College Access and Attendance Patterns: A Long-Run View*

Lutz Hendricks† Chris Herrington‡ Todd Schoellman§

July 2018

Abstract

We harmonize the results of 42 different data sets and studies dating back to the early 20th century to construct a time series of college attendance patterns for the United States. We find an important reversal around the time of World War II: before that time, family characteristics such as income were the better predictor of college attendance; afterwards, academic ability was the better predictor. We construct a model of college choice that can explain this reversal. The model's central mechanism is an exogenous rise in the demand for college that leads better colleges to become oversubscribed. These colleges institute selective admissions and raise their quality relative to the remaining colleges, as in Hoxby (2009). Rising quality at better colleges attracts high-ability students, while falling quality at the remaining colleges dissuades low-ability students, generating the reversal.

*We thank Rui Castro for a helpful discussion and seminar and conference participants at the University of Western Ontario, Universitat Autònoma de Barcelona, University of Oslo, Colby College, University of Toronto, the Atlanta Fed, the Society for Economic Dynamics, the NBER Summer Institute, the Conference on Human Capital and Financial Frictions at Georgetown, the CIREQ conference on Human Capital, Occupational Choice and Inequality, NBER Time and Space, the Midwest Macroeconomic Meetings, the Ridge Workshop on Growth and Development in Macro, and the ASU Reunion conference. We are grateful to Charles Petersen for bringing additional historical sources to our attention. The views expressed herein are those of the authors and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

†University of North Carolina, Chapel Hill. E-mail: lutz@hendricks.org.

‡Virginia Commonwealth University. E-mail: cmherrington@gmail.com.

§Federal Reserve Bank of Minneapolis. E-mail: todd.schoellman@gmail.com

1 Introduction

A central goal of U.S. higher education policy is to make college broadly accessible. A common interpretation of this goal is that any student with the appropriate abilities and interests should be able to attend college; family characteristics such as wealth or income should not affect college attendance decisions (Bowen et al., 2005). Belley and Lochner (2007) document college attendance patterns that speak to this goal. They characterize college attendance as a function of student test scores and family wealth in the 1979 and 1997 National Longitudinal Survey of Youth (NLSY79, NLSY97). They find that family wealth is a stronger predictor of college attendance for the later cohort of students in the NLSY97, which suggests a potential decline in access. Lochner and Monge-Naranjo (2011) explain this change through a decline in the relative generosity of federal financial aid programs over this time.[1]

Less is known about access to college and college attendance patterns for earlier cohorts. The widespread belief is that access likely improved in the mid-20th century because of, for example, declining discrimination and the introduction of federal loan and aid programs designed to alleviate borrowing constraints (Bowen et al., 2005). However, there is little systematic evidence on access to college outside of narrative descriptions of admissions policies and outcomes focusing mostly on selective Ivy League schools (Karabel, 2006). Our first contribution is to fill this gap by documenting college attendance patterns similar to Belley and Lochner (2007) but for a much longer period.

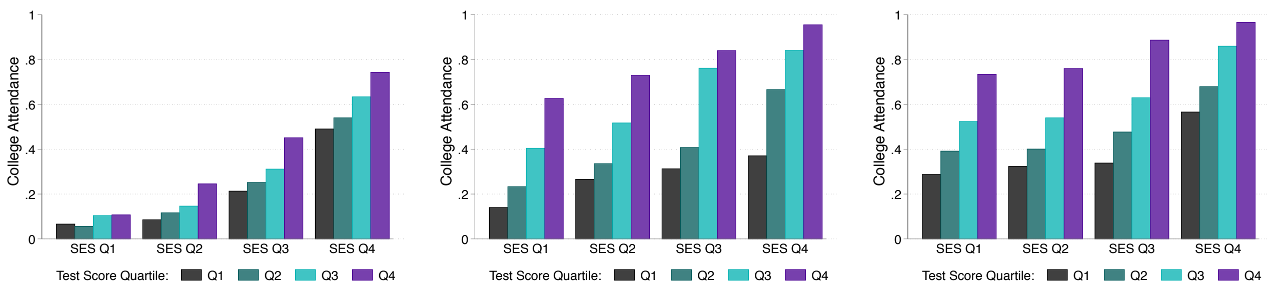
To do so, we collect, harmonize, and analyze the results from 42 data sets and studies that cover college attendance patterns as far back as the high school graduating class of 1919. Our data cover two broad eras. For the graduating classes of roughly 1960 onward, we have periodic access to nationally representative samples of high school students, including in many cases the underlying microdata. We are aware of no such surveys before 1960, and no surveys with extant microdata covering cohorts earlier than 1957. Instead, we have collected the published reports from 36 studies that investigated college attendance patterns around the country before 1960.

These early studies suggest dramatically different college attendance patterns than we see

[1] A large related literature focusing mostly on the NLSY79 generally finds little role for borrowing constraints for college decisions for that cohort (Cameron and Tracy, 1998; Cameron and Heckman, 1999; Carneiro and Heckman, 2002; Keane and Wolpin, 2001; Cameron and Taber, 2004). The patterns documented in Belley and Lochner (2007) and Lochner and Monge-Naranjo (2011) suggest this may be changing. See also Bailey and Dynarski (2011) for subsequent changes in access and Ionescu (2009) for a detailed analysis of the importance of the current federal student loan program.

Figure 1: Changing Patterns of College Attendance: Select Cohorts

(a) 1933 Cohort (b) 1960 Cohort (c) 1979 Cohort



today. For example, Updegraff (1936) collected information on 15 percent of Pennsylvania's 1933 high school graduating class. His report includes a table with college attendance rates for students that vary with respect to IQ test score and socioeconomic status (constructed using parental education and occupation). We reproduce his results on college attendance by IQ test score and socioeconomic status quartiles in Figure 1a.[2] Family background played the dominant role in determining who attended college; academic ability played a surprisingly small role. For comparison, Figures 1b and 1c show the same figures constructed from Project Talent and the NLSY79, which are nationally representative surveys covering the high school graduating classes of 1960 and (roughly) 1979. The figures reveal a complete reversal: by the 1960 cohort, academic ability drives college attendance, with little change between 1960 and 1979.

We harmonize and replicate similar results from the other published tabulations, allowing us to form a time series on college attendance patterns. We find large changes in sorting patterns. Updegraff's findings are typical of studies from the 1920s and 1930s. There are few studies during or shortly after World War II, but by the mid-1950s, there is growing evidence of a complete reversal, with academic ability playing a strong role in college attendance and family background playing less of a role. We see little evidence of a systematic trend in these patterns since 1960.

The timing of our empirical findings rules out two common candidate explanations for changes in who attends college. First, the reversal in sorting predates federal government loan and grant programs. We confirm using historical surveys that students and their families paid 85–90 percent of the total cost to attend college until the 1960s; loans of

[2]The published tabulations are not exactly quartiles, with 20–30 percent of the population per bin.

any type play almost no role in college financing throughout. Second, the reversal affects both genders and lasts long after the surge of federal spending associated with the GI Bill, suggesting that it is not simply the result of the government paying for college for veterans.

The second contribution of our paper is to provide a new theory in which the rise of college attendance generates a national integration of the market for higher education. The key intuition is that although the rising demand for college affects all types of students equally, it sets off a chain reaction: better colleges hit capacity constraints; better colleges institute selective admissions; colleges become more dispersed in quality; and students apply to a broader set of colleges. These endogenous changes are consistent with facts documented by Hoxby (2009) under the general title of the national integration of the market for higher education. The result is a transition from an equilibrium where all students had access to colleges of roughly the same quality to an equilibrium where high-ability students had access to better colleges but low-ability students had access to worse colleges. This change in the choice set generates the reversal.

We formalize this idea in a model featuring a large number of locations, each with a single college and a continuum of students. Students are heterogeneous with respect to their academic ability, which governs how much they learn in college, and their family background, which governs the resources they can consume if they attend college. Students decide whether to work after high school, attend their local college, or attend a college outside their local area at an extra cost. Colleges are heterogeneous with respect to their quality, which is determined by their endowment and the average ability of students they attract. Colleges accept students until they hit an enrollment cap; at that point, they adopt selective admissions and accept only the students with the highest ability.

We feed into this model two exogenous driving forces. The main force is a rising value of college that affects all students equally and leads to an overall increase in the propensity to attend college.[3] The second driving force is improved information about students' abilities, motivated by the widespread adoption of standardized college admissions testing (from 6 percent of college freshmen in 1945 to 76 percent in 1960; see Section 3). We calibrate the model to fit the large change in sorting patterns between 1933 and 1960, as shown in Figures 1a and 1b. We show that the model can do so using just these forces.

The model endogenously produces the national integration of the market for higher ed-

[3] An existing literature has proposed several possible explanations for the rise in college attendance. See Goldin and Katz (2008), Restuccia and Vandenbroucke (2014), Donovan and Herrington (2018), and Castro and Coen-Pirani (2016). The nature of the underlying driving force is not important for our results.

ucation. In the calibrated 1933 equilibrium, only 8 percent of colleges are selective, and the gap in the mean test score percentile between the top and bottom colleges is just 10 percent. Given these small differences, most students prefer to attend their local college. By contrast, in the calibrated 1960 equilibrium, 86 percent of colleges are at least minimally selective and the gap in the mean test score percentile between the top and bottom colleges is 30 percent. These large differences give students more incentive to apply outside their local area, which half of students do. High-ability students are pulled into college by the fact that they can access the top one-third of colleges, where quality rises because of peer effects. Low-ability students are pushed out by the fact that they can access only the bottom two-thirds of colleges, where quality falls. Thus, the reversal is an endogenous reaction to changing college quality by student type.

Although our empirical results suggest that federal loan and grant programs occurred too late to generate the reversal, there are two other mechanisms by which the government may have played a role. Each is a possible source of the exogenous increase in the value of college that is central to our results. First, while the direct financial effect of the GI Bill was short-lived, it is often credited with generating a lasting perception that college was broadly valuable, which may have increased attendance even in the absence of direct government funding. Second, college costs fell starting in the mid-1930s. High school graduates in 1947 paid less for public college (relative to GDP per capita) than any other cohort; the figure is less than one-third of what graduates paid during the Great Depression or in recent years (Donovan and Herrington, 2018). Generous local and state government subsidies helped to pay for this decline in college cost, and so it may be that these other branches of government played an important role in the change in sorting.

A final finding of interest is that there has been little trend in access to college since 1960. On its face, the lack of a trend may be surprising given that the federal government did introduce and subsequently expand loan and aid programs designed to increase access. On the other hand, the large rise in college tuition since 1947 tends to decrease access. One possibility is that the race between tuition and federal loan programs in determining access may have been taking place long before 1979.[4]

The rest of the paper proceeds as follows. Section 2 introduces our historical data and describes the trends in college access and attendance patterns. Section 3 describes the historical context that motivates our model. Section 4 describes the model, Section 5

[4]This explanation treats rising college costs as exogenous, but several theories have linked them back to college spending, income inequality, or even loan availability itself (Comerford et al., 2016; Cai and Heathcote, 2018; Gordon and Hedlund, forthcoming).

provides a quantitative assessment, and Section 6 considers extensions. Finally, Section 7 concludes.

2 Historical Data

The central empirical claim of our paper is that the importance of family background in determining who attends college has declined throughout the twentieth century, while the importance of academic ability has risen. The evidence for the reversal in attendance patterns is derived from two very different types of sources. For the modern era (high school graduating classes of 1960 onward), we have access to microdata or published results from large nationally representative surveys with multiple measures of family background and academic ability as well as students' post-graduation outcomes. These sources are largely familiar to economists and include most prominently Project Talent and the NLSY79.

For students graduating before 1960, our evidence comes from studies conducted by researchers in a variety of fields, including psychology, economics, and education. We have collected and harmonized the results from three dozen such studies. We start with the data sets used in Taubman and Wales (1975) and Hendricks and Schoellman (2014), which cover college attendance by academic ability. We have added more studies of this type to our database. More importantly, we have identified a number of additional studies that tabulate college attendance as a function of family background or as a bivariate function of academic ability and family background.

The original microdata from studies before 1957 no longer exist. Instead we rely on their published results, which we have collected from journal articles, dissertations, books, technical volumes, and government reports. The design, sample, and presentation of results are different for each study. Nonetheless, it may be helpful to consider a hypothetical typical study that utilizes the most common elements in order to understand our approach. Appendix D.1 and particularly Table D1 gives references for the studies used and summarizes some of the most pertinent metadata for each.

In a typical study, a researcher worked with a state's department of education to administer a questionnaire and an aptitude or ability examination to a sample or possibly the universe of the state's high school seniors in the spring, shortly before graduation. Students' academic ability was measured by their performance on the examination or, in some cases, by their rank in their graduating class. The questionnaire inquired about students' family background, with typical questions covering parental education and occupation or estimates of the family's income. These data were used to rank students based on family income or an index of socioeconomic status that would combine several different elements of the data. Finally, the researchers would inquire about students' plans for college or, alternatively, follow up at a later date with the students, their parents, or school administrators to learn about the actual college attendance. Our main data source for this era is published tabulations of these results giving the fraction of students of different academic ability or family background levels (or, ideally, both) that attended college. Most sources cover only whether the students attended college, with little comparable detail about which college they attended; Chetty et al. (2017) have information about this for recent cohorts.

Our goal is to summarize the results of these studies in a simple way that is easy to compare over time. We start with the subset of studies for which we have the ideal information, which is the full bivariate cross-tabulation of college-going as a function of family background and academic ability. We convert family background and academic ability categories into percentile ranges. We then treat the reported tabulations as data on $C(s,p)$, where C is the percentage of students in a group who attend college and s and p are the midpoints of the percentile intervals of ability (score) and family background (parents), respectively. We regress $C(s,p)$ on s and p and report the estimated coefficients β_s and β_p, which capture the importance of academic ability or family background for college while controlling for the other factor.[5] This control is useful because family background and academic ability are positively correlated in every study for which we can cross-tabulate the two.

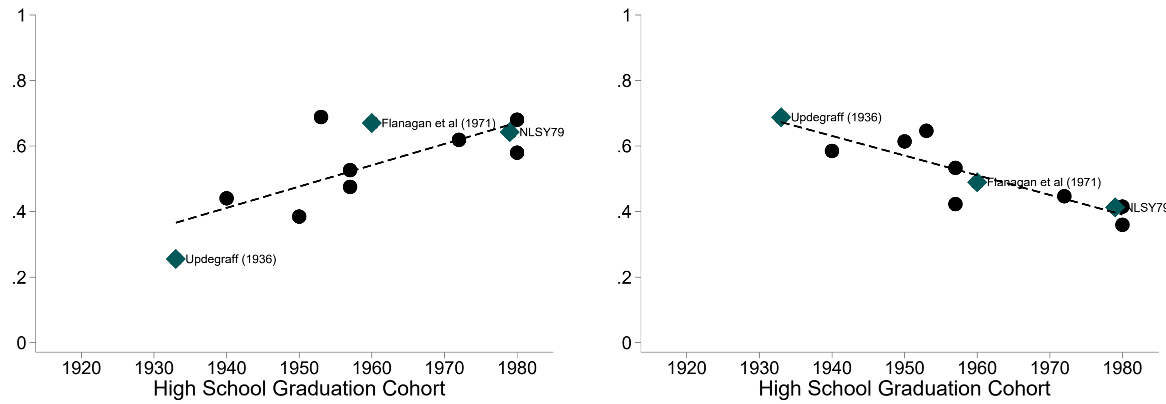
Figure 2 plots the estimated coefficients β_s and β_p against high school graduation cohort. The role of academic ability (test scores or grades) has risen sharply over time, in line with the previous work of Taubman and Wales (1975) and Hendricks and Schoellman (2014). The role of family background (parental income or socioeconomic status) has fallen. Studies conducted before World War II tend to find that family background is more important than academic ability, while studies after World War II tend to find the opposite.

We have highlighted three data points of particular importance. Updegraff (1936) is the first study to cross-tabulate college attendance by family background and academic ability. It shows that prior to World War II, family background rather than academic ability was a more important determinant of who attended college. Flanagan et al. (1971) is the first nationally representative study with existing microdata. It shows that sorting patterns had already reversed by 1960. The NLSY79 is the starting point for most of the existing

[5] Similar results obtain if we instead standard normalize s and p instead of using percentiles; see Figure B1 in the Appendix.

Figure 2: Changing Patterns of College Attendance: Bivariate Studies

(a) Academic Ability (b) Family Background



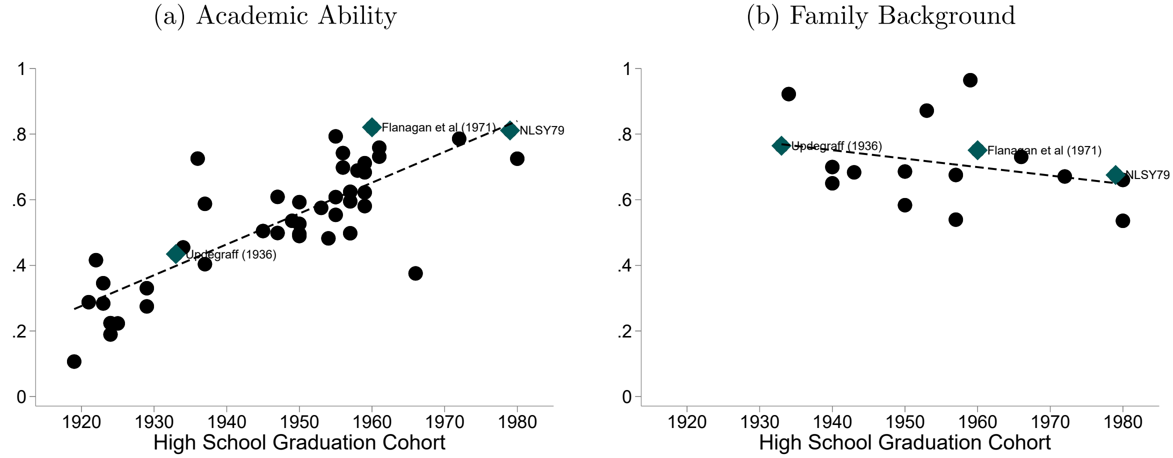
literature. Our data suggest that the level of sorting did not change appreciably between Project Talent and the NLSY79. Thus, in our quantitative exercises we attempt to explain what changed sorting between 1933 and 1960.

In addition to these studies with full bivariate tabulations, we have many more studies that tabulate college-going as a function of family background or academic ability alone. We construct a similar time series with these univariate tabulations, now regressing $C(p)$ on p or $C(s)$ on s individually. Figure 3 shows the results. Figure 3a shows that a large number of studies investigated the role of academic ability for college attendance before World War II and consistently found that it played little role. Figure 3b shows that we have fewer studies that investigate family background but that they support a declining role for family background. The trend is weak, but this is not surprising since we do not control here for academic ability. Academic ability and family background are positively correlated and selection on academic ability is increasing over time, which generally provides a bias in favor of finding an increased role for family background.

