CHAPTER 4

Do Historically Black Institutions of Higher Education Confer Unique Advantages on Black Students? An Initial Analysis

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Throughout most of the late nineteenth and early twentieth centuries, the majority of black American citizens lived and were educated in the south. They were formally excluded from southern segregated white institutions of higher education and found higher educational opportunities only in Historically Black Institutions (HBIs).[1] Some HBIs (for example, Morehouse, Spelman, and Fisk) were private institutions that were initially established by church-related organizations. Others (for example, Florida A&M, Grambling, and Morgan State) were public institutions established in the southern states after the Civil War to provide separate education for black youths. In the absence of allowing blacks to attend the same institutions as whites, the establishment of the public HBIs was necessary if the southern states were to meet the requirements of the second (1890) Morrill Act. As part of providing funding for land grant institutions, the act required that the states provide educational opportunities for all of their citizens.

As the black population began to move to the north in response to urban industrial employment opportunities, the relative importance of the HBIs for the education of black college age students began to decline. The famous 1954 *Brown v. Board of Education* Supreme Court decision,

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which outlawed separate but equal public schools, actually had very little impact on many of the southern states, and formally segregated higher educational systems remained. When integrated at all, the white institutions often did so only as a result of legal suits pursued by the NAACP.[2] It was not until the passage of the 1964 Civil Rights Act, Title VI of which prohibited the allocation of federal funds to segregated public educational institutions, that any real progress at integration was made. However, this progress was very slow, and in the 1973 Supreme Court decision *Adams v. Richardson*, the southern states were formally and finally ordered to dismantle their dual higher educational systems.

As recently as 1964, over half of all bachelor's degrees granted to black Americans were granted by HBIs. By 1973, with the continued black migration to the north and the beginnings of integrated higher education in the south, the HBI share had fallen to about one-quarter to one-third, a range in which it remains today. The 105 institutions officially classified as HBIs that exist today are listed in Table 4.1. Over 90 percent of the institutions are four-year institutions, and over 95 percent of the students enrolled in HBIs attend four-year institutions. While more HBIs are private than public, the former are often quite small, and about three-quarters of the students at HBIs are enrolled in public institutions. Approximately 20 percent of all black college students are now enrolled in HBIs.

Despite the declining relative importance of HBIs in the production of black bachelor's degrees, in recent years they have become the subject of intense public policy debate for two reasons. First, court cases have been filed in a number of southern states that assert that black students continue to be underrepresented at traditionally white public institutions, that discriminatory admissions criteria are used by these institutions to exclude black students (e.g., basing admissions only on test scores and not also on grades), and that per student funding levels, program availability, and library facilities are substantially poorer at public HBIs than at other public institutions in these states (Johnson 1991). In one 1992 case, *United States v. Fordice*, the Supreme Court ruled that Mississippi had not done enough to eliminate racial segregation in its state-run higher educational institutions (Chira 1992). Rather than mandating a remedy, however, the Court sent the case back to the lower courts for action.

What should the appropriate action be? Should it be to integrate more fully both the historically white and the historically black institutions by breaking down discriminatory admissions practices at the former and establishing some unique programs at the latter? Should the HBIs be

Table 4.1. Historically Black Colleges and Universities, by Location and Year Founded

Alabama
Alabama A&M Univ. (Huntsville), 1875—U
Alabama State Univ. (Montgomery), 1874—U
Carver State Tech. College (Mobile), 1962—U2S
Concordia College (Selma), 1922—R2S
Fredd State Tech. College (Tuscaloosa), 1965—U2S
J. F. Drake State Tech. College (Huntsville), 1961—U2S
S. D. Bishop State Junior College (Mobile), 1927—U2
Lawson State College (Birmingham), 1965—U2
Miles College (Birmingham), 1905—RS
Oakwood College (Huntsville), 1896—R
Selma Univ. (Selma), 1876—RS
Stillman College (Tuscaloosa), 1876—RS
Talladega Univ. (Talladega), 1867—RS
Trenholm State Tech. College (Montgomery), 1966—U2S
Tuskegee Univ. (Tuskegee), 1881—R

Arkansas
Arkansas Baptist College (Little Rock), 1901—RS
Philander Smith College (Little Rock), 1877—RS
Shorter College (Little Rock), 1886—R2S
Univ. of Arkansas (Pine Bluff), 1873—U

Delaware
Delaware State College (Dover), 1891—U

District of Columbia
Howard Univ., 1867—R
Univ. of the District of Columbia, 1851—U

Florida
Bethune-Cookman College (Daytona Beach), 1904—R
Edward Waters College (Jacksonville), 1866—RS
Florida A&M Univ. (Tallahassee), 1877—U
Florida Memorial College (Miami), 1879—R

Georgia
Albany State College (Albany), 1903—U
Clark Atlanta Univ. (Atlanta), 1865—R
Fort Valley State College (Fort Valley), 1895—U
Interdenominational Theol. Center (Atlanta), 1958—R
Morehouse College (Atlanta), 1867—R
Morehouse School of Medicine (Atlanta), 1978—R
Morris Brown College (Atlanta), 1881—R
Paine College (Augusta), 1882—RS
Savannah State College (Savannah), 1890—U
Spelman College (Atlanta), 1881—R

Kentucky
Kentucky State Univ. (Frankfurt), 1886—U

Louisiana
Dillard Univ. (New Orleans), 1869—R
Grambling State Univ. (Grambling), 1901—U
Southern Univ. A&M College (Baton Rouge), 1880—U
Southern Univ. of New Orleans (New Orleans), 1959—U
Southern Univ. (Shreveport), 1964—U2
Xavier Univ. of Louisiana (New Orleans), 1915—R

Maryland
Bowie State College (Bowie), 1865—U
Coppin State College (Baltimore), 1900—U
Morgan State Univ. (Baltimore), 1867—U
Univ. of Maryland-Eastern Shore (Princess Anne), 1886—U

Michigan
Lewis College of Business (Detroit), 1874—R2S

Table 4.1. (continued)

Mississippi
Alcorn State Univ. (Lorman), 1871—U
Coahoma Junior College (Clarksdale), 1949—U2
Jackson State Univ. (Jackson), 1877—U
Mary Holmes College (West Point), 1892—R2S
Mississippi Valley State Univ. (Itta Bena), 1946—U
Rust College (Holly Springs), 1866—R
Tougaloo College (Tougaloo), 1869—RS
Hinds Community College, Utica Campus, (Raymond), 1954—U2S

Missouri
Lincoln Univ. (Jefferson City), 1866—U
Harris-Stowe State College (St. Louis), 1857—U

North Carolina
Barber-Scotia College (Concord), 1867—RS
Bennett College (Greensboro), 1873—RS
Elizabeth City State Univ. (Elizabeth City), 1891—U
Fayetteville State Univ. (Fayetteville), 1877—U
Johnson C. Smith Univ. (Charlotte), 1867—R
Livingstone College (Salisbury), 1879—RS
North Carolina A&T State Univ. (Greensboro), 1891—U
North Carolina Central Univ. (Durham), 1910—U
Saint Augustine's College (Raleigh), 1867—R
Shaw Univ. (Raleigh), 1865—R
Winston-Salem State Univ. (Winston-Salem), 1892—U

Ohio
Central State. Univ. (Wilberforce), 1887—U
Wilberforce Univ. (Wilberforce), 1856—RS

Oklahoma
Langston University (Langston), 1897—U

Pennsylvania
Cheyney State Univ. (Cheyney), 1838—U
Lincoln University (Lincoln), 1854—U

South Carolina
Allen Univ. (Columbia), 1870—RS
Benedict College (Columbia), 1870—R
Claflin College (Orangeburg), 1869—RS
Clinton Junior College (Rock Hill), 1894—R2S
Denmark Tech. College (Denmark), 1948—U2S
Morris College (Sumter), 1908—RS
South Carolina State Univ. (Orangeburg), 1896—U
Voorhees College (Denmark), 1897—RS

Tennessee
Fisk Univ. (Nashville), 1867—RS
Knoxville College (Knoxville), 1875—R
Lane College (Jackson), 1882—RS
LeMoyne-Owen College (Memphis), 1862—R
Meharry Medical College (Nashville), 1876—R
Morristown College (Morristown), 1881—R2
Tennessee State Univ. (Nashville), 1912—U

Texas
Huston-Tillotson College (Dallas), 1876—RS
Jarvis Christian (Hawkins), 1912—R
Paul Quinn College (Dallas), 1872—RS
Prairie View A&M Univ. (Prairie View), 1876—U
Saint Philip's College (San Antonio), 1927—R2
Southwestern Christian College (Terrell), 1949—US
Texas College (Tyler), 1894—RS
Texas Southern Univ. (Houston), 1947—U
Wiley College (Marshall), 1873—RS

U.S. Virgin Islands
College of the Virgin Islands (St. Thomas), 1962—U

Table 4.1. (continued)

Virginia	West Virginia
Hampton Univ. (Hampton), 1868—R	Bluefield State College (Bluefield), 1895—U
Norfolk State Univ. (Norfolk), 1935—U	West Virginia State College (Institute), 1891—U
Saint Paul's College (Lawrenceville), 1888—RS	
Virginia State Univ. (Petersburg), 1882—U	
Virginia Union Univ. (Richmond), 1865—R	

Source: 43 Code of Federal Regulations 608.2 (revised as of July 1, 1991), "What Institutions Are Eligible to Receive a Grant under the HBCU Program?" and Charleen M. Hoffman et al.
Note: U = public; R = private; 2 = two-year; 5 = 1990 fall enrollment < 1,000.

eliminated and their campuses either folded into the historically white institutions or abandoned? Or should effort be directed at equalizing per student expenditure levels and facilities between campuses, rather than at worrying about the racial distribution of students at each campus, even if such policies might result in "voluntary separate but equal" institutions?

From an economic efficiency perspective, the appropriate policy responses depend at least partially upon the answers to a number of questions: Do HBIs, per se, provide unique advantages to black students that they could not obtain at other institutions? If they do, is this because of the racial composition of their faculty or the racial composition of their students? If they do, would enrolling more black college students in higher expenditure per pupil integrated institutions actually leave these students in a worse position?

There is a long literature that stresses the importance of HBIs to black students, especially those from poorer socioeconomic and academic backgrounds. A summary of the literature is found in Pascarella and Terenzini (1991).[3] This literature suggests that students at HBIs are likely to have better self-images, be psychologically and socially better adjusted, and to have higher grades than their counterparts at other institutions. Although many studies have asserted that HBIs graduate a larger proportion of the black students that enroll in them than do other institutions, a much smaller number of studies have addressed (with mixed findings) whether HBIs continue to appear to enhance black students' degree probabilities once one controls for differences in the characteristics of the students that attend HBIs and other institutions. Only a handful have addressed whether attendance at an HBI, per se, enhances black students' subsequent labor market and educational success; these studies typically find that it does not. None of these studies takes account of the process by which black students decide to enroll (or are prevented from enrolling) in different types of institutions.

To shed some light on these issues, the next section presents econometric analyses of whether black college students who attended HBIs in the early 1970s had higher graduation rates, higher early career labor market success, and higher probabilities of attending graduate school than did their counterparts who attended other institutions. These analyses use data from the National Longitudinal Study of the High School Class of 1972 (NLS72). The econometric methods we employ control for characteristics of the students, characteristics of the institutions, and the above mentioned matching process between students and institutions.[4]

The second subject of policy debate relates to the production and employment of black doctorates (Ehrenberg 1992). Despite vigorous (or nonvigorous?) affirmative action efforts, the proportion of black faculty at major American universities is typically quite low. In part, this reflects the small number of black doctorates that are produced annually, and many people stress the need to increase the production of black doctorates to overcome this problem. Projections of forthcoming overall shortages of doctorates also reemphasize the need to increase black doctorate production to help avert these shortages, independent of concerns about the need for black faculty to serve as role models for black students.

What is the best way to increase the flow of black students into doctoral programs? Do HBIs currently serve disproportionately as the source of the black undergraduate students who go on for doctoral degrees? Should new doctoral programs be set up, or existing programs strengthened, at HBIs to enhance the flow of black doctorates? Or should attempts be made to recruit more black students from HBIs or from other institutions into existing doctoral programs at leading Research I institutions? In part, the appropriate policy responses depend on the answer to another question: Do those black undergraduate students from HBIs who go on to doctoral study and those who get doctoral degrees at HBIs fare as well in the academic labor market as do their counterparts from other institutions?

The third section provides partial answers to some of these questions by using special tabulations prepared for us from the National Research Council's Survey of Earned Doctorates. A brief concluding section summarizes the implications of our findings and suggests directions for future research.

DID HISTORICALLY BLACK INSTITUTIONS OF HIGHER EDUCATION CONFER UNIQUE ADVANTAGES ON BLACK STUDENTS IN THE 1970S?

This section presents a detailed description of our analyses of data on black college students from the NLS72. We focus on students who first enrolled in a four-year HBI or other four-year college within three years after their June 1972 graduation from high school.[5] Our interest is in learning whether attendance at an HBI per se increased the probability that these students received a bachelor's degree by 1979, improved their early (1979) labor market outcomes (as measured by earnings and an index of occupational prestige), and increased the probability that they subsequently enrolled in an advanced degree program.

