The Changing Role of Family Income in College Selection and Beyond

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Abstract

Previous literature has established that the role of family income has grown substantially at predicting college entry decisions when comparing the 1979 and 1997 National Longitudinal Surveys of Youth (e.g., Belley and Lochner (2007)). In this article, I further examine the changing role of family income as a determinant of college quality choice, degree attainment, and post-schooling earnings. I document that the role of family income has remained important and relatively stable at explaining college quality choice, its importance increasing only for the choice of four- over two-year colleges. In contrast, pre-college academic achievement has become much more important at predicting college quality choice, indicating a substantial strengthening of student college sorting. I also document that for a given college type, family income has remained an important predictor of graduation outcomes, its effect staying similar in magnitude. However, its role in explaining the post-schooling earnings of college graduates has dropped substantially. In contrast, the quality of the degree-granting college has become a much stronger determinant of both graduation outcomes and post-graduation earnings. I argue that all of these findings are consistent with the hypothesis of rising returns to college coupled with tighter financial constraints.

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1. INTRODUCTION

Whether or not to go to college and what type of college or university to choose are among the most important decisions that people make. These choices are influenced by students' learning ability and family income, among other factors. The term "learning ability" refers collectively to all student characteristics at the time of high school graduation that matter for both their academic success and labor market success (e.g., college preparedness, work ethic, grit, ambition).[1] Better learners tend to better enjoy their academic studies and may also prefer occupations that require a college or postgraduate degree. Also, higher-income families can better navigate the admissions system and are better suited to alleviate the financial burden associated with college, especially with more expensive, selective schools. Family background, such as parents' experience with college, may also matter for how accurately the student perceives the financial returns to different types of college.

Previous studies have examined the changing role of family income and academic achievement (a proxy for learning ability) for college entry. College admissions requirements were highly idiosyncratic in the mid-1800s. However, they slowly became more uniform and meritocratic by the mid-1900s, and general admissions

1. This ability should not be seen as merely the result of innate intelligence or academic potential. Learning ability can be shaped by many factors, including disparities in economic and educational opportunities, all of which are outside the scope of this analysis.

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standards continued to rise (Beale (1970)). The SAT debuted in 1926, and by 1960, more than three-fourths of admissions directors considered it "absolutely essential" to their admissions process (Beale (1970)).

Hendricks and Schoellman (2014) document that, compared with academic ability, parental socioeconomic status was a stronger determinant of college attendance before WWII, but its role reversed in the postwar period. While academic ability continues to be the most important determinant of college enrollment today, parental income has increased in importance in the past few decades (Belley and Lochner (2007)).

Following Belley and Lochner (2007), I employ the 1979 and 1997 National Longitudinal Survey of Youth (Bureau of Labor Statistics (2019a, 2019b)), with my focus extending beyond college entry. I ask whether or not parental income matters for the type of college students choose (among two-year community colleges, least-selective four-year colleges, selective four-year colleges, and highly selective four-year colleges), for whether or not students eventually earn a bachelor's degree, and for how much they earn in labor markets conditional on degree attainment outcomes. Precisely, I document the changing role of family income as a determinant of college quality choice, bachelor's degree attainment, and post-schooling earnings.

In my empirical analysis, I include controls for measures of learning ability at the time of high school graduation. Doing so allows me to exclude the role of income that affects academic achievement through childhood investments. This strategy also allows me to place my analysis in the context of the aforementioned literature that examines the relative roles of income and learning ability as well as work on the consequences of academic ability and college quality for various student outcomes (e.g., Light and Strayer (2000) and Dillon and Smith (2020)). In my analysis of labor market earnings of college graduates, I also include controls for the quality of the degree-granting college alongside controls for learning ability. This allows me to discuss the changing returns to college quality.

Of course, including these controls is an imperfect solution, and one needs a structural model to get at the causal influence of family income and/or college quality on student outcomes. In this article, however, my goal is to simply outline data trends with these imperfect controls in place. My results can then be used as empirical targets for calibrating models of student decision making.[2] In fact, to assist with the calibration of such models is another important goal of this article, and I provide detailed summary statistics for each cohort in Appendix 2.

To carry out my empirical analysis, I categorize each college/university in the US into four groups that vary by "quality": $q \in \{1, 2, 3, 4\}$. The lowest type (type 1) comprises community colleges offering a transferable associate degree. Four-year institutions are ranked in terms of their freshmen's average SAT score, from lowest to highest, and are then split into three groups based on freshmen enrollment. Type 2 comprises the lowest-ranked colleges that account for a third of all freshmen. Type 3 comprises middle-ranked colleges, and type 4 represents top-ranked colleges, each with a third of enrolled freshmen. By construction, the higher-type colleges are more selective. I refer to these higher types as higher-quality colleges because measures of selectivity highly correlate with per-student instruction-related expenditures.

College quality $q \in \{1, 2, 3, 4\}$ correlates with net tuition payments and parental transfers. In addition, two-year schools allow students to take evening classes, which allow them to work longer hours while being enrolled. The data show that parental transfers increase with college quality but much more so for the students from high-income families. These factors may make lower-quality schools more attractive to lower-income students. In addition, higher-quality colleges may offer better learning opportunities and higher-quality instruction but may also teach harder curriculum and set more stringent graduation requirements. These factors may make higher-quality schools less attractive to less academically prepared students.

My main findings are as follows. First, I confirm previous findings regarding the increasing role of parental income for college entry. I then document that the role of family income has remained important and relatively stable at explaining college quality choice, its importance increasing only for the choice of four-year colleges over two-year colleges. In contrast, learning ability as measured by test scores has become much more important at predicting college quality choice, implying a substantial strengthening of student college sorting, i.e., a growing ability gap between the most selective and least selective institutions. I argue that these findings are a result of increased returns to college coupled with tighter financial constraints (to be discussed later). With increased college applications, highly selective schools have had to further raise admissions standards, which has resulted in a larger ability gap between high- and low-quality schools.

I also document that for a given college type, family income has remained an important predictor of graduation outcomes, its effect remaining unchanged in magnitude. But its role in explaining post-schooling earnings of college graduates has dropped substantially, as has the role of test scores. In contrast, the quality of the degree-granting college has become a much stronger determinant of both graduation outcomes and post-graduation

2. This is, for example, what my coauthors and I do in Leukhina, Hendricks, and Koreshkova (2022), where we report the causal influence of college quality on post-schooling earnings.

earnings. I argue that such an increase in returns to quality (and the declining importance of income and test scores) is a reflection of the growing ability gap between high- and low-quality colleges. In other words, high-quality schools have become more accurate proxies of students' true ability. This trend is manifested in the growing importance of quality and weakening importance of other explanatory variables. A complementary explanation is that with stronger ability sorting, higher-quality schools have shown a stronger response in terms of further investments in quality such as instructional quality and academic advising. These investments would also help increase graduation rates and post-schooling earnings.

The rest of the article is organized as follows. I describe my college- and student-level datasets in Section 2. My empirical analysis is reported in Section 3. I conclude in Section 4.

2. DATA

The entire college-level dataset, as well as summary statistics of student-level data presented in Appendix 2, are available on my website.[3]

2.1 College-Level Data

To rank colleges on "quality," I compile a dataset of 3,000 colleges and universities in the US as well as information about their average SAT scores and freshman enrollment in 2000. I use the Integrated Post Secondary Education Data System (IPEDS) available through the National Center for Education Statistics to obtain this information and supplement it with SAT scores from Barron's Profiles of American Colleges (Barron's Educational Series, Inc. College Division (1992)) and American Universities and Colleges (Praeger Publishers (1983)) for colleges with missing data.

I categorize all colleges into four types. The lowest quality (type 1) comprises community colleges offering a transferable associate degree. Four-year institutions are ranked in terms of their freshmen's average SAT score, from lowest to highest, and they are split into three groups based on freshman enrollment. Type 2 comprises the lowest-ranked colleges that account for a third of all freshmen. Type 3 comprises the middle-ranked colleges, and type 4 represents the top-ranked colleges, each with a third of enrolled freshman.

I refer to higher-type colleges as higher-quality colleges because better SAT averages not only indicate better learning and networking opportunities from one's peers but also strongly correlate with measures of instructional quality (e.g., faculty-student ratios and faculty salaries). I will use "type" and "quality" interchangeably throughout the article. In addition, I include community colleges in my analysis because over a third of college entrants start in a community college, with 95 percent of them stating that their ultimate goal is a bachelor's degree (Bowen, Chingos, and McPherson (2009)). According to my classification, higher-type colleges host a more strictly selected group of students, provide higher-quality but perhaps more challenging instruction, and cost more.

Figure 1 represents the distribution of average freshmen SAT scores in four-year colleges and marks cutoff values that split these colleges into three types. It shows that in 2000, one-third of four-year college freshmen study in colleges with the average freshmen SAT score of over 1136. Another third enroll in universities with the reported average SAT score of below 1136 and above 1033. The remaining one-third of entrants enroll in schools reporting average scores of below 1033.

To give a few examples of my classification, I find that Ivy League, selective private schools, most flagship universities and many other selective public universities (e.g., Truman State, Iowa State, North Carolina State, University of California at Santa Barbara) fall into type 4 category. Type 3 category includes many flagship universities and directional schools (e.g., University of Connecticut, University of Vermont, University of New Mexico, University of Arizona, Arizona State, University of California at Santa Cruz, Washington State, Michigan State, Northwest Missouri State, University of Central Florida). Type 2 colleges include the least selective public and private colleges (e.g., Eastern Michigan, Texas A&M-Corpus Christi, San Diego State, East Carolina, Missouri Valley College, Stillman College, Mercy College).

