Family Background, Academic Ability, and College Decisions in the 20th Century U.S.

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VERY PRELIMINARY

Abstract

We harmonize the results of a number of historical studies to document changes in the patterns of who attends college over the course of the 20th century. We find that family income or socioeconomic status were more important predictors of who attended college before World War II, whereas academic ability was afterward. We construct and calibrate a model to understand what forces can explain the magnitude and timing of these changes. We find that changes in college financing play a small role. The rise in the college earnings premium explains the greatest part.

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1 Introduction

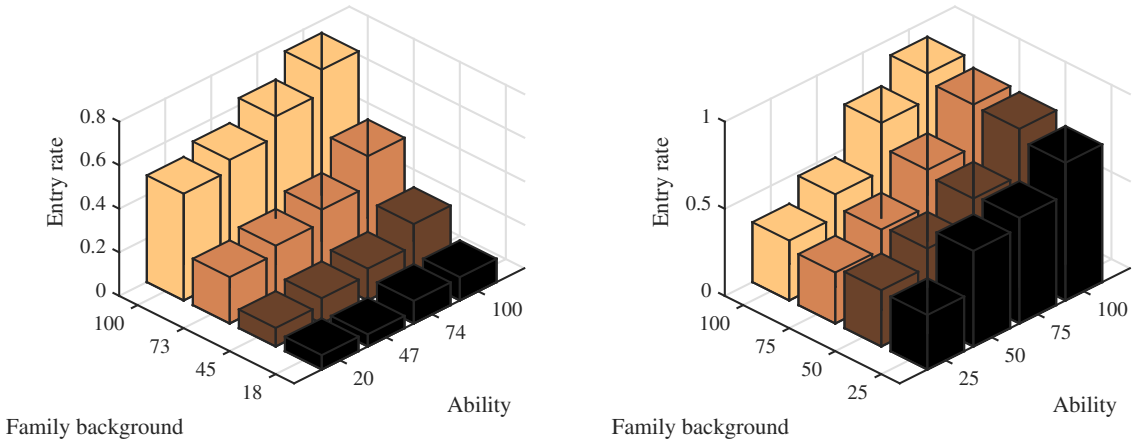
A common stated goal of university admissions and higher education policy in the U.S. is to secure access to university for all students of merit (Bowen et al., 2005). That is, college attendance should be open to all students with demonstrated academic ability in the form of test scores or high school grades, irrespective of the family characteristics they cannot control such as income or wealth. These ideals play a central role in motivating federal grant, loan, and aid programs. However, recent work by Belley and Lochner (2007) and Lochner and Monge-Naranjo (2011) documents a decline in access for recent cohorts and links this change to the failure of federal aid programs to keep pace with rising college tuition and other costs.

This analysis and the broader policy debate focuses on college attendance patterns for current and recent cohorts of high school graduates. The goal of this paper is to provide a broader historical context for this analysis and debate. We make two contributions. First, we construct a novel database that documents patterns of college attendance as far back as the high school graduating class of 1919. We show that the changes in these patterns in the early to mid-20th century are far larger than those for recent cohorts. Second, we construct and calibrate a model of college attendance decisions. Our goal is to understand the driving forces that are capable of replicating the timing and magnitude of the changes in college attendance patterns in our data.

Our empirical contribution involves collecting, harmonizing, and analyzing the results from over forty datasets or studies that cover college attendance patterns. Our data cover two broad eras. For the graduating classes of 1960 onward, we have periodic access to microdata on nationally representative samples of high school students, including notably Project Talent, NLSY79, and NLSY97. These surveys include multiple measures of students' academic abilities, family characteristics, and college attendance decisions that allow us to construct directly college attendance patterns. We are unaware of extant microdata covering any earlier cohorts. Instead, we have collected the published reports from over two dozen studies that investigated college attendance patterns for these earlier cohorts. Our analysis for this earlier period rests on these published results.

These early studies suggest dramatically different college attendance patterns than we see today. For example, Updegraff (1936) collected information on 15 percent of Pennsylvania's 1933 high school graduating class. In his report, he provides a table giving college attendance rates for students with different ranges of IQ test score and socioeconomic status

(constructed using parental education and occupation). We reproduce his results on college attendance by test score and socioeconomic status groupings that approximate quartiles in Figure 1a. Family background played the dominant role in determining who attended college; academic ability played a surprisingly small role, except perhaps at the very highest quartile. This finding is suggestive on its own. To provide context, we replicate the study as closely as possible in the NLSY79, mimicking how Updegraff measured family background, academic ability, and college attainment. The results, shown in Figure 1b, show a complete reversal: by the 1979 cohort academic ability is the dominant determinant of college attendance, with almost no role for family background.



(a) 1933 Cohort

(b) 1979 Cohort

Figure 1: Changing Patterns of College Attendance: 1933 and 1979 Cohorts

We harmonize and replicate similar results from more than two dozen other historical studies, then merge them with the results of the modern microdata to form a time series on college attendance patterns. We find large changes in sorting patterns over time. Updegraff's findings are typical of studies from the 1920s and 1930s. By the 1950s there is strong evidence of a reversal, with academic ability becoming the more important determinant of who attended college. This change was due to a large increase in the importance of academic ability and a modest decline in the importance of family background. The patterns have fluctuated without a clear trend since roughly 1960.

Having documented these trends, our second goal is to understand why they occurred. To

this end, we construct a model of college choice for students that vary in their endowed academic ability and family background. Given the emphasis in the literature on the financial environment we pay particular attention to modeling college expenses (tuition and consumption) and college financing (parental transfers, student work, and borrowing subject to credit constraints). We calibrate the model to fit college attendance and college financing patterns of modern cohorts from the NLSY79 and High School and Beyond.

We then conduct counterfactual exercises designed to help understand changing patterns of college attendance in the 20th century. We focus on changes in the financial environment for two earlier cohorts: the 1933 and 1960 high school graduates. We feed in exogenously the borrowing limits and college tuition cost these cohorts faced. We also recalibrate a subset of parameters so that the model endogenously reproduces the college lifetime earnings premium and college financing choices of these cohorts. We then ask how far our model can go towards fitting the changes in sorting patterns. We find that we can account for about three-fourths of the change in the importance of academic ability, but little of the change in the importance of family background. The main force that affects enrollment decisions is the rise of the college earnings premium, which induces more high-ability students (but not low-ability ones) to attempt college. The other changes we feed into the model play little role.

Our paper is related to two key literatures. The first is an active literature on college financing and college attendance today. A number of papers documented that family income played little role in college attendance after controlling for individual characteristics such as ability in the NLSY79 (Cameron and Tracy, 1998; Cameron and Heckman, 1999; Carneiro and Heckman, 2002). Keane and Wolpin (2001) and Cameron and Taber (2004) also argue that borrowing constraints played little role in student's decisions. However, Belley and Lochner (2007) and Bailey and Dynarski (2011) show that the importance of family background has subsequently risen.[1] Lochner and Monge-Naranjo (2011) attribute this change to the failure of student loan programs to keep up with rising tuition. Ionescu (2009) models college details and the current Federal Student Loan Program in great detail and finds that it plays little role. Relative to this literature, our main contribution is to put this debate into historical context.

The second literature seeks to understand the rise in educational attainment and college attainment in particular. Restuccia and Vandenbroucke (2013) model it as an optimal

[1]Similarly, Galindo-Rueda and Vignoles (2005) documents that the importance of ability in determining educational attainment declined in the UK between 1958 and 1970.

response to the rise in the skill premium. Goldin and Katz (2008) concur, but add a number of institutional factors that may have played a role in the relatively rapid expansion of education in the U.S. Donovan and Herrington (2014) emphasize the decline in real college costs relative to income for cohorts born prior to 1950 and the rising college earnings premium realized by cohorts born after 1950. Relative to these papers we differ mostly in focusing on issues of who attends college rather than the average rise in attendance. Perhaps the most closely related papers along this dimension are Taubman and Wales (1972) and Hendricks and Schoellman (2014), who study the increasing importance of academic ability in determining who attends to college. We add to this literature by incorporating the joint effect of family background, which allows us to isolate other potentially important factors like financing and borrowing constraints.

The paper proceeds as follows. Section 2 presents the data sources, our harmonization procedure, and then the key new facts on college attendance patterns. Section 3 gives the model of college attendance. Section 4 contains our calibration procedure and Section 5 the results. Section 6 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 this claim is derived from two very different types of sources. For the modern era (high school graduating classes of 1960 onward) we have access to large, nationally representative microdata 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 Project Talent, NLSY79, and NLSY97. For students graduating before 1960, our evidence comes from the studies conducted by researchers in a variety of of fields, including psychology, economics, and education.

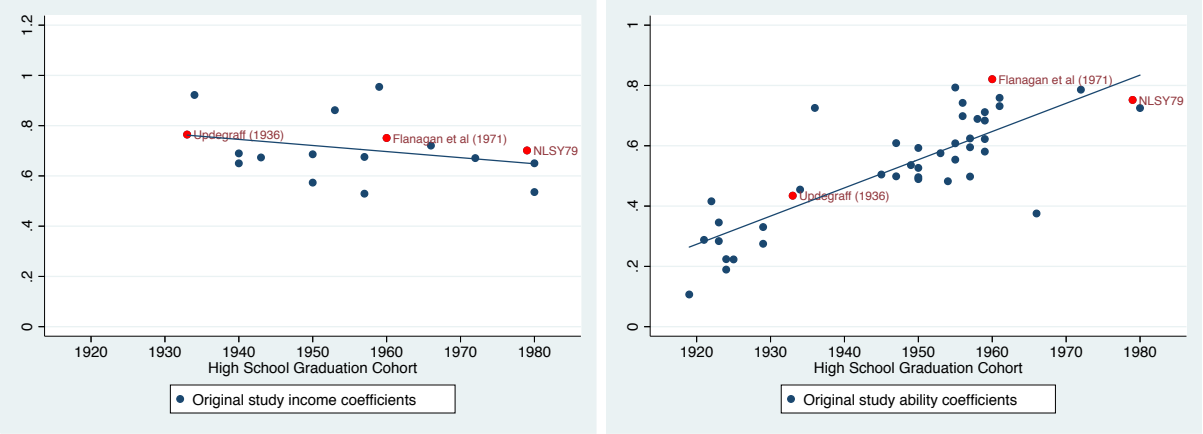
The original microdata from the pre-1960 studies no longer exist. Instead we rely on their published results, which we have collected from journal articles, dissertations, books, technical volumes, and government reports. The design, sample, and presentation of results are different for each study. Nonetheless, it may be helpful to consider a hypothetical typical study that utilizes the most common elements in order to understand our approach. Table C1 in the appendix 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. A student's 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 the student's family background, with typical questions covering parental education and occupation or estimates of the family's income. This data was 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 the student's plans for college or, alternatively, follow up at a later date with the student, the student's 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 and/or family background that attended college.

