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THE NONEQUIVALENCE OF HIGH SCHOOL EQUIVALENTS

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ABSTRACT

This paper analyzes the causes and consequences of the growing proportion of high-school-certified persons who achieve that status by exam certification rather than through high school graduation. Exam-certified high school equivalents are statistically indistinguishable from high school dropouts. Both dropouts and exam-certified equivalents have comparably poor wages, earnings, hours of work, unemployment experiences and job tenure. This is so whether or not ability measures are used to control for differences. Whatever differences are found among exam-certified equivalents, high school dropouts and high school graduates are accounted for by their years of schooling completed. There is no cheap substitute for schooling. The only payoff to exam certification arises from its value in opening post-secondary schooling and training opportunities. However, exam-certified equivalents receive lower returns to most forms of post-secondary education and training.

We also discuss the political economy of the recent rapid growth of exam certification. There has been growth in direct government subsidies to adult basic education programs that feature exam certification as an output. In addition, there has been growth in government subsidies to post-secondary schooling programs that require certification in order to qualify for benefits. These sources account for the rapid growth in the use of exam certification in the face of the low economic returns to it.

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This paper examines the causes and consequences of a neglected social phenomenon - the recent rapid growth in the fraction of persons who achieve high school certification by means of an equivalency exam rather than through the traditional route of high school graduation. In 1968, only five percent of all new high school certificates were awarded through equivalency exams. By 1987, the corresponding figure was in excess of fourteen percent. In 1968, only two percent of all persons who completed their education with high school degrees were exam certified. In 1987, the corresponding figure was almost eleven percent.

Conventional wisdom and statistical practice equates the two types of certification. For example, it was only in 1988 that the Current Population Survey - the central framework for socioeconomic accounting in the U.S. - distinguished the two types of certification in standard surveys. The 1990 U.S. Population Census is the first to distinguish exam-certified equivalents from high school graduates.

This paper challenges the conventional wisdom. Exam-certified high school equivalents are not identical to traditional high school graduates in terms of their ability as measured by a standard psychometric test (the Armed Forces Qualifying Test), in terms of their wages and hours of work or in terms of their post-certification educational and training decisions. We demonstrate that exam-certified high school equivalents are psychometrically inferior to traditional high school graduates. We note elsewhere (Cameron and Heckman, 1991a,b) that the determinants of high school certification by exam are very different from the determinants of traditional high school graduation. We demonstrate here that the economic consequences of the two avenues of high school certification are quite different - exam certified persons are indistinguishable from high school dropouts who are uncertified. Differences in wages among high school graduates, exam certified equivalents and dropouts are accounted for by years of schooling attained. There is little evidence of value added from exam certification beyond the effect of years of schooling completed on wages. However, exam-certified graduates are more likely to take vocational and technical training while traditional high school graduates are more likely to attend academic four-year colleges and complete academic programs when they begin them. Exam-certified high

school graduates are more likely to participate in some form of post-secondary training than are non-exam-certified high-school-dropouts. Exam-certified persons who take post-secondary schooling and training earn lower returns than high school graduates undertaking the same activity. Whatever return there is to high school equivalency certification comes from returns to post-secondary training.

Contrary to these facts, it is widely believed that exam-certified high school equivalents are the equals of traditional high school graduates in all relevant behavioral dimensions. This view is fostered in part by the American Council on Education, a private organization representing institutions of higher education as well as regional education associations. That organization administers the most widely used equivalency exam - the GED (for General Educational Development). Researchers affiliated with the American Council on Education claim that

> *"...persons who meet state/provincial established minimum score levels for the high school equivalency credential based on GED tests should be considered high school graduates for admissions, military, licensing and employment purposes. The test results...demonstrate this achievement equivalency". (Malizio and Whitney, 1982, p. 10)*

The growing use of GED certification suggests an important role for widespread misperception on the part of test takers. However, there are several reasons why informed persons may take the GED even if the gross returns to it are low: (a) the costs of exam certification are low and hence commensurate with gross returns: (b) exam certification qualifies high school dropouts to take post-secondary training which may enhance earnings; and (c) state and federal adult basic education programs and manpower training programs subsidize exam certification. Performance standards in federal and state human resource bureaucracies have led to an emphasis on easily monitored objectives such as high school equivalency at the expense of less easily measured improvements in basic skills. Such an emphasis would

appear to be justified in light of the claims of the American Council on Education.

The growth in the level and proportion of exam-certified high school credentials is a direct consequence of federal and state human resource policies. Since the mid-1960's, both federal and state governments have increasingly subsidized adult basic education programs which have placed a growing emphasis on adult equivalency as a clearly identified and desirable objective. In addition, a high school degree or an exam-certified-equivalent is required for participation in a host of post-secondary vocational and academic financial support programs increasingly subsidized by federal and state governments over this period. The demand for participation in these subsidized programs induced a derived demand for high school certification on the part of high school dropouts.

A major conclusion of this paper is that the GED is a vehicle for participation in post-secondary education due to its value in satisfying bureaucratically determined qualifications for admission and financial support. The subsidy to these programs reconciles the apparent conflict between low gross returns to obtaining the GED and the large and growing demand for GEDs. The GED does not signal achievement of market skills above and beyond what is signified by a person's years of attained schooling. Accordingly, it is not appropriate to consider the GED as an educational end in itself - an emphasis placed in many contemporary state and federal programs.

Our paper develops in the following way. Section one documents basic facts about high school equivalency and reasons for growth in this form of high school certification. Psychometric and market evidence demonstrates the nonequivalence of high school equivalents. Section two presents evidence on the economic returns to high school equivalency. The paper concludes with a summary.

1. The Changing Structure Of High School Certification and Its Consequences For Measuring The Determinants and Consequences of Educational Decisions

A. The Growth in High School Equivalency and Certification

There are three main routes through which Americans achieve certification as high school

graduates: (a) through traditional course attendance, culminating in graduation at the end of the 12th grade; (b) through night school and other formal schooling programs for those who drop out of traditional high school programs; and (c) through certification on a standardized exam for high school dropouts. Although the vast majority (84.5% in 1987) of all new high school credentials are issued through traditional route (a), a sizeable proportion of new graduates come from the less traditional avenues (b) and (c). The largest non-traditional source is from persons certified by an equivalency exam - roughly 14% of all newly issued high school credentials obtained in 1987 were secured by this means. Virtually all of these credentials come from individuals who passed the nationally-normed GED exam developed by the American Council on Education. Graduation through formal adult secondary schooling produced no more than 2% of all new high-school-certified persons in 1987.

There has been a dramatic change in the number of exam-certified high school graduates over the period 1953-1988. Figure 1 plots the percentage of GED recipients relative to all high school graduates for each year over the period. It rises from less than two percent in 1954 to more than 14 percent in 1986. The period 1965-1985 is one of especially rapid growth. There has been concomitant growth in the percentage of all persons with high school diplomas (and no further academic degree) who achieve that status by GED certification. Figure 2 reveals that of the total stock of persons with only high school degrees by 1987, more than 10% achieved their degree by taking a GED exam. In 1968, only 2% of the total stock was exam-certified. Figure 3 documents the near stability in non-GED sources of high school graduates. Certification through adult education courses ("other programs") has grown over the period 1974-1987, but the level is low (ranging between 1-2% of all new high school graduates) and the growth rate is small. The major change in the source of high school credentials is growth in GED certification.

The GED testing program began in 1942 as the Veterans Testing Service and was a joint venture of the United States Armed Forces Institute and the American Council on Education. The premise of the

Figure 1: New GED Recipients as % of Total New Recipients of High School Credentials: (GED + High School Graduates)

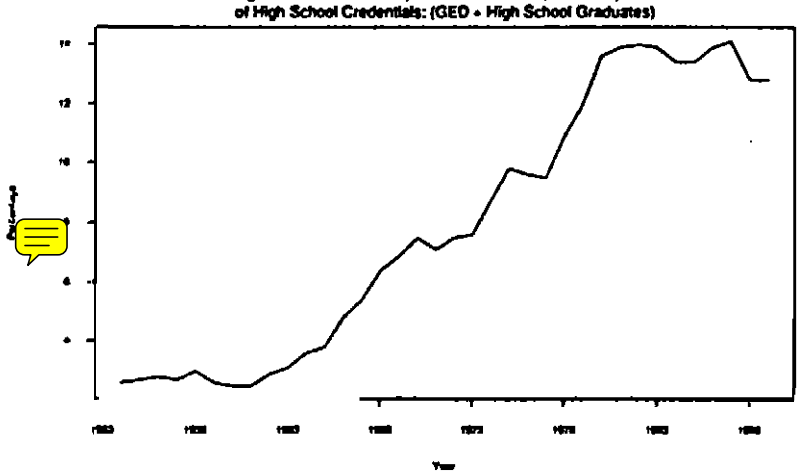
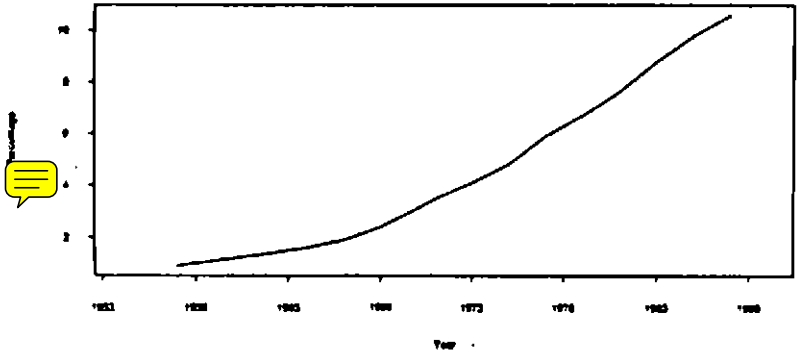
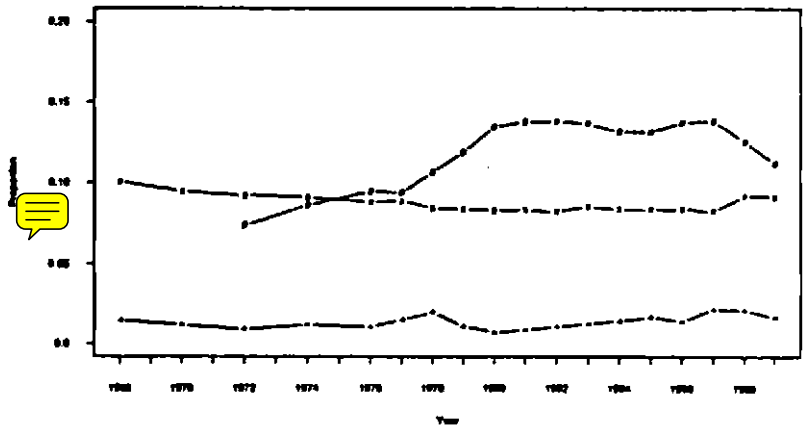


Figure 2: GED Recipients as % of Total Stock of Persons 15 Years of Age or Older with High School Credentials Only: (GED + High School Graduates Only)



Source: The GED Testing Service, American Council on Education, One Dupont Circle, N.W., Washington, D.C. 20036.
Digest of Education Statistics, 1999, U.S. Department of Education, National Center For Education Statistics, Office of Educational Research and Improvement, 1999 (Table 99, p. 103 and Table 98, p. 104), U.S. Department of Commerce, Bureau of the Census, Series P-20, Current Population Reports, Population Characteristics, Educational Attainment in the United States, [illegible] selected years.

Figure 3
Proportion of Individuals Completing High School by Type of Program



Year

o—o: Private High School Graduates
—: High School Graduates from Other Programs
Δ—Δ: GED R[illegible]

Year

o—o: Public High School Graduates

testing program was that the life experience of military personnel could substitute for classroom training in developing skills associated with high school certification. The relevant skills could be measured by an exam. By 1952, all but three states issued certificates of high school equivalence to veterans and servicemen who passed the Veterans Testing Service exam. The Armed Forces accepted exam-certified equivalents as the equals of high-school-graduates in making their enlistment and screening decisions -- even for service academies. A Commission on Accreditation of Service Experiences in 1952 documented the widespread acceptance of the GED as a high school certificate by major firms and state and local governments. In that same year the American Council on Education began to offer the exam to non-veteran civilians and its name was changed to the GED. By 1963, all 50 states used the GED exam to certify high school dropouts.

The post-1963 growth in the proportion of high-school-certified persons taking the GED evident in figure 1 is directly linked to the large scale and unprecedent expansion of the federal government and state programs in human resources that began in the Kennedy-Johnson era. The two main social programs that fueled the post-1963 growth in GED recipiency are (a) the 1966 Adult Basic Education Act and subsequent amendments to it and (b) a variety of federal programs for post-secondary education that created a demand for high school credentials to qualify for program benefits. Surprisingly, manpower training programs that expanded greatly in the 1960' and 1970' contribute little to the growth in GED recipiency.

The Adult Basic Education Act of 1966 was a War on Poverty program designed to provide adults with levels of education that were thought likely to elevate them out of poverty. Throughout the course of the Adult Basic Education program, the emphasis has shifted from an amorphous goal of improving basic skills to a more easily specified and monitored goal of producing GED-certified high school equivalents. Figure 4b reveals that enrollment in this activity expands throughout the period 1963-1986 although Figure 4a reveals that total expenditure on this program ceased to expand after 1973 and the

federal share in total program expenditure declines after that date. Figure 5 reveals that in 1972, 24% of all GED recipients were produced by Adult Basic Education Programs and the time series of GED recipiency closely tracks the time series of GED credentials produced by these programs. (These data are not available before 1972). Amendments to the 1966 Act set forth in 1970 drop the age of eligibility for participation in this program from 18 to 16 and add an explicit emphasis on high school completion via the GED or by night school as a main objective of the program. The amendments became operative in 1972. States responded to the reduced age requirements by lowering minimum age requirements for taking the GED. Most states began to allow persons who were out of school at least six months to take the exam irrespective of their age. Waiting periods for retaking the exam after failure were scaled down to zero - 90 days instead of the previous 90-180 days. In 1973, 20% of all GED degrees were produced by Adult Basic Education Act programs. By 1980, almost 40% of all GED' were trained by this program. Total enrollment increased four-fold between 1970-1980.

Manpower training programs were introduced and expanded during the early 1960', beginning with the Manpower Development and Training Act (MDTA) of 1962. The set of programs created by the Act did not emphasize academic training (Levitan and Gallo, 1988, chap. 1). Job Corps was an exception and did produce GED recipients. However this manpower program was never large. In 1975 the number of Job Corp GED recipients was less than 2% of the total granted. The successor programs to MDTA maintained its disinterest in high school certification as a major objective, and were negligible contributors to the level or rate of growth of GED recipiency. (Levitan and Gallo, 1988).

