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The American High School Graduation Rate: Trends and Levels

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THE AMERICAN HIGH SCHOOL GRADUATION RATE: TRENDS AND LEVELS*

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Abstract

This paper applies a unified methodology to multiple data sets to estimate both the levels and trends in U.S. high school graduation rates. We establish that (a) the true high school graduation rate is substantially lower than widely used measures; (b) the U.S. graduation rate peaked in the early 1970s; (c) majority/minority differentials are substantial and have not converged over the past 35 years; (d) lower post-1970 rates are not solely due to increasing immigrant and minority populations; (e) our findings explain part of the slowdown in college attendance and the rise in college wage premiums; and (f) growing high school graduation differentials by gender help explain increasing male-female college attendance gaps.

keywords: high school dropout rate; high school graduation rates; educational attainment.

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I. Introduction

The high school graduation rate is a barometer of the health of American society and the skill level of its future workforce. Throughout the first half of the 20th century, each new cohort of Americans was more likely to graduate high school than the preceding one. This upward trend in secondary education increased worker productivity and fueled American economic growth (see

Aaronson and Sullivan [2001] and Delong, Katz, and Goldin [2003]). In the past 25 years, rising wage differentials by education have increased the economic incentives to graduate from high school.[1] The real wages of high school dropouts have declined since the early 1970s while those of more skilled workers have risen sharply (see Autor, Katz, and Kearney [2005]). Heckman, Lochner and Todd [2008] show that the internal rate of return to graduating high school has risen to 50 percent in recent decades.

According to one widely used measure of high school completion issued by the National Center for Educational Statistics (NCES), U.S. students responded to these higher incentives by finishing high school at increasingly greater rates. Figure I plots the *high school status completion rate* overall and by race for each year since 1968 (Laird, Kienzl, DeBell, and Chapman [2007]). It is the percentage of 18- to 24-year-olds possessing a high school credential. By this measure—the most widely used in the literature—U.S. schools now graduate nearly 88 percent of students and black students have made substantial gains relative to non-Hispanic whites over the past four decades.

The NCES publishes a second measure of secondary schooling performance called *the 17-year-old graduation ratio* that is also plotted in Figure I. It is the number of public and private high school diplomas issued by secondary schools each year to students of any age divided by the size of the 17-year-old population size in the given year. This measure provides a very different assessment of the U.S. secondary schooling system.[2] Both the graduation ratio and status completion rate start at nearly the same level in 1968. However, unlike the status completion rate, the estimated graduation ratio peaks at 77 percent in 1969 and then slowly declines until suddenly reversing its long term trend starting around 2000.

It has been long noted that most of the growing discrepancy between the two measures is accounted for by the inclusion of General Educational Development (GED) certificates as graduates in the status completion rate (see Finn [1987], Frase [1988], Cameron and Heckman [1993]). A large

number of recent studies have debated the accuracy of these traditional measures and attempt to develop better estimates of the high school graduation rate (see Greene [2001], Swanson [2004], Swanson and Chaplin [2003], Miao and Haney [2004], and Warren [2005]). Heated debates about the levels and trends in the high school graduation rate have appeared in the popular press.[3] Depending on the data sources, definitions and methods used, the U.S. graduation rate is claimed to be anywhere from 66 to 88 percent in recent years—a wide range for such a basic educational statistic. The range of estimated minority rates is even greater—from 50 to 85 percent. It is also claimed that the many data sources available for computing graduation rates do not always yield comparable results (Mishel and Roy [2006], Warren and Halpern-Manners [2007]).

This paper reconciles these varying estimates and shows why such dramatically different conclusions have been reached. We find that when comparable estimators are used on comparable samples, a consensus can be reached on both levels and trends across all major data sources. After adjusting for multiple sources of discrepancy including differences in sample construction, we establish that (1) the U.S. high school graduation rate peaked at slightly over 80 percent in the early 1970s; (2) the high school graduation rate is both substantially lower than the commonly reported 88 percent status completion rate and higher than many recent estimates in the literature; (3) only about 65 percent of blacks and Hispanics leave school with a high school diploma and minority graduation rates are substantially below the rates for non-Hispanic whites. We find no evidence of convergence in black-white graduation rates over the past 35 years.

The high school graduation rate is of interest in its own right as a measure of the performance of American schools. It also has wider implications. The use of inflated measures of high school attainment strongly affects some commonly accepted empirical findings in labor economics. For instance, we find that up to 18 percent of the recent rise in the college-high school wage gap and 24 percent of the change in the college-dropout gap can be explained by improper

measurement of educational categories in Current Population Survey (CPS) data. Part of the slowdown in male college attendance rates documented by Card and Lemieux [2001] is due to declining rates of high school graduation among males. Half of the growing gap in female versus male college enrollments documented by Goldin, Katz and Kuziemko [2006] can be attributed to higher levels of high school graduation among females and declines in male high school graduation rates. Proper measurement has implications for the study of the effects of educational policy changes on secondary attainment rates. Many estimates of the effects of policies on high school graduation that are reported in the literature are based on poorly constructed graduation estimators that produce inflated levels and inaccurate time-trends.

The paper proceeds as follows. Section II reviews the recent debate about high school graduation rates. Section III shows how various adjustments affect estimated rates. Section IV synthesizes the discussion and presents estimates of historical patterns of graduation rates by race and sex. Section V presents evidence on how the trends in graduation that we document affect a number of interpretive issues in the economics of education. Section VI concludes.

II. The Graduation Rate Debate

Prior to the research of Cameron and Heckman [1993], it was widely believed that GED recipients were equivalent to high school graduates. Thus the growing difference in Figure I between the status completion rate that counts GED recipients as graduates, and the graduation ratio, was not a cause for concern. Their study, along with a large body of subsequent work summarized in Boesel, Alsalam and Smith [1998], showed this belief to be false. Although GED recipients have the same measured academic ability as high school graduates who do not attend college, on average, they have the economic and social outcomes of otherwise similar dropouts who do not exam certify (Heckman and LaFontaine [2006, 2008]). Despite having similar measures of

cognitive ability, GED recipients perform significantly worse in most dimensions of economic and social life when compared to high school graduates. GED recipients lack non-cognitive skills such as perseverance and motivation that are essential to success in school and in life (Heckman and Rubinstein [2001]). The GED opens education and training opportunities but GED recipients do not reap the potential benefits of these options because they are unable to finish the skill enhancement programs that they start. GED recipients attrite from the military at the same rate as other dropouts and they exit post-secondary schooling with nearly the same degree attainment rates as other dropouts who start with no credential (See Laurence [2008] and Heckman and LaFontaine [2008]).

With the passage of the No Child Left Behind (NCLB) Act in 2001, the federal government formally recognized the poor performance of GED recipients by excluding them from official measures of high school graduation. Currently, only those students who receive a secondary credential that is fully aligned with each state's academic standards are to be counted as high school graduates.[4] NCLB also renewed interest among researchers in estimating high school graduation rates because it made increasing high school graduation as one of its goals and required states and schools to monitor them as measures of adequate yearly progress (AYP). School districts and states that did not meet AYP requirements were sanctioned, primarily in the form of reduced federal funding.[5]

Using the new definition of who is a high school graduate, many scholars began to claim that the United States had a dropout crisis (see Greene [2001], Swanson [2004], Swanson and Chaplin [2003], Miao and Haney [2004] and Warren [2005]). These studies claim that contrary to the nearly 90 percent completion rate estimate that includes GED recipients, the true rate in recent years was closer to 70 percent. African-American and Hispanic rates were often calculated to be as low as 50 percent nationally (see Greene [2001] and Swanson [2004]). Historical trends in high school

graduation also came under closer scrutiny. In agreement with the earlier findings of Cameron and Heckman [1993], some scholars found that high school graduation rates peaked in the late 1960s and have since stagnated or fallen (see Chaplin [2002] and Miao and Haney [2004]).

In response to these studies, Mishel and Roy [2006] argue that graduation rates are not nearly as low as those reported in the recent literature. They argue that overall graduation rates are 83 percent and that minority graduation rates are 75 percent, rather than the 50 percent claimed by other researchers. This paper uses a variety of sources of data to examine these competing claims.

III. Estimating the U.S. High School Graduation Rate

At the outset, we clarify what this paper does and does not do. We estimate *high school graduation rates*. We are *not* estimating the stock of skilled labor by educational category, although that would be a useful task.[6] We are also *not* presenting a quality-adjusted high school graduation rate. Such a rate would adjust graduates, dropouts and GEDs by a scale reflecting the value of the stated education level in production.[7] We also do not estimate the option value conferred by the degree.[8] Like Mishel and Roy (2006), we are interested in estimating the high school graduation rate – the rate at which individuals in cohorts graduate high school through a normal process of matriculation, seat time and formal graduation.

In what follows, it is important to distinguish between a "*completer*" and a "*graduate*". Following the NCES convention, we use the term "high school *completer*" to indicate a person who either graduated high school or obtained an alternative credential (e.g., GED). High school *graduates* are those who receive a traditional high school diploma from an accredited high school program.

Using household surveys, school administrative data and longitudinal surveys, we recalculate national high school graduation rates by race and gender. We discuss the problems and limitations of each data source in detail and show that, after adjusting for a variety of sources of discrepancy

among alternative measures, all of these data sources give a consistent picture of U.S. graduation rates.

A. Census and CPS-Based Estimates

The Current Population Survey (CPS) is a monthly survey of approximately 50,000 U.S. households administered by the Bureau of Labor Statistics. It is primarily designed to track employment and earnings trends in the civilian non-institutional population.[9] The CPS also collects the educational status of each household member.

Every October, the CPS administers an educational supplement that asks detailed questions concerning the educational history and attainment level of each household member. The NCES uses this data to calculate the 18- to 24-year-old status completion rate depicted in Figure I. Several recent papers have discussed the problems that arise from using the status completion rate as a measure of secondary school performance (see, e.g., Chaplin [2002], Greene [2001], Mishel and Roy [2006], Sum et al. [2003], and Swanson and Chaplin [2003]). These studies claim that the status completion rate is a poor measure of the high school graduation rate because: (1) GED recipients are counted as high school graduates; (2) institutional and military populations are excluded from the CPS; (3) one household member responds for the entire household roster (proxy response bias); (4) the CPS is not able to locate all persons eligible for the survey (low sample coverage); and (5) recent immigrants, who were never enrolled in U.S. secondary schools, are included in the estimates.

Using decennial Census data, we assess the importance of each of these potential sources of bias for the true high school graduation rate. A sub-sample of the Census, the Integrated Public Use Microdata Series (IPUMS), contains more detailed education and demographic information than the CPS for both a 1 percent and 5 percent representative sample of the entire U.S. resident population. It is a useful tool for examining potential sources of bias in CPS-based estimates because it does not

suffer from many of the disadvantages of the CPS. First, its universe is more inclusive than that of the CPS because it samples both institutional and military populations. Second, coverage rates are significantly higher in the Census than in the CPS. Finally, the Census began asking immigration questions long before the CPS did so. Immigrants who did not attend U.S. schools can be identified and excluded from the calculation of the graduation rate starting with the 1970 data.

For our purposes, Census data have two important drawbacks. In contrast to the CPS supplements that are available on an annual basis, Census data are only available every ten years. In addition, the Census questionnaire does not distinguish between GED recipients and regular high school graduates. However, using data from the GED testing service and a method similar to that used by Laird et al. [2007], we are able to estimate the total number of GED recipients in each survey year for a given age range and deduct them from the total number of people reporting high school completion in the Census data. The estimated numbers of GED recipients using this method are in very close agreement with independent estimates obtained from survey data and are well within sampling error.[10] We employ these survey data sources to obtain estimates for the distribution of GED recipients by gender and race/ethnicity in each Census year.

Contrary to the claim of Mishel and Roy [2006], we do not find that the status completion rate based on the CPS provides a reasonable assessment of the graduation rate. It suffers from a number of sources of significant bias for the high school graduation rate and distorts trends both within and across groups.

