Engineering Educational Opportunity: Impacts of 1980s Policies to Increase the Share of Black College Graduates with Major in Engineering or Computer Science

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The share of the U.S. population choosing to train as engineers has remained stubbornly fixed near 2 percent over the past 50 years, despite strong upward trends in the share of the population with college degrees. Figure 1 illustrates these trends, comparing U.S. born adults who turned 22 in the 1950s to those who turned 22 in later decades. Given the stability of the propensity to train in engineering, one might be tempted to conclude that the inclination to enter an engineering career path is predetermined, with no role for the influence of educational environment. However, the success of national efforts to increase the participation of black students in engineering during the 1960s, 1970s and especially during the 1980s confirms that it is possible to encourage students to engage in demanding engineering curricula. This chapter documents the persistent impacts of 1980s policies, particularly policies at Historically Black Colleges and Universities (HBCUs), on educational and labor market outcomes.

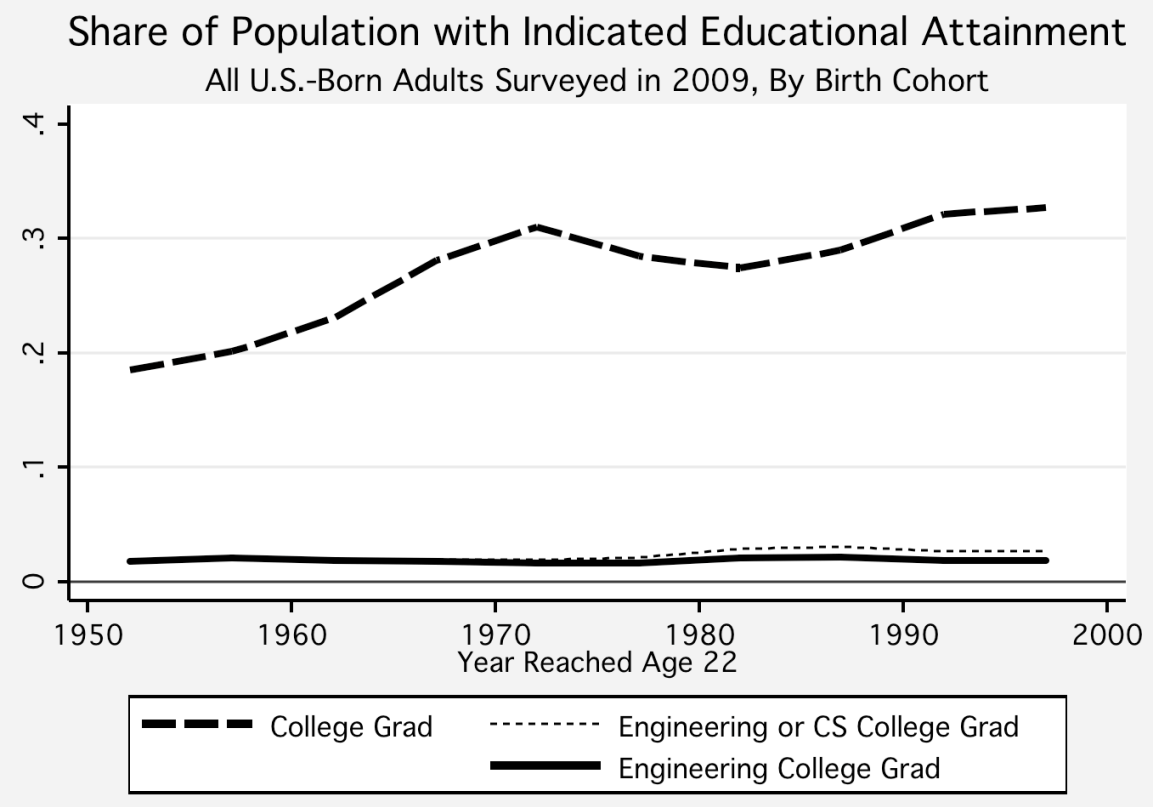

Figure 1—Share of U.S. Population Reporting College Degree, College Degree with Major in Engineering, or College Degree with Major in Engineering or Computer Science, by Birth Cohort (Year Reached Age 22, in Five-Year Intervals).