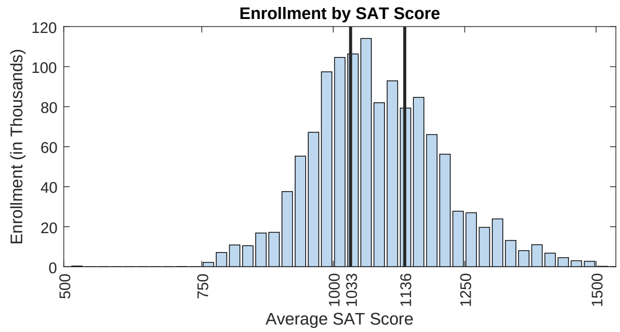
2.2 Student-Level Data

To study how family income and college outcomes interact, I use the 1979 and 1997 National Longitudinal Survey of Youth (NLSY), referred to as the NLSY79 and NLSY97, respectively (Source: National Longitudinal Surveys, Bureau of Labor Statistics).[4] NLSY97 is an ongoing survey that tracks the lives of 8,984 millennials, many of whom entered college around 2000. The NLSY79 follows an older cohort that comprises 12,686 baby boomers, many of whom entered college around 1980.

3. https://sites.google.com/view/oksanaleukhina/research

4. This research was conducted with restricted access to Bureau of Labor Statistics (BLS) data. The views expressed here do not necessarily reflect the views of the BLS.

Figure 1
Freshmen Enrollment by Their Institution's Average SAT Score



NOTE: The figure represents the distribution of average freshmen SAT scores in four-year colleges and marks cutoff values that split these colleges into three types.

In each survey round, respondents answer questions on a variety of topics, including education and income. The survey contains complete earnings histories for at least 15 years following college graduation and allows me to identify colleges that students attended and degrees they received. I augment the public-use data files with restricted information available in Geocode and official college transcript data. Geocode data allow me to identify specific colleges appearing in student records, and college transcripts provide accurate information on colleges attended, degree attainment, and complete college credit histories.

All survey participants were administered an Armed Forces Qualification Test (AFQT), which aggregates a battery of aptitude test scores into a scalar measure. The tests cover numerical operations, word knowledge, paragraph comprehension, and arithmetic reasoning.

2.3 Mapping of Model and Data Objects

I use several empirical models that require a definition of high school graduates, college entrants, college graduates, college quality at entry, quality of degree-granting college, labor earnings, work experience, and some measure of learning ability. I use the AFQT test percentile as a measure of learning ability. It is also possible to use high school grade point averages (GPAs) but doing so would be inconsequential for my results as it highly correlates with AFQT test scores (e.g., Borghans et al. (2011)).

I classify vocational students in the data as high school graduates who never entered college. I classify a student in the data as a college entrant if they enroll in college within two years of high school graduation. In turn, I define enrollment as follows. For students with available college transcripts, I require enrollment in at least nine credit hours.[5] For students without available college transcripts, I require a self-report of at least part-time enrollment. I classify a college entrant as a college graduate if they received a bachelor's degree within six years of starting college.

See Appendix 1 for more details on the data. Appendix 2 presents the two tables containing summary statistics for college freshmen in the NLSY79 and NLSY97 surveys.

3. THE CHANGING ROLE OF INCOME FOR COLLEGE-RELATED DECISIONS

The NLSY79 students graduate from high school around 1980 and go to college in the early 1980s, while the NLSY97 students graduate from high school roughly 20 years later and go to college in the early 2000s. Because the main increase in the college premium took place in the late 1980s, the NLSY97 students go to college in the era of greater returns to college. Hence, their behavior is more reflective of the current cohorts' decision making. In what follows, I discuss students' choices with respect to college entry and choice of college quality and how they vary with family income and learning ability. I also document the consequences of these choices—schooling outcomes and post-college earnings.

3.1 College Entry

Previous literature has established that the role of family income has grown substantially at predicting college entry decisions, when comparing the NLSY79 and NLSY97 cohorts (e.g., Belley and Lochner (2007)). I report my own analysis of college entry, for completeness and comparison to the previous literature.

5. I drop from my sample those high school graduates who enroll in college three to five years after high school graduation. Those who enroll later in life are simply treated as non-entrants.

Table 1
Probit Regression Estimates for College Entry, Marginal Effects

	1979 Cohort	1997 Cohort	1979 Cohort	1997 Cohort
AFQT Quart 2	0.118***	0.175***	0.116***	0.167***
	(0.016)	(0.021)	(0.016)	(0.021)
AFQT Quart 3	0.321***	0.367***	0.320***	0.357***
	(0.019)	(0.021)	(0.019)	(0.021)
AFQT Quart 4	0.593***	0.519***	0.593***	0.513***
	(0.017)	(0.019)	(0.017)	(0.019)
log(Family Income)	0.022**	0.081***	0.023**	0.083***
	(0.008)	(0.008)	(0.008)	(0.008)
Female			0.075***	0.104***
			(0.013)	(0.013)
Observations	7,187	4,879	7,187	4,879

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

NOTE: The table reports marginal effects from the probit regression of college entry choice, estimated on the sample of high school graduates. Marginal effects are reported as sample averages. AFQT score quartiles are defined over the sample of high school graduates. Standard errors are reported in parentheses.

I start by summarizing the college entry choice via a probit model, estimated for each cohort separately. The explanatory variables of college enrollment include the test score quartile indicators and log of family income. The estimated marginal effects of the explanatory variables are shown in Table 1. For the younger (1997) cohort, all of the effects are highly significant ($p < 0.001$) and economically relevant. The coefficient on log of family income is 0.081, which means that for a 10 percent increase in family income, the expected probability of college entry increases by 0.81 percentage points (pp). This is a large effect, especially when considered in the context of high-income inequality across families—relative to the bottom quartile of family income, students from the top quartile are 23 pp more likely to attend college.[6] Thus, parental income is an important determinant of college entry even once I control for academic ability. The effect of academic ability is also statistically significant and economically meaningful. An increase in the test score from the first to second quartile increases college entry probability by 18 pp. As the test scores rise further to the third and top quartile, entry probabilities rise by additional 19 and 15 pp.

For the older (1979) cohort, parental income is less significant ($p < 0.01$) and economically much less relevant. The marginal effect of log of family income is 0.02—one-fourth of its value for the younger cohort. A 10 percent increase in family income raises enrollment probability by only 0.22 pp. The effect of academic ability is highly significant and more dispersed—smaller for low-ability students and larger for high-ability students. An increase in the test score from the first to second quartile increases college entry probability by 12 pp. College entry probability rises by an additional 20 and 27 pp as the test scores rise to the third and top quartile.

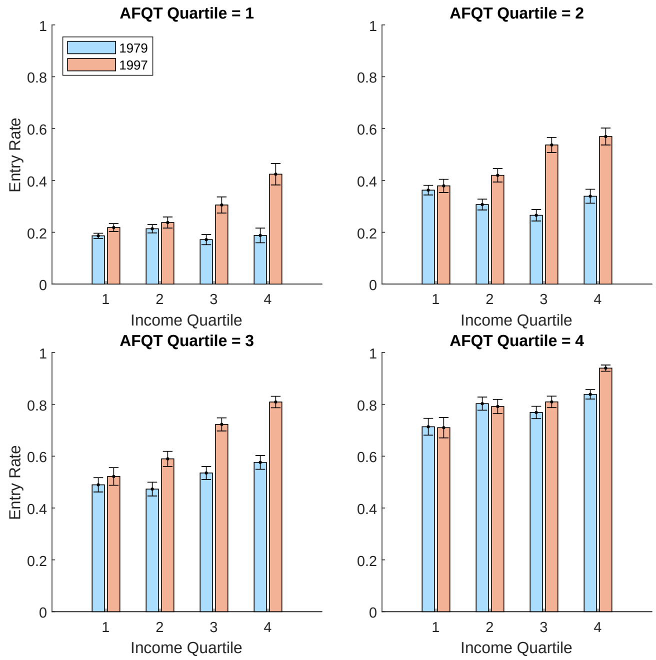
To summarize the change between the two cohorts, income has become drastically more important for college entry of the younger cohort, while the effect of academic ability has become stronger at the bottom and weaker at the top of the ability distribution. Mechanically speaking, this has happened because entry rates increased the most for medium-ability students. This is clear from Figure 2, which tabulates average college entry rates by quartile of family income and test scores.[7] This figure helps visualize the effect of income within each different test score quartile and allows me to see whether or not the probit income effects are driven by a particular group of students.

Consider the older (NLSY79) cohort first. When moving across panels from the bottom test score quartile to the top, the figure shows that the average entry rates increase from 19 to 32 percent, then to 52 percent, and finally to 80 percent, revealing a strong correlation of academic ability and college entry. However, when looking within a given test quartile, college entry rates appear to be flat as I vary parental income for students with test scores below median (the top two panels) and increase them slightly for students scoring above median (the bottom two panels). Thus, the small positive aggregate income effect seen in NLSY79 data is driven entirely by higher-ability students. This is also confirmed by the estimates of the college entry probit with included interaction terms between test scores and family income (see Table 24 in Appendix 2.2.4). For this

6. This result is obtained by reestimating the same probit regression with family income quartiles in place of log of family income.
7. The corresponding numbers are reported in Tables 10 and 11 in Appendix 2.1.2.

Figure 2

College Entry Rates, by Income and Test Scores



NOTE: The figure reports average college entry rates by quartile of family income and test scores. The entry rate, for a given group of students, measures the fraction of high school graduates in that group who enter college within two years of graduation. AFQT score quartiles are defined over the sample of high school graduates. Standard errors are marked by brackets.

general specification, I estimate that the marginal effect of log of family income is around 0 for the NLSY79 students scoring below median and is about 0.07 for students scoring above median.

Returning to Figure 2 to examine the NLSY97 cohort, we see that college enrollment increases dramatically for students of this cohort (from 44 percent to 57 percent) except for low-income students (regardless of test scores) and for the highest-scoring students (regardless of family income). The latter group's enrollment is already high and therefore has little room to increase. In other words, the dramatic rise of college attendance is driven by higher-income students of low and medium ability. As a result, what we see in the cross-sectional enrollment data for the 1997 cohort is that college entry rates exhibit a strong positive correlation with family income within each test score quartile (i.e., in each panel). Thus, the strong aggregate effect of parental income on college entry is not driven by students of a particular ability level. I also confirm this result by estimating the more general probit specification, which allows for interaction effects between test scores and income (see Table 24 in Appendix 2.2.4). The marginal effects of log family income on college entry are significant for each test score quartile and measure at 0.05, 0.07, 0.13, and 0.11.

