What Explains Rising Labor Supply Among U.S. Undergraduates, 1970-2003?

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Abstract: Today's college enrollees are more likely to work, and work more, than those of the past. October CPS data reveal that since 1970, average labor supply among 18 to 22 year old full-time, four-year undergraduates has nearly doubled, from 5.0 hours to 9.6 hours per week. Nearly half of these "traditional" college students work for pay in a given week, and the average working student works 21 hours per week. Borrowing constraints are a plausible culprit, but would have to be much more pervasive than commonly thought to explain rising employment even among wealthy students. I evaluate the credit constraints hypothesis along with several alternative explanations for the increase in student labor supply, including changes in demographic composition, rising wages, rising returns to work experience, declines in educational quality, institutional crowding, and declining preferences for leisure. Using multiple data sources, I conclude that none of these alternative hypotheses come close to fully explaining the dramatic change over time. When broadly defined to include "fuzzy" constraints on borrowing for discretionary consumption as well as self-imposed constraints on borrowing, credit constraints may be driving the trend even among high-income populations.

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I. Introduction

Today's college enrollees are more likely to work, and work more, than their counterparts in the past. The trend is most dramatic among "traditional" undergraduates: 18 to 22 year olds enrolled full-time at four-year institutions.[2] Overall, labor supply among traditional undergraduates has nearly doubled, from 5.0 hours to 9.6 hours per week. Nearly half of these students work for pay in a given week, and the average working student works 21 hours per week—significantly more time than the typical student spends on schoolwork outside of class.[3] This pattern is clearly evident even within age, race, gender, family income, and institutional subgroups.

An immediate concern is that this increase may reflect tightening financial constraints. Unless student employment has other benefits, students would be better off borrowing money instead of spending time working, so that they could finish college faster or better. But if students' ability to borrow is not rising as fast as college costs, they may have little choice but to work. This in turn may delay or diminish their acquisition of human capital, thus decreasing the return on their educational investment.

This concern is reinforced by empirical evidence that student employment interferes with academics. Two studies that use plausibly exogenous variation to estimate the consequences of student employment find significant negative effects on academic performance. Tyler (2003) uses cross-state variation in the stringency of child labor laws to instrument for hours worked by twelfth graders, and concludes that working an additional 10 hours per week is associated with a

[2] Part-time students have always worked significant amounts and there is no trend for this group over time. Labor supply has increased among two-year college enrollees (from 12 hours per week in 1970 to about 16 hours in 2003), but the trend is not as steep as for four-year students, and it has not increased since the mid-1980s.

[3] The National Survey of Student Engagement (2004) reports an average of 14 hours per week studying for full-time seniors in college, and an average of 13 hours per week studying full-time first-year undergraduates (the same survey reports average weekly work hours of 14 and 8 for seniors and first-years, respectively). Stinebrickner and Stinebrickner (2004) also report an average of 2 hours per day of studying.

0.20 standard deviation decrease in math test scores. Similar effects may apply to college student employment. Stinebrickner and Stinebrickner (2003) examine students at Berea College, all of whom are required to work at least 10 hours per week, and who are randomly assigned to an on-campus job. Because some jobs allow students to work more than 10 hours per week, while others do not, the authors use initial job assignments to instrument for hours worked. They find that an additional hour worked per week decreases the first semester grade point average by 0.162 points out of a four-point scale. Moreover, rising levels of term-time employment roughly correspond with an increase in the time students take to complete their degrees (Bound, Lovenheim, and Turner, 2007). In 2003, less than 40 percent of college graduates age 30 and younger had earned their degree by age 22, compared to about 60 percent in the 1970s and 1980s (Turner, 2005).