Sample: American Community Survey 2009, restricted to those born in the U.S. with current age range 32-81 (age 22 in 1950-1999)

Among college graduates educated between the 1950s and the 1970s, only 2 percent of black college graduates majored in engineering, compared to nearly 7 percent of all U.S. graduates. As a share of the entire birth cohort of black individuals who reached age 22 during these decades,

0.37 percent trained as engineers. This share more than doubled to 0.79 percent among those who turned 22 during the 1980s or 1990s, still far below the national rate near 2 percent (Figure 2). Today, a racial gap in the propensity to enter engineering remains, but the gains resulting from 1980s policies persisted through the 1990s and into the new century.

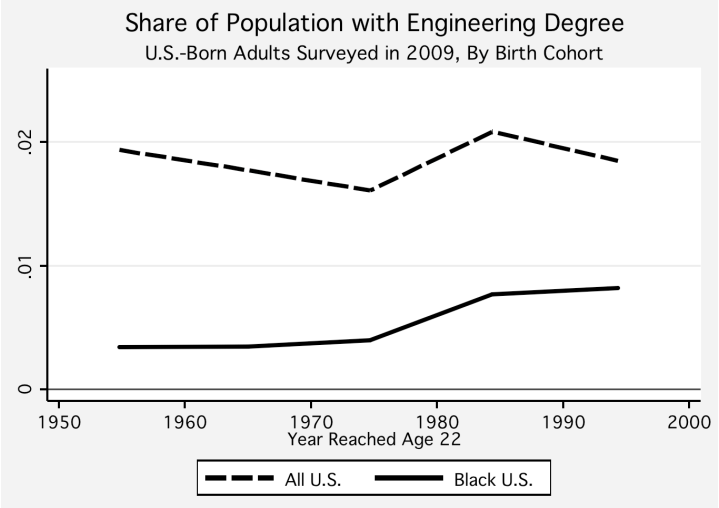

Figure 2—Share of U.S. Population Reporting College Degree with Major in Engineering, by Birth Cohort (Year Reached Age 22, in Ten-Year Intervals) and Race. *Sample: American Community Survey 2009, restricted to those born in the U.S. with current age range 32-81 (age 22 in 1950-1999), lower curve restricted to those indicating black or African American heritage*

Whether by fortuitous accident or insightful strategizing on the part of educational activists, the field of computer science did not emerge as a popular college major choice until exactly this period of expanding educational opportunities. Evidence presented later in this chapter suggests that 1980s policies at HBCU institutions prevented a large racial gap in the propensity to study computer science from ever becoming the status quo (Figure 3).

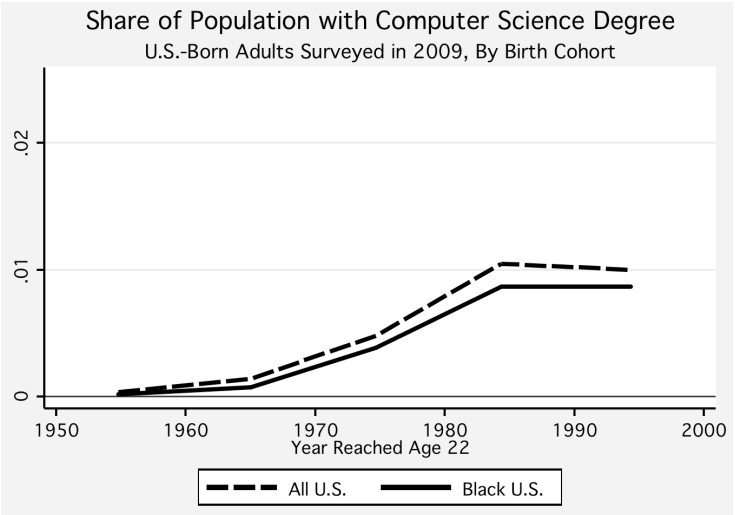

Figure 3—Share of U.S. Population Reporting College Degree with Major in Computer Science, by Birth Cohort (Year Reached Age 22, in Ten-Year Intervals) and Race. *Sample: American Community Survey 2009, restricted to those born in the U.S. with current age range 32-81 (age 22 in 1950-1999), lower curve restricted to those indicating black or African American heritage.*