In addition to the growth in programs that made attainment of the GED as a main objective, there was substantial expansion in programs that required high school degrees or their equivalents to receive benefits. These programs fueled the demand for high school certification. Figure 6a charts the growth in expenditure on major post-secondary educational funding programs which required high school certification for eligibility. Figure 6b charts participation in numbers. There was gradual growth in

Figure 4a: Federal, State and Local Expenditures on Adult Basic Education (millions of 1986 dollars)

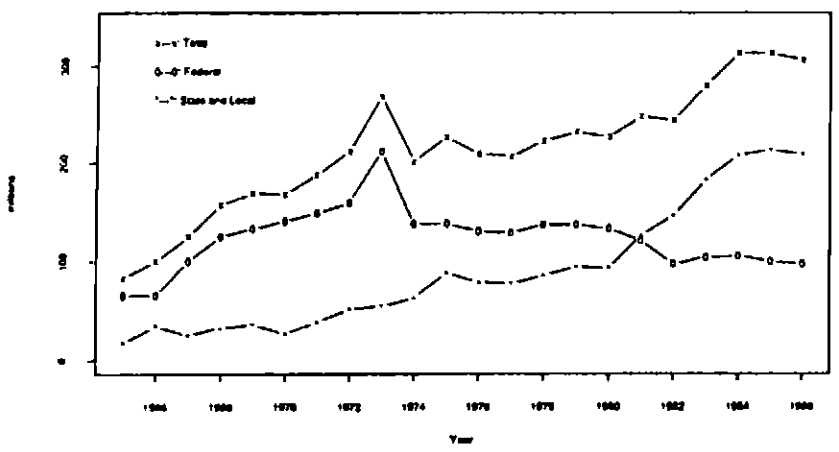
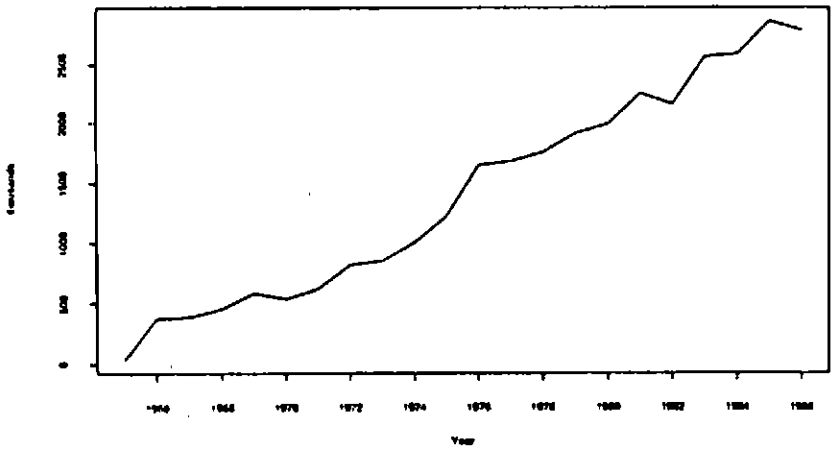
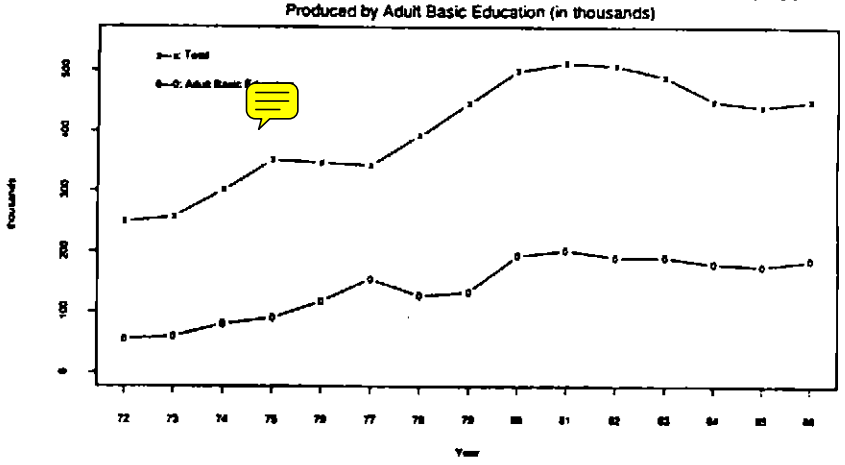


Figure 4b: Enrollment in Adult Basic Education (thousands)



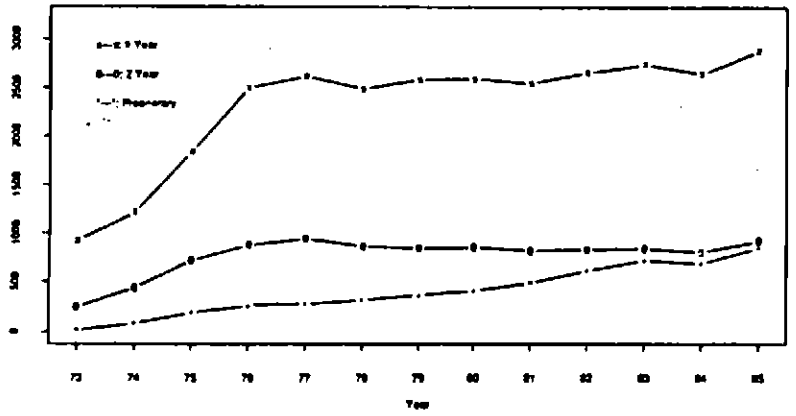
Source: Council on Adult Education, ANNUAL REPORT TO THE PRESIDENT OF THE UNITED STATES, selected years.

Figure 5: Total Number of GED Credentials Issued and Total Number of GED Credentials Produced by Adult Basic Education (in thousands)



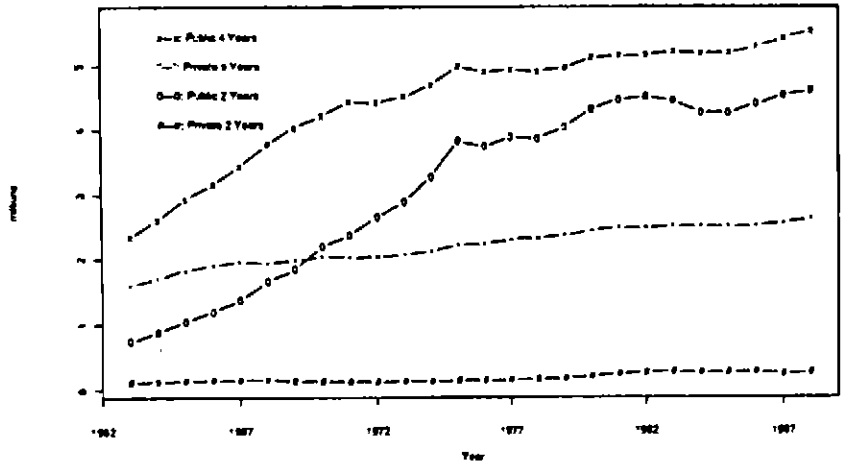
Sources: Council on Adult Education, ANNUAL REPORT TO THE PRESIDENT OF THE UNITED STATES, selected years. American Council on Education, 1988 GED STATISTICAL REPORT, 1990.

Figure 6a: Total Federal Expenditures on Major Postsecondary Education Programs: Pell Grants, Work-Study and SEOG (millions of 1986 dollars), By Type of Institution



Sources: Office of Student Financial Assistance, U.S. Department of Education (USDE), OSFA PROGRAM BOOK, July 1991; Data Collection and Management and Office of Student Financial Assistance, U.S. Department of Education, PROGRAM BOOK, A Summary of 1964-65 Program Statistics, Winter 1966; National Center for Education Statistics, USDE, OERI, Digest of Education Statistics, 1990 (NCES 91-660).

Figure 6b: Total Enrollment in Institutions of Higher Education*



*Data on proprietary schools are not available.
Source: National Center for Education Statistics, U.S. Department of Education, DIGEST OF EDUCATION STATISTICS, 1990

Figure 7a: Federal Expenditures on Major Postsecondary Education Programs (millions of 1986 dollars)

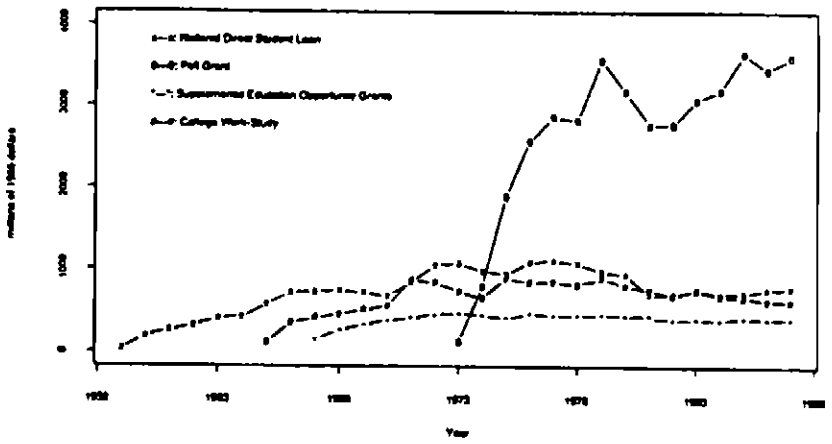
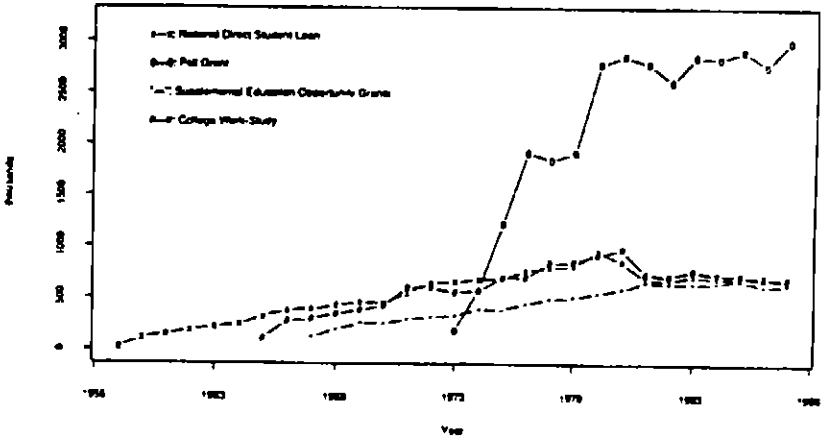


Figure 7b: Participants in Major Federal Postsecondary Education Programs (in thousands)



Sources: Office of Student Financial Assistance, U.S. Department of Education (USDE), OSFA PROGRAM BOOK, July 1991; Data Collection and Management and Office of Student Financial Assistance, U.S. Department of Education, PROGRAM BOOK, A Summary of 1964-65 Program Statistics, Winter 1966; National Center for Education Statistics, USDE, OERI, Digest of Education Statistics, 1990 (NCES 91-660).

National Defense Student Loans (NDSL), work-study support programs and the Supplementary Educational Opportunity Grant program (SEOG) during the period 1963-1975 when GED certification was growing steadily. All of these programs required a high school degree or its equivalent for eligibility. Not only did the scale of these programs increase over the period 1963-1975, but their benefits became applicable to less academically oriented post-secondary institutions such as not-for-profit propriety training centers.

The most dramatic development in post-secondary educational finance was the growth in the Pell grant program in the period 1973-1981. Starting in 1973, benefits for all components of this program could be used to finance proprietary training. Family income restrictions were relaxed and loans became more widely available to the middle class in 1976. As recorded in Figures 7a and 7b, Pell grants to proprietary students continue to grow after 1978 while payments to two and four year college students stabilize after 1976.

Between 1977 and 1981 guaranteed disbursements rose sharply with the passage of new Student Loans amendments that allowed students at all non-profit and proprietary postsecondary institutions access to government grants and loans to high school graduates and GED degree holders, and that liberalized family income restrictions on loan eligibility. (See Figures 8a and 8b) There was a sharp rise in the number of GED degrees issued relative to all high school credentials during this same period (Figure 1).

In 1979 and 1980, however, new regulations began to take effect that allowed any individual with the "ability-to-benefit," including high school dropouts, to participate in any of these programs. A General Accounting Office study of proprietary institutions in 1984 found dropouts to be more likely than high school graduates and GED holders to drop out from their programs and more likely to default on loans and on grant obligations (GAO, 1984, pg. 56). Because of the threat of federal sanctions imposed on institutions with loan default rates exceeding 15% for two consecutive years, lending agencies had an incentive to screen out dropouts. The "ability-to-benefit" requirement remains controversial (Fraas, 1990

Figure 8a: Guaranteed Student Loan Program* Annual Commitments

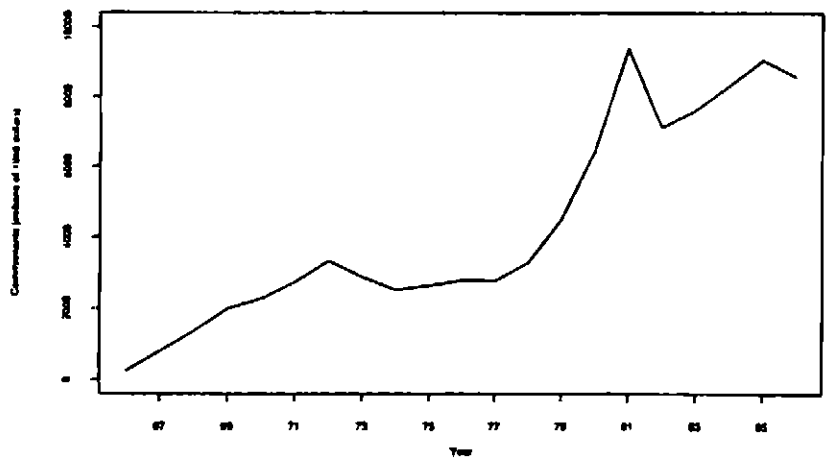
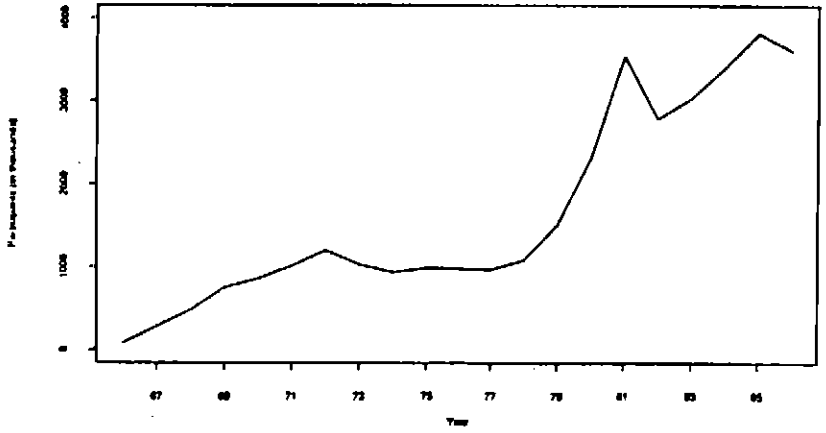
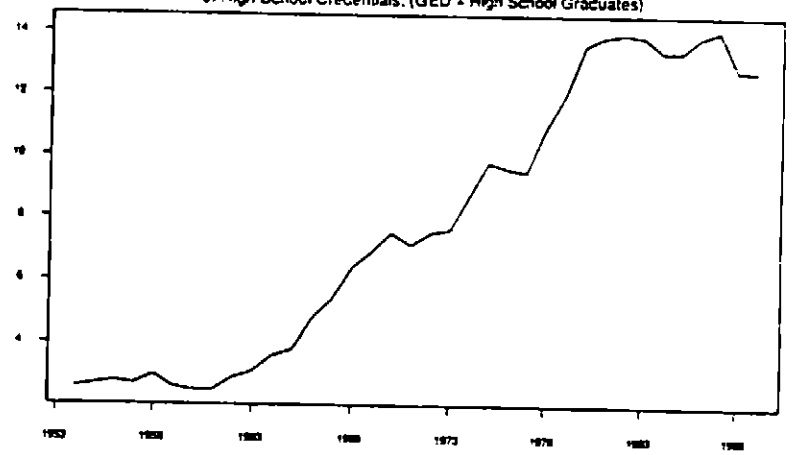


Figure 8b: Guaranteed Student Loan Program* Annual Participants



* Includes regular GSL, GSL-FISLP and total PLUS loans. Breakdown by type of school is not available.
Sources: Office of Student Financial Assistance, U.S. Department of Education (USDE), OSFA PROGRAM BOOK, July 1981. Data Collection and Management and Office of Student Financial Assistance, U.S. Department of Education, PROGRAM BOOK: A Summary of 1984-85 Program Statistics, Winter 1985. National Center for Education Statistics, USDE, OERI, Digest of Education Statistics, 1990 (NCES-91-660)

Figure 9: New GED Recipients as % of Total New Recipients of High School Credentials: (GED + High School Graduates)



1953-1963
1) Opening, of the GED to civilians, the name of Veterans' Testing Service changed to GED Testing Service in 1963

1965
1) Higher Education Act and National Vocational Student Loan Insurance Act are signed into law

2) Expansion of Adult Basic Education and a new emphasis on high school completion through the GED

1973
1) Begining and rapid expansion of the Pell grant program

2) Expansion of Adult Basic Education and a new emphasis on high school completion through the GED

1976
Family income restrictions on Pell grant are liberalized

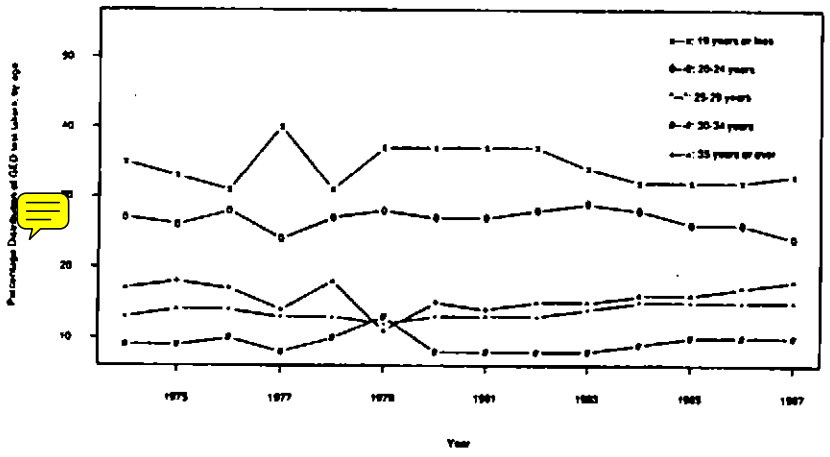
Appendix A). In fact, a Congressional Research Service Report found that in 1986, dropouts comprised only 9% of proprietary school students, 1% of two-year college vocational students, and 3% of students enrolled in any postsecondary program in a community college (Apling and Aleman, pg. 25). By way of comparison, 74% of the persons in the proprietary schools were high school graduates and 9% were GED holders. Among two-year college vocational students 88% were high school graduates and 8% were GED recipients. Among students enrolled in community college postsecondary programs, 86% were high school graduates and 8% were GED holders.