Credit constraints are not the only possible explanation for rising student employment, however. The increase over time is striking, but student work is hardly a new phenomenon. Even in 1970 nearly 30 percent of traditional students were working, including more than one in five students from the top quartile of family income.[4] Unless all of these students are credit constrained, many students apparently believe there are benefits to working that outweigh any potential harm to their studies. Neither Tyler (2003) nor Stinebrickner and Stinebrickner (2003) examine the longer-term effects of student work on labor market outcomes. But two particularly careful non-experimental analyses, by Ruhm (1997) and Light (1999), conclude that high school employment improves future labor market outcomes in the decade after high school graduation, despite possibly negative effects on academic achievement. Moreover, the presence of credit constraints remains a matter of debate among economists, with several studies arguing that such constraints are nonexistent or quantitatively unimportant (see, e.g., Cameron and Taber, 2004,

[4] Author's calculations using October CPS data on 18 to 22 year old full-time four-year college enrollees.

and Carneiro and Heckman, 2002, respectively), and no study arguing that such constraints might apply even to relatively rich students.

Even in the absence of borrowing constraints, students may rationally combine school and work under the reasonable assumption that additional hours spent studying within a given time period produce diminishing marginal amounts of human capital (Ben-Porath, 1967). Students will balance the benefits of working against the costs to their academic performance and progress. Thus many factors other than credit constraints may help explain the changes over time, including changes in demographic composition, rising student wages, rising returns to experience for student workers, changes in educational quality or returns to quality, institutional crowding, or declining preferences for leisure. All of these possible explanations must be considered; the rise in student employment cannot be taken as prima facie evidence of tightening credit constraints.

In Section II, I outline the trends in student employment using data from the October Current Population Survey (CPS). I show the increase over time cannot be explained away by any simple shifts in student demographics. In Section III, I describe a stylized model of human capital investment and analyze its key predictions regarding student employment. I also draw upon both classical and behavioral economics to develop a new schema clarifying the different types of credit constraints students may face. Some types of constraints, such as “fuzzy” constraints on the ability to finance discretionary spending or constraints that are internally-imposed, may apply across the income distribution. In Section IV, I draw upon a broad array of empirical evidence to weigh the plausibility of pervasive credit constraints against other possible explanations for the dramatic changes over time.

I find evidence consistent with tightening financial constraints that extend well into the middle and upper classes. While alternative factors such as compositional shifts and institutional crowding can explain some portion of the trend, they cannot explain the magnitude of the increase over time. I conclude that while credit constraints are not the only reason that students work, they are a likely driver of the changes over time—even for relatively wealthy students. In Section V, I discuss implications for policy: in particular, the paradox that broadening access to credit may not alleviate all types of credit constraints.

II. Trends in college student labor supply, 1970-2003

In this section, I briefly review basic trends in employment and college enrollment among high school graduates of traditional college age (18 to 22 year olds), from 1970 to 2003.[5] I then document that full-time, four-year college enrollees work dramatically more during the school year than similar students of the past.

It is a well-known trend that college enrollment has risen dramatically over the past several decades: the percentage of 18 to 22 year old high school graduates who are enrolled in either a two-year or four-year college rose from 31 percent in the early 1970s, to 55 percent in 2003. Enrollment has risen in both two-year and four-year institutions, and both part-time and full-time enrollments are increasing. Contrary to popular impression, two-year students comprise a smaller share of traditionally-aged college enrollees today than 30 years ago (27 percent versus 30 percent), although part-time students comprise a slightly larger share (13 percent versus 10 percent). In any case, the overall increase in enrollments for this age group is

[5] Over the same time period, high school graduation rates for this age group have edged up to 80 percent from 78 percent.

driven by what we think of as “traditional” college students—full-time students at four-year institutions.

Surprisingly, over the same time period October employment for these young high school graduates has remained basically constant at about 63 percent.[6] Average weekly hours of work (including zeros for those not working) hover around 19-20 hours per week, with a barely perceptible decline over time.

Since employment has remained stable while college enrollment has increased, it follows that more young people today are combining school and work. Figure 1 illustrates this trend by categorizing individuals by their activities: college only, college and work, work only, or neither. The expanding or contracting band widths over time show the shifts in distribution across categories. The figure shows that the fraction of 18 to 22 year old high school graduates combining school and work has more than doubled, to 28 percent in 2003 from only 12 percent in 1970.