These questions are all addressed in the context of models that permit the students' choice of college type (HBI or non-HBI) to be treated as endogenous. In places, the models also control for the process that determined whether an individual was employed in 1979. The sensitivity of our findings to the statistical models used are stressed throughout.

DESCRIPTIVE STATISTICS

Descriptive statistics for the 638 black students in our sample are found in Table 4.2. Forty-seven percent or 298, of these students attended HBIs at some time during the 1972–1979 period, while the remaining 340 students always attended other institutions.[6]

Mean SAT test scores (SAT) were substantially lower, and high school ranks (HSRANK) were somewhat poorer, for the students at HBIs. These students also tended to come from families with lower incomes (PARINC), and their parents were slightly less likely to have earned bachelor's degrees (DADBA, MOMBA). Not surprisingly, they were much more likely to have gone to high school in a state in the southeastern region of the country (SOUTH), where the majority of HBIs are located. Indeed, the proportion of full-time equivalent undergraduates enrolled in HBIs (SLOTS) in the states in which students went to high school was typically twice as large for students who subsequently enrolled in HBIs than it was for students who did not subsequently enroll in HBIs.

Characteristics of the high schools that the students attended also differed between the two groups. Students enrolled in HBIs were more likely to have attended a public high school (PUBHS), to have greater proportions of black high school classmates (BSTUDH) and black high

Table 4.2. Descriptive Statistics: NLS72 Sample

	HBI Sample			Non-HBI Sample		
Variable	*N*	*Mean*	*S.D.*	*N*	*Mean*	*S.D.*
SAT	189	69.157	13.264	237	76.024	16.186
HSRANK	239	.402	.262	297	.372	.262
MALE	298	.399	.491	340	.368	.483
PAR INC	233	70.990	51.048	273	80.745	54.023
DADBA	294	.092	.289	335	.099	.298
MOMBA	295	.108	.312	338	.112	.316
DADSEI	243	30.432	18.359	289	29.904	18.273
BFACH	279	.400	.253	308	.235	.213
PUBHS	298	.919	.273	340	.882	.323
BSTUDH	279	.621	.318	308	.478	.325
COLL24	279	.445	.215	308	.448	.211
URBHS	279	.237	.426	308	.289	.454
SLOTS	298	.127	.077	340	.060	.078
SOUTH	298	.718	.451	340	.323	.469
CSAT	298	69.986	7.791	340	102.128	11.052
BFACC	255	.617	.131	317	.037	.043
BSTUDC	298	.925	.106	340	.100	.110
EXPST	298	27.362	12.005	340	31.295	21.209
PRIV	298	.332	.472	340	.274	.446
WAGE79	253	5.807	3.047	288	6.298	4.076
SEI79	253	43.415	17.067	288	45.829	17.641
BA79	298	.554	.498	340	.515	.501

Sources: Higher Education General Information Survey (HEGIS) (1972): EXPST, PRIV. SLOTS; HEGIS (1976): BSTUDC; Equal Employment Opportunity Commission (1989): BFACC; American Council on Education (1972): CSAT; NLS72: all other variables.

Where:

SAT	individual's total SAT score (divided by 10) (ACT scores converted to SAT scores using Astin's [1971] conversion method)
HSRANK	individual's high school rank (1 = lowest, 0 = highest)
MALE	1 = male, 0 = female
PARINC	parents' pretax income in 1972 (divided by 100)
DADBA	1 = father has a bachelor's degree, 0 = father does not have a bachelors' degree
MOMBA	1 = mother has a bachelor's degree, 0 = mother does not have a bachelor's degree
DADSEI	father's index of occupational prestige (10 = low, 90 = high)
PUBHS	1 = individual attended a public high school, 0 = other
BSTUDH	proportion of black students in the individual's high school
BFACH	proportion of black teachers in the individual's high school
COLL24	proportion of 1971 graduates at the individual's high school who went to two- or four-year colleges
URBHS	1 = urban high school, 0 = other
SLOTS	proportion of full-time equivalent undergraduate enrollment in HBIs in the individual's high school state
SOUTH	1 = went to high school in the southeast region, 0 = other
CSAT	average total SAT score of incoming freshmen at the individual's college (divided by 10)
BFACC	proportion of black faculty at the individual's college in 1989

Table 4.2. (continued)

BSTUDC	proportion of full-time equivalent black undergraduate students at the individuals's college
EXPST	educational and general expenditures per full-time equivalent student at the individual's college (divided by 100)
PRIV	1 = individual attended a private college, 0 = public college
WAGE79	individual's hourly earnings in 1979
SEI79	individual's index of occupational prestige in 1979
BA79	1 = individual received a bachelor's degree by 1979, 0 = did not receive a bachelor's degree by 1979

school teachers (BFACH), but were less likely to have gone to high school in an urban area (URBHS).

The characteristics of the colleges the students attended also differed. Mean SAT scores at the college or university in which the students enrolled (CSAT) were over 300 points lower in the HBI sample, while expenditures per full-time equivalent student (EXPST) averaged about 10 percent lower. The proportions of black students (BSTUDC) and black faculty (BFACC) at the students' institutions were both much higher in the HBI sample, and students at HBIs were more likely to be attending a private institution (PRIV).[7]

Turning to some of the outcomes that will be of interest to us, the proportion of students that had received a bachelor's degree by the 1979 survey data (BA79) was .04 higher in the HBI sample. In contrast, average hourly earnings for the roughly 85 percent of both samples that were employed in 1979 (WAGE79) was almost 10 percent lower in the HBI sample. An index of employed individuals' occupational prestige (SEI79) was also slightly lower for the HBI sample than for the non-HBI sample.[8]

One goal of our study was to estimate the effects of characteristics of colleges, other than whether they were HBIs, on students' educational and labor market outcomes. Of interest were questions such as: were outcomes higher at institutions that had greater expenditures per student and/or greater student test score selectivity? Were the advantages, if any, that can be attributed to HBIs due to the racial composition of the faculty or the racial composition of the students? Given that they historically have had different missions, did private HBIs benefit black students more or less than public HBIs did?

Our ability to answer such questions is limited by the high correlations that existed among these college characteristics; these correlations are tabulated in Table 4.3. It is clear that in the pooled sample we could not hope to disentangle the effects of HBIs from the effects of other variables. Similarly, in the non-HBI sample, the high correlations between CSAT

Table 4.3 College Characteristics Correlation Matrices

	CSAT	*EXPST*	*BSTUDC*	*BFACC*	*PRIV*
All (*N* = 638)					
HBI	.86	−.11	.97	.95	.06
CSAT		.40	−.86	−.83	.05
EXPST			−.16	−.11	.32
BSTUDC				.96	.08
BFACC					.06
HBI = 0 (*N* = 340)					
CSAT		.70	−.17	−.13	.34
EXPST			−.29	−.17	.30
BSTUDC				.56	−.00
BFACC					−.06
HBI = 1 (*N* = 298)					
CSAT		.33	−.29	−.18	−.00
EXPST			−.25	−.04	.43
BSTUDC				.44	.14
BFACC					−.01

Note: All variables are defined in Table 4.2.

and EXPST and between BSTUDC and BFACC made it unlikely that we could estimate the effects of the variables. Correlations are substantially lower in the HBI sample; and hence, throughout the paper, we attempt to estimate the effects of the various institutional characteristics on the different outcomes attained by students enrolled in HBIs.

THE DECISION TO ATTEND AN HBI

Prior attempts to estimate whether attendance at HBIs improves black students' graduation probabilities or labor market outcomes have, for the most part, treated whether a black student attended an HBI as exogenous (Thomas and Gordon 1985; Cross and Astin 1981; Pascarella et al. 1987; Pascarella, Smart, and Stoecker 1989). If students are not randomly assigned to HBIs, such a procedure may lead to biased coefficient estimates. As a first step, this section analyzes students' decisions to attend HBIs.

Given that a black student enrolled in a four-year institution, what determines whether it was an HBI? The answer is a complex one because it depends not only on the student's preferences and resources, but also on the policies pursued by institutions. For example, a number of southern states use scores on standardized tests as the sole criterion to gain admission to their historically white public institutions of higher education, in spite of the facts that black students often do poorly on these tests and that even the generators of the tests recommend that scores *not* be used as the only criterion for admissions decisions.

In the absence of being able to estimate a structural model in which we can identify both the admissions decision rules of all institutions and the preferences of each student, we adopt a simpler reduced form approach. A student's choice of institutional type, which resulted from his or her preferences and the constraints imposed by various institutions' decision rules, is assumed to have depended on the student's high school rank and SAT scores, characteristics of the student's family and of the high school that he or she attended, and the characteristics of the HBIs and the other higher educational institutions in the state in which the student attended high school.

Why consider the characteristics of only institutions in a single state? It is well known that, nationwide, the vast majority of students attend college in the same state in which they went to high school. As Table 4.4 indicates, this was true in the 1970s for students who attended HBIs as well. In 1976, 58 percent of the students enrolled in private HBIs, and 84 percent of the students enrolled in public HBIs, were in-state students.[9] Since roughly three-quarters of all students in HBIs attended public institutions, the overall in-state percentage was around 78.

Table 4.4 also contains a set of regression equations that seeks to explain the variation across HBIs in the proportion of freshmen that were in-state students. One key finding is that (holding the tuition level for out-of-state students constant) the lower was the tuition level for in-state students, the higher was the proportion of in-state students. In addition (other variables held constant, including tuition), private HBIs tended to attract a greater proportion of in-state students, and more selective HBIs tended to attract a smaller proportion of in-state students. These findings suggest several state-level institutional variables that should have influenced whether in-state students enrolled in an HBI in the state and, as described below, we include several in the model.

Table 4.5 presents probit estimates of our model of the determinants of whether an individual in our sample attended an HBI.[10] The only state-level variable included in the analyses reported in column 1 is SLOTS, the proportion of full-time equivalent undergraduate students in the student's high school state that were enrolled in HBIs.[11] The specification reported in column 2 adds three additional measures. RELTUI is the average (weighted by full-time equivalent [FTE] enrollments) tuition in HBIs in the state relative to the weighted average tuition for other institutions in the state. RELFAC is the weighted average proportion of

Table 4.4. Determinants of the Proportion of Freshmen at HBIs That Are In-State Students (Absolute Value of t Statistic)

	(1)		(2)		(3)		(4)	
	Fall '76	*Fall '88*	*Fall '76*	*Fall '88*	*Fall '76*	*Fall '88*	*Fall '76*	*Fall '88*
INT	.963 (16.3)	.803 (9.5)	.740 (3.7)	.447 (2.3)	.939 (13.5)	.760 (6.3)	.839 (3.7)	.591 (2.4)
PRIV	.095 (1.0)	.219 (1.9)	.064 (0.7)	.222 (2.0)	.169 (1.5)	.240 (1.7)	.153 (1.4)	.247 (1.7)
TUIN[a]	−.361 (3.5)	−.238 (3.3)	−.314 (2.8)	−.236 (3.3)	−.481 (4.0)	−.255 (2.8)	−.461 (3.6)	−.256 (2.8)
TUOUT[a]	.031 (0.4)	.069 (1.1)	.031 (0.4)	.075 (1.2)	.096 (1.2)	.113 (1.4)	.085 (1.0)	.113 (1.4)
RAT84			.235 (1.2)	.071 (2.1)			.022 (0.6)	.034 (0.8)
19 State dummies included?	no	no	no	no	yes	yes	yes	yes
N	89	94	89	94	89	94	89	94
$\bar{R}^2$	.395	.412	.391	.426	.526	.468	.515	.458

Sources: *Barron's Profile of American Colleges* (Woodbury, NY: Barron's Educational Service, 1984): RAT84; National Center for Education Statistics (NCES), Higher Education General Information System (HEGIS) (1976), and Integrated Postsecondary Educational Data System (IPEDS) (1988): Residence and Migration of College Students (1988): PSAME; HEGIS (1976) and IPEDS: Institutional Characteristics (1988): PRIV, TUIN, TUOUT.

Note: Also included are dummy variables for nonreporting of tuition levels and, in columns 2 and 4, absence of a selectivity rating. The weighted mean proportions of students that were in-state students (PSAME) in 1976 and 1988, respectively, were .58 and .37 in the private HBIs, and .84 and .74 in the public HBIs.

Where:

INT	intercept
PRIV	1 = private institution, 0 = public
TUIN	tuition level if private, in-state tuition level if public
TUOUT	tuition level if private, out-of-state tuition level if public
RAT84	Barron's 1984 selectivity rating of the institution (4 = competitive, 5 = less competitive, 6 = noncompetitive)
PSAME	proportion of freshmen that are in-state students

[a]Coefficients have been multiplied by 1,000.