Temporal coincidence cannot establish causation. However, the close association between the growth in GED recipiency and the growth in government programs that subsidize attainment of the GED or require high school certification for eligibility is strongly suggestive of an important role for government subsidy policies in accounting for the growth in GED certification. (See Figure 9). This evidence helps to reconcile the growth in GED certification and the low gross returns to obtaining a GED which we document in this paper.

B. Some Features of the Recent GED Exam and Those Who Take It

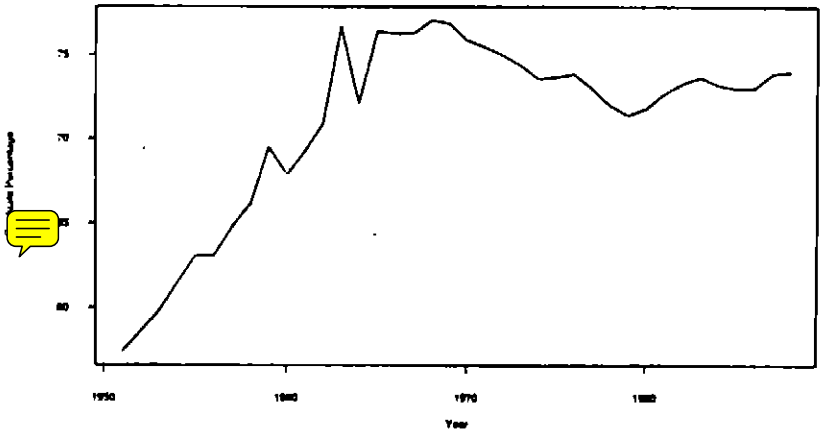
The age distribution of GED test-takers has remained roughly constant over time although the influence of the baby boom and subsequent baby bust is evident (see Figure 10). Most GED test-takers are less than 25 years old. Assuming temporal stability of pass rates by age, the baby boom accounts for part of the post-1970 growth in GED-certified graduates as a fraction of total high-school-certified persons. Between 1970 and 1987, the ratio of 16-19-year-olds to 20-24-year-olds fell from .89 to .75. Over the same period, the proportion of persons age 17 relative to ages 20-44 declined from .056 to .040. Relatively more persons were in the age brackets at risk for the GED than in the age brackets at risk for traditional high school graduation. However, rough calculations suggest that changing population proportions by age account for, at most, two points of the eight-percentage-point growth in GED-certified persons as a proportion of total new certified persons that occurred over this period.

Figure 10: GED credentials issued by age of recipient



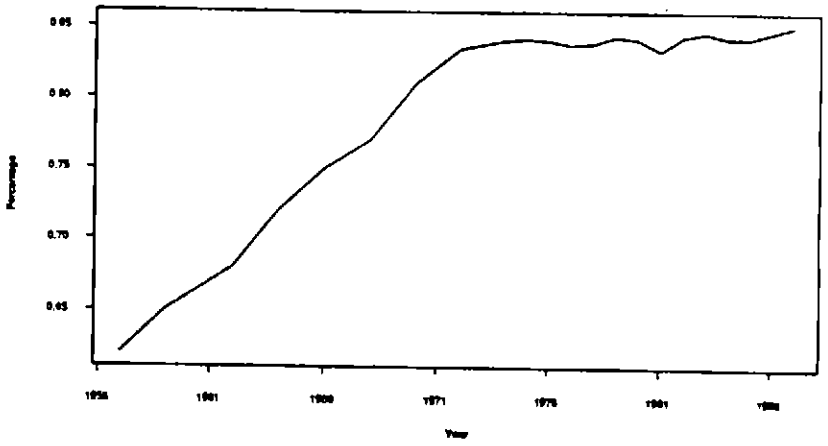
Source: American Council on Education, General Educational Development Testing Service, GED Statistical Report, various years.

Figure 11: High School graduates compared with population 17 years of age



Note: Includes graduates of regular day school programs. Excludes graduates of other programs, which separately reported, and recipients of high school equivalency certificates. Source: U.S. Department of Education, National Center For Education Statistics, Statistics of Public High Schools Biennial Survey of Education in the United States; Statistics of State School [illegible] Statistics of Nonpublic Elementary and Secondary Schools; Common Core of Data surveys; and U.S. Department of Commerce, [illegible] of the Census, Current Population Reports, Series P-25

Figure 12: % of All Persons 20-24 With at Least a High School Diploma



Source: U.S. Department of Commerce, Bureau of the Census, Series P-20, Current Population Reports, Population Characteristics, Educational Attainment in the United States: March (in selected years).

The growth in exam-certified equivalents explains an apparent contradiction in the data on high school dropouts. Figure 11 plots the proportion of traditional high school graduates for cohorts of 17-year-olds over the period 1951-1988. The proportion declines after 1968, although it slightly rebounds in the late 1970' and 1980'. Figure 12 shows a very different pattern over the period 1971-1986 for high-school-certified persons age 20-24. The recent growth in exam certification explains the discrepancy between the two figures. (See also Chester Finn, 1987). There appear to be sharp differences in the use of GED certification by race. Table 1 documents that Black CPS-measured high school equivalents are twice as likely as whites to have the GED. Part of the measured convergence of black and white high school attainment rates (Kominski, 1990) appears to be due to growing high school certification of Blacks by GED exams.

High school certificates awarded by adult education institutes reward students for completing a traditional high school curriculum at a somewhat later stage of life than do typical high school graduates. Equivalency exams operate on a radically different principle. Since the GED certifies the vast majority (well in excess of 90%) of all exam-certified high school graduates over the period 1970-1987, we focus our attention on that exam.

GED candidates 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). Conceptual - and not factual - knowledge is stressed. The focus is on general knowledge and not specific details. (Malizio and Whitney, 1982). Individual states set pass rates, but these vary within a fairly narrow band. The majority of the states (29) require a minimum score of 35 (out of 80 possible - 20 is the minimum score) on each exam and an average of 45 over all exams. Most of the rest require a minimum of 40 and an average of 45. (GED, 1989 Annual Statistical Report, p. 30.) Graduating high school seniors are used to norm the test. Fifty percent of graduating high school seniors score 50 points or higher.

Table 1

A. Proportion of Individuals Receiving a GED or Graduating High School (Standard Error of Mean in Parentheses)

A. Age 25*

	Blacks	Hispanics	Whites
GED	.10 (.01)	.07 (.01)	.06 (.01)
HS Graduate	.65 (.02)	.62 (.02)	.82 (.01)
% of CPS Measured High School Equivalents /Who Are GED Certified	13.33	10.14	6.8
Sample Size	844	559	1523

B. Age 21

	Blacks	Hispanics	Whites
GED	.07 (.01)	.05 (.01)	.05 (.01)
HS Graduate	.63 (.01)	.61 (.01)	.81 (.01)
% of CPS Measured High School Equivalents/Who Are GED Certified	10.0	7.6	5.8
Sample Size	1451	947	2439

*The proportions at Age 28 were the same after rounding to two digits as those presented for Age 25.
Source: NLSY (Appendix A)

By setting the minimum passing level at 35 on the distribution of graduating seniors with a range of scores set at 20-80, the GED examiners guarantee that GED graduates outperform graduating high school seniors on the test.[1] This is an artifact of test construction although Malizio and Whitney (1982, p. 10 as quoted in the introduction to this paper) use such evidence to conclude that GED-certified persons are the equals or superiors of high school graduates. Below, and in Cameron and Heckman, 1991b, we demonstrate that GED recipients are psychometrically inferior to high school graduates in terms of the Armed Services Qualifying Test and its components.

Candidate preparation for the GED is limited. In April and May 1980, a survey was conducted of 13,000 GED candidates at 250 randomly selected GED testing centers throughout the United States. The median examinee spent 20 hours preparing for the test and spent $10 in preparation costs. Seventy-five percent of the examinees spent 60 hours or less in preparation. The upper 5 percentile reported more than 200 hours in preparation. The upper quartile of the candidates spent $25 in direct-out-of-pocket costs or $30, including lost salary. (Malizio and Whitney, 1981, Table 18). Even at the upper 5 percentile point in the distribution of costs, the corresponding figures are $100 and $106. Twenty-one percent did not prepare in any way. Only 22% took the GED practice test and 40.5% studied from a book or manual. Less than 1% of the candidates incurred any expenses for individual tutoring. Despite the generally low level of preparation, usually more than 70% of those taking the exam pass it in any given sitting. Candidates who fail may retake the exam without penalty, although there is a short (two-three month) waiting period in some states. In Corpus Christi Texas, one of the authors (Heckman) in 1991 observed a federally sponsored GED program that gave persons initially certified at fourth grade levels in numeracy and literacy four weeks of intensive instruction. The program has a first time pass

[1]More precisely, GED recipients must score better than high school graduates scoring less than 35. If the distributions of ability were identical in the two groups, then mean, median and all quantile test scores would necessarily be higher for GED recipients. The evidence in Malizio and Whitney (1982) suggests that GED recipients have a thinner right tail of test scores compared to high school graduates.

rate of 80%. If the objective of GED certification is so easy to attain, it is natural to conjecture that its intrinsic economic value might be low.

C. Psychometric and Other Evidence On The Nonequivalence Of Exam-Certified Equivalents

Despite a torrent of claims to the contrary issued from the American Council on Education, there is considerable evidence that GED-certified persons do not possess the same skills or motivation as high school graduates. Janice Laurence (1983, Table 1) notes that high school dropouts and GED-certified high school equivalents have basically the same attrition rates from the U.S. military over the period 1977-1979, and both groups attrite at twice the rate of high school graduates. She goes on to note that in 1982, the U.S. Army required for minimal admission standards that GED-certified graduates and high school dropouts should be in the 31st percentile of the Armed Forces Qualifying Test (AFQT) distribution. High school graduates were only required to be in the 16th percentile. The higher minimum scores were judged necessary to guarantee successful completion of basic training courses by GED-certified applicants.

An extensive study of the performance of GED recipients in the University of Wisconsin system has been performed by Pawasarat and Quinn (1986). At the University of Wisconsin - Milwaukee, GED-certified persons had lower completion rates for the first four semesters than did high school graduates from the bottom 20 percentiles of their high school class (31% vs. 41%). The four-semester-completion rates for high school graduates in the top 50% of their class was 62% - twice that of the GED graduates. At the University of Wisconsin-Madison, only 73% of GED holders admitted to the school enrolled for a second semester, compared to a 95% rate for all entrants to the school. At Milwaukee Area Technical College - a vocational school - GED-holders seeking a two-year Associate Degree had attrition rates comparable to those of high school dropouts. Over the period 1980-1983, 8% of GED entrants attained the two-year Associate Degree, compared to 10% of high school dropouts and 30% of high school graduates. A study of the Milwaukee labor market by Pawasarat and Quinn finds that 48% of the firms

interviewed preferred hiring conventional high school graduates to GED-certified graduates, while the rest of the employers were indifferent between persons with the two types of high school credentials.

Psychometric evidence from the National Longitudinal Survey of Youth, ages 13-20 in 1978, contradicts the psychometric claims of equivalency for the two types of high school certification made by the American Council on Education. (The survey is described at length in Appendix A). Table 2 displays the results of the Armed Forces Qualifying Test (AFQT) for males administered to all members of the NLSY sample. For the random subsample of the data (Panel A of Table 2), AFQT scores for the deciles going from the bottom to the top are presented, as well as mean scores. High school graduates have statistically significantly higher mean test scores than do GED holders who, in turn, have statistically significantly higher mean test scores than do high school dropouts. The pattern is the same at each decile from the top to the bottom. The pattern holds true for a sample standardized to have the same approximate age at the time they take the exam (Panel B), or for an enriched sample that oversamples blacks and hispanics (results not shown). The same pattern is found for persons who do not complete four-year colleges both for the entire sample and for those who were 16 or 17 at the time the test was given: GED recipients are not the psychometric equivalents of high school graduates. (Cameron and Heckman, 1991b). However, they psychometrically dominate high school dropouts. Similar patterns appear for each race group: whites, blacks and hispanics. A Wilcoxon test for stochastic dominance (Bickel and Doksum, 1977) - a statistical concept that compares distributions of the same outcome for different groups and determines if higher outcomes are more common in one group than another-is presented in the first row of Table 3. It reveals that the high school graduate AFQT distribution first-order-stochastically dominates the GED-AFQT distribution, and the latter distribution first-order-stochastically dominates the AFQT distribution of high school dropouts. The same pattern is found for persons who do not attend college and for disaggregated components of the AFQT exam. (See Cameron and Heckman 1991b).

Table 2

Means and Deciles of Testscores on the AFQT Exam

A. Random Sample

	N	Means and Standard Error of Means	Deciles (Lowest to Highest)								
			10	20	30	40	50	60	70	80	90
HS Grad	2168	75.8 (0.40)	48	61	68	74	79	84.0	88	93	97.0
GED	209	64.7 (1.28)	38	48	54	61	66	70.5	76	82	88.5
DROPOUT	436	45.5 (0.79)	25	30	35	39	43	48.0	53	60	70.0
TOTAL	2813	70.1 (0.40)	37	49	60	68	74	80.0	85	90	96.0

B. Random Sample: Those 16 and 17 When They Took the AFQT Exam

	N	Means and Standard Error of Means	Deciles (Lowest to Highest)								
			10	20	30	40	50	60	70	80	90
HS Grad	679	72.1 (0.61)	45.0	56	65	70	75.0	79.0	84	88.0	94.0
GED	81	60.3 (2.00)	31.5	44	49	55	60.5	68.5	73	78.5	85.5
Dropout	166	44.8 (1.14)	25.0	30	34	39	42.0	46.0	52	60.0	70.0
TOTAL	926	67.0 (0.61)	34.0	45	54	63	69.0	75.0	80	86.0	93.0

Table 3A
Wilcoxon Tests For First Order Stochastic Dominance
(with Chi-Square Approximations)
Family Background and Outcome Measures
For the 25 years old Random Sample

Variable	High School vs. GED		Dropout vs. GED	
	Chi-Square	Prob > Chi-Square	Chi-Square	Prob > Chi-Square
AFQT Score	46.04	.0001	68.40	.001
Annual Hours	7.31	.0068	0.04	.840
Hourly Wage	10.31	.0001	2.37	.130
Family Income	28.30	.0001	11.40	.007
County Average Earnings (unskilled)	4.31	.0381	3.17	.075

Table 3B
Wilcoxon Tests For First Order Stochastic Dominance
(with Chi-Square Approximations)
Family Background and Outcome Measures
For the 28 years old Random Sample

Variable	High School vs. GED		Dropout vs. GED	
	Chi-Square	Prob > Chi-Square	Chi-Square	Prob > Chi-Square
AFQT Score	20.9	.0001	20.6	.0001
Annual Hours	4.84	.028	1.02	.31
Hourly Wage	9.71	.0014	.78	.38
Family Income	13.61	.0002	2.26	.133
County Average Earnings (unskilled)	.82	.52	.10	.77

Table 4

Mean Family Background Characteristics of Random Sample At Age 25
(Standard Error of Means in Parentheses)

	Number of Observations	Family Income (1967$)	Number of Siblings	Highest Grade Completed of Father	Highest Grade Completed of Mother
Drop Out	266	7072 (247.7)	4.384 (.163)	9.102 (.190)	9.786 (.157)
GED	102	8791 (436.2)	3.518 (.229)	11.102 (.276)	10.784(.212)
H.S. Diploma	1466	11530(151.3)	3.063 (.054)	12.390 (.089)	12.056(.067)
				Hispanic	Black
				.130 (.020)	.222 (.025)
				.079 (.025)	.149 (.034)
				.058 (.006)	.089 (.007)

Wages of unskilled workers in the county. See Appendix A for precise definition.

D. Direct Behavioral Comparisons

This subsection presents simple mean-difference and univariate distributional comparisons among high school dropouts, GED recipients, and high school graduates. Using the NLSY data for male youth age 13-20 in 1978 we compare the determinants and labor market and educational consequences of the three types of high school certification status.