Contemporaneous observers described the organized efforts of HBCUs during the 1980s to expand educational opportunities in engineering, computer science and other technical fields, "to prepare their students for expanded career choices" (Trent and Hill 1994). They describe an encouraging pedagogical environment that exemplifies the heart of what education can be: “They take students who may not have been well prepared in high school for careers in the ‘hard

sciences' and graduate them with degrees in science and engineering" (Trent and Hill 1994). While the focus of this study is a story about efforts to provide equal opportunity, this portion of our history provides useful lessons about successful strategies to improve and expand educational opportunities for all.

Background

As recently as the 1960s, a large share of black engineers were trained at one of only 6 HBCU campuses with an engineering program (HBCU6).[1] Each of these 6 campuses still plays an important role today. Four are public universities enrolling primarily in-state students: Prairie View A&M in Texas, Southern University and A&M College in Louisiana, North Carolina A&T State University, and Tennessee State (Agricultural and Industrial) University. The remaining two institutions, Howard University in Washington, D.C. and Tuskegee in Alabama, are private institutions with a somewhat wider geographic pull.

Soon after the passage of the 1964 Civil Rights Act, social activists joined forces with educators and also with engineering corporations concerned that they might face future sanctions. The resulting organizations began to organize well-funded efforts to expand the pool of qualified black engineers (Blackwell 1981, Lusterman). During the 1970s, the Sloan Foundation committed more than $12 million, and major engineering employers donated more than $15 million {note: I am still digging up numbers to estimate how much more money was involved, I think it was a lot more}. In the early 1970s, the Planning Commission for Expanding Minority Opportunities in Engineering produced a "blueprint for action" that treated this effort as an engineering problem with a multifaceted plan, and established several new organizations to oversee and implement the project (PCEMOE 1974, SWE 2004, Blackwell 1981). Mechanisms included funding to expand and improve programs at the HBCU6 institutions (lusterman, Blackwell 1981), funding to establish dual degree partnerships in which students at HBCU campuses with no engineering program would complete three years of preparation before transferring to complete their studies at an engineering institution, thousands of undergraduate minority engineering scholarships, and incentives for individual engineering programs to begin or expand recruitment efforts (PCEMOE 1974, Blackwell 1981, Lusterman). By 1983, nearly half of all U.S. engineering programs were actively recruiting minority students (Blackwell 1987).

Through the 1990s, opportunities for black students to enroll in engineering programs continued to expand. In the southern states, several historically black campuses added accredited engineering programs: Alabama A&M, Florida A&M, University of the District of Colombia, Morgan State (Maryland), Hampton University (Virginia), and the representation of black engineering students at other institutions continued to expand. In the most recent decade, additional engineering programs were accredited at Jackson State (Mississippi), South Carolina State, Virginia State, and Norfolk State (Virginia).[2] Growth spurred by the addition of new

[1] The exact share is impossible to determine because educational statistics by race were not collected until later.

[2] Since programs must be operational before they can be evaluated for accreditation, the actual dates of establishment are earlier. Accreditation dates are based on information provided at the website of *ABET*, Inc., formerly known as the *Engineer's Council for Professional Development* (1932-1980) and the *Accreditation*

HBCU programs was matched by equally strong trends toward inclusion at engineering programs across the country.

