has a minor effect on the estimated standard errors of coefficients of wage equations.

Table 7.2 **Mean Family Background Characteristics and Wilcoxon Tests of Equality**

	Mean (standard error of the mean)			Chi-Square *P*-values	
	Dropout	GED	High School Diploma	Dropout vs. GED	GED vs. High School Diploma
Family income (1990$)	24,930 (518)	29,838 (839)	39,557 (383)	.00	.00
Highest grade father	8.6 (.12)	10.3 (.16)	12.2 (.06)	.00	.00
Highest grade mother	9.6 (.10)	10.6 (.12)	12.0 (.04)	.00	.00
Number of siblings	4.3 (.09)	3.4 (.10)	3.0 (.04)	.00	.00
Broken home	.29 (.02)	.26 (.02)	.13 (.01)	.55	.00
Black	.22 (.01)	.19 (.02)	.12 (.01)	.36	.00
Hispanic	.14 (.01)	.09 (.01)	.05 (.00)	.02	.00
N (proportion of total population)	884 (.183)	468 (.097)	3,485 (.720)	NA	NA

Note: The sample consists of individuals interviewed in the initial 1979 wave and in the 1987 wave of the NLSY. The means are weighted to account for oversampling of the black and Hispanic populations. Only the random sample portion of the data was used to construct the Wilcoxon tests. NA = not applicable.

Table 7.3 **Means of the Training Variables for Recipients of High School Diplomas or GEDs**

Degree	First Training Action after Completing High School Degree (standard errors of the mean)					
	Attend Four-Year College	Attend Two-Year College	Vocational Training	Company Training/ Apprenticeship	Military	Other*
High school diploma ($N = 2,925$)	.38 (.01)	.23 (.01)	.08 (.00)	.05 (.00)	.05 (.00)	.21 (.01)
GED ($N = 304$)	.13 (.02)	.22 (.03)	.13 (.02)	.05 (.01)	.10 (.02)	.37 (.04)

Note: See the footnote of table 7.2 for the sample inclusion criteria. The means are weighted to account for minority oversampling.

*Other = work with no training, unemployment, or out of labor force.

Table 7.4 **College Education after Receiving High School Degree (standard errors of the means in parentheses)**

A. Initial College Choice (% of sample)

Degree	First Enter Four-Year College	First Enter Two-Year College	No College
High school diploma	.37 (.01)	.23 (.01)	.40 (.01)
GED	.10 (.02)	.20 (.02)	.69 (.02)

B. Completion Rates for Four-Year College Starters[a]

Degree	Complete Four Years or More	Complete Two to Three Years	Complete Less than Two Years
High school diploma	.51 (.01)	.21 (.01)	.28 (.01)
GED	.00 (NA)	.10 (.04)	.90 (.04)

C. Completion Rates for Two-Year College Starters

Degree	Transfer to a Four-Year School and Graduate	Complete Two to Three Years	Complete Less than Two Years
High school diploma	.12 (.01)	.27 (.01)	.61 (.01)
GED	.01 (.01)	.15 (.04)	.84 (.03)

Note: The sample is defined for the subset of individuals who received a high school degree by 1983 and left school by 1987—approximately 25 percent of the sample were dropped by these criteria. NA = not applicable; no GED recipients started four-year colleges and completed them.

[a]These are persons who start at four-year colleges.

to aggregate GED recipients and conventional high school graduates, in studies of the determinants of secondary schooling.

2. Parental education plays an important role in school attendance and completion decisions; *father's* education plays an important role in determining GED acquisition by dropouts; mother's education is inconsequential.

3. Family income plays an important role in determining *formal* schooling decisions but not in determining GED-acquisition decisions.

4. Children from broken homes are less likely to graduate from high school; the effect of a broken home on GED acquisition is much weaker.

5. Better opportunities in unskilled labor markets encourage school dropping-out decisions and inhibit acquisition of a GED.

6. There are pronounced differences in schooling determinants among racial/ethnic groups; even controlling for ability as measured by the Armed Forces Qualification Test (AFQT), it is not possible to combine the models determining secondary education for racial/ethnic groups.

Table 7.5 reports estimates of logistic secondary school attendance and transition probabilities following Mare (1980). The tables present separate and pooled estimates for samples of NLSY white, black, and Hispanic males. Table 5, panel *A*, reports estimates for the combined sample, and panels *B–D* show separate estimates for black, Hispanic, and white samples, respectively.[5]

The first column reports the determinants of ninth-grade completion. (Since virtually all individuals in the NLSY complete the earlier grades, analysis of lower-grade transitions is not worthwhile.) The reported coefficients are the effects of unit changes in the associated variables on the log-odds ratio for completing ninth grade. The second column reports estimates of the determinants of transitions from ninth grade to high school attendance. The sample used to estimate this transition probability consists of those who completed ninth grade. The third and fourth columns report estimates of high school certification obtained either through a conventional high school diploma and through the GED, respectively. In our sample, more than 91 percent of all GED achievers had completed ninth grade. Finer disaggregation of the data by grade within high school is not empirically fruitful. Accordingly, the base state for these final secondary transitions is "attend high school."

For the completion of ninth grade and the transition from ninth grade to high school, the grade attainment probability is

$$P = \frac{\exp(x\beta)}{1 + \exp(x\beta)}.$$

For transitions from "attend high school" to "high school diploma" (state 1) or "GED" (state 2) the probability of transition to state i is

5. The combined sample is not a representative random sample because both blacks and Hispanics are overrepresented. Nevertheless, the slope estimates of a logit are robust with respect to such oversampling and represent consistent estimates of population parameters (Cosslett 1981).

Table 7.5 **Schooling Transitions through High School Completion for NLSY Males: Logistic Transition Probabilities (*t*-ratios in parentheses)**