Table 4.5. Probit Estimates of the Decision to Attend an HBI (Absolute Value of t Statistic)

	(1)	(2)
SLOT	5.780 (7.2)	3.841 (3.8)
HSRANK	.310 (1.2)	.292 (1.1)
PUBHS	.434 (2.3)	.354 (1.8)
BFACH	1.020 (2.3)	1.016 (2.2)
BSTUDH	.216 (0.7)	.217 (0.7)
COLL24	.279 (0.9)	.612 (1.9)
URBHS	.129 (0.9)	.200 (1.2)
SAT	−.017 (3.4)	−.018 (3.4)
MALE	.202 (1.7)	.201 (1.7)
MOMBA	.014 (0.1)	−.077 (0.4)
DADBA	−.049 (0.2)	.111 (0.5)
DADSEI	.005 (1.2)	.001 (1.4)
PARINC	−.001 (0.4)	.000 (0.1)
RELTUI		.497 (1.9)
RELFAC		.009 (1.2)
RELSAT		−.738 (0.6)
χ^2/DOF	170.142/20	197.386/25
N	638	638

Note: Also included in the equation are dichotomous variables for nonreporting of high school rank; SAT scores; other high school characteristics; mother's and father's education; father's occupational status; parents' family income in 1972; and, in column 2, the absence of HBIs in the student's state of residence in 1972 and the absence of data on black faculty in a state that has at least one HBI.

Where:

SAT	individual's total SAT score (ACT scores converted to SAT scale) if reported, 0 = SAT not reported
RELTUI	average (weighted by FTE enrollments) tuition in HBIs in the student's high school state relative to average (weighted) tuition in other institutions in the state
RELFAC	average (weighted) proportion of black faculty in HBIs in the state relative to the average (weighted) proportion of black faculty in other institutions in the state
RELSAT	average (weighted) SAT score of HBIs in the state relative to the average (weighted) SAT score of other institutions in the state

All other variables are defined in Table 4.2.

black faculty in HBIs in the state relative to the weighted average proportion of black faculty in other institutions in the state. Finally, RELSAT is the weighted average SAT score in HBIs in the state relative to the weighted average SAT scores of other institutions in the state. Our expectation is that these variables, respectively, should be negatively, positively, and positively related to the probability of enrollment in an HBI.

The estimates in Table 4.5 suggest that students with higher test scores were less likely to attend HBIs. Students from public high schools and high schools with a greater proportion of black teachers were more likely to attend HBIs. Males were more likely to attend HBIs than were females. Finally, parents' educational backgrounds and income do not appear to have influenced the students' decision to attend an HBI.

The fraction of full-time equivalent undergraduate student slots in a state that were available in HBIs also mattered. While the other state-level variables proved to be jointly significant when included in the model, individually only RELTUI approached statistical significance, and its coefficient was positive. Higher levels of RELTUI may have signified increased relative quality of HBIs in a way not captured by SAT scores and, thus, may have led to an increased probability of black students' enrollment in an HBI.

THE CHARACTERISTICS OF THE COLLEGES STUDENTS ATTENDED

Characteristics of colleges, other than whether they are HBIs, may influence a student's educational and early labor market outcomes. The quality of an institution (as measured by its expenditure per student) or the quality of its students (as measured by their average test scores) have been shown to matter (James et al. 1989). Within the HBI sector, the proportions of students and faculty that were black varied considerably, and if HBIs did prove to confer unique advantages on black students, it is important to learn whether it was the racial mix of the students and/or that of the faculty that was responsible.[12] Finally, as noted at the start of this chapter, private and public HBIs may have had differential impacts on students. Thus, in some specifications, we include each of these variables in the educational and labor market outcome equations that appear in subsequent sections.

Of course, the characteristics of institutions chosen by students are not random, and it is of some interest to understand how individuals are matched to institutional characteristics. Table 4.6 provides such estimates for individuals enrolled in HBIs and those individuals enrolled in other institutions. The characteristics analyzed are the average SAT score in the institution (CSAT), institutional expenditures per student (EXPST), the proportions of black faculty (BFACC) and students (BSTUDC), and whether the institution was private (PRIV).[13] In each case, the characteristic was assumed to depend on the weighted mean value across institutions in the sector in the state in which the individual went to high school of the same characteristic, as well as a vector of characteristics of the individual, his or her family, and the high school that he or she attended.

Not surprisingly, given that most individuals remained in the same state for college, the mean values of the state/sector characteristics prove to be important predictors. In addition, more able students, as measured by higher test scores and class rank, enrolled in institutions with higher average test scores and higher expenditures per student. For students not enrolled in HBIs, an increase in their test scores also was associated with lower proportions of black students and black faculty in the institution that the students attended. For students enrolled in HBIs, an increase in the proportion of black teachers in their high school was associated with an increase in the proportion of black faculty in their college. Finally, if a student graduated from high school in a state that had no HBIs and he or she attended an HBI, other variables held constant, the student tended to be enrolled in an HBI with higher average test scores, expenditures per student, proportions of black faculty and black students, and probability of being private. These latter findings suggest some of the institutional characteristics that black families who sent their children out of state to HBIs were interested in obtaining.

RECEIPT OF A BACHELOR'S DEGREE BY 1979

The proportions of students who received bachelor's degrees by 1979 were .554 in the HBI sample and .515 in the non-HBI sample (see Table 4.2). What happens to the difference in these proportions once one controls for differences between the two groups in the characteristics of individuals and of the schools they attended, as well as the process by which students enrolled in HBIs or other schools?

Table 4.7 presents probit estimates of the probability that a bachelor's degree was received by 1979. Equations were estimated for students who attended HBIs, students who attended other institutions, and the pooled sample. In the separate sample cases, specifications were reported in which the probability was assumed to have varied with measures of the individual's ability and family background, and then the probability was assumed to have varied with these variables plus the characteristics of the college the individual attended. The pooled analyses included a dichotomous variable for whether the individual attended an HBI and also specifications in which this variable was treated as endogenous. To accomplish the latter, instruments for the student's institutional type were obtained from the choice of sector equations reported in Table 4.5 (see Maddala 1983).

Turning first to the estimates by sector, students whose high school class rank was better were more likely to have received a degree in both

Table 4.6. Determinants of the Characteristics of the Colleges Attended (Absolute Value of t *Statistic)*

	CSAT		*EXPST*		*BFACC*		*BSTUDC*		*PRIV*[a]	
	OTHER	*HBI*	*OTHER*	*HBI*	*OTHER*	*HBI*	*OTHER*	*HBI*	OTHER	HBI
MALE	1.708 (1.6)	.684 (0.8)	2.162 (0.9)	−.041 (0.0)	.001 (0.2)	.002 (0.2)	−.021 (1.7)	−.008 (1.7)	.100 (0.5)	−.106 (1.1)
HSRANK	−4.886 (2.1)	−3.853 (2.0)	−5.629 (1.1)	−4.937 (1.6)	−.007 (0.6)	.023 (0.6)	−.019 (0.7)	.029 (1.1)	−.853 (2.2)	−.565 (1.3)
SAT	.199 (4.5)	.048 (1.2)	.351 (3.8)	.190 (3.0)	−.000 (1.6)	−.000 (0.6)	−.963 (1.9)[b]	.761 (1.4)[b]	.005 (0.7)	.005 (0.6)
PARINC	−.004 (0.4)	−.004 (0.4)	−.024 (1.0)	.029 (1.8)	.000 (0.4)	−.000 (0.1)	−.000 (0.5)	.061 (0.5)	−.002 (1.3)	.003 (1.2)
DADSEI	−.014 (0.4)	.043 (1.6)	−.080 (1.0)	−.002 (0.0)	.038 (2.0)[b]	.096 (0.2)[b]	−.001 (1.2)	−.000 (0.5)	.013 (2.2)	−.009 (1.4)
MOMBA	4.259 (2.3)	−2.210 (1.4)	7.748 (2.0)	−2.972 (1.2)	.014 (1.5)	.002 (0.6)	.023 (1.1)	.022 (1.1)	.064 (0.2)	−.528 (1.6)
DADBA	1.058 (0.5)	1.173 (0.6)	−1.384 (0.3)	3.634 (1.2)	−.002 (0.2)	−.026 (0.8)	−.002 (0.9)	−.010 (0.5)	−.237 (0.3)	.333 (0.8)
PUBHS	−1.141 (0.7)	−3.066 (2.0)	−1.967 (0.6)	−4.417 (1.8)	.009 (1.6)	.010 (0.3)	.038 (2.0)	.020 (1.0)	−.290 (1.2)	−.416 (1.3)
BFACH	5.966 (1.4)	−1.266 (0.5)	13.877 (1.6)	−5.500 (1.2)	.019 (0.9)	.002 (0.0)	.005 (0.1)	.087 (2.2)	.172 (0.3)	.732 (1.2)
BSTUDH	−1.693 (0.6)	.230 (0.1)	−1.850 (0.3)	3.003 (0.8)	−.019 (1.4)	−.024 (0.5)	−.019 (0.6)	−.044 (1.4)	.391 (0.9)	−.693 (1.4)
COLL24	6.057 (2.1)	1.638 (0.8)	7.076 (1.1)	−.350 (0.1)	.027 (1.9)	−.076 (1.9)	.002 (0.1)	−.054 (1.9)	.917 (1.9)	−.142 (0.3)
URBHS	−.481 (0.3)	.969 (0.8)	−2.574 (1.0)	−2.038 (0.7)	.008 (1.3)	.021 (1.0)	.049 (3.3)	−.003 (0.2)	−.267 (1.3)	.603 (2.4)
OSAT	1.027 (7.1)									
OEXP			1.208 (5.9)							
OPBF					.763 (3.0)					
OPBS							1.130 (5.4)			
OPRIV									1.801 (3.4)	

HSAT		.617 (9.3)								
HEXP				.496 (8.3)						
HPBF						.868 (8.0)				
HPBS								.614 (9.0)		
HPRIV										2.780 (5.7)
HDV		45.299 (9.1)		16.476 (4.9)		.541 (7.3)		.520 (8.1)		1.266 (3.5)
$\bar{R}^2$/DOF	.319/319	.298/276	.190/319	.213/276	.029/296	.207/232	.104/319	.274/276		
χ^2/DOF									48.019/20	64.121/21

Note: Also included in each equation are dichotomous variables for nonreporting of high school rank; SAT; parents' income; father's occupational prestige; mother's and father's educational level; high school characteristics; and, in BFACC equation for HBIs, black faculty.
Where:
HSAT average (weighted) SAT score in HBIs in the student's high school state (divided by 10), 0 if no HBIs in the state
HEXP average (weighted) expenditure per pupil in the student's high school state (divided by 100), 0 if no HBIs in the state
HPBF average (weighted) proportion of black faculty in HBIs in the state, 0 if no HBIs in the state
HPBS average (weighted) proportion of black students in HBIs in the state, 0 if no HBIs in the state
HPRIV average (weighted) proportion of students in the student's high school state in HBIs who are in private institutions, 0 if no HBIs in the state
HDV 1 = no HBI's in the student's high school state, 0 = otherwise
OSAT, OEXP, OPBF, OPBS, OPRIV are similarly defined save that they refer to institutions other than HBIs.
All other variables are defined in Table 4.2.
[a]Probit analyses.
[b]Coefficient has been multiplied by 1,000.

Table 4.7. Probit Estimates of Probability That Bachelor's Degree Received by 1979 (Absolute Value of t Statistic)

	Students at HBIs		Other Students		Pooled–All Students	Pooled–All Students HBI Endogenous	
	(1H)	(2H)	(1O)	(2O)	(1A)	(1/1)[a]	(1/2)[b]
MALE	−.051 (0.3)	−.013 (0.1)	−.217 (1.4)	−.238 (1.5)	−.132 (1.2)	−.151 (1.4)	−.149 (1.4)
SAT	.008 (1.0)	.010 (1.2)	.020 (3.1)	.016 (2.3)	.015 (3.1)	.018 (3.5)	.018 (3.5)
HSRANK	−1.239 (3.4)	−1.275 (3.5)	−.950 (2.9)	−1.011 (2.1)	−1.085 (4.6)	−1.077 (4.5)	−1.079 (4.5)
MOMBA	.533 (1.7)	.493 (1.6)	.354 (1.3)	.406 (1.4)	.449 (2.3)	.437 (2.2)	.435 (2.2)
DADBA	−.236 (0.7)	−.238 (0.7)	−.118 (0.4)	−.149 (0.5)	−.159 (0.7)	−.173 (0.7)	−.177 (0.8)
DADSEI	−.002 (0.4)	−.002 (0.3)	.014 (2.5)	.014 (2.4)	.217 (1.2)	.006 (1.4)	.005 (1.4)
PARINC[a]	.328 (1.7)	.367 (1.8)	−.095 (0.6)	−.060 (0.7)	.088 (0.7)	.105 (0.8)	.102 (0.8)
HBI					.254 (2.3)	.615 (2.5)	.604 (2.7)
CSAT		−.015 (1.3)		.002 (0.2)			
PRIV		.174 (0.9)		.144 (0.8)			
BFACC		−1.049 (1.5)		−1.657 (0.6)			
BSTUDC		−.179 (0.2)		−1.069 (1.1)			
EXPST		−.006 (0.7)		.003 (0.6)			
χ^2/DOF	35.002 (13)	40.573 (19)	57.544 (13)	66.908 (19)	83.641 (14)	84.457 (14)	85.438 (14)

Note: Also included in each equation are dichotomous variables for nonreporting of SAT; high school rank; mother's and father's education levels; father's occupational prestige index; parents' income; and, in (2), proportion of black faculty in 1990 at the institution.
Where:
HBI 1 = student attended a historically black institution, 0 = student attended another institution
All other variables are defined in Table 4.2.
[a]Instrument for HBI derived from Table 4.5, column 1.
[b]Instrument for HBI derived from Table 4.5, column 2.

sectors. Higher SAT scores were associated with higher completion probabilities as well, but the relationship is statistically significant only for students who did not attend HBIs. Students from wealthier families, as measured by higher family income or higher father's occupational prestige, had higher completion probabilities, as did students from families where the mother had a bachelor's degree.