In order to summarize the results of these many studies, we convert family background and academic ability categories into percentile ranges. We then treat the reported tabulations as data on $C(IQ)$ and $C(F)$, where C is the percentage of students in a group who attend college and IQ and F are the midpoints of the percentile intervals. We regress $C(IQ)$ on IQ and $C(F)$ on F and report the estimated coefficients β_{IQ} and β_F, which capture the importance of academic ability and family background for college attendance decisions in a way that is easily compared over time.

Figure 2 plots these coefficients against high school graduation cohort. There are three main facts to note. First, Figure 2a shows that the importance of family background (family income or socioeconomic status) has declined over time, although there is substantial noise in the trend. Second, Figure 2b shows that the importance of academic ability (test scores or grades) has sharply risen over time, in line with the previous work of Taubman and Wales (1972) and Hendricks and Schoellman (2014). Studies conducted before World War II were especially likely to find academic ability to be unimportant in determining who attended college. Finally, comparing the two figures shows that family background was a much more important determinant of who attended college before World War II, whereas academic ability is a more important determinant afterwards. Finally, we note that while the pre-1960 studies are less ideal in that we do not have access to nationally representative microdata, the many tabulations we have collected from around the country agree on the broad trends we are interested in.



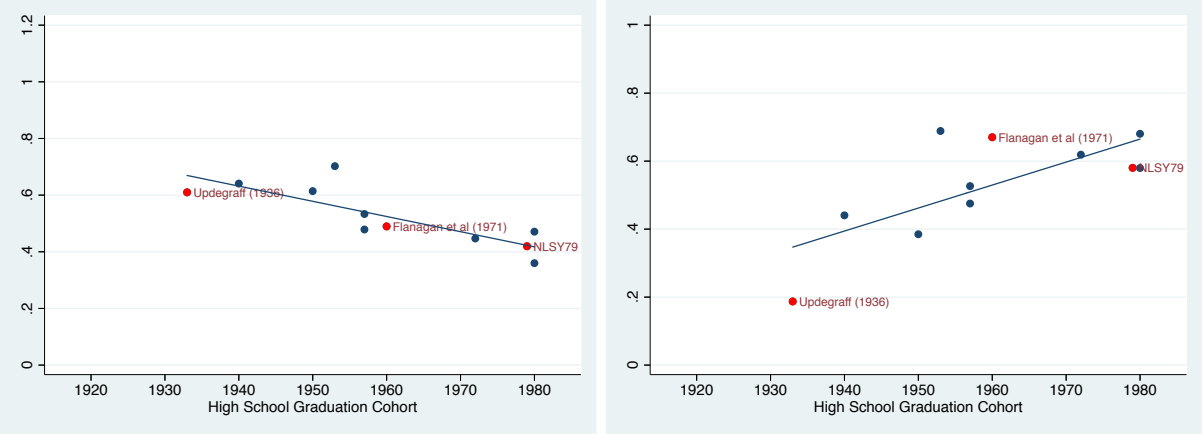
(a) Family Background (b) Academic Ability

Figure 2: Changing Patterns of College Attendance: Univariate Studies

In our quantitative analysis we focus on three particular studies, highlighted here in red. Each offers the full set of data that we need for our analysis. Further, each one is representative of what we view as one of three distinct eras in the history of college attendance. Updegraff (1936) captures the pre-World War II or Depression era, when family background was a more important determinant of who attended college than academic ability. Flanagan et al. (1971) and NLSY79 are both from the modern era, where academic ability is now the main determinant. The main difference between these modern cohorts is on the financing side; Flanagan et al. (1971) studies one of the last cohorts to graduate before the introduction of the federal loan programs, while the cohorts in NLSY79 have access to these programs.

Figure 2 presents the results of tabulations of college-going as a function of family background or academic ability alone. For a subset of our studies we have a bivariate cross-tabulation of college-going as a function of both factors. This allows us to provide a crude measure of the importance of academic ability "controlling" for family background, and vice-versa. This control is important because family background and academic ability are positively correlated in every study for which we can cross-tabulate the two. To summarize the results of these cross-tabulations, we construct transform the reported tabulations into observations $C(IQ, F)$ similar to our $C(IQ)$ and $C(F)$ above. We then regress these observations on the IQ and F simultaneously and study the estimated coefficients β_{IQ} and β_F.

Figure 3 shows the results. There are fewer data points because we have cross-tabulations



(a) Family Background (b) Academic Ability

Figure 3: Changing Patterns of College Attendance: Bivariate Studies

for only a subset of studies. However, the patterns are broadly similar to those shown in Figure 2. The main difference is that the decline in the importance of family background is more pronounced after controlling for academic ability. The reason for this is that college attendees are more strongly selected on academic ability over time and academic ability is positively correlated with family background; this confounding trend weakened the relationship depicted in Figure 2a. Again, we highlight the three studies of particular interest in red.

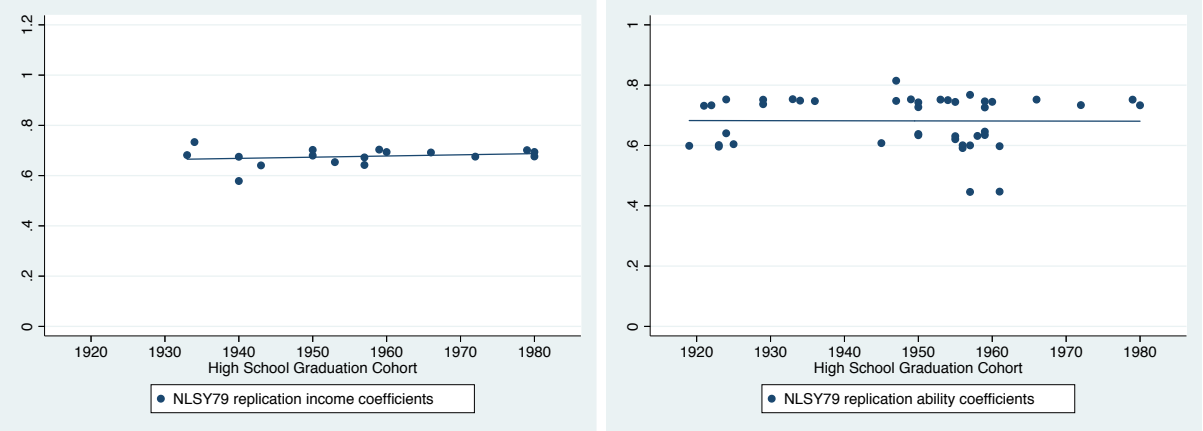
2.1 Controlling for Variation in Historical Study Design

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. One possible concern is that these details may matter and may influence the trends in β_F and β_{IQ} that we are documenting. To help address this concern, we re-create each original study as closely as possible in the NLSY79, similar to the procedure described in the introduction for Updegraff (1936). We then study the implied importance of academic ability and family background in determining who goes to college. Since the underlying college attendance patterns are the same in all of these replications, the results allow us to speak to the role of the variation in study design in affecting our results.

We focus on replicating four main components of study design. First, we match whether

the study used test scores or class rank. The former is measured using AFQT score; the latter using class rank at high school graduation. Second, we match whether the study used parental income or socieconomic status. The former is measured using family income at the time of high school graduation; the latter is measured using principal componenent analysis to extract the common component from father's occupation, education of both parents, and family income. Third, we match how the study measured college attendance: either prospectively by asking their plans, or by following up at a later date to see whether they had yet attended college. We use the number of years of college high school seniors planned to attend for the former and the longitudinal aspect of the NLSY to track actual attendance for the latter. Finally, we form the data into bins whose marginal size is the same as the original study.

A simple example may help. Goetsch (1940) reports college-going as a function of family income for students who score on the top fifteen 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. Within the NLSY79, we restrict our attention to those who scored in the top fifteen percent on a standardized test, namely the AFQT. We then sort the remaining children on family income and form them into bins that contain the same 24, 8, 16, ... percent of the income distribution.



(a) Family Background (b) Academic Ability

Figure 4: Counterfactual Changes in Patterns of College Attendance: Univariate Studies

We find one aspect of study design that contributes importantly to our results. It is consistently true that socioeconomic status is a stronger predictor of college attendance

than is family income. This holds when comparing different studies of similar cohorts and also when comparing within studies where both measures are available, of which we have three. The average gap from the within-study comparisons is 0.29. We adjust up all of the estimated β_F from family income studies by this amount to make them "SES-equivalent" studies. Conceptually, we can think of two reasons why to prefer estimates based on SES and adjust those based on income. First, socioeconomic status may be a stronger predictor of lifetime income and hence the student's financial means. Second, socioeconomic stauts may be less prone to measurement error, particularly as compared to studies that ask students to report family income. Note that these adjustments do not affect our calibration below because each of our three calibration studies uses SES as the measure of family background anyway.