Table 4 reveals that family background variables are ordered in the expected direction. High school dropouts are more likely to be minority group members and come from larger families with lower incomes and less educated parents than do GED recipients who, in turn, have poorer background characteristics than high school graduates.[2] The Wilcoxon test, reported in Table 3, reveals that the family income distribution of traditional high school graduates stochastically dominates that for GED recipients and dropouts. There is no stochastic-ordering relationship for family income between the latter two groups. (Similar results hold for people age 28).

Tables 5A and 5B present evidence on labor market outcomes for individuals with the three types of high school status. At age 25 (Table 5A), the mean labor market status of high school dropouts is the same as that of GED recipients. The small premium in hourly wages and salary for GED recipients over those of dropouts is not statistically significant. Both groups are inferior to high school graduates in terms of hours, wages, salaries, weeks worked, and length of time on their current job. The lower work experience of high school graduates is a consequence of their greater schooling. The relationships in means carry over to first-order-stochastic dominance on these variables: GED and high school dropouts are indistinguishable, and both groups have labor market outcome distributions that are first-order-

[2]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 of his/her siblings - provided they share common family characteristics. This sampling induces a stochastic dependence among sibling observations which we analyze in Appendix A where it is shown to have a minor effect on the estimated standard errors of the coefficients of wage equations.

Table 5A

Labor Market Outcomes
Random Sample Means (Standard Deviation of Means in Parentheses)

A. Age 25

	High School Dropout	GED	High School Graduates
N:(Working/In Sample)	266/284	102/114	1092/1466
Hourly Wage*	2.052 (.078)	2.147 (.096)	2.515 (.038)
Annual Salary*	3306.8 (153.1)	3847.2 (241.7)	4930.9 (89.49)
Weeks Last Year Worked*	41.2 (.88)	43.0 (1.29)	46.54 (.332)
Hours Worked Last Year*	1773.8 (47.78)	1859.15 (79.2)	2079.4 (22.08)
Job Tenure in Weeks*	92.68 (2.85)	78.06 (6.631)	121.36 (3.11)
Total Weeks Worked††	157.8 (6.133)	157.10 (9.26)	149.26 (3.16)
Unemployed or out of force	.060 (.014)	.070 (.024)	.021 (.004)

B. Age 28

	High School Dropout	GED	High School Graduates
N:(Working/In Sample)—	91/96	46/48	518/626
Hourly Wage*	2.236 (.140)	2.501 (.282)	3.024 (.081)
Annual Salary*	4285.6 (391.7)	4669.8 (558.6)	6169.8 (141.5)
Weeks Worked Last Year*	43.74 (1.80)	42.54 (2.28)	47.92 (.439)
Hours Worked Last Year*	1997.3 (86.32)	1847.5 (122.5)	2178.9 (30.6)
Job Tenure in Weeks*	131.3 (14.34)	96.10 (14.38)	178.03 (6.65)
Total Weeks Worked††	232.7 (13.16)	220.8 (20.6)	195.6 (6.0)
Unemployed or out of force	.052 (.023)	.042 (.029)	.024 (.006)

*These variables defined only if the person works in the year of survey.
—Number of individuals working/In sample.
††Total weeks worked since age 16.

stochastically dominated by those of high school graduates. (See Table 3A). Table 4B reveals the same pattern at age 28, when post-school investment activity begins to diminish and long-term differences in wages and labor supply begin to emerge. High school dropouts are indistinguishable in their means from GED recipients, and both are inferior to high school graduates. As displayed in Table 3B, the relationships for means carry over to more general first-order-stochastic dominance relationships for entire distributions.

One way to gauge the economic significance of these results is to examine the implications for the estimated "rate of return" to education arising from the CPS convention that equates GED recipients and high school graduates. Using two samples of NLSY observations of young men ages 25-28 (enriching the random sample with black and hispanic subsamples), we compute a least squares regression of log hourly wages on mutually exclusive dummy variables that measure whether or not a person has a high school diploma (= 1 if a person has a high school diploma irrespective of subsequent achievement) or two years of college, or four years of college. (See Table 6A, column one). Column two shows the effect of distinguishing how the high school diploma was achieved: through a GED or through a traditional degree program.

Defining high school diploma in the CPS-Census manner produces a differential effect on wages at age 25 of four-year college attendance compared to high school graduation of 21% (Column 1). Breaking out the GED from the traditional high school diploma produces a college-high school differential of only 19.6% for the traditional high school degree. The comparable figures at age 28 are 21.9% and 20.7% respectively. F-tests based on more robust McKinnon-White (1985) standard errors reject the hypothesis that GED recipients should be considered the same as high school graduates, but do not reject the hypothesis that GED recipients are indistinguishable from high school dropouts. The CPS-Census convention of equating GED recipients to high school graduates overstates the returns to college education relative to traditional high school graduation. Inappropriate pooling of the two types of high school

Table 6A
Log Hourly Wage Equations at Age 25
Persons in College at Age 25 Deleted as are Person not Working
Wage Equation with Education Dummies
N = 2308; T-Statistics[a] in Parentheses

	Combine GED and HS Graduate	Disaggregate GED and HS Graduate
Intercept	.690 (22.9)	.690 (23.0)
H. S. Graduate	.130 (5.5)	.144 (6.5)
GED	-na-[b]	.060 (1.5)
2 Yrs. College + HS	.231 (5.0)	.236 (5.4)
2 Yrs. College + GED	-na-[b]	.169 (1.1)
4 Yrs. College	.340 (10.2)	.340 (10.2)
Black	-.190 (9.1)	-.190 (9.1)
Hispanic	-.050 (1.8)	-.050 (1.8)
Year 1982	.024 (0.9)	.023 (0.7)
Year 1983	.001 (0.0)	.001 (0.1)
Year 1984	-.036 (1.1)	-.032 (1.0)
Year 1985	-.071 (1.1)	-.070 (0.9)
Year 1986[c]	-.036 (2.0)	-.038 (1.8)
F-Test:	Probability > F	
GED = 0	-na-[b]	.13
GED = HS Grad	-na-[b]	.02

Note: All the education dummies are defined exclusively.
[a]Calculated using McKinnon-White standard errors to correct for heteroskedasticity.
[c]Year 1987 is the left out year indicator.
[b]Not applicable

Table 6B
Log Hourly Wage Equations At Age 28
Persons in College at Age 28 Deleted as are Persons not Working
Wage Equation with Education Dummies
N = 1016 : T-Statistics[a] in Parentheses

	Combine GED and HS Graduate	Disaggregate GED and HS Graduate
Intercept	.836 (19.6)	.835 (19.4)
H.S. Graduate	.162 (4.4)	.174 (4.7)
GED	-na-[b]	.062 (1.0)
2 Yrs. College + HS	.337 (6.3)	.355 (6.7)
2 Yrs. College + GED	-na-[b]	.112 (0.6)
4 Yrs. College	.381 (7.9)	.381 (7.9)
Black	-.161 (4.9)	-.159 (4.8)
Hispanics	-.027 (0.7)	-.025 (0.6)
Year 1985	-.086 (2.4)	-.089 (2.5)
Year 1986[c]	-.051 (1.4)	-.049 (1.3)
R^2	.11	.12
F-Test:	Probability > F	
GED = 0	-na-[b]	.38
GED = HS GRAD	-na-[b]	.04

Note: All the education dummies are defined exclusively.
[a]Calculated using McKinnon-White standard errors to correct for heteroskedasticity.
[c]Year 1987 is the left out year indicator.
[b]Not applicable

credentials would cause the college-high school differential to increase over the period of the late 1970's and 1980's, as GED certification became a wide-spread phenomenon but the effect appears to be relatively small. Approximately 10% of the growth of the four year college - high school differential documented for younger workers (with 5 years of work experience) documented by Katz and Krueger (1990) arises from falsely attributing the market productivity of traditional high school graduates to GED recipients.

Additional evidence on the nonequivalence of high school equivalents is presented in Tables 7 and 8, which look at post-certification educational choices for both types of degrees. Table 7 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 not undertake any post-secondary education. Table 8 reveals that GED graduates are less likely than high school graduates to attend four-year colleges, or graduate from them if they attend them. Attendance and completion rates at two-year colleges are comparable for the two groups.

The evidence from the NLSY and the other studies indicates that GED recipients are not the equivalents 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 post-secondary academic education and are less likely to finish an educational program if they begin it. The balance of this paper and our companion papers (Cameron and Heckman, 1991a,b) presents a more refined statistical analysis of the NLSY that supports these basic conclusions.

2. Econometric Evidence On The Non-Equivalence of Exam-Certified Equivalents

A. Introduction

This section presents econometric evidence on the nonequivalence of exam-certified equivalents. We demonstrate that controlling for detailed person-specific and market characteristics, the unadjusted differences reported in section 1 remain. GED-certified persons are much closer to high school dropouts

Table 7

Random Sample NLSY

First Action After Completing Degree

	Attend 4 yr College	Attend 2 yr College	Vocational Training	On The Job Training/ Apprentice-ship	Military	Other*
Graduate High School (N = 1902)	36.6%	23.3%	7.6%	3.4%	4.8%	24.3%
GED (N = 164)	15.0%	23%	10%	3.3%	10%	40%

*Other = Work with no Training, Unemployment, Out of Labor Force

Table 8

Post-Secondary Decisions of GED Recipients and High School Graduates

Panel A
All Educational Decisions After Receiving Degree

	Attend Four Year College	Attend Two Year College	No College
H.S. Diploma (N = 1902)	30.3%	32.3%	37.4%
GED (N = 164)	16%	27%	58%

Panel B
Completion Rates For Four Year College
Attend Four Year College to Graduation**

H.S. Diploma (N = 566)	75%	NA†	NA†
GED (N = 42)	5%	NA†	NA†

Panel C
Completion Rates For Two Year College Attendance

	Attend Four Years and Graduate	Finish Two Year	Completes Less Than Two Years
H.S. Diploma (N = 584)	34.7%	21%	44.3%
GED (N = 42)	2%	25%	73%

*Only 3.2% of the sample attended a two year college and then went on to a four year school.

**These are persons who start at four year colleges.

†Not Applicable

Source: NLSY (see Appendix A)

than are high school graduates. Subsection C presents evidence on this question for wages and hours of work. Subsection D documents that most of the (low) gross return to GED certification comes from returns to post-secondary schooling and training. However, the gross returns from these activities are lower for GED certified persons than for high school graduates. This evidence supports our contention that the growth in GED certification over time arises partly from the growing subsidy to post-secondary programs that require high school credentials.

Subsection E presents an analysis for unemployment, labor force participation and job turnover. On these dimensions of labor market attachment, GED-certified persons are much closer to high school dropouts than high school graduates. Subsection F presents some confirmatory longitudinal evidence. The section concludes with a brief assessment of the consequences of the CPS and Census convention that equates high school graduates with GED recipients for measuring the time series of the returns to education. Before presenting this evidence, we first sound a cautionary methodological note.

B. A Remark on Conventional Testing Criteria

The evidence presented in this section of the paper is largely based on classical testing theory for multivariate regression models. Because we use "robust" procedures (McKinnon-White, 1985) we do not rely on standard, and controversial, normality assumptions. Nonetheless, there is a well-known ambiguity in the classical theory that centers on the choice of a correct significance level for conducting a test and the matter of how it should be adjusted in different sample sizes. (Lindley, 1957). These considerations are especially relevant for this paper in light of the small samples available in the NLSY compared to the Current Population Survey samples that have generated so much of the recent knowledge on the structure of the wages and labor supply.

In order to avoid placing undue-and increasing- weight on minimizing type II errors (the probability of accepting a false null hypothesis) as sample sizes increase, the probability of type I errors (i.e. the significance level) should be adjusted downward with sample size. Stated more simply, given

that P values are to be used, we should be more tolerant - less likely to reject a null for any P value-on a small sample like the NLSY than on a large sample like the CPS.

In the context of this paper, this advice comes down to two principles that are important to keep in mind in reading the evidence reported below: (a) when one rejects a null hypothesis in a model fit on the NLSY, one can be relatively confident in doing so; (b) when one does not reject, but the sign pattern of estimated differences seems plausible, one should not be too confident in accepting the null.

C. The Direct Effects of Certification on Wages and Hours Worked

This subsection demonstrates that GED-certified males are more like high school dropouts than high school graduates in terms of their labor supply and wages. Tables 9A-9D present estimates of alternative specifications of labor supply and wage equations that distinguish GED recipients from traditional high school graduates. We estimate wage and labor supply equations at ages 25 and 28 for two different samples. The first specification (model 1) is fit on samples of young men not in college (two-year or four-year) at ages 25 or 28 who also are working at those ages. The second specification (model 2) is fit on samples of young men who have not attended any college up to age 25 or 28 and who work in the year following the date at which the age is attained. These samples are defined so that data on hourly wages are available for each observation and so that persons holding low-wage part-time student jobs are excluded from our analysis. In order to correct for potential sample-selection bias problems that arise from excluding workers on the basis of their labor force or educational activity, we estimate a bivariate-selection-correction model presented in Appendix B. The variables used in the analysis are defined in Appendix A although the common English meanings are precise enough.

For all specifications of the wage and labor supply equations with and without selection corrections, we are unable to reject the hypothesis that GED recipients are indistinguishable from high school dropouts (see the "P" values for the test of the hypothesis "GED = 0" given at the base of Tables 9A-9D). For all specifications of the labor supply equations and for specifications of the wage functions

TABLE 9A: OLS Regressions at Age 25 for log-wages and log-hours (year effects not reported)
Model 1: Persons in college at age 25 deleted as are persons not working.*
N = 2308 : T-Statistics** in Parentheses

	LOG-HOURLY WAGES				LOG-ANNUAL HOURS	
	Means No Selection	Means With Selection	Wage Equation/No Selection	Wage Equation W/Selection	Hours Equation No Selection	Hours Equation W/Selection
Intercept	.690 (23.0)	.59 (11.8)	.45 (8.9)	.34 (6.7)	2.85 (68.7)	2.9 (60.7)
GED	.060 (1.5)	.030 (0.9)	.071 (2.1)	.044 (1.4)	.041 (0.8)	.027 (0.8)
HS Graduate	.144 (6.5)	.108 (5.0)	.108 (4.8)	.075 (3.1)	.143 (5.8)	.132 (4.8)
Selection γ_1***	-	.310 (3.4)	-	.38 (3.2)	-	-.102 (0.50)
Selection γ_3***	-	-.710 (3.0)	-	-.021 (0.8)	-	-.86 (3.2)
Tenure	-	-	.15 (10.7)	.148 (10.8)	-	-
Tenure Sq.	-	-	-.01 (5.6)	-.010 (5.5)	-	-
Experience	-	-	.044 (7.0)	.042 (6.2)	-	-
Unemp. Rate	-	-	-.020 (6.9)	-.020 (3.9)	-.010 (2.7)	-.001 (0.2)
2 Yrs. College + GED	.169 (1.1)	.104 (0.7)	.147 (1.0)	.077 (0.6)	.088 (0.5)	.102 (0.5)
2 Yrs. College + HS	.236 (5.4)	.167 (3.6)	.205 (5.0)	.151 (3.6)	.321 (5.2)	.304 (4.8)
College Grad	.340 (10.2)	.241 (6.7)	.341(10.7)	.256 (7.4)	.250 (6.2)	.274 (5.3)
Black	-.190 (9.1)	-.080 (2.1)	-.13 (6.0)	-.093 (2.5)	-.20 (6.4)	-.10 (2.4)
Hispanic	-.050 (1.8)	-.021 (0.5)	-.05 (1.1)	-.006 (0.2)	-.05 (1.3)	-.03 (1.0)
R^2	.10	.12	.20	.21	.04	.06
F-test:	Probability > F					
GED=0	.13	.37	.04	.14	.38	.41
GED=HS GRAD	.02	.03	.36	.35	.01	.02

*Persons may have taken postsecondary vocational training.
**Calculated using modified McKinnon-White standard errors to correct for heteroskedasticity and estimated parameter (Appendix B).
***γ_1 corresponds to coefficient on selection correction term controlling for working and not attending college in Appendix equation B-2.
γ_3 corresponds to coefficient on selection correction term controlling for college enrollment in Appendix equation B-2.