2.1 Patterns by Gender

Our results so far have covered aggregate trends. A large literature has documented important changes in the access of women and minorities to educational and labor market

Figure 3: Changing Patterns of College Attendance: Univariate Studies

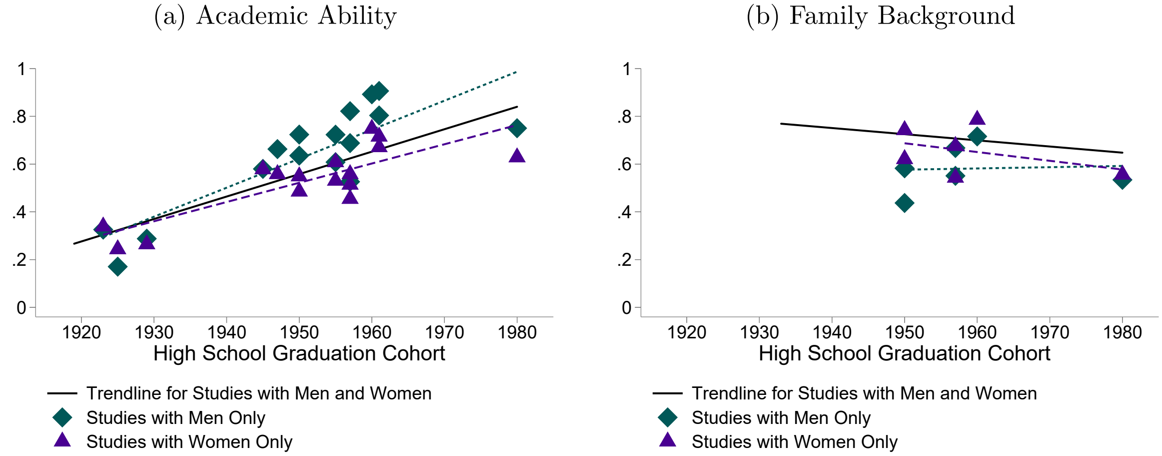


opportunities over this time.[6] Hsieh et al. (2018) argue that these changes may have contributed to aggregate economic growth. About one-third of our historical studies tabulate results separately for men and women, allowing us to study whether the trends differ. We focus on tabulations of college-going as a function of academic ability or family background separately; we have the full bivariate tabulation only for three sources around 1960. We repeat our measurement exercises separately for each gender and then study the time series for men and women separately, with comparison to the trend for the two genders combined from the previous subsection.

The results are shown in Figure 4. We have a large number of studies investigating the role of academic ability by gender, including three studies from the 1920s. Those studies show that academic ability was equally unimportant for both genders in the 1920s and that it became more important for both in the 1940s and 1950s. Academic ability seems to have risen in importance more for men than for women, as indicated by the fact that the data points for men exceed those for women for almost all studies in the 1950s. We have fewer studies investigating the role of family background by gender, and the first such study dates only to 1950. Family background is equally important for men and women in 1980, and it appears from the few available studies to have been more important for women than for men in the 1950s. This is consistent with the conventional wisdom that the college attendance choices of women were more sensitive to family income in the past because it

[6]See Altonji and Blank (1999) for an overview of labor market differences between men and women, including historical trends.

Figure 4: Changing Patterns of College Attendance by Gender



was harder for them to work their way through college, both because they had fewer job opportunities and because they earned lower wages (Greenleaf, 1929; Hollis, 1957).

Unfortunately, we have little to say about the importance of race. None of our sources from before the 1950s provide separate tabulations by race. In large part, this is because most of these studies were conducted in northern states where black students would have been much less common. Of the few studies of southern states, several explicitly mention that they restrict attention to schools for white students, and we suspect the others may have done so implicitly. Hence, our early data sources and our overall trends should really be read as applying to white students. We have computed in the NLSY79 that black and Hispanic students are relatively more sorted by academic ability and less sorted by family background than are white students. Given the absence of earlier race-specific data, we can only speculate about the long-term trends implied by this fact.

2.2 Controlling for Variation in Historical Study Design

Our baseline results combine the findings of studies that differ in numerous ways, such as which proxies they use for family background or academic ability, when they measured college attendance, the size of the bins they used for tabulations, and so on. In this section we explore whether variation in study design systematically affects the estimated trends in β_p and β_s that we document.

Our approach is based on fixing a data set for which we have the microdata – the NLSY79

– and exploring the implications of varying four dimensions of study design. First, studies vary in whether they measure academic ability using test scores or class rank. Within the NLSY, we experiment with using the Armed Forces Qualifying Test (AFQT) score or class rank at high school graduation. Second, studies vary in whether they measure family background using parental income or socioeconomic status. Within the NLSY, we experiment with using family income at the time of the student's high school graduation or creating an index of socioeconomic status. Third, studies vary in whether they measure college attendance plans or actual college attendance. Within the NLSY, we experiment with using whether high school seniors planned for one or more years of college (versus zero) and using the longitudinal aspect of the NLSY to track whether they actually attended college. Finally, historical studies grouped academic ability and family background into bins of various sizes. We do the same within the NLSY. Details on sample selection and measurement are available in Appendix A.

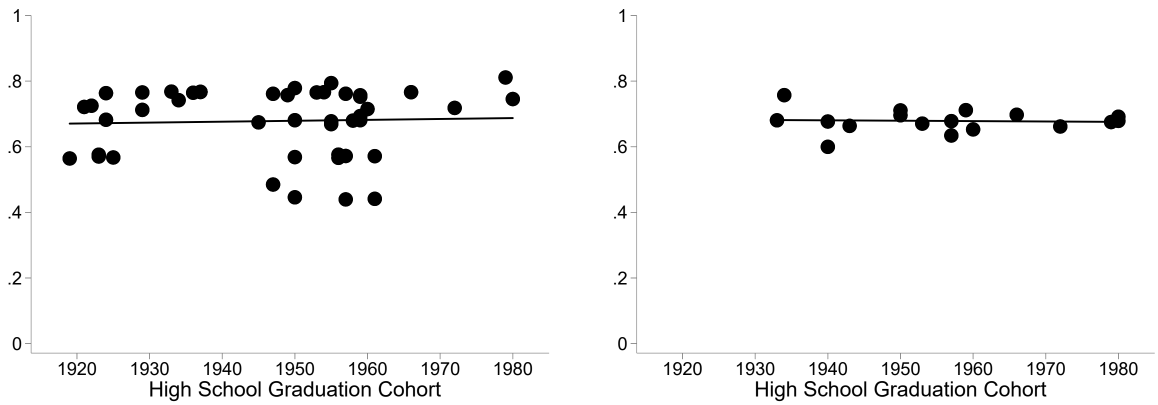
We vary these four dimensions systematically within the NLSY and study how they affect the resulting estimates β_s and β_p. By far the most important dimension is family background. Estimates of β_p are systematically larger when family background is measured as socioeconomic status than when it is measured as parental income.[7] We conjecture that this result may arise because socioeconomic status is a better measure of permanent income than is parental income in one year. Fortunately, our three main studies of interest (Updegraff (1936), Project Talent, and NLSY79) all use socioeconomic status as the measure of family background. We find lesser roles for the other dimensions.

To formalize these findings, we conduct a falsification test. We mimic each of our historical studies by taking the NLSY data and setting the four dimensions of interest to match those of the original study. For example, Goetsch (1940) reports college-going as a function of family income for students who score in the top 15 percent of a standardized test. She provides tabulations for eight family income categories, containing 24, 8, 16, 22, 20, 7, and 3 percent of the relevant population. We take students who score in the top 15 percent of the AFQT in the NLSY and form them into eight family income categories, containing the same percentage of the population. We then estimate the counterfactual β_p that Goetsch would have found if she had conducted her study on the NLSY sample.

[7] Specifically, we regress β_s and β_p on cohort while including dummy variables to control for study design parameters (e.g., a dummy for using test scores instead of grades). There is a consistent, statistically significant effect of using socioeconomic status rather than income, which raises β_p by 0.22 in the bivariate case and 0.30 in the univariate case. We find similar effects when we focus solely on the NLSY79. Our time series figures above are all adjusted for this gap (by increasing implied coefficients from studies that use income).

Figure 5: Counterfactual Changes in Patterns of College Attendance: Univariate Studies

(a) Academic Ability (b) Family Background



In Figure 5, we re-create Figure 3 with our counterfactual estimates of β_s and β_p plotted against high school graduation cohort (for the original study).[8] It is clear from this figure that variation in study design induces noise in our estimates of β_s and β_p. Given the same NLSY79 data, we can find a range of possible results depending on what proxies we use and how we format the data. However, the main message is that this variation seems to be uncorrelated with time and hence likely does not bias our estimates of the underlying trends.[9]

3 The Growth and National Integration of the Market for Higher Education

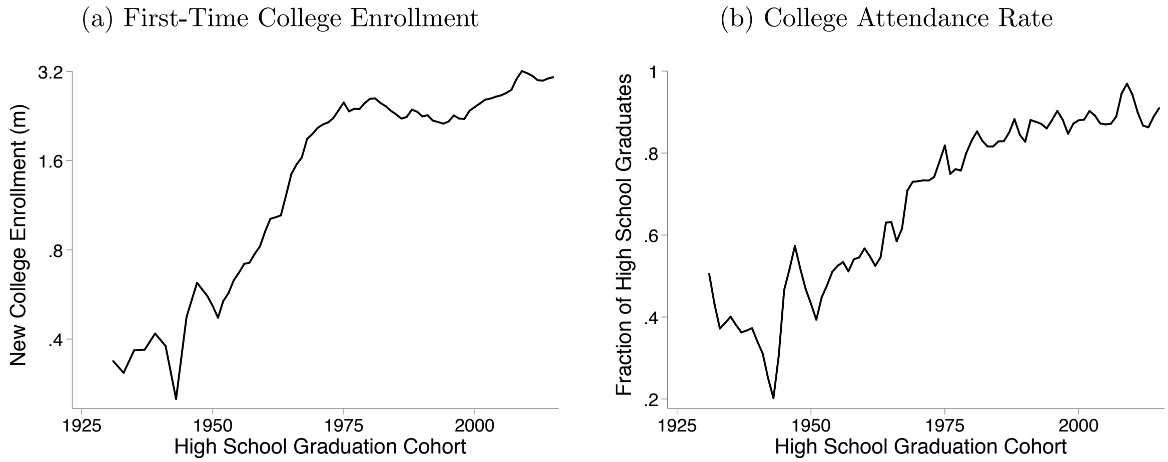
Our empirical results show that college attendance patterns changed sharply in the 1940s and 1950s. In the next section, we formulate a model that is grounded in two important changes that affected colleges after the war: the growth and national integration of the market for higher education. The model takes the expansion of college as an exogenous driving force and endogenously produces the national integration of the market for higher educa-

[8]Similar results apply for the bivariate studies; see Figure B2 in the Appendix.

[9]An alternative worry is that older tests may have been worse, which would explain our time trend in academic ability measures. In Hendricks and Schoellman (2014), we document that the predictive validity of tests seems reasonably stable over time. Further, a similar pattern emerges if one compares across cohorts taking the same test.

tion. The latter differentially affects the quality of colleges available to high-ability and high-income students, which affects their attendance decisions and generates the reversal. Here we document some of the relevant facts that motivate our model setup.

Figure 6: Increase in College Attendance



We start with attendance. Figure 6 shows the dramatic increase in college enrollment using statistics on high school graduates and new college enrollment by year from the Biennial Survey of Education and the Digest of Education Statistics. We show complementary statistics derived from census data in Appendix C. Figure 6a shows total new college enrollment by year. Enrollment hovered around 400,000 students per year during the Great Depression and fell during World War II. There was a large spike after the war (associated in part with the GI Bill) but also a strong upward trend until around 1970. Our historical data and our model focus on the college attendance decisions of high school graduates. Figure 6b shows college enrollment relative to high school graduation rates. These figures were low during the Great Depression and fell during World War II. They spiked after the war but also show a sustained long-term increase to around 80–85 percent.

The model takes as exogenous a generic rise in the value of college, which affects all students equally and which is calibrated to reproduce the surge in enrollment. Although the underlying source of the rise in the value of college is not important for our purposes, it is worth noting that there are at least four well-known culprits for the surge in attendance. First is the rising college wage premium (Goldin and Katz, 2008). Second and related is a long-term change in the nature of high school and college curriculums, with the latter particularly becoming more applied and more attractive from a career perspective over this time period (Alon, 2018). Third is declining college tuition costs between 1935 and 1955. In Appendix C, we present data following Donovan and Herrington (2018) showing that the real tuition cost of public colleges showed no trend between 1935 and 1955. Since incomes were generally rising during this period, public college became much more affordable, expanding access. Fourth is the Servicemen's Readjustment Act of 1944, commonly known as the GI Bill, which greatly subsidized college attendance especially for veterans of World War II (Bound and Turner, 2002). Although the direct financial outlays to pay for college were short-lived, the GI Bill is often credited with changing broader social perceptions about the value of college.

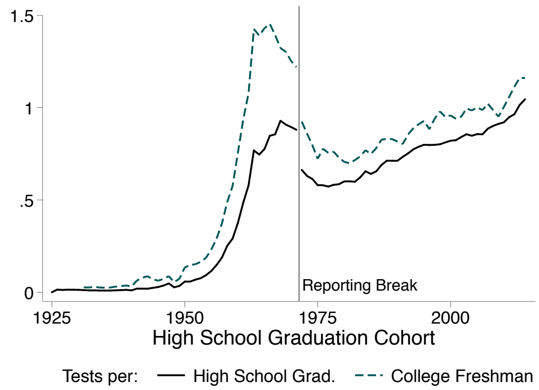
We now turn to the national integration of the market for higher education. An important driving force for this change is that college applications and admissions procedures became standardized and streamlined after World War II. Prior to World War II, college admissions decisions were based on whether students had demonstrated mastery of certain knowledge. The subjects to be mastered, level of knowledge required, and mechanism for demonstrating mastery varied widely by college and year, with many colleges offering multiple paths to achieve admissions (Kurani, 1931). Given the idiosyncratic nature of college requirements and admissions processes, college guides from the 1930s recommended that students choose a college as early as possible and then work with its admissions department to demonstrate compliance with the relevant standards (Halle, 1934). In many states, high schools would form a relationship with a local college. The high school tailored its curriculum to the college's requirements, while the college agreed to certify and accept the high school's graduates for admissions.

This system was replaced by a homogeneous system based on standardized college admissions exams (the SAT and later its competitor, the ACT) after the war. Appendix C describes some of the forces that led to widespread adoption of these exams, including rapidly falling costs of administering and scoring exams. Figure 7 shows the main takeaway: an explosion of test-taking took place from 1950 to 1965. At the peak, there were more tests taken than college freshmen, and roughly three-quarters of high school seniors took a test.[10]

The standardization of admissions and the surge of demand for college had two important implications that will act as mechanisms for our model. First, they led students to apply to more colleges over a larger geographic area. Hoxby (2009) documents some geographic

[10]Figures include ACT test-taking from its introduction in 1959 onward. The discontinuity reflects a break in how the SAT reports test-taking; until 1971 it reports tests taken, while from 1972 it reports unique test-takers.

Figure 7: Rise of College Entrance Examinations



facts and cites the fall in transportation and communication costs. Before the war, students applied to multiple colleges only rarely because of the difficulty of complying with multiple admissions requirements.[11] College guides from after the war already recommend applying to "three or four" colleges (Dunsmoor and Davis, 1951). Just under three-fourths of applicants applied to a single college in 1947; only one-half did so by 1959; and less than one-third did so by 1979 (Roper, 1949; Flanagan et al., 1964; Pryor et al., 2007). This "plague" or "specter" of multiple applications was a recurring topic of discussion among admissions officers in the 1950s.[12]

Second, the growth in applications allowed better colleges to switch from recruitment to selective admissions. Before the war, the typical college accepted all students who met the posted requirements.[13] The surge of attendance after the war was sufficiently large and rapid that more desirable colleges found it infeasible to expand enrollment in proportion to their applications. College entrance exam scores emerged as a key metric of college quality and selectivity. The result was the "fanning out" of colleges documented in Hoxby (2009): average student test scores have risen at top colleges but fallen for median and below-median colleges since at least 1962.

[11]Partridge (1925) provides figures from a large urban high school with a large majority of students attending college, which was rare at the time. Even at this evidently advantaged high school, only 11 percent of students applied to more than one college.

[12]See Duffy and Goldberg (1998) pp. 37–39 and Bowles (1967) p. 117.

[13]From Duffy and Goldberg (1998), p. 35: "[S]tudents tended to apply only to their first-choice college, and they were usually accepted" and "Admissions officers visited selected high schools, interviewed candidates for admissions, and then usually offered admission to students on the spot." Less politely, this was the "warm body, good check" stage of admissions (p. 34). Admission was certainly implied under the widely used certificate system (Wechsler, 1977).

These changes lead us to formulate a model that takes as exogenous the general increased demand for college and produces changes in sorting patterns consistent with the national integration of college. By contrast, we abstract from changes in college financing, which would seem to be a plausible alternative explanation. The reason we do so is that the changes in sorting patterns we document take place before 1960, whereas significant federal government involvement in college financing via grants and loans starts only in 1959 with the National Defense Education Act and does not become quantitatively important until the 1960s. The main form of earlier financing was the GI Bill, which was enormous (accounting for one-quarter of all college income at its peak) but also short-lived and applied only to men, and so is unlikely to drive our lasting changes. Appendix C has further details.

To document this point, we draw on three surveys that collected information on how students financed college throughout the 1950s (Hollis, 1957; Iffert and Clarke, 1965; Lansing et al., 1960). These surveys all agree on the broad picture of college financing. The main source of financing was students and their families, with the reported share ranging between 80 and 87 percent in the three studies. The next leading categories were scholarships (4.8–8.4 percent) and "other" (2.6–7.1 percent). Only 1.9–3.3 percent of students and 14 percent of families report borrowing from any source, with the total borrowed accounting for a tiny fraction of total expenditures. Similarly, Harris (1962) reports that loans only accounted for about 1 percent of all undergraduate student charges in 1956. Where loans did exist, they were generally financed by endowed funds, managed by individual colleges, and typically had to be repaid in several (no more than 10) years. To be clear, these figures were quite different by 1969–1970; the share paid for by families had fallen below three-quarters, with loans taking up much of the shortfall (Haven and Horch, 1972). Given that the goal of our quantitative exercise is to explain the switch in attendance patterns between 1933 and 1960, we focus on a model where students cannot borrow throughout.

4 Model

We develop a model of college choice and admissions that captures the forces described in Section 3. The economy contains a discrete number of locations (islands) indexed by $i \leq I$. Each location is home to a single college and a measure 1 of new high school graduates per year. Locations are heterogeneous with respect to the quality of the local college but are otherwise identical. Each college sets an admissions policy that specifies the expected ability needed for admission. Students with heterogeneous family backgrounds and expected abilities decide whether to attend the local college, attend college elsewhere, or work straight out of high school.

The model is static: it covers the college attendance decisions of a single high school graduation cohort in isolation. Our goal in the next section is to show that the model can generate a quantitatively significant reversal of who attends college, consistent with the data. When we do so, we simulate two equilibria of the model, corresponding to the equilibrium of the 1933 and 1960 cohorts. Most parameters will be held fixed, but we will allow two to vary over time; we denote these parameters with a t subscript to highlight their particular role in the analysis.