Otherwise, we find that most of the other aspects of study design have litlte impact on our results. To make this clear, we regress college attendance on the midpoint of the percentile range for each simulated study, exactly as we did in the previous subsection. The results $\widehat{\beta_F}$ and $\widehat{\beta_{IQ}}$ are plotted against cohort in Figure 4. This figure replicate exactly Figure 2.[2] There are two main takeaways from these figures. First, variation in study design induces noise in our estimates of β_F and β_{IQ}. 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. The second point is that there is no consistent bias in the time trend of how study design affects our estimates. Studies of older cohorts seem to roughly similar results on average as studies of newer cohorts. This lends confidence to our conclusion that the trends depicted in Figures 2 and 3 reflect genuine changes in who attends college.[3]

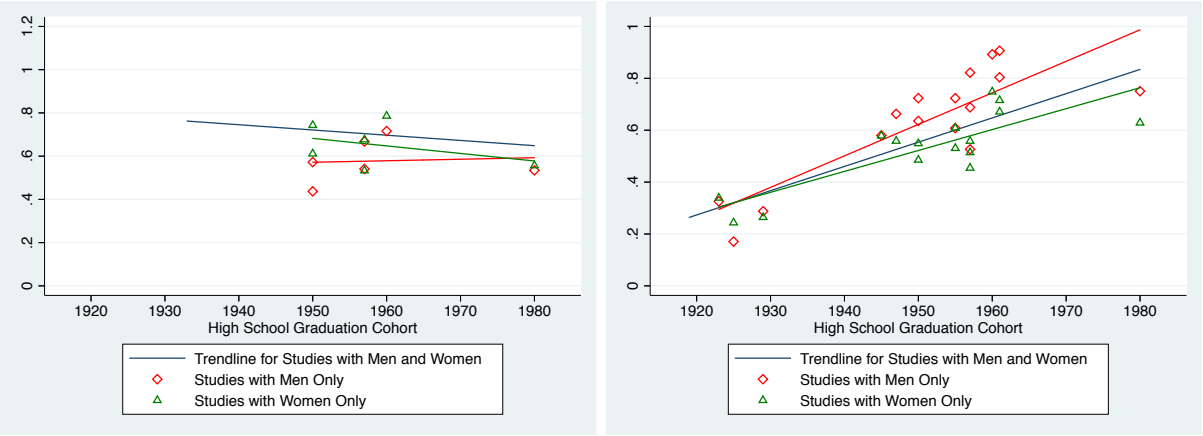
2.2 Gender, Race, and College Attendance

Another natural question is whether our results apply to all groups, or whether they are explained by changing attendance patterns only for women or blacks. This hypothesis may be natural given that the college and labor market opportunities available to women and blacks changed substantially over this period. To investigate the role of gender, we measure changes in college attendance patterns of men in the subset of studies that give separate tabulations by gender. We then compare these patterns to the overall trend for

[2]Similar results apply for the bivariate studies; see Figure C1 in the Appendix.

[3]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.

both genders, shown in Figure 5.



(a) Family Background (b) Academic Ability

Figure 5: Changing Patterns of College Attendance by Gender

Relatively few studies separately tabulate results on family background by gender. The results of these few studies show no evidence of a bias from including women. However, the first such studies are available only in 1950; it is possible that there were differences earlier in the period. A larger number of studies separately tabulate results on academic ability by gender. College attendance of men seems to depend somewhat more on academic ability, as measured by the difference between the blue and red trend lines. On the other hand, both trend lines slope up, suggesting that increased sorting by academic ability is a common phenomenon that has affected both men and women.

Tabulations by race are almost non-existent in our historical sources. In large part this is because most of these studies were conducted in northern states where black students would have been much less common. For example, of the thirty-nine sources tabulated in the appendix, only five draw on southern states. 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.

3 Model

The previous section documented large changes in college attendance patterns over the twentieth century. We find that family income or socioeconomic status were more important predictors of who attended college before World War II, whereas academic ability was afterward. Our goal now is to provide a model to help understand these patterns. We are most interested in identifying potential driving forces that can replicate the timing and magnitude of the observed compositional changes.

To overview, our model describes the behavior of families with a child who is a high school senior and is considering whether to attempt college or work. Families are heterogeneous in several respects, including most importantly their child's ability and their financial resources. They are also imperfectly informed about the child's ability. Given their endowment, they decide whether the child should attempt college and, if so, how to finance it. The alternative to college is working as a high school graduate. Students who attempt college graduate with a probability that depends on their ability. Those who do not graduate spend two years in college before exiting without a degree. After finishing with school, students work as a high school graduate, college dropout, or college graduate.

Our model includes several factors that vary exogenously over time (for students of different high school graduation cohorts). These factors have the potential to drive changes in the composition of who attends college and explain the changes in sorting. We focus here on three such change: the college earnings premium; the cost of college; and limits on students' ability to borrow. Our main question is whether these obvious candidate explanations can generate changes in sorting patterns consistent with the data, or whether we need to consider other factors. We now outline the model and these driving forces in more detail.

3.1 Demographics, Endowments, and Preferences

The model is set in discrete time, with a period lasting one year. For convenience we describe the problem of families in a single cohort. Since there are no interactions between cohorts, we only need to clarify what features of the environment change by cohort. A cohort is a continuum of families who each have one child that has just graduated high school and is of age $a = 18$. The child lives until age $a = A$.

Families in a cohort are heterogeneous along five dimensions. First, the family varies in their endowment of an initial parental resource y_p. The only role of parents in the model

is to possess this endowment, which they endogenously split between transfers to their children and their own consumption. Second, the family varies in the ability of the child, x. Ability is an endowed characteristics that has two effects in our model: it raises wages, and it makes a student more likely to graduate from college. However, families are initially only imperfectly informed about the child's ability. We denote by m the unbiased but noisy signal the family possesses of x. Third, the family is endowed with a local tuition cost of college τ. We think of heterogeneity in τ as arising at least in part through cross-state variation in funding for public education or the availability of nearby colleges. Finally, the student is endowed with relative preferences for work and college η_w and η_c. These preference terms are mostly to help speed computation of the model.

The only remaining endowment in the model is time: the child possesses one unit of time in each period of their life. They face two main time allocation decisions. First, at the start of their life they decide whether to attempt college or work. Second, if they attend college they allocate their time between work and non-work; we think of non-work as comprising both study time and leisure. For simplicity, we abstract from a work-leisure decision for those outside of college. We choose to model the within-school time allocation decision because student work may be an important source of financing in an environment with binding borrowing constraints. We now discuss the problems and value functions for new high school graduates, college students, and workers in turn.

3.2 College Entry and Parental Transfers

When the child is age 18, the family has the initial endowment $(y_p, m, \tau, \eta_w, \eta_c)$, consisting of parental resources, the signal of ability, the local cost of college, and their taste for college and work. The first two choices of the family are whether the child will attempt college or enter the labor force directly as a high school graduate, and how much of the parent's resources they will transfer to the child. We denote by V_{HS} the value of entering the labor market and V_c the value of attempting college, so that the solution to this problem is simply:

$$\max \left\{ V_{HS}(y_p, m, \eta_w), V_c(y_p, m, \tau, \eta_c) \right\}. \tag{1}$$

After the child chooses whether to attempt college, the parent makes a transfer of resources to the child. We allow the size of this transfer to vary between students who attempt college

and those who work. The value of a student who works is determined as:

$$V_{HS}(y_p, m, \eta_w) = \max_{z_w \geq 0} u_p(y_p - z_w) + \bar{\eta} - \gamma\eta_w + \mathbb{E}_x \left\{ V_w(z_w, x, HS) \right\}. \tag{2}$$

Here the parent divides their resources y_p between a transfer to the child z_w, which forms the child's initial assets, and consumption for the parent $y_p - z_w$, from which they derive utility given by the function u_p. The child also derives utility from her choice given by $\bar{\eta} - \gamma\eta_w$. $\bar{\eta}$ is a preference for work versus college that is common to a cohort. Below, we consider allowing this parameter to vary to capture trends in the desirability of work versus school. η_w is the idiosyncratic disutility of working as a high school graduate, which is drawn from an extreme-value type-I distribution and scaled by the parameter γ.

After receiving transfers and realizing preferences, the student enters the labor market and works. The value of doing so is given by V_w and depends on their initial assets given by the transfer z_w, their ability x (which is uncertain, hence the expectation), and their education HS. We discuss the problem of workers further below.

The value of a student who chooses to attempt college:

$$V_C(y_p, m, \tau, \eta_c) = \max_{z_c \geq 0} u_p(y_p - z_c) - \gamma\eta_c + V_1(z_w, m, \tau) \tag{3}$$

As above the parent divides their resources between their own consumption and a transfer to their child. The child has an idiosyncratic disutility of entering college given by $\gamma\eta_c$, where again η_c is drawn from an extreme-value type-I distribution and scaled by the parameter γ. $V_1(z_w, m, \tau)$ is the value of entering the freshman year of college with initial assets z_w, ability signal m, and tuition cost τ. We explain this further in the next subsection.

3.3 College

Students who attempt college do not necessarily graduate. Instead, they invest two years before learning whether they will pass or drop out. During these two years they choose consumption c, leisure l, and the assets to carry forward k' to maximize their value given

by:

$$V_1(z_w, m, \tau) = \max_{k',c,l}(1+\beta)u(c+\bar{c}(m), 1+\bar{l}_m - l) + \beta^2 E_x \left\{(1-\pi(x)V_w(k', x, CD) + \pi(x)V_3(k', m, \tau)\right\}$$
$$\text{s.t. } 2c + 2\tau + k' = z_w + 2w_c l \tag{4}$$
$$k' \geq \underline{k}$$

$u()$ captures the directly utility of consumption and leisure while in college. It includes taste shifters $\bar{c}(m)$ and $\bar{l}(m)$ that vary by ability signal. These capture the idea that college can be more enjoyable and leisurely for students with better ability signals; they are included directly in the utility function so that they can affect the marginal utility of consumption. This approach helps us match patterns of work and consumption in college, as we show below.

Students' choices have to respect two budget constraints. First, the usual period budget requires that consumption, tuition payments, and savings equal the value of saved assets and work income during college. Note that we restrict the value of consumption, tuition, and labor earnings to be the same in each of the first two years of college. Second, their borrowing is subject to a debt limit $\underline{k}$.

The continuation value after two years in college is the determined by the probability that they remain in college, $\pi(x)$, which depends on their ability, and the value of continuing in college V_3 or entering the labor market as a college dropout $V_w(k', x, CD)$. Given the structure of our model, everyone who can continue in college will want to do so. Students who remain in college finish the last two years and graduate with certainty. As in the first two years of college, they choose consumption, leisure, and assets to carry forward to maximize their value given by:

$$V_3(k, m, \tau) = \max_{k',c,l}(1+\beta)u(c+\bar{c}(m), 1+\bar{l}(m) - l) + \beta^2 \mathbb{E}_x V_w(k', x, CG)$$
$$\text{s.t } 2c + 2\tau + k' = Rk + 2w_c l \tag{5}$$
$$k' \geq \underline{k}$$

The utility function and budget constraints are the same as in their first two years of college. The only difference is that the continuation value now is simply the value of entering the labor market as a college graduate, $V_w(k', x, CG)$.