Why did family income become a more important determinant of college entry? One possible explanation is the rise of the college degree premium that occurred in the 1980s (discussed in Section 3.4). If higher-income families care more about their children's status (college degree and income), they are more likely to respond by encouraging their children to enter college. A complementary explanation involves tighter financial constraints (see, for example, Belley and Lochner (2007) and Lochner and Monge-Naranjo (2011)). Indeed, I document that the average tuition paid by freshmen has increased by a factor of three for the younger cohort, from \$4,000 to \$13,552. Even though the amount of grants and scholarships has also increased, the direct cost of college has more than doubled, from \$3,628 to \$8,624.[8] In the meantime, the increase in the borrowing limits for subsidized Stafford loans did not keep up with rising college costs. The borrowing limit for the first year of college has barely changed at all, increasing from \$2,500 in 1982 to \$2,625 in 2000. These explanations are consistent with the observation that entry rates increase (conditional on AFQT) but the response has become stronger for higher-income families.

Another interesting hypothesis for the rising importance of family income premises that family income

8. Because tuition is not reported in NLSY79, I obtain tuition estimates for the older cohort from the High School and Beyond survey, conducted by the National Center for Education Statistics.

has also become more correlated with human capital investments before high school graduation—any type of investment that increases college entry. If so, then family income has become a stronger indicator of student learning ability, which could manifest itself as an increase in its correlation with college entry (within test score quartiles). I can rule this hypothesis out by rejecting its premise.

If the correlation between family income and early human capital investments has increased over time, it would likely show up in the correlation between income and test scores. After all, it is difficult to think of any type of investment that would affect college entry but not academic achievement. Therefore, it makes sense to examine changes in the joint distribution between family income and student test scores. Tables 8 and 9 in Appendix 2.1.1 report the mass of students in each combination of family income quartile and test score quartile for each of the two cohorts. All of the entries sum up to one.

We see that families in the top quartile of the income distribution make substantially more human capital investments in their offspring—their children are about three times more likely to be in the top quartile of the distribution than in the bottom quartile. The opposite is true for families in the bottom income quartile. For both cohorts, test scores highly correlate with family income, but this correlation is about the same—0.34 for the 1979 cohort and 0.36 for the 1997 cohort.

3.2 Choice of College Type

I have discussed that the importance of family income as a determinant of college entry has increased drastically over time. Did its influence also change for the choice of college type? Students from wealthier families may be better able to afford higher tuition rates. They may also have access to more accurate information regarding the quality of various institutions and college admissions process more generally (**hoxby_missing_2013**; Hoxby and Turner (2013)). This may be a result of attending better-quality high schools, hiring of college counselors, or simply their parents' personal experiences.

Figure 3 helps visualize the evolution of the role of family income for student sorting. Each panel corresponds to a particular quartile of family income defined over all students graduating from high school. For each panel, I report the distribution of freshmen across college type for each of the two cohorts. The corresponding numbers are given in Tables 16 and 19 in Appendix 2.2.2. As explained in Section 2, I focus on four types of college of varying quality—two-year community colleges and three types of four-year colleges. For example, for the 1997 cohort, 30 percent of college entrants with family incomes in the top quartile enter type 4 colleges and another 30 percent enter type 3 colleges. About 20 percent enter type 2 schools, and the remaining 20 percent enroll in two-year schools.

The shift toward higher-quality schools is seen most clearly for families in the top half of the income distribution. If I were to break this down further into student test scores, I would see that it is driven primarily by students in the top half of the test score distribution. In other words, higher-income families make sure that their relatively high-achieving children enroll in better schools. In contrast, the low-achieving students are much more likely to go to two-year schools regardless of their family income. For example, among the low-scoring (bottom quartile) high-income (top quartile) students who enrolled in college, the fraction sorting into community colleges increases from 56 to 64 percent (not shown).

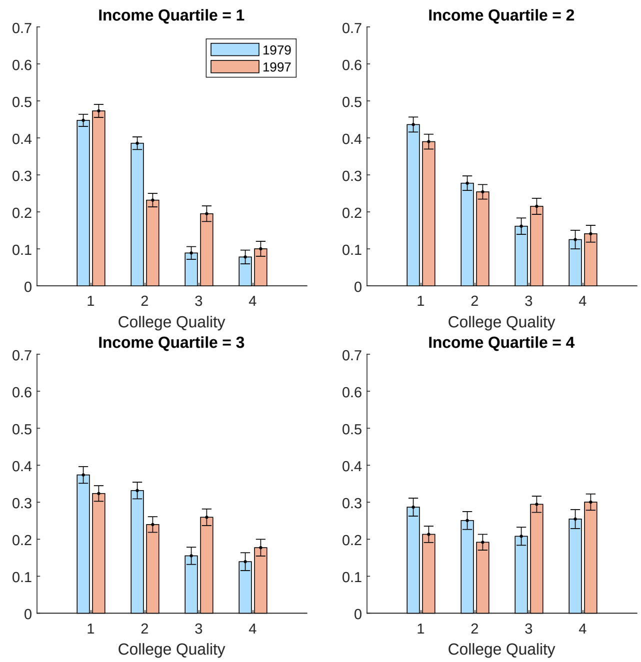
In any case, my discussion suggests that it is important to control for test scores when looking at the effect of income on student college sorting. Students who are better prepared academically are more likely to prefer the more challenging curricula offered in better-quality schools. They are also more likely to be admitted by higher-quality schools. To this end, I estimate a multinomial logit model of college quality choice, with test score controls included.

Table 2 reports the marginal effects of parental income and test scores on college quality choice, as implied by the estimation of a multinomial logit model on NLSY79 data. Relative to freshmen who scored in the bottom quartile, freshmen in the second quartile do not make significantly different choices with respect to college quality. Freshmen in the third quartile, however, are 17 pp less likely to choose a two-year college; they are 9 pp and 6 pp more likely to select colleges of quality 3 and 4, respectively. Students in the top quartile are 38 pp less likely to choose a two-year college and are 14 pp and 25 pp more likely to choose quality 3 and 4. All of these effects are important and highly significant. The likelihood of choosing colleges of quality 2 is similar regardless of test scores.

The effect of family income on choice of college is important and economically significant. For a 10 percent increase in family income, the expected probability of choosing a two-year college or the less selective four-year colleges decreases by 0.5 pp each, while the probability of choosing quality 3 and quality 4 rise by 0.3 pp and 0.7 pp.

Table 3 reports the multinomial logit estimates for the younger (1997) cohort. I can assess the changing role of income for college quality choice by comparing these estimates to those reported in Table 2. Recall that for the younger cohort of students, family income is a more important determinant of college entry. However,

Figure 3
College Quality Choice, by Income



NOTE: The figure reports the freshmen distribution over college types, for each quartile of family income. Family income quartiles are defined over the sample of high school graduates. The lowest quality (quality 1) comprises community colleges offering a transferable associate degree. To define quality 2–4 categories, I rank four-year institutions according to their freshmen's average SAT score, from lowest to highest, and split them into three groups of equal freshmen enrollment. Standard errors are marked by brackets.

it appears that its influence on where students go to college has not change as much, with it being important in the 1980s and still important in the 2000s. The only notable change, relative to the older generation, is that richer parents are more likely to shy away from two-year colleges in favor of the less selective four-year schools. To be precise, a 10 percent increase in family income decreases the expected probability of choosing a two-year college and the least selective four-year colleges by 0.72 pp and 0.28 pp, respectively.

When comparing these numbers to the corresponding NLSY79 estimates (0.46 pp and 0.54 pp), the income effects on the choice of quality 3 and 4 remain similar in magnitude. Including gender in the above two logit specifications does not significantly change the above estimates; I report those estimates in Tables 25 and 26 of Appendix 2.2.4. Gender is insignificant for the choice of college quality for the NLSY79 cohort. For the younger cohort, women appear to slightly prefer four-year colleges.

Why does family income now matter more than it used to for the choice of lower-quality four-year colleges over community colleges? The rise of the college degree premium coupled with tighter financial constraints is again likely responsible for this observation. If higher-income families care more about their children's status, they may respond by encouraging their children to enroll in four-year rather than two-year colleges, which allows for an easier pathway to a bachelor's degree. Moreover, as a result of tighter financial constraints, the younger cohort have had to rely more heavily on family transfers, work more hours while in college, and enroll in less expensive colleges. Such downgrading of college choice would disproportionately affect lower-income families.

Further comparing Tables 2 and 3 reveals that the effect of test scores on college choice has increased dramatically. Relative to the lowest quartile, students in the top quartile, for example, are now 48 pp less likely to enroll in a two-year college and are 33 pp more likely to enroll in quality 4 schools. These effects are a magnitude larger compared to the corresponding estimates for the 1979 cohort (i.e., 38 pp and 25 pp). Tables 14 and 17 in Appendix 2.2.2 may be helpful in visualizing the increase in sorting by test scores. This change is a direct result of increased college entry among the lower-scoring high school graduates. Increased college entry implies a greater dispersion of test scores among college freshmen. Because the lower-scoring entrants tend to enroll in community colleges and the less selective four-year schools, the effect of test scores on college quality choice grew mechanically.

Table 2
Multinomial Logit of College Quality Choice, Marginal Effects, 1979 Cohort

	Quality 1	Quality 2	Quality 3	Quality 4
AFQT Quart 2	-0.060	0.016	0.020	0.024
	(0.043)	(0.039)	(0.026)	(0.019)
AFQT Quart 3	-0.166***	0.016	0.087**	0.063***
	(0.041)	(0.038)	(0.027)	(0.018)
AFQT Quart 4	-0.375***	-0.021	0.142***	0.254***
	(0.038)	(0.037)	(0.027)	(0.023)
Log(Family Income)	-0.046**	-0.054**	0.027	0.073***
	(0.016)	(0.017)	(0.016)	(0.019)
Observations	2,017	2,017	2,017	2,017

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

NOTE: The table reports marginal effects from the multinomial logit regression of college quality choice, estimated on the sample of college freshmen. Marginal effects are reported as sample averages. AFQT score quartiles are defined over the sample of high school graduates. Standard errors are reported in parentheses.