4.1 Colleges

Colleges have endowments $\bar{q}_i$ spaced uniformly on the interval $[\underline{q}, \overline{q}]$. This endowment represents the literal endowment of the college: the land, buildings, and financial accounts that a college possesses. The college's quality q_i depends on both its endowment and the mean ability of its students $\bar{a}_i$, $q_i = \bar{q}_i + \bar{a}_i$.

Colleges set an admission criterion, which is specified as a minimum expected student ability for acceptance, $\underline{a}_i$. Their objective is lexicographic. Their first priority is to maximize enrollment e_i, until it hits capacity E. Keeping enrollment high is important for colleges because they need to finance large fixed costs associated with building maintenance. For colleges that are at capacity, their goal is to maximize quality, which leads them to set the highest value of $\underline{a}_i$ that maintains full enrollment. We hold capacity fixed in the baseline model, motivated by the fact that enrollment rose quickly after the war, leaving colleges little time to build classrooms or dormitories. For example, first-year enrollment in 1947 was 150 percent larger than in 1943 and 50 percent larger than the pre-war peak. However, we will also explore extensions where capacity expands in Section 5.

4.2 Students

High school graduates have heterogeneous endowments (a, p, g, s, l). Ability a affects how much they learn in and benefit from college. Family (parental) background p determines the resources students can access to finance consumption if they attend college. It can be thought of as including transfers from parents plus income from work while in college, minus payments for tuition. Children from richer families can access more funding and enjoy higher consumption while in college, making it more enjoyable. Students are endowed with two noisy signals of their ability, g and s. Finally, l is their endowed location, which determines the quality of their local college. Endowments are drawn from a distribution $F(a, p, g, s)$ that is constant across locations and (in the baseline analysis) over time.

Ability is unobservable to students and to colleges when application and admissions decisions are made. Instead, students and colleges form expectations about the student's ability. Below we assume that p, g, and s are all correlated with a and hence are potentially useful for forming expectations. Our first time-varying driving force is the subset of this information $\mathbb{I}_t$ that is observed by cohort. We assume that pre-war cohorts had information sets $\mathbb{I}_t = (p, g)$, while post-war cohorts had more information, $\mathbb{I}_t = (p, g, s)$. The variable g represents grades or, more broadly, the set of information that is available to students throughout, while s represents new information available to post-war cohorts, such as test scores on standardized college entrance examinations. We denote by $\mathbb{E}(a \mid \mathbb{I}_t)$ the expected ability given available information.

Given this time-varying information set, graduates make an irrevocable decision whether to work as a high school graduate or attend college. High school graduates who enter the labor force directly possess a single unit of human capital that they supply to the labor market inelastically at the prevailing wage for high school graduates when they are of age $j \in \{0, 1, ..J\}$, w_j^{HS}. They solve a simple life-cycle consumption problem:

$$\max_{c_j} \sum_{j=0}^{J} \beta^j \log(c_j)$$
$$s.t. \sum_{j=0}^{J} c_j R^{-j} = \sum_{j=0}^{J} w_j R^{-j},$$

where β is the discount rate and R is the gross interest rate. We assume $\beta R \equiv 1$, which gives that consumption is constant over the life cycle and allows us to solve for the flow value of being a high school graduate V_t^{HS}.[14] This value can vary over time to capture growing wages or (indirectly) changes in the non-pecuniary aspects of working as a high school graduate.

Alternatively, graduates can choose to attend a college. We start by defining the value of attending the local college, which is feasible as long as the student's expected ability exceeds

[14] $V_t^{HS} \equiv \log\left(\frac{\sum_{j=0}^{J} w_{t+j}^{HS} \beta^j}{\sum_{j=0}^{J} \beta^j}\right) \sum_{j=0}^{J} \beta^j$.

the college's cutoff, $\mathbb{E}(a \mid \mathbb{I}_t) \geq \underline{a}_l$. The student finances consumption while in college using family resources p, which gives them flow utility $\log(p)$. Students are restricted from borrowing against their future income although they would wish to do so, consistent with the financial environment through the mid-1960s. Upon graduation they acquire human capital given by a CES production function that takes the student's ability and college quality as inputs, $h(a, q) = [\phi q^\gamma + (1-\phi)a^\gamma]^{\alpha/\gamma}$. The virtue of a CES production function is that it allows flexibility in γ, which governs how substitutable college quality is for student ability. The parameter α governs the overall curvature of human capital formation.

College graduates enter the labor market and supply $h(a, q)$ units of labor inelastically each year at the prevailing wage for college graduates when they are of age j, w_j^C. They solve a similar life-cycle consumption problem as high school graduates. Extending the logic above, the expected post-graduation utility of working as a college graduate taken before ability is known can be represented as $\sum_{j=1}^J \beta^j \mathbb{E}_a[\log(h(a, q)) \mid \mathbb{I}_t] + V_t^C$.[15] The total value of attending the local college is then given by

$$V(p, \mathbb{I}_t, l) = \log(p) + \hat{\alpha}\mathbb{E}_a \left[\log\left(\left[\phi q_l^\gamma + (1-\phi)a^\gamma\right]^{1/\gamma}\right) \mid \mathbb{I}_t\right] + V_t^C, \tag{1}$$

where $\hat{\alpha} \equiv \alpha \sum_{j=1}^J \beta^j$.

Finally, students can pay cost κ to apply to and attend non-local colleges. This cost represents transportation costs, search frictions, out-of-state tuition fees, and so on. Once this cost is paid, students can attend any college where their expected ability meets the admissions criteria. On the other hand, it reduces their consumption while in college to $p - \kappa$. These trade-offs are embedded in the value function for non-local applicants:

$$W(p, \mathbb{I}_t, l) = \mathbb{E}_a \left\{ \max_{i \neq l : \mathbb{E}(a \mid \mathbb{I}_t) \geq \underline{a}_i} V(p - \kappa, \mathbb{I}_t, i) + \bar{\zeta}\zeta_i \right\}, \tag{2}$$

where ζ_i is an i.i.d. type-I extreme value taste shock for college i. It is revealed to students only after they choose to apply outside their local area. Its primary purpose is to make the model more tractable computationally by smoothing students' application behavior across the parameter space. The parameter $\bar{\zeta}$ controls the dispersion of the shocks, which in turn controls the relative importance of taste versus human capital formation for college choices.

Students choose among these three options (work as high school graduate, attend local

[15]If we assume that college takes one period, then $V_t^C \equiv \log\left(\frac{\sum_{j=1}^J w_{t+j}^C R^{-j}}{\sum_{j=1}^J R^{-j}}\right) \sum_{j=1}^J \beta^j$.

college, search among all colleges) to maximize lifetime utility:

$$\max \left\{ V_t^{HS} + \bar{\eta}\eta_{HS}, V(p, \mathbb{I}_t, l) + \bar{\eta}\eta_V, W(p, \mathbb{I}_t) + \bar{\eta}\eta_W \right\}, \tag{3}$$

where the ηs are again i.i.d. type-I extreme value taste shocks scaled by $\bar{\eta}$ and introduced mainly for computational tractability. As is standard in these problems, the level of utility is not identified, so without loss of generality we normalize $V_t^{HS} \equiv 0$ for each cohort and interpret V_t^C as the relative attractiveness of college as compared to high school. As discussed above, we will allow this to increase over time, consistent with the rising college wage premium or, more generally, a variety of factors that made college more attractive at this time.

We then have two driving forces that we will vary as we simulate the choices of different cohorts: V_t^C, which we use to fit the fraction of each cohort that attends college, and $\mathbb{I}_t$, which captures the improved signals of students' abilities after the introduction of standardized testing.

4.3 College Admissions Algorithm

An equilibrium in this model consists of college choices for students (whether to attend and, if so, which college), admissions cutoffs for colleges, and college qualities. The choices need to maximize the lifetime utility of each student (equation (3)) and the lexicographic objective of the colleges. The equilibrium quality of each college also has to be consistent with the set of students who actually attend the college.

If we allow for arbitrary application and admissions behavior by students and colleges, this model will tend to have multiple equilibria because of the peer effects. For example, if we take an equilibrium and rank colleges from highest to lowest quality, it may be the case that we can switch the student bodies of the highest- and lowest-quality colleges and obtain a new equilibrium. The extent of multiplicity depends on the relative importance of peer effects as compared to differences in college endowments in the overall production of college quality. We sidestep this issue by focusing on the equilibrium produced by a college admissions algorithm that we find intuitively appealing.

The algorithm works as follows. We start by forming a guess of the quality of each college q_i, which is restricted to be weakly increasing in college endowment $\bar{q}_i$. We rank students by expected ability, $\mathbb{E}(a \mid \mathbb{I}_t)$. Working down from the student with the highest expected ability, the algorithm assigns each student in turn to their most preferred available outcome: working as a high school graduate, attending the local college, or attending their most preferred college nationwide. When a student chooses college i, enrollment e_i is increased by one student.

At some point, when allocating the student with expected ability $\widehat{\mathbb{E}(a \mid \mathbb{I}_t)}$, we will hit the enrollment limit at college i, $e_i = E$. We use this point to define college i's admissions cutoff: $\underline{a}_i \equiv \widehat{\mathbb{E}(a \mid \mathbb{I}_t)}$. Note that this step automatically satisfies the college's objective. The college would not want to set its cutoff any higher because then it would not be at capacity; it cannot set its cutoff any lower or it would violate the capacity constraint. Students with expected ability smaller than this cutoff cannot attend college i.

We continue this procedure until all students are allocated. We then compute the expected quality of all colleges and compare it to our initial guess. We iterate on quality until it matches students' expectations.

This algorithm has three desirable features. First, it produces an equilibrium where student ability and college endowment are positively related, discarding any possible equilibria where high-ability students coordinate on attending the low-endowment college to benefit from peer effects. Second, it is tractable and converges rapidly. Third, experimentation suggests that it produces a unique equilibrium given a set of parameters.

5 Quantitative Assessment

In this section, we calibrate the model and study its implications for the time series patterns of sorting. We simulate two equilibria of the model, corresponding to the 1933 (Updegraff (1936)) and 1960 (Project Talent) cohorts. These cohorts span the reversal in sorting, and the corresponding studies offer the full bivariate tabulation of college-going as a function of academic ability and family background that we prefer. Stopping with the 1960 cohort also allows us to abstract from federal government involvement in college financing, which comes later.

We calibrate the model to fit the fraction of students of different types who attend college in the two cohorts, as well as the application behavior of students by cohort. As emphasized in the last section, most of our parameters are time-invariant. Our calibration exercise is thus judged on whether we can generate a quantitatively large reversal in college attendance patterns using two time-varying driving forces: a change in the relative value of college for all students and an increase in information about students' abilities. We show that the model is capable of doing so. We explore the mechanism, which is that the endogenously generated change in application and admissions behavior differentially affects the quality of college available to students of different types. Finally, we disentangle the two driving forces and show that the rising value of college is primarily responsible for our results.

5.1 Calibration

The model has a number of parameters that need to be calibrated for a quantitative assessment. We start with the parameters relevant to colleges. We assume that colleges have endowments spaced uniformly on the interval $[\underline{q}, \bar{q}]$. We also need to choose the capacity of each college, E.

The second set of parameters govern students' endowments. We assume that $(a, \log(p))$ are drawn from a bivariate normal distribution with mean (μ_a, μ_p), standard deviations $(1, \sigma_p)$, and correlation ρ.[16] We assume that the signals g and s are unbiased draws from a normal distribution with standard deviations σ_g and σ_s.[17] The variable g represents the signal available to students of both cohorts; we refer to it as "grades" for ease of exposition, but it should be interpreted more broadly. The variable s captures the signal provided by test "scores" on standardized college admissions exams, which became widespread after the war. Since all variables are jointly normal, we can solve analytically for $\mathbb{E}(a \mid \mathbb{I}_t)$.

The third set of parameters govern human capital formation and its labor market returns. The human capital production function has three parameters, ϕ, γ, and $\hat{\alpha}$, which govern the relative weight on quality versus ability in the production of human capital; the elasticity of substitution between the two; and the overall curvature of human capital production. The parameter κ is the extra cost to apply to non-local colleges. V_t^C is the relative value of college (as compared to high school) for cohort t, which captures differences in wages, among other factors.

Finally, we have two preference parameters, $\bar{\eta}$ and $\bar{\zeta}$, which provide a scale to the type-I i.i.d. extreme value shocks for the three broad choices (work as a high school graduate, attend local college, attend national college) and for specific non-local colleges, respectively. All told, this gives us 17 parameters, which are summarized in Table 1.

[16] Our human capital production function requires a to be positive. We truncate the distribution and replace all non-positive values with a small positive value.

[17] We also explored allowing for a more general structure of correlations between (a, p, g, s) but found that doing so does not substantially improve the model fit or change its predictions.

Table 1: Calibrated Parameters

Parameter	Description	Value
Colleges		
$\underline{q}$	Lower bound on college endowments	0.61
$\overline{q}$	Upper bound on college endowments	2.26
E	College capacity	0.55
Endowments		
μ_p	Mean log parental transfer	-0.08
μ_a	Mean ability	0.90
σ_p	Standard deviation of log transfer	0.10
ρ	Correlation of parental transfers and ability	0.43
σ_g	Noise in grades	0.74
σ_s	Noise in test scores	1.50
Human capital production		
γ	Substitution between ability and quality	-0.26
ϕ	Weight on quality	0.74
$\hat{\alpha}$	Curvature of human capital production	0.71
κ	Application cost	0.41
V_t^C	Relative value of college	(-0.37, 0.66)
Preferences		
$\bar{\eta}$	Scale of taste shocks among broad education choices	0.08
$\bar{\zeta}$	Scale of taste shocks among colleges	0.08

Note: Table gives model parameters, a brief description of their role, and the calibrated value.

We choose these parameters to fit a weighted quadratic loss function with 32 moments from each cohort, or 64 in total. Our main targets are the share of students in each (s, p) quartile and the share of each (s, p) quartile that attends college for each cohort. We map the test scores and indices of socioeconomic status in the data into the model objects s and p. Note that for the 1933 cohort, we match the model and the data on the basis of test scores, even though we have assumed that agents in the model do not know test scores. The idea is that although we have access to test scores from Updegraff (1936), and students covered by this study likely did as well, test scores – particularly standardized college admissions test scores – were generally rare at the time.

Finally, we fit a measure of how nationally integrated the market for higher education is. Before World War II, most students applied to only a single college, typically one with a close relationship with their high school. Our best estimate for the 1933 cohort is that 85 percent apply to just one college, which is a midpoint between the estimate of 89 percent from the 1920s and 75 percent from 1947 (see Section 3 for sources). By contrast, about one-half of students in the 1960 cohort applied to multiple colleges (Flanagan et al., 1964). We calibrate the share of students attending non-local colleges in the model to fit the share of students who apply to multiple colleges in the data. Our underlying idea is that students who apply to only a single college are probably choosing a college with a close relationship with their high school and a high probability of acceptance, which is how we think of the local college in our model. Submitting multiple applications indicates a broader search.

5.2 Model Fit

Table 1 describes the calibrated parameters. We highlight two areas of special interest. First is the human capital production function. This function puts a large weight on college quality ($\phi = 0.74$). It also finds that college quality and student ability are complementary inputs to the formation of human capital ($\gamma < 0$). This calibrated production function implies that students, particularly high-ability students, have incentives to seek out high-quality colleges.

Second, we are interested in the evolution of the parameters that vary by cohort. The relative value of attending college V_t^C rises substantially. This rise generates the increase in college attendance, which turns out to drive most of our results. We allow for additional information about students' abilities in later cohorts in the form of s ("test scores"). The large variance of s relative to g suggests that these test scores do not improve the precision

Table 2: Summary of Model Fit, 1933 and 1960

	1933 Cohort		1960 Cohort	
	Data	Model	Data	Model
College attendance	0.29	0.29	0.53	0.52
Local college attendance	0.85	0.85	0.51	0.51
β_s	0.23	0.29	0.71	0.78
β_p	0.69	0.67	0.48	0.60

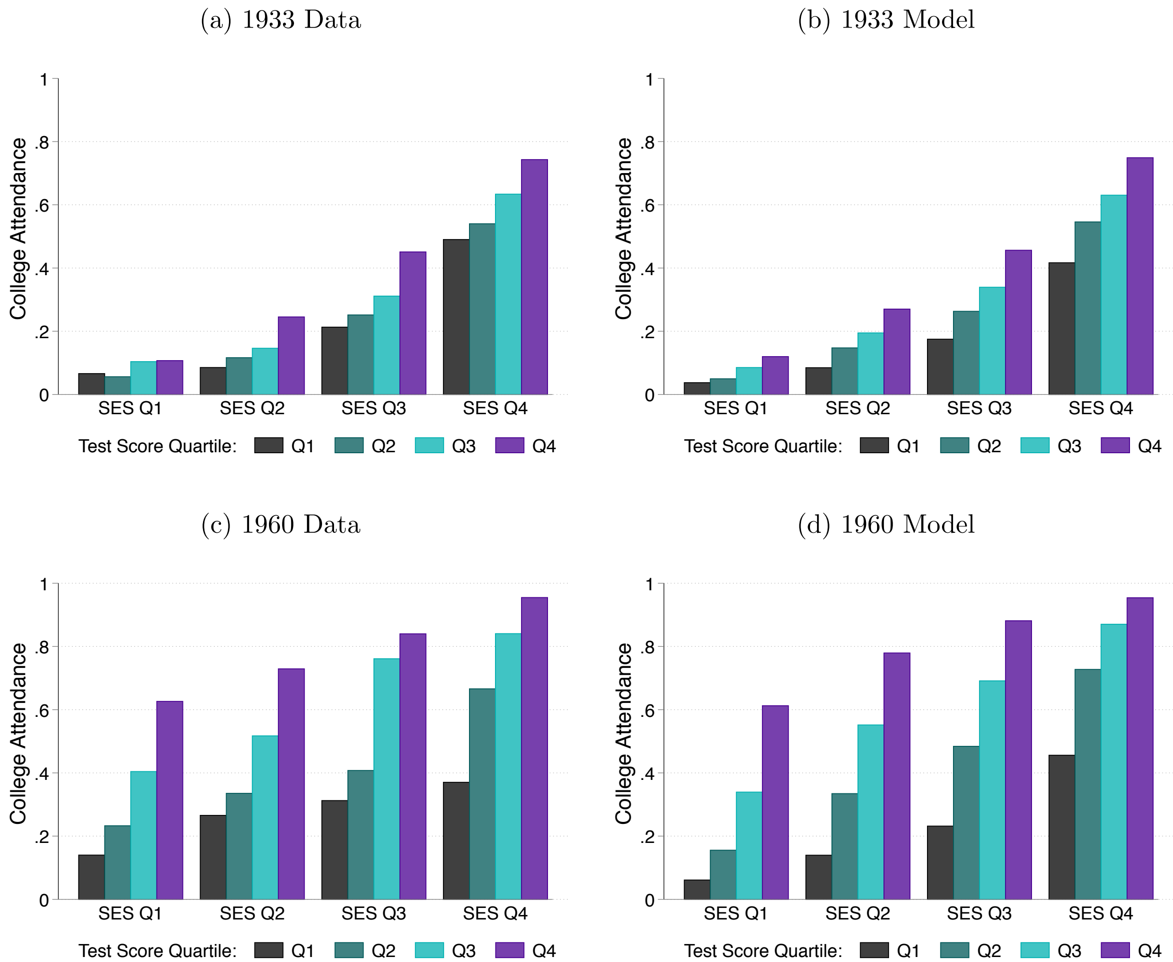
Note: Columns compare the model to the data for the 1933 and 1960 high school graduation cohorts. The rows provide four moments: the share of graduates who attend college; the share of college students who attend a local college; and the importance of test scores and family background for determining who attends college.

of expected ability forecasts by much. Nonetheless, we show below that this change does help the model fit the reversal in sorting patterns.