3.4 Work

The problem of a worker is straightforward in our model. They are fully informed about their ability x and face no further uncertainty. Recall that we abstract from a labor-leisure choice for workers. Then their problem consists of taking the initial k as given and choosing a lifecycle consumption path c_a that maximizes utility subject to the lifetiem budget constraint. The only complication is that our model allows workers to enter the labor market at three distinct points: at age 18, working as high school graduates; at age 20, working as college dropouts; and at age 22, working as college graduates. To economize on notation, we define by A_s the age of entry to the labor force for students with education level s, and by w_s the wage rate for students with education level s. Then we can compactly represent the problem of any worker as the solution to:

$$V_w(k, x, s) = \max_{c_a} \sum_{a=1}^{A-A_s} \beta^{a-1} u_w(c_a) \tag{6}$$
$$s.t. \sum_{a=1}^{A-A_s} R^{1-a} c_a = Y(s, x) + Rk$$

We abstract from borrowing constraints for workers and focus on the lifetime budget constraint, which requires that the present discounted value of consumption be paid for using the initial asset position and the present discounted value of labor earnings, given by $Y(s, x)$.[4]

Equations (1)–(6) specify the complete problem of a family in this environment. In the next section we specify the functional forms and calibration strategy that allow us to take this model to the data. Our calibration relies on using cross-sectional moments from modern U.S. data. Given that we fit this data successfully, our results rely on feeding in various time series changes and quantifying how they affect the main moments of interest.

[4]Incorporating reasonable borrowing constraints for workers into our model is unlikely to change our results. The reason is that workers in our model face no uncertainty. Hence, standard consumption smoothing motives will lead workers with positive k_{A_s} to spend it down and workers with negative k_{A_s} to pay off their debt smoothly over their lifetime. The only way to overturn this result would be if workers are sufficiently impatient, with $\beta R < 1$, or if the age-earnings profile is sufficiently steep. We plan to verify below that in our calibrated model borrowing constraints would not bind.

4 Calibration

We calibrate our model in two main steps. First, we specify functional forms. Second, we calibrate the model to replicate key relationships in the 1979 cohort.

4.1 Functional Forms

We need to specify four sets of functional forms: one for preferences; one for endowments; one for college graduation probabilities; and one for wages. We discuss each in turn.

For preferences we use CRRA utility functions:

$$u_p(c_p) = \omega_p \left[\frac{c_p^{1-\varphi_p}}{1-\varphi_p} - 1 \right] \tag{7}$$

$$u(c,l) = \left[\frac{c^{1-\varphi_c}}{1-\varphi_c} - 1 \right] + \omega_l \frac{(1-l)^{1-\varphi_l}}{1-\varphi_l} \tag{8}$$

$$u_w(c) = \omega_w \frac{c^{1-\varphi_c}}{1-\varphi_c}, \tag{9}$$

where ω represent the relevant weights and φ the relevant elasticities. The weight on consumption in the college period has been normalized to unity.

College students have consumption and leisure shocks $\bar{c}(m)$ and $\bar{l}(m)$. We parameterize these as being proportional to m and uniformly distributed over the intervals $[0, \bar{c}_{max}]$ and $[0, \bar{l}_{max}]$. As noted above, the preference for college and work shocks η_c and η_w are drawn independently from type-I extreme value distributions. Then the remaining endowment and preference parameters are given by $(y_p, x, m, \tau, \omega_p)$. We assume that $(\log(y_p), m, \tau, \omega_p)$ are jointly normally distributed. The marginal distribution of the ability signal can be normalized to be $\mathbb{N}(0,1)$. Then we calibrate the marginal distribution of the remaining variables, governed by $(\mu_y, \sigma_y, \mu_\tau, \sigma_\tau, \mu_p, \sigma_p)$ and the vector of correlation coefficients. Finally, we assume that the signal is noisy but unbiased, with a correlation given by $\alpha_{x,m}$. When mapping the model to the data, we use test scores as our proxy for the student's signal and assume that these are a noisy but unbiased subset of their true signal, with the standard deviation of test scores around the signal given by σ_{IQ}.

We assume that the probability of graduating college given ability is given by a logistic

formula,

$$\pi(z) = \pi_0 + \frac{\pi_1 - \pi_0}{1 + \pi_a \exp(-\pi_b z)} \tag{10}$$

where π_0, π_1, π_a, and π_b govern the shape of the distribution. π_0 is the baseline probability of passing college for any student, and π_1 is the maximum probability of passing college for a hypothetical student with infinite ability. π_a and π_b govern the curvature of the graduation probability with respect to ability x for intermediate cases.

Finally, the earnings process is given by $Y(s, x) = \phi_s x + \hat{e}(s)$. This allows ability and education to both affect wages. The parameter ϕ_s captures the return to ability, which can vary with education.

4.2 Cross-Sectional Calibration

We now turn to the calibration of the model. We fix some parameters exogenously. These parameters are given in Table 1. We assume that high school graduates, college dropouts, and college graduates start work at ages 18, 20, and 22, and that everyone retires at age 66. We fix the endowment of log-parental income at levels consistent with the NLSY79. We fix some parameter preferences at standard values and set the magnitude of preference shocks to a small level of $\gamma = 0.1$. Finally, we take the log-wage returns to ability from Hendricks and Schoellman (2014) and set the gross interest rate to 1.04.

The remainder of our parameters are calibrated to targets representing the high school graduating class of 1979. Most of our targets consist of a rich set of moments on college attendance, college graduation, and college financing from the NLSY79. We cut the sample to include only high school graduates, consistent with the model, and then form students into quartiles based on socioeconomic status and AFQT test score. As discussed above, we treat AFQT as a noisy proxy for the student's signal. We calibrate the noise of this proxy σ_{IQ} as part of the calibration procedure. We then take as moments the full matrix of college entry and college graduation rates by the 4×4 matrix of $[SES, AFQT]$, as well as the vectors of parental income; hours worked by the student in college; earnings by the student in college; fraction of students with debt at the end of college; tuition and fees paid while in college; and mean debt at the end of college by SES and AFQT quartiles. We also collect some targets from High School & Beyond, which collected better information on parental transfers and direct college costs (tuition, fees, and cost of books net of scholarships and grants) for a very similar cohort. Once again we restrict the sample to high school

Table 1: Fixed Parameters

Parameter	Description	Value
Demographics		
A	Retirement Age	66
A_s	Age at Entry	18, 20, 22
Endowments		
μ_y, σ_y	Distribution of $\log(y_p)$	$4.34, 0.65$
Preferences		
β	Discount factor	0.98
φ_c	Curvature on consumption	2.00
ω_c	Weight on consumption	1.00
φ_l	Curvature on leisure	2.00
γ	Magnitude of preference shocks	0.10
Other		
ϕ_{HSG}, ϕ_{CG}	Returns to ability	$0.155, 0.194$
R	Interest rate	1.04

graduates, form quartiles, and compute parental transfers and tuition payments by SES and AFQT quartile. We construct total parental transfer as the sum of annual transfers while the student is in college, consistent with the model. Details of the construction of these moments is available in Appendix A.

Finally, we need data on labor earnings to discipline $Y(s, x)$. Note that $Y(s, x)$ is the present discounted value of lifetime earnings by education and ability, which is related to but distinct from the usual college wage premium. To construct this we need long series of annual labor earnings by education, which we get from the Current Population Survey. We still have to extrapolate earnings somewhat for the early years of older cohorts, since the CPS data become available only in 1965. We then construct the present discounted value of lifetime earnings for each education level by aggregating earnings using the model-implied discount rate. Details are available in Appendix B.

We have a total of 91 moments to discipline 22 model parameters. Since our model is overidentified, we select all the parameters jointly to minimize a weighted loss function. Table 2 give most of the resulting parameters. The parameters that matter the most for our results are the dispersion of tuition costs (which is wide); the dispersion of parental altruism (which is narrow); and the substitution between parental and child utility (which is strong).

Two sets of parameters remain. $(\pi_0, \pi_1, \pi_a, \pi_b)$ govern the shape of the graduation proba-

Table 2: Calibrated Parameters

Parameter	Description	Value
Endowments		
μ_τ, σ_τ	Marginal distribution of τ	$3.9, 3.0$
σ_{IQ}	IQ noise	0.32
Preferences		
ω_l	Weight on leisure	0.23
ω_w	Weight on u(c) at work	8.60
φ_p	Curvature of parental utility	0.54
μ_p	Weight on parental utility	0.44
σ_p	Std of weight on parental utility	0.14
$\bar{\eta}$	Preference for HS	-0.10
$\bar{c}_{max}$	Max free consumption	0.9
$\bar{l}_{max}$	Max free leisure	0.10
Other		
$\bar{Y}_s$	Log skill prices	6.48, 6.52, 6.72
w_c	College wage	24.4

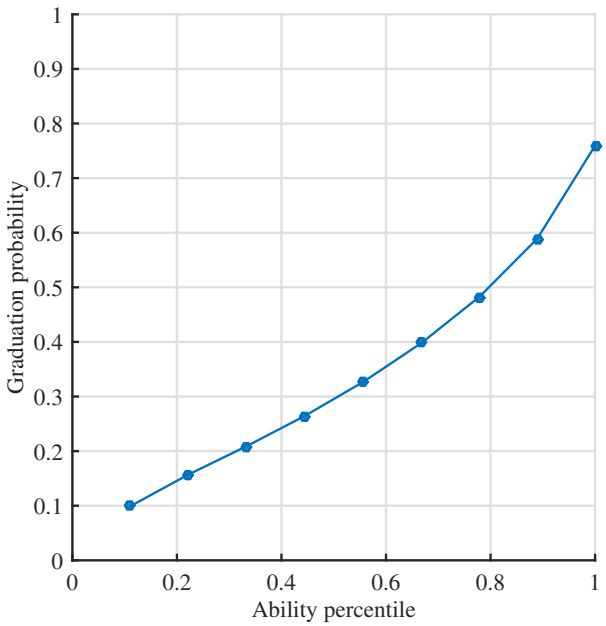


Figure 6: Probability of Graduating College by Ability Percentile

Table 3: Endowment Correlations

	x	m	IQ	ω_p	$\ln(y_p)$
x	1.00	0.90	0.85	0.23	0.72
m		1.00	0.95	0.27	0.79
IQ			1.00	0.25	0.76
ω_p				1.00	-0.21
$\ln(y_p)$					1.00

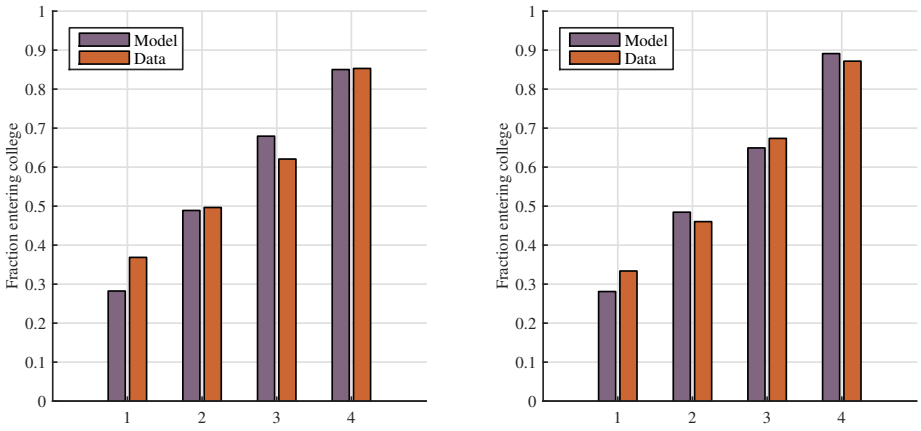
bility function. Rather than show them separately, Figure 6 plots the actual function. The function implies that probability of graduation is nearly linear in ability, rising from ten percent for the lowest ability students to seventy percent for the highest. Finally, Table 3 shows the correlations of endowments and ability signals implied by the model calibration. We find strong correlation between ability, the ability signal of students, measurable proxies to researchers, and family income. Only parental altruism is weakly correlated with the remaining endowment terms.