Variable	No School to Complete Ninth Grade	Complete Ninth Grade to Attend High School	Attend High School to		
			High School Diploma	GED	High School Degree[a]
		A. Combined Blacks, Hispanics, and Whites			
Intercept	2.736 (4.22)	2.710 (4.20)	1.471 (3.72)	0.932 (1.74)	1.80 (4.61)
Number of siblings	−0.105 (3.29)	−0.162 (5.21)	−0.039 (1.75)	−0.037 (1.18)	−.040 (1.76)
Family income	0.037 (4.63)	0.025 (3.71)	0.025 (6.06)	−0.002 (0.30)	.022 (5.45)
Highest grade, father	0.162 (5.43)	0.085 (2.90)	0.093 (4.63)	0.064 (2.36)	.089 (4.49)
Highest grade, mother	0.109 (3.12)	0.059 (1.71)	0.050 (2.14)	0.012 (0.39)	.042 (1.90)
Broken home	0.205 (0.94)	−0.609 (3.17)	−0.399 (3.13)	−0.278 (1.60)	−.38 (3.00)*
Farm, age 14	−0.502 (1.68)	−0.347 (1.09)	0.230 (0.83)	−0.621 (1.46)	.136 (0.50)
South, age 14	−1.064 (5.04)	−0.691 (3.53)	0.388 (3.11)	0.238 (1.41)	.367 (2.99)
County average earnings	−0.132 (5.05)	−0.049 (1.84)	−0.087 (5.89)	−0.090 (4.31)	−.088 (6.00)
Black	0.991 (3.90)	0.995 (4.20)	−0.331 (2.22)	−0.413 (2.03)	−.344 (2.31)
Hispanic	0.688 (2.49)	0.576 (2.16)	−0.078 (0.45)	0.052 (0.22)	−.056 (0.32)
N	3,965	3,815	3,660	3,660	
−2 *log-likelihood:	1,006.4	1,141.9	4,325.9	4,462.9	
		B. Blacks			
Intercept	2.949 (2.60)	1.458 (1.32)	1.523 (2.32)	1.846 (1.86)	1.91 (3.0)
Number of siblings	−0.085 (1.57)	−0.125 (2.48)	−0.026 (0.83)	−0.001 (0.03)	−.023 (0.73)
Family income	0.030 (1.78)	−0.005 (0.34)	0.0024 (3.06)	−0.006 (0.49)	.021 (2.7)
Highest grade, father	0.121 (2.18)	0.025 (0.43)	0.122 (3.54)	0.145 (2.82)	.125 (3.7)
Highest grade, mother	0.133 (1.93)	0.219 (3.44)	0.056 (1.38)	0.053 (0.89)	.055 (1.4)
Broken home	0.161 (0.46)	−1.041 (3.13)	−0.318 (1.67)	−0.784 (2.83)	−.374 (2.0)
Farm, age 14	−0.465 (0.70)	0.083 (0.11)	0.283 (0.50)	−1.130 (0.99)	.177 (0.32)
South, age 14	−0.778 (2.02)	0.024 (0.07)	0.428 (2.40)	−0.277 (1.08)	.344 (2.0)
County average earnings	−0.095 (2.33)	−0.024 (0.60)	−0.135 (5.22)	−0.227 (5.30)	−.145 (5.6)
N	1,225	1,181	1,129	1,129	
−2 *log-likelihood:	339.6	385.1	1,566.4	1,614.3	
		C. Hispanics			
Intercept	5.139 (4.54)	4.329 (3.67)	2.687 (3.65)	1.788 (1.81)	2.98 (4.2)
Number of siblings	−0.106 (1.99)	−0.224 (4.02)	−0.030 (0.66)	−0.081 (1.32)	−.040 (0.89)
Family income	0.038 (2.73)	0.037 (2.57)	0.033 (3.76)	−0.011 (0.88)	.027 (3.2)
Highest grade father	0.151 (3.17)	0.118 (2.42)	0.032 (0.95)	0.042 (0.94)	.033 (1.0)
Highest grade mother	0.067 (1.31)	−0.070 (1.35)	0.004 (0.11)	−0.019 (0.40)	.001 (.10)
Broken home	0.513 (1.32)	0.005 (0.01)	−0.408 (1.60)	−0.059 (0.18)	−.331 (1.3)
Farm, age 14	−1.405 (3.27)	0.080 (0.12)	−0.303 (0.59)	−0.719 (0.84)	−.371 (0.73)
South, age 14	−1.100 (2.81)	−0.466 (1.11)	0.244 (0.87)	0.223 (0.61)	.240 (0.87)

Table 7.5 (continued)

Variable	No School to Complete Ninth Grade	Complete Ninth Grade to Attend High School	Attend High School to		
			High School Diploma	GED	High School Degree[a]
County average earnings	−0.203 (4.23)	−0.079 (1.53)	−0.127 (3.50)	−0.098 (2.00)	−.122 (3.4)
N	764	705	661	661	
−2 *log-likelihood:	317.4	285.8	970.7	998.4	
		D. Whites			
Intercept	0.776 (0.54)	3.544 (2.84)	−1.055 (1.53)	−1.085 (1.23)	−.66 (0.98)
Number of siblings	−0.121 (1.84)	−0.159 (2.72)	−0.094 (2.02)	−0.054 (0.88)	−.087 (1.90)
Family income	0.035 (2.76)	0.029 (2.96)	0.020 (3.29)	0.003 (0.36)	.020 (3.1)
Highest grade father	0.198 (3.47)	0.119 (2.31)	0.129 (3.34)	0.043 (0.89)	.120 (3.1)
Highest grade mother	0.155 (2.18)	0.060 (0.93)	0.174 (3.65)	0.082 (1.35)	.157 (3.4)
Broken home	0.133 (0.30)	−0.540 (1.60)	−0.549 (2.22)	0.058 (0.19)	−.450 (1.8)
Farm, age 14	1.638 (1.56)	−0.708 (1.65)	0.418 (1.00)	−0.230 (0.40)	.348 (0.8)
South, age 14	−1.250 (3.45)	−1.365 (4.47)	0.398 (1.62)	0.658 (2.20)	.44 (1.8)
County average earnings	−0.056 (2.09)	−0.104 (1.92)	−0.022 (1.89)	−0.017 (1.56)	−.021 (1.0)
N	1,976	1,929	1,870	1,870	
−2 *log-likelihood:	327.0	435.1	1,703.7	1,744.1	

Notes: County average earnings is defined at the county level for unskilled jobs. Family income and county average earnings are denominated in thousands of 1990 dollars. See the Appendix for further definitions of the variables.

[a]High school diploma and GED combined.

$$P_i = \frac{\exp(x\beta_i)}{1 + \exp(x\beta_1) + \exp(x\beta_2)}, \quad i = 1, 2,$$

while the transition probabilities to the other states are defined analogously. Observe that

$$\ln\left(\frac{P_i}{P_j}\right) = x(\beta_i - \beta_j).$$

The coefficients in all models are measured relative to the dropout state.[6]

In the combined sample, family income plays a powerful positive role in the probability of each attainment and transition, except for the transition from "attend high school" to "GED." Mother's education plays a similar positive

6. The consequences of correcting for selective sample attrition (arising from serially correlated unobservables in schooling transition equations) is briefly discussed in section 7.5 and is extensively discussed in Cameron and Heckman (1992a and 1993b).

role. Father's education plays a more powerful role than mother's education, both in terms of its effects on log-odds ratios and in terms of statistical significance. Broken-home status plays an important negative role in later transitions but is not a statistically strong determinant of GED attainment.[7] The number of siblings exerts a strong negative influence in early schooling attainment and transition equations but not in the later ones. As opportunities in unskilled work (county average earnings in unskilled jobs) improve, males are less likely to complete schooling.

Since comparing point estimates of parameters in a nonlinear model can be misleading, the magnitude of these effects is illustrated by simulations in table 7.6 for each transition and for each racial/ethnic group. The first column of panel *A* shows the effect of a 33 percent increase in parents' family income on the probability of completing ninth grade. The second column shows the effect of a 33 percent increase in parents' family income on the probability of attending high school given ninth-grade completion. This effect is decomposed into two parts: a carry-over effect and an own-effect. For the first transition, it is defined in the following way. Let $P_9 \cdot P_{\text{AHS}|9}$ denote the probability of attending high school (= the probability of completing ninth grade times the probability of attending high school given ninth-grade completion), and let $\tilde{P}_9 \cdot \tilde{P}_{\text{AHS}|9}$ denote the probability associated with a change in one or more of the explanatory variables. The total change in the probability is $\tilde{P}_9 \cdot \tilde{P}_{\text{AHS}|9} - P_9 \cdot P_{\text{AHS}|9}$ and can be decomposed into $\tilde{P}_9 \cdot (\tilde{P}_{\text{AHS}|9} - P_{\text{AHS}|9}) + P_{\text{AHS}|9} \cdot (P_9 - P_9)$.[8] The first term is the own-effect associated with the change in the probability of attending high school given the probability of ninth-grade completion, and the second term is the carry-over effect reflecting the increase in the probability of attending high school arising from an increase in the probability of completing the ninth grade. More generally, carry-over effects are defined in the following way. If i is the origin state and j is the destination state, P_{ij} is the probability of making the transition. Let "0" denote the base state. The probability of attaining state ℓ is

$$P_\ell = P_0 \left(\sum_{w=1}^{W} \prod_{S=1}^{I_w} P_{w(s),w(s+1)} \right),$$

where I_W = the number of steps in path w starting from 0 and ending at ℓ, s is the step in the path associated with state $w(s)$, and W = the number of paths that start from "0" and end at ℓ. A path is indexed by $w(s)$, $w(s+1)$, . . . , etc., the transitions that define it (the same intermediate state may appear in several paths). Let "~" denote the new value of the associated probability that results

7. A more natural specification interacts father's education with broken-home status, but there is no strong statistical support for this interaction, and when it is entered, it does not reverse any conclusion in this paper.