When one adds institutional characteristics to the analysis, they prove not to be statistically significant as a group in each sector; individually, no single characteristic was statistically significant either.[14] One cannot infer from these results, therefore, that increasing institutional selectivity, expenditure per student, or the proportions of black students or faculty increased black students' completion probabilities in either sector. Nor were private institutions associated with higher completion rates than those of public institutions. Turning to the pooled analyses, the results in column 1A clearly indicate that, holding other factors constant, the probability that a bachelor's degree was received by 1979 was significantly higher if the student attended an HBI than if the student attended another institution. Indeed, one can make use of the coefficient estimates from column 1A and the values of the explanatory variables for each individual to compute how much higher the probability would have been for each individual if he or she had attended an HBI.[15] When this is done, the mean value of these differentials is .090, and the standard deviation of the differentials is only .015. This is strong evidence that the probability of these black students receiving a bachelor's degree by 1979 was higher if they attended HBIs than if they attended other institutions.[16]

The estimates in column 1A do not control for the fact that enrollment in an HBI was not a random occurrence. To do so, we compute instrumental variable estimates for the probability that a student was enrolled in an HBI from each of the two enrollment models found in Table 4.5. We then reestimate the graduation probability model twice, replacing the dichotomous HBI variable in turn by each of the instruments. The resulting estimates appear in columns 1I1 and 1I2 of Table 4.7.

The latter two sets of coefficients prove to be virtually identical. The coefficients of the HBI instrument in both cases are much larger than the original HBI coefficient found in column 1A. Indeed, when one computes the implied impacts of attending an HBI in these models, as described above, one finds that the mean probabilities of obtaining a bachelor's degree by 1979 were over .20 higher in each of these two models if the individual attended an HBI. That is, controlling for the endogeneity of whether these students attended an HBI substantially increased our estimate of the HBI/non-HBI probability of graduating by 1979 differential.

Given that we obtained virtually identical estimates when the two different instruments for attendance at HBIs were used, for simplicity, in the remainder of the chapter, we report results only for the instrument derived from the specification that excludes the relative characteristics from the enrollment equation (Table 4.5, column 1).

EARLY CAREER EARNINGS

Table 4.8 presents estimates of the logarithm of 1979 hourly earnings equations for individuals who initially were enrolled in HBIs, but who were employed in 1979 and not enrolled full-time in college. Missing from this sample then is full-time undergraduate or graduate students and/or individuals who were unemployed or not in the labor force. Table 4.9 presents similar estimates for individuals who were initially enrolled in other institutions.

Equations were estimated that both excluded and included whether the individual had received a bachelor's degree by 1979. For each of these cases, since enrollment in an HBI was nonrandom, specifications were also estimated that controlled for the factors that determined whether an individual enrolled in an HBI, using the sample selection bias correction method suggested by Heckman (1979).[17] As is well known, this involves computing, and then adding, an estimated correction factor (the inverse Mills' ratio) to the model and then reestimating the models.

Since employment in 1979 was also a nonrandom event, specifications were also estimated that controlled for the probability that each individual was observed employed. These latter specifications made use of estimated employment status equations and were estimated under the assumption that the correction factors for attendance at an HBI and employment in 1979 were independent of each other.[18]

The explanatory variables included in these models were personal and family characteristics of the individual, the area unemployment rate in 1979, and, to control for price differences across areas, a vector of regional dichotomous variables and a dichotomous variable that indicates whether the individual attended an urban high school. The high school urbanization variable served as a proxy for the extent of urbanization in the area in which the individual resided in 1979. Some specifications also included the characteristics of the college that the student attended. However, in neither sector did any of these college characteristics appear to significantly influence early career wages.

Table 4.8. Logarithm of 1979 Hourly Earnings Equations: HBI Students (Absolute Value of t Statistic)

	OLS				Selectivity Corrected			
	(1)	(2)	(3)	(4)	(1A)	(2A)	(3A)	(4A)
MALE	.283 (4.7)	.271 (4.3)	.277 (4.8)	.259 (4.4)	.282 (4.6)	.304 (4.9)	.279 (4.8)	.298 (5.0)
SAT	.002 (0.1)	.002 (0.6)	.001 (0.4)	.001 (.03)	.002 (.06)	.002 (0.6)	.001 (0.2)	.001 (0.2)
HSRANK	−.350 (2.6)	−.328 (2.4)	−.252 (2.0)	−.220 (1.7)	−.349 (2.7)	−.336 (2.5)	−.252 (2.0)	−.249 (2.0)
URBHS	.107 (1.5)	.111 (1.4)	.131 (1.9)	.138 (1.9)	.108 (1.5)	.121 (1.6)	.131 (1.9)	.141 (2.0)
MOMBA	−.177 (1.7)	−.167 (1.6)	−.228 (2.3)	−.215 (2.1)	−.178 (1.7)	−.230 (2.1)	−.227 (2.3)	−.267 (2.6)
DADBA	.141 (1.2)	.135 (1.1)	.176 (1.5)	.167 (1.2)	.143 (1.2)	.110 (0.9)	.174 (1.5)	.147 (1.3)
DADSEI[a]	−.476 (0.2)	−.387 (0.2)	−.319 (0.2)	−396 (0.2)	−.001 (0.2)	−.000 (0.2)	−.000 (0.1)	−.000 (0.1)
PARINC[a]	.794 (1.0)	.662 (0.9)	.519 (0.8)	.349 (0.5)	.001 (1.0)	.001 (1.4)	.000 (0.7)	.001 (1.0)
UNEMP	7.866 (2.0)	7.569 (1.9)	5.409 (1.4)	4.983 (1.3)	7.818 (2.0)	10.248 (2.5)	5.478 (1.4)	7.499 (1.9)
CSAT		.001 (0.1)		.002 (0.5)				
PRIV		.020 (0.3)		−.016 (0.2)				
BFACC		.313 (1.1)		.353 (1.3)				
BSTUDC		−.345 (1.1)		−.352 (1.2)				
EXPST		.001 (0.2)		.002 (0.6)				
BA79			.298 (5.3)	.310 (5.5)			.300 (5.3)	.282 (5.0)
λ (HBI)					−.014 (0.2)	−.006 (0.1)	.024 (0.2)	.031 (0.4)
λ (EMP)						−.395 (1.9)		.320 (1.6)
$\bar{R}^2$	.121	.109	.216	.211	.118	.128	.212	.218
N	253	253	253	253	253	253	253	253

Note: Each equation also includes seven regional dichotomous variables (to control for cost of living) and dichotomous variables for the nonreporting of SAT, high school rank, high school characteristics, mother's and father's education levels, father's occupational status, and parental income.

Where:

UNEMP 1979 unemployment rate in the individual's state of residence

BA79 1 = received a bachelor's degree by 1979, 0 = did not receive a degree by 1979

λ (HBI) inverse Mills' ratio for attendance at HBI

λ (EMP) inverse Mills' ratio for employed in 1979

[a]Coefficient has been multiplied by 1,000.

Table 4.9. Logarithm of 1979 Hourly Earnings Equations: Non-HBI Students (Absolute Value of t *Statistic)*

	OLS				Selectivity Corrected			
	(1)	*(2)*	*(3)*	*(4)*	*(1A)*	*(2A)*	*(3A)*	*(4A)*
MALE	.157 (2.9)	.155 (2.8)	.173 (3.2)	.172 (3.1)	.174 (3.2)	.194 (3.5)	.190 (3.5)	.207 (3.7)
SAT	.001 (0.4)	.001 (0.3)	.000 (0.1)	.000 (0.1)	−.001 (0.3)	−.000 (0.1)	−.002 (0.7)	−.001 (0.4)
HSRANK	−.150 (1.3)	−.132 (1.0)	−.097 (0.8)	−.076 (0.6)	−.146 (1.3)	−.118 (1.0)	−.092 (0.8)	−.073 (0.6)
URBHS	.229 (3.7)	.230 (3.6)	.229 (3.7)	.228 (3.6)	.228 (3.7)	.236 (3.8)	.228 (3.7)	.235 (3.8)
MOMBA	−.076 (0.8)	−.090 (0.9)	−.097 (1.0)	−.113 (1.2)	−.087 (0.9)	−.103 (1.1)	−.108 (1.2)	−.120 (1.4)
DADBA	.119 (1.1)	.120 (1.0)	.127 (1.1)	.128 (1.2)	.159 (1.5)	.113 (1.0)	.168 (1.6)	.124 (1.1)
DADSEI[a]	.001 (0.7)	.002 (0.7)	.001 (0.4)	.001 (0.5)	.002 (1.1)	.002 (1.2)	.002 (0.8)	.002 (1.0)
PARINC[a]	.002 (2.7)	.002 (2.6)	.002 (2.8)	.002 (2.8)	.001 (2.4)	.001 (2.5)	.001 (2.6)	.002 (2.7)
UNEMP	1.036 (0.2)	1.584 (0.3)	1.690 (0.4)	2.284 (0.5)	2.506 (0.6)	4.367 (1.0)	3.176 (0.8)	4.783 (1.1)
CSAT		−.001 (0.2)		−.001 (0.3)				
PRIV		.012 (0.2)		.004 (0.1)				
BFACC		1.035 (1.0)		1.130 (1.1)				
BSTUDC		−.187 (0.5)		−.145 (2.7)				
EXPST		.002 (0.9)		.002 (0.8)				
BA79			.141 (2.7)	.143 (2.7)			.142 (2.7)	.126 (2.4)
λ (HBI)					.238 (2.4)	.241 (2.4)	.240 (2.4)	.241 (2.4)
λ (EMP)						−.291 (1.7)		−.261 (1.6)
$\bar{R}^2$	.104	.089	.124	.111	.119	.127	.140	.145
N	288	288	288	288	288	288	288	288

Note: See footnote to Table 4.8 for the other variables included in the model.
[a]Coefficient has been multiplied by 1,000.

Our interest in these equations is primarily for the purpose of computing estimates from them as to whether individuals who attended HBIs earned more than they would have earned if they had attended other institutions. We make such estimates in a later subsection. For now, we note only two findings. First, the return to earning a bachelor's degree by 1979 was higher for individuals who attended HBIs than for other individuals. Second, correction for both types of sample selection bias appear important for individuals who did not attend HBIs, and correction for selection bias associated with employment status appears important for individuals who attended HBIs.

Table 4.10 presents estimates of wage equations when the data for individuals who attended both HBIs and other institutions were pooled together, and a dichotomous variable for attendance at an HBI was added to the model. The −.021 coefficient of this variable in column 1, which is statistically insignificantly different from zero, suggests that enrollment in an HBI did *not* lead to an increase in early career earnings for black college students in the sample. This conclusion continues to hold when the sample selection bias correction method is used to control for being employed (column 1A), when enrollment at an HBI is treated as endogenous and an instrumental variable estimate used instead of the actual value (column 1B), and when the instrumental variable and the sample selection bias correction method are used simultaneously (column 1C). That is, we find no evidence that attendance at an HBI led, on average, to increased 1979 hourly earnings.[19]

What if we add whether an individual received a bachelor's degree by 1979 to the model, treat the degree attainment and wage equations as recursive, and estimate the augmented wage equation? The coefficient of HBI becomes −.036 and remains statistically insignificant. However, attainment of a bachelor's degree raises the logarithm of earnings by a statistically significant .214. Since individuals who attended HBIs were more likely to graduate, one may ask whether this positive indirect effect of HBIs on earnings was larger than the negative direct effect of attendance at an HBI.