Estimating the True Magnitude of Trends

The first effort to collect nationally representative statistics on the racial composition of engineering graduates was conducted by the Engineering Manpower Commission (EMC) as part of their 1968-1969 survey of engineering programs. The six HBCU6 institutions accounted for 60 percent of all U.S. black engineering graduates reported in each of the first two years of the survey (EMC 1970, 1971). The EMC warns that data collected in the early years may exaggerate the degree of racial stratification because many institutions, but none of the HBCU6 institutions, left the racial counts blank. Unless these blanks were all true zeros, they would lead to an exaggerated picture of the contribution of the HBCU6 institutions. As administrators became accustomed to answering these questions, the counts may have become more accurate.

Evidence from other sources suggests that approximately half of all black engineering graduates were trained at the six HBCU6 institutions during the 1960s. The Project Talent longitudinal survey of students from the high school classes of 1960 and 1961 includes 8 black students who held bachelor's degrees in engineering when they were resurveyed 11 years after high school. Of the 8, 3 attended one of the HBCU6 institutions, and the remaining 5 attended northern institutions. While this example is suggestive, the sample is small, with 95 percent confidence interval suggesting anywhere between 10 and 75 percent of black engineering students might have been educated at the HBCU6 institutions. An additional source of information is the 1993 National Survey of College Graduates (NSCG93), a retrospective survey that asked a representative sample of college graduates where (and when) they attended high school and college. The data are recoded to regional-level indicators to protect confidentiality, but these do permit estimation of the proportion of black engineers educated during the 1960s who were trained in southern states. The sample is still relatively small (n=37), but a 95 percent confidence interval around this estimate suggests that between 42 and 75 percent were educated in the south—most likely in HBCU6 programs.[3] Although these data cannot provide a precise accounting, they help us understand the degree to which growing EMC counts reflect improved counting rather than true gains, and will allow us to estimate national counts during the 1960s.

The NSCG93 data also reveal that the vast majority of engineering college graduates attended high school and college on the same side of the north-south divide. When all cohorts are combined, 89 percent of high school graduates from the south attended college in the south (n=167), and 88 percent of high school graduates from the north attended college in the north (n=164). Despite the proliferation of engineering recruitment efforts, these patterns did not vary much over time. Among those graduating between 1976 and 1988, the corresponding statistics

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Board for Engineering and Technology (1980-2005).
http://www.abet.org/AccredProgramSearch/AccreditationSearch.aspx

[3] The NSCG93 data also reveal that, among 1960s black engineering graduates, between 47 and 80 percent attended high school in the south (n=37), and can be combined with data from the NSCG2003 to narrow this confidence interval to between 45 to 70 percent (n=64). The NSCG2003 public version does not include information about location of bacholor's degree.

are 90 percent (n=101) and 87 percent (n=122).[4] Hence, the impacts of the policy changes described above are likely to be geographically localized.

In the 1975-1976 academic year, the U.S. Department of Education began to count the number of black graduates in broad categories of academic field, but accredited engineering programs were initially combined with less rigorous technology subjects in aggregate statistics. Beginning in the 1982-1983 academic yearthe government counts by race and gender were collected at a finer level of detail, and began to correspond to EMC estimates. The data presented in Figures 4, 5 and 6 assemble all of the best available estimates of the annual number of bachelor's degrees in engineering earned by black men and women in the U.S. between 1959-1960 and 2009-2010.

Figure 4a depicts trends among graduates of HBCU campuses, with trends at the original six institutions indicated separately. This figure clearly depicts a sharp jump around 1980, with some later growth due to the addition of new HBCU campuses. Figure 4b depicts trends at other U.S. campuses, and shows a steep upward slope that lasted 30 years. In both figures 4a and 4b, estimates between 1968 and 1982 come from the EMC, and later estimates come from NSF. In the 1960s, the number of engineering graduates from the HBCU6 campuses is used as an estimate of the number of black graduates from these campuses, and is also used as an estimate of the number of black graduates from all other U.S. campuses.