Turner (2005) has shown that college students are taking longer to finish their degrees: could it be that young adults are simply shifting some of their labor supply to earlier years as they shift some of their schooling into the future? In fact, it is not the case that 18 to 22 year olds are working more but 23 to 27 year olds are working less. I demonstrate this by comparing two simulated cohorts: high school graduates who were aged 18 in 1970-1974 versus those where were 18 in 1990-1994. Using repeated cross-sectional data from the CPS, I link the data from those who were 18 in 1970 with data from those who were 19 in 1971, 20 in 1972, and so on. Figure 2 shows that while those in the recent cohorts are more likely to be enrolled in school at every age (shown by combining the bottom two bands of each bar), *at no age has labor force*

[6] Unless otherwise noted, the “employment rate” here refers to the employment-to-population ratio. Labor force status is not a particularly useful concept for college students, since those enrolled in school will generally be in the labor force if they work and not in the labor force if they do not work.

participation decreased (shown by combining the middle two bands in each bar). Although the phenomenon is most pronounced for 18 to 22 year olds, young high school graduates are combining work and school in substantial numbers throughout early adulthood.

When the sample is limited to 18 to 22 year old college students enrolled full-time at four-year institutions, the trend emerges clearly.[7] Figure 3 shows employment rates on the left axis, and average weekly hours on the right axis. The bottom line shows that average hours including zeros have nearly doubled, increasing steadily from 5.0 hours in 1970 to 9.6 hours in 2003. The bolded line shows that only 29 percent were employed in the survey week in 1970, compared with 46 percent in 2003.[8]

Not only are more students working, but employed students work more hours than in the past. Average hours among workers have increased from about 17 to 21 hours per week, and many students work significantly more. Just over one-quarter of college enrollees work 20 or more hours per week, compared to just 11 percent in 1970, and 6.7 percent were working full-time in 2003 (up from 3.5 percent in 1970).

I have thus far presented the data as a combination of two trends: increasing college enrollment, and increasing employment by college students. An alternative hypothesis suggested by Figure 1 is that devoted college students haven't changed at all, but some individuals who in a previous era would have worked-only (perhaps obtaining some training on the job) are now shifting into college. These marginal individuals may be better thought of as "enrolled workers"

[7] For the remainder of the paper, all references to college students will refer to 18 to 22 year old full-time four-year college enrollees, unless otherwise noted. I focus on this group both because they represent "traditional" college students and because the trends are strongest for this group (in contrast, part-time and two-year enrollees have always worked at much higher levels).

[8] Employment and hours data are taken from the October CPS question, "How many hours did you work last week?" Surveys that ask more generally about typical weekly hours or jobs held "during the school year" (such as the NLSYs or NPSAS) tend to elicit substantially higher estimates.

instead of "working students." In order to completely explain the trend, three out of every four "new" college enrollees would have to be these "enrolled workers."[9]

If this were the case, controlling for the changing composition of the college student population would eliminate the apparent increase over time. Relevant covariates are limited in the CPS, but one can examine subgroups defined by race, gender, age, dependency status, parental income quartile, parental education, and attendance at public versus private institutions (see appendix for figures broken out by each of these characteristics).[10, 11] Although the trend is slightly stronger for some groups (such as students at public institutions, and 19 to 21 year olds) and slightly weaker for others (such as those in the top income quartile), dramatic increases are evident for every subgroup I examine. It is thus clear that compositional changes are not going to explain away the trend.

Nonetheless, there are important differences in levels of work along some shifting dimensions, most notably age and dependency status, which may explain some of the change over time. For example, older, independent students make up an increasing fraction even of this "traditional" college population. In 1970, 21 and 22 year olds made up only 11 percent of this group, but comprise 37 percent of the sample in 2003. Also, the percentage of the sample defined as independent increases from about 8 percent to 16 percent over this time period. sTo summarize the role of compositional change, I regress hours worked on age and dependency status, as well as gender, race/ethnicity, marital status, region, parental income quartile, parental

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[9] College-only has increased by 6 percentage points, while college-plus-work has increased by 16 percentage points.

[10] Anyone who is not a household head or spouse is classified as dependent. This will include some individuals living with roommates rather than parents. It would be ideal to more specifically identify dependent children of household heads; unfortunately the coding of dependent children is inconsistent over time. The coding of the CPS's "household relationship" variable changed in 1989, 1994, and 1995, each time making it easier to identify dependent children (in early years, dependent children shared a category with other relatives of the household head). Large drops in the percentage of individuals classified as dependents occur at each of these points.