The answer is no. The analogous (single-equation) estimate of the marginal impact of attending an HBI on degree attainment by 1979 was .090, and thus the total effect of attendance at an HBI on 1979 earnings is estimated in percentage terms as −.017 ([.214][.090]−.036). Similar findings occur (column 3C) when we control for both the endogeneity of HBI and for sample selection (employment) bias. With attendance at HBI treated as endogenous, the estimated mean impact of attendance at an HBI on degree attainment was .215. Hence, the estimated total effect

Table 4.10. Logarithm of 1979 Hourly Earnings Equations: All Students (Absolute Value of t Statistic)

	OLS			Selectivity Corrected					
	(1)	(2)	(3)	(1A)	(1B)	(1C)	(3A)	(3B)	(3C)
MALE	.204 (5.2)	.218 (5.7)	.213 (5.6)	.222 (5.6)	.208 (5.3)	.225 (3.6)	.232 (6.0)	.224 (5.8)	.237 (6.1)
SAT	.001 (0.9)	.001 (0.3)	.001 (0.4)	.002 (1.1)	.001 (0.4)	.001 (0.8)	.001 (0.5)	−.000 (0.3)	.000 (0.1)
HSRANK	−.264 (3.1)	−.185 (2.2)	−.190 (2.2)	−.242 (2.8)	−.265 (3.1)	−242 (2.8)	−.173 (2.0)	−.185 (2.2)	−.173 (2.0)
URBHS	.182 (4.0)	.188 (4.2)	.193 (4.3)	.194 (4.2)	.182 (4.0)	.194 (4.2)	.197 (4.3)	.187 (4.2)	.197 (4.3)
MOMBA	−.129 (1.9)	−.161 (2.5)	−.161 (2.5)	−.153 (2.3)	−.130 (1.9)	−.155 (2.3)	−.177 (2.7)	−.162 (2.4)	−.180 (2.7)
DADBA	.126 (1.6)	.140 (1.8)	.145 (1.9)	.085 (1.0)	.130 (1.7)	.088 (1.1)	.107 (1.4)	.146 (1.9)	.110 (1.4)
DADSEI	.001 (0.5)	.000 (0.1)	.000 (0.3)	.001 (0.6)	.001 (0.6)	.001 (0.8)	.000 (0.2)	.000 (0.3)	−.001 (0.5)
PARINC	.001 (2.7)	.001 (2.7)	.001 (2.5)	.001 (2.9)	.001 (2.5)	.001 (2.8)	.001 (2.8)	.001 (2.5)	.001 (2.7)
UNEMP	3.961 (1.4)	3.574 (1.3)	2.998 (1.1)	5.829 (2.0)	4.269 (1.5)	6.110 (2.1)	5.041 (1.8)	4.028 (1.5)	5.526 (2.0)
HBI	−.021 (0.5)	−.036 (0.9)	−.121 (2.2)	−.007 (0.2)			−.024 (0.6)		
BA79		.214 (5.7)	.142 (2.8)				.200 (5.2)	.217 (5.7)	.200 (5.3)
HBI*B79[a]			.151 (2.1)						
λ(EMP)				−.303 (2.4)		−.316 (2.5)	−.237 (1.9)		−.259 (2.1)
HB̂I[b]					−.112 (1.1)	−.068 (0.7)		−.159 (1.6)	−.121 (1.2)
$\bar{R}^2$	.129	.179	.184	.137	.130	.139	.183	.182	.187
N	541	541	541	541	541	541	541	541	541

Note: See footnotes to Tables 4.2, 4.7, and 4.8 for variables included in the model.

[a]The product of HBI and BA79.

[b]Instrumental variable estimate of HBI.

of attendance at an HBI on earnings in percentage terms was the direct effect (−.131) plus the indirect effect (.200)(.215) or −.088.

Finally, column 3 reports the results of allowing the effects of attendance at an HBI on earnings to vary with whether the individual actually graduated by 1979. The pattern of coefficients suggests that, holding other variables constant, individuals who had not graduated from HBIs earned less than individuals who had not graduated from other institutions. In contrast, other things held constant, graduates of HBIs earned more than graduates of other institutions. There may have been a larger payoff to attending an HBI, but only if the student succeeded in graduating. The lower earnings for nongraduates who attended HBIs undoubtedly reflects either perceptions that their quality, or the quality of the education they have received, is lower than that for nongraduates of other institutions, or simply increased discrimination against them.

EARLY CAREER OCCUPATIONAL PRESTIGE

Tables 4.11, 4.12, and 4.13 replicate the analyses of the previous three tables but replace the logarithm of hourly earnings with the index of occupational prestige in the occupation in which the individual was employed in 1979. The rationale for using this alternative variable is that individuals may trade off earnings early in their careers for training opportunities. Thus, occupational prestige may be a better measure of early career success than is earnings.

The results obtained when this alternative success measure is used are very similar to the earnings results, although neither correction for sample selection bias due to the nonrandom nature of employment status nor correction for attendance at an HBI mattered here. Once again, the analyses conducted for the pooled sample (Table 4.13) suggest that attendance at an HBI did not lead to an increase in black students' early career occupational success.[20]

ENROLLMENT IN GRADUATE EDUCATION

Historically, HBIs graduated many of the black Americans who went on to graduate and professional schools and who ultimately assumed professional positions in the black community. We discuss the role HBIs play in the production of black doctorates in the next section. Here, we examine the probability, conditional on having received a bachelor's degree by 1979, that graduates of HBIs in our sample were enrolled in a master's, doctoral, or professional degree program by 1979.

Table 4.11. 1979 Occupational Status Equations: Non-HBI Students (Absolute Value of t *Statistic)*

	OLS				Selectivity Corrected	
	(1)	*(2)*	*(3)*	*(4)*	*(1B)*	*(3B)*
MALE	−.891 (0.4)	−1.301 (0.6)	.895 (0.5)	.520 (0.6)	−.607 (0.2)	.678 (0.3)
SAT	.291 (3.5)	.267 (3.0)	.214 (2.8)	.209 (2.6)	.273 (3.1)	.190 (2.2)
HSRANK	−8.358 (1.8)	−7.647 (1.6)	−2.636 (0.6)	−1.756 (0.4)	−8.319 (1.8)	−1.910 (0.4)
URBHS	2.635 (1.1)	2.790 (1.2)	3.126 (1.5)	3.079 (1.4)	2.310 (1.0)	2.778 (1.3)
MOMBA	2.397 (0.7)	2.626 (0.7)	.250 (0.1)	.250 (0.1)	2.221 (0.6)	.291 (0.1)
DADBA	5.189 (1.2)	5.523 (1.3)	6.046 (1.6)	6.350 (1.7)	5.479 (1.2)	6.994 (1.7)
DADSEI	.116 (1.5)	.111 (1.5)	.055 (0.8)	.058 (0.8)	.126 (1.7)	.065 (1.0)
PARINC	.001 (0.0)	−.006 (0.3)	.011 (0.5)	.003 (0.1)	−.002 (0.1)	.000 (0.0)
UNEMP	−13.382 (0.1)	−17.946 (0.2)	9.464 (0.1)	7.478 (0.1)	−.541 (0.0)	5.245 (0.1)
CSAT		.144 (1.0)		.147 (1.1)		
PRIV		.866 (0.3)		−.007 (0.0)		
BFACC		49.009 (1.1)		55.166 (1.5)		
BSTUDC		−28.715 (2.0)		−23.847 (1.8)		
EXPST		−.055 (0.8)		−.076 (0.6)		
BA79			15.083 (7.9)	14.936 (7.7)		15.199 (7.7)
λ(HBI)					2.934 (0.9)	2.777 (0.9)
λ(EMP)					−.826 (0.1)	1.902 (0.3)
$\bar{R}^2$	.129	.134	.290	.293	.125	.290
N	288	288	288	288	288	288

Note: Also included in each equation are dichotomous variables for the nonreporting of SAT; high school rank; urban high school; mother's and father's education levels; father's occupational status; parents' family income; and, where relevant, the proportion of black faculty.

Table 4.12. 1979 Occupational Status Equations: HBI Students (Absolute Value of t *Statistic)*

	OLS				Selectivity Corrected	
	(1)	(2)	(3)	(4)	(1B)	(3B)
MALE	−3.998 (1.8)	−3.750 (1.7)	−4.417 (2.1)	−4.175 (2.1)	−3.196 (1.4)	−3.476 (1.8)
SAT	.051 (0.5)	.033 (0.3)	.016 (0.2)	−.012 (0.1)	.012 (0.1)	−.047 (0.5)
HSRANK	−16.383 (3.4)	−16.057 (3.3)	−11.212 (2.6)	−10.731 (2.4)	−16.154 (3.3)	−11.302 (3.6)
URBHS	−4.619 (1.7)	−4.266 (1.6)	−3.516 (1.5)	−3.204 (1.3)	−4.387 (1.6)	−3.599 (1.5)
MOMBA	−1.087 (0.2)	−.967 (0.2)	−3.556 (1.0)	−3.337 (1.0)	−2.303 (0.6)	−3.961 (1.1)
DADBA	−4.475 (1.0)	−5.060 (1.1)	−2.987 (0.7)	−3.578 (0.9)	−5.661 (1.3)	−3.772 (0.9)
DADSEI	.052 (0.7)	.069 (1.0)	.061 (1.0)	.071 (1.1)	.065 (0.9)	.075 (1.2)
PARINC	.087 (3.4)	.082 (3.0)	.072 (3.0)	.063 (2.7)	.089 (3.3)	.068 (2.9)
UNEMP	146.892 (1.4)	134.510 (1.2)	40.018 (0.4)	6.955 (0.0)	205.719 (1.9)	75.181 (0.8)
CSAT		−.206 (1.2)		−.141 (0.9)		
PRIV		2.834 (1.0)		1.123 (0.5)		
BFACC		.460 (0.0)		7.120 (0.1)		
BSTUDC		−11.168 (1.0)		−10.228 (1.0)		
EXPST		.093 (0.8)		.145 (1.4)		
BA79			15.205 (7.9)	15.196 (7.8)		15.130 (7.7)
λ(HBI)					2.590 (0.8)	4.249 (1.5)
λ(EMP)					−9.970 (1.5)	−4.527 (0.7)
$\bar{R}^2$	.116	.113	.297	.296	.119	.299
N	253	253	253	253	253	253

Note: See footnote to Table 4.11 for the other variables included in the model.

Table 4.13. 1979 Occupational Status Equations: All Students (Absolute Value of t *Statistic)*

	OLS		*Selectivity Corrected*					
	(1)	*(2)*	*(1A)*	*(1B)*	*(1C)*	*(2A)*	*(2B)*	*(2C)*
MALE	−2.762 (1.8)	−1.836 (1.3)	−2.534 (1.6)	−2.595 (1.7)	−2.385 (1.5)	−1.899 (1.5)	−1.490 (1.1)	−1.515 (1.1)
SAT	231 (3.6)	.166 (2.9)	.235 (3.7)	.212 (3.2)	.220 (3.3)	.164 (2.9)	.127 (2.1)	.126 (2.0)
HSRANK	−12.293 (3.7)	−6.706 (2.2)	−12.080 (3.6)	−12.363 (2.5)	−12.133 (3.6)	−6.740 (2.2)	−6.731 (2.2)	−6.778 (2.2)
URBHS	−.032 (0.0)	.646 (0.4)	.178 (0.1)	−.138 (0.1)	.036 (0.8)	.608 (0.4)	.313 (0.2)	.293 (0.2)
MOMBA	.761 (0.2)	−1.597 (0.7)	.405 (0.1)	.798 (0.3)	.409 (0.2)	−1.504 (0.6)	−1.584 (0.7)	−1.540 (0.6)
DADBA	−.754 (0.3)	.311 (0.1)	−1.253 (0.4)	−.646 (0.2)	−1.177 (0.4)	.461 (0.2)	.558 (0.2)	.628 (0.2)
DADSEI	.100 (1.9)	.069 (1.5)	.103 (2.0)	.105 (2.0)	.108 (2.1)	.068 (1.5)	.079 (1.7)	.078 (1.7)
PARINC	.036 (2.0)	.034 (2.3)	.037 (2.2)	.033 (2.0)	.035 (2.0)	.034 (2.2)	.030 (2.0)	.030 (1.9)
UNEMP	61.374 (0.9)	24.785 (0.4)	84.955 (1.1)	65.543 (0.9)	89.456 (1.2)	17.087 (0.2)	36.016 (0.6)	32.931 (0.5)
HBI	−.602 (0.4)	−2.016 (1.6)	−.433 (0.3)			−2.071 (1.6)		
BA79		15.175 (11.2)				15.246 (11.0)	15.367 (11.3)	15.400 (11.2)
λ(EMP)			−3.924 (0.9)		−4.148 (0.9)	1.141 (0.3)		.528 (0.1)
$\hat{HBI}$[a]				−3.274 (1.0)	−2.736 (0.8)		−7.415 (2.2)	−7.489 (2.4)
$\bar{R}^2$	.109	.281	.109	.111	.110	.279	.286	.284
N	541	541	541	541	541	541	541	541

Note: See footnote to Table 4.11 for the other variables included in the model.

[a]Instrumental variable estimate of HBI.

In the aggregate, 33 percent of the individuals who received a bachelor's degree by 1979 were enrolled in such programs by 1979. The comparable percentages for graduates of HBIs was 27 and for graduates of other institutions 38. These raw percentages, however, ignore differences in the two groups in students' academic ability or family backgrounds (e.g., income), both of which might influence their propensities to attend graduate or professional school.

Table 4.14 presents estimates of probit probabilities of enrollment in graduate programs by 1979, conditional on having received a bachelor's degree. The simplest model (column 1) included measures of a student's academic ability at the time he or she graduated from high school, the student's family background at that time, and whether the student attended an HBI. A student's academic ability and parents' income both positively influenced the probability of having been enrolled in postgraduate education, but attendance at an HBI per se did not significantly increase this probability. Use of an instrument for attendance at an HBI, to control for its nonrandom nature (column 2), did not change any of these findings.

When the data were stratified by whether the students attended an HBI, the characteristics of the institutions the students attended can be entered into the models. This is done is columns 4 (non-HBIs) and 6 (HBIs). In each case, an increase in the proportion of black students in the institution's undergraduate student body is associated with an increase in the probability of enrollment in graduate education.

DID ATTENDANCE AT AN HBI MATTER?

Table 4.15 summarizes the predicted mean (across individuals) proportional differential impacts of enrollment in an HBI on the probability of having received a bachelor's degree by 1979, on hourly earnings (if employed) in 1979, and on the occupational prestige index (if employed) in 1979.