Table 3
Multinomial Logit of College Quality Choice, Marginal Effects, 1997 Cohort

	Quality 1	Quality 2	Quality 3	Quality 4
AFQT Quart 2	-0.116**	0.030	0.085**	0.001
	(0.042)	(0.037)	(0.028)	(0.019)
AFQT Quart 3	-0.308***	-0.010	0.237***	0.080***
	(0.039)	(0.034)	(0.028)	(0.021)
AFQT Quart 4	-0.479***	-0.066*	0.216***	0.329***
	(0.036)	(0.033)	(0.027)	(0.024)
Log(Family Income)	-0.072***	-0.028*	0.023	0.077***
	(0.012)	(0.011)	(0.015)	(0.015)
Observations	2,089	2,089	2,089	2,089

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

NOTE: The table reports marginal effects from the multinomial logit regression of college quality choice, estimated on the sample of college freshmen. Marginal effects are reported as sample averages. AFQT score quartiles are defined over the sample of high school graduates. Standard errors are reported in parentheses.

There are two reasons why the lower-scoring entrants tend to choose lower-ranked colleges and open-door community colleges. First, these schools may set lower graduation standards and select a less challenging curriculum. Second, these schools may also be the only option for many of the lower-achieving students. After all, with increased dispersion of academic achievement among the applicant pool and less room to increase operating capacity, higher-quality four-year schools likely needed to become more selective, thereby effectively barring entry for some of the lower-scoring students.

3.3 Graduation Rate

I have discussed that family income has become a more important determinant of college entry and college choice. In this section, I discuss its additional effect on graduation outcomes—the effect that goes beyond the choice of college type. Does family income play an important role in ensuring that students complete the required curriculum and obtain a bachelor's degree, and did this effect change over time?

One way that parental income can influence graduation outcomes is by alleviating financial constraints. A student from a high-income family may not need to work as much during their studies in college if family transfers are sufficient. This allows them to allocate more time toward academic studies. There may also be non-financial shocks associated with low-income students that directly reduce the amount of time and mental effort the student can devote to academic studies. Low-income students are also more likely to be first-generation college students, so their parents are less able to help them navigate through college. Graduation rates, tabulated by income and quality, or by income and test scores, are reported in Tables 20–23 in Appendix 2.2.3. I will return to these later.

Table 4
College Graduation Probit, Marginal Effects

	1979 Cohort	1997 Cohort	1979 Cohort	1997 Cohort
Enters Quality 2	0.297***	0.377***	0.294***	0.369***
	(0.029)	(0.029)	(0.029)	(0.029)
Enters Quality 3	0.355***	0.508***	0.353***	0.500***
	(0.038)	(0.029)	(0.038)	(0.029)
Enters Quality 4	0.442***	0.590***	0.443***	0.585***
	(0.041)	(0.032)	(0.041)	(0.032)
AFQT Quart 2	0.142***	0.062	0.143***	0.058
	(0.037)	(0.039)	(0.037)	(0.038)
AFQT Quart 3	0.252***	0.130***	0.250***	0.126***
	(0.036)	(0.038)	(0.036)	(0.037)
AFQT Quart 4	0.448***	0.201***	0.451***	0.202***
	(0.036)	(0.040)	(0.037)	(0.039)
Log(Family Income)	0.054***	0.053***	0.054***	0.057***
	(0.015)	(0.013)	(0.015)	(0.013)
Female			0.039	0.089***
			(0.022)	(0.019)
Observations	2,017	2,089	2,017	2,089

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

NOTE: The table reports marginal effects from the probit regression of college graduation (i.e., bachelor's degree attainment within six years of college entry), estimated on the sample of college entrants. Marginal effects are reported as sample averages. AFQT score quartiles are defined over the sample of high school graduates. Standard errors are reported in parentheses. The lowest college quality category (quality 1) comprises two-year colleges. Quality 2-4 categories refer to four-year institutions, ranked from least to most selective. The omitted category of students comprises those that started in community colleges (quality 1) and scored in the bottom quartile of the test distribution.

To assess the role of parental income for college degree attainment, I estimate a probit model where the discrete variable of interest is college graduation and the explanatory variables are quality of first college, test scores, and family income. The omitted category of students comprises those who start in community colleges (quality 1) and score in the bottom quartile of the test distribution. I also estimate a specification with gender controls to capture possible gender effects on academic performance. Table 4 reports my estimates for each cohort.

Let us first consider the first two columns. The marginal effect of family income on graduation is economically important, statistically significant, and stable over time. I find that a 10 percent increase in family income increases graduation probability by about 0.55 pp for both cohorts. Comparing columns 3 and 4, I see that including gender controls does not alter the income effect estimates. College quality and test scores enter as controls, but it is interesting to examine how their effects change for the younger cohort. For the 1979 cohort, the effects of college quality and test scores on graduation outcomes are both statistically significant and comparable in magnitude. Enrolling in the most selective four-year colleges (quality 4), as opposed to a community college, raises graduation probability by 44 pp. To compare across four-year schools, I estimate that enrolling in type 4 over type 2 schools raises graduation probability by $44 - 30 = 14$ pp. The effect of test scores is also important. Compared to college freshmen who score in the bottom quartile of the test distribution, top scoring students' graduation rates are 45 pp higher.

While the effect of parental income on graduation remains unchanged over time, my estimates reveal a significant increase in the importance of college quality and a decline in the importance of test scores. For the 1997 cohort, enrolling in the most selective colleges (type 4) raises graduation probability by as much as 59 pp when compared to two-year schools and by $59 - 38 = 21$ pp when compared to less selective colleges (type 2). These effects are 34 percent and 50 percent larger than the corresponding estimates for the 1979 cohort. In contrast, the effect of test scores is reduced by over 50 percent. Relative to freshmen who score in the bottom quartile of the test distribution, top scoring students' graduation rates are only 20 pp higher.

One possible explanation for the growing importance of college quality and the reduced importance of test scores at explaining graduation outcomes is, once again, a widening ability gap between top- and bottom-quality institutions. As explained earlier, the increased aggregate college entry rate (from 44 to 57 percent) implies a greater dispersion of learning ability among the applicant pool. High-quality colleges with limited spots have had to raise their admissions standards. The marginal students ended up in community colleges and low-quality four-year institutions.

As a result, I expect that the academic performance of students attending top-quality schools would increase relative to the performance of students at bottom-quality schools. In fact, the overall graduation rates barely change at all (from 53 percent to 55 percent) as the graduation rate (i.e., BA degree attainment) for community college starters decline (from 20 percent to 17 percent), while graduation rates in colleges of quality 3 and quality 4 increase (see Tables 20 and 22 presented in Appendix 2.2.3). Put another way, with stronger sorting on learning ability, high-quality colleges have become more accurate proxies of student ability. This is reflected in probit marginal effects as the increased importance of quality at the expense of test scores.

A complementary explanation is that with stronger ability sorting, higher-quality schools have shown a stronger response in terms of further investments in quality such as instructional quality and academic advising. Such investments would directly help increase graduation rates. Hoxby (2009) provides evidence for both the increased ability gap between the most selective and the least selective schools as well as the fanning out of instructional expenditures per student across college types. The author argues that "colleges that were initially selective will have found that their students, as they increased in aptitude, will have demanded (and been willing to pay for) better-qualified faculty, better facilities, and otherwise improved quality of instruction."

3.4 Earnings

I have shown that for a given college type, family income has remained an important predictor of graduation outcomes, its effect staying similar in magnitude. In this section, I examine its role in explaining post-schooling earnings. I show that parental income's role in explaining post-schooling earnings has dropped by about 50 percent. Test scores have also become less important at explaining earnings. In contrast, schooling outcomes and school quality have become stronger determinants of post-schooling earnings.

Generally speaking, parental background can influence one's income in ways that extend beyond schooling outcomes, which I have already discussed. Higher-income families tend to have more experience with high-skilled jobs and therefore may be better equipped to help with college major selection and occupation/career choice as they can provide better help navigating the job search process. Higher-income families also have access to networks that can lead to more lucrative opportunities. Finally, for a given college type and tuition charges, high-income students typically come out of college with less debt, which allows them to consider careers with high but backloaded earnings (e.g., professional degrees).

To assess the effect of parental income on post-schooling earnings, I consider only working individuals with high levels of labor market attachment. The specifics of the earnings sample creation are given in ??. Earnings regressions are estimated in two stages and separately for each education group. In the first stage, I use my panel data to estimate the experience profiles and back out individual fixed effects. I allow for different experience profiles between college entrants and college nonentrants. Precisely, I estimate the following fixed effects regression:

$$log(y_{it}) = f(exp_{it}) + const + u_i + \varepsilon_{it},$$

where $f(exp_{it}) = \beta_1 exp_{it} + \beta_2 \frac{exp_{it}^2}{10} + \beta_3 \frac{exp_{it}^3}{100} + \beta_4 \frac{exp_{it}^4}{1000}$ denotes the experience quartic, separately for college entrants and college nonentrants. The log earnings fixed effect for each individual is then $FE_i = const + u_i$. In the second stage, I regress individual fixed effects on fixed individual-level variables of interest, such as test scores and family income.

I start by considering all students together so as to demonstrate the average effect of income on labor market earnings and point out the rise in the college premium, which constituted part of my narrative in Section 3.2. The second-stage regression estimates, for both cohorts, are reported in Table 5. The first two columns contain the estimates for the specification without the gender controls. All of the coefficient estimates are highly significant and economically meaningful for both cohorts. The college dropout premium remains stable over time, at about 13 percent. The college graduation premium, however, is significantly higher for the 1997 cohort (57 percent versus 46 percent).[9] The rise seen in the college premium during the 1980s is, of course, a well-known fact.