TABLE 9B: OLS Regressions at Age 25 for log-wages and log-hours (year effects not reported)
Model 2: Samples defined for those who do not complete any college and who are not working.*
N = 1410 : T-Statistics** in Parentheses

	LOG-HOURLY WAGES				LOG-ANNUAL HOURS	
	Means No Selection	Means With Selection	Wage Equation/No Selection	Wage Equation W/Selection	Hours Equation No Selection	Hours Equation W/Selection
Intercept	.68 (19.0)	.61 (14.5)	.46 (8.2)	.35 (5.8)	2.9 (42.0)	2.9 (35.0)
GED	.048 (1.2)	-.015 (0.4)	.066 (1.5)	.033 (1.0)	.015 (0.2)	.030 (0.4)
HS Diploma	.128 (4.8)	.088 (3.4)	.085 (3.2)	.049 (2.0)	.180 (4.6)	.160 (3.8)
Selection γ_1***	-	.25 (3.9)	-	.25 (4.2)	-	.05 (0.9)
Selection γ_3***	-	-.50 (2.7)	-	-.10 (1.0)	-	-.85 (0.3)
Tenure	-	-	.17 (9.7)	.164 (9.3)	-	-
Tenure Sq.	-	-	-.01 (4.6)	-.011 (4.3)	-	-
Experience	-	-	.05 (5.7)	.053 (5.8)	-	-.003 (0.9)
Unemp. Rate	-	-	-.018 (5.4)	-.022 (5.2)	-.011 (2.1)	-
Black	-.21 (2.6)	-.13 (3.8)	-.15 (5.6)	-.14 (4.2)	-.22 (5.4)	-.12 (2.4)
Hispanic	-.09 (2.7)	-.05 (1.4)	-.07 (2.3)	-.04 (1.3)	-.08 (1.7)	-.06 (1.3)
R^2	.07	.10	.18	.19	.04	.05
F-test:	Probability > F					
GED=0	.21	.69	.12	.32	.78	.66
GED=HS GRAD	.05	.07	.60	.66	.002	.002

*Persons may have taken postsecondary vocational training.
**Constructed using modified McKinnon-White standard errors.
***γ_1 corresponds to coefficient on selection correction term controlling for working and not attending college in Appendix equation B-2.
γ_3 corresponds to coefficient on selection correction term controlling for college enrollment in Appendix equation B-2.

TABLE 9C: OLS Regressions at Age 28 for log-wages and log-hours (year effects not reported)
Model 1: Persons in college at 28 deleted as are persons not working.*
N = 1016 : T-Statistics** in Parentheses

	LOG-HOURLY WAGES				LOG-ANNUAL HOURS	
	Means No Selection	Means With Selection	Wage Equation No Selection	Wage Equation W/Selection	Hours Equation No Selection	Hours Equation W/Selection
Intercept	.84 (19.6)	.78 (12.5)	.67 (8.0)	.55 (5.6)	3.1 (40.9)	3.24 (28.2)
GED	.062 (1.0)	.037 (0.6)	.115 (1.7)	.101 (1.5)	-.053 (0.8)	-.074 (1.2)
HS Diploma	.174 (4.7)	.134 (3.6)	.154 (4.4)	.121 (4.0)	.090 (2.2)	.061 (1.9)
Selection γ_1**	-	.59 (2.5)	-	.59 (2.2)	-	-.210 (1.8)
Selection γ_2**	-	-.68 (2.0)	-	-.10 (0.8)	-	-1.42 (4.5)
Tenure	-	-	.12 (7.2)	.124 (7.6)	-	-
Tenure Sq.	-	-	-.010 (5.0)	-.010 (5.8)	-	-
Experience	-	-	.023 (3.0)	.021 (2.6)	-	-
Unemp. Rate	-	-	-.020 (5.1)	-.02 (2.6)	-.019 (3.8)	-.010 (1.5)
2 Yrs. College + GED	.112 (0.6)	.085 (0.70)	.150 (0.9)	.100 (1.4)	.121 (1.3)	-.110 (2.0)
2 Yrs. College + HS	.355 (6.7)	.297 (5.8)	.322 (6.0)	.290 (6.0)	.153 (2.7)	.123 (2.2)
College Grad	.382 (7.9)	.317 (5.5)	.38 (8.2)	.301 (5.7)	.166 (3.7)	.135 (3.0)
Black	-.16 (4.8)	-.05 (1.00)	-.13 (4.0)	-.09 (2.1)	-.110 (3.5)	-.041 (0.9)
Hispanic	-.02 (0.60)	.02 (0.30)	-.01 (0.2)	.01 (0.2)	-.81 (1.8)	-.020 (0.8)
R^2	.12	.14	.22	.022	.06	.10
F-test:	Probability > F					
GED=0	.38	.49	.09	.13	.42	.26
GED=HS GRAD	.04	.06	.52	.72	.02	.03

*Persons may have attended postsecondary vocational training.
**Calculated using modified McKinnon-White standard errors to correct for heteroskedasticity and estimated parameter error (Appendix B).
***γ_1 corresponds to coefficient on selection correction term controlling for working and not attending college in Appendix equation B-2.
γ_2 corresponds to coefficient on selection correction term controlling for college enrollment in Appendix equation B-2.

TABLE 9D: OLS Regressions at Age 28 for log-wages and log-hours (year effects not reported)
Model 2: Samples defined for those who do not complete any college
and who are not working.*
N = 732 : T-Statistics** in Parentheses

	LOG-HOURLY WAGES				LOG-ANNUAL HOURS	
	Means No Selection	Means With Selection	Wage Equation/No Selection	Wage Equation W/Selection	Means No Selection	Means With Selection
Intercept	.75 (16.1)	.75 (11.0)	.56 (5.0)	.49 (4.5)	3.0 (49.0)	3.1 (29.0)
GED	-.072 (1.0)	-.08 (1.0)	.042 (0.7)	.031 (0.4)	-.045 (0.6)	-.042 (0.7)
HS Diploma	.171 (3.8)	.155 (3.7)	.154 (3.7)	.131 (3.3)	.106 (2.7)	.108 (2.7)
Selection γ_1***	-	-.21 (1.7)	-	.26 (1.1)	-	-.13 (0.4)
Selection γ_2***	-	-.05 (0.4)	-	-.09 (1.0)	-	-.12 (1.8)
Tenure	-	-	.15 (6.9)	.146 (7.0)	-	-
Tenure Sq.	-	-	.04 (3.9)	-.010 (4.1)	-	-
Experience	-	-	-.03 (5.3)	.041 (4.5)	-	-
Unemp. Rate	-	-	-.03 (4.8)	-.031 (5.8)	-.026 (4.1)	-
Black	-.20 (4.7)	-.18 (2.8)	-.15 (3.9)	-.170 (2.8)	-.17 (4.0)	-.12 (2.1)
Hispanic	-.03 (0.6)	-.03 (0.4)	-.003 (0.2)	-.007 (0.1)	-.08 (1.8)	-.06 (1.0)
R^2	.06	.07	.18	.19	.04	.07
F-test:	Probability > F					
GED=0	.27	.28	.50	.65	.52	.45
GED=HS GRAD	.001	.001	.11	.12	.02	.02

*Persons may have attended postsecondary vocational training.
**Calculated using modified McKinnon-White standard errors to correct for heteroskedasticity and estimated parameter error (Appendix B).
***γ_1 corresponds to coefficient on selection correction term controlling for working and not attending college in Appendix equation B-2.
γ_2 corresponds to coefficient on selection correction term controlling for college enrollment in Appendix equation B-2.

that exclude job tenure and work experience, we reject the hypothesis that the GED degree is equivalent to the high school diploma ("GED = HS GRAD"). When job tenure and work experience are entered as regressors in wage equations, there is less evidence of a distinction between the two forms of high school certification. There is a strong negative relationship total work experience and GED status. The wage equations at ages 25 and 28 and the labor supply equation at age 28 reveal an important role for the local unemployment rate.[3]

Using conventional statistical significance levels, the NLSY data strong reject the hypothesis that GED recipients are the labor market equals of high school graduates. The same data do not reject the hypothesis that high school dropouts and GED recipients are indistinguishable. A closer look at the evidence indicates, however, that GED recipients are between dropouts and graduates in their economic standing but are a lot closer to the former than the latter. These findings suggest that with larger data sets, it is likely (very likely if fixed significance levels are retained) that recipients of GEDs will be shown to have a somewhat superior labor market position compared to high school dropouts.

It is plausible that the differences in economic outcomes among the GED recipients, dropouts and high school graduates are largely due to differences in ability. (Recall the ordering reported in Table 2). Tables 10A and 10B present estimates of augmented versions of the models presented in Tables 9A-9D when an AFQT test score - interpreted as a measure of ability - is added to wage and hours of work equations. AFQT scores may be as much a consequence as a cause of schooling, so the results shown in these tables should be interpreted with caution. Introduction of the AFQT variable tends to reduce the precision and size of the estimated GED and high school graduation coefficients, as would be expected

[3]The selection-correction procedure used in this paper does not play a central role in producing these inferences. However, it does affect the strength of the inference in the specifications of the wage function that include tenure and experience. In Cameron and Heckman, 1991b, we examine the fit of estimated selection-corrected and uncorrected wage and labor supply functions to the data. The selection-corrected wage models fit the data although the uncorrected wage models do not. Neither corrected nor uncorrected hours models fit the data.

TABLE 10A: Selection Corrected Log-Wage and Log-Hour Regressions (year effects not reported)
Including the Score on the AFQT Test at Age 25
T-Statistics* in Parentheses

	LOG-HOURLY WAGES				LOG-ANNUAL HOURS			
	Model 1 No Selection	Model 1 With Selection	Model 2 No Selection	Model 2 With Selection	Model 1 No Selection	Model 1 With Selection	Model 2 No Selection	Model 2 With Selection
Intercept	.39 (9.0)	.41 (9.1)	.38 (7.0)	.40 (7.7)	2.7 (44.1)	2.8 (32.0)	2.7 (38.0)	2.7 (34.1)
GED	-.038 (1.0)	-.045 (1.1)	-.040 (1.0)	-.067 (1.2)	-.058 (1.0)	-.067 (1.0)	-.06 (0.9)	-.065 (1.0)
HS Graduate	.032 (1.3)	.029 (1.1)	.033 (1.2)	.020 (0.6)	.116 (3.3)	.11 (3.0)	.13 (3.0)	.12 (2.6)
Selection γ_1**	-	.16 (2.3)	-	.12 (2.0)	-	-.18 (0.5)	-	-.04 (0.8)
Selection γ_2**	-	-.41 (4.0)	-	-.56 (3.2)	-	-.91 (4.1)	-	-.91 (3.4)
2 Yrs. College + GED	-.04 (0.3)	-.05 (0.4)	-	-	.004 (0.1)	.025 (0.1)	-	-
2 Yrs. College + HS	.061 (1.4)	.034 (0.8)	-	-	.253 (3.6)	.240 (3.6)	-	-
College Grad	.120 (3.0)	.077 (2.0)	-	-	.203 (3.6)	.200 (3.4)	-	-
Black	-.056 (2.3)	-.06 (2.1)	-.10 (3.1)	-.03 (0.8)	-.13 (3.5)	-.06 (1.4)	-.16 (3.3)	-.07 (1.1)
Hispanic	.017 (0.6)	-.01 (0.3)	-.01 (0.4)	.007 (0.1)	-.01 (0.3)	-.04 (0.2)	-.04 (1.0)	-.05 (0.8)
AFQT Score	.006 (12.4)	.004(4.5)	.006 (7.9)	.005 (7.0)	.003 (4.0)	.003 (3.0)	.003 (2.9)	.003 (2.7)
R^2	.14	.15	.10	.12	.06	.06	.05	.06
F-test:	Probability > F							
GED=0	.33	.23	.27	.22	.31	.23	.40	.30
GED=HS GRAD	.02	.04	.04	.05	.0005	.0005	.0002	.002

*Calculated using modified McKinnon-White standard errors to correct for heteroskedasticity and estimated parameter error (see McKinnon and White, 1986).
**γ_1 corresponds to coefficient on selection correction term controlling for working and not attending college in Appendix equation B-2.
γ_2 corresponds to coefficient on selection correction term controlling for college enrollment in Appendix equation B-2.

TABLE 10B: Selection Corrected Log-Wage and Log-Hour Regressions (year effects not reported)
Including the Score on the AFQT Test at Age 28
T-Statistics* in Parentheses

	LOG-HOURLY WAGES				LOG-ANNUAL HOURS			
	Model 1 No Selection	Model 1 With Selection	Model 2 No Selection	Model 2 With Selection	Model 1 No Selection	Model 1 With Selection	Model 2 No Selection	Model 2 With Selection
Intercept	.56 (8.7)	.31 (2.6)	.57 (6.0)	.54 (6.3)	2.8 (33.1)	3.5 (34.1)	2.9 (29.6)	3.0 (26.0)
GED	-.02 (0.4)	-.026 (0.50)	-.15 (2.1)	-.130 (2.2)	-.19 (2.1)	-.19 (2.1)	-.23 (2.60)	-.21 (2.1)
HS Graduate	.08 (2.0)	.07 (1.7)	.077 (1.6)	.077 (1.6)	.07 (1.2)	.07 (1.3)	.05 (0.9)	.06 (1.0)
Selection γ_1**	-	.29 (4.1)	-	.06 (0.6)	-	-.20 (1.7)	-	-.13 -1.0)
Selection γ_2**	-	-.17 (2.8)	-	-.08 (1.7)	-	-.43 (5.4)	-	-.21 (2.5)
2 Yrs. College + GED	-.11 (0.6)	-.11 (0.7)	-	-	-.22 (1.0)	-.15 (0.7)	-	-
2 Yrs. College + HS	.17 (2.9)	.16 (2.9)	-	-	.13 (1.5)	.10 (1.3)	-	-
College Grad	.18 (3.1)	.14 (2.4)	-	-	.17 (2.2)	.12 (1.5)	-	-
Black	-.04 (1.4)	-.1 (2.1)	-.10 (1.8)	-.08 (1.4)	-.10 (2.0)	.05 (0.5)	-.18 (2.8)	-.12 (2.5)
Hispanic	.04 (1.0)	-.002 (0.1)	.03 (0.5)	.03 (0.5)	-.08 (1.4)	-.04 (0.8)	-.07 (1.0)	-.05 (0.8)
AFQT Score	.005 (5.6)	.005 (6.2)	.005 (4.1)	.004 (3.9)	.001 (1.0)	.002 (1.7)	.002 (1.4)	.002 (1.2)
R^2	.15	.16	.08	.09	.05	.08	.05	.06
F-test:	Probability > F							
GED=0	.75	.57	.04	.04	.04	.03	.01	.04
GED=HS GRAD	.04	.05	.005	.001	.002	.002	.005	.001

*Calculated using modified McKinnon-White standard errors to correct for heteroskedasticity and estimated parameter (see McKinnon and White, 1986).
**γ_1 corresponds to coefficient on selection correction term controlling for working and not attending college in Appendix equation B-2.
γ_2 corresponds to coefficient on selection correction term controlling for college enrollment in Appendix equation B-2.

if the test score merely proxies schooling. However, the bottom two lines of these tables reveal that the central inferences of Tables 9A-9D are not reversed. GED recipients are statistically indistinguishable in terms of their hourly wages and hours of work from high school dropouts and have lower wages and hours of work than traditional high school graduates.

The observed ordering in economic status among dropouts, GED recipients and high school graduates may simply be due to differences in years of schooling completed. Table 11A reveals that on average dropouts have completed one fewer year of schooling than GED recipients. Table 11B establishes that almost 60% of the GED recipients have completed eleven years of schooling compared to only 33% for the dropouts. About 45% of the dropouts have nine or less years of schooling compared to only 10% of the GED recipients.

If the ordering in labor market outcomes among graduates, GED recipients and dropouts is simply due to years of schooling completed, the value of high school exam certification as an end in itself is in doubt. Government sponsored programs with such an emphasis are misguided.