8. An alternative decomposition weights the own-effect by P_9 rather than by $\tilde{P}_9$ and the carry-over effect by $\tilde{P}_{\text{AHS}|9}$. The difference between the two decompositions is minor.

Table 7.6 **Simulation Results for Secondary School Transitions: Changes in Probabilities of Attaining Given Grade Level (carry-over effects as a % of total effects[a] in parentheses)**

	Complete Ninth Grade[b]	Attend High School	GED	High School Graduation
	A. 33 Percent Increase in Family Income			
Combined	.008	.013 (46)	−.012 (−2)	.039 (24)
Black	.006	.004 (141)	−.010 (−6)	.032 (10)
Hispanic	.014	.024 (47)	−.018 (−25)	.062 (26)
White	.005	.011 (36)	−.009 (−4)	.028 (27)
	B. 33 Percent Decrease in Number of Siblings			
Combined	.006	.014 (31)	.002 (66)	.014 (58)
Black	.006	.014 (40)	−.001 (40)	.016 (48)
Hispanic	.012	.030 (33)	.011 (25)	.018 (124)
White	.003	.008 (28)	−.001 (12)	.012 (33)
	C. 33 Percent Decrease in County Average Earnings			
Combined	.021	.029 (56)	.011 (24)	.054 (33)
Black	.017	.009 (424)	.055 (2)	.048 (21)
Hispanic	.054	.070 (61)	.008 (103)	.128 (33)
White	.006	.018 (24)	.002 (−326)	.020 (55)
	D. 33 Percent Increase in Highest Grade Father			
Combined	.010	.016 (50)	−.002 (48)	.037 (31)
Black	.008	.010 (73)	.010 (10)	.039 (22)
Hispanic	.012	.021 (50)	.007 (38)	.019 (64)
White	.008	.016 (41)	−.013 (10)	.047 (23)
	E. 33 Percent Increase in Highest Grade Mother			
Combined	.008	.013 (50)	−.006 (9)	.029 (31)
Black	.012	.032 (36)	.004 (64)	.044 (48)
Hispanic	.007	−.003 (−118)	−.005 (−28)	.003 (157)
White	.008	.012 (50)	−.014 (−54)	.051 (16)

[a]Carry-over effects are expressed as a percentage of the total effects. A negative percentage means the carry-over and total effects are of opposite sign. A percentage greater than 100 means the carry-over effect is larger than the total effect. See text for a definition of carry-over effects.

[b]No carry-over effect for the initial state.

from changing conditioning values of the covariates. The total change in the probability is $\tilde{P}_\ell - P_\ell$. The *carry-over* effect for destination ℓ is defined to be

$$\sum_{w=1}^{W}\left[\tilde{P}_0\left(\prod_{s=1}^{l_w-1}\tilde{P}_{w(s),w(s+1)}\right)-P_0\left(\prod_{s=1}^{l_w-1}P_{w(s),w(s+1)}\right)\right]P_{w(l_w-1),\ell}.$$

In table 7.6 we express this as a percentage of the total change in probability $(\tilde{P}_\ell - P_\ell)$. This term measures the effect of a change in the regressor on the state probabilities of being eligible to make the next transition into state ℓ, weighted by the base transition probabilities (evaluated at the base level of the regressors). It is an index of the importance of the change in the regressor as it operates through the history of the process leading up to the transition indicated by the column heading.

Table 7.6 illustrates some interesting differences between racial/ethnic groups. All groups are sensitive to changes in variables representing family resources (see panel *A* for family income and panel *B* for the number of siblings), though Hispanics are much more so than blacks or whites. This is true at the initial sorting out stage of "complete ninth grade" and at "attend high school" and "high school diploma." For the high school graduation decisions of all groups, only a small portion of the influence of family income can be attributed to the carry-over effect (10–27 percent). Family income affects high school graduation primarily through the decision to graduate from high school once the individual has decided to attend high school (the own-effect). These results are consistent with a simple economic model. Family resources (as measured by family income) positively affect schooling, suggesting that credit markets for human capital are less than perfect. Competition for family resources (as measured by the number of siblings) reduces schooling opportunities for an individual.

Responsiveness to the unskilled wage rate is another indirect measure of the influence of the family-resource constraint. As opportunities for low-skilled labor rise, the demand for additional schooling declines. Again, initially and at each transition, Hispanics are much more responsive than blacks or whites to changes in the opportunity cost of attending school (panel *C*). For the decision to graduate from high school, whites show little response to changes in this variable; most of the influence comes through the carry-over effect (55 percent of the total or about a 1-percentage-point change in the probability). Blacks are more than twice as responsive as whites, with most of the impact coming at the transition to "high school diploma" (the carry-over effect for blacks is also about 1 percentage point). For Hispanics a substantial carry-over effect (a 4-percentage-point increase in the probability) is compounded by a large own-effect (an approximately 8.5-percentage-point increase in the probability).

Parental education represents measures of family permanent income not captured by other measures of family resources, as well as direct measures of environmental influence and parental investment in children. The effects of these variables are exhibited in panels *D* and *E*. Parental education influences the schooling decisions of young blacks and whites about equally and more strongly than it does the decisions of young Hispanics, who as noted above are most sensitive to changes in unskilled job opportunities and family resources. For Hispanics, the small influence these variables have on the high school graduation decision comes mainly through the carry-over effect.

Since decisions to take the GED exam are often made in the late teens and early twenties, parental resources and influences are less important in shaping this decision. In general, the sign of the GED response is ambiguous. For example, an increase in family income will not only increase the number of dropouts seeking GED certification or high school graduation, it will also increase the number of potential GED recipients who choose to graduate from high

school instead. Furthermore, since parameter estimates were obtained from a small sample of GED recipients, we must exercise care in interpreting these numbers. Increasing family resources (panels *A* and *B*) decreases the number of GED recipients (more individuals go on to graduate from high school instead). Reducing the unskilled opportunity wage increases GED recipiency. Increasing parental education has an ambiguous though inconsequential impact.

Tests of equality of the coefficients of the transition probabilities—from "attend high school" to "high school diploma" and "GED" are rejected for the combined sample for each racial/ethnic sample—black, Hispanic, and white. In this sense, the two states are not equivalent.[9] Table 7.5, column 5, reveals the consequences of pooling "GED" and "high school diploma" as final destination states. The pooled samples clearly distort the GED attainment equations. In the pooled estimates, estimated family background and resource effects tend to weaken and sometimes become statistically insignificant.