The model delivers a good fit to the data. Table 2 briefly summarizes the four main moments we target for the 1933 and 1960 cohorts: the fraction of high school graduates who attend college; the fraction of college enrollees who choose the local college; and sorting by test score and family background. For the table, we reduce the sorting to the estimated coefficients β_s and β_p from a bivariate regression of college attendance on test scores and family background, in line with Section 2. The model fits the targets well, with the main challenge being that it captures only about half of the decline in the importance of family background for college attendance. Figure 8 shows the full pattern of college entry by (s, p) quartiles from the data and the model for the 1933 and 1960 cohorts. Family background dominates attendance patterns for the 1933 cohort, but academic ability does for the 1960 cohort, consistent with the data. The main area where the model struggles is with the increase in attainment of students with low test scores, particularly those with low test scores and below-median family background. The model predicts that these students have low human capital formation in college and has a hard time accounting for their rising tendency to go to college.

We focus on the model's implied changes in sorting by test scores (s) and family background (p) because this is what we observe in the data. However, the model also allows us to construct sorting when ability is measured directly (a) or proxied for by expected ability $(\mathbb{E}(a \mid \mathbb{I}_t)$, constructed using the information available to students and colleges). Table 3 compares the sorting in 1933 and 1960 when ability is proxied for by test scores, actual ability, or expected ability. In each case, we measure sorting using the coefficients of a

Figure 8: College Attendance Patterns



regression of college attendance on the respective ability proxy and family background, as in Section 2.

Table 3 offers two main lessons. First, there are large differences in the implied patterns of sorting depending on which ability proxy is used. "Ability" sorting is weakest when measured by test scores because our calibration implies that test scores are a noisy proxy for ability. It is much stronger when measured using actual ability. Finally, it is stronger still when measured using expected ability because that is the information available to agents for college attendance and admissions decisions. In some cases, students are sorting into college based on noise in their expectations.[18]

[18]The measured sorting on family background follows an inverse pattern. This finding can be understood primarily as a result of using noisy, correlated regressors. For example, when ability is proxied using test

Table 3: Sorting by Cohort for Alternative Proxies for Ability

	1933 cohort		1960 cohort	
	Ability Proxy	Family	Ability Proxy	Family
Test scores (s)	0.29	0.67	0.78	0.60
Ability (a)	0.61	0.51	1.08	0.39
Expected ability ($\mathbb{E}(a \mid \mathbb{I}_t)$)	0.84	0.37	1.46	0.17

Note: Columns give estimated coefficients from a joint regression of college attendance on an ability proxy and family background in the calibrated 1933 and 1960 equilibria of our model. Rows give different ability proxies: test scores (as in the baseline); ability; and expected ability given available information.

These findings are consistent with the results from Cooper and Liu (2016), who find that much of the apparent mismatch between students and colleges on the basis of test scores is due to noise in test scores. The findings suggest a more nuanced view of the historical trends. The model implies that ability has always been more important for college attendance than family background. Focusing on sorting by test scores can obscure this fact.

The second main lesson of this table is that students become more sorted on ability and less sorted on family background over time regardless of which proxy we use to measure ability. In fact, the increase in sorting on ability is larger than the increase in sorting on test scores. Thus, our findings do still support that college has become more "meritocratic" over time. In the next section, we explain how the model is able to generate this change.

5.3 Model Mechanisms

The model generates a large reversal in college attendance patterns. The calibrated 1933 equilibrium features a local market for college: few students attend college, and most who do attend their local college. The exogenously higher V_t^C in the 1960 equilibrium increases the share of students who wish to attend college. For colleges, this implies that many of the best colleges are oversubscribed, and so selective admissions is more common. For students, it implies that many more students apply to and attend colleges outside their local area. In equilibrium, this national integration of the market for higher education leads to a different menu of colleges and college qualities available to students of different types, which in turn generates different college attendance patterns. Although there are important feedback effects between college and student behavior, we consider each in turn.

scores in the regression, then the coefficient on family background is inflated because family background is correlated with expected ability, which is only imperfectly controlled for by test scores.

For colleges, the main effect of the expansion of enrollment is that many more colleges are capacity constrained and practice selective admissions. Whereas in the 1933 equilibrium only 8 percent of colleges have selective admissions, in the 1960 equilibrium 86 percent do. Recall that our definition of selective admissions is minimal: it means only that a college is at capacity and imposes any floor on expected ability for admission.

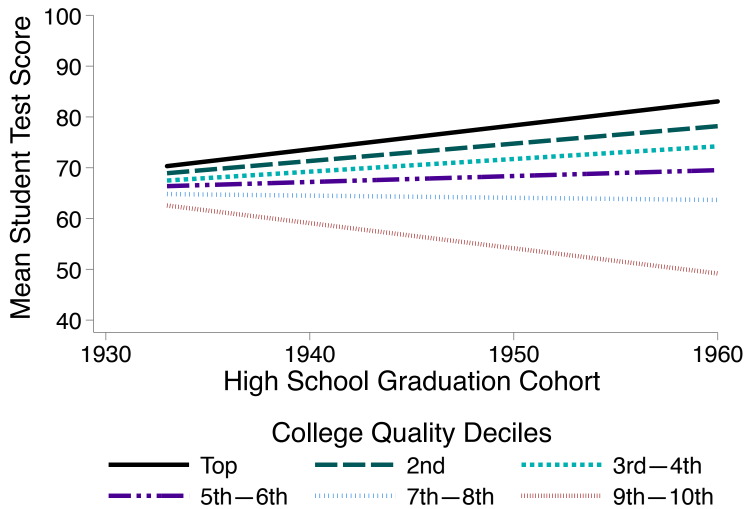
The widespread adoption of selective admissions leads colleges to be much more differentiated by student ability. This change can be understood as the result of three differences between the 1933 and 1960 equilibria. First, colleges that practice selective admissions in the 1933 equilibrium are even more selective in the 1960 equilibrium. Second, many more colleges are selective in the 1960 equilibrium. Finally, the fact that most students in the 1933 equilibrium attend their local college implies that even low-quality colleges have some high-ability students. Many fewer students attend local colleges in the 1960 equilibrium, which further reduces the average student ability in these low-quality colleges.

Hoxby (2009) identifies growing quality heterogeneity as one of the central features of the national integration of the market for college. She constructs a figure that ranks colleges by median test score (e.g., SAT test score) of their student bodies, with test score again acting as the empirical proxy for expected ability. She shows that test scores have risen at the top colleges but fallen for below-median colleges. Figure 9 shows the same figure implied by our model. Here, we rank colleges by test score, then compute the average test score of the top decile of colleges, the second decile, and the bottom four quintiles, where each decile has an equal share of enrollment. We plot the points against time to mimic the same figure in Hoxby, although of course we have only two equilibria.

In the 1933 equilibrium, only the very top decile of colleges is selective, so the gap in test scores between top and bottom colleges is small, less than 10 percent. In the 1960 equilibrium, college quality is much more dispersed. Mean test scores are higher for above-median colleges but lower for below-median colleges. The gap between top and bottom colleges in the 1960 equilibrium is around 30 percent. This figure matches the earliest figures in Hoxby (2009) quite well. She finds that the gap in 1962 was 40 percent and suggests based on spotty earlier evidence that the gap in the 1950s was probably around 20 percent. Hence, both the level and the trend in college quality heterogeneity are consistent with existing evidence.

For students, the main changes are higher college attendance (which is delivered by the exogenous rise in V_t^C) and lower rates of local college attendance. The model is calibrated to fit each change. The higher dispersion of colleges by quality and the lower rates of local

Figure 9: Fanning out of Colleges



college attendance have important implications for the menu of colleges available to each student. One metric that speaks to this changing menu is the fraction of students who have access to their first-choice college, meaning the college they would attend if students were individually exempted from admissions standards. In the 1933 equilibrium, 99 percent of students can do so. This finding is explained by the fact that few colleges are selective, but also by the fact that quality gaps are generally small enough that most students prefer to attend their local, unselective college.

In the 1960 equilibrium, only 55 percent of students can attend their first-choice college. The share of students who can attend their first-choice college varies strongly in characteristics such as test score. For example, Figure 10 plots the fraction of students who can attend their first-choice college by (s, p) quartile. While most top-quartile test score students can attend their most preferred college, few bottom-quartile test score students can.

A second metric to gauge the changing menu of college qualities is to examine the changing distribution of human capital and college quality. Table 4 provides several statistics that summarize these changes. Focusing on the first row, we see that the average human capital of college graduates declines over time. The distribution also becomes more dispersed because of increased stratification. Students in the top 27 percent of the 1960 human capital distribution have more human capital than the top 27 percent of the distribution in 1933, while students in the bottom 73 percent have less. Quality drops at 64 percent of colleges, again suggesting growing dispersion.

Figure 10: Access to First-Choice College

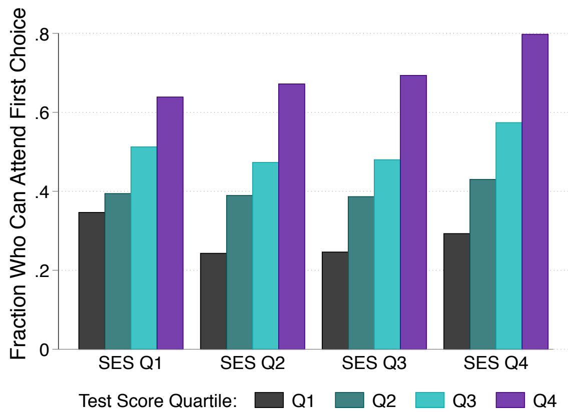


Table 4: Human Capital Formation

	Δ mean $\log(h)$	Share higher h	Share higher q
Baseline	-0.12	0.27	0.36
No change in sorting	-0.11	0.00	0.00
No change in attainment	-0.01	0.63	0.48

Note: Columns give the change in mean human capital of college graduates between 1933 and 1960, the share of college graduates with higher human capital in 1960, and the share of colleges with higher quality in 1960. Rows give the baseline model and counterfactual models that hold either sorting patterns or college attendance rates fixed.

The next two rows in Table 4 give the results from counterfactual experiments that explain these findings. The second row shows the same statistics for the case in which, for each agent, we take the decision of whether or not to attend college from the 1960 equilibrium, but the decision of which college to attend from the 1933 equilibrium. This row shows that the expansion of college lowers the mean human capital of college graduates, primarily because the students who enter college in the 1960 equilibrium but not the 1933 one have lower expected ability. By itself, this change implies that all students should have lower human capital and all colleges should have lower quality. The third row shows results from the reverse case: for each agent, we take the decision of whether or not to attend college from the 1933 equilibrium, but the decision of which college to attend from the 1960 equilibrium. This row shows that sorting improves outcomes for about two-thirds of students and about one-half of colleges. For the most part, these are high expected ability students who sort into selective colleges with their peers. Overall, the results in the first row combine the effects of an expansion of education, which lowers average human capital and quality, and a change in sorting, which raises human capital and college quality for selective colleges and the high-ability students who attend them.

Thus, the model endogenously produces changes in application and admissions behavior consistent with the national integration of the market for higher education and the facts documented in Section 3. These changes combine to imply very different college qualities available to students of different academic abilities and family backgrounds, because colleges are more selective and more differentiated by quality, and students are more willing to apply to non-local colleges. The change in college qualities available to students drives the change in sorting patterns. In the next section, we consider which of the driving forces is most responsible for our results.

5.4 Decomposing Results

Next we decompose the results to highlight the role of three essential ingredients: the rising value of college; changing information; and capacity constraints for colleges. In order to do so, we take our calibrated model with the parameters from Table 1. These parameters fit the 1933 and 1960 data as well as possible. We then construct three alternative 1960 equilibria, which hold $\mathbb{I}_t$ fixed at the 1933 level, hold V_t^C fixed at the 1933 level, and allow capacity to triple, respectively. We show the results in Table 5. The rows are the same fit statistics as in Table 2, as well as two summary statistics for the model mechanism: the share of college students who can attend their first-choice college and the share of colleges that are selective. The columns show results for the 1933 and 1960 baseline calibrations and the three counterfactual 1960 equilibria.

The first main message of Table 5 is that the rising value of college is the central driving force for many of our results. A model that allows only for the rising value of college, with no change in information over time, generates the same increase in aggregate college attendance, the same national integration of the market for college, and the same switch to selective admissions. However, it generates only a portion of the change in sorting patterns: about one-third of the rise in the importance of academic ability and none of the decline in the importance of family background for college admissions.

By contrast, changing information is responsible mostly for generating a portion of the change in sorting patterns. The mechanism is a straightforward information story: when test scores become available, students and colleges' forecasts of student ability put more weight on test scores and less weight on family background. This information effect gener-

Table 5: Decomposing Model Results

	1933 cohort	1960 cohort			
		Baseline	No Test Scores	Constant V_t^C	Capacity
College attendance	0.29	0.52	0.52	0.29	0.80
Local college attendance	0.85	0.51	0.51	0.81	0.67
β_s	0.29	0.78	0.46	0.47	0.48
β_p	0.67	0.60	0.68	0.61	0.46
Access to first choice	0.99	0.56	0.55	0.98	0.78
Fraction selective	0.08	0.86	0.86	0.12	0.12

Note: Columns compare results from the model for the baseline 1933 calibration, the baseline 1960 calibration, and alternative 1960 equilibria where the information set $\mathbb{I}_t$ is held fixed, V_t^C is held fixed, or capacity is allowed to expand (triple). Rows display the share of graduates who attend college; the share of college students who attend a local college; and the importance of test scores and family background for determining who attends college. The last two rows contain moments related to how the model works: the share of students who can attend their first-choice college and the share of colleges that are selective.

ates about one-third of the rise in the importance of academic ability and almost all of the decline in the importance of family background for college admissions.

The model also includes an interaction effect between the two forces, particularly in explaining the rise in the importance of test scores for college admissions. The two driving forces interact through selective admissions. For example, consider a high s, low p student. In the 1933 equilibrium, this student is highly unlikely to go to college (only about 10 percent of such students do in the data and in the calibrated equilibrium). Rising V_t^C makes this student more likely to attend college. Allowing the student to observe s makes them more likely to attend college because it raises their expected ability and hence their expected gains from college. The interaction between the two comes through the college choice set: as other high-ability students become more likely to go to college, college quality at top colleges rises, which makes college yet more attractive to this student.

Finally, the last column of Table 5 shows the importance of capacity constraints. We allow college capacity to triple in the 1960 equilibrium, which is a change that is chosen to be unrealistically large and to keep the fraction of selective colleges roughly the same in the 1933 and 1960 equilibria. This expansion of capacity makes it much harder to generate the national integration of the market for higher education. The model generates only about half of the decline in local college attendance, and most students can access their first-choice college. This change has important implications for sorting patterns. In particular, it is much harder for the model to generate the rise in sorting on test scores, since the national integration is the key mechanism that makes college more attractive to high-ability students. The model does generate more of a decline in sorting on family background, but this mostly comes about because of the very high rate of college attendance overall, which makes selection of all types harder to detect. We conclude that limited capacity is an important component of our model. However, we have verified that fixed capacity is not absolutely essential; allowing capacity to expand by 70 percent, in line with the increase in enrollment, produces similar results, including the changes in sorting patterns.

6 Extensions

In this section, we consider two extensions to the baseline model. We focus on two plausible alternative driving forces that might generate the reversal in sorting patterns: changes in the pool of high school graduates and changes in the college application cost.

6.1 Time-Varying High School Graduation Patterns

In the baseline analysis, we assume that the distribution of students $F(a, p)$ is the same for both cohorts and calibrate the correlation parameter ρ between a and p to fit the observed distribution $F(s, p)$ as well as possible in the two cohorts. However, the empirical results from Section 2 all concern the college-going behavior of high school graduates. Given that the high school graduation rate is rising over this period, one potential concern is that changes in the set of students who graduate high school may contribute to or confound the reversal in sorting patterns we document.

To explore this idea in our model, we need to know the distribution of all students (not just high school graduates) by (s, p) quartile or, equivalently, the high school graduation rate by (s, p) quartile. Fortunately, Updegraff (1936) is a rare example of a historical study that records outcomes for all students with at least a sixth-grade education, which we take to cover all students. Similar data do not exist for Project Talent. Instead, we use data from the NLSY79. Since this is a later cohort with a higher high school graduation rate than Project Talent, we hypothesize that substituting NSLY79 data overstates the importance of rising high school graduation rates and changing high school graduate composition.

We recalibrate the model. We now choose ρ to fit the observed distribution over (s, p) quartiles for all students (not just high school graduates) in these two cohorts and explicitly feed in the high school graduation rate by (s, p) quartiles for each cohort, measured from Updegraff (1936) and the NLSY79. The rest of the calibration procedure remains the

Table 6: Model Results with Time-Varying Graduation

	Data	Model	
		Baseline	Time-Varying Graduation
College attendance	0.24	0.22	0.22
Local college attendance	-0.34	-0.34	-0.33
β_s	0.48	0.49	0.48
β_p	-0.21	-0.07	-0.04
Access to first choice	-	-0.44	-0.44
Fraction selective	-	0.78	0.78

Note: Columns compare results from the data (where available), the baseline model, and an alternative model that allows for time variation in the composition of students who graduate high school. The rows give the difference in each moment $m_{1960} - m_{1930}$, where the moments m are: the share of graduates who attend college; the share of college students who attend a local college; the importance of test scores and family background for determining who attends college; the share of students who can attend their first-choice college; and the share of colleges that are selective.

same. We study the results in Table 6, which shows the model-implied changes in our four moments of interest (college attendance, share of college attendance that is local, and sorting by test score and family background) as well as two moments that speak to the model's mechanism: the share of students that can attend their first-choice college and the share of colleges that are selective. Columns give results for the data (where available), the baseline model, and the model with time-varying high school graduates. The main message of the table is that allowing the set of high school graduates to vary over time has little effect on our results. The model captures slightly less of the change in sorting patterns, but overall we conclude that variation in who graduates high school does not have a first-order effect on our results.

6.2 Falling Application Cost

The main exogenous driving force in our baseline model is a rise in the value of college V_t^C, which captures, for example, the rising college wage premium. Hoxby (2009) emphasizes a second change around this time: declining costs of applying to and attending distant colleges, driven by declines in communication and transportation costs. Her work motivates us to allow for κ_t to vary over time in the model to see whether declining application costs are a plausible alternative driving force to V_t^C. To do so, we recalibrate the model and allow κ_t to vary by cohort.