Mishel and Roy [2006] make calculations similar to the ones made in this paper. However, they do not simultaneously correct for all of the biases or fully account for GED recipients in the Census data. When these adjustments are made, we find that the two largest sources of bias are inclusion of GED recipients as graduates and a form of response bias to the CPS education question. Low sample coverage of the CPS is empirically unimportant. Bias from the CPS exclusion

of military personnel is negligible. The exclusion of prisoners plays only a small role overall, but is important when computing race and gender differentials in graduation rates. We next discuss each of these points in detail and the effect of accounting for them on graduation rate estimates.[11]

The GED

The GED began as a small scale program designed to exam-certify veterans who interrupted their high school training to serve in the armed forces during World War II. Quinn [2008] documents how the GED program has shifted from its original mission of certifying older veterans to become a substitute for high school graduation among school-age youth. Over 700,000 high school dropouts attempt to certify as "high school equivalents" each year through the GED program and over 65 percent of test takers are under the age of twenty-four.[12] In 1960, only 2 percent of all new high school credentials were awarded through equivalency exams in the United States. Of all new high school credentials issued in the U.S. each year, currently 15 percent are obtained through GED certification.[13]

GEDs, on average, earn at the rate of dropouts. However, the GED is still generally accepted as the equivalent of a high school diploma for college admissions to many institutions and for eligibility to participate in job training and financial aid programs. Historically, GED recipients have also been counted as high school graduates in many official federal, state, and local education statistics.

Some states even issue state-accredited high school diplomas on the basis of GED test scores.[14] In New Jersey, for example, an individual can mail in GED test scores that meet the state's GED score requirement to qualify for a state-endorsed high school diploma. Candidates do not even need to reside in the state in order to qualify.[15] These credentials are then included in official state diploma counts issued by NCES and in calculations of state graduation rates.[16] In fact, in some

years, administrative data show that diplomas issued in New Jersey are greater than the total number of students enrolled in the 12th grade. Unsurprisingly, New Jersey is estimated to have one of the highest graduation rates in the country (see Greene [2001] and Swanson [2004]).[17]

Another troubling aspect of the GED program is its disproportionate use by minorities. The GED program conceals serious problems in minority educational attainment rates.[18] Historical trends in the status completion rate suggest that minorities are closing the secondary schooling gap with majorities (see Figure I). However, black male high school completers are almost twice as likely as white males to possess a GED certificate (Cameron and Heckman [1993]) and a substantial proportion of these GED credentials are produced in prisons. Prison GED recipients now account for over 10 percent of all GED certificates issued in the U.S. each year.[19] For black males, 22 percent of all GED credentials are produced by the prison system each year compared to 5 percent and 8 percent for white and Hispanic males, respectively.[20] Prison GED credentials have very low economic returns (Tyler and Kling [2007]). It is of great concern that measures that do not count these alternative credentials (obtained in prison or otherwise) as graduates still show large gaps between minority and majority groups as well as no convergence over the past 35 years.

Counting GED recipients as dropouts has a substantial impact on the estimated graduation rate (Table I(a)).[21] This table presents the change in the estimated graduation rate in the 2000 Census data under various sample restrictions and assumptions commonly made in the literature. All categories are mutually exclusive so that an individual is only counted once.[22]

The overall graduation rate is increased by 7.4 percentage points when GED recipients are counted as high school graduates. The increase is greater for males than for females, in part due to the high rate of GED certification among males in prison. Excluding GED recipients lowers black graduation rates more for blacks than for whites. The overall black rate falls by roughly 2 percentage points more than the overall white rate after excluding GED recipients.[23] Due in large part to the

disproportionate number of black males obtaining GED credentials in prison, the greatest bias occurs in the black male estimates—more than 10 percentage points.

Incarceration

There has been an explosion in the growth of the incarcerated population since the early 1980s.[24] In 2002, the total incarcerated population exceeded 2 million people.[25] Minority males, especially young black males, have been disproportionately affected by tougher anti-crime measures. Nearly one out of every ten black males age 18-24 is now incarcerated. It is estimated that more than one-third of all black male high school dropouts ages 20-35 were in prison on an average day in the late 1990s – a higher proportion than is found in paid employment (Western and Pettit [2000]).

Educational attainment among the prison population is extremely low.[26] Of all prisoners, seventy-eight percent are uncertified high school dropouts or GED recipients. Furthermore, 56 percent of the incarcerated high school completers obtain that status through GED certification.[27]

Excluding the prison population has only a small effect on the overall graduation rate, increasing it by slightly more than 1 percentage point (Table I(a)), but has more substantial impacts on race and gender comparisons.[28] Overall male rates are biased upward by 1.8 points when prisoners are excluded while overall female rates are virtually unchanged. Excluding the prison population decreases the estimated black-white gap in high school graduation rates by 2.4 percentage points. This change is even greater when the sample is limited to males. The black-white male gap is biased downward by nearly 4.6 points when the prison population is excluded, as it is in computing status completion rates based on CPS data.

These calculations are potentially very sensitive to the order in which they are performed. Table I(b) performs the calculations in a different order, reversing the roles of GED and prison. The numbers change somewhat. The black-white graduation gap closes by 2% (instead of 2.4%)

when prisoners are excluded. For males the gap is lowered by 3.7% (instead of 4.6%). Counting GEDs as high school graduates reduces the black-white graduation gap by only .7% (compared to 1.6% in Table I(a)) and by 2.3% (compared to 2.4% in Table I(a)) for females. These calculations demonstrate the importance of incarceration in distorting the statistics on black graduation rates. Tables I(c)-I(f) displayed in Web Appendix S.0 show results from other orders of decomposition. The conclusions of Tables I(a)-I(b) are generally robust to the alternative decompositions.

Armed Forces

In 2000, 91 percent of military recruits across all services were high school graduates; 7.4 percent were GED recipients, and only 1.5 percent were uncertified dropouts.[29] Most military personnel are high school graduates and excluding them could potentially bias the estimated high school graduation rate downward.[30] However, because the military is a relatively small segment of the population, excluding the military population from the CPS has only a minor effect on the overall graduation rate. The net effect of excluding armed forces personnel is one-tenth of a percentage point overall (Table I(a)). The estimates by race are also largely unchanged due to similar high school attainment rates among enlisted whites and minorities.

Immigration

Recent immigrants who never attended high school in the United States are a growing fraction of CPS-sampled 18-to-24-year-olds. Hispanics account for most of this group. Census data show that almost half of Hispanics in this age group immigrated within the last ten years. These recent Hispanic immigrants are primarily low-skilled Mexican workers who have significantly lower high school attainment rates than U.S.-educated Hispanics. The large influx of immigrants into the United States in the past two decades imparts a serious bias to both levels and trends.[31] A

meaningful evaluation of the performance of the U.S. educational system should not include people who never attended U.S. schools or those who did so only briefly.

To examine the effect of immigration on the graduation rate estimates, we exclude from the 20-24 year old sample immigrants who entered the U.S. within the past 10 years. Including immigrants biases the overall high school graduation rate downward by 2.6 points (Table I(a)). The largest bias is observed for Hispanic attainment rates—nearly 11 percentage points overall. Hispanic male rates are more strongly affected than Hispanic female rates by the inclusion of immigrants. In the next section we show that the trends in Hispanic graduation rates are also strongly affected by this bias. The migration of workers with low levels of education has increased substantially over the past 40 years.

Low Coverage and Response Bias

Low coverage rates are a potential source of bias in CPS data. This source of bias is distinct from the CPS exclusion of the non-civilian and institutional populations. Coverage is usually discussed in terms of the *coverage ratio*, defined as the population estimate for a given group divided by the known target population size for that group based on an independent data source. Overall, the coverage ratio of the CPS is .92. This means that the CPS population estimate for the civilian non-institutional population is 92 percent that of the Census count. Coverage rates vary substantially by age and race.[32] Young minority males are the least likely to be sampled. For example, the coverage ratio for black males ages 20-29 is only .66 in the CPS. In contrast, the coverage ratio for non-black males in this age group is .85. CPS sample weights are adjusted by race and sex to account for this known undercoverage in an attempt to eliminate potential bias.[33] However, Sum et al. [2003] argue that low coverage leads to an upward bias in CPS-based graduation rates, because those who are missed by the survey likely have lower educational attainments than the sampled population.

Using the Census data, we can partially assess the role of incomplete coverage in estimating graduation rates since Census coverage rates are much higher than CPS coverage. A concerted effort is made by the Census Bureau to obtain complete counts of the entire resident population every ten years including the military and institutional populations. As a result, the overall coverage ratio is .98.[34] Census coverage of minorities greatly exceeds that in the CPS data. The coverage ratio for black males and females age 20-29 in the Census data is .91 and .96, respectively. In addition, the inclusion of the incarcerated and military personnel in the Census data further mitigates the potential bias of CPS-based estimates.

To assess the role of undercoverage in biasing CPS-based estimates of high school graduation rates, we compare the educational attainment distributions in the CPS March 2000 demographic supplement with those found in the 2000 Census data for the civilian non-institutional population.[35] The CPS March and Census educational attainment question are essentially the same. Due to the similarity in the sample designs and timeframes, the estimates should be closely aligned in the two surveys.[36]

The overall population totals for 20-24 year olds in the civilian non-institutional population are nearly identical in the two data sources. The CPS underestimates those with low educational attainments and more so for minority groups (Table II). The CPS overestimates the fraction of high school completers (both GEDs and high school graduates) in the 20- to 24-year-old population relative to the Census and undercounts uncertified dropouts. As a result, the overall completion rate based on the CPS data is nearly 2 percentage points higher than the Census and this difference is even greater for minority groups.

A closer examination of the distributions of educational responses in the two data sources reveals that the data align across all educational categories with the exception of two.[37] The CPS substantially undercounts dropouts who completed 12th grade, but received no diploma and

overestimates the percentage of high school graduates who did not attend college relative to the Census (Table II). The difference between the two data sources in the number of dropouts reporting all other grade levels (completing 11th grade or less) is negligible for all groups with the exception of black males.

Given that the CPS underestimates the number of dropouts in only one educational category, it is unlikely that low sample coverage is the source of the discrepancy. If the discrepancy in the number of dropouts is due to undercoverage, we would expect a more uniform pattern of undercounting across all of the lower education categories (11th grade and less).

A number of Census Bureau reports have discussed errors that arise in measuring the 12th grade no-diploma category. Singer and Ennis [2003] show that the 12th grade no-diploma responses showed the highest rates of inconsistency when respondents are reinterviewed. Scanniello [2007] reports similar discrepancies when comparing educational responses in the CPS March against the Census-conducted American Community Survey data (ACS). The ACS is a new survey similar in sample design, mode of administration and coverage to the IPUMS.

Scanniello suggests that the discrepancy in the 12th grade, no-diploma category likely results from differences in survey administration. Census Bureau surveys are primarily administered through a mail questionnaire while the CPS is primarily conducted through telephone interviews. It appears that respondents are able to more accurately distinguish between the two categories in the Census and ACS data for two reasons. First, respondents see the available choices when responding to the paper-based ACS and Census surveys whereas the choices are read to them over the phone in the CPS. This may be particularly important for getting respondents to distinguish between completing 12th grade with no degree and finishing with a diploma. Second, the ACS and Census instrument allows each member of the household to fill out questions that pertain to them rather than have one person respond for the entire household as is the case in the CPS. CPS proxy

respondents are unlikely to be able to distinguish between someone who completed 12th grade with or without a diploma.[38]

The final two rows of Table II summarize our findings by estimating the total bias in the CPS design as well as the total bias in the CPS-based status completion rate by race. The CPS design bias is calculated as the total bias resulting from the undercount of dropouts and the exclusion of prisoners and military personnel from the sample. This source of bias results in the CPS overstating high school completion by 3 points overall and by over 5 points for blacks. The total bias calculation adds the bias resulting from assuming that GED recipients are high school graduates to the previous survey design bias totals. The 2000 CPS status completion rate overstates the graduation rate by 8 percent overall and over 15 points for blacks. In 2000, the bias in using the status completion rate as an estimate of the Hispanic high school graduation rate in 2000 is very small. The inclusion of recent immigrants offsets the other sources of bias.[39]

B. Common Core of Data Estimates

The Common Core of Data (CCD) are collected on an annual basis from state departments of education. They report the number of students enrolled in each grade level as well as the number of high school diplomas issued. From these data, an approximate cohort high school graduation rate can be calculated by dividing the number of diplomas issued in a given year by the number of entering ninth-grade grade students four years earlier. Some measures adjust the enrollment and diploma counts for migration between states while others average one or more years of enrollment data to form a smoothed estimate of the entering freshman class. This data source has become more valuable and widely used today because it is the basis for estimates at the state, district and even school level, as required by NCLB. Most recent national graduation rate estimates based on CCD data are between 68-70 percent – substantially lower than those reported in the previous section

based on household survey data (see Greene [2001], Swanson and Chaplin [2003] and Warren and Halpern-Manners [2007]).