Although it is computationally convenient to aggregate racial/ethnic groups, the same model does *not* apply to whites, blacks, and Hispanics. Family resource variables play a much weaker role in black schooling decisions than they do in those of whites and Hispanics. Minority schooling decisions are more sensitive to opportunities in the unskilled labor market. Parental environmental variables play a much weaker role in the high school certification decisions of Hispanics than they do in those of whites and blacks. The decision to take a GED exam from the dropout state is not systematically related to parental environmental, family resource, or labor market opportunities for whites, although labor market opportunities play an important role for blacks and Hispanics, and parental environmental variables play an important role for blacks. The data reject the hypothesis of equality of the *slope* coefficients for the secondary-schooling-attainment model for all three racial/ethnic groups and for any pairs of those groups—black-Hispanic, black-white, and Hispanic-white.[10]

We do not report estimates of models analogous to those reported in table 7.5 when ability (AFQT score) is added to the model. It is an important variable (in the sense of having strong statistically predictive power) in high school graduation and GED certification decisions, as well as in the other educational

9. These tests are not reported here. The highest p-value of any of these tests was .005. We tested both equality of slope coefficients and equality of slopes and intercepts. These are tests of the *necessary* conditions for the two states in a multinomial logit model to be the same, except for a random (i.i.d. Weibull) error. A better test would consider collapsing the two states into one, but this entails inference about boundary values of parameters. If these states are aggregated into a univariate logit, the resulting model is decidedly inferior in predicting GED+high school graduation decisions. Estimates from the more general multinomial logit model support the estimates reported here.

10. These tests are not reported here. The p-value of pooling all three groups was .001. The highest p-value for the tests pooling any two of the three racial/ethnic groups was .015 for the test of equality between Hispanics and whites.

attainment decisions. Its addition to the fitted models weakens the impact of parental background variables on high school certification decisions in the combined sample. It has the same effect on the family resource and parental background variables for whites and Hispanics. In results not reported here, family resources and parental background variables are strong determinants of AFQT ability. Whether AFQT ability is a "cause" or a consequence of schooling is problematic.

When ability is added as a regressor, the hypothesis that the determinants of traditional high school graduation are the same as the determinants of GED attainment can still be rejected for each demographic group and for the combined sample. (All tests had a p-value lower than .01.) Tests of equality for all three racial/ethnic groups and for each pair of racial/ethnic groups reject the hypotheses at the conventional .05 level when ability is added to the model, except for the hypothesis that whites and Hispanics can be pooled (the p-value is .14). In empirical work not reported here, we find that the addition of school-quality variables does not systematically affect dropping-out/continuation decisions when the baseline set of regressor variables for the model of tables 7.5 is included. Despite the changing structure of the returns to education documented by Murphy and Welch (1988), we find little evidence of structural changes in the school-participation equations when the samples are split into a pre-1981 period and a post-1981 period.

The central conclusion of this section is that the determinants of GED certification are not the same as the determinants of traditional high school graduation. However, given the relatively small size of the GED population, pooling GED certification and traditional high school graduation as destination states does not substantially affect inference about the determinants of conventional high school graduation. Compare the columns 3 and 5 of table 5.7.

7.5 The Determinants of Postsecondary Schooling and Training

In the previous sections, we established that the determinants of GED acquisition are different from those of the attainment of a traditional high school diploma. This difference persists even when a standard measure of ability (AFQT score) is introduced into secondary-schooling attainment equations. It remains to consider whether the GED has the same value as the traditional high school degree in predicting postsecondary schooling and training choices. The most commonly stated reason for taking a GED is to gain admission to some form of training or schooling program (Malizio and Whitney 1981). The GED may signal ability to learn even if it does not predict ability to earn.

Using the model of educational attainment presented above, we find that the two forms of secondary school certification do not have the same predictive power for postsecondary college attendance and completion, even controlling for family background characteristics, labor market characteristics, and the AFQT measure of ability. This is so whether or not college attendance and

completion equations are disaggregated by race/ethnicity. In this sense, the GED and the high school diploma are not equivalent in their predictive power.

The traditional educational attainment literature is preoccupied with *academic* postsecondary schooling and training. However, individuals select from a broader menu of postsecondary options, including vocational schools and company training. Extending the conventional schooling-attainment model to accommodate these extra schooling and training options produces a more interpretable model of postsecondary schooling transitions in which the GED credential and the traditional high school diploma have *equal* predictive power in explaining the *next* transition taken after attainment of secondary credentials. However, GED-certified persons *do not complete* postsecondary schooling and training programs at the same rate as high school graduates. This evidence is consistent with the view that persons who wish to participate in postsecondary schooling and training programs obtain GED credentials but are less successful than regular high school graduates in completing them.

Table 7.7 presents estimates of the parameters of postsecondary college attendance probabilities for combined samples of whites, blacks, Hispanics, and racially disaggregated samples. The combined sample (panel *A*) reveals a powerful role for family income, resource constraints (number of siblings), parental education, and labor market opportunities in explaining attendance of high school graduates at two-year and four-year colleges.[11] Controlling for parental background and family resources, blacks and Hispanics are *more likely* to attend college, although they are not more likely to graduate from four-year colleges.

These estimates are in sharp contrast with the estimates of parameters of the transition probability from "GED" to "attend college." Family-resource variables play no role in explaining that transition, nor do labor market opportunity variables. Black GED recipients are less likely to attend college. Observe that no estimates of transition probabilities from "GED and attend college" to "graduate college" are reported. Only *two* of the 336 GED holders in our sample completed four years of college by the end of the survey. Aggregation tests decisively reject the hypothesis that the transition-to-college equations are the same for GED recipients as for traditional high school degree holders.[12] Despite the fact that we reject the hypothesis of equality of origin states, there is little harm in pooling observations from the two states in estimating the determinants of the transition from traditional high school to college.[13] We also test the hypotheses that various racial/ethnic groups can be aggregated. These hypotheses are all rejected at a .01 significance level.

11. Recall that the slope estimates are consistent estimators of the population parameters, although the intercept estimates are biased and consequently simulations will be biased as well.

12. The largest p-value among the tests was .03 for Hispanics.

13. Since the traditional high school graduates form a much larger population than GED recipients (table 7.2), combining the two groups makes only small differences in parameter estimates. The impact of family income on college attendance, for example, fell by less than 10 percent when GED recipients were pooled with high school graduates.

Table 7.7 **Postsecondary Schooling Transitions for NLSY Males: Logistic Transition Probabilities (*t*-ratios in parentheses)**