Table 7: Model Results with Falling Application Costs

	Data	Model	
		Baseline	Variable Application Costs
College attendance	0.24	0.22	0.22
Local college attendance	-0.34	-0.34	-0.33
β_s	0.48	0.49	0.46
β_p	-0.21	-0.07	-0.05
Access to first choice	-	-0.44	-0.45
Fraction selective	-	0.78	0.78

Note: Columns compare results from the data (where available), the baseline model, and an alternative model that allows the college application cost κ_t to vary in addition to V_t^C . The rows give the difference in each moment $m_{1960} - m_{1930}$, where the moments m are: the share of graduates who attend college; the share of college students who attend a local college; the importance of test scores and family background for determining who attends college; the share of students who can attend their first-choice college; and the share of colleges that are selective.

Table 7 summarizes the results in the same format as Table 6. Overall, we find a modest role for time-varying application costs, at least as a driving force for the reversal in sorting patterns. The calibrated search cost remains essentially constant at $\kappa_t = 0.41$, as in the baseline calibration. Not surprisingly, the model results do not change. We have also considered experiments where κ_t replaces V_t^C as the main driving force, but we found that calibrated versions of that model could not generate much of the rise in college attendance, which is a crucial part of the mechanism of interest. We conclude that while application and travel costs fell during this period, they do not appear to be responsible for the reversal in sorting patterns we have documented.

7 Conclusion

This paper documents large changes in the patterns of college attendance in the United States during the 20th century. We draw on and harmonize the results of a number of studies and data sets describing college attendance patterns for high school graduates from 1919 to 1979. Our main finding is that prior to World War II, family income or socioeconomic status was a more important predictor of who attended college, whereas academic ability was more important afterward.

The timing of these changes rules out common candidate explanations for changes in who attends college. Instead, we provide a new theory in which the rise in college attendance generates a national integration of the market for higher education. The key intuition is that although the rising demand for college affects all types of students equally, it sets off a chain reaction in the model: colleges hit capacity constraints; colleges institute selective admissions; colleges become more dispersed in quality; and students apply to a broader set of colleges. The result is a transition from an equilibrium where all students had access to colleges of roughly the same quality to an equilibrium where high-ability students had access to better colleges but low-ability students had access to worse colleges. This change in the choice set generated the reversal.

The model generates the reversal in sorting without relaxing borrowing constraints, consistent with the evidence on college financing in this era. The rising demand for college may be a stand-in for other government policies. Public college subsidies were at their most generous, and costs at their lowest, shortly after World War II. Tuition relative to GDP per capita in 1950 was less than one-third of its current level. The subsequent introduction and then expansion of federal loan and aid programs was matched by a trend increase in public college tuition. Hence, the race for access between college tuition and federal loan programs at the heart of Lochner and Monge-Naranjo (2011) may have been taking place since the 1960s. This idea is a promising avenue for future research.

References

Aikin, Wilford M., *The Story of the Eight-Year Study*, Vol. 1 of *Adventure in American Education*, New York: Harper & Brothers, 1942.

Alon, Titan, "Earning More by Doing Less: Human Capital Specialization and the College Wage Premium," 2018. Mimeo, Northwestern University.

Altonji, Joseph G. and Rebecca M. Blank, "Race and Gender in the Labor Market," in Orley C. Ashenfelter and David Card, eds., *Handbook of Labor Economics*, Vol. 3, Amsterdam: Elsevier, 1999, chapter 48, pp. 3143–3259.

Ames, Walter Ray, "Intelligence of High School Seniors in Montana." PhD dissertation, University of Wisconsin–Madison 1926.

Bailey, Martha J. and Susan M. Dynarski, "Inequality in Postsecondary Education," in Greg J. Duncan and Richard J. Murnane, eds., *Whither Opportunity? Rising Inequality, Schools, and Children's Life Chances*, New York: Russell Sage Foundation, 2011, chapter 6, pp. 117–132.

Barker, Richard W., "The Educational and Vocational Careers of High School Graduates Immediately Following Graduation in Relation to Their Scholastic Abilities," Master's thesis, State University of Iowa 1937.

Belley, Philippe and Lance Lochner, "The Changing Role of Family Income and Ability in Determining Educational Achievement," *Journal of Human Capital*, 2007, *1* (1), 37–89.

Benson, Viola E., "The Intelligence and Later Scholastic Success of Sixth-Grade Pupils," *School and Society*, 1942, *55*, 163–167.

Berdie, Ralph F., *After High School – What?*, Minneapolis, MN: University of Minnesota Press, 1954.

_ **and Albert B. Hood**, *Trends in Post-High School Plans Over an 11-Year Period*, Minneapolis, MN: Student Counseling Bureau, University of Minnesota, 1963.

Book, William F., *The Intelligence of High School Seniors as Revealed by a Statewide Mental Survey of Indiana High Schools*, New York: Macmillan, 1922.

Bound, John and Sarah Turner, "Going to War and Going to College: Did World War II and the GI Bill Increase Educational Attainment for Returning Veterans?," *Journal of Labor Economics*, 2002, *20* (4), 784–815.

Bowen, William G., Martin A. Kurzweil, Eugene M. Tobin, and Susanne C. Pichler, *Equity and Excellence in American Higher Education*, Charlottesville: University of Virginia Press, 2005.

Bowles, Frank, *The Refounding of the College Board, 1948-1963*, New York: College Entrance Examination Board, 1967.

Cai, Zhifeng and Jonathan Heathcote, "College Tuition and Income Inequality," 2018. Mimeo, Federal Reserve Bank of Minneapolis.

Cameron, Stephen and James J. Heckman, "Can Tuition Policy Combat Rising Wage Inequality?," in Marvin H. Kosters, ed., *Financing College Tuition: Government Policies and Educational Priorities*, Washington, DC: American Enterprise Institute Press, 1999, pp. 76–124.

_ **and Joseph Tracy**, "Earnings Variability in the United States: An Examination Using Matched-CPS Data," 1998. Mimeo, Columbia University.

Cameron, Stephen V. and Christopher Taber, "Estimation of Educational Borrowing Constraints Using Returns to Schooling," *Journal of Political Economy*, 2004, *112* (1), 132–182.

Carneiro, Pedro and James J. Heckman, "The Evidence on Credit Constraints in Post-Secondary Schooling," *Economic Journal*, 2002, *112* (482), 705–734.

Castro, Rui and Daniele Coen-Pirani, "Explaining the Evolution of Educational Attainment in the United States," *American Economic Journal: Macroeconomics*, 2016, *8* (3), 77–112.

Chetty, Raj, John N. Friedman, Emmanuel Saez, Nicholas Turner, and Danny Yagan, "Mobility Report Cards: The Role of Colleges in Intergenerational Mobility," National Bureau of Economic Research Working Paper 23618 2017.

College Board, "Trends in Student Aid," various years.

Colvin, Stephen S. and Andrew H. MacPhail, *Intelligence of Seniors in the High Schools of Massachusetts*, Washington, DC: Government Printing Office, 1924.

Comerford, David, José V. Rodríguez Mora, and Michael J. Watts, "The Rise of Meritocracy and the Inheritance of Advantage," 2016. Mimeo, University of Edinburgh.

Conlan, Timothy J., *The Evolution of a Problematic Partnership: The Feds and Higher Education*, Vol. 6 of *The Federal Role in the Federal System: The Dynamics of Growth*, Washington, DC: Advisory Commission on Intergovernmental Relations, 1981.

Cooper, Russell and Huacong Liu, "MisMatch in Human Capital Accumulation," National Bureau of Economic Research Working Paper 22010 2016.

Cowen, Philip A., *Needs and Facilities in Higher Education in New York State*, Albany: University of the State of New York and the State Education Department, 1957.

Daughtry, Alex A., *A Report on the Post-Graduation Activities of the 1955 Kansas High School Graduates*, Emporia, KS: Graduate Division of the Kansas State Teachers College, 1956.

Davis, Allison, Burleigh B. Gardner, and Mary R. Gardner, *Deep South: A Social Anthropological Study of Caste and Class*, Columbia: University of South Carolina Press, 2009.

Davis, Helen E. and Elmo B. Roper, *On Getting Into College: A Study Made for the Committee on Discriminations in College Admissions*, Washington, DC: American Council on Education, 1949.

Donovan, Kevin and Christopher Herrington, "Factors Affecting College Attainment and Student Ability in the U.S. since 1900," 2018. Mimeo, Yale University.

Duffy, Elizabeth A. and Idana Goldberg, *Crafting a Class: College Admissions and Financial Aid, 1955-1994*, Princeton, NJ: Princeton University Press, 1998.

Dunsmoor, Clarence C. and Oliver C. Davis, *How to Choose that College: A Guide for Students and Parents*, Boston, MA: Bellman, 1951.

Eckland, Bruce K. and Louise B. Henderson, *College Attainment Four Years After High School* Washington, DC, National Center for Education Statistics, 1981.

Flanagan, John C., Frederick B. Davis, John T. Dailey, Marion F. Shaycoft, David B. Orr, Isadore Goldberg, and Clinton A. Neyman Jr., *The American High-School Student: The Identification, Development, and Utilization of Human Talents*, Pittsburgh, PA: Project TALENT Office, University of Pittsburgh, 1964.

_ , **Marion F. Shaycoft, James M. Richards Jr., and John G. Claudy**, "Five Years After High School," Technical Report, American Institutes for Research and University of Pittsburgh 1971.

French, John W., M. Clemens Johnson, William G. Mollenkopf, and Glen Stice, *Background Factors Relating to College Plans and College Enrollment Among Public High School Students*, Princeton, NJ: Educational Testing Service, 1957.

Gardner, Burleigh B., Mary R. Gardner, and Martin B. Loeb, "Social Status and Education in a Southern Community," *School Review*, 1942, *50* (3), 179–191.

Gardner, John A., *Transition from High School to Postsecondary Education: Analytical Studies*, Washington, DC: Center for Education Statistics, Office of Educational Research and Improvement, U.S. Department of Education, 1987.

Goetsch, Helen Bertha, *Parental Income and College Opportunities*, New York: Bureau of Publications Teachers College, Columbia University, 1940.

Goldin, Claudia and Lawrence F. Katz, *The Race between Education and Technology*, Cambridge, MA: Harvard University Press, 2008.

Gordon, Grey and Aaron Hedlund, "Accounting for the Rise in College Tuition," in Charles R. Hulten and Valerie A. Ramey, eds., *Education, Skills, and Technical Change: Implications for Future U.S. GDP Growth*, National Bureau of Economic Research Studies in Income and Wealth, Chicago: University of Chicago Press, forthcoming.

Grayson, Lawrence P., "A Brief History of Engineering Education in the United States.," *Engineering Education*, 1977, *68* (3), 246–264.

Greenleaf, Walter James, *Self-Help for College Students*, Washington, DC: United States Government Printing Office, 1929.

Halle, Rita S., *Which College?*, New York: Macmillan, 1934.

Harno, Albert J., *Legal Education in the United States: A Report Prepared for the Survey of the Legal Profession*, San Francisco: Bancroft-Whitney, 1953.

Harris, Seymour Edwin, *Higher Education: Resources and Finance*, New York: McGraw-Hill, 1962.

Haven, Elizabeth W. and Dwight H. Horch, *How College Students Finance Their Education: A National Survey of the Educational Interests, Aspirations, and Finances of College Sophomores in 1969–1970*, Princeton, NJ: College Scholarship Service of the College Entrance Examination Board, 1972.

Hendricks, Lutz and Todd Schoellman, "Student Abilities During the Expansion of US Education," *Journal of Monetary Economics*, 2014, *63*, 19–36.

Henmon, Vivian A.C. and Frank O. Holt, *A Report on the Administration of Scholastic Aptitude Tests to 34,000 High School Seniors in Wisconsin in 1929 and 1930*, Madison, WI: Bureau of Guidance and Records of the University of Wisconsin, 1931.

Herrnstein, Richard J. and Charles Murray, *The Bell Curve: Intelligence and Class Structure in American Life*, New York: Free Press, 1994.

Hiatt, Mark D. and Christopher G. Stockton, "The Impact of the Flexner Report on the Fate of Medical Schools in North America after 1909," *Journal of American Physicians and Surgeons*, 2003, *8* (2), 37–40.

Hollis, Ernest V., *Costs of Attending College: A Study of Student Expenditures and Sources of Income*, Washington, DC: U.S. Government Printing Office, 1957.

Horn, Laura and Stephanie Nevill, "Profile of Undergraduates in U.S. Postsecondary Education Institutions, 2003-04: With a Special Analysis of Community College Students (NCES 2006-184)," U.S. Department of Education. Washington, DC: National Center for Education Statistics. 2006.

Hoxby, Caroline M., "The Changing Selectivity of American Colleges," *Journal of Economic Perspectives*, 2009, *23* (4), 95–118.

Hsieh, Chang-Tai, Erik Hurst, Charles I. Jones, and Peter J. Klenow, "The Allocation of Talent and U.S. Economic Growth," 2018. Mimeo, Stanford University.

Iffert, Robert E. and Betty S. Clarke, *College Applicants, Entrants, Dropouts*, Washington, DC: U.S. Department of Health, Education, and Welfare, 1965.

Ionescu, Felicia, "The Federal Student Loan Program: Quantitative Implications for College Enrollment and Default Rates," *Review of Economic Dynamics*, 2009, *12* (1), 205–231.

Jencks, Christopher and David Riesman, *The Academic Revolution*, Garden City, NY: Doubleday, 1968.

Jennings, Dolf, *A Report On the Activities of the 1958 Montana High School Graduates Enrolling in College, Autumn 1958*, Helena, MT: Montana State Department of Public Instruction, Guidance and Counseling Services, 1960.

Jones, Tom Morris, "Comparisons of Test Scores of High School Graduates of 1954 who Go to College with Those who Do Not Go: And a Study of Certain Factors Associated with Going to College." PhD dissertation, University of Arkansas 1956.

Junker, Buford H., *Hometown; A Study of Education and Social Stratification* 1940.

Karabel, Jerome, *The Chosen: The Hidden History of Admission and Exclusion at Harvard, Yale, and Princeton*, Boston: Houghton Mifflin Harcourt, 2006.

Keane, Michael P. and Kenneth I. Wolpin, "The Effect of Parental Transfers and Borrowing Constraints on Educational Attainment," *International Economic Review*, 2001, *42* (4), 1051–1103.

Keller, Robert J., R. A. Kehl, and T. J. Berning, "The Minnesota Public High School Graduates of 1945 - One Year Later," in Ruth E. Eckert, ed., *Higher Education in Minnesota*, Minneapolis, MN: University of Minnesota Press, 1950.

Kurani, Habib A., *Selecting the College Student in America: A Study of Theory and Practice*, New York: Teachers College, Columbia University, 1931.

Labaree, David F., "An Uneasy Relationship: The History of Teacher Education in the University," in Marilyn Cochran-Smith, Sharon Feiman-Nemser, and D. John McIntyre, eds., *Handbook of Research on Teacher Education: Enduring Issues in Changing Contexts*, Washington, DC: Routledge, 2008, chapter 18.

Lansing, John B., Thomas Lorimer, and Chikashi Moriguchi, *How People Pay for College*, Ann Arbor, MI: Survey Research Center, Institute for Social Research, University of Michigan, 1960.

Little, J. Kenneth, "A Statewide Inquiry into Decisions of Youth about Education Beyond High School," Technical Report, School of Education, University of Wisconsin 1958.

Livesay, Thayne M., "Test Intelligence and College Expectation of High School Seniors in Hawaii," *Journal of Educational Research*, 1942, *35* (5), 334–337.

Lochner, Lance J. and Alexander Monge-Naranjo, "The Nature of Credit Constraints and Human Capital," *American Economic Review*, 2011, *101* (6), 2487–2529.

Lynaugh, Joan E., "Nursing the Great Society: the Impact of the Nurse Training Act of 1964," *Nursing History Review*, 2008, *16* (1), 13–28.

Mann, G. W., "Selective Influence of Desire to Attend College," *High School Journal*, 1924, *7* (1), 8–9.

Manuel, Herschel T., *Abilities of College Freshmen, 1937 and Other Studies* Research Bulletin Number 7, University Station, Austin, TX: Administrative Board of the Texas Commission on Coordination in Education, 1938.

_ , *Youth of College Age in Texas* Research Bulletin Number 9, University Station, Austin, TX: Administrative Board of The Texas Commission on Coordination in Education, 1939.

Medsker, Leland L. and James W. Trent, *The Influence of Different Types of Public Higher Institutions on College Attendance from Varying Socioeconomic and Ability Levels* Cooperative Research Project, No. 438, Berkeley, CA: Center for the Study of Higher Education, University of California, 1965.

Morehead, Charles G., "What's Happening to Our High-School Seniors?," *Journal of Arkansas Education*, 1950, *23*, 12–27.

Nam, Charles B. and James D. Cowhig, *Factors Related to College Attendance of Farm and Non-farm High School Graduates, 1960* Series Census-ERS (P-27) No. 32, Washington, DC: Bureau of the Census, 1962.

OBrien, Francis P., "Mental Ability with Reference to Selection and Retention of College Students," *Journal of Educational Research*, 1928, *18* (2), 136–143.

Odell, Charles W., *Are College Students a Select Group?*, Urbana, IL: University of Illinois, 1927.

Partridge, E. A., "College-Entrance Credentials from the High-School Point of View," *School Review*, 1925, *33* (6), 422–427.

Phearman, Leo T., "Comparisons of High School Graduates Who Go to College with Those Who Do Not Go to College." PhD dissertation, State University of Iowa 1948.

Pierson, Frank C., *The Education of American Businessmen: A Study of University-College Programs in Business Administration*, New York: McGraw-Hill, 1959.

Pryor, John H., Sylvia Hurtado, Victor B. Saenz, José Luis Santos, and William S. Korn, *The American Freshman: Forty Year Trends*, Los Angeles: Higher Education Research Institute, UCLA, 2007.

Restuccia, Diego and Guillaume Vandenbroucke, "Explaining Educational Attainment across Countries and over Time," *Review of Economic Dynamics*, 2014, *17* (4), 824–841.

Roper, Elmo Burns, *Factors Affecting the Admission of High School Seniors to College: A Report by Elmo Roper for the Committee on a Study of Discriminations in College Admissions*, Washington, DC: American Council on Education, 1949.

Ruggles, Steven, Trent J. Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek, "Integrated Public Use Microdata Series: Version 5.0 [Machine-readable database]," Minneapolis, MN: Minnesota Population Center [producer and distributor] 2010. Available online at http://usa.ipums.org/usa/.

Scott, Don A., "The Scholastic Ability of Iowa High School Graduates in Relation to Their Intended Educational, Vocational, and Professional Careers and to the Institutions of Higher Education They Plan to Attend." PhD dissertation, University of Iowa 1935.

Sewell, William H. and Vimal P. Shah, "Socioeconomic Status, Intelligence, and the Attainment of Higher Education," *Sociology of Education*, 1967, *40* (1), 1–23.

Shafroth, Will, ed., *Annual Review of Legal Education for 1938*, Chicago, IL: American Bar Association, 1939.

Sibley, Elbridge, "The Relation Between College Attendance and Economic Status," in "Matching Needs and Facilities in Higher Education," Albany, NY: Williams Press, 1948, chapter Appendix, pp. 113–126.

Stanley, Marcus, "College Education and the Midcentury GI Bills," *Quarterly Journal of Economics*, 2003, *118* (2), 671–708.

State University of New York, *Crucial Questions about Higher Education*, Albany: State University of New York, 1955.