Table 12 sheds valuable new light on this question. That table displays the effect on wages of interacting dropout and GED indicator variables with actual years of schooling completed. The benchmark group is dropouts with nine or fewer years of schooling. Dropouts with an additional year of completed schooling earn 8 to 10% higher wages. The same is true for GED recipients (holding post-secondary schooling constant). Differences between GED recipients and dropouts are almost completely accounted for by years of schooling. At the same completed schooling level a GED earns only 1% more than a high school dropout. GED' with 11 years of completed schooling earn only 3% less than high school graduates. Dropouts with 11 years of schooling earn only 4% less than high school graduates. Using the "P" values shown at the bottom rows of the table, we do not reject the hypothesis that GED recipients and droputs with the same years of schooling earn the same wages. (See the first three rows of the lower table). High school graduates and GED recipients or high school dropouts with 11 years

Table 11A

Mean Years of Secondary School Completed
for GED Recipients and
Drop Outs at Age 25
Random Sample

	N	Mean	Standard Error of Mean
Drop Out	238	9.46	.08
GED	125	10.40	.07

Table 11B

Percent Distribution of Years of School Completed
For GED Recipients and Dropouts at Age 25

	7 or Less	8	9	10	11
Drop Out	8.1	13.2	24.3	21.8	32.6
GED	1.8	3.6	5.2	31.2	58.2

Table 12
Log-Wage Regressions Interacting GED and Dropout with Years of Secondary School Completed
Year Effects Not Reported (t-Statistics in Parentheses)

	Age 25	Age 28
Intercept	.613 (17.6)	.800 (19.4)
Dropout - 10 Years	.100 (2.1)	.046 (0.9)
Dropout - 11 Years	.179 (3.7)	.120 (1.5)
GED - 9 Years or Less	-.156 (1.7)	-.020 (0.6)
GED - 10 Years	.113 (1.6)	-.010 (0.3)
GED - 11 Years	.191 (3.9)	.151 (2.1)
HS Graduate	.225 (7.5)	.211 (4.6)
2 Years of College + GED	.249 (1.3)	.152 (1.0)
2 Years of College + HS	.318 (6.3)	.390 (5.9)
4 Years of College	.421 (11.2)	.422 (7.3)
Black	-.189 (8.9)	-.160 (4.8)
Hispanic	-.040 (1.6)	-.024 (0.6)
R^2	.11	.12
F Test:	Probability > F	
GED 11 = Dropout 11	.58	.49
GED 10 = Dropout 10	.69	.76
GED 9 = Dropout 9	.09	.52
HS Grad = GED 11	.62	.40
HS Grad = GED 10	.05	.04
HS Grad = GED 9	.00	.00
HS Grad = Dropout 11	.24	.13
HS Grad = Dropout 10	.01	.01
HS Grad = Dropout 9	.00	.00
2 Yr College HS = 2 Yr College GED	.20	.13
Joint Test: GED = Dropout	.52	.84
Joint Test: GED = HS Grad (Excludes 2-Year College)	.00	.14
Joint Test: GED = HS Grad (Includes 2-Year College)	.00	.12

Note: Education dummies are defined exclusively. Dropout - 9 Years or less is the left out indicator. The t-statistics used the McKinnon-White procedure for heteroskedasticity.

of schooling are also indistinguishable. (See rows four and seven). High school graduates earn statistically significantly higher wages only compared to GED recipients or dropouts with ten or fewer years of schooling. Note further that high school graduates who completed two year colleges earn 6% more than GED-certified males with two years of college but this difference is not statistically strong (as measured by "P" values). Too few GED-certified persons completed four years of college to make a meaningful comparison at that education level.

Table 13 pushes the analysis of Table 12 a bit further. When the total number of years of schooling completed are added to the models of Tables 6A and B, one cannot reject the Mincer (1974) specification that the coefficients on the dummy variables indicating GED, high school graduation, and various years of college certification are jointly insignificant at conventional significance levels. There are no statistically precise "sheepskin" or "certification" effects in the data controlling for the total number of years of schooling completed. The GED cannot, after all, turn a sow's ear into a silk purse. There is no cheap way to acquire the skills obtained from conventional classroom instruction.

Cameron and Heckman, 1991b, present a parallel analysis for hours of work. Again, years of schooling completed, not certification levels, account for differences in labor supply behavior.

C. Direct and Indirect Effects of Certification

The GED effects just discussed are partial or direct measures that hold constant GED effects on post-secondary schooling and training. The total effect of GED acquisition on wages also includes the effect of certification on the volume of post-secondary schooling and training multiplied by the return to this activity. Tables 7 and 8 discussed in section one reveal that GED recipients are more likely to take post-secondary training and schooling than high school dropouts although they are less likely to attend and complete such programs than high school graduates.

Table 14 presents evidence on the indirect effect of GED certification and high school graduation on wage rates. The wage equations reported in Table 9 are augmented to partition years of college

Table 13

Log-Wage Regressions at Age 25 and 28 Controlling for the Total Number of Years of School and College Combined*
(Year Effects Not Reported)

	Age 25	Age 28
Intercept	.152 (1.6)	.509 (3.4)
GED	-.016 (0.7)	.015 (0.4)
HS Graduate	-.009 (0.3)	.080 (1.4)
2 Years of College + GED	-.094 (0.6)	-.045 (0.2)
2 Years of College + HS	-.024 (0.4)	.200 (2.2)
4 Years of College	-.029 (0.4)	.149 (1.3)
Black	-.188 (8.9)	-.160 (5.0)
Hispanic	-.034 (1.3)	-.015 (0.4)
Years of School	.057 (5.4)	.034 (2.4)
R^2	.11	.12
F-test:	Probability > F	
GED = 0	.46	.72
GED = HS Grad	.52	.21
Joint Test: All Education Dummy Variables = 0	.54	.16
Joint Test: College Education Dummy Variables = 0	.78	.16

Notes: Education Dummies are defined exclusively. We failed to reject the hypothesis at the 10% level that Years of School has statistically different effects for years of college and years of secondary school at ages both 25 and 28.

*The t-statistics reported are calculated using the McKinnon-White procedure to correct for heteroskedasticity.

Table 14
Direct and Indirect Effects
of GED and High School Graduation on
Log Wages (T-statistics in Parentheses)
A. Age 25

	High School Graduate	GED
College (combined)	.0430 (4.8)	.0090 (0.8)
Weeks of Off-the-Job Training	.0080 (0.3)	.0150 (0.9)
Apprenticeship/Company Training	.0130 (5.5)	.020 (2.5)
Military Training	.0040 (1.2)	.028 (1.9)
Total Indirect Effect	.068 (5.4)	.072 (1.6)
Total Direct Effect	.129 (5.3)	-.003 (0.2)
Total Effect	.197 (5.2)	.069 (1.1)

B. Age 28

	High School Graduate	GED
College (combined)	.0890 (5.4)	.0118 (0.5)
Off-the-Job Training	.0028 (0.7)	.0190 (0.8)
Apprenticeship/Company Training	.0154 (3.6)	.0066 (0.3)
Military Training	.0002 (0.3)	.0036 (0.8)
Total Indirect Effect	.107 (4.6)	.041 (0.6)
Total Direct Effect	.142 (3.6)	.024 (0.5)
Total Effect	.249 (4.2)	.065 (0.6)

Note: These numbers are calculated from the log-wage specification presented in column one of Table 9A - controlling for the effects of GED recipiency, high school graduation, two-and four-year college education, year effects, and black and hispanic race variables as well as year dummies - augmented with variables to control for weeks of off-the-job training, weeks of military training, and completion of one year of college. Weeks of off-the-job training includes total weeks of training from a vocational-technical school, nursing school, flight school, business college, barber school, or beauty college. Weeks of military training is total weeks of military training taken while on active military duty, including active duty in the reserves. Weeks of off-the-job training, weeks of military training, and the college education indicators are interacted with dummies for GED recipiency and high school graduation to estimate separate returns for college, off-the-job-training, and military training for both GED recipients and high school graduates. To construct the indirect effect of off-the-job training and military training, the estimated coefficient associated with each variable is multiplied by the sample mean number of weeks of off-the-job weeks and military training. To calculate the college indirect effects, the sample proportions for GED recipients and high school graduates for one-year of college, two-years of college and four-years of college are multiplied by the return to each level of education estimated from the augmented wage equation. The sum is the indirect effect of college education. The estimate of the variance is described in Table 15A.

The total indirect effect is simply the sum of these components. The direct effect is the value of the estimated coefficient associated with the indicator for GED recipiency and high school graduation. The total effect is the sum of the direct and indirect effects.

completed more finely and to include off-the-job training, apprenticeship and company training and military training as additional post-secondary training and schooling choices. In Cameron and Heckman (1991a,b) we document that it is necessary to broaden the range of post-secondary schooling and training options considered - beyond the conventional focus on college education - in order to obtain economically interpretable empirical models.

Table 15 reports the components needed to estimate the indirect effects reported in Table 14. In the column labeled "estimated returns", the estimated effect of an extra unit of post-secondary schooling or training on log wages is reported for GED recipients and high school graduates. The rates of return to post-secondary activity for the two forms of certification are statistically indistinguishable. (See the first test at the base of the table). However, by age 28, the returns to college for high school graduates are higher than they are for GED recipients. With the exception of military training, GED recipients take less post-secondary training or schooling than high school graduates. The product of the rate of return and the volume of training taken is the contribution of the form of the post-secondary activity reported in each row to wages. The sum across rows is the estimated total indirect effect. The estimated direct effect is the coefficient on GED or high school graduation holding constant year effects, post-secondary schooling and dummy variables for race. The omitted educational category is high school dropouts.

The indirect effect of high school graduation ranges between 34% to 42% of the total effect on wages. For GED recipiency, the indirect effect ranges between 100% (at age 25) and 63% (at age 28) of the estimated total effect. Although the estimated parameters for GED recipients are not precisely determined, the evidence assembled in Table 14 indicates the effect of the GED on wages comes primarily through its effect on certification for post-secondary training. The indirect effects for high school graduates and GED recipients are nearly identical at age 25 and statistically indistinguishable at age 28.

The evidence reported in Tables 6, 9 and 15 also weakly indicates that the return to post-

Table 15A
Direct and Indirect Effects of GED Recipiency and
High School Graduation on Log-Wages
Estimated Returns and Sample Means
Age 25

	High School Graduates			GED Recipients		
	Estimated Returns*	Sample Means**	Product†	Estimated Returns*	Sample Means**	Product†
One-Year of College	.047 (1.4)	.10 (.007)	.005 (1.3)	.045 (0.5)	.07 (.019)	.003 (0.5)
Two-Year of College	.086 (1.6)	.11 (.008)	.009 (1.5)	.110 (0.9)	.05 (.016)	.006 (0.9)
Four-Years of College	.190 (6.6)	.15 (.009)	.029 (6.3)	-NA-[N]	0[N]	0
Weeks of Off-the-Job Training	.001 (0.4)	8.0 (0.7)	.008 (0.3)	.002 (1.1)	7.6 (1.6)	.015 (0.9)
Weeks of Apprenticeship or Company Training	.003 (5.9)	4.0 (0.5)	.013 (5.5)	.007 (2.8)	2.9 (1.0)	.020 (2.5)
Weeks of Military Training	.002 (1.3)	2.2 (0.3)	.004 (1.2)	.005 (2.5)	5.5 (1.3)	.028 (1.9)
Total Indirect Effect	-	-	.068 (5.4)	-	-	.072 (1.6)
Total Direct Effect	-	-	.129 (5.3)	-	-	-.003 (0.2)
Total Effect		-	.197 (5.2)	-	-	.069 (1.1)
Joint Test: Estimated returns for High School Graduates = Estimated returns for GED Recipients			Probability > F = .16			
Joint Test: Sample means for High School Graduates = Sample Means for GED Recipients			Probability > F = .00			

Table 15B

Direct and Indirect Effects of GED Recipiency and
High School Graduation on Log-Wages
Estimated Returns and Sample Means
Age 28

	High School Graduates			GED Recipients		
	Estimated Returns*	Sample Means**	Products†	Estimated Returns*	Sample Means**	Products†
One-Year of College	.138 (2.6)	.09 (.010)	.0120 (2.4)	.052 (0.4)	.07 (.031)	.0036 (0.4)
Two-Year of College	.174 (3.7)	.14 (.012)	.0243 (3.5)	.082 (0.5)	.10 (.039)	.0082 (0.5)
Four-Year of College	.251 (6.1)	.21 (.015)	.0527 (6.1)	-[N]	0[N]	0
Weeks of Off-the-Job Training	.0003 (0.2)	9.1 (0.9)	.0028 (0.7)	.0019 (1.0)	10.1 (3.4)	.0190 (0.8)
Weeks of Apprenticeship or Company Training	.0028 (4.1)	5.5 (0.9)	.0154 (3.6)	.0020 (0.4)	3.3 (1.0)	.0066 (0.3)
Weeks of Military Training	.0001 (0.2)	2.3 (0.4)	.0002 (0.3)	.0006 (1.0)	6.1 (2.8)	.0036 (0.8)
Total Indirect Effect	-	-	.107 (4.6)	-	-	.041 (0.6)
Total Direct Effect	-	-	.142 (3.6)	-	-	.024 (0.5)
Total Effect	-	-	.249 (4.2)	-	-	.065 (0.6)
Joint Test: Estimated returns for High School Graduates = Estimated returns for GED Recipients			Probability > F = .72			
Joint Test: Sample Means for High School Graduates = Sample Means for GED Recipients			Probability > F = .00			

Note: Sums and Products may not appear exact due to rounding of the numbers presented above.
*t-statistics are in parentheses and are constructed using McKinnon-White standard errors.
**Standard errors of the mean are in parentheses.
†The variance of the product is calculated using the delta method to get $\text{var}[\hat{\beta}\cdot\hat{\mu}] = \hat{\mu}^2\text{var}(\hat{\beta}) + \hat{\beta}^2\text{var}(\hat{\mu})$, where $\text{var}(\hat{\beta})$ is the variance of the estimated return and $\text{var}(\hat{\mu})$ is the variance of the sample mean. There is no covariance since $\hat{\beta}$ and $\hat{\mu}$ are orthogonal. Note that ignoring the variance of the sample mean gives us the same t-statistic for the products as for the estimated returns. Including this term as we do makes little if any difference in the t-statistic of the product.
[N]There were no GED recipients who had completed college by age 25.

secondary schooling and training differs between high school graduates and GED recipients. These differences are only partly accounted for by the lesser amount of time spent in post-secondary education by GED recipients. One possible source of these differences is the choice of curriculum within each type of post-secondary education but we have no direct evidence on this issue.

E. The Effect of the GED on Unemployment, Labor Force Activity and Job Tenure

Table 16 presents mean proportions of time spent unemployed, mean weeks of job tenure and mean weeks out of the labor force for high school graduates, GED recipients and high school dropouts. At age 28, GED recipients have higher unemployment rates than dropouts or high school graduates, and lower job tenure than the other educational groups. Their labor force activity more closely resembles that of high school dropouts than high school graduates. At age 25, the same patterns are found except that GED recipients have slightly lower unemployment rates than high school dropouts.

Tables 17A and 17B report regressions of unemployment and job tenure on the same baseline variables used in Tables 6 and 9. (Time out of the labor force is not separately analyzed since it can be generated from the time unemployed and hours of work equations.) At age 25 and 28, GED recipients are indistinguishable from dropouts and are sharply and unfavorably distinguished from high school graduates. These results hold up even when years of schooling are entered as separate regressors. (See Cameron and Heckman, 1991b)

F. Some Longitudinal Evidence

Using the longitudinal structure of the NLSY, we compare a variety of characteristics of GED recipients in the year before and after they receive their certificate. Table 18A excludes persons in the military in the year before or after receiving the GED.[4] There is little evidence of any GED-induced change in labor market outcomes in these tables, although the small sample sizes may preclude precise

[4]The exclusion of military personnel is done to avoid making pay comparisons between military and civilian wage scales. The exclusion turns out not to affect our conclusions.

Table 16

Mean Proportion of Time Spent Unemployed Last Year, Weeks of Tenure, and Weeks Out of the Labor Force Last Year (Standard Errors of The Mean in Parentheses) For Persons Not in College

A. Age 25

	HS Graduate	GED	Dropout
Proportion of Time Unemployed Last Year*	.106 (0.01)	.180 (.02)	.207 (.01)
Total Weeks of Tenure**	121.5 (3.1)	76.2 (6.5)	90.5 (2.8)
Weeks Out-Of-Labor Force Last Year**	2.2 (0.2)	3.4 (0.3)	4.7 (0.4)

B. Age 28

	HS Graduate	GED	Dropout
Proportion of Time Unemployed Last Year*	.080 (.01)	.203 (.03)	.170 (.02)
Total Weeks of Tenure**	178.0 (5.5)	96.2 (14.1)	132.2 (9.0)
Weeks Out-Of-Labor Force Last Year**	2.9 (0.3)	6.7 (1.8)	7.0 (0.9)

*For individuals not in college -- weeks unemployed/(52 weeks - time out-of-labor force).

**Tenure is total weeks of tenure on current or last job, using individuals who held a job in the last calendar year and who were not attending college.

Table 17A

Proportion of Time Spent Unemployed*
in the Last Calendar Year, Weeks of Tenure,and Weeks of Experience
Years Effects Not Reported
(Standard Errors in Parentheses)

Age 25

	Proportion of Time Unemployed**	Weeks of Tenure†
Intercept	.157 (9.2)	100.81 (15.3)
GED	-.021 (0.9)	-8.5 (0.9)
HS Graduate	-.077 (5.8)	29.3 (5.7)
2 Yrs College + GED	-.131 (2.1)	38.9 (1.2)
2 Yrs College + HS	-.143 (6.5)	29.9 (2.4)
4 Yrs College	-.133 (6.5)	-13.3 (1.7)
Black	.081 (6.6)	-35.1 (7.4)
Hispanic	.002 (0.2)	-12.8 (2.4)
R^2	.06	.06
F:Test:	Probability > F	
GED = 0	.38	.48
HS GRAD = GED	.01	.00

Note: McKinnon-White standard errors are used to construct the t-statistics.
*Weeks unemployed/(52 Weeks - Weeks Out of Labor Force)
**2.5% of the sample were out of the labor force for 52 weeks and were excluded from this regression as were individuals attending college.
†Tenure is weeks of tenure on current or last job. Individuals who did not hold a job in the last calendar year or who were attending college were excluded.