The primary reason for this discrepancy is due to the use of 9th grade enrollments in the denominator (Miao and Haney [2004] and Mishel and Roy [2006]).[40] The CCD data do not report estimates of the number of entering ninth graders. Instead they report the total ninth-grade *enrollment* in each year. Upper level students are typically held back at the 9th grade. This causes CCD estimators that use 9th grade enrollments to be biased downward because they double count the retained students in the denominator.

To gauge the magnitude of this bias, we proxy grade retention by calculating the ratio of 9th grade enrollments to 8th grade enrollments in the previous year expressed in percentage terms for public schools (see Figure II). In the mid-1950s, fall 9th-grade enrollment counts were nearly identical to the previous year's fall eighth-grade class size. By 2000, they were over 13 percent larger. Ninth-grade retention bias is even greater for minorities than for whites. Minority 9th grade enrollments are often 20-26 percent greater than the previous year's 8th enrollment count, as opposed to only 6-10 percent for whites. This severely biases estimated minority graduation rates downward relative to those of whites if one uses 9th grade enrollment in the denominator. The claim that only 50 percent of minorities graduate high school is based on this biased estimator.[41]

To avoid this problem, we use the previous year's eighth-grade enrollments to proxy for the entering ninth-grade class. This estimator—first used by Miao and Haney [2004]—avoids the problem of ninth-grade retentions and produces estimates that are consistent with Census and all other data sources. Figure III plots the estimated trends in public school graduation based on this estimator for the graduating classes of 1960-2005. By this measure, the overall U.S. graduation rate steadily increased throughout the early 1960s and peaked in the early 1970s. It then steadily declined from this point until the early 1980s. Graduation remained stagnant throughout the 1980s until

declining sharply during the early 1990s only to rebound again after 2000. However, even with this recent surge, the U.S. high school graduation rate today is still below the peak attained during the early 1970s.

The bias for minority graduation rates is substantial. In 1960, the bias associated with dividing by the 9th grade enrollment rather than 8th grade enrollment was negligible. In recent years, the difference between the two estimators is as large as 9 points overall and 14 points for minorities. For the 2000 Census cohort, the 9th grade estimator yields an overall graduation rate of only 68 percent. This is very different from the Census estimate of 77 percent. Estimated minority graduation rates miss the mark completely. The Hispanic rate is 52 percent, while the black rate is 50 percent. Both estimates differ substantially from those obtained from both the Census and the eighth grade-based measure.[42]

Comparisons between the CCD and Census micro-data estimates are in close agreement. Assuming that students graduate at age 18, comparing the CCD estimates for the graduating classes of 1994-1998 to the 2000 Census estimates for those ages 20 to 24, we find that the two data sources agree. The overall Census estimate for these graduating cohorts is 77.1 percent while the CCD estimate is 76.6 percent. The predicted rates for whites, blacks and Hispanics in the Census are 81 percent, 66 percent, and 63 percent, respectively. Using CCD data, we estimate rates of 80.5 percent, 62 percent, and 65 percent, respectively.[43]

While the Census and 8th grade estimator generally agree in levels and exhibit the same overall trends in graduation over time, the 8th grade estimator consistently produces slightly lower overall estimates (~ 1 percent) than the Census and longitudinal data sources over time. For minorities, the disparity between the two sources is greater – generally 3 to 5 points. The discrepancy likely arises from the inclusion of more types of diplomas in the Census estimator. Many post-high school training and education programs such as Job Corps, Adult Basic Education and Adult

Secondary Education also issue state-endorsed regular high school diplomas that are not counted in the CCD school-based data. The diplomas issued by these programs are relatively small overall since their primary focus is on GED certification.[44] However, these post-schooling diplomas are more important for estimating minority rates since enrollment in these programs draws heavily from minority populations. CCD-based measures provide the best available indicator of the performance of American public schools while the Census and other survey data are more indicative of final attainment.

IV. Historical Trends and Comparisons across Data Sources

Historical trends in high school graduation have received less attention than measurements of contemporary school performance. Both Miao and Haney [2004] and Heckman and Rubinstein [2001] find that the national graduation rate has declined since the late 1960s. Mishel and Roy [2006] argue that progress has been made and gains are substantial among minorities. We confirm the finding of lower post-1970 graduation rates found using CCD data across a wide range of survey data sources. All sources agree and exhibit the same general patterns exhibited in Figure III. Contrary to previous claims in the literature, racial gaps in graduation have remained largely unchanged since the 1950 birth cohort. Convergence between minority and majority groups based on the traditional measures as depicted in Figure I can be fully accounted for by differential GED certification and incarceration rates.

C. Census

Combining Census data with a number of independent data sources, it is possible to construct high school graduation measures by race and sex that exclude GED recipients in each available Census sample. We use GED testing service and survey data to estimate the race and gender distributions of

all GED recipients ages 20-24 and 25-29 in each Census from 1970 through 2000.[45] This allows us to compute estimates of graduation rates by race and sex for two cohorts that, together, span the entire 10 years between each of the available decennial Census samples.

Table III shows estimated graduation rates by cohort and race. These rates exclude recent immigrants and do not count GED recipients as high school graduates. Consistent with the findings based on CCD data, the highest estimated graduation rates are for the first two cohorts and stand at nearly 81 percent. The graduation rate declines to 77 percent in the most recent Census. The Census estimates are in near perfect agreement both in levels and trends with those estimated from CCD data using the 8th grade estimator shown in Figure III.

Unlike the CCD data, the Census data allow us to compute long term historic trends in graduation by race and gender. They show little or no progress. For example, the gap between black males and white males is 17.4 percent for 20-24 year olds in 1980 and is nearly identical to that for 20-24 year olds in the 2000 Census (18.1 percent). The corresponding gaps between white males and Hispanic males (excluding immigrants) are, respectively, 17.4 percent and 18.6 percent for these two cohorts. We also estimate the bias due to including recent immigrants in the Hispanic calculations by computing Census rates that include these individuals. The bias that results from including recent immigrants has grown from 2 percentage points in the first cohort to nearly 9 points for the latest cohort.

Calculations by gender reveal very different patterns for males and females. The decline in high school graduation is concentrated almost exclusively among young males (Table III). Female rates have remained nearly constant throughout the past 40 years. The forces affecting the increasing high school dropout rate operate more strongly on men than on women.

Popular conceptions about historical trends in high school attainment for different race and sex groups comes primarily from the NCES-issued status completion rate shown in Figure I. The

Census calculations presented here are at odds with the rate shown in Figure I. Table IV shows how misleading status completion rates are for measuring trends in graduation rates between different race and gender groups. Overall, the difference in levels between the CPS status completion rate and the Census-based graduation estimates has grown from only 1 percent for 20-24 year olds in 1970 to around 10 percent in recent years. The combination of higher GED certification and incarceration rates has led to even large discrepancies for black males. The CPS-based status completion rate now overestimates graduation rates for this group by 21 percentage points.

D. Longitudinal Data

Longitudinal data offer many advantages over household-based surveys for computing more accurate measures of educational attainment. First, they avoid proxy bias. Education questions are asked directly of the individual and are verified during follow-up surveys. In many longitudinal surveys, the education responses of the individual are verified through official high school transcripts so that a more detailed and accurate educational history for each individual can be formed. Sample attrition is one potential source of bias in longitudinal data. As members of a sample leave the survey for various reasons (e.g., death, survey refusal, survey design), the remaining sample may no longer be representative of the underlying population.

Comparing estimated graduation rates across four cohorts of National Longitudinal Surveys (NLS) data confirms the major conclusions of the Census and CCD analysis.[46] The highest overall estimates are obtained for those born between 1946 and 1950 (Table V). The graduation rate then declines slightly in the first NLSY79 cohort (those born 1957-1960) until falling off for those born after 1960. This is very similar to the pattern observed in the Census as shown in Table III. By the last NLS cohort, the 1980-1984 birth cohort, the overall graduation rate has fallen nearly 4 points relative to the early NLS cohort. An additional longitudinal dataset, the National Longitudinal Study

of Adolescent Health (AddHealth) survey, confirms the low estimates found in the most recent cohort (NLSY97). AddHealth respondents were born during the same period as the NLSY97 sample and the estimated rates are nearly identical for all race and sex groups across the two surveys.

Estimates by race and sex are also in agreement with Census estimates and confirm the low graduation rates for minority students found in Census and CCD data. The NLS male graduation rate declines sharply while the female rate is stagnant. As observed in Census data, the black rate rises from the earliest NLS68 cohorts and then remains stagnant from both NLSY79 cohorts through the NLSY97 cohorts. The NLSY79 estimates a high school graduation rate of 69.7 percent for blacks born from 1957-1960. The estimate for blacks born 25 years later is a slightly lower 69.1 percent. The levels in black graduation rates by cohort are consistent with those obtained from Census data.

E. Comparisons Across Data Sources

Recent studies of the high school graduation rate report widely different and often contradictory estimates. We find that when similar methods are used on identical populations, estimated graduation rates are in substantial agreement both in trends and levels for all race and sex groups. We summarize our analysis by comparing the estimates obtained from the Census household data, correcting for GED recipients and recent immigration, with those obtained from longitudinal data sources such as the NLSY surveys, as well as the estimates obtained from NCES and CCD data. In addition to the data sources discussed so far, we add the National Survey of Families and Households (NSFH).[47] Figure IV presents the estimated graduation rates across different birth-year cohorts and data sources. Rates for the same cohorts, using the same definition of high school graduation, are in agreement across all data sources in both overall levels and trends.

V. Investigating the Causes and Consequences of Declining Graduation

The U.S. high school graduation rate declined throughout most of the entire post-1970 period. Our findings have important consequences for understanding a number of first-order economic questions.

A. Skill Price and Wage Gap Estimates

A large literature documents increases in the economic return to college graduation relative to high school completion or dropping out of high school since the late 1970s. This increase was concentrated among younger workers (Card and Dinardo [2002]). Throughout the 1980s, the real wages of dropouts and high school completers declined (Autor, Katz and Kearney [2005]).

A substantial fraction of the measured growth in the college-high school premium and the decline in the real wages of dropouts relative to college graduates in recent decades can be explained by the growth in GED certification over this period. Both before and after certification, GED recipients on average earn more than uncertified high school dropouts and less than high school graduates. Growth in GED certification leads to a decline in both the estimated return to graduating high school as well as the estimated return for those who drop out.

Table VI reports estimates of the contribution of the GED to distortions in measured skill prices between educational categories for younger workers over the period of the 1980s to early 1990s, based on NLSY79 data.[48] There is a dramatic change in GED recipiency from the oldest NLSY79 cohort to the youngest (see panel A.) The percentage of GEDs among reported high school graduates increases from 9% to 20%. The percentage of dropouts who receive a GED increases from 38% to 60%.