[11] Parental income and education are available only for students who are still dependent on their parents (dependent students, even if living away at college, are to be surveyed as part of their parents' household).

education dummies, and public/private enrollment status.[12] Using the parameter estimates from this regression I predict hours worked for students in the remainder of the time period; these predictions indicate how much we would have expected labor supply to change as a result of compositional changes alone. The predicted values are plotted against actual values in Figure 4. This shows that compositional changes (primarily by age and dependency status) can explain about one hour of the increase over time, or about 22 percent of the actual increase.[13] This still leaves a substantial unexplained increase of 3.6 hours per student per week.

Of course, there is still room for substantial compositional shifts even within these broad demographic groups. Even among white, male, middle-income nineteen year olds attending private universities, the marginal student may have a higher propensity to work. In the next section, I present a simple theoretical framework for analyzing student employment, which will illuminate the potential importance of more subtle compositional shifts. It is clear nonetheless that the rise in student labor supply is a remarkably broad-based trend that cannot be explained away by any *simple* shifts in student demographics.

II. Student Employment in Human Capital Investment Theory

Under the simplest model of human capital investment, versions of which were formulated by Becker (1962) and Rosen (1976) and later utilized and adapted by many authors, it is not optimal to interlace periods of schooling with periods of work. Doing so necessarily postpones the moment at which the individual will complete her education, and thus reduces the

[12] Parental income and education dummies are set to zero for independent students, and the dependency dummy serves as the missing data indicator in these regressions. Income quartiles are defined overall all families including at least one member between age 16 and 30, regardless of college enrollment status (for example, over this time period approximately 42 percent of dependent 18-22 year old college enrollees came from top-income-quartile families).

[13] If the more liberal (but less consistent) measure of dependency status is used, this fraction rises to 26 percent (see footnote 10).

number of years she can spend in the labor force reaping the returns on her investment. Only in the presence of credit constraints may it be optimal to combine work and school.

I will return to the topic of credit constraints at the end of this section. However, a minor modification of the standard model will justify a life-cycle phase combining school and work even in the absence of credit constraints. While the simplest model assumes that human capital can be obtained at constant marginal cost, the time students devote to schoolwork likely produces diminishing marginal amounts of human capital within any given period. As Yoram Ben-Porath (1967) writes in introducing his model of human capital investment,

> It is hard to think of forms of human capital that the individual can acquire as final goods—he has to participate in the creation of his human capital. His own abilities, innate or acquired, the quality of co-operating inputs, the constraints and opportunities offered by the institutional setup—all determine the "technology" or the production function. (p. 352)

As long as the human capital production function is concave, students will balance the marginal benefits of working against the marginal costs to their academic performance and progress. Focusing on school alone thus will not be optimal for all students in all situations.

The basic intuition underlying the concavity of human capital production is that students' time becomes less productive as more and more of it is devoted to schoolwork. This seems a plausible assumption. This concavity could be interpreted as an additional dimension of student ability, including mental focus and stamina, developmental maturity, organizational ability, or study skills. It need not be fixed by nature, though; it also may result from institutional factors regarding course offerings and logistics. For example, as students add more courses they may find they are more restricted in their choices of instructors and course times. At some point, course availability may be restricted such that marginal costs effectively become infinite—the student may not be able to enroll in any additional courses that would count towards the degree.

In equilibrium, the marginal benefits the student gains from an additional hour of working while in school should just equal the marginal costs, in terms of foregone (or delayed) human capital. If working students take longer to graduate, or graduate with fewer credits or lower grades, this does not necessarily indicate a market failure or irrationality on the part of working students. But the higher the estimated marginal costs, the higher the marginal benefits ought to be.