The influence of family income is significant and important for both cohorts, but its influence declines over time. For the older cohort, a 1 percent increase in family income results in a 0.14 percent increase in earnings. The influence of family income is reduced by about a half—to 0.08 percent—for the younger cohort. In the meantime, the importance of test scores remains roughly the same, decreasing slightly near the top of the test

9. While I control for observed differences between nonentrants and college graduates, part of the college premium may reflect differences in unobserved characteristics (such as learning ability, as defined in the introduction).

Table 5
Log Earnings Regressions (Stage 2), All Students

	1979 Cohort	1997 Cohort	1979 Cohort	1997 Cohort
AFQT Quart 2	0.095***	0.092***	0.104***	0.103***
	(0.022)	(0.022)	(0.020)	(0.021)
AFQT Quart 3	0.167***	0.124***	0.169***	0.135***
	(0.020)	(0.023)	(0.019)	(0.021)
AFQT Quart 4	0.223***	0.166***	0.209***	0.153***
	(0.023)	(0.028)	(0.022)	(0.027)
College Dropout	0.132***	0.129***	0.151***	0.149***
	(0.021)	(0.019)	(0.021)	(0.018)
College Graduate	0.461***	0.571***	0.493***	0.626***
	(0.025)	(0.020)	(0.024)	(0.020)
Log(Family Income)	0.139***	0.077***	0.132***	0.068***
	(0.011)	(0.010)	(0.010)	(0.009)
Female			-0.351***	-0.246***
			(0.015)	(0.016)
Constant	7.888***	8.416***	8.118***	8.608***
	(0.115)	(0.099)	(0.107)	(0.096)
Observations	5,476	3,832	5,476	3,832

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

NOTE: The table reports the coefficients of the earnings regressions estimated on the sample of all high school graduates. The omitted category of students comprises high school graduates who did not enroll in college and scored in the bottom quartile of test scores distribution. The college graduate category refers to college entrants who obtained a bachelor's degree within six years of college entry. The college dropout category refers to students that enrolled in college but did not graduate. AFQT score quartiles are defined over the sample of high school graduates. Standard errors are reported in parentheses.

score distribution. For the older cohort, for example, earnings increase by 22 percent when comparing students in the top quartile of test scores to those in the bottom quartile. For the younger cohort, the increase is smaller, measuring at 17 percent.

These findings are consistent with the narrative I have proposed to explain the observed changes in college choice and graduation rates. With greater numbers enrolled in college among the younger generation high school graduates, more of them get screened out through the observed college degree attainment. In other words, college graduation has become a more accurate measure of learning ability. As a result, the coefficients on test scores and parental income has gotten smaller over time. Also, note that introducing gender controls in columns 3 and 4 increases the dropout and college degree premia and increases the estimated gain in the college premium (from 11 pp to 13.3 pp). The rest of the estimates do not change substantially.

A supplementary earnings regression breaks down the overall college graduation premium into graduation premia associated with different types of colleges (type 2-4). The estimates are reported in Table 27 of Appendix 2.2.4. It is remarkable to see that the rise in the overall graduation premium is driven primarily by type 4 schools. Comparing columns 3 and 4, which report the estimates from the specification with gender controls, I see that the type 2 and type 3 premia both increase by about 10 pp, but the type 4 premium increases by about 20 pp.

In the above estimation of the second-stage regressions, I pulled all students together, thereby effectively forcing the same effect of income and test scores on everyone. I can break these down further by considering each education group separately. Table 6 reports the estimates of the second-stage log earnings regressions for those high school graduates who never entered college. For both cohorts, the effect of parental income is similar in magnitude to the one I estimated for the full sample of students. For the older cohort, a 1 percent increase in family income results in a 0.15 percent increase in earnings. The effect declines to 0.08 percent for the younger cohort. The coefficients on the test scores are also similar in magnitude to those estimated on the full sample. Gender controls do not significantly change the estimates.

Finally, Table 7 reports the estimates of the second-stage log earnings regressions for the sample of college graduates. This group of students is highly selected on attributes that matter for both academic and labor market success. These are the students who chose to enter college and completed the requirements for a bachelor's degree. I regress the earnings' fixed effects on test scores, family income, and the quality of the degree-granting college. Perhaps the most remarkable finding in this table is that over time, the quality of the degree-granting

Table 6

Log Earnings Regressions (Stage 2), High School Graduates

	1979 Cohort	1997 Cohort	1979 Cohort	1997 Cohort
AFQT Quart 2	0.102***	0.080**	0.116***	0.096***
	(0.023)	(0.027)	(0.021)	(0.024)
AFQT Quart 3	0.190***	0.139***	0.185***	0.145***
	(0.026)	(0.032)	(0.024)	(0.030)
AFQT Quart 4	0.190***	0.154***	0.199***	0.141***
	(0.033)	(0.039)	(0.029)	(0.038)
Log(Family Income)	0.150***	0.079***	0.142***	0.073***
	(0.013)	(0.012)	(0.012)	(0.012)
Female			-0.338***	-0.289***
			(0.018)	(0.022)
Constant	7.764***	8.402***	7.998***	8.582***
	(0.129)	(0.123)	(0.128)	(0.124)
Observations	3,462	1,882	3,462	1,882

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

NOTE: The table reports the coefficients of the earnings regressions estimated on the sample of those high school graduates who did not enroll in college. AFQT score quartiles are defined over the sample of high school graduates. Standard errors are reported in parentheses.

college has become much more important in magnitude and statistical significance. I have already shown that college quality has grown in importance for graduation outcomes, and I now find that it has also become more important for post-schooling labor market outcomes. In fact, nothing else matters as much for the younger cohort's earnings as the quality of their degree-granting college.

To see this, consider the last two columns that report specifications with gender controls. For the 1979 cohort, test scores, family income, and gender are all very important and highly significant at explaining the earnings variation among the college graduates. A 1 percent increase in family income implies a 0.12 percent increase in earnings. An increase in test scores from the bottom to top quartile implies a 26 percent increase in earnings. Graduating from what I consider today to be the more selective colleges (type 4) increases earnings by only 6 percent when compared to the less selective four-year schools, but even this small effect is not statistically significant. For the 1997 cohort, however, the effect of the more selective colleges (type 4) is highly significant and much larger in magnitude, measuring at 18 percent. Test scores bear no additional influence on earnings, and their effect is close to zero and statistically insignificant. Family income still matters, but its influence is reduced by a half and is only weakly significant ($p < 0.05$).

The earnings regressions estimated on the sample of college graduates alone effectively drive my narrative home. As a result of increased college entry, higher-quality colleges have rationed out their limited spots by raising admissions standards, thereby getting more selective over time. To the extent that college admissions officers can observe students' characteristics beyond those captured by test scores and parental income, it is not surprising that college quality have strengthened its predictive power of student true ability, while the opposite is true for parental income and test scores.

3.5 College Selectivity over Time

I have alluded to the growing ability gap between high- and low-quality schools. I documented this in my multilogit estimates, which show that test scores have become drastically more important at explaining college quality choice. I can also visualize this change using Figure 4, which clearly shows that the high-scoring students (AFQT quartiles 3 and 4) are increasingly choosing quality 3 over quality 1 and quality 2 schools. Students in the bottom of the test score distribution, however, are increasingly selecting into two-year schools.

Generally speaking, growing college stratification on test scores is part of a longer-run trend and is well documented in Hoxby (2009). In this article, I consider only two cohorts of students and use AFQT test scores to highlight the change in college stratification. Figure 5 provides additional evidence for growing stratification, for the longer period of time and using SAT scores. Because two-year colleges do not require SAT scores, I do not include these colleges in the sample used to produce this figure. It shows that the dispersion of average student SAT scores has increased across four-year colleges in the US between 1970 and 2000. Yet, the strongest change happened between 1960 and 1970, which is not depicted here but is discussed in Hoxby (2009).

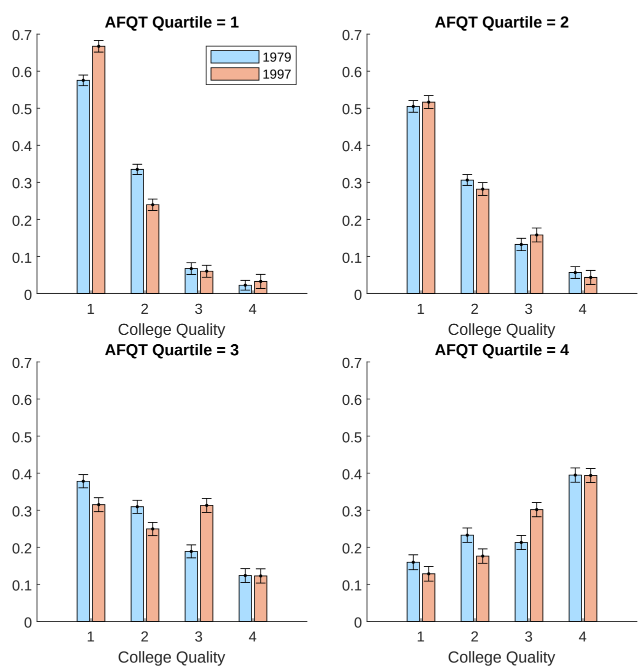
Table 7
Log Earnings Fixed Effects Regressions (Stage 2), College Graduates

	1979 Cohort	1997 Cohort	1979 Cohort	1997 Cohort
AFQT Quart 2	0.028	-0.005	0.076	-0.014
	(0.075)	(0.072)	(0.064)	(0.071)
AFQT Quart 3	0.142*	0.006	0.193***	0.005
	(0.061)	(0.072)	(0.049)	(0.072)
AFQT Quart 4	0.229***	0.049	0.256***	0.029
	(0.059)	(0.071)	(0.053)	(0.072)
Degree from Quality 3	0.055	0.063	0.042	0.050
	(0.049)	(0.041)	(0.045)	(0.042)
Degree from Quality 4	0.091	0.185***	0.059	0.176***
	(0.054)	(0.049)	(0.050)	(0.050)
Log(Family Income)	0.128***	0.066**	0.118***	0.057*
	(0.034)	(0.023)	(0.029)	(0.024)
Female			-0.373***	-0.174***
			(0.037)	(0.032)
Constant	8.440***	9.136***	8.706***	9.357***
	(0.362)	(0.254)	(0.309)	(0.267)
Observations	896	1,088	896	1,088

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

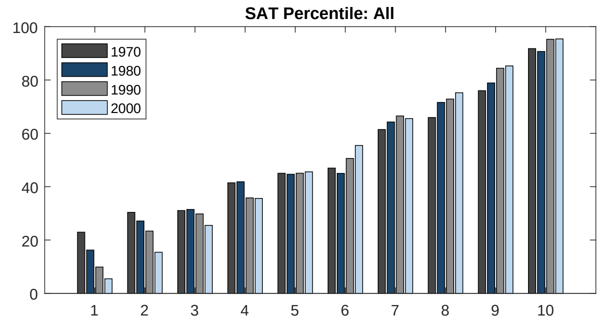
NOTE: The table reports the coefficients of the earnings regressions estimated on the sample of college graduates (i.e., those who obtained a bachelor's degree within six years of college entry). AFQT score quartiles are defined over the sample of high school graduates. Standard errors are reported in parentheses. College quality 2-4 categories refer to four-year institutions, ranked from least to most selective. The omitted category comprises students graduating from quality 2 institutions.