4.3 Model Fit

We verify the model's ability to fit the key patterns in the data before using it to explore the historical changes in college attendance patterns. Since our model is overidentified, we do not fit all targets exactly. Nonetheless, we generally do a good job of fitting both the levels and the broad trends across both socioeconomic status and test score quartiles.

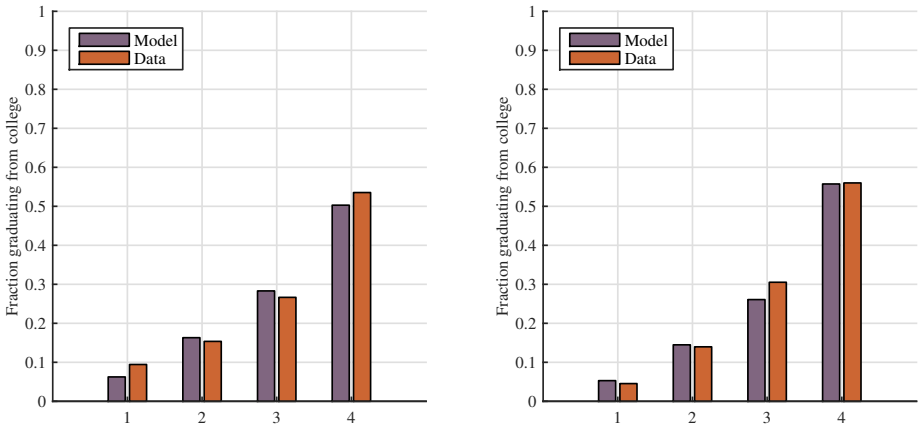
Figure 7 shows the model fit for college attendance patterns. We use the same format for all subsequent graphs, so we explain at some length. Panel (a) shows the variation by family background quartile, while panel (b) shows the variation by academic ability quartile. Within each panel the bars show college attendance. Purple bars show the model, while red show the data. Thus, overall we get the level of college attendance right, and we also capture the broad idea that attendance decisions vary more across test score quartiles than across family income quartiles. Figure 8 shows the patterns for college graduation. The model fits well, and does a particularly good job of capturing the fact that graduation is even more sharply rising in ability than attendance.

We also want the model to be consistent with how students actually finance college. There are three mechanisms to finance college in the model: parental transfers; student work; and borrowing. Figure 9 shows the patterns for hours worked, which vary surprisingly little



(a) Family Background (b) Academic Ability

Figure 7: Model Fit: College Attendance Patterns

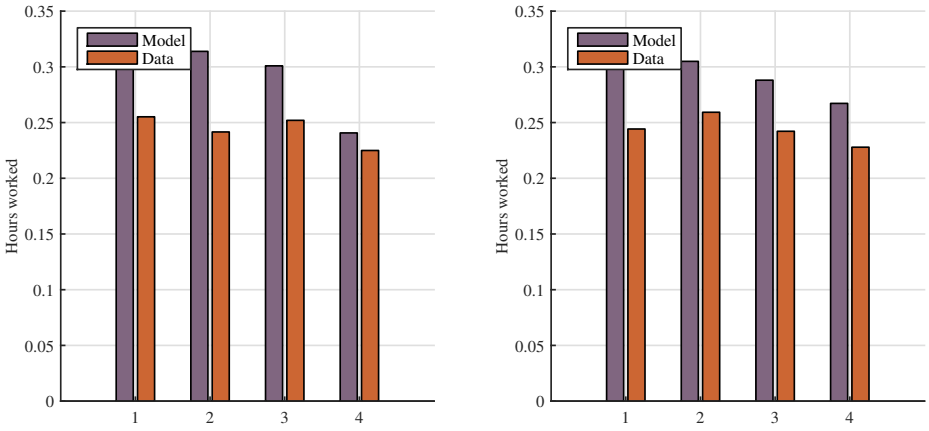


(a) Family Background (b) Academic Ability

Figure 8: Model Fit: College Graduation Patterns

with either income or test score. Again, the model delivers both. The consumption and leisure shifters $\bar{c}(m)$ and $\bar{l}(m)$ are important for generating these facts. In the absence of these terms, it is extremely difficult for the model to explain why hours worked in college vary so little across groups.

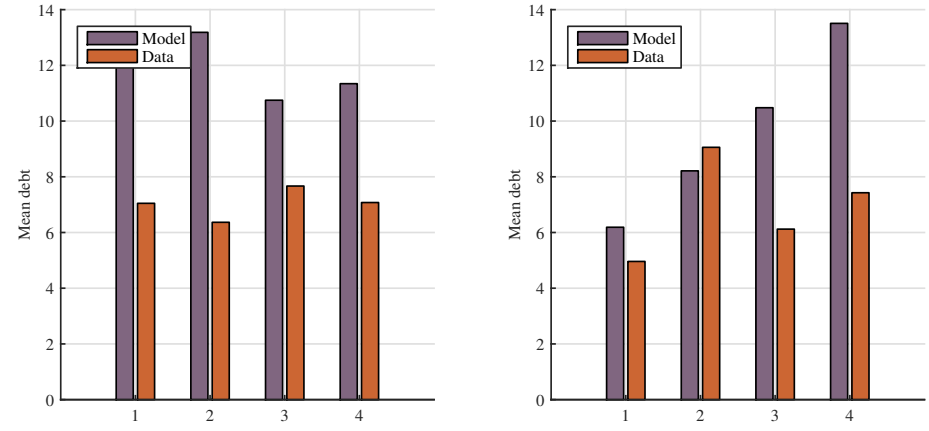
Finally, Figure 10 shows the patterns for mean debt at college exit (graduation or dropout). The model over-predicts the uptake of debt and the mean debt at the end of college. Given that the model currently over-emphasizes debt for recent cohorts, our results below on



(a) Family Background (b) Academic Ability

Figure 9: Model Fit: Hours Worked In College Patterns

the relatively low importance of the introduction of borrowing programs are even more surprising. We now turn to these results.



(a) Family Background (b) Academic Ability

Figure 10: Model Fit: College Debt Patterns

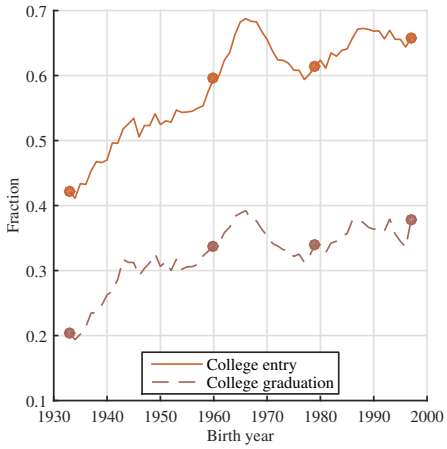


Figure 11: College Attendance and Graduation

5 Time Series Results

Now we investigate what driving forces can account for the changing patterns of college attendance over the twentieth century as shown in Figures 2 and 3. We focus on two studies that provide detailed data on earlier cohorts, Updegraff (1936) (the 1933 cohort) and Flanagan et al. (1971) (the 1960 cohort). Before turning to this analysis, we provide some context on the main trends in college attendance and financing over this period. First, it is important to remember that college attendance and graduation increased substantially over time. Figure 11 shows the patterns, with the four markers denoting the four main studies: Updegraff, Project Talent, the NLSY79, and the NLSY97. While only 40 percent of students attended college and 20 percent graduated in 1933, today the figures are roughly 65 and 35 percent, nearly twice as large.

There were also substantial trends in the broader financial environment for college attendance over this period. We have summarized three of the most important ones in Figure 12: the lifetime earnings premium of going to college, the tuition cost of paying for college, and the amount students can borrow to finance college. Figure 12a shows that the college premium fluctuated until roughly 1970, then rose substantially afterwards. This figure differs from the usual college wage premium figure because it shows the premium for the present discounted value of future earnings against high school graduation year. Figure 12b gives the tuition cost of college, measured in real 2010 dollars. This cost is measured as total tuition receipts of all colleges divided by number of students, taken from Donovan and Herrington (2014). This measure more accurately reflects what students pay than those

Table 4: Summary: Sorting and Financial Conditions for Select Studies

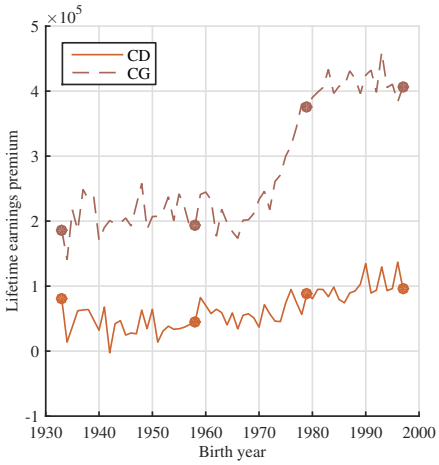
Study	Updegraff (1936)	Flanagan et al. (1971)	NLSY79
Cohort	1933	1960	1979
Panel A: Attendance and Sorting			
College entry rate	0.39	0.53	0.58
β_{IQ}	0.22	0.70	0.58
β_F	0.68	0.48	0.42
Panel B: Financial Conditions			
College premium	0.36	0.35	0.56
Borrowing limit	0	0	22,596
College cost	2,154	2,038	2,731

that draw on published or reported tuition prices. The cost has risen nearly uniformly from about $2,000 in 1933 to nearly $5,500 today. Finally, Figure 12c gives the statutory borrowing limits set by the federal government.[5] Federal loans were introduced in 1965. Their generosity has tended to be eroded by inflation until the limit is expanded by law, with the most notable jump in 1982. Before 1965, there were some limited private loan programs or government programs restricted to small groups. Our evidence for the period suggests that these programs played a very limited role in financing college; for a typical cohort, loans were used to finance a few percent of total college expenses. Once again, each of the main study dates is marked in these figures, for reference.