Stroup, Francis and Dean C. Andrew, *Barriers to College Attendance: The Report of a Study of Factors Related to Eductional Discontinuance of High-School Graduates* 1959.

Taubman, Paul and Terence Wales, "Mental Ability and Higher Educational Attainment in the Twentieth Century," in F. Thomas Juster, ed., *Education, Income, and Human Behavior*, Cambridge, MA: National Bureau of Economic Research, 1975, pp. 45–70.

Tillery, Dale, *Distribution and Differentiation of Youth: A Study of Transition from School to College*, Cambridge, MA: Ballinger, 1973.

Trent, James W. and Leland L. Medsker, *Beyond High School: A Study of 10,000 High School Graduates*, San Francisco: Jossey-Bass, 1968.

Updegraff, Harlan, *Inventory of Youth in Pennsylvania*, Washington, DC: American Youth Commission of the American Council on Education, 1936.

U.S. Census Bureau, *Statistical Abstract of the United States*, Washington, DC: U.S. Government Printing Office, various years.

Warner, W. Lloyd and Paul S. Lunt, *The Social Life of a Modern Community*, New Haven, CT: Yale University Press, 1941.

Wechsler, Harold S., *The Qualified Student: A History of Selective College Admission in America*, New York: John Wiley & Sons, 1977.

White, Reuel C., *These Will Go to College: A Study of Future Demand for Admission to College by Secondary School Graduates in the Cleveland-Akron-Lorain Area*, Cleveland: Press of Western Reserve University, 1952.

Wiegman, Robert R. and Paul B. Jacobson, "How Well Did They Know?," *Journal of Higher Education*, 1955, *26* (5), 267–270.

Online Appendices: Not for Publication

A National Longitudinal Survey of Youth Details

This appendix describes the 1979 National Longitudinal Survey of Youth (NLSY79) data used to replicate the historical studies. Our sample of NLSY79 respondents is obtained by taking the universe of respondents (including the supplementary oversamples) and first dropping individuals with missing data on birth year, Armed Forces Qualifying Test (AFQT) score, or those who have not completed high school by May 1 of the year following their 19th birthday.

We measure family background using either income or socioeconomic status (SES). In the case of income, we use total net family income in the past calendar year. The question asks for income during the previous calendar year, so we take observations during the survey year after the individual turns 18 in order to capture income during the year the individual turned 18. If individuals are missing the income variable for this year, but at least two other observations of the same variable are available, then we impute family income by regressing total net family income on the child's age and interpolating or extrapolating to age 18. If income data is missing and cannot be imputed, then we drop those individuals. All income variables are inflation adjusted to 1978, which was the first year of reported income when the survey was initiated in 1979.

We measure socioeconomic status by creating an index from parental income, mother's and father's years of education, and father's occupation. Our index closely follows the procedure of Herrnstein and Murray (1994), Appendix 2. Parental income is total net family income in 1978 or an average of 1978 and 1979 if both are available. If neither are available but the data exist for at least two other years, then we impute income in 1978 as described above. Each parent's education is measured as the highest grade completed. For father's occupation, we take Duncan's socioeconomic index score associated with the three-digit occupation code as shown in the NLSY79 codebook supplement. For each of these variables, we calculate a z-score and construct an SES index as an equally weighted average of all non-missing z-scores. We prefer this approach over principal component analysis because it allows us to include more students who are otherwise dropped because they miss some components of the index. Nonetheless, we have verified that we obtain similar results if we measure socioeconomic status as the first principal component extracted from the same four variables.

We measure student ability using either standardized test score or class rank. In the former case, we take the respondent's percentile score on the AFQT. In the latter case, we compute the class rank percentile from the respondent's rank in class and the class size, both of which come from the NLSY transcript survey.

We measure college attendance as either prospective or actual attendance. For prospective attendance, we utilize responses to the survey question that reads: "As things now stand, what is the highest grade or year you think you will actually complete?" This question was asked in 1979, 1981, and 1982. We check responses up to age 20 and count individuals as planning to attend college if they answer more than 13 years (i.e., completing at least one year of college). For actual attendance, we utilize the longitudinal aspect and check each respondent's highest grade completed for the requisite number of years following their 19th birthday. Individuals are counted as attending if they complete at least 13 years of education.

Finally, when calculating the college attendance rates, we weight the individual observations. In each case, we obtain custom weights corresponding to the survey years that we use for that particular replication. For example, replicating a historical study with a seven-year follow-up to check college attendance would require six years of additional data compared to a replication that used a one-year follow-up. Custom weights are obtained from the NLSY79 at https://www.nlsinfo.org/weights/nlsy79.

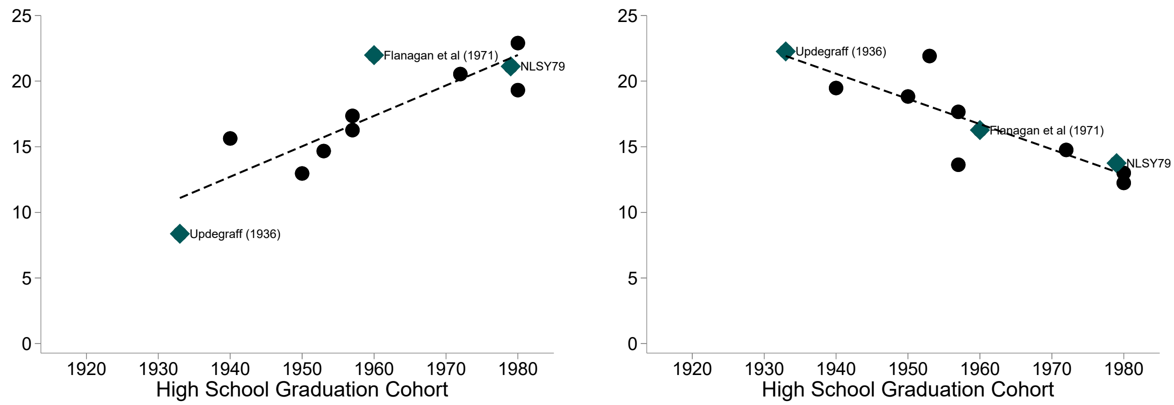
B Additional Empirical Results

This appendix contains extra figures with empirical results and robustness checks. Figure B1 is similar to Figure 2 in the text. The only difference is in how we estimate β_s and β_p. In the baseline analysis, we regress $C(s,p)$ on the midpoint of the percentile range, which treats the underlying college-going relationship as being linear in percentiles. An alternative is to think of s and p as being normally distributed and $C(s,p)$ as being linear in s and p. This would lead us to regress $C(s,p)$ on the points whose inverse normal CDF is equal to the midpoints of the percentile range. Mechanically, in the case of quartiles, the former uses $(0.125, 0.375, 0.625, 0.875)$ while the latter uses $(\Phi^{-1}(0.125), \Phi^{-1}(0.375), \Phi^{-1}(0.625), \Phi^{-1}(0.875))$. Doing so does not substantially alter the underlying trends.

Figure B2 is the companion to Figure 5; it shows what happens if we replicate only the bivariate study results within the NLSY79 and plot the time series. As with Figure 5, there is no discernible time trend, suggesting that study design details do not systematically bias

Figure B1: Changing Patterns of College Attendance: Standard Normalized Variables

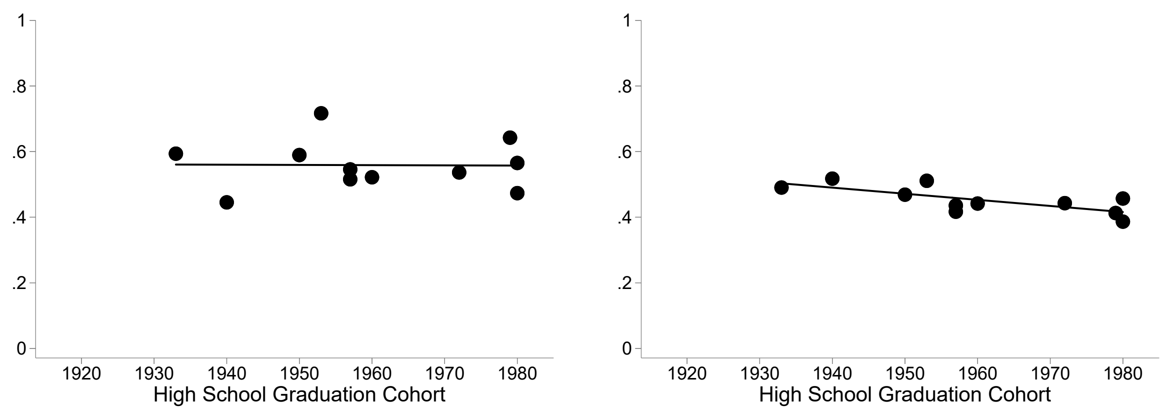
(a) Academic Ability (b) Family Background



our results.

Figure B2: Counterfactual Changes in Patterns of College Attendance: Bivariate Studies

(a) Academic Ability (b) Family Background



C Changes in College and College Financing

This appendix summarizes some of the relevant history of college financing and changes in the nature of college.

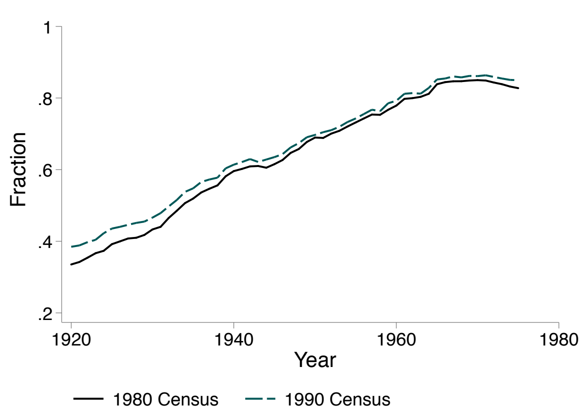
C.1 College Attendance

Figure 6 in the text showed the time series of college attendance taken from aggregate educational records. Figure C1 shows the same information using data from the U.S. Census Bureau, taken from Ruggles et al. (2010). Using the census has two advantages. First, we can measure the high school graduation rate consistently over time. Second, we can consistently measure the rate of high school graduation and college entry by high school graduation cohort, whereas enrollment-based statistics may misdate students who graduated or start college after a delay.

The U.S. Census has used two educational attainment questions over time; we explore each. In the 1980 census, respondents were asked about their years of schooling. We define the high school graduation rate as the fraction of each high school graduation cohort (birth year plus 18) that had 12 or more years of schooling. Similarly, we define the college entry rate as the fraction of those with 12 or more years of schooling that had 13 or more years of schooling. In the 1990 census, respondents were asked about their highest educational attainment. We define the high school graduation rate as the fraction of each cohort with a high school diploma or GED, and the college entry rate as the fraction of high school graduates with some college. These two questions show very similar patterns overall.

Figure C1: College Attendance: Census Data

(a) High School Graduation



(b) College Attendance

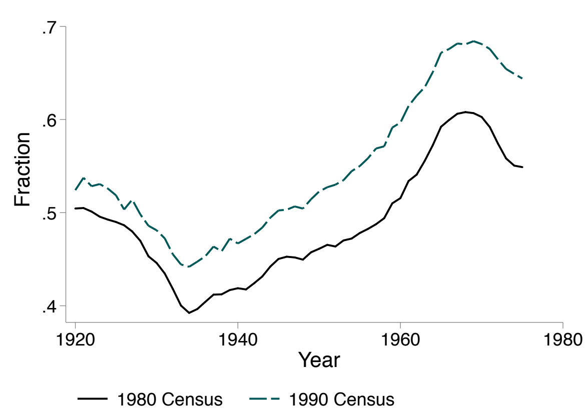


Figure C1a shows that high school graduation rates rose almost uniformly from the 1920 to the 1970 cohorts, from 40 to 90 percent, where it leveled off. This figure motivates us to explore the importance of allowing for time-varying composition of high school graduates in Section 6.1. Figure C1b shows the fraction of high school graduates that attempted college. It looks very similar to Figure 6b constructed from enrollment data, except that the drop and increase in college entry from the Great Depression through the 1950s is more pronounced.

C.2 College Cost

We list several mechanisms that may in turn have explained the rise in college attendance. One is the decline in relative college costs after World War II. We present the details here. Our approach follows Donovan and Herrington (2018), which contains data sources and details. College cost is measured as the total tuition revenue of public colleges and universities divided by total enrollment at the same colleges and universities. This series has two desirable properties. First, tuition revenue is an improvement on reported tuition because it accounts for any grants or other financial aid provided by the university. Second, we focus on public universities because our paper is about access to college. We have little to say about the separate question of why some students choose to pay a higher price in order to attend private colleges.

Figure C2: College Cost Time Series

(a) CPI Adjusted

(b) Relative to GDP per capita

We consider two methods of converting the nominal cost series to real values, both of which are shown in Figure C2. First, we adjust the nominal values to real values (in 2010 dollars) using the overall Consumer Price Index (CPI). This series is shown in Figure C2a. The inflation-adjusted cost of college showed no trend between 1920 and 1950 but started rising afterward. Annual inflation was 2.4 percent from 1960–1979 and 3.7 percent from 1980 to 2000.

Second, we create a measure of annual college "affordability" by taking the ratio of nominal college costs over nominal GDP per capita. This series is shown in Figure C2b. College affordability was similar in the 1920s and the 1990s, but with dramatic swings in between. The sharp decline in income during the Great Depression implies that college was quite unaffordable, with the cost relative to income peaking at 15.2 percent in 1932. From 1932 to 1950, college affordability improved dramatically, as the real price of college remained fixed but GDP per capita increased. The college cost by this metric bottoms out at 3.8 percent. In other words, college was at its most affordable immediately following World War II; Harris (1962) notes that "college instruction became a bargain item." Low college costs were in part a matter of public policy, as policymakers limited the rate of tuition increases in most states (Harris, 1962). Notably, these cost data *exclude* direct tuition payments to colleges for veterans under the GI Bill, which we discuss in the next section. Although costs subsequently rose modestly, the large increases in costs happen after 1980.

C.3 Federal Support for College

We now turn to the changing role of the federal government in college financing. We focus on the federal government because most state and local government support for colleges takes the form of direct budget support. This form of support affects the tuition that (especially public) universities charge students, but we have already accounted for this in our cost of college series above. The main point of this section is to show that most federal support for colleges worked similarly before 1960. Direct federal support for students through loans and grants, which are not accounted for in our cost series, became widespread only after the mid-1960s. This fact implies that it cannot explain the changes we observe between 1933 and 1960 and leads us to abstract from changes in college financing in the model.

Table C1 summarizes federal financial involvement in higher education through 1958. Prior to World War II, the federal government provided little income to college, accounting for less than 10 percent of the educational and general income collected by institutions of higher education. This funding was generally directed toward specific non-instructional activities, such as support for agricultural research (Conlan, 1981). Federal funding increased after World War II, but it remained tied to research programs. The main exception was a very large but short-lived spike associated with the GI Bills, particularly the one following World

Table C1: Federal Role in College Financing Pre-1958

	Year				
	1919–1920	1929–1930	1939–1940	1947–1948	1957–1958
Federal gov. share of college income	7.4	4.3	6.7	34.1	18.9
Veterans' tuition and fees	0.0	0.0	0.0	23.6	0.1
Other	7.4	4.3	6.7	10.5	18.8

Note: Share measured as receipts from federal government relative to educational and general income of colleges. Data above taken from the 1956–1958 *Biennial Survey of Education*, "Historical Summary of Higher Education Finance Statistics."

War II.

The available evidence does suggest that the maximal effects of the GI Bill were large for men; both Stanley (2003) and Bound and Turner (2002) estimate that veterans in peak cohorts increased attendance by roughly 20–50 percent. However, this effect was confined to male veterans of a narrow range of cohorts, roughly the "high school graduation" cohorts of 1941–1946 (although not all graduated high school). Those born earlier were too old to have been affected; those born later were more strongly influenced by the Korean War. The Korean War policies changed incentives by allowing drafted men to defer service to attend college, making college a substitute for rather than a complement to service in the armed forces for many young men.

We do not model the GI Bill directly because it affected a narrow range of cohorts of men, whereas the trends we observe appear to be general across cohorts and also affect women. Further, Stanley (2003) finds no evidence that men from lower socioeconomic status backgrounds increased their postsecondary education in response to the GI Bill; the increase in attendance was almost entirely concentrated among students from above-median SES backgrounds. This evidence suggests that it is unlikely that the GI Bill directly generated the change in college attendance patterns we observe through its effect on financing, although as noted in the text, it certainly played a part in generating a large surge in college attendance and helping to reform college admissions.

The first explicit, generally available aid for college was introduced in 1958 through the National Defense Education Act.[19] This act brought about the first federally sponsored student loans (Perkins loans), which were initially directed toward students who would study subjects of national interest, which included particularly science, math, and engineering

[19]With the exception of subsidies to work-study programs as part of the National Youth Administration between 1935 and 1939. This program started two years after the 1933 cohort graduated high school and so had little effect on our cohorts of interest.

Table C2: Federal Role in College Financing Post-1958

	Year			
	1959–1960	1969–1970	1979–1980	1999–2000
Real spending per pupil for aid (2010 $)	703	2,361	2,672	4,545
Share of aid designated "general"	0.28	0.48	0.68	0.95
Share of aid in form of loans	0.15	0.39	0.40	0.70

Note: Spending figure for 1960 from the 1965 edition of the U.S. Census Bureau (various years); for remaining years, they are from College Board (various years). Federal aid spending is deflated by the CPI to 2010 dollars. The second row gives the share of aid that is general, meaning available to all students rather than specific subpopulations such as veterans. The third row gives the share available as loans (Perkins, Stafford, and so on) versus other (grants, veterans' payments, work-study, and tax benefits).

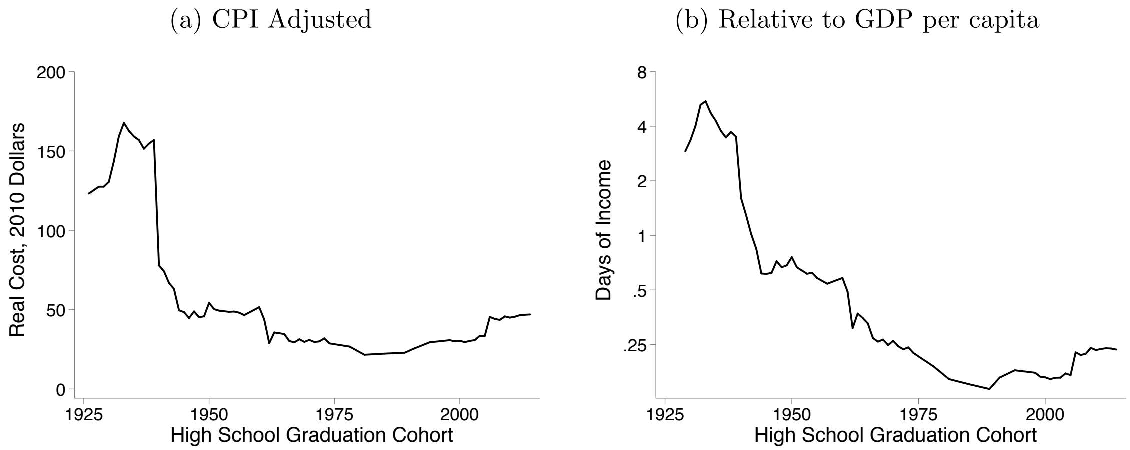
(Conlan, 1981). Federal support expanded dramatically with the Higher Education Act of 1965 and the 1972 Higher Education Amendments. These pieces of legislation expanded the National Defense Education Act; introduced subsidized loans for college students; transferred control of work-study programs to the Department of Education; and introduced programs to provide financial assistance to students with limited financial means, including particularly Pell grants.