Table 17B

Proportion of Time Spent Unemployed* in
the Last Calendar Year, Weeks of Tenure, and Weeks of Experience
Years Effects Not Reported
(Standard Errors in Parentheses)

Age 28

	Proportion of Time Unemployed**	Weeks of Tenure†
Intercept	.096 (4.5)	146.1 (10.77)
GED	.061 (1.6)	-42.2 (1.8)
HS Graduate	-.053 (3.0)	55.0 (5.0)
2 Yrs College + GED	-.153 (1.6)	-30.0 (0.6)
2 Yrs College + HS	-.120 (4.1)	15.5 (1.1)
4 Yrs College	-.130 (4.5)	8.6 (0.9)
Black	.102 (6.0)	-32.1 (3.1)
Hispanic	.030 (1.5)	-12.0 (1.0)
R^2	.09	.06
F:Test:	Probability > F	
GED = 0	.10	.06
HS GRAD = GED	.00	.00

Note: McKinnon-White standard errors are used to construct the t-statistics.
*Weeks unemployed/(52 Weeks - Weeks Out of Labor Force)
**2.5% of the sample were out of the labor force for 52 weeks and were excluded from this regression as were individuals attending college.
†Tenure is weeks of tenure on current or last job. Individuals who did not hold a job in the last calendar year or who were attending college were excluded.

Table 18A

Means For Those Working Before and After* Obtaining the GED
(Excluding Those in the Military the Year Before or the Year After Receiving GED)

	Before			After	
Variables		Mean	Standard Error of the Mean	Mean	Standard Error of the Mean
Hourly Wage	107	1.75	0.08	1.80	0.08
Annual Earnings	107	2901.2	208.45	2945.6	212.20
Annual Hours	107	1541.4	76.61	1563.3	73.3
Annual Weeks Worked	107	38.0	1.46	37.7	1.44
Current Tenure (Weeks)	107	59.4	6.05	58.50	6.45
Experience (Weeks)	107	98.9	6.83	126.5	8.48
Ever Been in the Military	107	.05	0.02	-NA-	-NA-
Ever Taken Vocational Training	107	.15	0.04	.20	0.04
Ever Received Company Training or Apprenticeship	107	.03	0.15	.06	0.02
Current Vocational** Training	107	-NA-	-NA-	.07	0.02
Current Company Training† or Apprenticeship	107	-NA-	-NA-	.03	0.02

*Means are calculated at the interview before obtaining the GED and at the interview after obtaining the GED. Those in secondary school or not working for another reason before obtaining the GED and those attending college or not working for another reason after obtaining the GED are excluded.

**This variable is one if the individual had a vocational training program within one year of the time of receiving the GED.

†This variable is coded one if the individual participated in any company training or apprenticeship program within one year of the time of receiving the GED.

Table 18B

Before and After Wage Comparisons
For GED Recipients Who Worked Before and After Receiving Their Degree
(Standard Error of Mean in Parentheses)

	Proportion	Before	2 Years After	Difference*
Same Job Before and 2 Years After	58%	2.03 (.21)	2.11 (.22)	.07 (.14)
Any Job Changes After The GED	52%	1.59 (.07)	1.90 (.11)	.31 (.13)
Total	100%	1.70 (.08)	1.95 (.10)	.25 (.11)

Note: Individuals in the Military either in the year before or after the GED are excluded, as are individuals in school before or in college after.

*The standard error is computed assuming the variance of the difference is given by var(wage before) + var(wage after) - 2 cov(wage before, wage after).

determination of these changes.

In Cameron and Heckman (1991b), we document that GED recipients are more likely to change jobs than are high school dropouts. Since a significant portion of the wage growth of young men comes from job changing, it is interesting to compare the wage growth of GED recipients who change jobs after they receive the GED with the wage growth of GED recipients who stay put. Table 18B reveals that post-GED job changers receive some increase in wages but it is unclear how much of this growth to attribute to job changing and how much to attribute to receipt of the GED.

G. The Effect of Mismeasurement of GED Status On CPS-Based Studies Of The Changing Returns To Schooling

Until recently (1988), the Current Population Survey did not distinguish GED recipients from high school graduates. It is natural to ask "How much of the measured difference in log-wage between four-year college graduates and pooled GED and traditional high school graduates is due to inappropriately assuming that the two categories of high school certification have the same economic reward"? Using the estimates reported in Tables 9A and 9C combined with estimates based on pooling exam-certified high school graduates with traditional high school graduates, we obtain the numbers reported in Table 19. Inappropriate pooling of the two forms of high school certification raises the measured difference high school graduates and four-year college graduates by a modest 7% at age 25, and 6% at age 28. Inappropriate pooling has modest effects on two year - four year college differentials and two year - high school differentials as well.

In Cameron and Heckman (1991a,b) we document that inappropriate pooling of the two forms of certification has only minor effects on CPS based estimates of the effects of school graduation on transitions to post-secondary schooling.

Summary and Conclusion

Over the past twenty five years, there has been dramatic growth in the proportion of high school

Table 19

Effect of Separating GED and Traditional High School Graduation on College - Traditional High School Wage Differential

	Age 25 (Table 9A)		Age 28 (Table 9B)	
	Without Selection Correction	With Selection Correction	Without Selection Correction	With Selection Correction
Pooled	.210	.147	.219	.193
Separated	.195	.136	.207	.183
% Reduction in Differential	7.1%	7.5%	5.6%	5.7%

Two-Year College - Traditional High School Wage Differential

	Age 25 (Table 9A)		Age 28 (Table 9B)	
	Without Selection Correction	With Selection Correction	Without Selection Correction	With Selection Correction
Pooled	.098	.069	.175	.157
Separated	.091	.064	.181	.162
% Reduction in Differential	8.9%	7.5%	-3.4%	-3.2%

Two-Year College - Four Year College Wage Differential

	Age 25 (Table 9A)		Age 28 (Table 9B)	
	Without Selection Correction	With Selection Correction	Without Selection Correction	With Selection Correction
Pooled	.109	.078	.044	.034
Separated	.103	.072	.027	.018
% Reduction in Differential	5.6%	8.5%	37%	9.1%

credentials achieved by means of exam-certification rather than by the traditional route of high school graduation. The growth in exam certification helps to reconcile the recent decline in the proportion of 17 year old high school graduates and the constancy in the proportion of 20-24 year olds with high school certificates. Exam certification is the principal vehicle through which black high school certification rates have approached that of whites. This paper explores the causes and consequences of this phenomenon.

The main conclusion of this paper is that exam-certified high school equivalents are statistically indistinguishable from high school dropouts. Both dropouts and exam-certified equivalents have comparably poor wages, earnings, hours of work, unemployment experiences and job tenure. GED-certified persons are intermediate between traditional graduates and high school dropouts in their measured ability and in their market status. They are much closer to dropouts than graduates. Controlling for ability, GED-certified males have inferior labor market status compared to high school graduates.

Our main conclusion is strengthened when account is taken of years of schooling completed. Whatever difference is found among GED recipients, dropouts and high school graduates is largely accounted for by years of schooling. There is no cheap substitute for classroom instruction. Educational programs that focus on the GED as an end in itself are misguided.

Whatever economic return exists from GED recipiency arises from its value in opening post-secondary schooling and training opportunities. GED recipients take less post-secondary training than high school graduates (military training is an exception to this rule), and receive lower returns - especially for their college education. The available evidence indicates that GED recipients who attend college take a more vocationally oriented curriculum than high school graduates. Both anecdotal and econometric evidence suggests little direct market value for the GED controlling for returns from post-secondary training.

An important qualification to this analysis should be stated. The sampling frame of the NLSY has forced us to confine our attention to the early stages of adulthood. It is possible that GED recipients and

high school dropouts will look more dissimilar at older ages and that GED recipients and high school graduates will look more similar. That issue can only be settled by looking at later waves of the NLSY data not currently available or by using other data sources with older persons.

Since the economic value of GED recipiency is low, its recent dramatic growth as a means of high school certification is apparently paradoxical. Our investigation of the political economy of the GED resolves this paradox. Federal and state Adult Basic Education programs subsidize GED test taking and use GED recipiency as a measure of monitoring bureaucratic performance in these programs. The growth in funding and participation in these programs tracks the time series of GED recipiency closely. These subsidies to test-taking partly resolve the paradox.

In addition, over the past twenty five years, there has been dramatic growth in the federal subsidy to post-secondary schooling and training programs. High school certification is a requirement for participation in these programs. This subsidy has created a derived demand for GED certification.

The evidence assembled here strongly suggests that the dramatic rise in GED certification is a consequence of Federal and state government policies. The direct subsidy to certification and the derived demand for GED certification in order to receive subsidies for post-secondary training reconcile the low gross economic returns to certification and the rapid growth in GED recipiency.

References

American Council on Education, "A Study of the General Education Development Testing Program", Washington, D.C.: American Council on Education, 1956.

Apling, Richard N., and Aleman, Steven R., "Proprietary Schools: A Description of Institutions and Students," CRS Report for Congress No. 90-428 EPW, Washington, 1990.

Bickel, Peter, and Doksum, Kjell. Mathematical Statistics: Basic Ideas and Selected Topics. San Francisco: Holden-Day, 1977.

Blackburn, McKinley; Bloom, David; and Freeman, Richard. "The Declining Economic Position of Less-Skilled American Males." Working Paper No. 3186. Cambridge, Mass.: National Bureau of Economic Research.

Cameron, Stephen, and Heckman, James. "Determinants and Educational Consequences of High School Dropout and GED Certification", unpublished manuscript, University of Chicago, June, 1991a.

_____, "The GED", unpublished manucript, University of Chicago, June 1991b.

DeSantis, Vincent, "The Adult Education Act 1964-1979: A Political History," Upper Montclair, NJ: National Adult Education Clearinghouse, 1979.

Finn, Chester E. "The High School Dropout Puzzle" The Public Interest (Spring 1987): 173-192.

Fraas, Charlotte J. "Proprietary Schools and Student Financial Aid Programs: Background and Policy Issues," CRS Report for Congress No. 90-427 EPW, Washington, 1990.

GED Testing Service. The 1989 Statistical Report. Washington, D.C.: American Council on Education, 1990.

Heckman, James. "Sample Selection Bias as a Specification Error." Econometrica 47 (January 1979): 153-161.

_____, and Walker, James. "The Relationship Between Wages and Income and the Timing and Spacing of Births: Evidence from Swedish Longitudinal Data." Econometrica 58, No. 6 (November 1990): 1411-1441.

Katz, Larry, and Murphy, Kevin M. "Changes in Relative Wages, 1963-1987: Supply and Demand Factors." Unpublished manuscript. Cambridge, Mass.: National Bureau of Economic Research, February 1990.

Katz, Larry and Allen Krueger, "Changes in The Structure of Wages in The Public and Private Sectors", Princeton University, November, 1990.

Kominski, Robert. "Estimating The National High School Dropout Rate." Demography 27, No. 2 (May 1990): 303-311.

Laurence, Janice. "The Diploma As A Military Performance Predictor: It Works, But Why?." Human Resources Research Organization. Paper presented at 91st Annual Convention of American Psychological Association, Anaheim, California, August 1983.

Levitan, Sar A., and Gallo, Frank, A Second Chance, Kalamazoo, Michigan: UpJohn Institute, 1989.

Lindley, David V., "A Statistical Paradox", Biometrika, Vol. 44, 1957, pp. 187-192.

Malizio, Andrew, and Whitney, Douglas. "Examinee and High School Senior Performance on The GED Tests: A Detailed Analysis." GED Testing Service. Research Studies No. 3. Washington, D.C.: American Council on Eduation, June 1982.

_____. "Who Takes The GED Tests? A National Survey of Spring 1980 Examinees." GED Testing Service. Research Studies No. 1. Washington, D.C.: American Council on Education, March 1981.

McKinnon, James, and White, Halbert. "Some Heteroskedasticity - Consistent Covariance Matrix Estimators with Improved Finite Sample Properties." Journal of Econometrics 29 (1985): 305-325.

Mincer, Jacob. Schooling, Experience and Earnings, New York: Columbia University Press For NBER, 1974.

National Center for Education Statistics, The Condition of Education, Washington, D.C.: U.S. Department of Education, 1990.

Pawasarat, John, and Quinn, Lois. "Research on The GED Credential And Its Use in Wisconsin." Employment and Training Institute. Milwaukee, Wis.: University of Wisconsin, August 1986.

Tallis, G. M. "The Moment Generating Function of the Truncated Multi-normal Distribution." Journal of The Royal Statistical Society Series B (1961): 223-229.

U.S. General Accounting Office, Many Proprietary Schools Do Not Comply With The Department of Education's Pell Grant Program Requirements. Washington, 1984.

U.S. Bureau of the Census, Statistical Abstract of the United States: 1984, Washington, D.C., 1983.

Appendix A

Introduction

Appendix A contains several supplemental discussions and the means for the data used in our empirical analysis. It is organized as follows: Section 1 contains a brief description of the NLSY data. Section 2 describes the NLSY data we use for the analysis of self-selection decisions. Section 3 describes the county average earnings variable. Section 4 describes the AFQT score. Section 5 contains a description of the wage and labor market outcome data. Section 6 presents a discussion of GED exam preparation. Section 7 presents estimates of wage equations, taking into account intra-family correlation of the residuals.

1. Background on the NLSY Data

The micro data we use are from the 1979-1987 waves of the National Longitudinal Survey of Youth (NLSY). The NLSY includes a randomly chosen sample of 6,111 U.S. youths and a supplemental sample of 5,296 randomly chosen black, hispanic, and non-black, non-hispanic, economically-disadvantaged youths. The youths were ages 13-20 in 1978 and were interviewed annually beginning in 1979. Our sample consists of males who were in the random sample, the black supplemental sample, and the hispanic supplemental sample. From these samples a total of 3,003 observations are available from the random sample, 1,105 from the supplemental black sample, and 729 from the supplemental hispanic sample. Combining the blacks from the random sample and the blacks from the supplemental sample, we have a total of 1461 randomly-chosen blacks. Similarly, we have 939 randomly-chosen hispanics. Finally, from just the random sample we have a total of 2437 randomly-chosen non-black, non-hispanic youths.

2. Data for the Analysis Self Selection Decisions

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 grade completed of the mother and 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 neither; and regional labor market characteristics at age 14 and in each sample year. Finally, 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. The county and state unemployment rate from the NLSY are merged with supplementary measures of county and state labor market conditions. Finally, as a measure of ability, we use test scores from the Armed Services Vocational Aptitude Battery, administered to all NLSY respondents in 1980. This test is described below.

For about 10% of our sample, Family Income 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 that of his parental family.

Another two 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 a broken home were likely to report a highest grade completed for both parents.

3. Data on Local Labor Market Conditions

We describe the County Average Earnings variable in this section. From the NLSY data we know the state and county for each respondent for each year of the survey starting in 1978, and for the state at age 14. It also has county unemployment rates for each year. However, since we could identify each state and county, we merged into our data a supplementary data set from the Bureau of Economic Analysis[1] containing more detailed measures of labor market conditions by industry for the

[1]We would like to thank Joe Hotz and Seth Sanders for supplying us with the tapes and documentation for these data.

years 1969 to 1986. These data, collected mostly from state unemployment insurance programs, contain measures of total full-time and part-time employment and earnings both in the county and 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.

4. Armed Services Vocational Aptitude Battery

In 1980, the Armed Services Vocational Aptitude Battery (ASVAB) was administered to NLSY respondents, with a completion rate for the total sample of approximately 94%. The NLSY respondents were ages 16 to 23 when the test was taken. Groups of 5 to 10 persons were tested at more than 400 sites throughout the country, and each individual was given a 50 dollar honorarium for completing the test.

The ASVAB consists of a battery of ten 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 word knowledge, arithmetic reasoning, paragraph comprehension, and one-half of numeric operations. The AFQT is 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.