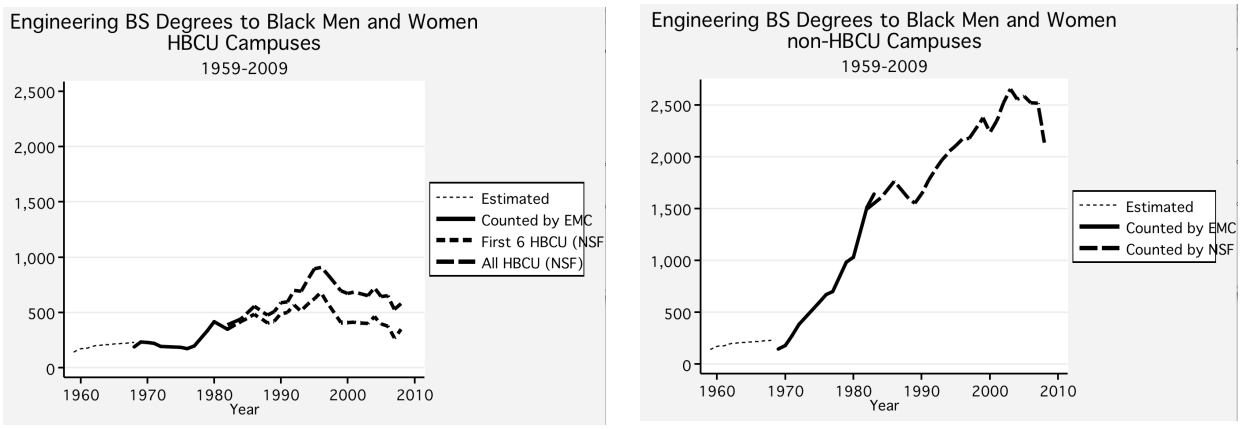


Figure 4—Number of Black Engineering Graduates from HBCU (4a) and Other (4b) Campuses, 1959-2009.

Figure 5 combines the counts from the two groups of institutions, and adds another trendline showing a slow rate of growth at southern institutions other than the HBCU campuses until the late 1980s. {note: only 4 data points so far}

[4] Among those who earned engineering degrees between 1944 and 1965, 22 percent of southern high school graduates (n=23) and 96 percent of northern high school graduates (n=18) attended college in the north.