There is a sizeable change in conventionally measured college-high school gaps in earnings, weekly wages and hourly wages over the same period for 25-29 year olds (see panel B). "College"

here means having a four year degree or higher. "High school" means the standard measure used in the literature: those who either graduated with a diploma or are exam-certified GED recipients. A bias arises from measuring college-high school gaps when high school completers and GED recipients are lumped into one category in log wage regressions. The estimated bias is reported in panel C. The bias is the difference in the estimated college-high school gap between a procedure that aggregates GED recipients into the high school category (Model 1) and a procedure that disaggregates them (Model 2). The downward bias in estimated wage returns that results from assuming that the two types of high school completion status produce the same wages more than doubles over the sample period. This is true for all compensation measures. The percentage of the nominal college-high school compensation gap explained by the GED is reported in panel D. It increases from 6.1% to 9.5% for annual earnings, from 3.3% to 6% for weekly wages and from 2.6% to 5.9% for hourly wages.

The last panel, at the base of Table VI, reports the percentage of the overall change in the indicated gap that is explained by misclassifying GEDs as high school completers—the common practice in the recent literature. For the college-high school wage gap for 25-29 year olds, 18% of the growth in the gap in annual income, 13% of the growth in the gap in weekly wages and 14% of the growth in the gap in hourly wages is due to misclassification bias.[49] The gap is greater for annual earnings than for other compensation dimensions. This reflects the lower labor supply of GEDs compared to high school graduates.

A parallel set of calculations for the college-dropout gaps for ages 25-29 year olds (panels E, F and G) shows that misclassification also plays a substantial role in explaining levels and trends of this measured wage differential. The bias is generally larger than for the college-high school graduate gap (compare panel D with panel C), but the percentage of the gaps explained by misclassification are generally smaller (compare panels D and G). From the bottom panel, we see

that 24% of the growth in the college-dropout gap in annual earnings, 14% of the weekly wage gap and 5% of the hourly wage gap is due to misclassification bias.

Improperly accounting for GED recipients also leads to different conclusions regarding relative wage trends by education. Using March CPS data, Autor, Katz and Kearney [2005] estimate that real high school graduate weekly wages declined by 9.9 percent between 1979 and 1995. Using NLSY79 data, we find a similar 10.5 percent decline in weekly wages over a similar time frame (from a .215 to .193 log point gap relative to dropouts). However, almost all of the measured decline is due to growth in GED certification. Separating GEDs from regular high school graduates reveals that high school wages were stable over this period (.225 to .221).

Compensation gaps by race and gender for persons classified as terminal high school graduates are also affected by treatment of GEDs. Table VII reports OLS and median regression results that compare the annual earnings, weekly wage and hourly wage differences of high school completers across different race/gender/ethnicity groups. A greater fraction of minority relative to majority and male relative to female high school completers come via GED certification. As a result, minority-majority annual earnings gaps for high school completers are biased upwards, sometimes substantially so. The effects are generally stronger for annual earnings because of the lower labor supply of GED recipients. Gaps based on median regressions are less sensitive and are generally smaller.

B. The Slowdown in the Supply of Skilled Labor

The conventional explanation for the rising college-high school wage gap is the slowdown in the relative supply of college-educated labor in the face of rising demand for highly skilled labor (Katz and Murphy [1992]). Declines in high school graduation account for a substantial portion of the recent slowdown in the growth of college educated workers.[50] The slowdown is not due to

declines in rates of college attendance among those who graduate high school (Figure V) but instead is due in large part to a growing fraction of youth who do not complete high school.[51]

We perform standard growth accounting by decomposing the change in college graduation $\Delta P(D)$, where "Δ" stands for change and P(D) is the probability of getting a 4 year college degree (D), into the following components:

$$\Delta P(D) = [\Delta P(H)*P(C|H)*P(D|C)] + [P(H)*\Delta P(C|H)*P(D|C)]$$
$$+[P(H)*P(C|H)*\Delta P(D|C)]+ P(C|H)*\Delta P(H)*\Delta P(D|C)$$
$$+P(D|C)*\Delta P(H)*\Delta P(C|H) + \Delta P(H)*\Delta P(C \mid H)*\Delta P(D \mid C)]$$

where P(H) is the probability of graduating high school, P(C|H) is the probability of attending college given high school graduation and P(D|C) is the probability of obtaining a four year degree given college attendance. The results of this decomposition based on the estimates presented in Figure V are reported in Table VIII. The growth in college attendance and graduation for cohorts born before 1950 was primarily fueled by growth in high school graduation. This contribution diminishes and turns negative in more recent cohorts. All post-1950 growth in college graduation comes through increases in college attendance conditional on graduating high school and degree completion given the choice to attend college.

Table VIII also reveals that the greater decline in high school graduation rates among males relative to females accounts for a substantial part of the differential growth in college attendance for women discussed in Goldin, Katz and Kuziemko [2006]. Men now graduate from high school at substantially lower rates than women. For recent birth cohorts, the gap in college attendance between males and females is roughly 10 percent. However, the gap in college attendance given high school graduation is only 5 percent. Approximately half of the growing gender gap in college going

and a large part of the sluggishness in the growth of college-educated labor during a period of rising economic return to college education can be explained by declining rates of high school graduation.

C. Potential Causes of the Growth in Dropouts

This paper show that the fraction of native-born high school dropouts has increased. The U.S. has now fallen behind other OECD countries in measures of secondary schooling attainment as well as student performance (OECD [2006]). The origins of this dropout problem have yet to be fully investigated, and we believe this is an important area for future research. However, a few candidate explanations have emerged. One potential explanation is increasing educational standards in the presence of relatively easily acquired alternative credentials such as the GED. A series of studies have linked high stakes testing and stiffer educational standards to increased GED test taking (see Lillard and DeCicca [2001] and Warren, Jenkins and Kullik [2006]). Exploiting an exogenously mandated increase in the GED passing standard, Heckman, LaFontaine and Rodriguez [2008] show that raising GED passing standards lowers state level high school dropout rates, especially for minorities. As educational standards are raised, students appear to use the more easily acquired GED credential as a way to circumvent the newer standards.

There is also a lot of evidence suggesting a powerful role for the family in shaping educational and adult outcomes. A growing proportion of American children are being raised in single parent families and for an increasing fraction of their childhoods (See McLanahan [2004]). Children reared in these adverse environments are more likely to drop out of high school (McLanahan and Sandefur [1994]). The analysis of Krein and Beller [1988] shows that boys in single parent homes complete less schooling than girls, which may help to explain divergent trends in dropout rates by gender. Heckman [2008] and Cunha and Heckman [2009] present evidence on this issue.

VI. Conclusion

The U.S. high school graduation rate is neither as low as some claim nor as high as many believe. When the same definition of "high school graduate" is applied to comparable populations, we show that all major data sources agree.

Differences in data and methodology documented in this paper produce the large discrepancies in estimates that appear in the recent literature. Recent estimates based on CCD data are substantially biased downward by growth in ninth-grade retentions. This problem can be avoided by using eighth-grade enrollment as the benchmark entering population since retention in this grade is low. This estimator aligns with estimates from other data sources.

The most important source of bias in estimating high school graduation rates comes from the inclusion of GED recipients as high school graduates. In recent years, this practice has biased graduation rates upwards of 7-8 percentage points. Especially striking are the comparisons in graduation rates between minorities and whites. Our estimate of the black graduation rate is 15 percentage points higher than the 50 percent rate reported in some recent studies. It is also 15 points lower than the NCES status completion rate. About 65 percent of blacks and Hispanics leave secondary schooling with a diploma.

Many previous studies report convergence in white and minority high school completion rates. These estimates are based on the civilian non-institutional population using CPS data and do not count those who are in prison. When GED recipients are counted as dropouts (incarcerated or not), there is little convergence in high school graduation rates between whites and minorities over the past 35 years.

We link part of the measured slowdown in the growth of college attendance and completion, growing gender difference in college attainment and rising wage premiums to lower high school graduation rates over the past 40 years. In the first half of the 20th century, growth in high school

graduation was the driving force behind increased college enrollments. The post-1970 declines in graduation flattened college attendance and completion rates as well as the skill attainment of the U.S. workforce. To increase the skill level of the future workforce, America needs to confront its high school dropout problem.

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Notes

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[1] See Figure S.1 in the Web Appendix (http://jenni.uchicago.edu/estimating_hsgraduation/).

[2] These numbers are not available by race. Growth in the proportion of people taking the GED is reported in Web Appendix S.3.

[3] For a sample, see the heated debate in the popular press in May 2006 www.washingtonpost.com/wp-dyn/content/article/2006/05/22/AR2006052201187.html; www.washingtonpost.com/wp-dyn/content/article/2006/05/22/AR2006052201197.html; and www.washingtonpost.com/wp-dyn/content/article/2006/05/22/AR2006052201189.html.

[4] See United States Congress [2001]. In practice, there is some flexibility built into No Child Left Behind for states to define their own graduation standards. The law further states that "Another definition, developed by the State and approved by the Secretary in the State plan" (Title I Final Regulations, Sec. 200.19 (a)(1)(i)(B)) could also be employed. See Swanson [2003] for a detailed discussion of the implementation of NCLB graduation measures in each state.

[5] Currently, raising test scores is the primary focus of AYP and it is not known how schools will be sanctioned based on high school graduation rates (see Swanson [2003b]).

[6] Aaronson and Sullivan (2001) and Delong, Katz and Goldin (2003) estimate time series trend in the stock of skills in the U.S. but assume that GEDs are the equivalent of high school graduates.

[7] Assuming that wages equal marginal products, a wage-weighted quantity aggregate would capture the effective stock of skills.

[8] Preliminary estimates by Heckman and Urzua (2008) suggest a very low option value for the degree for the average recipient.

[9] See Web Appendix Part A for a more detailed description of CPS and Census data.

[10] See Table S.1 in the Web Appendix at http://jenni.uchicago.edu/estimating_hsgraduation/ for a more detailed description of this calculation.

[11] The population totals used to compute our Census graduation rates are listed in Web Appendix Tables A.1 through A.7.

[12] Appendix Figure S.2 shows that the average age of GED recipients at the time they pass the GED test adjusted for the age composition of the population has declined sharply since the beginning of the program. While the changing demographic structure associated with the Baby Boom and the Baby Bust accounts for a small part of the time series of the age pattern of GED test takers, most of the decline in the average age is due to other factors.

[13] See Web Appendix Figure S.3

[14] According to the current GED Testing Service (2007) statistical report, the following states issue standard high school diplomas on the basis of GED test scores: AR, CT, FL, HI, KS, MD, NE, NJ, NM and OK.

[15] See http://www.state.nj.us/education/students/ged/ged11.htm for more details about the New Jersey GED program.

[16] With the available data, it is not possible to fully account for alternative completers who are issued state diplomas. The graduation rates reported in this paper are not strict upper bounds since we lack the information required to fully account for these completers. This is true of both administrative and survey data estimates. NCLB likely exacerbates this potential source of bias since it increases the incentives for states to raise reported graduation rates by any means possible. For instance, when New Jersey increased the difficulty of the state exit exam, the numbers enrolled in Special Review Assessment (SRA) diploma program increased dramatically.

[17] New Jersey, as well as most other states with high stakes exit exams, offers an alternative program for those who fail the High School Proficiency Assessment (HSPA). The SRA administers diplomas based on a series of untimed locally administered tests similar in content to the GED and distinct from the HSPA. In 2006, 12 percent of all graduates and over 1/3 in urban areas came through the SRA program (See State of New Jersey Department of Education [2006], 2005-06 School Report Card).

[18] This has important implications for a large body of economic research devoted to differences in earnings between minorities and whites. Substantial gaps remain in the market wages of minorities compared to those for whites. Part of this gap is a result of minorities obtaining less valuable GED credentials rather than high school diplomas. See the discussion in Section V.A and the more complete discussion in Heckman and LaFontaine [2008] for evidence on this question.

[19] See Web Appendix Table S.2.

[20] See Table S.2.1 in the Web Appendix.

[21] The estimated graduation rates for each race and gender group of this cohort are shown in Table A.1 in the Web Appendix.

[22] Web appendix S.0 presents alternative bias calculations based on different orderings of inclusions and deletions that supplement the calculation in Table I(a). We discuss one version in Table I(b) in the next section. The estimated bias terms do not substantially differ from those reported in Table I(a). The largest differences due to the order in which the decomposition is performed arise in the relative bias estimated for the inclusion of GED recipients and exclusion of prisoners for black males.