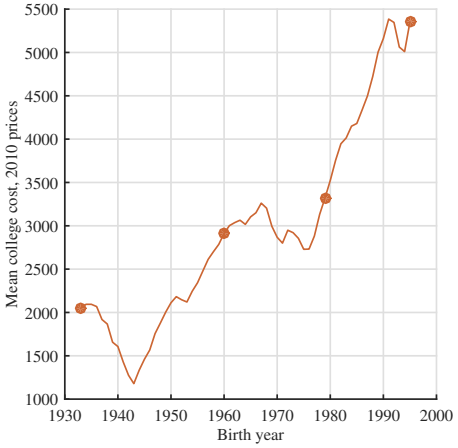
In order to feed these trends into our model we need to account for inflation and growth in incomes. To do so, we detrend all figures by nominal GDP per worker from NIPA.[6] Table 4 summarizes the main information for the three cohorts of interest. The main point we want to make with this table is that there is a mismatch in timing between when the college attendance and sorting patterns changed versus when college financial conditions changed. The attendance and sorting changes were largely complete by 1960, if not a few years earlier; the rise in the college earnings premium, the rise in college tuition, and the introduction of federal loan programs were all between 1960 and 1979. Thus, although the financial variables are obvious candidate explanations for these patterns, the model will have a hard time with the disparity in timing. We formalize this problem in the next subsection.

[5] Computed as the sum of subsidized and unsubsidized loans, from finaid.org.

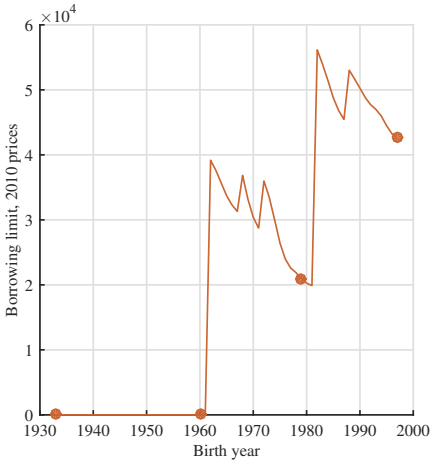
[6] We would prefer to measure directly family income or annual wage income, but are not aware of any annual series for these figures.



(a) Lifetime Earnings Premium



(b) Tuition Cost



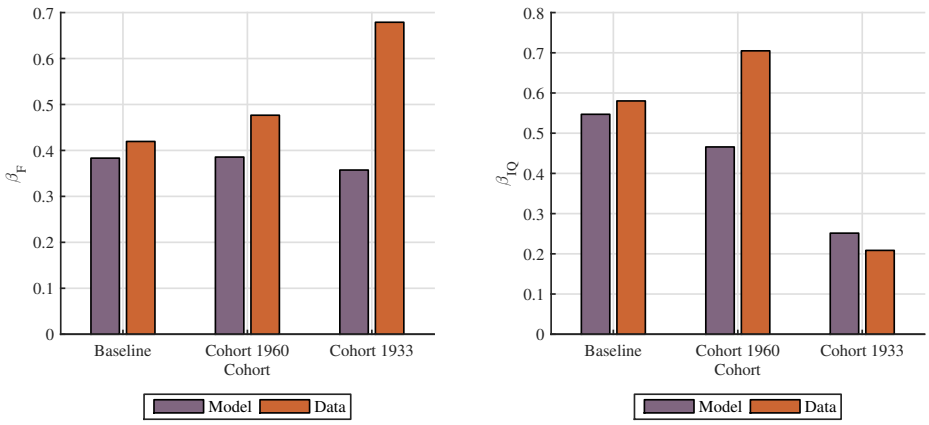
(c) Statutory Borrowing Limits

Figure 12: Trends in College Financing

5.1 Financial Environment

Our first counterfactual experiments demonstrate how far one can go with the changing financial environment towards generating these sorting patterns. We conduct two experiments, designed to replicate the 1933 and then the 1960 cohorts. We hold most parameters fixed as in the baseline model. We feed in the borrowing limit $\underline{k}$ and the mean college cost μ_τ exogenously, holding the coefficient of variation σ_τ/μ_τ fixed. We recalibrate $\hat{e}(s)$ to fit the (lower) college earnings premium for these earlier cohorts. We recalibrate $\bar{\eta}$, the cohort-specific preference for working as a high school graduate, to fit the overall college

attendance and graduation rates. Changes in earnings and borrowing limits change how students finance college. We know from several sources how college was financed before the federal loan programs (Hollis, 1957; Lansing et al., 1960; Iffert and Clarke, 1965). Roughly two-third of expenses were paid by parents; another 20–25 percent by the students; and the last ten percent came from a myriad of minor sources. We recalibrate μ_p to target the share paid by families versus students. We assume that this share was the same for both the 1933 and 1960 cohorts, although our estimates actually draw on the period 1945–1965.



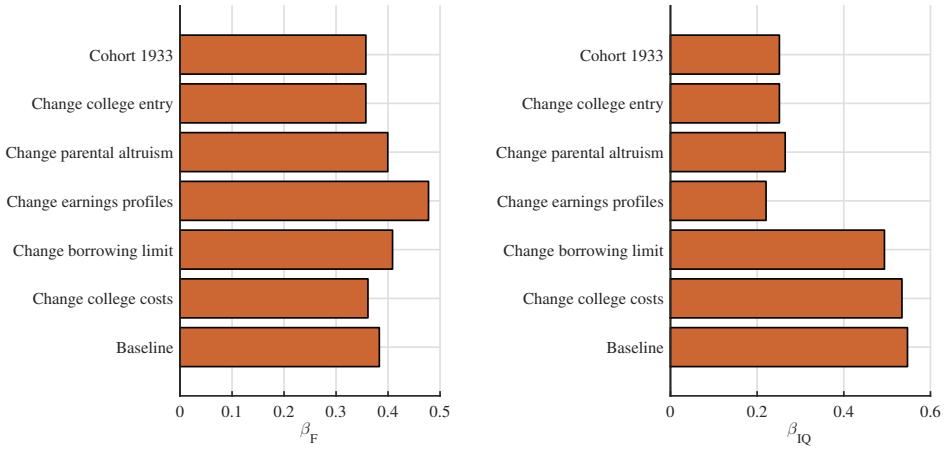
(a) Family Background (b) Academic Ability

Figure 13: Model Predictions: Changes in Sorting

Figure 13 shows the main results. It shows the changes in sorting as summarized by a simple regression of college attendance on family background and test score percentiles, as in Section 2. The model fits the data patterns closely for the baseline (1979) cohort. Our main question of interest is what level of sorting it predicts for the earlier cohorts. The figure shows that the model does predict lower levels of sorting by academic ability for earlier cohorts, generating approximately 75 percent of the total change, although the timing is somewhat off. The model generates none of the change in sorting by family background.

This experiment changes many factors simultaneously. We find it useful to decompose the total change to identify which driving forces are relatively more important. Here, we focus on the 1933 cohort. To conduct this exercise, we start with the baseline calibration of the 1979 cohort. We then feed in the alternative, 1933 calibrated parameters one at a time, measuring the cumulative impact. To make the results easier to interpret, we recalibrate $\bar{\eta}$

at each step to fit the total 1979 college attendance.



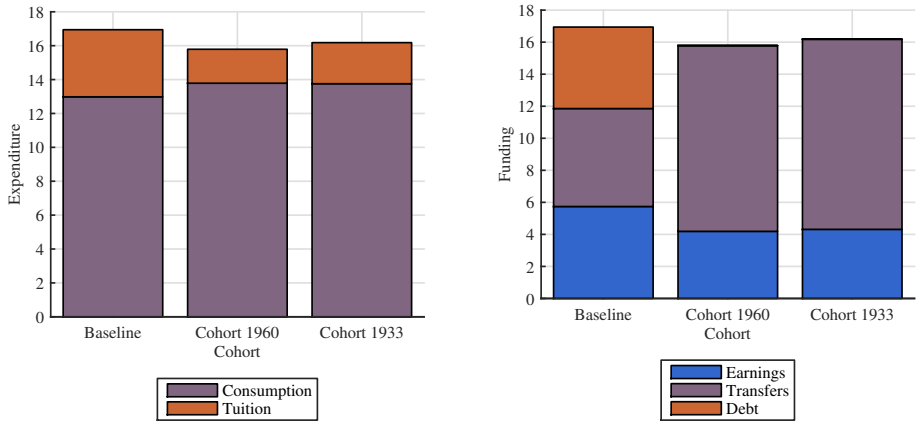
(a) Family Background (b) Academic Ability

Figure 14: Model Predictions: Changes in Sorting

Figure 14 shows the results. It should be read from bottom to top, cumulatively. Starting from the baseline calibration, changing college costs does almost nothing in the model. Eliminating borrowing has a modest effect, mostly on the sorting by family background. The biggest factor is changing the lifetime earnings gain to college. Changing parental altruism again has a minimal effect in the wrong direction. Finally, we recalibrate $\bar{\eta}$ to fit the attendance of the 1933 rather than the 1979 cohort, which has only a modest effect.

Thus the bulk of our results comes from the rising lifetime earnings gain to college. The intuition for this result is as follows. The earnings premium is large for recent cohorts, which generates a strong incentive for students to graduate college. The probabilty of graduating is strongly increasing in ability, so this selects strongly on ability signals and ability. However, as we project the model back to the 1933 cohort, the college earnings premium declines, weakening this margin. Other factors become relatively more important for college attendance. The main such factors in our model are preferences. Hence, college attendance in 1933 is mainly a function of having a taste for college.

One final question raised by the decomposition is: why do borrowing constraints matter so little? Students in the 1979 cohort are financing around a third of college through debt; it would seem that the absence of this mechanism for earlier cohorts should have more important effects. Figure 15 shows the model-implied patterns of expenditure and sources of income by cohort. Recall that we target the share paid by parents and children in earlier



(a) Spending (b) Sources of Income

Figure 15: Model Predictions: Changes in Financing and Spending

cohorts, so the large increase in the role of parental expenditures is generated by construction to fit the data. What is more surprising is that this the only margin of adjustment. Expenditures do not fall at all, even though much of expenditure is discretionary, e.g., not needed to fund direct purchases such as tuition, books, and fees. It seems that given the preference parameters we calibrate altruism is strong and parental transfers make up the entire adjustment.