In addition to the single-equation (pooled sample) estimates that have already been discussed, estimates are presented for when separate "outcome equations" were estimated for individuals attending HBIs and other institutions. In these latter cases, estimates of mean differentials are reported for individuals initially in each sector. In addition, to ascertain the sensitivity of the findings to the statistical model used, estimates are reported for models in which attendance at an HBI was treated as exogenous, attendance at an HBI was treated as endogenous, and (where relevant) being employed was treated as endogenous. In each

Table 4.14. Probit Probability of Enrollment in Graduate Programs by 1979 (Absolute Value of t *Statistic)*

	All		*Non-HBI*		*HBI*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
MALE	.046 (0.2)	.027 (0.2)	.112 (0.5)	.094 (0.4)	.106 (0.4)	.178 (0.7)
SAT	.011 (1.8)	.013 (2.0)	.009 (1.0)	.004 (0.5)	−.011 (1.0)	.011 (0.9)
HSRANK	−.713 (1.5)	−.694 (2.0)	−.142 (0.3)	−.064 (0.1)	−2.059 (3.1)	−2.042 (3.0)
MOMBA	.278 (1.0)	.273 (1.0)	.463 (1.4)	.289 (0.8)	.030 (0.6)	−.044 (0.1)
DADBA	−.569 (1.6)	−.559 (1.6)	−.059 (0.1)	−.050 (0.1)	−2.273 (2.6)	−2.290 (2.5)
DADSEI	.003 (0.6)	.003 (0.6)	.002 (0.3)	.002 (0.3)	.004 (0.6)	.006 (0.5)
PARINC	.003 (2.1)	.003 (2.1)	.002 (1.0)	.003 (1.1)	.007 (2.4)	.007 (2.2)
HBI	−.194 (1.3)					
$\hat{\text{HBI}}$[a]		.047 (0.1)				
CSAT				.017 (1.1)		−.015 (0.8)
PRIV				−.044 (0.2)		−.231 (0.7)
BFACC				−4.747 (0.8)		−1.832 (1.6)
BSTUDC				3.547 (1.7)		4.914 (2.0)
EXPST				.003 (0.4)		.023 (1.5)
N	340	340	175	175	165	165
χ^2/DOF	28.6 (14)	27.0 (14)	13.3 (13)	19.1 (19)	34.5 (13)	42.0 (19)

Note: Probit probabilities conditional on having received a bachelor's degree and enrollment in a master's, doctoral, or professional degree program. The proportions of college graduates enrolled in such programs were: All (340): .33; HBI: .27; Non-HBI: .38.

[a]Instrumental variable estimate of HBI.

Table 4.15. Predicted Mean Percentage Impacts of Enrollment in HBI (Standard Deviation of Impact across Individuals)

	BA79		
	HBI Exogenous	HBI Endogenous[a]	
Single equation	.090 (.015)	.213 (.039)	
Separate equation for each sector			
a) in HBIs	.288 (.385)		
b) not in HBIs	.255 (.334)		
	WAGE79		
		HBI Endogenous[a]	
	HBI Exogenous	(N)	(Y)
Single equation	−.021	−.107	−.066
Separate equation for each sector			
a) in HBIs	−.020 (.152)	−.302 (.135)	−.293 (.140)
b) not in HBIs	.020 (.173)	.045 (.188)	.050 (.197)
	SEI79		
		HBI Endogenous[a]	
	HBI Exogenous	(N)	(Y)
Single equation	−.013	−.073	−.061
Separate equation for each sector			
a) in HBIs	−.007 (.155)	−.090 (.140)	−.089 (.144)
b) not in HBIs	−.010 (.166)	−.089 (.164)	−.078 (.172)

Note: (N) = no sample selection correction for employment status; (Y) = sample selection correction for employment status—assumed to be independent of sample selection correction for sector choice.

[a]Endogenous dichotomous variable in the single equation, sample selection correction for institutional sector in the separate equation for each sector model.

case, the models used are those that excluded the vector of institutional characteristics and (for wages and occupational status) excluded receipt of a bachelor's degree by 1979. In each case, the predicted impact was computed for each individual in the sample and then the mean of the individual responses reported.[21]

Table 4.15 makes clear that attendance at an HBI substantially increased the probability that black students in the sample received a bachelor's degree by 1979. Depending on the specific model and statistical method used, the mean probability was between 9 and 29 percent higher if a student attended an HBI. In contrast, the impact of attendance at an HBI on early career labor market success, as measured by 1979 earnings or occupational prestige, was much smaller. In many cases the estimates were negative, although given the statistical insignificance of the underlying coefficients, all of these impacts on early career labor market success are probably insignificantly different from zero.

How could HBIs have improved black students' graduation probabilities but not improved their early career labor market success? At least two explanations come to mind. On the one hand, employers may have discriminated more against black graduates of HBIs than they did against black graduates of other institutions.[22] On the other hand, the quality of education received by black students and the graduation standards may have been lower at HBIs. The data we have used do not permit us to distinguish between these two explanations.[23]

The Production and Early Career Attainment of Black U.S. Citizen Doctorates

Historically, HBIs have provided many of the black college graduates who have gone on to earn doctoral degrees in the United States. In recent years, approximately 40 percent of the new doctorates granted to black citizens have gone to individuals who received their undergraduate degrees from HBIs, even though HBIs grant only about 30 percent of the bachelor's degrees received by black Americans. Thus, HBIs are asserted to be an important component of the pipeline for the production of black doctorates (U.S. House of Representatives 1991).

This section investigates the role of HBIs in the production of black doctorates, using special tabulations prepared for us by the National Research Council from the Survey of Earned Doctorates (SED). Each year when doctoral candidates submit their dissertations to their graduate schools and receive their degrees, they are asked to respond to the SED. Of primary interest to us here are their responses relating to their field of doctoral study, the institutions at which they received their undergraduate and graduate degrees, and their plans for future employment or study. Because of the small number of doctoral degrees granted to black citizens in any one year, most of the tabulations that follow are based on data from a recent five-year period.

Table 4.16 presents data on the share of doctorates granted by HBIs to black U.S. citizens and the share that went to individuals who received their undergraduate degrees from HBIs, by field, over the 1987–91 period. Focusing initially on the latter, the share of doctorates granted to black citizens with undergraduate degrees from HBIs was .39. However, this aggregate figure masks considerable variation across fields. Over 47 percent of all black citizens' doctorates granted during the period were in the field of education, and the share of education doctorates going to individuals with undergraduate degrees from HBIs was .48. While the

Table 4.16. Share of Black U.S. Citizen Doctorates by Field, 1987–91

Field	*Total Doctorates Granted to Black U.S. Citizens*	*Share Granted by HBIs*	*Share Granted to Graduates of Undergraduate HBIs*
Physical sciences	164	.10	.28
Engineering	125	.03	.21
Life sciences	382	.10	.36
Social sciences	330	.09	.27
Psychology	507	.08	.22
Humanities	383	.06	.33
Education	1,993	.09	.48
Professional/other	331	.13	.43
Total Doctorates	4,215	.09	.39

Source: Computed from special tabulations prepared by the Office of Scientific and Engineering Personnel, National Research Council from the Survey of Earned Doctorates (sponsored by five federal agencies—National Science Foundation, National Institute of Health, U.S. Department of Education, National Endowment for the Humanities, and the U.S. Department of Agriculture—and conducted by the National Research Council.)

analogous shares for the professional fields, the life sciences, and the humanities were all greater than .3, the shares in the physical sciences, the social sciences, engineering, and psychology were less than .3. In these latter fields, at least, undergraduates from HBIs are not overrepresented among new black doctorates.

This table also indicates that the share of doctorates granted by HBIs was .09 during the period. The number of HBIs that grant doctoral degrees in any year is actually very small. For example, as Table 4.17 indicates, in 1991 there were only eight such institutions, and over two-thirds of the total number of degrees they granted were by Howard and Clark Atlanta Universities alone. If one excludes doctorates granted in education, the number of HBIs producing doctorates falls to four. The small number of doctorates produced annually by many of the doctoral programs in HBIs leads to the concern that these programs may be too small to reach the critical mass necessary to efficiently train doctoral students (Bowen and Rudenstine 1992).

What types of graduate institutions do graduates of HBIs attend for doctoral study, and how do these compare to the institutional types that other black doctorates attend? This question is of some importance because, as we show below, where one attends graduate school heavily influences a new black doctorate's employment prospects. To answer this question, Table 4.18 presents cross-tabulations, by field, of black doctorates' undergraduate and graduate institutional types. The graduate institutions are broken down into HBIs, Research I doctorate-granting

Table 4.17. HBIs That Conferred Doctorates in 1991, by Major

Institution	*Total*	*PS*	*EAM*	*MC*	*ENG*	*BIO*	*HEA*	*AGR*	*PSY*	*SOC*	*HUM*	*EDU*	*PROF*
Howard	60	2			1	14	1		7	13	6	4	12
Clark Atlanta	74	2				4			3	9	3	44	9
Morgan State	3											3	
Univ. Maryland-Eastern Shore	2		1					1					
Jackson State	4											4	
South Carolina State	15											15	
Meharry Medical	4					4							
Texas Southern	26											26	
Total	188	4	1	0	1	22	1	1	10	22	9	96	2

Source: National Research Council, *Doctorate Recipients from United States Universities: Summary Report 1990* (Washington, D.C.: National Academy Press, 1991), Appendix Table A7.

Note: Some of these doctorates went to other than black U.S. citizens. Abbreviations for majors are as follows: PS = Physical Sciences; EAM = Earth, Atmospheric, and Ocean Sciences; MC = Mathematics and Computer/Information Sciences; ENG = Engineering; BIO = Biology; HEA = Health; AGR = Agriculture; PSY = Psychology; SOC = Social Sciences; HUM = Humanities; EDU = Education; PROF = Professional.

Table 4.18. Number of Black U.S. Citizen Doctorates Granted, by Field and Type of Undergraduate and Doctoral Institution, 1987–91

Undergrad. Inst.	All				HBIS				Liberal Arts I and Research I				Other			
Field of Doctorate / Doctoral Inst.	(T)	(H)	(R)	(O)	(T)	(H)	(R)	(O)	(T)	(H)	(R)	(O)	(T)	(H)	(R)	(O)
Physical sciences	164	16	87	61	46	11	16	19	58	3	44	11	60	2	27	31
		(.10)	(.53)	(.37)		(.24)	(.35)	(.41)		(.05)	(.76)	(.19)		(.03)	(.45)	(.52)
Engineering	125	4	86	35	26	2	14	10	53	1	49	3	46	1	23	22
		(.03)	(.69)	(.28)		(.08)	(.54)	(.39)		(.02)	(.92)	(.06)		(.02)	(.50)	(.48)
Life sciences	382	37	217	128	139	25	66	48	91	2	72	17	152	10	79	63
		(.10)	(.57)	(.34)		(.18)	(.48)	(.34)		(.02)	(.79)	(.19)		(.07)	(.52)	(.41)
Social sciences	330	29	173	128	88	14	44	30	90	4	62	24	152	11	67	74
		(.09)	(.52)	(.39)		(.16)	(.50)	(.34)		(.04)	(.69)	(.27)		(.07)	(.44)	(.49)
Psychology	507	41	238	228	114	22	47	45	189	9	114	66	204	10	77	117
		(.08)	(.47)	(.45)		(.19)	(.41)	(.40)		(.05)	(.60)	(.35)		(.05)	(.38)	(.58)
Humanities	383	22	223	138	128	15	57	56	112	3	83	26	143	4	83	56
		(.06)	(.58)	(.36)		(.12)	(.45)	(.44)		(.03)	(.74)	(.23)		(.03)	(.58)	(.39)
Education	1,993	177	705	1,111	955	146	296	513	238	3	135	100	800	28	274	498
		(.09)	(.35)	(.56)		(.15)	(.31)	(.54)		(.01)	(.57)	(.42)		(.04)	(.34)	(.62)
Professional/other	331	42	155	134	141	30	56	55	70	3	39	28	120	9	60	51
		(.13)	(.47)	(.40)		(.21)	(.40)	(.39)		(.04)	(.56)	(.40)		(.08)	(.50)	(.42)
Total doctorates	4,215	368	1,884	1,963	1,637	265	596	776	901	28	598	275	1,677	75	690	912
		(.09)	(.45)	(.47)		(.16)	(.36)	(.47)		(.03)	(.66)	(.31)		(.05)	(.41)	(.54)

Source: Special tabulations prepared by the Office of Scientific and Engineering Personnel, National Research Council from the Survey of Earned Doctorates (sponsored by five federal agencies—National Science Foundation, National Institute of Health, U.S. Department of Education, National Endowment for the Humanities, and the U.S. Department of Agriculture—and conducted by the National Research Council).

Note: Figures in parentheses represent share of doctorates in the field/undergraduate institution category from the graduate institution category. Column subheads are as follows: (T) = all doctorate granting-institutions; (H) = historically black institutions that grant doctorates; (R) = Research I doctorate-granting institutions; (O) = all other doctorate-granting institutions.

institutions (the institutions that produce a large number of doctorates in a number of fields and whose doctoral programs are often highly rated), and other institutions.[24] The undergraduate institutions are broken down into HBIs, Liberal Arts I (selective liberal arts) and Research I institutions, and other institutions.