Figure 4
College Quality Choice, by Test Scores



NOTE: The figure reports the freshmen distribution over college types, for each AFQT quartile. AFQT quartiles are defined over the sample of high school graduates. The lowest quality (quality 1) comprises community colleges offering a transferable associate degree. To define quality 2-4 categories, I rank four-year institutions according to their freshmen's average SAT score, from lowest to highest, and split them into three groups of equal freshmen enrollment. Standard errors are marked by brackets.

Figure 5
Average Freshmen SAT Score Percentile, by Decile of Selectivity



NOTE: The figure represents the distribution of average freshmen SAT score percentiles in four-year colleges. All colleges are split into deciles according to their freshmen SAT score in 2000 and using freshmen enrollment as weights. Average SAT percentiles are then depicted for each group of colleges in 1970, 1980, 1990, and 2000.

4. CONCLUSION

In this paper, I examine the role played by family income for college-related decisions of two cohorts—the baby boomers who graduated from high school around 1980 and the millenials who graduated 20 years later. Compared to the older cohort, the millenials graduating from high school around 2000 faced a greater return to college but tighter financial constraints. Consistent with the findings of the previous literature, I find that the role of family income has grown substantially at predicting college entry decisions. In fact, college entry has increased primarily for higher-income, low- and medium-ability students. I argue this is because higher-income families were better able to respond to greater college returns in the face of rising costs.

Family income is also important for the choice of college type, for both cohorts. Higher-income students tend to select higher-quality college. I document that family income became only slightly more important at explaining college quality choice, its importance increasing only for the choice of four-year colleges over two-year ones but not for the choice between different types of four-year schools. I also documented that for a given college type, family income has remained an important predictor of graduation outcomes, its effect staying similar in magnitude. But its role in explaining post-schooling earnings of college graduates dropped substantially. In contrast, the quality of the degree-granting college became a much stronger determinant of both graduation outcomes and post-graduation earnings.

I also find that student test scores have become much more important at predicting college quality choice, indicating a substantial strengthening of student college sorting. I explain that this was likely a result of increased college enrollment, which put pressure on higher-quality schools with limited capacities to raise admissions standards, i.e., became more selective. In addition, because of increased enrollment, the marginal students entering college in 2000 were weaker in terms of test scores when compared to the 1980s marginal students. With more stringent admissions standards, these students had to concentrate in open-admissions two-year colleges or the least selective four-year colleges. This resulted in a growing ability gap between students in the top and bottom schools.

It is then, perhaps, not surprising that college quality became much more important at explaining both college graduation rates and post-graduation earnings, whereas the importance of test scores declined. With the growing ability gap between highly selective and least selective colleges, college quality simply became a more accurate proxy of student unobserved ability, which is what matters for academic and labor market success. While I propose a reasonable hypothesis to explain my findings, more model-based quantitative work is needed to understand differences in college-related outcomes between the two cohorts.

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APPENDIX 1. DATA DETAILS

To categorize four-year institutions into quality groups, I need institution-level data on freshmen enrollment and institution-level data on average freshmen SAT for the early 2000s. This is the time period of college attendance for students in the NLSY97 cohort.

Appendix 1.1 College Quality

Institution-Level Average Freshmen SAT Scores

I pull SAT scores for 2001-2009 from IPEDS. IPEDS has 25th and 75th percentile scores on the reading and mathematics sections; I calculate a single "average" SAT score as the sum of the means of these percentiles. I fill in missing values with average SAT scores from the 2008 US News College Rankings, compiled by Dillon and Smith (2020). For colleges still lacking SAT scores in a given year, I pull 25th and 75th percentile ACT subject scores from IPEDS, calculate an "average" ACT score as the sum of the means of these percentiles, and calculate the SAT score analogous to these ACT scores.

To create a single SAT score for the early 2000s—the main measure I use to split colleges into types—I calculate the average SAT score for years 2000-2003. I impute missing SAT scores from SAT scores in years 2004, 2005, 2006 ... 2009. For institutions with missing SAT scores, I impute them by regressing nonmissing SAT scores for this decade on a combination of cogent variables (e.g., graduation rate, admission rate).

I also compile institution-level SAT data for earlier decades for the purpose of creating Figure 5. I obtain the early 1970s institution-level SAT scores from Barron's Educational Series, Inc. College Division (1972), compiled and shared with me by Mark Long (Long (2010)). For schools with a missing SAT value, I impute SAT scores by estimating a regression of non-missing SAT scores on Barron's selectivity scores from that year.

I construct the early 1980s institution-level SAT scores as follows. First, I obtain 1982 SAT scores from Barron's Educational Series, Inc. College Division (1982), compiled by Mark Long. For schools with a missing value, I impute SAT scores by regressing non-missing scores on Barron's selectivity score from 1982 (available from the same source). I obtain 1980 and 1983 SAT scores from Barron's Educational Series, Inc. College Division (1980) and Praeger Publishers (1983). I use the average of the 1980, 1982, and 1983 SAT scores as the institution-level SAT score for the early 1980s.

I obtain the early 1990s institution-level SAT scores from Barron's Educational Series, Inc. College Division (1992), compiled by Mark Long. For schools with a missing value, I impute SAT scores by regressing the SAT score on Barron's selectivity score from 1992 (available from the same source). For schools without selectivity data, I instead impute SAT scores by regressing nonmissing SAT scores on a combination of cogent variables from the decade (e.g., graduation rate, admission rate).

Institution-Level Freshmen Enrollment

To create my measure of freshmen enrollment for the early 2000s, I use first-time, full-time undergraduate degree- or certificate-seeking enrollment from IPEDS. To create a single "enrollment" value for the 2000s, I calculate the average enrollment from the years 2001, 2002, and 2003. I obtain freshmen enrollment data from the 1970s from Barron's Educational Series, Inc. College Division (1972), compiled and shared with me by Mark Long. I repeat the same procedure to obtain first-time enrollment for 1982 and 1992, using Barron's Educational Series, Inc. College Division (1982) and Barron's Educational Series, Inc. College Division (1992).

College Quality Definition (Types)

I categorize all two-year colleges that offered a general education associate degree as quality 1 institutions. To categorize four-year institutions into quality 2-4 groups, I calculate enrollment-weighted tertiles of institution-level average freshmen SAT scores for the early 2000s (see above). Institutions with average SAT scores in the lowest (middle/highest) tertile are classified as quality 2 (quality 3/quality 4). When creating these groups, I exclude colleges with SAT scores, which I impute using regressions. I then assign these colleges their groups based on their imputed SAT scores and the cutoffs between tertiles.

Appendix 1.2 NLSY Data

Graduation Dates

Respondents report their highest grade completed and the highest degree received, at each interview. I use this information to identify high school graduates and college graduates in the data. When official transcripts are available and in case of conflicting information, I use transcript data, which include degrees granted.

Real Earnings

Respondents reported both annual labor income (i.e., income earned in the year before the interview) and job-level wages and hours, which can be used to proxy income over a given period of time. I follow Dillon and Smith (2017) and use the self-reported annual labor income as my measure of earnings. I adjust for inflation by translating all nominal earnings to 2000 dollars using the annual Consumer Price Index (CPI). I fill in missing earnings values using values in adjacent years. That is, if income in year t is missing, I do the following:

- I impute missing income in year t with the average of reported income values in years $t - 1$ and $t + 1$, if those are available.

- If only one of those income values is available, I use that value to impute the missing income while making a 3 percent annual growth adjustment.

Earnings Sample

My objective is to define a sample with a relatively strong labor force attachment so that I can examine the effects of degree attainment, college type, and parental income on labor market earnings. I consider individuals who work at least 1,000 hours or earn at least $8,000. The lower bound for earnings is used because hours are missing for many respondents. I trim the outliers as follows: I trim real incomes above $200,000, and for those with nonmissing hours, I trim incomes that imply hourly earnings below $3.

I approximate respondent i's labor market experience at time t, that is, exp_{it} as the respondent's age minus the typical age at which individuals with the same schooling attainment enter the workforce (i.e., 19, 21, or 24 for nonentrants, college dropouts, and college graduates, respectively).

AFQT

- NLSY79: Three versions of AFQT scores are provided for respondents who took the test: 1981 scores, 1989 (renormed) scores, and 2006 (renormed) scores. Each set of scores is adjusted by NLSY staff for age and is given as a percentile for each respondent. I use the 2006 renormed scores when calculating AFQT quartiles and percentiles among high school graduates as these allow for direct comparison to the 97 sample. I make no attempt to infer scores for respondents who did not take the test.
- NLSY97: I use the provided AFQT scores, adjusted by NLSY staff for age and given as a percentile, to calculate AFQT quartiles and percentiles among high school graduates. I make no attempt to infer scores for respondents who did not take the test.