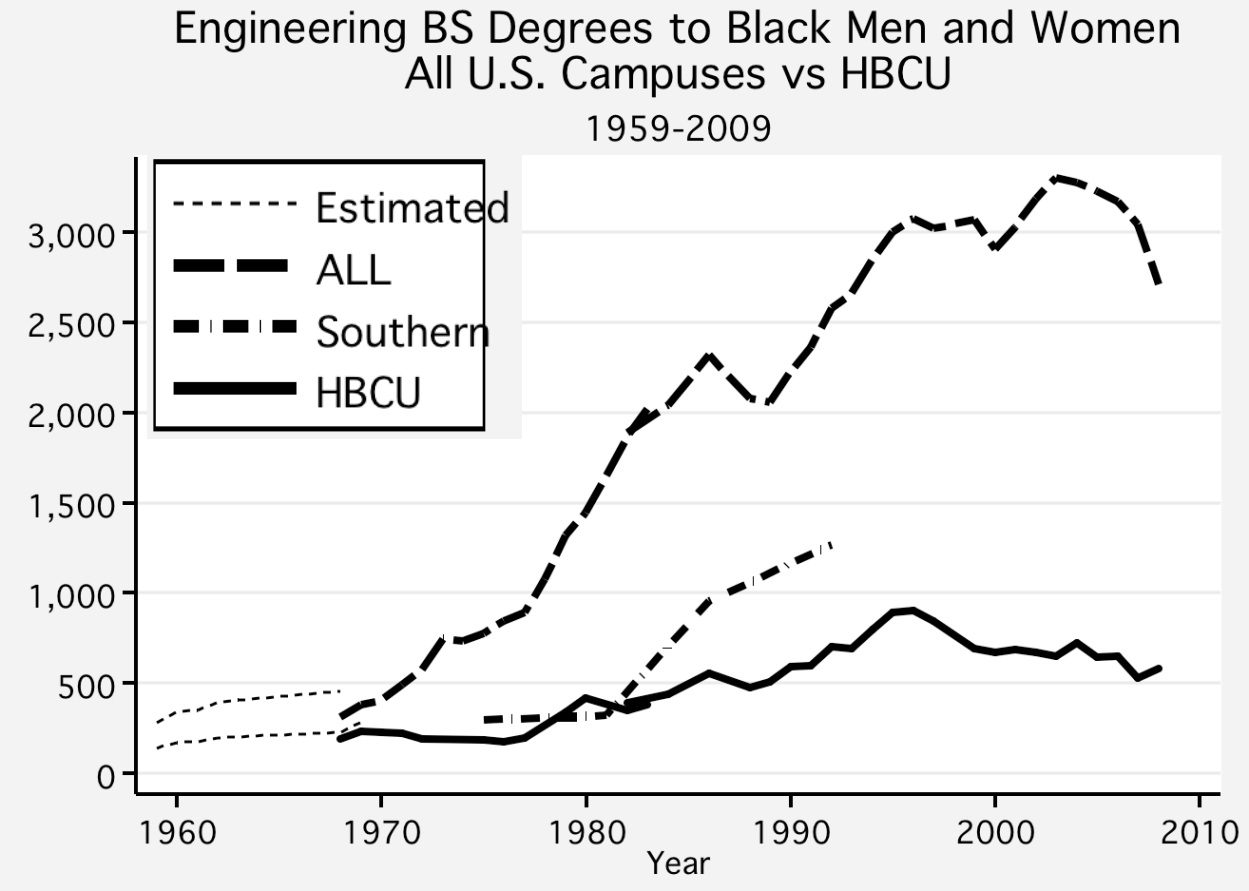


Figure 5- Number of Black Engineering Graduates from U.S. Campuses, 1959-2009.

The timing of changes suggest that students born in the north or the 6 states containing the HBCU6 institutions would have experienced rapid expansion of opportunities to study engineering between the 1970s and 1980s, but that only later cohorts of students from other southern states would have benefitted from the change. Figure 6, based on the same 2009 survey as figures 1-3, confirms that this is what happened.