Variable	High School Diploma to Attend College	GED to Attend College	Attend College to Graduate College	Graduate College to Postgraduate School
	A. Combined Blacks, Hispanics, and Whites			
Intercept	−2.463 (7.79)	−4.380 (2.86)	−0.778 (1.85)	−1.766 (2.86)
Number of siblings	−0.090 (4.80)	−0.004 (0.05)	−0.051 (1.80)	−0.069 (1.71)
Family income	0.012 (5.27)	−0.014 (1.25)	0.009 (3.10)	0.002 (0.49)
Highest grade father	0.109 (6.98)	0.189 (2.65)	0.065 (2.95)	0.033 (1.24)
Highest grade mother	0.119 (6.05)	0.056 (0.77)	0.074 (2.73)	0.080 (2.29)
Broken home	0.020 (0.18)	0.853 (2.26)	−0.271 (1.68)	−0.190 (0.84)
Farm, age 14	−0.034 (0.19)	0.000 (0.00)	0.177 (0.60)	0.191 (0.52)
South, age 14	−0.113 (1.17)	0.045 (0.11)	0.071 (0.53)	−0.401 (2.31)
County average earnings	−0.017 (2.66)	0.011 (0.41)	−0.022 (1.54)	−0.009 (0.49)
Black	0.305 (2.73)	−1.502 (3.03)	−0.123 (0.75)	0.098 (0.47)
Hispanic	0.797 (6.00)	0.118 (0.25)	−0.014 (0.07)	0.233 (0.95)
N	2915	336	1768	859
−2 *log-likelihood	3,622.6	232.7	1,655.8	1,065.8
	B. Blacks			
Intercept	−2.266 (3.58)	−9.960 (2.39)	−1.281 (1.47)	−3.172 (2.15)
Number of siblings	−0.095 (3.18)	0.131 (0.65)	−0.072 (1.61)	0.146 (2.01)
Family income	0.008 (1.43)	0.013 (0.67)	0.004 (0.51)	0.006 (0.56)
Highest grade father	0.020 (0.61)	0.066 (0.26)	0.074 (1.61)	0.135 (1.92)
Highest grade mother	0.220 (5.31)	0.129 (0.55)	0.064 (1.16)	0.071 (0.84)
Broken home	−0.010 (0.06)	1.465 (1.51)	−0.404 (1.52)	−0.191 (0.45)
Farm, age 14	−0.882 (1.71)	0.000 (0.00)	0.269 (0.29)	2.037 (1.61)
South, age 14	−0.195 (1.14)	−1.264 (0.95)	0.115 (0.48)	−0.342 (0.91)
County average earnings	−0.013 (1.13)	−0.107 (0.79)	−0.022 (0.77)	−0.033 (0.86)
N	835	114	446	184
−2 *log-likelihood	1,033.6	41.2	446.2	205.2

		C. Hispanics		
Intercept	0.292 (0.40)	−1.366 (0.76)	−0.426 (0.52)	−3.621 (2.16)
Number of siblings	−0.061 (1.55)	0.025 (0.18)	−0.024 (0.39)	0.012 (0.13)
Family income	0.009 (1.46)	−0.009 (0.34)	0.022 (2.20)	0.017 (1.25)
Highest grade father	0.018 (0.62)	0.164 (1.61)	−0.026 (0.59)	0.052 (0.70)
Highest grade mother	0.081 (2.48)	−0.005 (0.05)	0.055 (1.16)	0.022 (0.28)
Broken home	−0.325 (1.27)	0.196 (0.27)	−0.624 (1.62)	−0.127 (0.18)
Farm, age 14	0.319 (0.63)	0.000 (0.00)	0.816 (0.92)	2.166 (1.60)
South, age 14	−0.440 (1.72)	0.061 (0.08)	0.503 (1.43)	−1.151 (1.92)
County average earnings	−0.038 (1.86)	−0.059 (1.35)	−0.015 (0.38)	0.072 (1.21)
N	473	82	292	111
−2 *log-likelihood	614.3	65.8	280.7	124.6
		D. Whites		
Intercept	−4.284 (8.53)	−5.013 (1.91)	−1.907 (2.92)	−1.344 (1.61)
Number of siblings	−0.150 (4.58)	−0.131 (0.88)	−0.094 (1.87)	−0.275 (4.02)
Family income	0.013 (4.27)	−0.003 (2.11)	0.008 (2.26)	0.002 (0.45)
Highest grade father	0.220 (9.02)	0.280 (2.37)	0.107 (3.32)	0.024 (0.72)
Highest grade mother	0.158 (4.59)	0.073 (0.65)	0.168 (3.54)	0.127 (2.68)
Broken home	0.272 (1.44)	1.209 (2.19)	0.039 (0.15)	−0.242 (0.75)
Farm, age 14	0.107 (0.48)	0.000 (0.00)	0.101 (0.30)	−0.119 (0.28)
South, age 14	0.087 (0.62)	0.484 (0.80)	−0.107 (0.55)	−0.390 (1.73)
County average earnings	−0.016 (1.86)	0.014 (0.30)	−0.054 (2.45)	−0.029 (1.18)
N	1607	136	1,030	564
−2 *log-likelihood	1,874.6	107.9	894.7	698.2

Notes: County average earnings is defined at the county level for unskilled jobs. Family income and county average earnings are denominated in thousands of 1990 dollars. See the Appendix for further definitions of the variables.

Disaggregating by race/ethnicity produces qualitatively similar findings for each racial/ethnic group, but the coefficient estimates for blacks and Hispanics are less precisely determined. Simulations in table 7.8 illustrate the magnitude of these effects. Parental education plays an important role in "high school diploma" to "attend college" decisions, particularly for black youths and white youths. For Hispanics, the influence of these variables is relatively small, as it was for the high school graduation decision. For blacks and whites, these variables are important in determining college completion and postcollege education as well, though the majority of the influence operates through the carry-over effect (columns 3 and 4 of panels *D* and *E*).[14] Family resources (panels *A* and *B*) and opportunity wages (panel *C*) also play an important role in all postsecondary transitions (except for GED recipients' college attendance decisions). Most of the influence of these variables here, too, comes indirectly through the carry-over effect. Exclusive focus on transition equations (as opposed to attainment equations) understates the contribution of income, parental education, and local labor markets to minority college attendance.

The estimates for the combined sample and the results for whites produce the anomalous result that GED-certified persons from broken homes are more likely than those from intact families to attend college. Such statistical results are a possible sign of uncontrolled selection bias. The results displayed in Table 7.7 do not control for selective participation in higher grades of schooling. Those persons who come from broken homes and complete the GED may be more motivated to attend college. Estimates controlling for attrition bias due to unobservables, using a nonparametric method described in other work (Cameron and Heckman 1992a, 1993a), reveal the same general patterns of coefficient size and statistical significance as appear in the estimates in table 7.7.[15] In particular, the anomalous results for broken-home effects remain in a variety of specifications.

In results not reported here, adding the AFQT ability variable to the model reported in table 7.7 does not reverse the sense of any of the statistical tests regarding the nonequivalence of GED certification and high school graduation as origin states for college attendance or of the tests regarding the nonequality of the coefficients for the different racial/ethnic groups. The main effect of the addition of the AFQT variable to the base set of regressor is to weaken the size and statistical significance of family income and family background variables.

While it is conventional to focus on collegiate postsecondary schooling, it may be misleading to do so. Many persons who take the GED do so to gain admission to noncollegiate vocational and technical training or to satisfy edu-

14. See n. 15 for a caveat about results for the last two transitions.

15. The two major exceptions occur for the transitions to graduate college and to attend postgraduate school. Using the same model but a different set of data, Cameron and Heckman (1993a) use nonparametric methods to control for selection bias and find much larger and more reasonable estimates of transition parameters of these last two transitions. They also present a specification analysis detailing the consequences of not controlling for unobserved variables.