In Table C2 we summarize how these changes affected direct federal support for students between 1960 and 2000. We highlight three main changes. First, real federal spending per pupil has seen tremendous growth. While the (inflation-adjusted) figure was just $700 per pupil in 1960, it more than tripled by 1970, largely as a result of the new legislation passed in 1965. The figure continued to grow modestly and was nearly $2,700 per pupil by 1979 (roughly when the NLSY79 cohort graduated high school) and continued to grow until it stood at over $4,500 per pupil in 2000. Underlying this aggregate figure were two important changes in the composition of aid. First, while nearly three-quarters of aid was targeted to specific groups in 1960 (largely veterans), the share of aid that was available to the general student body subsequently rose. Second, the federal government offered many more loans; while loans were only 15 percent of total aid in 1960, they rose to more than two-thirds by 2000. These findings are consistent with government reports on how students financed college in Section 3.

C.4 College Admissions Exam Costs

Figure 7 in the text shows the dramatic growth of standardized college admissions tests after World War II. Here, we explore the three main driving forces that generated the

Figure C3: College Admissions Exam Cost Time Series



growth in testing. Although the names of the college admissions exams and the entities responsible for them have changed numerous times over the years, we fix terminology for ease of exposition: the College Board refers to the entity responsible for the SAT test; its competitor is the ACT test.

The first driving force was a drastic decline in the cost of administering standardized admissions tests. Figure C3 shows the cost of the SAT, indexed either for inflation or by nominal GDP per capita, as we did for college costs.[20] The cost measured in 2010 dollars fell from roughly \$150 to \$50 over the course of a decade. Measured relative to income, it declined from roughly a week's to less than a day's wage over the same period. The major innovation was the introduction of automatic scoring machines for standardized tests in 1937. Labor shortages during the war made standardized tests even more attractive relative to the previous written exams that had to be graded by professionals.

At the same time, results from a large-scale experiment in college admissions as well as the general experience with veterans attending college on the GI Bill suggested that detailed subject requirements offered little value as admissions tools (Aikin, 1942; Jencks and Riesman, 1968). Finally, the College Board used its leverage as a provider of admissions services and distributor of an influential college guide to pressure schools to require the SAT for admissions in the 1950s (Bowles, 1967). Although midwestern colleges generally resisted, most signed up for the competing ACT exam during or shortly after 1959.

[20] The cost of the SAT is taken from various college guides for early years and from College Board (Educational Testing Service) brochures for later years.

C.5 Changes in College

One complication with studying changes in college attendance patterns is that college itself has changed. This raises the potential concern that what it means to "attend college" or who is counted as "attending college" may have changed over time. Broadly, our principal goal is to construct the most consistent series possible that includes students who acquire a broad education in a wide range of subjects but excludes those who acquire a shorter, narrower education that is specific to a particular vocation or occupation. Here we explain how we apply this principle to construct measures of college attendance given three important changes in college over the 20th century.

First, American colleges used to be dedicated more narrowly to the liberal arts education. Students who wanted training for a specific profession often acquired that elsewhere, either through apprenticeships or at schools dedicated to the teaching of a single subject. Over the course of the 20th century, these specialized schools were abolished, and their teaching functions moved into colleges and universities. These changes generally predate our period of interest for engineering and agriculture (Grayson, 1977). Teacher's colleges (also called normal schools) were slowly transitioned into regional state universities that offered a full range of degrees; these included UCLA and Arizona State University (Labaree, 2008). Given that this education is broad and general, we include those who enroll in normal schools as attending college when they are separately enumerated.

For business, two distinct types of institutions went by the name "business school." The first was the business school attached to a university, as in the modern sense. While such schools were rare before 1910, they became increasingly common over the next few decades (Pierson, 1959). Since students who attend these schools necessarily attend college, they are correctly included in our figures. The second was a stand-alone institute that specialized in teaching particular business skills, including secretarial, accounting, or trade courses. In some cases, we have reports of the number of students intending to attend these institutes, but we exclude them from our college enrollment figures given the short duration and specialized, vocational nature of their training. Finally, the education of nurses changed during this period. Before 1964, most nurses were trained in three-year programs housed in hospitals that focused on "ward management, medical diagnosis and treatment, and sanitation" (Lynaugh, 2008). Reforms initiated in 1964 moved most nurse training to the university setting as a part of four-year programs. We chose to exclude the small numbers of students who report enrolling in nursing schools in the pre-reform period because the education provided, while lengthy, is narrowly focused on a particular vocation.

The second change in American colleges was specific to medical and legal training. In the 19th century, students of these two subjects acquired their training in apprenticeships or by enrolling in specialized schools, often directly from high school. Reform efforts in the early 20th century gradually pushed both subjects into universities as post-graduate subjects to be studied after exposure to or graduation from an undergraduate program. These changes generally happened before our period of interest. The great majority of medical schools required at least two years of prior college studies by 1920 (Hiatt and Stockton, 2003). The American Bar Association worked to enact similar standards in each state; by the 1930s they had succeeded in passing them in all states outside of the South (Harno, 1953; Shafroth, ed, 1939). Very few of our data points are from before 1920 or the South, so it is unlikely that changes in the location and requirements for medical or law school affect our trends.

The third and final change in American colleges is the growth of junior colleges or community colleges, institutions that specialize in granting two-year degrees. Although institutions of this type first arose in the 19th century, their popularity expanded greatly in the first half of the 20th century. In fact, from 1920 to 1940, the number of junior colleges grew nearly tenfold, from 52 to 457, and their share of total resident college enrollment increased from 1.4 percent of students to over 10 percent.[21] Today, roughly 40 percent of college students are enrolled in junior or community colleges (Horn and Nevill, 2006).[22] The expansion of junior colleges explains part of the decline in college costs after the Great Depression (Figure C2b).

Community colleges are challenging to categorize because they enroll two types of students: those who are engaging in terminal vocational training and those who are pursuing a broader college degree. We include community college and junior college students in our figures because the majority of students who enroll there intend to transfer to a four-year institution (43 percent with definite plans) or receive a general associate's degree (30 percent) rather than receive an applied associate's degree or certificate (27 percent) (Horn and Nevill, 2006).

[21] These figures were collected from tables in the 1956–1958 *Biennial Survey of Education*.

[22] Currently, the term "community college" refers to public two-year institutions and "junior college" to the private equivalent, but this was not always the case. Nonetheless, the distinction is not important for our purposes, so we lump the two terms together.

D Historical Studies on College Attendance

The central empirical claim of our paper is that the importance of family background in determining who attends college has declined throughout the 20th century, while the importance of academic ability has risen. The evidence for this claim is derived from studies performed throughout the 20th century, primarily from the Great Depression onward. For studies that predate the 1960s, the underlying raw data are no longer extant. Instead, the figures in this paper rely on the results of the original studies as reported in published journal articles, books, technical reports, and dissertations.

The original studies were conducted by researchers in a variety of fields, including psychology, economics, and education. This appendix gives a brief description of the methodology used in each study. Table D1 summarizes the basic details. After the reference, the second and third columns summarize the location (typically a city or state) and the sample size used in the tabulations of interest, which may be smaller than the total sample size if variables are missing. The fourth and fifth columns give the high school graduation cohort and the way college attendance was measured, prospectively (asking about plans before graduation) or via follow-up (at variable lengths).

The second part of the table provides the measures of family background and academic ability used, as well as the number of bins used to describe the data.[23] In some studies, the underlying data were reported in score ranges, with very few observations at the bottom and the top of the test score distribution. In these cases, we aggregate bins somewhat to ensure that we have enough observations. We note this in the descriptions below and give in Table D1 the number of bins after aggregation.

D.1 Underlying Studies

This section gives further details on the sampling and variables of the studies used in the paper. Table D1 at the end summarizes the basic details of the studies in a single location.

[23] Hendricks and Schoellman (2014) conducted robustness checks showing that several other dimensions were unimportant in replicating these results, including the identity of the state studied or the test used to measure academic ability, as well as how or when college attendance was measured.

D.1.1 Book (1922)

Book (1922) arranged for more than 6,000 high school seniors throughout the state of Indiana to fill out a short questionnaire and complete an aptitude test, the Indiana University Intelligence Scale. The questionnaire asked about the student's family background (including their assessment of their family's income in five groups) as well as their plans for college. Published tabulations are based on schools that returned their reports on time. Unfortunately, the reported findings do not contain tabulations of college-going as a function of family background.

D.1.2 OBrien (1928)

OBrien (1928) arranged for more than 4,000 high school juniors and seniors throughout the state of Kansas to complete an aptitude test, the Terman Group Test of Mental Ability. He used continued communication with school officials at most schools to track the progress of students as late as six years after graduation. He provides figures on college enrollment by test score for 3,780 of the students in the initial study (for the rest, the school officials dropped out of the program). We aggregate some bins at the top and bottom of the score distribution with very few students.

D.1.3 Mann (1924)

Mann (1924) studied results from nearly 900 high school seniors enrolled in volunteering high schools throughout the state of North Carolina who filled out a short questionnaire and completed an aptitude test, the Mentimeter. The questionnaire asked about the student's college plans, including if available the specific college where the student planned to enroll. We aggregate some bins at the top and bottom of the score distribution with very few students.

D.1.4 Colvin and MacPhail (1924)

Colvin and MacPhail (1924) arranged for a sample of 3,000 high school seniors in Massachusetts to fill out a short questionnaire and complete an aptitude test, the Brown University psychological examination. The high schools were chosen to cover about one-fifth of all graduating students and to represent the state in terms of geography, school size, and economic conditions. The questionnaire asked about the student's family background (including their assessment of their family's income in five groups) as well as their plans for college. The study is closely modeled after Book (1922), and like that study, the reported findings do not contain tabulations of college-going as a function of family background.

D.1.5 Odell (1927)

Odell (1927) arranged for more than 12,000 high school seniors in Illinois to fill out a short questionnaire and complete an aptitude test, the Otis Test of Mental Ability. The sample covers more than half of the high schools and seniors of the state, although the author does not specify how they were chosen. The questionnaire asked about the student's family background (including their father's occupation), the student's grades, and their plans for college. The author was also the first to subsequently follow up on students' plans, by first asking students to list the colleges where they planned to enroll and then following up at those colleges the next year. He also checked whether students remained enrolled at the end of that year, providing a measure of one-year attrition at college. Some colleges did not cooperate, leading to an undercount of those entering college. We use the number known to have entered college by test score grouping and by self-reported average grades; similar results obtain if we instead use the number planning to enter college.

D.1.6 Ames (1926)

Ames (1926) arranged for 1,400 Montana high school seniors to fill out a questionnaire and complete an aptitude test, the Otis Test of Mental Ability. The study covered one-third of high schools and just under one-half of students, chosen to represent the state geographically. The questionnaire asked about the student's plans for college. The author collected a number of other potentially useful pieces of information (family income, class rank, and so on) but unfortunately did not produce usable tabulations from these data. We aggregate some bins at the top and bottom of the score distribution with very few students.

D.1.7 Benson (1942)

Benson (1942) followed up on an earlier study that administered an aptitude exam (the Haggerty Intelligence Examination) to sixth-grade students in Minneapolis. She followed their school records to determine whether they had dropped out or graduated high school and, for graduates, whether they had their credits transferred to a college. For those who did so, she followed up with the colleges to learn whether or not they had graduated. Her results give academic progress by original test score, which we use to compute the probability of high school graduates attending college and the probability of college entrants graduating as a function of test score.

D.1.8 Henmon and Holt (1931)

Henmon and Holt (1931) arranged for nearly 17,000 high school seniors representing 95 percent of the state of Wisconsin to fill out a short questionnaire and complete an aptitude test, the Ohio Psychological Test. The questionnaire asked about the student's plans for college. The authors also secured the assistance of high school and college officials to check which students actually enrolled during the subsequent fall, which is the basis for the figures used here. We aggregate some bins at the top and bottom of the score distribution with very few students.

D.1.9 Updegraff (1936)

Updegraff (1936) conducted an intensive survey of roughly 12 percent of the students who were on the sixth-grade class rosters in Pennsylvania in 1926. Using a number of college students and other employees organized under the guidance of faculty, they proceeded to locate and interview as many students as possible in the fall of 1934, by which time students should have graduated high school if they were to do so. The interview covered family background and academic progress, including high school graduation and enrollment in college. For the students whose answers were sufficiently complete, Updegraff constructed a measure of socioeconomic status based on replies to questions about ownership of household durables, father's occupation, mother's and father's education, and language spoken at home. Test scores come from school records on an intelligence test taken before the sixth grade. We aggregated categories for the college-going by socioeconomic status and test score exercise to ensure sufficiently large cell sizes.

D.1.10 Barker (1937)

Scott (1935) administered a questionnaire to a subsample of more than 4,000 high school seniors throughout the state of Iowa who also took the Iowa Every-Pupil Exam. The included schools were dispersed throughout the state, but larger schools are overrepresented because the author found that small schools were more likely to be closed by the time the materials arrived. The questionnaire asked students about their college plans. Barker (1937) followed up with the school administrators of most of the schools to determine whether or not the students had enrolled in college within two years.

D.1.11 Gardner et al. (1942)

Gardner et al. (1942) collected data on college attendance in Natchez, Mississippi, as part of an intensive sociological study in the tradition of W. Lloyd Warner's Yankee City studies (e.g., Warner and Lunt (1941)).[24] The authors collected pooled data on high school graduation and college-going from five cohorts directly from the school principal. They organized the students' families into socioeconomic classes based on their own observations from two years of living in the city. We have aggregated their "upper-upper" and "lower-upper" classes because the former (three students) is too small to be useful for analysis.

D.1.12 Livesay (1942)

Livesay (1942) arranged for more than 2,000 high school seniors in the state of Hawaii (93 percent of all seniors) to fill out a short questionnaire and complete an aptitude test, the American Council Psychological Examination. The questionnaire asked about the student's plans for school. The author followed up during the subsequent year to find out whether the students enrolled in college as planned. Although the original study included 20 test score bins, we collapse that number to 16 bins because the very top and bottom bins have few observations.

D.1.13 Goetsch (1940)

Goetsch (1940) used data from Wisconsin's statewide testing program, which administered a short questionnaire and an aptitude test, the Henmon-Nelson Test of Mental Ability, to all of the state's seniors. Goetsch selected students from the city of Milwaukee who scored in the top 15 percent of the test score distribution. She used the information provided in the questionnaire to connect the student's family to their state tax records, which she used

[24] As was common for such studies, the city is given a pseudonym in the original manuscript. The names were never a particularly well-kept secret and are openly mentioned in recent versions and discussions of the research (Davis et al., 2009).

to measure family income. She also mailed a follow-up questionnaire to the students a year after graduation to find out whether or not they had enrolled in college.

D.1.14 Manuel (1938)

Manuel (1938) arranged for many high schools in the state of Texas to administer the American Council Psychological Examination to high school seniors in the spring before graduation. He subsequently corresponded with school officials to learn about the college enrollment or other activities of seniors in the following fall. The study covers 900 students from 36 Texas high schools whose principals replied; the status of less than 10 percent of the sample is listed as unknown. The author corresponded with some of the high-scoring students who did not attend college to learn why they did not. We aggregated categories for the college-going by test score to ensure sufficiently large cell sizes.

D.1.15 Manuel (1939)

Manuel (1939) is a direct successor to Manuel (1938). The author noted in the 1938 study that responding high schools tended to be smaller and so arranged for high schools in the Dallas area to participate in a similar study. The study covers 800 students from 4 high schools that provided information on students' subsequent college attendance. The status of around one-third of the students is unknown. Because this follow-up was conducted one year later (1937 instead of 1936) the high schools used a different edition of the American Council Psychological Examination. Test norming at that time was not sufficiently advanced to guarantee that the results from different versions of the same test could be merged, so we treat the two studies separately. We aggregated categories for the college-going by test score to ensure sufficiently large cell sizes.

D.1.16 Sibley (1948)

Sibley (1948) utilized administrative data from schools and tax records for a sample of 1940 high school graduates from the state of New York. The sampling framework was designed to represent 10 percent of students throughout the state, although slightly different methodologies were employed in New York City versus the rest of the state. Principals were asked to furnish their students' graduating class rank, college enrollment status for the subsequent year, and parental names and addresses. Students whose college enrollment was unknown to the principal were excluded from the analysis. The names and addresses were used to link parents to New York State tax records and thereby to determine family income.[25]

D.1.17 Junker (1940)

Junker (1940) collected data on the college attendance plans of high school students of Dowagiac, Michigan, as part of an intensive sociological study along the same lines as Gardner et al. (1942).[26] The author collected all high school students' plans for attending college. He organized the students' families into socioeconomic classes based on his own observations from two months of living in the city. We have disregarded data from the highest class, which has no students in high school anyway.

D.1.18 Lansing et al. (1960)

Lansing et al. (1960) conducted a survey of a nationally representative sample of families about family characteristics, including income as of the time of the survey and the education of all children, including adult children. The reported results include college attendance for children 20–29 and 30–39 years old as of the time of the survey. We keep the data for these two groups separate and date them according to the midpoint of the age range, which makes them the 1943 and 1953 high school cohorts. Income is reported as of the survey year, not the year of high school graduation.

D.1.19 Keller et al. (1950)

Keller et al. (1950) arranged for a follow-up study of the 1945 class of Minnesota high school graduates. High school principals and superintendents were surveyed in the spring of 1946 and asked for basic information about the previous year's graduates, including demographic information, rank in class, and current activity. Responses for 83 percent of

[25] Sibley (1948) does not report directly the number of cases in each of the relevant bins. We use the 1944–1945 edition of the U.S. Census Bureau's *Statistical Abstract*, which reports the distribution of family income for families of two or more persons in 1941, to approximate the distribution of families by income. We correct for the difference between 1943 New York average income and 1941 U.S. average income using national and state per capita income figures from the same volume, which suggest roughly doubling income. The correspondence between adjusted bins in the *Statistical Abstract* and bins in Sibley are close but not exact.

[26] The original study was authored under a pseudonym and called the city "Hometown." The author's other writings of the time, under his real name, all concern Dowagiac and its school system.

the state's graduates were received. Principals of urban schools were less likely to furnish all the necessary information, probably because they were less likely to know the current status of all their graduates.

The 1945 class graduated toward the end of World War II, so the majority of men had enlisted by the spring of 1946. The figures given are for women and for civilian men; the total figures refer to the unweighted sum of the two. Enlisted and civilian men showed little variation in class rank, which is the main variable of interest here.

D.1.20 Phearman (1948)

Phearman (1948) utilized test score data from Iowa high schools that administered the Iowa Tests of Educational Development to seniors in the fall. He requested that the principals of high schools administering the exam furnish additional details about the seniors a year later, including whether they had graduated and enrolled in college, as well as their addresses. Roughly half of the principals participated. The researchers used the addresses to mail questionnaires to the students, which allowed them to collect information on family background such as father's occupation. More than half of the students replied to the questionnaires.