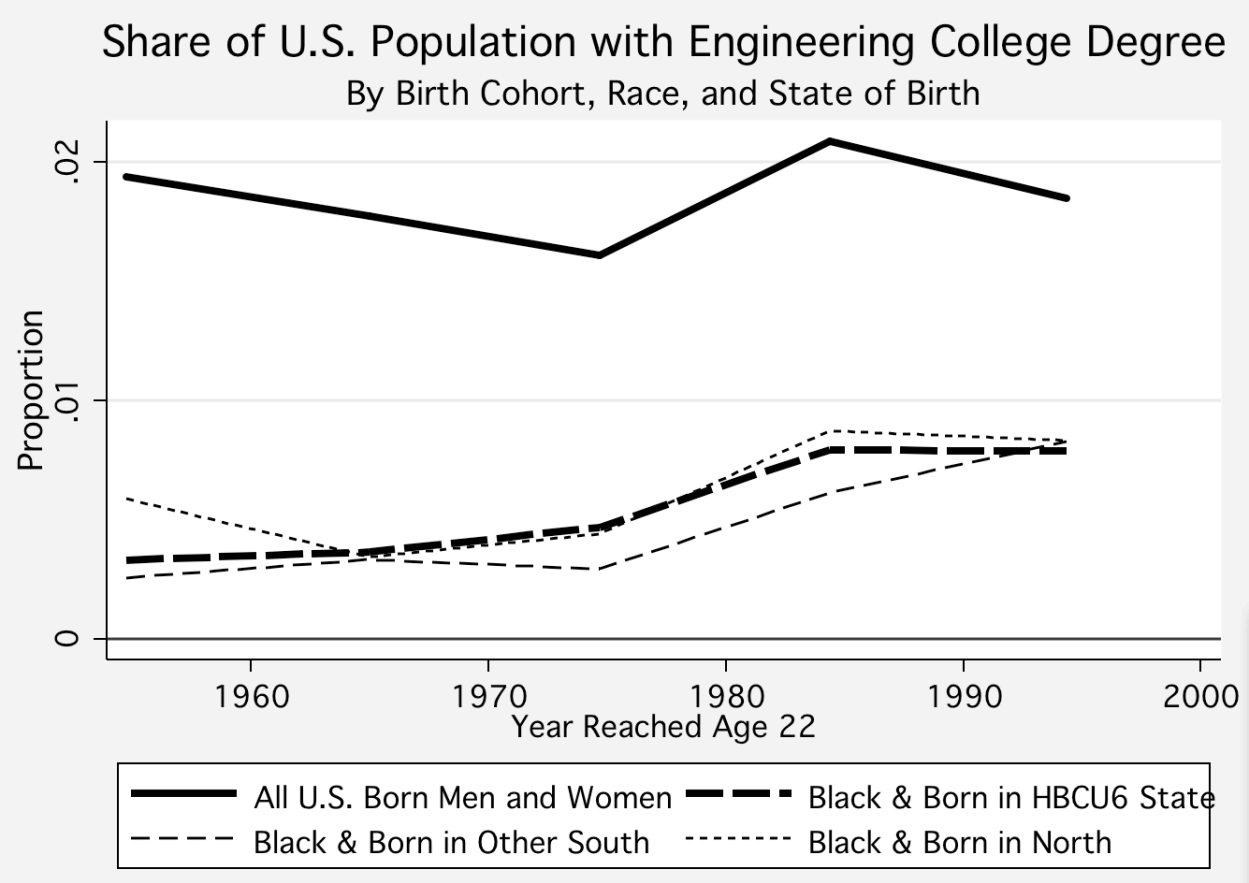


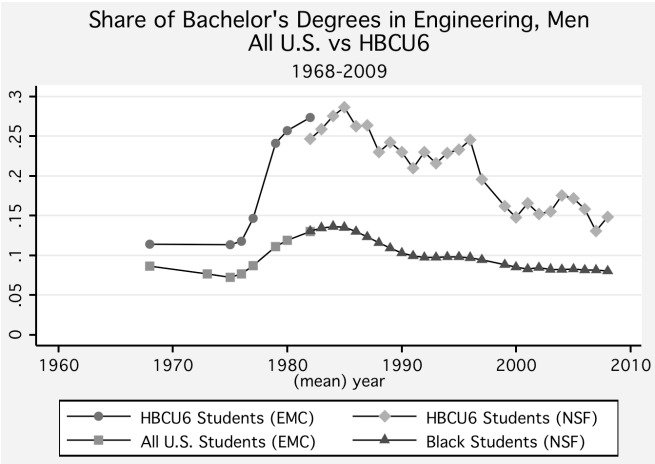
Figure 6- Regional Differences in Trends