[23] The percent distribution of non-institutional, non-military GED recipients by race and sex is calculated from CPS October data. See the Web Appendix A section 6 for further details and Table I(b) in the text discussed in the next subsection.

[24] See Web Appendix Figure S.4. This increase is not the result of an increase in violent crimes, but instead is due to mandatory and longer prison sentencing for non-violent drug offenders and repeat offenders. See Blumstein and Beck [2000] and Mauer [1999] for a discussion of this point.

[25] The total incarcerated population is even greater than this number because the figure excludes those who are serving short-term sentences or awaiting trial in local jails. The breakdown of the incarcerated population by type of institution and education for recent years is documented in Web Appendix Tables A.10-A.17.

[26] Lochner and Moretti [2004] estimate a causal relationship between education and crime. See Web Appendix Tables A.13-A.16 for data on the educational attainment of prisioners.

[27] These are based on the authors' calculations using inmate survey data from the Bureau of Justice Statistics. The percentage breakdowns by race can be found in Table A.16 of the Web Appendix.

[28] Mishel and Roy [2006] claim that including the incarcerated population only has a minimal impact on the estimated black-white gap in high school graduation. However, they do not account for the fact that more than 50 percent of the overall high school completion category in the incarcerated sample in the Census is composed of GED recipients, and the rate is even higher for young black males.

[29] See Web Appendix Table A.18.

[30] Web Appendix Figure S.5 shows that in the past, the military, and the Army and Marines in particular, did not require that members be high school graduates.

[31] See Web Appendix Figure S.6 for trends on immigration.

[32] See Web Appendix Figure S.7.

[33] For instance, suppose the CPS estimates 250,000 black males ages 20-24 in the civilian non-institutional while Census bureau estimates show there should be 500,000 in this category. The CPS weights for this category are doubled to account for the underestimate.

[34] See Web Appendix Figure S.7. Census coverage is benchmarked against estimated population totals from administrative birth, death and immigration records.

[35] See the Web Appendix A for a detailed discussion of the CPS March supplement.

[36] The most relevant comparison is that between the CPS March and Census surveys since they are closest in timeframe. The Census point of reference is April 1st while the CPS questionnaire is administered in the third week of March. In addition, the weights for the CPS March survey are based on the 2000 Census

population estimates while those for the October survey are based on the 1990 Census estimates. However, calculations using CPS October data yield similar conclusions to those found using the March data.

[37] See Web Appendix Table A.20 for the complete disaggregated estimates of the educational distributions across the two data sources.

[38] There is no way to analyze the role of survey administration with the existing data.

[39] These result are computed for the year 2000 and do not apply for the status completion rate time series since GED test taking, incarceration, immigration and other factors have changed considerably over the past 40 years.

[40] These administrative data-based graduation estimators include the Swanson Cumulative Promotion Index (CPI) and the Greene Method. See Web Appendix A for details on the construction of these estimators.

[41] For some sources that make this claim see Swanson and Chaplin [2003]; Greene [2001]; Losen et al. [2004] and Bridgeland, DiIulio and Morison [2006].

[42] Explanations for the patterns observed in Figure III are an important topic for future research. One possibility explored in Heckman, LaFontaine and Rodriguez (2008) is the availability and cost of GED certification relative to high school graduation. They find a close link between the two credentials. When the GED becomes more difficult, students substitute towards staying in school and graduating. For instance, the GED exam was redesigned and became more difficult in 2002, precisely when substantial gains in high school graduation are observed. They present estimates that abolishing the GED entirely is estimated to produce substantial gains in graduation rates.

[43] Census data include public and private schools while the CCD data are only for public schools. However, private school enrollments are relatively small and stable over time. Including private school enrollments does not greatly affect the CCD-based estimates.

[44] An evaluation of Job Corps by Schochet, Burghardt and Glazerman [2001] finds that 5.3 percent of Job Corps participants achieve high school diplomas within 48 months, while 41.6 percent GED certify. This focus on GED certification helps to explain the very low returns to Job Corps. The program has since shifted toward awarding more regular high school diplomas. The three year follow up (Schochet and Burghardt [2005]) shows essentially zero returns to the Job Corps and by implication, the GED.

[45] See Table S.1 and the discussion of these calculations in the Web Appendix.

[46] Our estimates for NLSY79, NLSY97, HSB and NELS data differ from the estimates reported by Mishel and Roy [2006] due to a number of biases that were not accounted for in their original calculations. These are discussed extensively in the web appendix and in the NBER working version of this paper.

[47] See the Web appendix part A subsection 14 for a description of this data source.

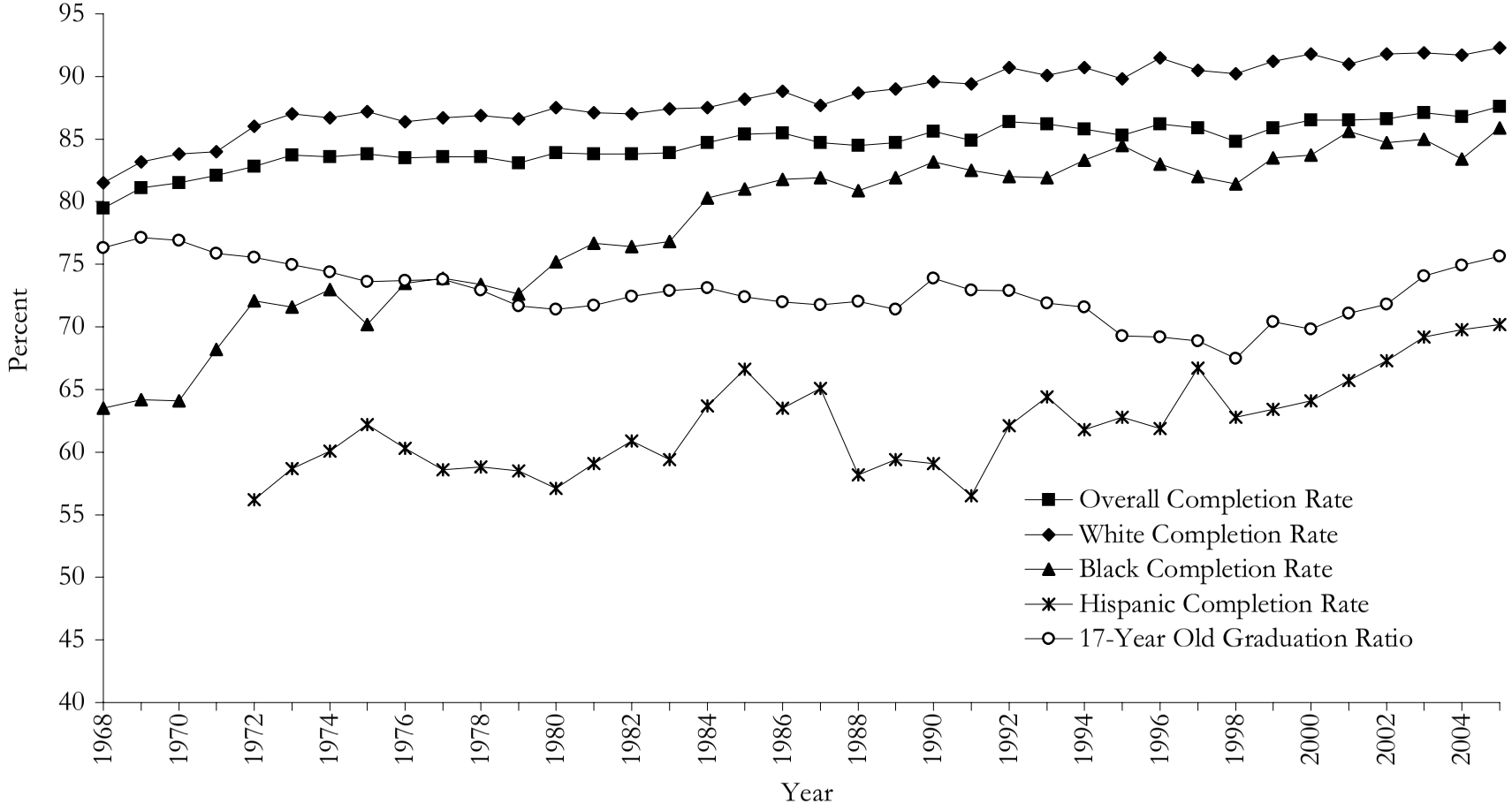
[48] We would prefer to use CPS data for this analysis. However, there are a number of problems in doing so. First, the CPS March supplement does not ask about GED status. Second, the CPS monthly samples only determine GED status after 1998 for persons across all age ranges. In the October supplement GED status is available only up to age 24 until 1992 and then up to age 29 thereafter. Finally, the GED variable in the CPS appears to be measured with substantial error. See Laird et al. [2005].

[49] The source of bias is that high ability dropouts who command higher earnings are more likely to certify as GEDs.

[50] Card and Lemieux [2001] document the slowdown in the growth of college educated workers.

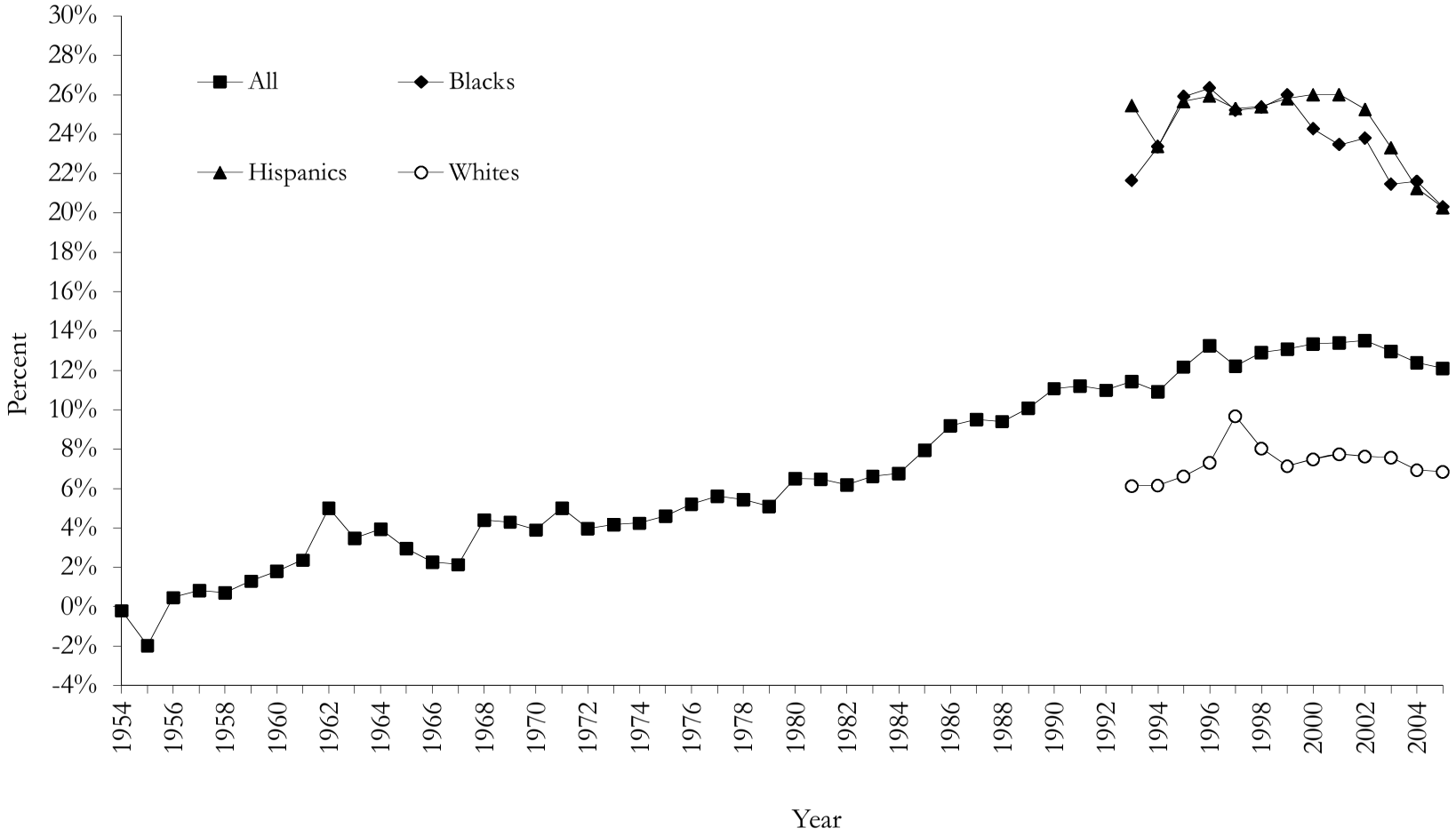
[51] There was a decline in college attendance for male high school graduates following the Vietnam War. College attendance provided a deferment from the draft.