Family Income at High School Graduation

- NLSY79: For survey years 1979-1986, parents of respondents still living in a parental household answered questions regarding household income (as opposed to the respondents themselves reporting on the subject). I use the parental response closest to when the survey participant turned 18 as a measure for family income at high school graduation. I adjust income to be in 2000 dollars using annual CPI.
- NLSY97: I use reported household income in round one as a measure for family income around the time respondents graduated from high school. These responses come from the parent questionnaire for respondents who were not considered independent at the time of interview and from the youth questionnaire for respondents who were considered independent.[10] I do not consider reported household income in additional rounds because parents were only interviewed in round one.

APPENDIX 2. ADDITIONAL STATISTICS

Appendix 2.1 High School Graduate Characteristics

Appendix 2.1.1 Joint Distribution of Test Scores and Family Income

Table 8
Joint Distribution of Income and Test Scores: NLSY79

	AFQT Quart 1	AFQT Quart 2	AFQT Quart 3	AFQT Quart 4	All
Income Quart 1	0.12	0.06	0.04	0.03	0.25
Income Quart 2	0.07	0.07	0.06	0.05	0.25
Income Quart 3	0.05	0.07	0.08	0.06	0.26
Income Quart 4	0.03	0.06	0.07	0.09	0.25
All	0.27	0.25	0.25	0.23	1.00

NOTE: The table reports the mass of students in each combination of family income and test score quartiles for the NLSY79 cohort. Quartiles are defined over the sample of high school graduates.

10. To be considered independent, a respondent had at least one of the following characteristics: was of age 18 or older, had a child, was enrolled in a four-year college, was or had been married or was in a marriage-like relationship at the time of the survey, was no longer enrolled in school, or was not living with any parent or parent figure. A large majority of youth were not independent as of the round one survey.

Table 9
Joint Distribution of Income and Test Scores: NLSY97

	AFQT Quart 1	AFQT Quart 2	AFQT Quart 3	AFQT Quart 4	All
Income Quart 1	0.10	0.06	0.04	0.03	0.23
Income Quart 2	0.07	0.07	0.06	0.05	0.25
Income Quart 3	0.04	0.06	0.07	0.08	0.26
Income Quart 4	0.03	0.05	0.08	0.10	0.26
All	0.24	0.25	0.25	0.26	1.00

NOTE: The table reports the mass of students in each combination of family income and test score quartile for the NLSY97 cohort. Quartiles are defined over the sample of high school graduates.

Appendix 2.1.2 College Entry, by Test Scores and Family Income

Table 10
College Entry Rates: NLSY79

	AFQT Quart 1	AFQT Quart 2	AFQT Quart 3	AFQT Quart 4	All
Income Quart 1	0.19	0.36	0.49	0.71	0.33
Income Quart 2	0.21	0.31	0.47	0.80	0.42
Income Quart 3	0.17	0.27	0.54	0.77	0.45
Income Quart 4	0.19	0.34	0.58	0.84	0.57
All	0.19	0.32	0.52	0.80	0.44

NOTE: The table reports the fractions of high school graduates who enrolled in college within two years of graduation, for each combination of family income and test score quartile. Quartiles are defined over the sample of high school graduates.

Table 11
College Entry Rates: NLSY97

	AFQT Quart 1	AFQT Quart 2	AFQT Quart 3	AFQT Quart 4	All
Income Quart 1	0.22	0.38	0.52	0.71	0.38
Income Quart 2	0.24	0.42	0.59	0.79	0.49
Income Quart 3	0.31	0.54	0.72	0.81	0.63
Income Quart 4	0.42	0.57	0.81	0.94	0.76
All	0.26	0.47	0.68	0.84	0.57

NOTE: The table reports the fractions of high school graduates who enrolled in college within two years of graduation, for each combination of family income and test score quartile.

Appendix 2.2 Freshmen Characteristics

Appendix 2.2.1 Summary Tables

Table 12

Average Characteristics of Freshmen, by Type of College: NLSY79

	All	Quality 1	Quality 2	Quality 3	Quality 4
AFQT Pctile among HS Grads	67	54	63	73	84
AFQT Pctile among Freshmen	50	35	45	55	71
Inc. Pctile among HS Grads	57	52	54	64	68
Inc. Pctile among Freshmen	50	44	47	56	61
Frac. Male	0.49	0.49	0.44	0.48	0.56
Frac. White	0.85	0.82	0.80	0.89	0.93
Frac. Graduating in 4 Yrs	0.29	0.06	0.29	0.38	0.53
Frac. Graduating in 5 Yrs	0.16	0.09	0.17	0.22	0.21
Frac. Graduating in 6 or 7 Yrs	0.10	0.06	0.10	0.14	0.12
Frac. Dropping Out	0.45	0.80	0.43	0.26	0.15
Observations	3,076	1,018	939	540	579

NOTE: The table summarizes various student characteristics for first-year college students, for each type of college. The lowest college quality category (quality 1) comprises two-year colleges. Quality 2-4 categories refer to four-year institutions, ranked from least to most selective.

Table 13

Average Characteristics of Freshmen, by Quality of College: NLSY97

	All	Quality 1	Quality 2	Quality 3	Quality 4
AFQT Pctile among HS Grads	63	47	59	71	83
AFQT Pctile among Freshmen	50	33	44	58	74
Inc. Pctile among HS Grads	61	52	58	65	72
Inc. Pctile among Freshmen	50	41	47	54	62
Frac. Male	0.45	0.48	0.41	0.41	0.48
Frac. White	0.80	0.72	0.72	0.89	0.90
Frac. Graduating in 4 Yrs	0.27	0.04	0.21	0.35	0.60
Frac. Graduating in 5 Yrs	0.19	0.06	0.24	0.28	0.20
Frac. Graduating in 6 or 7 Yrs	0.10	0.07	0.12	0.12	0.08
Frac. Dropping Out	0.45	0.83	0.43	0.24	0.12
Observations	2,739	948	672	625	494

NOTE: The table summarizes various student characteristics for first-year college students, for each type of college. The lowest college quality category (quality 1) comprises two-year colleges. Quality 2-4 categories refer to four-year institutions, ranked from least to most selective.

Appendix 2.2.2 College Sorting, by Family Income and Test Scores

Table 14

Joint Distribution of Quality and Test Scores: NLSY79 College Freshmen

	AFQT Quart 1	AFQT Quart 2	AFQT Quart 3	AFQT Quart 4	All
Quality 1	0.06	0.08	0.11	0.07	0.32
Quality 2	0.03	0.05	0.09	0.11	0.28
Quality 3	0.01	0.02	0.05	0.10	0.18
Quality 4	0.00	0.01	0.03	0.18	0.23
All	0.10	0.16	0.28	0.46	1.00

NOTE: The table reports the mass of college freshmen in each combination of college type and test score quartile. Test score quartiles are defined over the sample of high school graduates. The lowest college quality category (quality 1) comprises two-year colleges. Quality 2-4 categories refer to four-year institutions, ranked from least to most selective.

Table 15
Joint Distribution of Quality and Income: NLSY79 College Freshmen

	Income Quart 1	Income Quart 2	Income Quart 3	Income Quart 4	All
Quality 1	0.08	0.10	0.10	0.10	0.37
Quality 2	0.07	0.06	0.09	0.08	0.30
Quality 3	0.02	0.04	0.04	0.07	0.16
Quality 4	0.01	0.03	0.04	0.09	0.16
All	0.17	0.23	0.26	0.34	1.00

NOTE: The table reports the mass of college freshmen in each combination of college type and family income quartile. Family income quartiles are defined over the sample of high school graduates. The lowest college quality category (quality 1) comprises two-year colleges. Quality 2-4 categories refer to four-year institutions, ranked from least to most selective.

Table 16
Marginal Distribution of Quality, by Income: NLSY79

	Income Quart 1	Income Quart 2	Income Quart 3	Income Quart 4
Quality 1	0.45	0.44	0.37	0.29
Quality 2	0.39	0.28	0.33	0.25
Quality 3	0.09	0.16	0.16	0.21
Quality 4	0.08	0.13	0.14	0.25
All	1.00	1.00	1.00	1.00

NOTE: The table reports freshmen distribution over college types, for each quartile of family income. Family income quartiles are defined over the sample of high school graduates. The lowest college quality category (quality 1) comprises two-year colleges. Quality 2-4 categories refer to four-year institutions, ranked from least to most selective.

Table 17
Joint Distribution of Quality and Test Scores: NLSY97

	AFQT Quart 1	AFQT Quart 2	AFQT Quart 3	AFQT Quart 4	All
Quality 1	0.08	0.10	0.09	0.05	0.32
Quality 2	0.03	0.06	0.07	0.07	0.23
Quality 3	0.01	0.03	0.09	0.12	0.25
Quality 4	0.00	0.01	0.04	0.15	0.20
All	0.11	0.20	0.30	0.39	1.00

NOTE: The table reports the mass of college freshmen in each combination of college type and test score quartile. Test score quartiles are defined over the sample of high school graduates. The lowest college quality category (quality 1) comprises two-year colleges. Quality 2-4 categories refer to four-year institutions, ranked from least to most selective.

Table 18
Joint Distribution of Quality and Income: NLSY97

	Income Quart 1	Income Quart 2	Income Quart 3	Income Quart 4	All
Quality 1	0.06	0.08	0.09	0.08	0.32
Quality 2	0.03	0.05	0.07	0.07	0.22
Quality 3	0.03	0.05	0.08	0.11	0.25
Quality 4	0.01	0.03	0.05	0.11	0.20
All	0.14	0.21	0.29	0.36	1.00

NOTE: The table reports the mass of college freshmen in each combination of college type and family income quartile. Family income quartiles are defined over the sample of high school graduates. The lowest college quality category (quality 1) comprises two-year colleges. Quality 2-4 categories refer to four-year institutions, ranked from least to most selective.