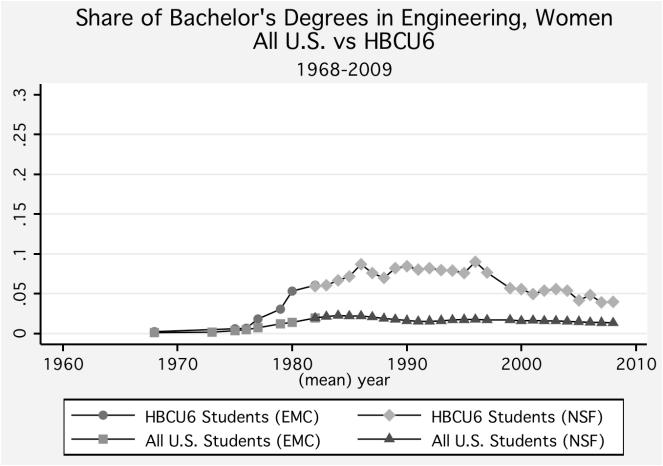
{add error bars}

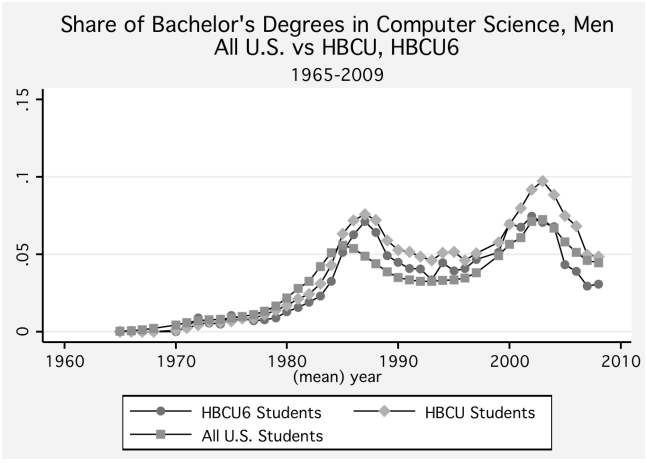
The impacts of the historical legacy of segregation and the geographic distribution of the HBCU6 institutions are evident in Figure 6. Expansion of opportunities to study engineering grew at similar rates among individuals born near the HBCU6 institution and those born in the north, but lagged behind among those born in other southern states. Institutional and historical features of the educational environment interacted with policy incentives, leading to uneven effectiveness of these policies across geographic regions.

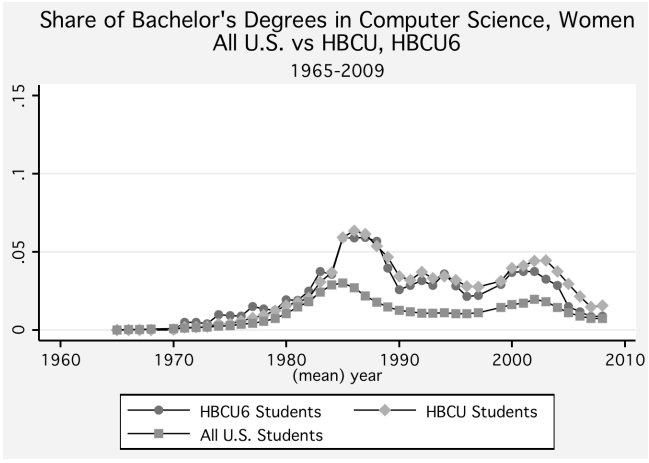
Gender—

Gender was an afterthought in national efforts to expand minority involvement in engineering and computer science careers. The "Blueprint for Action" does not mention women at all until page ***, though a halfhearted *** was added in a revision. And yet, the changes described above had a substantial impact on educational outcomes among both men and women, particularly at HBCU campuses.









The somewhat later effort to expand computer science programs at HBCU campuses had strong effects both at HBCU6 and other HBCU campuses, and had a relatively greater effect on women.

"The show doesn't go on because it's ready, it goes on because it's 11:30." Tina Fey

Effects on occupation and earnings coming soon…

Data Appendix

Figures 1-3 and statistics for birth cohorts described by the year of reaching age 22 are constructed from 2009 American Community Survey data, collected by the U.S. Bureau of Labor Statistics and provided as part of the IPUMS Project (cite rugges etc). The sample is restricted to individuals at least 31 years old, because this group is likely to have completed their education. Because the focus is on the U.S. educational system, individuals born in other countries are not included in the sample.

Individuals are coded as holding a college degree with a particular major based on either the first or second bachelor's degree major indicated.

All estimates are weighted by the person-specific weight.

Statistics conditioned on the actual year of college graduation are constructed from the 1993 and 2003 NSF National Surveys of College Graduates. These are representative samples of college graduates drawn from 1990 and 2000 Census respondents who indicated they were college graduates. The 1993 and 2003 surveys collected retrospective information about all college degrees, including field of degree and graduation dates. This sample is also restricted to individuals born in the U.S.

Appendix Table A-1—Share of College Graduates with Engineering Major, by Race and Cohort