Figure I. High School Status Completion Rate vs. 17-Year Old Graduation Ratio, NCES



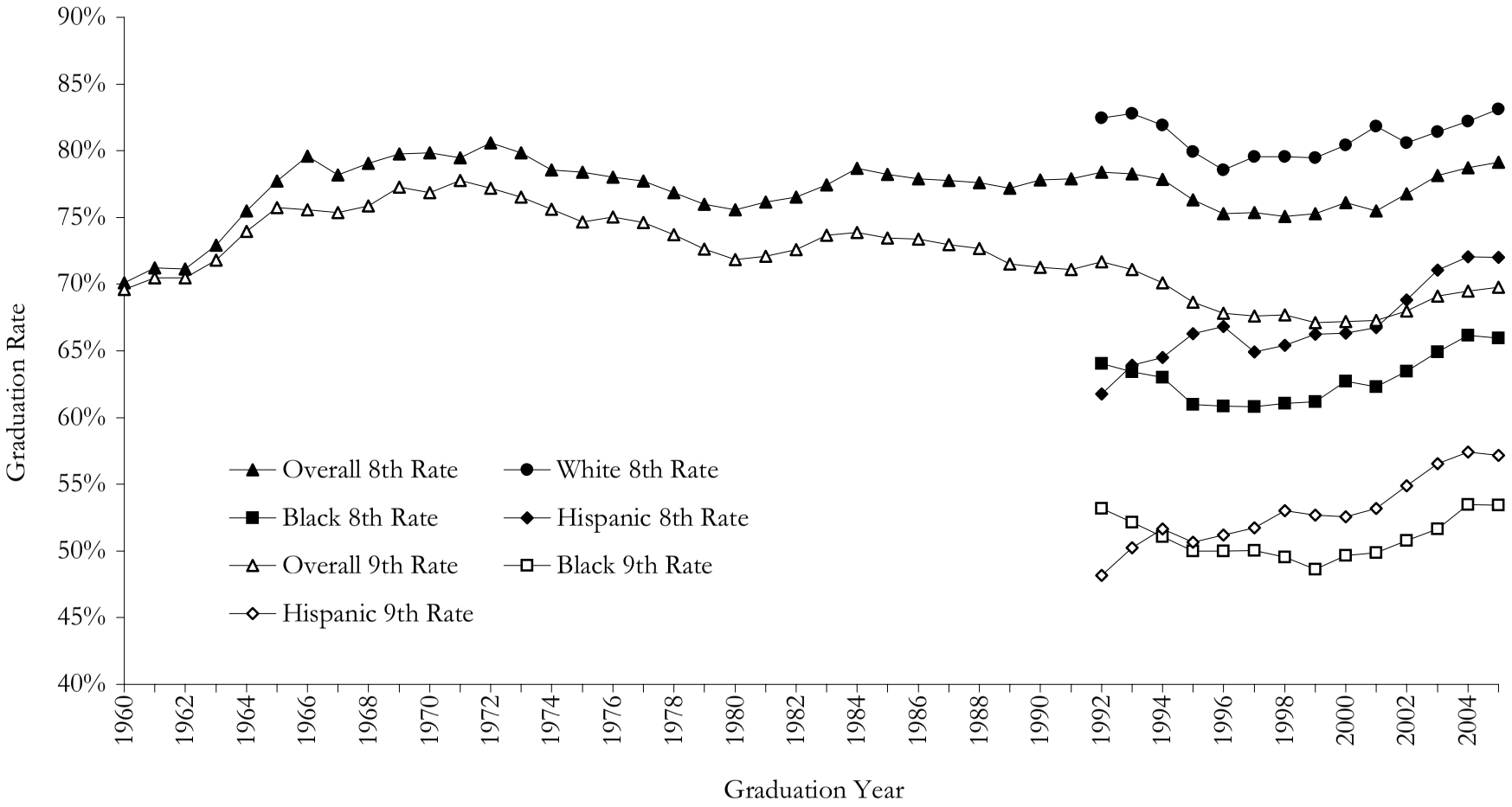
Source: Reproduced from NCES publication "Dropout Rates in the United States: 2005" (Laird et. al., June 2007). Rates prior to 1972 are based on authors' calculations using CPS data. The status completion rate is the percentage of 18- through 24-year-olds not enrolled in secondary school who have a high school credential. High school credentials include regular diplomas and alternative credentials such as GED certificates. Hispanic ethnicity is not available before 1972. The 17-year old graduation ratio is from the Digest of Education Statistics. HS graduates for the graduation ratio include both public and private school diplomas and exclude GED recipients and other certificates. October 17-year-old population estimates are obtained from Census Bureau P-20 reports.

Figure II. Percent of Ninth Grade Enrollments Relative to Eigth Grade Enrollments in the Previous Year Based on Public School Enrollment Counts, 1954 to 2005, NCES



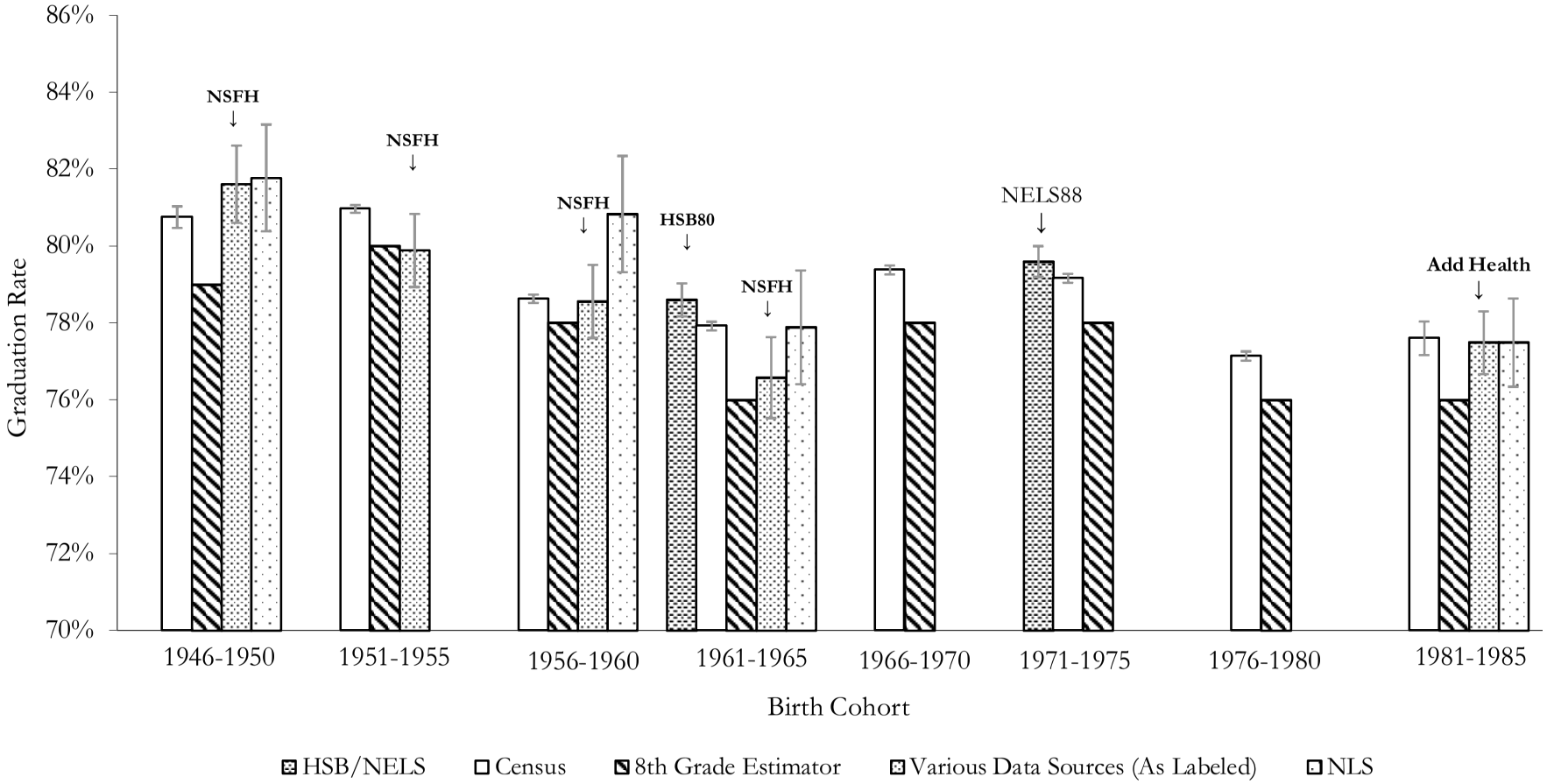
Notes: Authors' calculations based on CCD data obtained from the Digest of Education Statistics (various years). Data by race are only available beginning in 1992. For calculations by race, the following states are dropped in all years due to too many missing values: ID, KY, ND, UT. Enrollment counts by race for some states with missing values were imputed using a linear estimate based on previous and future enrollment counts by race in that state. See data appendix for further details.

Figure III. Public HS Graduation Rates by Race Using 8th and 9th Grade Estimators: 1960-2005