D.1.21 Roper (1949)

Roper (1949) arranged for interviews of a nationally representative sample of 10,000 high school seniors. The sample was designed to be nationally representative: it spanned the country and sampled communities of different sizes by design. The interviewers collected data on class rank from the high school principal and asked students about their plans for college. The survey distinguished between those who had applied and been accepted and those who had applied but had not (yet) been accepted. The interviewers followed up with the latter group to find out their enrollment status in the next fall. Interviewers also asked about other family characteristics, including father's occupation.

A second volume, Davis and Roper (1949), reports more findings from the same underlying study. We use any novel tabulations or those that include more detail.

D.1.22 Morehead (1950)

Morehead (1950) collected data from selected high school superintendents scattered throughout the state of Arkansas to report on the activities of 1,727 high school graduates from the class of 1949. Most of these schools had also participated in the administration of the American Council Psychological Examination, allowing the author to cross-tabulate college attendance with test scores.

D.1.23 Berdie (1954)

Berdie (1954) arranged for 93 percent of high school seniors in the Minnesota class of 1950 to fill out a short questionnaire and complete an aptitude test, the American Council Psychological Examination. The questionnaire asked about the student's family background, including their assessment of family background in broad groups ("frequently have difficulty making ends meet," "sometimes have difficulty in getting the necessities," "have all necessities but not many luxuries," "comfortable but not well-to-do," "well-to-do," and "wealthy"), as well as their plans for college. A follow-up questionnaire was conducted by mail with a sample of students the next year to determine whether they had actually enrolled in college or not. Three-fourths of selected students responded to the follow-up questionnaire.

The authors report plans for attending college by class score and test rank, but report actual college attendance by family income groups from the follow-up. We use both sources of data.

D.1.24 White (1952)

White (1952) selected 37 of the 60 high schools in northeast Ohio and then interviewed over 1,000 seniors at those high schools shortly before graduation. The researchers created an index of socioeconomic status based on replies about father's occupation, source of family income, and neighborhood of residence. Students were asked about their intention to go to college. The researchers recorded scores on an unspecified IQ test from the students' transcripts. The researchers also followed up with all transcript requests made to the high school to discern whether students had applied to and were enrolled in any colleges. Most of the necessary tabulations are provided using actual college attendance, but tabulations by gender are only given for intention to go to college.

D.1.25 Wiegman and Jacobson (1955)

Wiegman and Jacobson (1955) arranged for a sample of more than 1,000 high school seniors from throughout the state of Oregon to fill out a short questionnaire that included information on their class rank and chances of attending college. A follow-up survey was mailed to the principals of their high schools the next year to determine who had actually enrolled in college.

D.1.26 State University of New York (1955)

State University of New York (1955) arranged for more than 20,000 high school seniors in three geographic subregions of the state of New York to fill out a short questionnaire. The questionnaire asked about the student's family background and plans for college. Students who were not sure as to their plans were resurveyed in the fall to determine whether or not they had enrolled in college. Students' class rank and standardized test scores (on an unspecified IQ test) were collected from administrative records at the school. Finally, the researchers collected data on family income from the New York Department of Taxation and Finance for 7,988 students above a minimum score cutoff on the standardized test.

The tabulations give two sets of results. First, they give college-going as a function of test score for all students. Second, they give college-going as a function of family income and test score, but only for students whose test scores put them roughly in the top 30 percent of the test score distribution. We repeat this procedure in the NLSY by first selecting only the top-scoring students on the AFQT, and then classifying the remaining sample based on family income and studying college-going as in the original study.

D.1.27 Jones (1956)

Jones (1956) used data from Arkansas' statewide testing program, which administered the American Council Psychological Examination to more than 98 percent of the Arkansas high schools. The author questioned principals about whether the graduating seniors had enrolled in college during the subsequent fall. Notably, this is the first study in a southern state to present results separately for black and white students. We aggregated categories for the college-going by test score to ensure sufficiently large cell sizes.

D.1.28 Daughtry (1956)

Daughtry (1956) collected data in the fall of 1955 on student class rank in terciles and college plans of the previous spring's graduates from high school principals covering 94 percent of Kansas' graduating class.

D.1.29 French et al. (1957)

French et al. (1957) describe the results from a study of more than 35,000 high school seniors at a sample of schools chosen to be nationally representative of public high schools. Students took a very brief (20 question) ability test and then filled out a questionnaire about their plans for college and their family background. School principals provided details on students' grades. A follow-up with a sample of about one-fifth of schools the following fall was used to provide data on actual enrollment as well as plans for college. We use the results based on actual enrollment for the subsample of students in the follow-up.

D.1.30 Cowen (1957)

Cowen (1957) arranged for a representative sample of more than 65,000 high school seniors in the state of New York to fill out a short questionnaire and complete an aptitude test, the New York State Scholastic Ability Test. The questionnaire asked about the student's plans for college and the certainty of those plans. The results are split into two because the sample includes roughly one-sixth of New York City school seniors but more than half of the upstate seniors, and the author cautions against combining results.

D.1.31 Little (1958)

Little (1958) arranged for 36,000 high school seniors representing almost 95 percent of seniors in the state of Wisconsin to fill out a short questionnaire and complete an aptitude test, the Henmon-Nelson Test of Mental Ability. The questionnaire asked about the student's family background (including self-assessed family income) and plans for college. The author also asked school officials to provide each student's class rank. Results of this study concern only a working subsample of approximately one-sixth of the total. A questionnaire was sent to the parents of the students in this subsample the next fall to find out whether students had followed up on their plans. About one-half of the parents replied to this questionnaire. Reported tabulations use only plans for attending college. Sewell and Shah (1967) subsequently built on this study (see below).

In a separate phase of the study, Little collected data on the 1953 Wisconsin high school graduates who enrolled in Wisconsin high schools and their subsequent progress as of 1957. Tabulations include students who had left college, who were still enrolled, and who had graduated at the end of the fourth year, as a function of class rank and test score category.

D.1.32 Sewell and Shah (1967)

Sewell and Shah (1967) report results from a follow-up with one-third of the sample used in Little (1958); this subsample formed the basis for the ongoing Wisconsin Longitudinal Survey. The authors sent a follow-up questionnaire to the parents of the subsample of students seven years later using both mail and phon;. 87.2 percent of parents of the subsample replied. Sewell and Shah (1967) report findings by socioeconomic status of the family, which is constructed using a weighted combination of father's occupation, parental education, estimates of funding available to pay for college, and approximate family wealth and income. College attendance and college graduation by gender were reported as a function of this socioeconomic status and scores on the Henmon-Nelson Test of Mental Ability.

D.1.33 Stroup and Andrew (1959)

Stroup and Andrew (1959) administered a questionnaire to the 88 percent of high school seniors enrolled at schools that administered the American Council Psychological Examination in the state of Arkansas. The survey included questions about the student's family income in broad categories (such as "difficulty making ends meet" or "wealthy") and college plans, including specific institutions. The authors followed up with high school principals and colleges to verify the enrollment or non-enrollment of students at the colleges they had indicated they had planned to attend. Test scores were collected from administrative records for the testing program.

Basic statistics on college attendance rates are available separately for black and white students. These statistics indicate that a little more than 11,000 students in the sample were white and 1,300 were black, with 3,000 white students continuing on to college and 300 black students continuing on to college. All other tabulations are for the two groups combined.

D.1.34 Jennings (1960)

Jennings (1960) reports results from data collected on the 1958 graduates of Montana high schools. Data were collected from high school guidance personnel on the number of graduates, their class rank, whether or not they had enrolled in college, and the location of the college, if any. Substantial effort was made to cross-check this information with the records of the relevant college admissions officers or registrars. College registrars were contacted again after a year to check on the reenrollment of students at the start of the second year.

D.1.35 Nam and Cowhig (1962)

Nam and Cowhig (1962) administered a supplement to the Current Population Survey in October of 1959 that collected data on family background and college plans of high school seniors, in addition to the standard CPS questions on demographics, work, and income of household members. The authors also administered a follow-up survey to principals of the students' high schools the following fall to collect data from school records and actual college attendance. A total of 1,170 usable replies were received, which were then reweighted to be nationally representative. The authors collected scores from a wide variety of tests and harmonized them using equivalence tables. They also collected class rank from principals. Family income was measured using parental responses to the usual CPS questions.

D.1.36 Medsker and Trent (1965)

Medsker and Trent (1965) arranged for an intensive study of more than 10,000 high school students from 16 selected communities in the Midwest and California. Students took a short aptitude test and responded to a questionnaire. Data on class rank and intelligence test scores were collected, presumably from administrative records. The scores were from a number of different exams and were equated to a common scale, the School and College Ability Test. Students were mailed a questionnaire the October after their graduation to learn whether they had enrolled in college; more than 90 percent replied.

Preliminary results on one-year college persistence are available in the original study (Medsker and Trent, 1965). The authors also conducted a four-year follow-up study in 1963. More than half of the original sample responded to the questionnaire from this study, and responses were used to determine whether the college students had graduated, were still enrolled in (any) college, or had left college. Results of this study are given in Trent and Medsker (1968) by gender and for three academic ability groups.

D.1.37 Flanagan et al. (1971)

Flanagan et al. (1964) report the results from Project Talent, a nationally representative survey of 440,000 high school students in 5 percent of the nation's high schools. Students took an extensive battery of aptitude and ability tests. They also filled out lengthy surveys about their backgrounds, plans, interests, and activities. Flanagan et al. (1964) report results from a one-year follow-up with high school seniors. Tabulations provided include college attendance by the test scores and the student's estimate of family income. Flanagan et al. (1971) report results from a five-year follow-up to the initial study. Although response rates were somewhat low (roughly one in three), the authors undertook an intensive effort to locate and secure information from about 4 percent of non-respondents. They then reweighted respondents and non-respondents in constructing final statistics. Tabulations provided include college attendance by test scores and an index of socioeconomic status, where the index is created using value of home, family income, books in home, appliance and durable good ownership, whether the child had his or her own room, father's occupation, and parental education. The two studies give broadly similar results; we give preference to those from the later study because we prefer to use indices of socioeconomic status whenever possible.

D.1.38 Berdie and Hood (1963)

Berdie and Hood (1963) arranged for a second study that was very similar in design and execution to Berdie's 1954 study (see above). The authors arranged for 97 percent of high school seniors in the Minnesota class of 1950 to fill out a short questionnaire that asked about the student's family background, including their assessment of family in broad groups ("frequently have difficulty making ends meet," "sometimes have difficulty in getting the necessities," "have all necessities but not many luxuries," "comfortable but not well-to-do," "well-to-do," and "wealthy"), as well as their plans for college. The students' test scores were taken from a junior year administration of the Minnesota Scholastic Aptitude Test, while class rank was taken from administrative records. A follow-up study was conducted to learn the post-graduation activities of a sample of students. Tabulations cover only academic ability (grades and test scores) and only for the students' plans for college attendance, not their actual activity.

D.1.39 Tillery (1973)

Tillery (1973) reports the results from the SCOPE Project, which was a large survey of students in the ninth and twelfth grades of high school. In this survey, 34,000 seniors from four states (California, Illinois, Massachusetts, and North Carolina) took an aptitude exam, the Academic Ability Test, and filled out a questionnaire about their family background and college intentions. The key background indicator is family income relative to the national average (which they were given) in five groupings. For college plans, they were also asked for details on where they were applying. This information was used in an intensive follow-up the next year to determine which students had actually enrolled in college.

D.1.40 Eckland and Henderson (1981)

Eckland and Henderson (1981) analyze the National Longitudinal Study of the High School Class of 1972 (NLS72), a nationally representative sample of about 21,000 high school seniors from the spring of 1972. Students were administered a battery of tests and then filled out a questionnaire that asked about a number of family background characteristics. The test score is a composite derived from vocabulary, reading, letter groups, and mathematics test scores. Socioeconomic status is an index derived from information on father's and mother's education, parental income, father's occupation, and an index for ownership of various household items.

The NLS72 involves substantial efforts to follow up with students to measure their post-graduation education and work. This study presents results from 4.5 years after graduation. We focus on results for those who have ever attended college as a function of socioeconomic status and family background. The authors break down these results by race at several points.

D.1.41 Gardner (1987)

Gardner (1987) analyzes the High School and Beyond Survey, a nationally representative sample of 28,000 high school seniors from the spring of 1980. Seniors were administered a battery of tests, the scores of which were combined into a composite test score rating. They, or in a subsample of cases their parents, were asked to report family income. Students reported income in seven broad categories, while parents reported any dollar value. The dollar values of parents were recoded into the seven broad categories given to students. Students also reported the education and occupation of each parent; several variables on the learning environment in the home; and several variables on the household possession of consumer durables. These variables were combined with income to form a socioeconomic status variable. Two years later, 11,500 seniors were randomly chosen for follow-up, at which time data on college enrollment were collected.

For most of our analysis, we define college-going as someone who attended any school. The reported tabulations for college-going by family income and test score report only those who went to college at least six months instead of those who had ever attended college.

Table D1: Basic Sample Details, Part A

No.	Source	Location	Sample Size	Cohort	Type
1	Book (1922)	Indiana	5,748	1919	Prospective
2	OBrien (1928)	Kansas	3,264	1921 & 1922	Follow-up (6 years)
3	Mann (1924)	North Carolina	703	1923	Prospective
4	Colvin and MacPhail (1924)	Massachusetts	2,799	1923	Prospective
5	Odell (1927)	Illinois	11,321	1924	Follow-up (1 year)
6	Ames (1926)	Montana	1,189	1925	Prospective
7	Benson (1942)	Minneapolis	820	1929	Follow-up (10 years)
8	Henmon and Holt (1931)	Wisconsin	16,488	1929	Follow-up (1 year)
9	Updegraff (1936)	Pennsylvania	2,009	1933	Follow-up (2 years)
10	Barker (1937)	Iowa	3,767	1934	Follow-up (2 years)
11	Gardner et al. (1942)	Natchez, MS	191	1934	Follow-up (1–5 years)
12	Livesay (1942)	Hawaii	2,255	1936	Follow-up (1 year)
13	Goetsch (1940)	Milwaukee	1,023	1937	Follow-up (1 year)
14	Manuel (1938)	Texas	825	1937	Follow-up (1 year)
15	Manuel (1939)	Dallas	556	1938	Follow-up (1 year)
16	Sibley (1948)	New York	5,262	1940	Follow-up (1 year)
17	Junker (1940)	Dowagiac, MI	281	1940	Prospective
18	Lansing et al. (1960)	National	1,685	1943 & 1953	Follow-up (2–21 years)
19	Keller et al. (1950)	Minnesota	19,331	1945	Follow-up (1 year)
20	Phearman (1948)	Iowa	2,616	1947	Follow-up (1 year)
21	Roper (1949)	National	10,063	1947	Prospective
22	Morehead (1950)	Arkansas	1,727	1949	Follow-up (1 year)
23	Berdie (1954)	Minnesota	22,516	1950	Prospective & follow-up (1 year)
24	White (1952)	Northeast Ohio	1,053	1950	Prospective & follow-up (1 year)
25	Wiegman and Jacobson (1955)	Oregon	1,320	1950	Follow-up (1 year)
26	State University of New York (1955)	New York	20,784	1953	Prospective & follow-up (1 year)
27	Jones (1956)	Arkansas	12,058	1954	Follow-up (1 year)
28	Daughtry (1956)	Kansas	15,801	1955	Follow-up (1 year)
29	French et al. (1957)	National	6,248	1955	Prospective & follow-up (1 year)
30	Cowen (1957)	New York	54,705	1956	Prospective
31	Little (1958)	Wisconsin	31,137	1957	Prospective
32	Sewell and Shah (1967)	Wisconsin	9,007	1957	Follow-up (7 years)
33	Stroup and Andrew (1959)	Arkansas	12,706	1957	Follow-up (1 year)
34	Jennings (1960)	Montana	2,682	1958	Follow-up (1 year)
35	Nam and Cowhig (1962)	National	1,170	1959	Follow-up (1 year)
36	Medsker and Trent (1965)	Midwest/California	9,778	1959	Follow-up (1 year)
37	Flanagan et al. (1971)	National	32,527	1960	Follow-up (5 years)
38	Berdie and Hood (1963)	Minnesota	42,142	1961	Prospective
39	Tillery (1973)	Four States	33,965	1966	Follow-up (1 year)
40	Eckland and Henderson (1981)	National	20,092	1972	Follow-up (4 years)
41	Gardner (1987)	National	9,955	1980	Follow-up (2 years)

Note: Each row is a historical study on college attendance patterns. Columns provide the reference, geographic scope of the study, sample size, high school graduation cohort, and when college attendance was tracked.

Table D1: Basic Sample Details, Part B

No.	Background	Number	Ability	Number
1			Test score (Indiana University Intelligence)	10
2			Test score (Terman Group)	15
3			Test score (Mentimeter)	15
4			Test score (Brown University)	3
5			Test score (Otis) & class rank (student)	11 & 12
6			Test score (Otis)	9
7			Test score (Haggerty Intelligence)	15
8			Test score (Ohio Psychological)	32
9	Socioeconomic status (constructed)	10	Test score (unknown)	7
10			Test score (Iowa Every-Pupil)	8
11	Socioeconomic status (researcher)	5		
12			Test score (American Council)	16
13	Family income (tax records)	8	Test score (Henmon-Nelson)	1
14			Test score (American Council)	27
15			Test score (American Council)	25
16	Family income (tax records)	4	Class rank (administrative)	3
17	Socioeconomic status (researcher)	5		
18	Family income (parents)	5		
19			Class rank (administrative)	3
20			Test score (Iowa Tests of Educational Development)	11
21			Class rank (administrative)	5
22			Test score (American Council)	4
23	Family income (student)	6	Test score (American Council) & class rank (administrative)	21 & 20
24	Socioeconomic status (researcher)	5	Test score (unspecified IQ test)	3
25			Class rank (uncertain)	4
26	Family income (tax records)	3	Test score (unspecified IQ test)	3–4
27			Test score (American Council)	13
28			Class rank (administrative)	3
29			Test score (unnamed) & class rank (administrative)	4 & 10
30			Test score (New York State Scholastic)	6
31			Test score (Henmnon-Nelson) & class rank (administrative)	10 & 10
32	Socioeconomic status (researcher)	4	Test score (Henmon-Nelson)	4
33	Family income (student)	5	Test score (American Council)	3
34			Class rank (administrative)	5
35	Family income (parents)	5	Test score (various) & class rank (administrative)	4 & 4
36			Test score (various) & class rank (administrative)	5 & 5
37	Socioeconomic status (researcher)	4	Test score (unnamed)	4
38	Family income (student)	6	Test score (Minnesota Scholastic) & class rank (administrative)	10 & 10
39	Family income (student)	5	Test score (Academic Ability Test)	8
40	Socioeconomic Status (student)	3	Test score (composite)	3
41	Socioeconomic Status (student)	4	Test score (composite)	4

Note: Each row is a historical study on college attendance patterns. Columns provide how family background was measured and how many bins were used, as well as how academic ability was measured and how many bins were used.