In the aggregate, 9 percent of black doctorates during the 1987–91 period were granted by HBIs, 45 percent were granted by Research I institutions, and 47 percent were granted by other institutions. For those black doctorates whose undergraduate degrees were earned at HBIs, the comparable figures were 16, 36, and 47 percent, respectively; while for black doctorates from Liberal Arts I and Research I undergraduate institutions, the figures were 3, 66, and 31 percent, respectively. That is, black doctorates who earned undergraduate degrees at HBIs were much more likely to attend HBIs, and somewhat less likely to attend Research I institutions, for their doctoral study. Perusal of the field-specific data suggests that the same pattern holds for each of the doctoral fields, although in some cases the differences are not as large as the overall ones.

Why do black doctorates who received their undergraduate degrees from HBIs tend to be less likely to attend elite Research I doctoral programs than are graduates from Liberal Arts I and Research I institutions? In part, this tendency may reflect differences in the ability levels and undergraduate training of students from HBIs vis-à-vis their counterparts from research and liberal arts institutions. In part, it may reflect their personal preferences to remain for graduate study in what they perceive to be a supportive environment. And, in part, it may reflect ignorance about HBIs, discriminatory attitudes toward the graduates of HBIs, or the failure of faculty in the elite graduate programs to aggressively recruit potential graduate students from HBIs, most of which are located in different areas of the country than are the elite graduate programs.

The SED data do not permit one to distinguish between these various hypotheses. However, the facts that average test scores of black students tend to be lower at HBIs than at other institutions (see, e.g., Table 4.2) and that over a recent seven-year period only 20 percent of National Science Foundation Black Minority Graduate Fellowship winners received their undergraduate degrees at HBIs (Table 4.19) suggest that perceptions of differential ability or training are at least part of the problem. Indeed, 67 percent of these fellowship winners from HBIs came from four institutions, and 45 percent came from Howard University alone. The perceived quality of HBIs and their students may fall off quite rapidly.

Table 4.19. National Science Foundation Black Minority Graduate Fellowship Winners

Year	*Number of Black Winners*	*Number of Black Winners from HBIs*	*Share of Black Winners from HBIs*
1992	42	8	.191
1991	59	17	.288
1990	52	13	.250
1989	27	5	.185
1988	23	1	.044
1987	16	3	.188
1986	17	1	.059
1985	19	3	.158
Total 1985–92	255	51	.200

Source: Calculations from National Science Foundation, "Outstanding Science Students Awarded NSF Minority Graduate Fellowships" (Washington, D.C.: National Science Foundation): NSF PR 92–26, 91–23, 90–22, 89–18, 88–14, 87–16, 86–19, and 85–19).

The final information in the SED that is useful to us comes from the question that asks doctorates at the time their dissertations are approved if they have already made definite employment plans. For those who have, additional questions are asked about whether academic employment, another form of employment, or a postdoctoral appointment has been obtained. Finally, for those entering academic appointments, the name of the academic institution at which they will be employed is reported.

The tabulations reported in Table 4.20 indicate that, in the aggregate, 69 percent of all black U.S. citizen new doctorates during the 1987–91 period had definite employment plans at the time that they received their degrees and that 58 percent of these had definite plans to work in academia or in postdoctoral positions. The comparable percentages are both higher for doctorates from Research I institutions than they are for doctorates from HBIs; however, once one breaks the data down by field, a consistent pattern of results does not emerge. That is, once one controls for field, on balance doctorates from HBIs are roughly equally likely to have definite plans at the time they receive their degrees and equally likely to have a postdoctoral or an academic position as are doctorates from Research I institutions.

What is different, though, is the type of academic position doctorates receive if they do enter the academic sector. Table 4.21 provides data on the shares of black U.S. citizen new doctorates with definite plans in the academic sector who go on to employment in HBIs (including Howard University), Research I or Liberal Arts I institutions, and other institu-

Table 4.20. Black U.S. Citizen Doctorates, 1987–91

	All Inst.	Type of Doctoral Inst. HBI	Research I	Other	Type of Undergraduate Inst. HBI	Research I or Liberal Arts I	Other
All fields							
Total number	4,233	369	1,890	1,974	1,637	901	1,677
Share with definite plans	.69	.63	.71	.69	.71	.69	.68
Share of those with definite plans going to postdocs or academia	.58	.50	.65	.54	.55	.64	.60
Physical sciences							
Total number	164	116	87	61	46	58	60
Share with definite plans	.72	.44	.78	.70	.72	.71	.73
Share of those with definite plans going to postdocs or academia	.52	.72	.50	.53	.45	.53	.57
Engineering							
Total number	126	4	86	36	26	53	46
Share with definite plans	.67	.75	.71	.56	.65	.66	.70
Share of those with definite plans going to postdocs or academia	.51	.67	.54	.40	.35	.48	.61
Life sciences							
Total number	384	37	219	128	139	91	152
Share with definite plans	.71	.76	.71	.70	.72	.77	.68
Share of those with definite plans going to postdocs or academia	.80	.85	.78	.82	.84	.80	.76

Social sciences							
Total number	332	29	175	128	88	90	152
Share with definite plans	.63	.62	.65	.60	.68	.63	.59
Share of those with definite plans going to postdocs or academia	.73	.67	.76	.70	.75	.58	.80
Psychology							
Total number	507	41	238	228	114	189	204
Share with definite plans	.69	.54	.68	.72	.73	.62	.73
Share of those with definite plans going to postdocs or academia	.49	.41	.57	.44	.48	.53	.48
Humanities							
Total number	385	22	224	139	128	112	143
Share with definite plans	.74	.86	.72	.74	.81	.75	.67
Share of those with definite plans going to postdocs or academia	.91	.89	.90	.94	.91	.98	.86
Education							
Total number	2,002	177	706	1,119	995	238	800
Share with definite plans	.69	.60	.71	.69	.70	.72	.67
Share of those with definite plans going to postdocs or academia	.46	.26	.52	.46	.43	.51	.50

Source: Special tabulations prepared by the National Research Council's Office of Scientific and Engineering Personnel from the Survey of Earned Doctorates.

Table 4.21. Black U.S. Citizen New Doctorates, 1987–91, with Definite Plans in the Academic Sector

Share Going to Employment in:	All Inst.	Type of Doctoral Inst.: HBI	Type of Doctoral Inst.: Research I	Type of Doctoral Inst.: Other	Type of Undergraduate Inst.: HBI	Type of Undergraduate Inst.: Research I or Liberal Arts I	Type of Undergraduate Inst.: Other
All Fields							
HBIs	.23	.58	.18	.25	.41	.12	.12
RI/LAI inst.	.21	.04	.31	.13	.14	.36	.21
Other U.S. inst.	.56	.44	.51	.62	.46	.52	.67
Physical sciences							
HBIs	.32	.67	.27	.31	.67	.25	.10
RI/LAI inst.	.26	.00	.40	.15	.11	.50	.10
Other U.S. inst.	.42	.33	.33	.54	.22	.25	.80
Engineering							
HBIs	.30	1.00	.17	.57	.80	.18	.24
RI /LAI inst.	.27	.00	.38	.00	.00	.36	.29
Other U.S. inst.	.42	.00	.46	.43	.20	.45	.47
Life sciences							
HBIs	.34	.55	.23	.43	.62	.04	.18
RI/LAI inst.	.18	.09	.30	.05	.11	.30	.18
Other U.S. inst.	.48	.36	.47	.52	.28	.65	.63

Social sciences							
HBIs	.17	.40	.12	.21	.32	.12	.11
RI/LAI inst.	.25	.00	.35	.17	.16	.35	.25
Other U.S. inst.	.57	.60	.54	.63	.51	.54	.63
Psychology							
HBIs	.12	.80	.14	.04	.23	.13	.05
RI/LAI inst.	.31	.00	.32	.33	.26	.34	.31
Other U.S. inst.	.57	.20	.55	.64	.52	.53	.64
Humanities							
HBIs	.21	.63	.16	.25	.32	.16	.13
RI/LAI inst.	.28	.00	.34	.22	.11	.47	.28
Other U.S. inst.	.51	.38	.50	.53	.57	.37	.59
Education							
HBIs	.24	.40	.21	.25	.40	.08	.12
RI/LA I inst.	.15	.00	.27	.08	.12	.28	.14
Other U.S. inst.	.61	.60	.53	.68	.48	.64	.74

Source: Special tabulations prepared by the National Research Council's Office of Scientific and Engineering Personnel from the Survey of Earned Doctorates.

tions. In the aggregate, these shares are .23, .21, and .56, respectively. However, new doctorates from HBIs are much more likely to be employed in HBIs and much less likely to be employed in Research I or Liberal Arts I institutions than are new doctorates from Research I institutions.[25] Similarly, new doctorates whose undergraduate degrees were from HBIs are much more likely to be employed in HBIs and much less likely to be employed in Research I or Liberal Arts I institutions than are new doctorates whose undergraduate degrees came from Research I or Liberal Arts I institutions.[26] Similar results hold for each of the seven specific fields for which data are tabulated in Table 4.21.

Again, one cannot ascertain if the sorting by institution type that occurs in these data is due to inherent differences in the ability or training of black doctorates who attended HBIs as undergraduate or doctoral students vis-à-vis their counterparts at Research I or Liberal Arts I institutions, to lack of information about and effort to recruit students from HBIs by the Liberal Arts I and Research I institutions, or to discriminatory preferences. If, however, a social goal is to increase the flow of talented black students into Ph.D. programs and ultimately into academic positions in elite teaching and research institutions, a number of actions are possible.

First, one could increase the number and size of doctoral programs in HBIs.[27] Second, one could more aggressively recruit graduates of HBIs into the doctoral programs of Research I institutions and pursue extra efforts to retain these students until graduation. Third, one could more aggressively recruit black students who otherwise would attend HBIs to attend undergraduate programs at Research I or Liberal Arts I institutions. The data we have analyzed do not permit one to conclude which option is best. However, the third option is likely to have adverse effects on the "better" undergraduate HBIs, and, without other policies, the first option appears likely to continue the current segmentation of black doctorate employment. Hence, building "pipelines" between the HBIs' undergraduate programs and the Research I institutions' doctoral programs may well be the preferred strategy.

Concluding Remarks

What should public policy be toward the Historically Black Institutions of higher education? In an increasingly multicultural society, should public policy encourage the integration and/or incorporation of HBIs into the larger and often better funded historically white institutions? Or should public policy facilitate the HBIs "specializing" in the education of blacks and other underrepresented minorities on American campuses, by providing the HBIs with improved facilities and increased annual support?

At the outset, it should be stressed that the only real question relates to the status of public HBIs. There is a long tradition in American private education of institutions being established by particular religious groups and then continuing to draw the majority of their students from members of these groups. No one objects to Catholics voluntarily attending Notre Dame or Georgetown, Mormons voluntarily attending Brigham Young, or Jews voluntarily attending Yeshiva or Brandeis. If voluntary association with predominately members of one's own group in a private *nondiscriminating* institution is deemed by an individual to be in his or her best interest, this choice should be permitted. Hence, no one should question the importance to black Americans of the private HBIs, those institutions that receive much of their support through private fund-raising activities conducted by the United Negro College Fund.

What should public policy be toward the public HBIs? Our empirical analyses in the second section focused on all HBIs as a group; however, we did not find that the public/private distinction was an important predictor of the benefits of attendance at an HBI. For black students attending college in the early 1970s, attendance at an HBI did substantially enhance their probability of receiving a bachelor's degree within seven years. However, it had no apparent effect on their early career labor market success and on their probability of enrolling in postcollege graduate or professional schools. Moreover, for none of these outcomes did it appear that attendance at an HBI yielded larger benefits for students from low-income families or students with low test scores than it did for other black students.

Of course, "early success" is not the same as "career success," and in future work we will examine if data from later waves of the NLS72 provide any evidence of larger gains for students who attended HBIs.[28] In addition, all of our analyses were conditional upon students having enrolled in a four-year institution. We did not address whether the presence of HBIs enhances the probability that black students enroll in four-year institutions, and that too needs to be addressed in future research.

Furthermore, to contemplate making policy recommendations for the 1990s, up-to-date evidence is required on the effects of attendance at HBIs. Given that one needs data for at least seven to ten years after entrance to college to conduct any meaningful analyses, about the best one can do is to use data on students who entered college in the 1980s. In subsequent work, we will conduct such analyses using data from High School and Beyond, a national longitudinal survey of students who graduated from high school in 1980 and 1982.[29]

Our analyses of the National Research Council's Survey of Earned Doctorates provided evidence on the patterns of black doctorates in recent years with respect to their undergraduate institutions, their graduate institutions, and whether they achieved academic positions in major American liberal arts and research/doctoral institutions. To the extent that one wishes to get more black Americans into faculty positions at major American colleges and universities, our tabulations suggest the need to increase the flow of black students into doctoral programs in major research institutions.