One possibility would be to introduce into the model mechanisms that make parental transfers less elastic. We emphasize that while this could help fit the overall patterns between the beginning and the end of the period, it is unlikely to fit the timing of when sorting changed. Since federal loan programs were introduced only in 1965, any model change to discourage transfers in the face of lower debt limits would affect both of the earlier cohorts and introduce counterfactual changes in sorting by the 1960 cohort. This leads us to search for alternative mechanisms that might do a better job of fitting both the trends and the timing.

5.2 Other Driving Forces

Work in progress.

6 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 historical studies conducted before 1960 and add our own calculations using microdata from 1960 onward. Our main finding is that family income or socioeconomic status were more important predictors of who attended college before World War II, whereas academic ability was afterward.

We constructed a model of college attendance and college financing decisions for students with heterogeneous abilities and family backgrounds. We calibrated this model to rich data from the NLSY79 and HS&B. We then explored what driving forces could explain the timing and magnitude of changes in college attendance patterns.

Our first experiment focused on changes in college financing. We showed that the rising college earnings premium has a substantial impact. It can generate three-fourths of the rise in the importance of ability, but very little of the decline in the importance in family background. On the other hand, the changes in the tuition cost of college or borrowing limits have very minor effects on either pattern.

The main remaining question is what other driving forces can explain why the importance of family background has declined around the period of World War II. We hope to explore this in future iterations of this paper.

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A NLSY79 and HS&B Data

This appendix describes the procedures for constructing target data moments in the NLSY79. Beginning with the full sample of NLSY79 survey respondents, we first dropp those without a recorded birth year or AFQT score. We compute a socioeconomic status (SES) index taken as the first principal component from mothers and fathers education (highest grade completed), fathers occupation, and family income when the child was 18.[7] We dropp individuals for whom we do not have an SES index.

We then classify respondents as high school graduates if, by the survey following their 30th birthday, they reported that their highest grade completed was at least 12. We keep only high school graduates, and divide this population into quartiles by SES index and AFQT score. We classify respondents as college attendees if, by the survey following their 30th birthday, they had either: (i) reported that they were enrolled full-time as a college student; or (ii) reported their highest grade completed greater than 12. We classify respondents as college graduates if, by the survey following their 30th birthday, they reported that their highest degree completed was at least a 4-year college degree. We then calculate the share attending and graduating college by SES and AFQT quartiles separately and jointly.

Survey respondents report whether or not they took out any educational loans in each year, as well as the amount. Starting with the 1984 survey, students report on these questions separately for (up to) the last three institutions attended. For college graduates we classify them as having received educational loans if they report any loans up to and including the year they received their highest degree. For college dropouts we classify them as having received educational loans if they report any loans up to and including the survey following their 30th birthday. We then calculate the share of college attendees, dropouts, and graduates who received any educational loans by SES and AFQT quartiles separately and jointly. To compute the amount of educational loans, we add up the reported loans for all institutions (up to 3) in the last year the student reported loans. For graduates, this can be any year up to and including the year they received their highest degree, and for dropouts this can be any year up to and including the survey following their 30th birthday. Loan amounts are inflation adjusted using the CPI, and then we compute the average loan amount (conditional on having positive loans) by SES and AFQT quartiles separately and jointly.

[7] In some cases income is available at nearby ages but not age 18. In these cases we regress income on age, adjust the fitted income to age-18 equivalent, and use this instead.

During each survey year we can observe annual earnings and annual hours worked for the previous calendar year. We classify these earnings and hours as having occurred during college if the individual reports having been a full-time student during the previous calendar year. Earnings are adjusted for inflation using the CPI, and top coded values are replaced by 1.5 times the max value. Average earnings and average hours worked are computed by SES and AFQT quartiles separately and jointly for all college students and those in the first two years of college (i.e., highest grade completed less than 15 years).

B Current Population Survey Data

B.1 Sample

We use data from the March Current Population Survey from King et al. (2010) to construct median lifetime earnings by cohort and school level. Variable names below use the IPUMS naming conventions.

B.2 Sample Selection

Our sample contains men between the ages of 16 and 75 observed in the 1964–2010 waves of the CPS. We drop persons who live in group quarters. We also focus on the typical sample used for wage analyses: those who work for wages and report wage income, work at least thirty hours a week for at least thirty weeks a year, have valid information on schooling and positive weights (WTSUPP). This last restriction implicitly excludes the armed forces and the Hispanic oversample. We also drop outliers based on weekly wage (INCWAGE/WKSWORK2), where we consider workers to be outliers if their weekly wage is below 0.05 or above 100.0 times the median wage.

B.3 Education

Schooling is inconsistently coded across surveys. Prior to 1992, we have information about completed years of schooling (variable higrade). During this period, we define high school graduates as those completing 12 years of schooling (higrade=150), college dropouts as those with less than four years of college (151,...,181), and college graduates as those with 16+ years of schooling (190 and above). Beginning in 1992, the CPS reports education

according to the highest degree attained (educ99). For this period, we define high school graduates as those with a high school diploma or GED (educ99=10), college dropouts as those with "some college no degree," "associate degree/occupational program," "associate degree/academic program" (11,12,13,14). College graduates are those with a bachelors, masters, professional, or doctorate degree (15,16,17,18).

B.4 Earnings

We construct earnings as wage and salary income (INCWAGE) deflated by the Consumer Price Index. Top coded observations of INCWAGE are multiplied by 1.5. We then construct annual earnings for each cohort and education group as the median value when observed. For cases where it is not observed we impute earnings using the predicted age-earnings profile obtained by regressing log median earnings on age and year dummies (pooling all cohorts, but separately for each school group). We then adjust the mean of the profile to match the actual cohort mean for the first five years for which we have the actual data.

B.5 Lifetime Earnings

Lifetime earnings is constructed as the present value of earnings from the start of work up to age 66. We assume that work starts at ages 18, 20, or 22 for high school graduates, college dropouts, and college graduates. We discount future earnings used the model-implied interest rate. Lifetime earnings by education group are the input to the model.

C Online Appendix: Studies on College Attendance Patterns

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 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 of this paper rely on the results of the original studies as they were reported in published journal articles, books, technical reports, and dissertations.

The original underlying studies were conducted by researchers in a variety of fields, including psychology, economics, and education. The typical study had a limited geographic scope and covered a single cohort or a narrow range of cohorts. The most common design was a study that collected information on high school seniors in a single state about their background and their college-going intentions. The goal of this appendix is threefold. First, it contains the basic details of the underlying studies, which we refer to as the metadata: the geographic scope, cohorts covered, how the data were collected, the underlying variables used, and so on. Second, it discusses how we used the NLSY data to help harmonize the results of these various studies. Third, it discusses the robustness of our results to various alternative assumptions. We describe the general pattern of results and how we replicate them before turning to a discussion of the details of the original studies.

C.1 College Attendance, Academic Ability, and Family Background

The main source of data is historical sources that cross-tabulated college attendance with measures of academic ability, family background, or both. In discussing these sources, it is useful to separate them into two broad time periods. For students who graduated high school before 1960, the record is much more fragmentary. Most of our studies describe selected samples of students in a particular city or state; the sample was sometimes but not always representative of the area. Hence, we have collected any such study that covers this early period, and rely on the preponderance of evidence from 34 such studies to substantiate our claim. For students who graduated high school during or after 1960, the record is much more complete. There exist numerous studies of large, nationally representative samples of students. Further, the original microdata often exist for these such studies. Hence, for the post-1960 era we focus on large, representative samples, eschewing the task of collecting all such samples.

The underlying studies for the early samples differ along several key dimensions. First, they were conducted by different researchers in different geographic regions of the country, using different sample selection criteria, and so on. Second, the studies differed in how they collected information on each of the key variables. For academic ability studies used either class rank or test score on a standardized test, with varying tests over the years. For family background studies used family income or socioeconomic status, calculated different ways. Finally, to find college-going behavior studies either asked high school seniors about their

plans to attend college (typically in the spring), or they followed up with students, their family, or their high schools in order to ascertain the actual behavior of students. In Table C1, we overview the most important metadata from each of these studies. For each line we describe the details of a single study: the citation; the location (city, state, or nationwide); the breadth (a selected sample, a large sample of most of the state, a citywide or statewide sample of all persons); the high school graduating cohort; the way college was measured (prospectively, before graduation, or follow-up); the measure of background and academic ability; and the number of bins used to describe the data.

The raw results reported in these studies are consistent with the claims made in the paper about the changing relative importance of academic ability and family background. However, it is natural to be concerned about the comparability of the results reported in different studies. The approach we adopt here is to utilize the NLSY to act as a "bridge" to improve the comparability of the studies. The idea is that the NLSY79 and the NLSY97 provide detailed microdata on family income, socioeconomic status, test score, high school performance, and college-going. Hence, it is possible to re-create the exact tabulations published in earlier papers using the NLSY data. Our reported results compare the importance of academic background and family income for explaining college attendance, *relative* to what the researcher would have found if he or she implemented the same design for the modern cohorts in the NLSY.

To conduct these replication we focus on two key dimensions.[8] First, we measure family background and academic ability as in the original studies. For family background, we differentiate between income reported by parents, income reported by studies, and socioeconomic status (generated using a principal component analysis on father's occupation, parental education, and family income, similar to many of the original studies). For academic ability, we differentiate between test score and class rank. Second, we group the data in bins designed to deliver the same marginal distributions as in the original study, and then measure college attendance as a function of these bins. We compare the results from these replications to those from the original studies to help us understand whether the importance of academic ability and college attendance have changed over time.

An example may help. Goetsch (1940) reports college-going as a function of family income for students who score on the top fifteen percent of a standardized test. She provides tabulations for eight family income categories, containing 24, 8, 16, 22, 20, 7, and 3 percent

[8] 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.

of the relevant population. Within the NLSY, we restrict our attention who scored in the top fifteen percent on a standardized test, namely the AFQT. We then sort the remaining children on family income as reported by parents, then form them into bins that contain the same 24, 8, 16, ... percent of the income distribution.

The result is raw data $C(A, F)$ on college-going as a function of academic ability and family background, and simulated functions $\hat{C}(A, F)$ from the NLSY. We compare these two functions to understand the relative importance of family income F on college attendance C and $\hat{C}$ and how this has changed between 1937 and 1979. In the next subsection we give the details of all the studies in further detail.