A simple time allocation model captures the essence of this tradeoff. Consider a two-period model in which individuals divide non-leisure time *T* between schooling (*s*) and work (*h*) in the first period. Everyone works full-time in the second period. Individuals can freely borrow, so the goal is to choose *s* and *h* in the first period to maximize lifetime income. Base wages *w* vary by individual ability, *a*. In the second period, wages are $w(a) + r^s f(s(h); q^s, a) + r^h g(h; q^h, a)$ where r^s and r^h are the per-unit wage gains from observable school-based and work-based human capital, respectively. I assume that both *f( )* and *g( )* are increasing and concave in *s* or *h*, respectively, and both functions also depend on the quality of human capital obtained, q^s and q^h (low quality units require less time to produce) and individual ability *a* (low ability students require more time to produce the same number of units). The objective function is thus:

$$\underset{h}{Max}\, Y = hw(a) + \beta\left[w(a) + r^h g(h; q^h, a) + r^s f(s(h); q^s, a)\right]$$

where *s(h)=T-h* and β is a measure of total hours worked in the second period (it could also be interpreted as accounting for discount rates). The first-order condition for this problem is:

$$w(a) + \beta r^h \frac{\partial g(h; q^h, a)}{\partial h} = \beta r^s \frac{\partial f(s(h); q^s, a)}{\partial s}$$

Intuitively, the left side of this equation represents the lifetime earnings benefit to an additional hour of work in the first period, while the right side represents the lifetime earnings benefit to an additional hour of schooling. Both school and work generate human capital that can be converted to additional earnings in the second period, while work also provides wages in the first period. At the margin, the lifetime earnings benefit of an additional hour of school or work should be equal. Note, if neither *g( )* nor *f( )* were concave, the result would be a corner solution in which individuals would devote all of their non-leisure time to either school or work.

For simplicity, I assume that leisure time is fixed and that the individual is only making tradeoffs between school and work. If leisure were incorporated, individuals would ensure that an additional hour of school or work "purchases" the same amount of utility as an additional hour of leisure. I will not incorporate leisure explicitly but will discuss below how its inclusion would affect the comparative statics analysis. Key predictions are summarized below; further details can be found in an appendix.

Student wages. As in any model of labor supply, wages matter. When base wages rise, students will shift towards working more. The shift is smaller when base wages are a relatively small piece of lifetime earnings. If leisure were incorporated, an increase in base wages may make students feel richer, decreasing the marginal utility of income. In this case, overall time devoted to school and work may decrease even as students substitute some of their school time for work time. However, this shift in wages would have to be a permanent shift—something expected to persist into the second period. Because the first period is likely to make a relatively small contribution to lifetime earnings, temporary fluctuations in wages are not likely to have significant income effects (unless students are credit constrained).

Returns to work experience. In addition to wages (or in some cases, in place of wages), students may acquire valuable work experience through student employment. Even in relatively low-skill jobs, students may develop soft skills, build career networks, secure references, and/or acquire information that enables better job matches later in life. Students shift towards work in the first period when returns to work experience rise, all else equal. Incorporating leisure will again introduce the possibility of income effects going in the opposite direction.

The value of work experience may vary by subject. For example, those majoring in business may get more out of student employment than those majoring in English, particularly given the types of jobs available to young, part-time workers. Sales experience in a retail outlet may be directly relevant to a future businesswoman, but only marginally relevant to a future English teacher.

Work experience could be particularly valuable in the context of uncertainty: acquiring some amount both of formal and informal human capital may be a form of "portfolio diversification" that increases lifetime utility by decreasing risk even if it does not increase expected lifetime earnings.

Returns to schooling. On the other side of the equation, students have less incentive to work when the returns to schooling are high. The time spent working must come from somewhere, and a student who either takes a bit longer to finish her degree or graduates with a lower-quality education will pay a higher price in terms of future earnings when the returns to schooling are high. Incorporating leisure in this case only strengthens the result: if students feel richer when returns to schooling rise, they may increase their leisure time even as they shift their non-leisure time towards schooling.

Student ability. Intuitively, the relationship between ability and student work decisions is ambiguous. High ability students may have a comparative advantage in producing school-based human capital, and thus they have more to lose by increasing work hours at the cost of valuable school-time. On the other hand, if high-ability students also command higher wages, this will increase their incentives to work.