Table 19
Marginal Distribution of Quality, by Income: NLSY97

	Income Quart 1	Income Quart 2	Income Quart 3	Income Quart 4
Quality 1	0.47	0.39	0.32	0.21
Quality 2	0.23	0.25	0.24	0.19
Quality 3	0.20	0.22	0.26	0.29
Quality 4	0.10	0.14	0.18	0.30
All	1.00	1.00	1.00	1.00

NOTE: The table reports freshmen distribution over college types, for each quartile of family income. Family income quartiles are defined over the sample of high school graduates. The lowest college quality category (quality 1) comprises two-year colleges. Quality 2-4 categories refer to four-year institutions, ranked from least to most selective.

Appendix 2.2.3 Degree Attainment, by College Quality, Test Scores, and Family Income

Table 20
College Graduation Rates, by Quality and Test Scores: NLSY79

	AFQT Quart 1	AFQT Quart 2	AFQT Quart 3	AFQT Quart 4	All
Quality 1	0.05	0.09	0.23	0.38	0.20
Quality 2	0.23	0.40	0.52	0.75	0.55
Quality 3	0.33	0.61	0.62	0.82	0.72
Quality 4	0.28	0.43	0.71	0.89	0.84
All	0.13	0.27	0.45	0.76	0.53

NOTE: The table reports bachelor's degree attainment rates (within six years of starting college) for each combination of first college type and test score quartile. Test score quartiles are defined over the sample of high school graduates. The lowest college quality category (quality 1) comprises two-year colleges. Quality 2-4 categories refer to four-year institutions, ranked from least to most selective.

Table 21
College Graduation Rate, by Quality and Income: NLSY79

	Income Quart 1	Income Quart 2	Income Quart 3	Income Quart 4	All
Quality 1	0.14	0.18	0.22	0.24	0.20
Quality 2	0.41	0.50	0.53	0.68	0.54
Quality 3	0.64	0.53	0.73	0.75	0.69
Quality 4	0.65	0.73	0.77	0.90	0.82
All	0.33	0.39	0.48	0.62	0.48

NOTE: The table reports bachelor's degree attainment rates (within six years of starting college) for each combination of first college type and family income quartile. Family income quartiles are defined over the sample of high school graduates. The lowest college quality category (quality 1) comprises two-year colleges. Quality 2-4 categories refer to four-year institutions, ranked from least to most selective.

Table 22

Graduation Rates, by Quality and Test Scores: NLSY97

	AFQT Quart 1	AFQT Quart 2	AFQT Quart 3	AFQT Quart 4	All
Quality 1	0.12	0.14	0.20	0.29	0.17
Quality 2	0.35	0.56	0.53	0.71	0.57
Quality 3	0.63	0.62	0.76	0.80	0.76
Quality 4	0.79	0.89	0.79	0.90	0.88
All	0.23	0.36	0.53	0.76	0.55

NOTE: The table reports bachelor's degree attainment rates (within six years of starting college) for each combination of first college type and test score quartile. Test score quartiles are defined over the sample of high school graduates. The lowest quality (quality 1) comprises community colleges offering a transferable associate degree. To define quality 2-4 categories, I rank four-year institutions according to their freshmen's average SAT score, from lowest to highest, and split them into three groups of equal freshmen enrollment.

Table 23

Graduation Rates, by Quality and Income: NLSY97 Cohort

	Income Quart 1	Income Quart 2	Income Quart 3	Income Quart 4	All
Quality 1	0.15	0.15	0.13	0.27	0.17
Quality 2	0.41	0.49	0.66	0.63	0.57
Quality 3	0.56	0.71	0.75	0.82	0.75
Quality 4	0.76	0.85	0.88	0.88	0.86
All	0.35	0.45	0.55	0.68	0.55

NOTE: The table reports bachelor's degree attainment rates (within six years of starting college) for each combination of first college type and test score quartile. Test score quartiles are defined over the sample of high school graduates. The lowest quality (quality 1) comprises community colleges offering a transferable associate degree. To define quality 2-4 categories, I rank four-year institutions according to their freshmen's average SAT score, from lowest to highest, and split them into three groups of equal freshmen enrollment.

Appendix 2.2.4 Additional Empirical Estimates

Table 24
College Entry Probit with Interaction Terms, Marginal Effects

	1979 Cohort	1997 Cohort	1979 Cohort	1997 Cohort
AFQT Quart 2	0.125***	0.191***	0.12292***	0.182***
	(0.017)	(0.022)	(0.017)	(0.022)
AFQT Quart 3	0.321***	0.380***	0.31874***	0.369***
	(0.019)	(0.021)	(0.019)	(0.021)
AFQT Quart 4	0.584***	0.521***	0.58506***	0.515***
	(0.019)	(0.021)	(0.019)	(0.021)
Log(Family Income)				
at AFQT Quart 1	0.002	0.045**	0.00391	0.048**
	(0.010)	(0.015)	(0.010)	(0.015)
at AFQT Quart 2	-0.022	0.072***	-0.01922	0.074***
	(0.017)	(0.016)	(0.017)	(0.016)
at AFQT Quart 3	0.073***	0.127***	0.07569***	0.131***
	(0.022)	(0.018)	(0.022)	(0.018)
at AFQT Quart 4	0.070**	0.109***	0.06774**	0.110***
	(0.021)	(0.020)	(0.021)	(0.019)
Female			0.07394***	0.104***
			(0.013)	(0.013)
Observations	7,187	4,879	7,187	4,879

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

NOTE: The table reports marginal effects from the probit regression of college entry choice, estimated on the sample of high school graduates. In this specification, ln(family income) is interacted with AFQT quartiles. Marginal effects of log(income) are reported separately for each AFQT quartile. The remaining marginal effects are reported as sample averages. AFQT score quartiles are defined over the sample of high school graduates. Standard errors are reported in parentheses.

Table 25
Marginal Effects from the Multinomial Logit of College Quality Choice: NLSY79

	Quality 1	Quality 2	Quality 3	Quality 4
AFQT Quart 2	-0.063	0.019	0.021	0.023
	(0.043)	(0.039)	(0.026)	(0.019)
AFQT Quart 3	-0.167***	0.017	0.087**	0.064***
	(0.041)	(0.038)	(0.027)	(0.018)
AFQT Quart 4	-0.379***	-0.016	0.143***	0.252***
	(0.038)	(0.037)	(0.027)	(0.023)
Log(Family Income)	-0.046**	-0.054**	0.027	0.073***
	(0.016)	(0.017)	(0.016)	(0.019)
Female	-0.032	0.046	0.014	-0.028
	(0.024)	(0.024)	(0.020)	(0.020)
Observations	2,017	2,017	2,017	2,017

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

NOTE: The table reports marginal effects from the multinomial logit regression of college quality choice, estimated on the sample of college freshmen. Marginal effects are reported as sample averages. AFQT score quartiles are defined over the sample of high school graduates. Standard errors are reported in parentheses.

Table 26
Marginal Effects from the Multinomial Logit of College Quality Choice: NLSY97

	Quality 1	Quality 2	Quality 3	Quality 4
AFQT Quart 2	-0.112**	0.027	0.084**	0.001
	(0.042)	(0.037)	(0.028)	(0.019)
AFQT Quart 3	-0.302***	-0.013	0.235***	0.080***
	(0.039)	(0.035)	(0.028)	(0.021)
AFQT Quart 4	-0.477***	-0.067*	0.216***	0.329***
	(0.037)	(0.033)	(0.027)	(0.024)
Log(Family Income)	-0.075***	-0.027*	0.025	0.077***
	(0.012)	(0.011)	(0.015)	(0.015)
Female	-0.055**	0.027	0.027	0.001
	(0.020)	(0.019)	(0.020)	(0.017)
Observations	2,089	2,089	2,089	2,089

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

NOTE: The table reports marginal effects from the multinomial logit regression of college quality choice, estimated on the sample of college freshmen. Marginal effects are reported as sample averages. AFQT score quartiles are defined over the sample of high school graduates. Standard errors are reported in parentheses.

Table 27
Log Earnings Fixed Effects Regressions (Stage 2), All Students

	1979 Cohort	1997 Cohort	1979 Cohort	1997 Cohort
AFQT Quart 2	0.097***	0.096***	0.106***	0.107***
	(0.022)	(0.022)	(0.020)	(0.020)
AFQT Quart 3	0.168***	0.125***	0.170***	0.137***
	(0.020)	(0.023)	(0.019)	(0.021)
AFQT Quart 4	0.216***	0.145***	0.204***	0.134***
	(0.024)	(0.028)	(0.023)	(0.028)
College Dropout	0.131***	0.132***	0.150***	0.151***
	(0.021)	(0.019)	(0.021)	(0.018)
College Grad., Quality 2	0.418***	0.500***	0.462***	0.566***
	(0.036)	(0.028)	(0.034)	(0.029)
College Grad., Quality 3	0.475***	0.557***	0.508***	0.604***
	(0.037)	(0.028)	(0.035)	(0.028)
College Grad., Quality 4	0.515***	0.681***	0.529***	0.734***
	(0.044)	(0.036)	(0.041)	(0.037)
Log(Family Income)	0.138***	0.075***	0.131***	0.066***
	(0.011)	(0.010)	(0.010)	(0.009)
Female			-0.350***	-0.245***
			(0.015)	(0.016)
Constant	7.899***	8.445***	8.123***	8.634***
	(0.116)	(0.098)	(0.109)	(0.096)
Observations	5,476	3,832	5,476	3,832

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

NOTE: The table reports the coefficients of the earnings regressions estimated on the sample of all high school graduates. The omitted category of students comprises high school graduates who did not enroll in college and scored in the bottom quartile of the test score distribution. The college graduates of type Q college are defined as college entrants who obtained a bachelor's degree from type Q college within six years of college entry (to any type of college). The college dropout category refers to students who enrolled in college but did not graduate. AFQT score quartiles are defined over the sample of high school graduates. The lowest college quality category (quality 1) comprises two-year colleges. Quality 2-4 categories refer to four-year institutions, ranked from least to most selective. Standard errors are reported in parentheses.