Table 7.8 **Simulation Results for College Transitions: Changes in Average Probabilities of Attaining a Given Grade Level (carry-over effects as a % of the total effect in parentheses)**

	High School Diploma to Attend College	GED to Attend College	Attend College to Complete Four Years[a]	Complete Four Years to Attend Five or More Years
		A. 33 Percent Increase in Family Income		
Combined	.041 (51)	−.002 (47)	.038 (76)	.014 (93)
Black	.024 (63)	−.000 (456)	.017 (87)	.008 (77)
Hispanic	.047 (76)	−.006 (71)	.046 (66)	.023 (70)
White	.042 (37)	−.003 (23)	.041 (73)	.016 (89)
		B. 33 Percent Decrease in Number of Siblings		
Combined	.021 (21)	.000 (58)	.016 (73)	.008 (62)
Black	.025 (22)	−.000 (5)	.020 (69)	−.001 (−211)
Hispanic	.020 (33)	.002 (135)	.013 (77)	.002 (123)
White	.027 (17)	.001 (27)	.024 (70)	.024 (42)
		C. 33 Percent Decrease in County Average Earnings		
Combined	.036 (57)	.000 (66)	.033 (68)	.013 (82)
Black	.027 (8)	.000 (987)	.005 (592)	.007 (7)
Hispanic	.100 (67)	.008 (46)	059 (88)	.002 (−424)
White	.023 (35)	−.000 (−39)	.041 (39)	.027 (61)
		D. 33 Percent Increase in Highest Grade Father		
Combined	.079 (27)	.006 (−12)	.073 (75)	.033 (81)
Black	.026 (63)	.000 (45)	.032 (53)	.031 (47)
Hispanic	.017 (57)	.011 (21)	.003 (125)	.007 (24)
White	.154 (20)	.005 (−59)	.147 (76)	.060 (89)
		E. 33 Percent Increase in Highest Grade Mother		
Combined	.081 (21)	.001 (−257)	.077 (73)	.049 (67)
Black	.133 (20)	.000 (16)	.098 (85)	.044 (80)
Hispanic	.030 (6)	−.002 (80)	.030 (59)	.011 (78)
White	.122 (24)	−.001 (745)	.144 (65)	.106 (67)

[a]For high school graduates only. The comparable transition for GED recipients is not studied due to the small number who complete four years (see text for more discussion).

cational requirements posted by business establishments. We previously noted that GED recipients and traditional high school graduates were equally likely to attend two-year colleges, but GED recipients were much less likely to attend four-year colleges.

Table 7.9 presents evidence on the effects of family resources, family background, and labor market alternatives on the first transition taken after high school certification achieved through a GED or through a traditional diploma. We consider attendance at a four-year college, a two-year college, or a vocational-technical school; employment in a job with company training or an apprenticeship program; enlistment in the military; or employment in a job without any formal training. The benchmark state is "not working." For the combined sample (panel *A*) or for the separate racial/ethnic groups, we do not reject the hypothesis that the origin state (GED or traditional high school diploma) is irrelevant in explaining these transitions. The *p*-values of the tests

Table 7.9 **Transitions from High School Graduation or GED Acquisition to Two- or Four-Year College, Vocational-Technical School, Company Training or Apprenticeship, Military Service, and Work: Logistic Transition Probabilities (*t*-ratios in parentheses)**

Variable	Four-Year College	Two-Year College	Vocational Training	Company Training/ Apprenticeship	Military	Work
			A. Combined Blacks, Hispanics, and Whites			
Intercept	−2.531 (3.78)	−1.174 (1.75)	0.225 (0.30)	−2.435 (2.57)	0.587 (0.73)	0.541 (0.82)
Number of siblings	−0.129 (3.57)	−0.098 (2.71)	−0.099 (2.35)	−0.110 (1.89)	−0.067 (1.52)	−0.022 (0.64)
Family income	0.023 (3.57)	0.013 (2.00)	0.007 (0.99)	0.025 (3.12)	−0.025 (2.96)	0.015 (2.39)
Highest grade father	0.147 (4.45)	0.102 (3.07)	0.035 (0.94)	0.050 (1.04)	0.071 (1.75)	−0.001 (0.04)
Highest grade mother	0.191 (4.77)	0.127 (3.20)	0.079 (1.75)	0.027 (0.47)	0.063 (1.28)	0.023 (0.59)
Broken home	0.152 (0.66)	0.344 (1.49)	0.500 (1.92)	0.373 (1.07)	−0.251 (0.89)	0.294 (1.27)
Farm, age 14	0.197 (0.48)	0.099 (0.24)	0.218 (0.48)	−0.176 (0.67)	−0.604 (1.08)	0.305 (0.75)
South, age 14	−0.045 (0.23)	−0.301 (1.51)	−0.176 (0.77)	−0.549 (1.80)	−0.076 (0.32)	−0.013 (0.06)
County average earnings	0.019 (0.73)	0.017 (0.63)	−0.041 (1.29)	0.072 (2.22)	−0.035 (1.05)	0.029 (1.19)
Black	−0.043 (0.18)	−0.317 (1.29)	−0.563 (1.98)	−0.581 (1.59)	−0.458 (1.56)	−0.454 (1.85)
Hispanic	0.796 (2.52)	0.911 (2.89)	0.492 (1.40)	−0.054 (0.12)	0.028 (0.07)	−0.247 (0.76)
GED	−1.070 (3.51)	−0.541 (2.01)	0.255 (1.20)	0.200 (0.62)	−0.060 (0.18)	0.157 (0.56)
N	1,110	772	269	106	198	644
−2 *log-likelihood:	9,656.02					
			B. Black Sample			
Intercept	−0.936 (0.84)	−1.396 (1.20)	1.321 (0.96)	−4.354 (2.21)	1.178 (0.86)	0.875 (0.79)
Number of siblings	−0.186 (3.65)	−0.107 (2.05)	−0.141 (2.21)	−0.224 (2.07)	−0.105 (1.69)	−0.073 (1.46)
Family income	0.017 (1.93)	0.005 (0.40)	−0.004 (0.24)	0.025 (1.59)	−0.023 (1.48)	0.014 (1.22)
Highest grade father	0.029 (0.51)	−0.017 (0.30)	0.017 (0.24)	−0.060 (0.59)	0.054 (0.76)	−0.047 (0.84)
Highest grade mother	0.147 (2.16)	0.191 (2.70)	0.037 (0.44)	0.085 (0.68)	0.022 (0.27)	−0.044 (0.66)
Broken home	0.289 (0.91)	0.645 (1.97)	0.317 (0.81)	0.976 (1.71)	−0.003 (0.01)	0.541 (1.69)
Farm, age 14	−0.739 (0.93)	−0.407 (0.51)	−0.103 (0.12)	−0.039 (0.11)	−0.094 (0.14)	0.093 (0.13)
south, age 14	−0.109 (0.38)	−0.335 (1.13)	−0.055 (0.15)	−1.602 (2.67)	−0.145 (0.41)	0.217 (0.73)