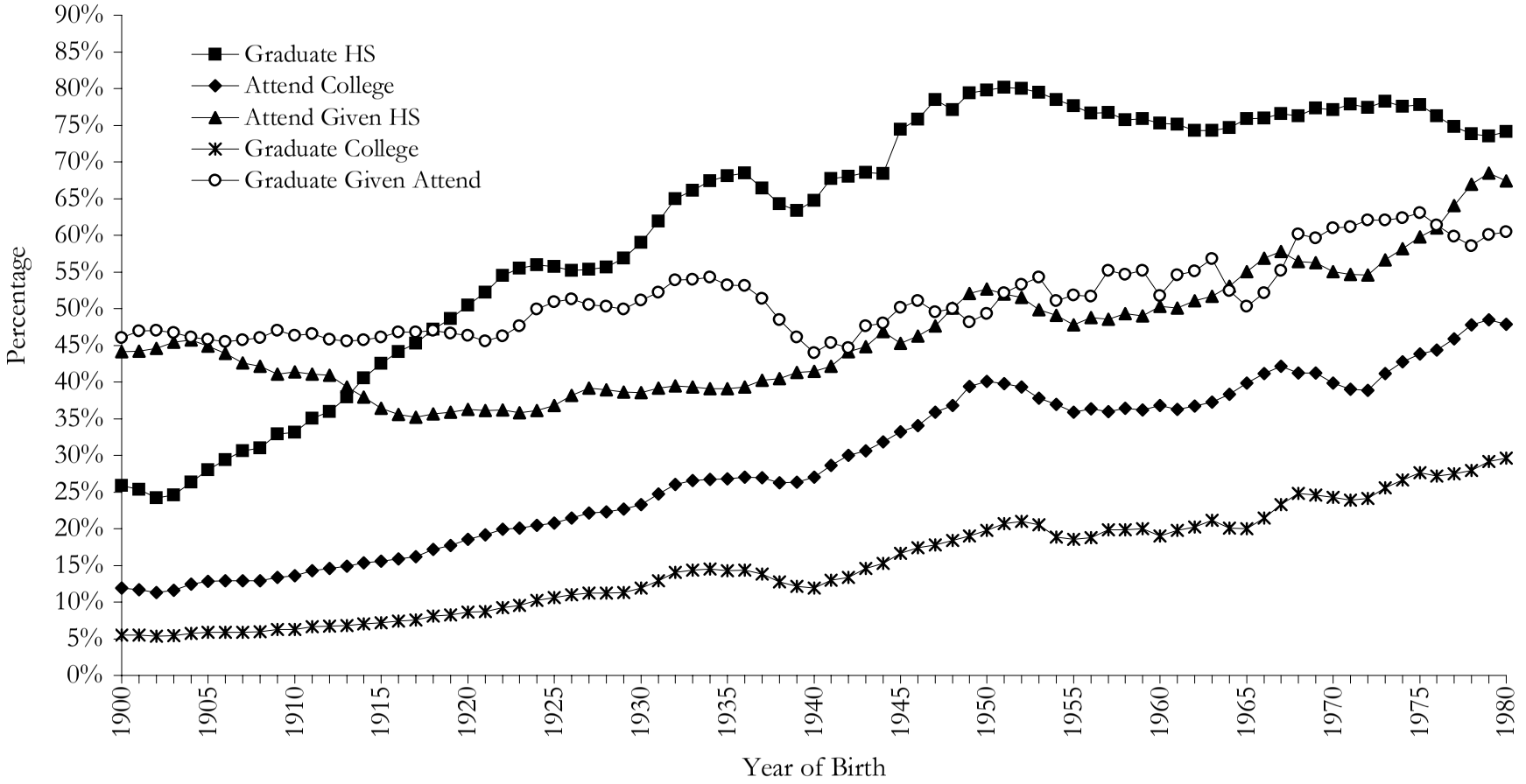
Notes: Authors' calculations based on CCD data obtained from the Digest of Education Statistics (various years). Data by race are only available beginning in 1992. For estimates by race, the following states were excluded in all years due to missing enrollment or diploma counts: ID, KY, ND, NH, SC, UT, VT, WA. Enrollment and diploma counts by race for some states with missing values were imputed using a linear estimate based on previous and future enrollment counts by race in that state. The race distribution of enrollments from 1987-1991 are estimated using CPS October data to extend the graduation rates by race to 1992 (the first year diplomas issued by race are available). Ungraded students were distributed across all enrollment totals prior to 1965. These students are estimated from the 1965 values and subtracted from the totals. White 9th rate not shown for clarity. See data appendix for more details.

Figure IV. Overall U.S. Graduation Rates Across All Data Sources Analyzed in this Paper



Notes: Authors' calculations from various data sources. Census graduation rates are ages 20-24 or 25-29 depending on cohort and do not include recent immigrants. The 8th grade estimator is calculated using CCD data. It is assumed that people graduate at age 18. For example, the graduation rate in the year 1968 is for those born in 1950. GED recipients are not counted as high school graduates in all calculations. The NLS data sources are the Young Men and Young Women (born 1946-1951), two cohorts of NLSY79 data (those born 1957-1960 and 1961-1964) and the NLSY97 (born 1980-1984). For all survey data, 99% confidence intervals are shown. CCD data do not allow for standard error calculations. The 1981-1985 "Census" estimates are calculated in the 2004 ACS. survey.

Figure V. Educational Attainment Decompositions, Males and Females 1900-1980 Birth Cohorts



Notes: 3-year moving averages based on CPS October, Census, CPS March and NCES data. HS graduates are those who obtained a regular public or private HS diploma (excluding GEDs) from the NCES. "Graduate HS" is the fraction of 8th grade enrollments for a given cohort who report a regular HS diploma. "Attend Given HS" is the fraction of recent HS graduates who report being enrolled the fall of the year following graduation. "Attend College" is college enrollments of recent HS graduates as a fraction of 18 year old cohort size. College graduates are those who report a BA or higher by age 25. "Graduate Given Attend" are those who obtained a four year degree as a fraction of the college enrollment total for that cohort. Two-year degrees are not included. "Graduate College" is the number of college graduates as a fraction of the 18 year old cohort size. Population estimates are from the Census P-20 reports. HS diplomas issued by sex are estimated from CPS October data after 1982.

Table I (a). Increase in the Estimated Graduation Rate Using Census 2000 Data under Various Assumptions

	Excluding GEDs	Excluding Prisoners	Excluding Immigrants	Excluding Military
Panel A. Overall				
All Races	-7.4%	1.0%	2.3%	-0.1%
Whites	-7.5%	0.6%	0.0%	-0.1%
Blacks	-9.5%	3.0%	-0.1%	-0.3%
Hispanics	-5.7%	0.7%	9.6%	-0.3%
Panel B. Males				
All Races	-8.1%	1.8%	2.8%	-0.3%
Whites	-8.7%	1.0%	0.0%	-0.2%
Blacks	-10.3%	5.6%	-0.3%	-0.6%
Hispanics	-5.0%	1.1%	10.6%	-0.6%
Panel C. Females				
All Races	-6.6%	0.1%	1.8%	0.0%
Whites	-6.3%	0.1%	-0.1%	0.0%
Blacks	-8.7%	0.3%	0.0%	-0.1%
Hispanics	-6.5%	0.1%	8.2%	-0.1%

Notes: Authors' calculations based on Census 2000 data (IPUMS). All estimates are weighted and race categories are mutually exclusive. Calculations are for the 20-24 year old population. Total GED recipients are estimated from GED testing service data. The recent immigrant category contains only those who are in the civilian non-institutional population and who emigrated to the U.S. after 1990. Those still enrolled in high school are excluded from calculations. The percentage of GEDs who are recent immigrants is estimated from CPS October data. Estimates of GEDs who are incarcerated or in the military are obtained from BJS and DOD data, respectively. The bias calculations are computed sequentially so that those belonging to multiple groups are only counted once. The order of the categories excluded matches the column order in each table.

Table I (b). Increase in the Estimated Graduation Rate Using 2000 Census Data under Various Assumptions

	Excluding Prison	Excluding GED	Excluding Immigrants	Excluding Military
Panel A. Overall				
All Races	0.7%	-7.0%	1.2%	-0.1%
Whites	0.3%	-7.3%	0.6%	-0.1%
Blacks	2.3%	-8.8%	3.2%	-0.3%
Hispanics	0.4%	-5.3%	1.3%	-0.3%
Panel B. Males				
All Races	1.2%	-7.5%	2.1%	-0.3%
Whites	0.6%	-8.3%	1.0%	-0.2%
Blacks	4.3%	-9.0%	5.9%	-0.6%
Hispanics	0.5%	-4.3%	2.3%	-0.6%
Panel C. Females				
All Races	0.1%	-6.5%	0.1%	0.0%
Whites	0.1%	-6.3%	0.1%	0.0%
Blacks	0.2%	-8.6%	0.3%	-0.1%
Hispanics	0.0%	-6.5%	0.1%	-0.1%

Notes: Authors' calculations based on Census 2000 data (IPUMS). All estimates are weighted and race categories are mutually exclusive. Calculations are for the 20-24 year old population. Total GED recipients are estimated from GED testing service data. The recent immigrant category contains only those who are in the civilian non-institutional population and who emigrated to the U.S. after 1990. Those still enrolled in high school are excluded from calculations. The percentage of GEDs who are recent immigrants is estimated from CPS October data. Estimates of GEDs who are incarcerated or in the military are obtained from BJS and DOD data, respectively. The bias calculations are computed sequentially so that those belonging to multiple groups are only counted once. The order of the categories excluded matches the column order in each table.

Table II. CPS March vs. Census Difference in % of Population Reporting a Given Education Level, Ages 20-24 in 2000

	Total	White	Black	Hispanic
A. CPS-Census Difference				
All Dropouts	-1.94%	-1.84%	-2.69%	-2.95%
HS Completers, no College	2.96%	2.97%	2.33%	4.75%
Dropouts, 11th Grade or Less	0.27%	-0.07%	1.39%	-0.20%
Dropouts, 12th Grade no Diploma	-2.21%	-1.78%	-4.08%	-2.75%
B. CPS Bias Relative to Census				
CPS Survey Design Bias*	2.99%	2.35%	5.55%	3.98%
Total Status Completion Rate Bias**	8.16%	9.92%	15.28%	0.65%

Notes: Authors' calculations based on 2000 CPS March and IPUMS data. All calculations are weighted. High school completers include those who earned a GED. Estimated population totals are 17,974,212 in the Census and 17,982,365 in the CPS March. (*) Computed as the bias from the undercount of dropouts and the exclusion of the institutionalized and military populations in the CPS survey. (**) Total bias from the undercount of dropouts, the exclusion of the institutionalized and military populations, the inclusion of immigrants and counting GEDs as HS graduates in the status completion rate.

Table III. Overall U.S. Graduation Rate by Race, Census IPUMS 1970-2000

Year of Birth Range	1946-1950	1951-1955	1956-1960	1961-1965	1966-1970	1971-1975	1976-1980
Panel A. Males and Females							
All Races	80.8%	81.0%	78.6%	77.9%	79.4%	79.2%	77.1%
Whites	83.8%	84.2%	81.7%	81.6%	82.6%	82.8%	81.7%
Blacks	63.7%	69.1%	68.0%	63.9%	69.2%	68.9%	66.4%
Hispanics	58.6%	64.6%	65.2%	62.6%	64.9%	62.3%	62.9%
Hispanics Inc. Immigrants	56.6%	54.5%	56.8%	53.3%	54.7%	52.0%	53.9%
Panel B. Males							
All Races	80.8%	80.6%	76.8%	76.2%	77.1%	77.3%	74.1%
Whites	84.0%	83.8%	80.2%	80.1%	80.8%	81.5%	79.1%
Blacks	60.9%	66.1%	62.8%	62.3%	64.6%	65.8%	61.0%
Hispanics	60.0%	64.0%	62.8%	61.0%	62.9%	61.4%	59.5%
Hispanics Inc. Immigrants	58.1%	54.0%	54.6%	49.6%	51.1%	48.2%	50.1%
Panel C. Females							
All Races	80.7%	81.4%	80.5%	79.7%	80.3%	81.0%	80.3%
Whites	83.6%	84.5%	83.2%	83.3%	83.3%	84.1%	84.3%
Blacks	66.0%	71.5%	72.6%	66.2%	71.3%	74.5%	71.5%
Hispanics	57.5%	64.4%	66.6%	71.0%	68.1%	67.3%	66.7%
Hispanics Inc. Immigrants	55.4%	55.1%	59.0%	57.5%	58.6%	56.3%	58.5%

Note: Authors' calculations from Census 1970, 1980, 1990 and 2000 data. Census graduation rates are ages 20-24 or 25-29 depending on cohort and do not include recent immigrants. Recent immigrants are those who entered the U.S. within the last ten years for 20-24 year olds and within the last fifteen years for 25-29 year olds. GED recipients are estimated for each cohort using GEDTS data and are deducted from the Census high school completer totals. 1981-1985 estimates from 2004 ACS data. Those who report never having enrolled in school are excluded. All races calculations include Asians, Native Americans and other race groups not shown separately.

Table IV. Difference between CPS Status Completion Rate and Census Graduation Estimate, 20-24 Year Olds by Race and Sex

	Survey Year			
Panel A. Males and Females	1970	1980	1990	2000
All Races	1.05%	5.77%	6.04%	10.49%
Whites	0.25%	6.30%	7.28%	11.52%
Blacks	1.46%	7.64%	14.12%	18.37%
Hispanics	-3.56%	-7.01%	-8.02%	1.05%
Black-White Gap	1.21%	1.33%	6.84%	6.84%
Panel B. Males				
All Races	1.52%	6.19%	7.38%	12.42%
Whites	0.72%	6.49%	8.72%	14.16%
Blacks	3.04%	9.67%	18.23%	21.69%
Hispanics	-5.03%	-5.97%	-9.73%	-0.40%
Black-White Gap	2.31%	3.18%	9.51%	7.53%
Panel C. Females				
All Races	0.67%	5.29%	6.07%	8.49%
Whites	-0.12%	6.10%	6.95%	8.81%
Blacks	0.12%	5.64%	12.49%	15.08%
Hispanics	-2.34%	-7.23%	-7.01%	2.61%
Black-White Gap	0.24%	-0.46%	5.54%	6.27%

Notes: Author's calculations based on Census and CPS October data. All estimates are weighted and race categories are mutually exclusive. All calculations are restricted to those ages 20-24 who report ever having attended school. Census graduation rates are based on those reported in Table II.