5. Analysis of Wages and Labor Supply

To examine the effects of having a GED or High School diploma on hourly wages and labor supply, we take a subset of our data that were sampled at ages 25 and 28. For 25-year-olds, we include everyone between ages 16 and 20 in January of 1978. Altogether, 3139 individuals from the random hispanic supplement and black supplement are interviewed at age 25. For our study of wages

at age 28, we could include only those ages 19 and 20 and a portion of those who were age 18 in January of 1978, for a total of 1284. Of these, approximately 6.5% were dropped at each age because of missing values in the job tenure variables, or because hourly wages were greater than $50 or less than $.40 (1967 dollars). Our sample has 2926 males age 25, and 1199 males age 28 years old. For those few in the military, the hourly wage was constructed using a measure of military income that includes allowances for housing and food and other special pay. Hourly wage is scaled in 1967 dollars and is the wage received on the current or last job during the time of the interview. If an individual was enrolled in college during the past survey year, he was counted as being enrolled in college and was excluded from our analysis on wages. Those who were counted as unemployed or out-of-the-labor force for a reason other than school attendance were those with no job during the survey year who were not in school. Definitions of all the variables used in this analysis, including those used in the decision rule for the selection correction follow.

Hourly Wage	Hourly wage in 1967 dollars at the current or most recent job.
Annual Earnings	Earnings for last year in 1967 dollars.
Annual Weeks	Total weeks worked last calendar year.
Annual Hours	Total hours worked last calendar year.
Tenure	Tenure in weeks at the current or most recent job.
Experience	Total experience in weeks excluding weeks worked in high school and weeks at the current or most recent job, since the individual was 16 years old.
Unemployment/Out of The Labor Force	Those who have no job during the previous year and are not in college.

6. Where the GED is Obtained

Table A-1 presents evidence on where individuals obtained the GED. Roughly 10-13% of the

sample obtains the GED in the military. (These persons are older than our sample average. Beginning in the early 1980's, the all-voluntary-military required a GED or high school graduation for admission). Roughly 3% of all GEDs were obtained in college programs. Blacks are much more likely and whites are much less likely to receive GED degrees while in government-sponsored-training programs. The black and white roles reverse in attainment of GED degrees while working.

Table A1

Preparation for the GED Exam
Programs Attended in the Last Six Months*

	Combined Sample	Black Sample	Hispanic Sample	White Sample
The Military	11%	9%	10%	13%
A College-Sponsored Program**	3%	3%	2%	3%
A Government-Training Program**	8%	13%	7%	4%
Vocational School**	3%	3%	3%	4%
Secondary School	25%	26%	28%	23%
None of the Above	50%	46%	50%	53%
N	404	121	84	199

*The cells are defined exclusively according to which program was taken most recently, though overlap between cells was minimal. GED must have been received between January 1, 1978 and the interview date in 1987.

**The individual is counted in one of these cells if he had attended the program within four months of receiving the GED.

7. Intra-family Correlations

One feature of the NLSY sampling scheme is that it includes all children living in a randomly-chosen household who were in the relevant age range. Since we can identify household

members in the data, we estimate the intra-class correlation coefficient for houshold members apply a GLS to the log-wage and log-hours regressions reported in the text. The estimates change little from the OLS estimate. For example, in Model 1 at age 25 with only black and hispanic indicator variables and High School graduate and GED indicators, we estimated the intra-family coefficient component to be .095. Twenty-three percent of the sample have a brother who was working at age 25. Applying a standard GLS procedure we obtain the following estimates ("t" statistics are in parentheses):

	OLS	GLS
GED	.0535 (1.395)	.0541 (1.411)
High School Graduate	.1892 (7.825)	.1900 (7.869)

The change is only about 1% for the estimated GED coefficient and associated test statistic. It is even less for High School graduates. For the other specifications reported in Table 15A, the estimated intra-family coefficient was between .085 and .069. Similarly trivial changes in the estimates were found in the other specifications as well.

Appendix B

The wage equation at ages 25 and 28 is

$$\ln W_i = Z_i\phi + \epsilon_i.$$

We seek to estimate the parameter vector ϕ. We use a sample of working persons not in college. Wages of working students - most of whom hold part-time jobs - are excluded. We correct for both sources of exclusion: "not-working" and "in college". We specify linear utility functions. For individual i,

(B-1) $U_{1i} = X_i\beta_1 + V_{1i}$ (working and not enrolled in college at the indicated age in the survey year following ages 25 or 28)

$U_{2i} = X_i\beta_2 + V_{2i}$ (enrolled in college in survey year following ages 25 or 28)

$U_{3i} = V_{3i}$ (not working in survey year following ages 25 or 28) .

We have thus normalized the coefficients of the regressors in U_3 to zero, so that we have for each individual i,

(B-2) $$\Pr_i(\text{work}) = \Pr(U_{1i} - U_{2i} > 0,\ U_{1i} - U_{3i} > 0)$$

$$= \Pr(V_{1i} - V_{2i} > X_i(\beta_2-\beta_1),\ V_{1i} - V_{3i} > -X_i\beta_1).$$

Letting $\eta_{1i} = V_{1i} - V_{2i}$ and $\eta_{2i} = V_{1i} - V_{3i}$,

$$\Pr(\eta_{1i} > X_i(\beta_2-\beta_1),\ \eta_{2i} > -X_i\beta_1).$$

The covariance matrix of (V_{1i}, V_{2i}, V_{3i}) has the following form:

$$V = \begin{bmatrix} \sigma_1^2 & \sigma_{12}^2 & 0 \\ \sigma_{12}^2 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}.$$

We estimate the parameters β_1, β_2, and the covariance matrix of η_{1i} and η_{2i}, using the multinomial probit algorithm of Borsch-Supan and Hajivassiliou (1990). Assuming that ϵ_i can be decomposed into a normal and non-normal additive component ρ_i, with the latter unaffected by selection, we obtain

(B-3) $$\epsilon_i = \gamma_1\eta_{1i} + \gamma_2\eta_{2i} + \rho_i \qquad \rho_i \perp \eta_{ji},\ j = 1,2.$$

For the wage equation, we have

$$\begin{aligned} &E(\ln W_i \mid \text{working and not in college}) \\ &= E(\ln W_i \mid \eta_{1i} > X_i(\beta_2-\beta_1),\ \eta_{2i} > -X_i\beta_1) \\ &= Z_i\phi + \gamma_1 E(\eta_{1i} \mid \eta_{1i} > X_i(\beta_2-\beta_1),\ \eta_{2i} > -X_i\beta) \\ &\quad + \gamma_2 E(\eta_{2i} \mid \eta_{1i} > X_i(\beta_2-\beta_1),\ \eta_{2i} > -X_i\beta_1). \end{aligned} \tag{B-4}$$

Using estimates of β_1, β_2, and the covariance matrix of η_{1i} and η_{2i}, we evaluate the two truncated moments above, using equation (3) on page 225 of Tallis (1961), using Monte Carlo simulation to form the probabilities in that expression. A thousand replications were taken to compute each probability accurately. The parameters ϕ, γ_1, and γ_2 are then estimated from the wage equation.

For the models with no selection, we use the McKinnon-White (1985) standard errors to account for more general forms of heteroskedasticity. For models with selection, we need to correct for the variance of the estimated parameters in the first step. The selection-corrected regression is

$$\ln W_i = Z_i\phi + \gamma_1\lambda_1(\beta_1,\beta_2,V) + \gamma_2\lambda_2(\beta_1,\beta_2,V) + \tau_i,$$

where β_1 and β_2 are defined above and V is the covariance matrix of β_1 and β_2. Rewriting we have

$$\begin{aligned} \ln W_i = {} & Z_i\phi + \gamma_1\lambda_1(\hat{\beta}_1,\hat{\beta}_2,\hat{V}) + \gamma_2\lambda_1(\hat{\beta}_1,\hat{\beta}_2,\hat{V}) \\ & + \gamma_1(\lambda_1(\beta_1,\beta_2,V) - \lambda_1(\hat{\beta}_1,\hat{\beta}_2,\hat{V})) + \gamma_2(\lambda_2(\beta_1,\beta_2,V) - \lambda_2(\hat{\beta}_1,\hat{\beta}_2,\hat{V})) + \tau_i \end{aligned}$$

The third and fourth terms arise from the error due to the variance in estimated parameters from the first step. The covariance matrix we use is formed by taking McKinnon-White standard errors on the diagonal. The off-diagonal elements are the elements from the estimated error in the first-step estimation, from above.

Model 2 is defined inclusively for samples of persons who have not attended college up to ages 25 or 28. They may have taken non-collegiate training courses.

U_1, U_2, U_3 refer, respectively, to:

U_1 = working and never attended college at indicated age for the survey year.

U_2 = ever attended college by indicated age.

U_3 = not working at indicated age for the survey year.

Coefficients and estimation procedures are identical to those defined for Model 1.

The coefficients of the probit models used to generate the sample selection corrections for samples at ages 25 and 28 are given in Tables B-1 and B-2, respectively. A positive coefficient indicates that an increase in the associated variable raises the probability of being in the state relative to a no-work-no-college state. There are few surprises in this table. A minor surprise is that family income at age 17 raises the probability that a person works and does not attend college relative to the no-work-not-attending-college state.

Goodness-of-fit Tests

To assess the fit of the model to the data, we calculate goodness-of-fit tests that compare data simulated from our model to the actual data. From the wage equation and equation (B-2) above, we have

$$\ln W_i = Z\phi + \gamma_1\eta_{1i} + \gamma_2\eta_{2i} + \rho_i .$$

We assume $\{\eta_{1i}, \eta_{2i}\}$ and ρ_i are normally distributed. The validity of our estimation results do not require that ρ_i is normal; however, we make this assumption to perform the goodness-of-fit tests

TABLE B-1

Multivariate Probit Estimates

	Model 1		Model 2	
Variable	Working and Not Attending College at Age 25 β_1	Enrolled in College at Age 25 β_2	Working and Not Attending College at Age 25 β_1	Enrolled in College by Age 25 β_2
Intercept	2.8 (7.9)	0.21 (0.45)	2.9 (6.9)	0.81 (1.6)
Number of Siblings	-.01 (0.60)	-.041 (2.20)	-.002 (0.14)	-.05 (2.40)
Family Income at Age 17	.014 (2.71)	.020 (3.08)	0.020 (3.60)	0.033 (5.01)
Highest Grade Completed of Father	-.01 (0.61)	.041 (2.22)	-.01 (0.60)	0.071 (3.4)
Highest Grade Completed of Mother	.03 (1.57)	.10 (4.11)	.025 (1.2)	.10 (4.25)
Broken Home	-.29 (2.85)	-.28 (2.30)	-.25 (2.40)	-.28 (2.26)
Farm Residence Age 14	.46 (1.73)	.37 (1.23)	.41 (1.50)	.52 (1.75)
South, Age 14	.12 (1.21)	.04 (0.34)	.131 (1.20)	.07 (0.54)
Black	-.43 (3.70)	-.40 (2.84)	-.41 (3.24)	-.33 (2.28)
Hispanic	.14 (0.85)	.42 (2.34)	.10 (0.62)	.53 (2.89)
Current County Unemp. Rate	-.08 (5.86)	-.04 (3.14)	-.09 (6.04)	-.05 (3.30)
County Average Earnings, Unskilled	-.04 (1.01)	-.143 (2.76)	-.09 (1.91)	-.161 (3.01)
Covariance Structure*	$Var(V_1) = .0561$ $Var(V_2) = 1.0$ $Cov(V_1, V_2) = .052$		$Var(V_1) = .139$ $Var(V_2) = 1.0$ $Cov(V_1, V_2) = .144$	

*We adopt the conventional normalization $Var(V_3) = 1$, $COV(V_1, V_3) = 0 = COV(V_2, V_3)$.
Measured in the year when the decision to obtain the GED or high school was made.

Table B-2

Decision Rules At Age 28 For Selection Correction of Wage Estimates

	Model 1		Model 2	
Variable	Working and Not Attending College at Age 25 β_1	Enrolled in College at Age 25 β_2	Working and Not Attending College at Age 28 β_1	Enrolled in College by Age 28 β_2
Intercept	2.14 (3.75)	-.35 (0.52)	2.29 (3.73)	.96 (1.40)
Number of Siblings	-.01 (0.41)	-.04 (1.15)	-.022 (0.80)	-.073 (2.31)
Family Income at Age 17	.020 (2.22)	.026 (2.42)	.021 (1.91)	.027 (2.52)
Highest Grade Completed of Father	.001 (0.05)	0.60 (2.05)	-.001 (0.03)	.052 (1.92)
Highest Grade Completed of Mother	.050 (1.42)	.090 (2.42)	.044 (1.82)	.140 (3.75)
Broken Home	-.064 (0.40)	-.002 (0.02)	.020 (0.11)	.106 (0.50)
Farm Residence Age 14	-.202 (0.70)	-.963 (1.95)	-.034 (0.10)	-.16 (0.40)
South, Age 14	.301 (1.83)	.181 (0.90)	.365 (2.00)	.211 (1.00)
Black	-.460 (2.50)	-.50 (2.10)	-.565 (2.62)	-.575 (2.40)
Hispanic	.223 (0.92)	.452 (1.60)	.233 (0.84)	.642 (2.13)
Current County Unemploy. Rate	-.070 (3.02)	-.031 (2.02)	-.071 (2.60)	-.030 (2.08)
County Average[=] Earnings, Unskilled	-.080 (1.52)	-.161 (2.16)	-.091 (1.30)	-.191 (2.10)
Covariance Structure[*]	$Var(V_1) = .011$ $Var(V_2) = 1.0$ $Cov(V_1, V_2) = .011$		$Var(V_1) = .004$ $Var(V_2) = 1.0$ $Cov(V_1, V_2) = .003$	

[*]We adopt the conventional normalization $Var(V_3) = 1$, $Cov(V_1, V_3) = 0 = Cov(V_2, V_3)$.
[=]Measured in the year when the decision to obtain the GED or high school was made.

and gauge the performance of the model.[1] The parameters ϕ, γ_1, and γ_2 are estimated from the wage regression, and the normalized covariance matrix, V, of $\{\eta_{1i}, \eta_{2i}\}$ is estimated from the multinomial probit. The βs in equation (B-1) are also estimated by multinomial probit.

We generate the simulated data in the following way. First, for those working, i.e., in state 1 in (B-1), we calculate $X_i(\beta_2 - \beta_1)$ and $-X_i\beta_1$. We then draw a bivariate normal with mean zero and covariance V; if $\eta_1 > X_i(\beta_2 - \beta_1)$ and $\eta_2 > -X_i\beta_1$, then we form $\epsilon = \gamma_1\eta_{1i} + \gamma_2\eta_{2i} + \rho_i$, where ρ_i is distributed normally with mean zero. The variance of ρ is calculated in the following way: estimate the variance of ϵ, Var (ϵ), from the residuals of the selection-corrected wage regression. However, $\text{Var}(\epsilon) = \gamma_1^2\,\text{Var}(\eta_1) + \gamma_2^2\,\text{Var}(\eta_2) + \gamma_1\gamma_2\,\text{Cov}(\eta_1,\eta_2) + \text{Var}(\rho)$. We know γ_1, γ_2, and the elements of the covariance matrix V; so we have identified Var(ρ). Using the estimates of ϕ from the wage equation, we thus calculate

$$W = Z\phi + \gamma_1\eta_{1i} + \gamma_2\eta_{2i} + \rho_i.$$

Following this procedure for each individual 1000 times, we then calculate the predicted distribution using the simulated data. We then compare the predicted distribution against the empirical distribution and calculate a Kolmogrov-Smirnov statistic, which tells us the maximum vertical distance between the empirical and predicted distributions. We also form a chi-square test.[2] The chi-square test is constructed as follows. Let $P_p(t)$ and $P_E(t)$ denote the predicted and empirical distributions. At the decile-values of the predicted distribution, we evaluate

$$\text{where} \quad I_p(t_i) = P_p(t_i) - P_p(t_i\text{-}1)$$

$$\text{and} \quad I_E(t_i) = P_E(t_i) - P_E(t_i\text{-}1)$$

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[1]Allowing ρ_i to be non-normal in a general way enables the unconditional (on the regressors) distribution to be perfectly fit, although obviously not all conditional distributions can be fit (provided that the distribution of ρ_i is not permitted to depend on regressors in an arbitrary fashion).

[2]These tests should be corrected for parameter estimation. However, as discussed in Heckman and Walker (1990), these corrections have been shown to be of secondary importance in numerous applications and so we do not perform them here.

$$\frac{N(I_p(t_i) - I_E(t_i))^2}{I_p(t_i)}, \qquad i=1,\ldots,5$$

where $P_p(t_i\text{-}1) = P_E(t_i\text{-}1) = 0$.

Summing over i, we obtain a chi-square statistic with four degrees of freedom.