County average earnings	0.049 (1.01)	0.049 (0.99)	−0.081 (1.30)	0.209 (3.02)	−0.056 (0.92)	0.053 (1.27)
GED	−1.975 (4.01)	−1.201 (2.61)	0.245 (0.91)	0.405 (0.65)	−0.830 (1.58)	−0.159 (0.46)
N	288	195	72	22	75	212
−2 *log-likelihood	2,876.93					
			C. Hispanics			
Intercept	−3.926 (2.58)	−1.758 (1.19)	−1.887 (1.18)	−5.407 (2.35)	−2.534 (1.33)	−3.374 (2.21)
Number of siblings	0.043 (0.53)	−0.086 (1.06)	0.018 (0.21)	0.066 (0.52)	0.083 (0.84)	0.044 (0.55)
Family income	0.033 (2.15)	0.019 (1.12)	0.020 (1.06)	0.028 (1.24)	−0.019 (1.13)	0.026 (1.49)
Highest grade father	0.084 (1.38)	0.048 (0.81)	0.034 (0.52)	0.132 (1.34)	0.057 (0.75)	0.027 (0.44)
Highest grade mother	0.163 (2.37)	0.089 (1.33)	0.083 (1.12)	0.025 (0.23)	0.114 (1.33)	0.047 (0.69)
Broken home	0.015 (0.03)	−0.346 (0.69)	1.026 (1.92)	−0.612 (0.67)	−0.989 (1.39)	0.090 (0.18)
Farm, age 14	0.213 (0.26)	−1.248 (1.27)	−0.055 (0.06)	−0.045 (0.13)	−0.245 (0.45)	−0.260 (0.32)
South, Age 14	0.127 (0.27)	−0.218 (0.46)	−0.092 (0.17)	−1.632 (1.44)	0.029 (0.05)	0.405 (0.85)
County average earnings	0.147 (1.82)	0.154 (1.94)	0.053 (0.61)	0.179 (1.51)	0.100 (1.20)	0.195 (2.39)
GED	−1.070 (2.01)	−0.731 (1.31)	0.305 (0.95)	1.000 (1.22)	0.540 (0.88)	0.652 (1.26)
N	152	163	59	16	33	105
−2 *log-likelihood:	1,668.05					
			D. Whites			
Intercept	−4.988 (4.47)	−3.266 (2.91)	−0.970 (0.78)	−2.285 (1.64)	0.164 (0.12)	0.470 (0.44)
Number of siblings	−0.206 (2.80)	−0.106 (1.44)	−0.136 (1.63)	−0.079 (0.83)	−0.100 (1.13)	0.009 (0.12)
Family income	0.020 (2.24)	0.012 (1.34)	0.006 (0.60)	0.024 (2.33)	−0.027 (2.35)	0.013 (1.46)
Highest grade father	0.280 (4.78)	0.242 (4.08)	0.087 (1.34)	0.103 (1.41)	0.114 (1.63)	0.022 (0.38)
Highest grade mother	0.320 (4.20)	0.204 (2.67)	0.142 (1.67)	0.032 (0.34)	0.086 (0.95)	0.056 (0.76)
Broken home	−0.019 (0.04)	0.357 (0.78)	0.068 (0.13)	0.172 (0.29)	−0.272 (0.51)	0.019 (0.04)
Farm, age 14	0.857 (1.12)	0.921 (1.21)	0.824 (1.03)	−0.705 (0.57)	0.293 (0.34)	0.875 (1.15)
South, age 14	0.059 (0.17)	−0.107 (0.31)	−0.230 (0.59)	0.160 (0.37)	0.064 (0.16)	−0.226 (0.65)
County average earnings	−0.017 (0.13)	−0.040 (0.30)	−0.118 (0.78)	0.054 (0.32)	−0.171 (1.48)	0.060 (0.77)
GED	−0.820 (2.51)	−0.535 (2.01)	0.895 (1.25)	0.942 (1.32)	0.640 (1.08)	0.852 (1.45)
N	670	414	138	68	90	327
−2 *log-likelihood:	4,927.36					

Notes: "Not working" is the left-out state. County average earnings is defined at the county level for skilled jobs. Family income and county average earnings are denominated in thousands of 1990 dollars. See the Appendix for further definitions of the variables.

are .18, .21, .28, and .31 for the combined, black, Hispanic, and white samples, respectively. However, we reject the hypothesis that racial/ethnic groups can be combined in the manner of panel *A*.[16] The results in table 7.9, taken as a whole, are more behaviorally interpretable than the results in table 7.7. For example, the perverse effect of broken-home status disappears in a model which considers a broader portfolio of postsecondary choices. Table 7.10 displays simulation results corresponding to the estimates reported in table 7.9.

Family-income effects are important not only for college attendance but also for participation in formal on-the-job or apprenticeship training programs and for employment in work without formal training. Vocational training, two-year colleges, and the military offer an escape from credit constraints: decreasing family income increases the likelihood that an individual will either enter the military or take vocational training and has little or no effect on the likelihood of two-year college attendance. Individuals with lower family incomes are less likely to attend four-year colleges, to take company training, or to work. Similar conclusions hold when we decrease the number of siblings and the demands on family resources fall. The largest part of the influence of the variables on four-year college, work, and company training/apprenticeship decisions operates through the own-effect and not through the carry-over effect. Furthermore, since the carry-over effect associated with these variables on the chances of graduating high school is positive (and inconsequential for GED recipiency), the own-effect is substantially negative for the transitions from complete high school to military, vocational training, two-year college, and the no-work state.

Changes in the opportunity wage matter, too. As average earnings in low-skill industries fall, individuals are more likely to enter two- or four-year colleges, vocational training (off-the-job), or the military, and less likely to obtain work, an apprenticeship, or other company (on-the-job) training. Nonfinancial factors influence decisions in the expected directions. Individuals whose parents have achieved less education are less likely to attend two or four-year college and more likely to take nonacademic training, no training, or enter the military. The same general patterns appear for each racial/ethnic group. In results not reported here, inclusion of the AFQT ability measure generally weakens the size and statistical precision of the estimated family-background variables, but does not reverse any qualitative conclusions—except (a) the black and Hispanic variables become positive and statistically significant in the college attendance equations (two- and four-year colleges); and (b) racial ethnic differences in first transitions after completing secondary certification tend to weaken.

One main result of this section is that, in a broader model of postsecondary choices, there is no distinction between the GED and the traditional high

16. The p-value for the tests combining blacks, Hispanics, and whites was .00, with or without the AFQT score. The p-value for the test combining blacks and Hispanics was .03 (.13 with the AFQT included). The test combining blacks and whites had a p-value of .00 (.01 with the AFQT), and the test combining Hispanics and whites had a p-value of .01 (.12 with the AFQT).

Table 7.10 **Simulation Results for College Training, Military, and Work: Changes in Average Probabilities of Attaining a Given Grade/Employment Level (carry-over effects as a % of the total effects in parentheses)**

	Four-Year College	Two-Year College	Vocational Training	Company Training/ Apprenticeship	Military	Work	No Work
			A. 33 Percent Increase in Family Income				
Combined	.030 (37)	.000 (96)	−.003 (−318)	.005 (20)	−.010 (−20)	.009 (41)	−.003 (191)
Black	.019 (50)	−.002 (373)	−.003 (79)	.005 (7)	−.008 (−22)	.012 (29)	−.002 (−639)
Hispanic	.031 (54)	.002 (131)	.002 (140)	.002 (6)	−.007 (−72)	.015 (35)	−.003 (10)
White	.029 (29)	−.004 (−250)	−.004 (39)	.007 (8)	−.011 (−2)	.006 (35)	−.003 (129)
			B. 33 Percent Decrease in Number of Siblings				
Combined	.014 (23)	.006 (−3)	.003 (65)	.001 (36)	.001 (49)	−.007 (−37)	−.003 (−40)
Black	.022 (20)	.000 (−66)	.003 (46)	.004 (14)	.000 (101)	−.006 (−565)	−.009 (−11)
Hispanic	−.003 (320)	.032 (20)	.002 (264)	−.001 (−54)	−.002 (−75)	−.001 (−35)	.002 (101)
White	.022 (14)	.001 (−589)	.003 (030)	−.000 (392)	.001 (44)	−.016 (−55)	−.001 (−4)
			C. 33 Percent Decrease in County Average Earnings				
Combined	.006 (138)	.009 (254)	.029 (25)	−.007 (2)	.018 (26)	−.001 (−27)	.008 (51)
Black	.006 (44)	.006 (115)	.047 (39)	−.017 (−18)	.037 (23)	−.006 (11)	.018 (68)
Hispanic	.019 (76)	.015 (90)	.058 (34)	−.001 (36)	.018 (52)	−.021 (−57)	.049 (27)
White	.003 (217)	.010 (36)	.012 (15)	−.002 (44)	.012 (11)	−.014 (−16)	.001 (233)
			D. 33 Percent Increase in Highest Grade Father				
Combined	.067 (22)	.014 (−14)	−.007 (−91)	−.003 (75)	−.001 (39)	−.032 (42)	−.006 (−71)
Black	.037 (38)	.002 (1387)	.005 (75)	−.003 (124)	.012 (32)	−.010 (273)	.004 (90)
Hispanic	.023 (35)	.002 (120)	−.001 (1640)	.007 (37)	.002 (91)	−.005 (13)	−.002 (−73)
White	.018 (14)	.042 (13)	−.016 (94)	−.007 (−1221)	−.005 (−14)	−.077 (−28)	−.009 (31)
			E. 33 Percent Increase in Highest Grade Mother				
Combined	.080 (14)	.008 (20)	−.005 (20)	−.008 (−8)	−.005 (−212)	−.038 (−71)	−.009 (2053)
Black	.051 (25)	.071 (20)	−.005 (33)	−.001 (80)	−.007 (−301)	−.051 (−1)	−.010 (−208)
Hispanic	.035 (6)	−.008 (26)	−.003 (14)	−.004 (13)	.001 (8)	−.018 (14)	−.005 (5)
White	.148 (12)	−.002 (20)	−.008 (9)	−.014 (−2)	−.010 (264)	−.068 (−2)	−.010 (−4)