C.2 Other Robustness Checks

(a) Family Background (b) Academic Ability

Figure C1: Counterfactual Changes in Patterns of College Attendance: Bivariate Studies

C.3 Underlying Studies

This section gives further details on the sampling and variables of the studies used in the paper. The tables at the end summarize the basic details of the studies in a single location.

C.3.1 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. Unfortunately the reported findings do not contain a cross-tabulation of college-going by income and test score jointly.

C.3.2 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). He also provides figures on college progress for all students who enrolled in Kansas colleges or universities, which includes more than half of those who enrolled in any college. Figures on college progress require some modest projection as to whether students still enrolled in college will graduate or not.

C.3.3 Mann (1924)

Book (1922) studied results from nearly 900 high school seniors 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.

C.3.4 Colvin and MacPhail (1924)

Colvin and MacPhail (1924) arranged for more than 3,000 students representing a random sample of high school seniors of Massachusetts to fill out a short questionnaire and complete an aptitude test, the Brown University psychological examination. 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 presentation of the results are closely

modeled after those of Book (1922) and like that study do not include a cross-tabulation of college-going by income and test score jointly.

C.3.5 Odell (1927)

Book (1922) arranged for more than 12,000 high school seniors representing more than half of the high schools of the state of Illinois to fill out a short questionnaire and complete an aptitude test, the Otis Test of Mental Ability. 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 at which they would 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 enter college by test score grouping and by self-reported average grades; similar results obtain if we use instead the number planning to enter college.

C.3.6 Ames (1926)

Ames (1926) arranged for 1,400 Montana high school seniors (just less than half the state total) to fill out a questionnaire and complete an aptitude test, the Otis Test of Mental Ability. 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.

C.3.7 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 probability of high school graduates attending college and probability of college entrants graduating as a function of test score.

C.3.8 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 the subsequent fall, which is the basis for the figures used here.

C.3.9 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 was 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 were taken from school records and to 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.

C.3.10 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. Barker (1937) conducted a follow-up with the school administrators of most of the schools to determine whether or not the students had enrolled in college within two years.

C.3.11 Gardner et al. (1942)

Gardner et al. (1942) collected data on the college attendance of 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)).[9] The authors collected data on students' graduation from high school and college-going 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 together their "upper-upper" and "lower-upper" because the former is too small to be useful for analysis (3 persons).

C.3.12 Livesay (1942)

Livesay (1942) arranged for more than 2,000 high school seniors in the state of Hawaii 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 the subsequent year to find out whether the student enrolled in college as planned.

C.3.13 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 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.

C.3.14 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 ten 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 address. Students whose college enrollment was unknown to the principal were excluded from the analysis. The names and addresses

[9] 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).

were used to link parents to New York state tax records and thereby to determine family income.[10]

C.3.15 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).[11] The author collected students' plans for attending college for all high school students. He organized the student's 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.

C.3.16 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.

C.3.17 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 were asked for basic information about the previous year's graduates, including demographic information, rank in class, and current activity. Responses for 83 percent of 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 it know the current status of all their graduates.

[10] Sibley (1948) does not report directly the number of cases in each of the relevant bins. We use the 1944–45 edition of the U.S. Census Bureau (various years), 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 US 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.

[11] 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 1945 class graduated towards 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.

C.3.18 Phearman (1948)

Phearman (1948) utilized test score data from Iowa high schools that administered the Iowa Tests of Educational Development to senior 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, and their address. 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 the students replied to the questionnaires.

C.3.19 Roper (1949)

Roper (1949) arranged for interviews of a nationally representative sample of 10,000 high school seniors. 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 been applied but not (yet) 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.

C.3.20 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 administration of the American Psychological Examination, which furnished test scores for most of these seniors.

C.3.21 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 Examination. The questionnaire 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. 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 from the follow-up. We use both sources of data.

C.3.22 White (1952)

White (1952) selected a sample of 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.

C.3.23 Wiegman and Jacobsen (1955)

Wiegman and Jacobson (1955) arranged or a sample of more than 1,000 high school seniors in 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.

C.3.24 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 re-surveyed in the fall to determine whether or not they had enrolled in college. The student's class rank and standardized test score (on an unspecified IQ test) were collected from administrative records at the school. Finally, the researchers collected family income from the New York Department of Taxation and Finance for 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 in roughly the top thirty percent of the test score distribution. We repeat this procedure in the NLSY by first selecting only the top-scoring students on the AFQT, then classifying the remaining sample based on family income and studying college-going as in the original study.

C.3.25 Jones (1956)

Jones (1956) used data from Arkansas' statewide testing program, which administered the American Council Examination to more than 98 percent of the Arkansas high schools. The author questioned principals about whether the graduating seniors had enrolled in college the subsequent fall. Notably, this is the first study in a Southern state to present results separately for black and white students.

C.3.26 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.

C.3.27 Educational Testing Service (1957)

Educational Testing Service (1957) describes 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, then filled out a questionnaire about their plans for college and 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.

C.3.28 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.

C.3.29 Little (1958)

Little (1958) arranged for 36,000 high school seniors representing almost 95 percent of 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 this subsample the next fall to find out if students had followed up on their plans. About one-half of 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 the university, 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.

C.3.30 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 seven years later using both mail and phone. 87.2 percent of parents of the subsample replied. The main new measure of interest is a complete record of graduation. Sewell and Shah (1967) also 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 (see above).

C.3.31 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 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 versus 1,300 black, with 3,000 white students continuing to college versus 300 black. All other tabulations are for the two groups combined.

C.3.32 Montana (1960)

Montana State Department of Public Instruction (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 re-enrollment of students at the start of the second year.

C.3.33 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. 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.

C.3.34 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 score 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 ninety 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 questionnaire in 1963. More than half of the original sample responded to this questionnaire, which was 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.

C.3.35 Flanagan et al. (1971)

Flanagan et al. (1971) 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. The Project Talent team created an index of socioeconomic status 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 results here come from a five-year follow-up study that tracks actual college student enrollment. Project Talent generally had high response rates and used weights to help reduce any bias from nonresponse.

C.3.36 Berdie and Hood (1963)

Berdie and Hood (1963) arranged for a second study 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. Unlike the prior study, this one had no follow-up. Usable information on family income was not provided.

C.3.37 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. 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.

C.3.38 Eckland and Henderson (1981)

Eckland and Henderson (1981) analyses 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, fathers 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 these results out by race at several points. We also use information on the college progress of those who entered in the fall of 1972; results are given for those who have graduated (in four years); those still and continuously enrolled (but have no degree yet); and those who dropped out at various points. The authors note that roughly one-third of students who drop out re-enroll at some point. Re-enrollment is positively correlated with academic aptitude.

C.3.39 Gardner (1987)

Gardner (1987) analyses the High School & Beyond Survey, a nationally representative sample of 28,000 high school seniors from the spring of 1980. Seniors were administered a battery of test, which was 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. 11,500 seniors were randomly chosen for Follow-up two years later, at which time data on school enrollment was 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 C1: Basic Sample Details

No.	Source	Location	Breadth	Cohort	Type
1	Book (1922)	Indiana	Large Sample	1919	Prospective
2	OBrien (1928)	Kansas	Large Sample	1921 & 1922	Follow-up (several yrs.)
3	Mann (1924)	North Carolina	Selected	1923	Prospective
4	Colvin and MacPhail (1924)	Massachusetts	Large Sample	1923	Prospective
5	Odell (1927)	Illinois	Large Sample	1924	Follow-up (1 year)
6	Ames (1926)	Montana	Large Sample	1925	Prospective
7	Benson (1942)	Minneapolis	Large Sample	1929	Follow-up (several yrs.)
8	Henmon and Holt (1931)	Wisconsin	Statewide	1929	Follow-up (1 year)
9	Updegraff (1936)	Pennsylvania	Large Sample	1933	Follow-up (1 year)
10	Barker (1937)	Iowa	Large Sample	1934	Follow-up (several yrs.)
11	Gardner et al. (1942)	Natchez, MS	Citywide	1934	Follow-up (multiple years)
12	Livesay (1942)	Hawaii	Statewide	1936	Follow-up (1 year)
13	Goetsch (1940)	Milwaukee	Citywide	1937	Follow-up (1 year)
14	Sibley (1948)	New York	Sample	1940	Follow-up (1 year)
15	Junker (1940)	Dowagiac, MI	Citywide	1940	Prospective
16	Lansing et al. (1960)	National	Sample	1943 & 1953	Follow-up (multiple years)
17	Keller et al (1950)	Minnesota	Large Sample	1945	Follow-up (1 year)
18	Phearman (1948)	Iowa	Large Sample	1947	Follow-up (1 year)
19	Roper (1949)	National	Sample	1947	Prospective
20	Morehead (1950)	Arkansas	Large Sample	1949	Follow-up (1 year)
21	Berdie (1954)	Minnesota	Statewide	1950	Prospective & Follow-up (1 year)
22	White (1952)	Northeast Ohio	Sample	1950	Prospective & Follow-up (1 year)
23	Wiegman and Jacobson (1955)	Oregon	Sample	1950	Follow-up (1 year)
24	State University of New York (1955)	New York	Sample	1953	Prospective & Follow-up (1 year)
25	Jones (1956)	Arkansas	Statewide	1954	Follow-up (1 year)
26	Daughtry (1956)	Kansas	Statewide	1955	Follow-up (1 year)
27	Educational Testing Service (1957)	National	Sample	1955	Prospective & Follow-up (1 year)
28	Cowen (1957)	New York	Sample	1956	Prospective
29	Little (1958)	Wisconsin	Statewide	1957	Follow-up (1 year)
30	Sewell and Shah (1967)	Wisconsin	Statewide	1957	Follow-up (multiple years)
31	Stroup and Andrew (1959)	Arkansas	Large Sample	1957	Follow-up (1 year)
32	Montana (1960)	Montana	Statewide	1958	Follow-up (1 year)
33	Nam and Cowhig (1962)	National	Sample	1959	Follow-up (1 year)
34	Medsker and Trent (1965)	Midwest/California	Sample	1959	Follow-up (1 year)
35	Flanagan et al. (1971)	National	Sample	1960	Follow-up (5 year)
36	Berdie and Hood (1963)	Minnesota	Statewide	1961	Follow-up (1 year)
37	Tillery (1973)	Four States	Large Sample	1966	Follow-up (1 year)
38	Eckland and Henderson (1981)	National	Sample	1972	Follow-up (4 years)
39	Gardner (1987)	National	Sample	1980	Follow-up (1 year)

Table C2: Basic Sample Details (cont'd)

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