This conclusion presumes that hiring practices at American universities will remain the same and that perceptions of the quality of students at lesser programs, as well as the quality of training they receive, will remain unchanged. If federal funding for doctoral programs at HBIs could lead to high-quality programs that attract high-quality students, such funding may provide a viable option. Given the likely small scale of these programs and the complementary resources (e.g., libraries, faculty quality in other closely related fields) that they will have available (or unavailable) to them, one must question whether this option makes sense. Building better pipelines between the undergraduate HBIs and the Research I institutions' doctoral programs appears to be a preferred strategy.

Of course, increasing the flow of black Americans into faculty positions at major American colleges and universities is not an objective shared by all. Many people are justifiably concerned with simply increasing the production of black Ph.D.s, regardless of where they are ultimately employed. None of the research that we conducted in the third section really bears on methods to accomplish this objective, and this too is a subject for future research.

APPENDIX 4.1

Formal Statistical Models Used in the Analyses

THE DECISION TO ATTEND AN HBI

The decision to attend an HBI can be modeled as:

$$
\begin{aligned}
I^*_{1i} &= Z_i\gamma_1 + u_{1i}\\
I_{1i} &= 1 \text{ if } I^*_{1i} > 0\\
I_{1i} &= 0 \text{ if } I^*_{1i} \leq 0.
\end{aligned}
\tag{4.1}
$$

Here I^*_1 is an unobservable variable indicating desire to attend an HBI, Z is a vector of covariates that influence the probability of attending an HBI, γ_1 is a vector of coefficients, and u_1 is a normally distributed disturbance term with mean 0 and variance σ_{11}. While we cannot observe the value of I^*_1, without loss of generality the individual is assumed to enroll in an HBI ($I_1 = 1$) if the value of I^*_1 is greater than zero and not to enroll in an HBI ($I_1 = 0$) otherwise. Under these assumptions, equation 4.2 describes the probit model that was used to estimate the choice of college sector, where Φ is the standard normal distribution function:

$$P(I_{1i} = 1|Z_i) = \Phi(Z_i\gamma_1/\sigma_1). \tag{4.2}$$

BACHELOR'S DEGREE ATTAINMENT

Separate equations, by sector, were estimated for whether an individual attained a bachelor's degree by 1979. We assumed that:

$$
\begin{aligned}
BA79^*_{Hi} &= B_i\gamma_H + W_{Hi}\alpha_H + v_{Hi}\\
BA79_{Hi} &= 1 \text{ if } BA79^*_{Hi} > 0\\
BA79_{Hi} &= 0 \text{ if } BA79^*_{Hi} \leq 0
\end{aligned}
\tag{4.3}
$$

$$
\begin{aligned}
BA79^*_{Oi} &= B_i\gamma_O + W_{Oi}\alpha_O + v_{Oi}\\
BA79_{Oi} &= 1 \text{ if } BA79^*_{Oi} > 0\\
BA79_{Oi} &= 0 \text{ if } BA79^*_{Oi} \leq 0.
\end{aligned}
\tag{4.4}
$$

Here *BA79** is an unobservable variable indicating desire to attain a bachelor's degree. Without loss of generality, the individual is assumed to have attained a bachelor's degree by 1979 (*BA79* = 1) if *BA79** is greater than zero and not to have a degree (*BA79* = 0) otherwise. *B* is a set of explanatory variables describing individual and family background characteristics, and W is a vector of variables describing college characteristics that one might expect to influence bachelor's degree attainment. Assuming that v_H and v_O are normally distributed disturbance terms with zero means, equations 4.3 and 4.4 can be estimated by probit maximum likelihood.[30] Equation 4.3 is estimated using the subsample that attended HBIs and 4.4 using the subsample that did not attend HBIs.

In order to compute the average percentage differential of whether an individual would have been more likely to achieve a bachelor's degree had he or she attended an HBI, probit coefficient estimates were used from equations 4.3 and 4.4 to construct predicted values $\widehat{BA79}_H$ and $\widehat{BA79}_O$ for each individual. The predicted percentage differential for each individual was calculated as:

$$(\widehat{BA79}_H/\widehat{BA79}_O) - 1. \tag{4.5}$$

The predicted percentage differential was then averaged across individuals, by sector.

Bachelor's degree attainment equations, using data pooled across individuals in both sectors, were also estimated, treating HBI first as exogenous and then as endogenous:

$$\begin{aligned} BA79^*_{Bi} &= B_I\gamma_B + \delta_B I_{1i} + v_{Bi} \\ BA79_{Bi} &= 1 \text{ if } BA79^*_{Bi} > 0 \\ BA79_{Bi} &= 0 \text{ if } BA79^*_{Bi} \leq 0. \end{aligned} \tag{4.6}$$

Assuming that v_B is a normally distributed disturbance term with mean zero and variance σ_{BB}, equation 4.6 can be estimated as a probit using maximum likelihood. In order to treat HBI as endogenous, an instrument for it, I_1, was obtained through estimation of equation 4.2, which is described in the first section of this appendix.

The difference in the probability of receiving a bachelor's degree by 1979 if an individual attended an HBI was computed for each individual in the sample, and the individual differences were then averaged:

$$(1/N)\Sigma[\Phi(\{B_i\hat{\gamma}_B + \hat{\delta}_B\}/\hat{\sigma}_B) - \Phi(\{B_i\hat{\gamma}_B\}/\hat{\sigma}_B)]. \tag{4.7}$$

Here Σ indicates summation over all of the individuals in the pooled sample; the coefficient δ_B was estimated first treating attendance at an HBI as exogenous and then using the instrumental variable estimate.

WAGE EQUATIONS

Hourly wage equations for individuals in each sector (HBI, non-HBI) were first separately estimated. Let $LNWAGE^*_{Hi}$ be the hourly wage rate received if an individual attended an HBI and $LNWAGE^*_{Oi}$ be that value if he or she attended an other (non-HBI) college.[31] The following equations were assumed:

$$LNWAGE^*_{Hi} = X_i\beta_H + W_{Hi}\omega_H + u_{Hi} \quad (4.8)$$

$$LNWAGE^*_{Oi} = X_i\beta_O + W_{Oi}\omega_O + u_{Oi}. \quad (4.9)$$

Here X is a set of individual, family, and background explanatory variables that might influence wage rate, W is a vector of college characteristics, and u_H and u_O are mean zero, normally distributed disturbance terms with variances σ_{HH} and σ_{OO}.

Because individuals may systematically self-select into an HBI or a non-HBI (based on tastes, constraints, etc.), estimation of equations 4.8 and 4.9 on data from each sector separately, without taking into account the college sector choice decision, may result in biased estimates of the coefficients. Thus, the choice of sector must be added to the model. The choice equation of whether to attend an HBI was described by equations 4.1 and 4.2; 4.2 was estimated by maximum likelihood techniques.

For any individual in the sample, realizations of $LNWAGE^*_H$ and $LNWAGE^*_O$ will not both be observed. If $I_1 = 1$, then $LNWAGE_H = LNWAGE^*_H$; if $I_1 = 0$, then $LNWAGE_H$ is not observed. If $I_1 = 0$, then $LNWAGE_O = LNWAGE^*_O$; if $I_1 = 1$, then $LNWAGE_O$ is not observed. The conditional (on college sector choice) expectations of equations 4.8 and 4.9 are:

$$\begin{aligned} E(LNWAGE_{Hi}|X_i, W_{Hi}) &= E(LNWAGE^*_{Hi}|X_i, W_{Hi}, I_{1i} = 1) \\ &= X_i\beta_H + W_{Hi}\omega_H + E(u_{Hi}|I_{1i} = 1) \\ &= X_i\beta_H + W_{Hi}\omega_H + (\sigma_{H1}/\sigma_1)[\phi(Z_i\gamma_1/\sigma_1)/\Phi(Z_i\gamma_1/\sigma_1)] \quad (4.10) \end{aligned}$$

$$\begin{aligned} E(LNWAGE_{Oi}|X_i, W_{Oi}) &= E(LNWAGE^*_{Oi}|X_i, W_{Oi}, I_{1i} = 0) \\ &= X_i\beta_O + W_{Oi}\omega_O + E(u_{Oi}|I_{1i} = 0) \\ &= X_i\beta_O + W_{Oi}\omega_O - (\sigma_{O1}/\sigma_1)[\phi(Z_i\gamma_1/\sigma_1)/(1 - \Phi(Z_i\gamma_1/\sigma_1))] \quad (4.11) \end{aligned}$$

where ϕ is the standard normal density function, $\sigma_{H1} = \text{cov}(u_H, u_1)$, and $\sigma_{O1} = \text{cov}(u_O, u_1)$.

Heckman (1979) describes a method to estimate consistently the coefficients described in equations 4.10 and 4.11. Equation 4.2, the college sector choice probit, can be estimated on the entire sample using maximum likelihood. Utilizing estimates of γ_1 and each individual's characteristics, the inverse of Mills' ratio (λ_H or λ_O) can be calculated for each observation in the sample, where $\lambda_H = [\phi(Z\gamma_1/\sigma_1)/\Phi(Z\gamma_1/\sigma_1)]$ and $\lambda_o = -[\phi(Z\gamma_1/\sigma_1)/(1-\Phi(Z\gamma_1/\sigma_1))]$. Then the predicted inverse Mills' ratio can be added as an explanatory variable to the wage equations. The coefficients of the explanatory variables can then be consistently estimated when OLS is applied to the augmented equations:

$$LNWAGE_{Hi} = X_i\beta_H + W_{Hi}\omega_H + \theta_H\hat{\lambda}_{Hi} + v_{Hi} \tag{4.12}$$

$$LNWAGE_{Oi} = X_i\beta_O + W_{Oi}\omega_O + \theta_O\hat{\lambda}_{Oi} + V_{Oi} \tag{4.13}$$

where $\theta_H = \sigma_{H1}/\sigma_1$ and $\theta_O = \sigma_{O1}/\sigma_1$.[32] Equation 4.12 was estimated for the subsample that attended HBIs, and 4.13 for the subsample that attended non-HBIs.

One problem with the above analysis is that not all of the individuals in the sample are employed.[33] The switching regression model with more than one decision function is described by Maddala (1983). The two decisions—HBI versus other (non-HBI) college attendance and employment—fall under what Maddala terms a "joint model"; all four outcomes can be observed in the sample.[34] Thus the decisions are defined over all of the observations in the sample. The following (reduced-form) employment equation can be added to the above model:

$$\begin{aligned} I^*_{2i} &= N_i\gamma_2 + u_{2i} \\ I_{2i} &= 1 \text{ if } I^*_{2i} > 0 \\ I_{2i} &= 0 \text{ if } I^*_{2i} \leq 0. \end{aligned} \tag{4.14}$$

I^*_2 is an observable variable indicating desire to be employed, N is a set of covariates (including nonlabor income, number of children, and state unemployment rate) that influences individuals' employment outcomes, and u_2 is a normally distributed disturbance term with mean zero. While we cannot observe the value of I^*_2, the individual is assumed to be employed ($I_2 = 1$) if the value of I^*_2 is greater than zero and not to be employed ($I_2 = 0$) otherwise. If it is assumed that cov(u_2, u_1) $= 0$, then equation 4.14 can be estimated as a probit on the entire sample, the inverse of Mills' ratio calculated for those who are employed, and then the ratio added to equations 4.12 and 4.13.[35]

Next, to compute the average percentage hourly wage differential between attendance at an HBI versus other college attendance, coefficients from equations 4.12 and 4.13 were used to construct predicted values of $LNWAGE_H$ and $LNWAGE_O$ for each individual. More specifically, for a random individual who went to college in a certain sector and was employed in 1979, we ask what were his or her expected earnings in the HBI sector and what were they in the non-HBI sector. Thus, college sector choice (and employment status) is taken into account in the predictions.[36] The predicted percentage differential for each individual was calculated by:

$$[\exp(\widehat{LNWAGE}_H + .5\mathrm{var}\{\widehat{v_H}\})/\exp(\widehat{LNWAGE}_O + .5\mathrm{var}\,\{\widehat{v_O}\})] - 1. \quad (4.15)$$

The predicted percentage differential was then averaged across individuals, by sector.

Hourly wage equations that used data pooled across individuals in both sectors were also estimated; HBI was first treated as exogenous, and then as endogenous:

$$LNWAGE^*_{Wi} = X_i\gamma_W + \delta_W I_{1i} + v_{Wi}. \quad (4.16)$$

$LNWAGE^*_W$ is observed if $I_2 = 1$ (i.e., the individual is employed) and not observed if $I_2 = 0$. The procedure for estimating equation 4.16 is similar to that described above for equations 4.8 and 4.9, and the Heckman (1979) method was again utilized. As in equation 4.6, $I_1 = 1$ if an individual attended an HBI, and $I_1 = 0$ otherwise; an instrument for I_1 was obtained through estimation of equation 4.2, which is described in the first section of this appendix.

OCCUPATIONAL STATUS EQUATIONS

The methodology for estimating the occupational status equations, by college sector and for the pooled sample, is the same as that described in the previous section. The only difference is in the way that the average percentage occupational status differential between HBI and non-HBI college attendance (analogous to equation 4.15) was computed. Unlike the wage equation, where the dependent variable is a logarithm, the dependent variable in the status equation is an index. Hence, for occupational status the following was calculated for each individual:

$$(\widehat{SEI79}_H/\widehat{SEI79}_O) - 1. \quad (4.17)$$

This was then averaged across individuals, by sector.