Table V: HS Graduation Rate Estimates Across Various Longitudinal Data Sources

	NLS68	NLS79	NLSY79	HSB80	NELS88	NLSY97	Add Health
Birth Cohorts	(1946-1950)	(1957-1960)	(1961-1964)	(1962-1964)	(1972-1974)	(1980-1984)	(1980-1982)
A. Overall							
All	81.8%	80.8%	77.9%	78.6%	79.7%	77.5%	77.5%
	(.005)	(.006)	(.006)	(.005)	(.004)	(.004)	(.008)
Whites	84.6%	84.4%	80.8%	80.8%	83.1%	80.2%	79.7%
	(.006)	(.008)	(.008)	(.006)	(.005)	(.006)	(.010)
Blacks	64.3%	69.7%	70.7%	71.9%	70.2%	69.1%	71.4%
	(.013)	(.013)	(.011)	(.010)	(.011)	(.010)	(.018)
Hispanics	…	60.9%	59.7%	64.7%	71.9%	72.3%	68.8%
	…	(.016)	(.015)	(.013)	(.012)	(.010)	(.025)
B. Males							
All	81.4%	79.5%	74.4%	77.4%	78.5%	75.2%	75.0%
	(.008)	(.009)	(.008)	(.007)	(.006)	(.006)	(.012)
Whites	84.3%	83.3%	78.0%	80.0%	82.2%	78.8%	76.8%
	(.009)	(.011)	(.011)	(.012)	(.008)	(.008)	(.015)
Blacks	60.0%	65.7%	64.6%	68.2%	67.1%	63.4%	67.7%
	(.018)	(.019)	(.017)	(.015)	(.014)	(.014)	(.028)
Hispanics	…	60.1%	54.5%	62.5%	72.0%	69.7%	69.0%
	…	(.024)	(.022)	(.017)	(.015)	(.015)	(.037)
B. Females							
All	82.1%	82.1%	81.5%	79.8%	81.8%	79.9%	79.9%
	(.008)	(.008)	(.008)	(.006)	(.006)	(.006)	(.010)
Whites	84.9%	85.5%	83.8%	82.5%	85.2%	81.8%	82.7%
	(.009)	(.010)	(.010)	(.009)	(.007)	(.008)	(.012)
Blacks	66.9%	73.3%	77.0%	75.0%	75.9%	75.0%	75.3%
	(.018)	(.017)	(.015)	(.014)	(.013)	(.013)	(.022)
Hispanics	…	61.7%	65.4%	66.4%	72.3%	75.2%	68.5%
	…	(.023)	(.021)	(.015)	(.013)	(.014)	(.035)

Source: Authors' calculations based on NLSY, NELS and HSB data. GED recipients are not counted as high school graduates in all calculations. All outcomes are weighted. The AddHealth data is restricted to those enrolled in the 7th and 8th grades in the initial survey. Hispanic samples are too small in NLS68 data to obtain reliable estimates. Standard errors in parentheses.

Table VI. The Role of the GED in Explaining Rising Educational Wage Gaps, Males and Females, Ages 25-29, NLSY79

	Birth Cohort		
	1957-1958	1959-1961	1962-1964
A. Prevalence of GED as a			
% of GED+HS Category	9.16%	13.82%	20.34%
	(.40)	(.35)	(.38)
% of GED+Dropout Category	38.29%	46.08%	60.14%
	(1.19)	(.83)	(.74)
B. College-HS Wage Gap			
log Annual Earnings	0.338	0.411	0.469
	(.033)	(.024)	(.023)
log weekly wage	0.297	0.358	0.418
	(.027)	(.020)	(.019)
log hourly wage	0.270	0.311	0.376
	(.025)	(.018)	(.018)
C. Bias in College-HS Gap from counting GEDs as Grads			
log Annual Earnings	0.021	0.030	0.045
	(.006)	(.005)	(.006)
log weekly wage	0.010	0.016	0.025
	(.004)	(.003)	(.004)
log hourly wage	0.007	0.010	0.022
	(.003)	(.003)	(.004)
D. % of current College-HS Gap explained by GED			
log Annual Earnings	6.1%	7.4%	9.5%
	(1.74)	(1.21)	(1.32)
log weekly wage	3.3%	4.5%	6.0%
	(1.37)	(.98)	(1.08)
log hourly wage	2.6%	3.3%	5.9%
	(1.29)	(.98)	(1.05)
E. College-Dropout Wage Gap			
log Annual Earnings	0.635	0.724	0.747
	(0.047)	(0.034)	(0.037)
log weekly wage	0.512	0.593	0.610
	(0.035)	(0.027)	(0.029)
log hourly wage	0.474	0.521	0.555
	(0.034)	(0.025)	(0.026)
F. Bias in College-Dropout Gap from Counting GEDs as HS Graduates			
log Annual Earnings	0.029	0.039	0.056
	(.025)	(.020)	(.026)
log weekly wage	0.041	0.051	0.054
	(.017)	(.014)	(.018)
log hourly wage	0.044	0.056	0.049
	(.017)	(.014)	(.017)
G. % of current College-Dropout Gap explained by GED			
log Annual Earnings	4.6%	5.4%	7.5%
	(3.8)	(2.6)	(3.2)
log weekly wage	7.9%	8.5%	8.9%
	(3.2)	(2.3)	(2.8)
log hourly wage	9.4%	10.7%	8.8%
	(3.3)	(2.5)	(2.8)

Percentage of Overall Change Explained by GED Misclassification from 1957 to 1964 Birth Cohorts

	Annual Earnings	Weekly Wage	Hourly Wage
Growth in College-HS Gap	18.4%	12.8%	14.4%
	(.08)	(.06)	(.06)
Growth in College-Dropout Gap	23.7%	13.6%	5.5%
	(.27)	(.23)	(.28)

Table VII. The Role of the GED in Explaining Compensation Gaps for HS Completers, Ages 30-34, NLSY79

	Log Annual Earnings		Log Weekly Wage		Log Hourly Wage	
A. Black-White Gap	OLS Regression	Median Regression	OLS Regression	Median Regression	OLS Regression	Median Regression
Overall Including GEDs	-.280	-.253	-.177	-.206	-.152	-.163
	(.041)	(.037)	(.025)	(.029)	(.023)	(.027)
Overall Excluding GEDs	-.199	-.187	-.157	-.156	-.132	-.126
	(.045)	(.048)	(.029)	(.037)	(.027)	(.031)
Males Including GEDs	-.427	-.323	-.265	-.271	-.209	-.225
	(.052)	(.047)	(.034)	(.043)	(.032)	(.041)
Males Excluding GEDs	-.352	-.262	-.252	-.243	-.195	-.191
	(.059)	(.064)	(.042)	(.061)	(.039)	(.047)
Females Including GEDs	-.094	-.137	-.061	-.107	-.077	-.117
	(.063)	(.059)	(.037)	(.050)	(.033)	(.040)
Females Excluding GEDs	-.032	-.070	-.051	-.078	-.064	-.074
	(.068)	(.062)	(.041)	(.054)	(.036)	(.045)
B. Hispanic-White Gap						
Overall Including GEDs	-.081	-.052	-.038	-.036	-.055	-.010
	(.049)	(.045)	(.032)	(.032)	(.030)	(.040)
Overall Excluding GEDs	-.001	-.021	-.020	.006	-.032	.026
	(.054)	(.051)	(.038)	(.045)	(.034)	(.046)
Males Including GEDs	-.186	-.126	-.123	-.104	-.090	-.058
	(.059)	(.053)	(.044)	(.045)	(.042)	(.047)
Males Excluding GEDs	-.133	-.083	-.117	-.091	-.094	-.033
	(.067)	(.060)	(.054)	-(.091)	(.049)	(.059)
Females Including GEDs	.026	.030	.057	.035	-.019	.018
	(.078)	(.084)	(.045)	(.058)	(.041)	(.059)
Females Excluding GEDs	.127	.042	.078	.071	.028	.081
	(.082)	(.092)	(.051)	(.065)	(.045)	(.062)
C. Female-Male Gap						
Overall Including GEDs	-.491	-.373	-.401	-.345	-.201	-.210
	(.035)	(.030)	(.025)	(.024)	(.021)	(.023)
Overall Excluding GEDs	-.527	-.402	-.433	-.379	-.226	-.242
	(.038)	(.030)	(.028)	(.028)	(.023)	(.025)
Whites Including GEDs	-.640	-.483	-.438	-.402	-.257	-.264
	(.049)	(.044)	(.033)	(.037)	(.030)	(.029)
Whites Excluding GEDs	-.675	-.499	-.467	-.436	-.285	-.292
	(.055)	(.050)	(.037)	(.043)	(.033)	(.029)
Blacks Including GEDs	-.308	-.293	-.242	.035	-.134	-.145
	(.061)	(.064)	(.035)	(.053)	(.031)	(.046)
Blacks Excluding GEDs	-.359	-.306	-.280	-.289	-.170	-.203
	(.064)	(.065)	(.039)	(.063)	(.035)	(.047)
Hispanics Including GEDs	-.438	-.254	-.259	-.224	-.161	-.143
	(.080)	(.067)	(.047)	(.056)	(.044)	(.060)
Hispanics Excluding GEDs	-.446	-.298	-.292	-.260	-.163	-.142
	(.086)	(.077)	(.056)	(.072)	(.050)	(.062)

Notes: Authors' calculations based on NLSY79 data. All calculations are based on the 1962-1964 birth cohorts when individuals were 30-34 years old. The sample is restricted to high school completers who do not have a two or four year college degree. Annual wages are constructed as the product of hours worked last year and hourly wage at the current/most recent job. The following individuals are excluded: those earning more than $200,000 annually; those who report less than $100 or more than $4000 weekly; and those who report less than $2 and more than $100 hourly. Robust Huber-White standard errors clustered by individual are reported for OLS estimates. Median standard errors are based on 500 bootstrap replicates clustered by individual.

Table VIII. The Sources of Change in College Graduation Rates, Broken Down by Pre- and Post-1950 Birth Cohorts

Birth Cohort	Total Change	Δ due to ΔP(H)	Δ due to ΔP(C | H)	Δ due to ΔP(D | C)	Δ due to Interaction
A. Overall					
1900-1949	13.89%	8.99%	3.17%	0.81%	0.92%
1950-1959	10.46%	-1.47%	6.70%	5.20%	0.03%
B. Males					
1900-1949	16.93%	12.38%	3.81%	0.40%	0.35%
1950-1959	2.26%	-1.59%	2.90%	0.86%	0.08%
C. Females					
1900-1949	13.72%	7.06%	3.69%	2.19%	0.78%
1950-1959	15.40%	-0.94%	9.50%	6.20%	0.65%

Notes: Authors' calculations based on CPS October, CPS March, Census and NCES data. The decomposition is given by: $\Delta P(D) = [\Delta P(H)*P(C \mid H)*P(D \mid C)] + [P(H)*\Delta P(C \mid H)*P(D \mid C)] + [P(H)*P(C \mid H)*\Delta P(D \mid C)] + [P(H)*\Delta P(C \mid H)*\Delta P(D \mid C) + P(C \mid H)*\Delta P(H)*\Delta P(D \mid C) + P(D \mid C)*\Delta P(H)*\Delta P(C \mid H) + \Delta P(H)*\Delta P(C \mid H)*\Delta P(D \mid C)]$. All college attendance and HS graduation probabilities are fixed at the previous cohort levels. "Δ due to ΔP(H)" is the first term of the above decomposition, "Δ due to ΔP(C | H) is the 2nd, "Δ due to ΔP(D | C)" is the 3rd term and "Δ due to Interaction" is the 4th. All calculations based on the data used to construct Figure V.