school diploma in predicting the first choice taken after secondary schooling. One can reject equality of the two forms of high school certification in predicting college choices estimated in the more traditional and restrictive model that lumps noncollegiate choices into a common state. As a practical matter, there is little harm in combining GED attainment and traditional high school graduation if one is interested in analyzing the determinants of the transition from traditional high school to attending college.

7.6 Summary and Qualifications

This paper presents basic facts about the determinants of routes that are alternatives to traditional high school graduation. We consider the economic and behavioral causes of GED certification.

We find that the determinants of traditional high school certification are different from the determinants of GED certification. Elsewhere (Cameron and Heckman 1993b), we establish that the economic consequences of the two types of certification are different. We also find that the GED and the traditional high school diploma are not equally good predictors in conventional college-attendance-and-completion models that combine noncollegiate choices into a single choice state. This finding is consistent with considerable anecdotal evidence. However, in a richer model of postsecondary schooling choices that recognizes the variety of nonacademic training options available to youth, the two forms of certification are equally good in explaining the first choice persons make after obtaining certification at the secondary level. Vocational training programs, two-year colleges, and the military appear to operate as alternatives that enable persons to evade credit constraints. Participation in company training, four-year college, and work *increases* with family wealth and resources.

Appendix

This appendix contains three supplemental discussions regarding the data used in our analysis. The first section describes the NLSY data we use for the analysis of schooling choices; the second describes the county-average-earnings variable; the third describes the AFQT score.

Data for the Analysis of Schooling Choices

In this section we describe the family-background and family-income measures and the schooling transition variables. To ascertain secondary school quality, we use measures of the number of full-time-equivalent teachers per student, percentage of faculty with graduate degrees in schools, and public school or private school (including parochial school attendance).

One limitation of the NLSY is that data on parents' family income is less than ideal. For about 10 percent of our sample, the family-income variable had missing values for one of two reasons: first, because of invalid skips in the interview, and second, because the family-income questions pertained to the respondent's family and not to that of his parental family. If an individual lived in his parents' house, in a dormitory or other student housing at school, in a troop barracks, aboard a Navy ship, or in other military quarters, or in a hospital, a jail, or a juvenile detention center, then reported family income was that of his parents' household. In fact, the income questions were asked of the individual's parent or guardian. If an individual lived in his own housing, an orphanage, or a convent or monastery, then reported family income was for his residential family (a type "C" interview) not his parental family. We tried to gauge the importance of the problem by imputing family income and flagging the imputed observations with a binary variable. We found no effects of the dummy in a series of estimated behavioral equations; nonetheless, the observations with imputed income were dropped.

Another 2 percent of the potential sample was deleted because of missing values in the highest-grade-completed variable for the mother or the father. Even individuals from broken homes were likely to report a highest grade completed for both parents.

We used highest grade completed and highest grade attended in 1987 to determine the level of school attainment. Individuals were aged 22–30 in that year. In addition to knowing highest grade completed and attended and knowing whether an individual was enrolled in school in 1987, we know whether the individual had a college degree by 1985. This variable was used to determine any discrepancies in computed highest grade completed. Finally, for those who obtained a GED, a moderate number reported having attended college before receiving the GED. These people were taking GED-preparation courses at community college, and we did not count them as having attended unless they attended college after obtaining the GED.

The first postsecondary transition records the first four-year college, two-year college, vocational school, or company training/apprenticeship program enrolled in within four years after high school graduation or GED recipiency. Few individuals undertake new academic or vocational training after this period, according to our data. Furthermore, there is little overlap between programs in subsequent transitions except that about half of individuals taking a vocational training course took at least one more vocational program in the four-year postgraduation period and approximately one-fourth of vocational school entrants later enrolled in a two-year college and vice versa. Individuals who took none of these programs but held a full-time job (more than 20 hours per week) for at least one month were counted as "working." All others were counted as not working. Other distinctions between "working" and "not working" failed to produce any consequential differences in our results.

Data on Local Labor Market Conditions

We describe the county-average-earnings variable in this section. We merged into the NLSY a supplementary data set from the Bureau of Economic Analysis[17] that contained more detailed measures of labor market conditions by industry for the years 1969–86. These data, collected from state unemployment-insurance programs, contain measures of total full-time and part-time employment and earnings, both in the county and in the state for each major industry. Using these measures, we constructed variables for average earnings per job for each skilled industry, by county and state, for each individual in the NLSY.

For the first schooling transition—complete ninth-grade—and for transitions from ninth grade to attending high school and from attending high school to either receiving a high school diploma or obtaining a GED, we construct a measure of average earnings per job in the unskilled sector as an opportunity cost of schooling. Since our data were broken down by industry, we used average earnings in the service, retail, and wholesale industries to proxy for unskilled wages. As an opportunity cost of college entry, we use average earnings in manufacturing, construction, mining, transportation, and public utilities. For the opportunity cost of completing college, we use average earnings in finance, real estate, and government (excluding the military).

Armed Services Vocational Aptitude Battery (ASVAB)

In 1980, the ASVAB was administered to NLSY respondents, with a completion rate for the total sample of approximately 94 percent. The NLSY respondents were aged 16–23 when the test was taken. Groups of 5–10 persons were tested at more than 400 sites throughout the country, and each individual was given a $50 honorarium for completing the test.

The ASVAB consists of a battery of 10 tests: general science, arithmetic reasoning, word knowledge, paragraph comprehension, numerical operations, coding speed, auto and shop information, mathematics knowledge, mechanical comprehension, and electronics information. The military uses ASVAB scores to determine eligibility and assignment qualifications for new enlistees. In particular, the Armed Services Qualification Test (AFQT) sums the scores for word knowledge, arithmetic reasoning, paragraph comprehension, and one-half the score for numeric operations. The AFQT is considered a general measure of trainability and is a primary criterion for enlistment eligibility for the armed forces. It is the measure of ability used in our analysis.

17. The authors thank Joe Hotz and Seth Sanders for supplying tapes and documentation for these data.

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