School quality. Some (e.g. Babcock and Marks 2007) have hypothesized that to the extent a college degree is purely a signal, students have incentives to "free-ride" off the hard work of their predecessors, completing their degrees with the least effort required. Intuitively, one might guess that when school quality is low (in this framework, meaning that coursework is not very demanding) students will have more time to spend working. But the opposite conclusion is relatively easy to reach: when q^s is low, the "price" of obtaining human capital is low, so there is an incentive to "buy" more human capital. Rather than freeing up more time for work, low-quality schooling may create incentives for students to pursue higher grades, "stock up" on additional courses or degrees (for example, adding double or even triple-majors), or simply to finish degrees faster, if their school allows. Allowing students to choose leisure time as well will strengthen this effect: when students can invest in schooling very cheaply, lifetime income will be higher, and thus the marginal utility of income lower than when q^s is very high. This would push students to reduce work even further, in favor of consuming more leisure.

The effect of school quality or course difficulty on student employment is thus ambiguous, and will depend both on students' ability to adjust their courseloads as well as on employers' ability to observe school quality. If quality is at least partially observable and employers pay accordingly, then the relatively low cost of producing human capital is weighed against relatively lower returns in the labor market, and the overall effect is ambiguous.

However, if school quality is completely unobservable to employers, then students may actually work less when school quality is low, taking advantage of the low "price" of obtaining observable increments of human capital.

Institutional context. Institutional context may affect student employment via at least two pathways. First, the educational production function is not necessarily fixed by nature, but may vary depending on institutional context. Institutional crowding may cause the production function to become flat after a point, if students are not able to get into all of the courses they want in a given term. Second, the structure of tuition and fee charges may affect student employment. The model above assumes that tuition is fixed (per term), so that it does not affect the marginal tradeoff between school and work. But if tuition is charged per-course, this will strengthen the incentives to work even in the absence of credit constraints. In the case of per-term charges, when tuition rises students may have an incentive to work less, if doing so makes it possible to complete schooling in fewer terms.

Preferences for leisure versus consumption. I have not explicitly considered individuals' choices of leisure time, instead focusing on the tradeoff between school and work. But implicitly, the marginal utility from the last hour of either school or work should equal the marginal utility from the last hour of leisure. If the marginal utility of leisure decreases (or marginal utility of income increases) for some exogenous reason, individuals will make more time available for both school and work. Students with stronger tastes for leisure will have less time available for both school and work activities.

Credit constraints. The factors above will influence student employment decisions even in the absence of credit constraints, as long as the educational production function is concave. But incorporating these other factors does not negate the potential for credit constraints. An individual is credit constrained if she is unable to finance the full costs of attendance, including both direct costs and opportunity costs (foregone earnings). The opportunity cost includes the cost of any other consumption, even if unrelated to schooling, that would otherwise have been purchased with foregone earnings. If students cannot borrow enough to maintain at least the consumption level they would enjoy as a non-student (their counterfactual consumption), this represents a credit constraint even if students can borrow enough to finance tuition and whatever their parents or society might consider nondiscretionary consumption.[14] In order to further clarify the types of credit constraints may affect student employment, it is helpful to analyze them along two dimensions: whether such constraints are "strict" or "fuzzy," and whether they are internally or externally imposed. The resulting possible types of constraints are summarized in Table 1.

An individual who is unable to borrow enough to cover the direct costs of schooling and nondiscretionary consumption may be said to face a "strict" credit constraint. Students facing strict constraints have two options: work more, or forego schooling altogether. Individuals who can borrow enough to cover direct costs and nondiscretionary consumption, but not enough to fully maintain their counterfactual consumption, may be said to face a "fuzzy" credit constraint. The constraint is "fuzzy" in the sense that one's counterfactual consumption is inherently unobservable even to the student herself (unlike direct costs). Moreover, an individual could alleviate a fuzzy constraint simply by lowering her consumption expectations—it is not necessary either to work more or to forego schooling.

Both types of constraints are real: both will distort behavior. Either may cause students to work more and spend less time on schoolwork, thus delaying or diluting their educational

[14] Assuming that the educational investment is a good one, lifetime income will be higher if an individual chooses to enroll. Thus, in the absence of credit constraints there is no reason for an individual to choose a lower level of consumption as a student than as a non-student.

progress; either may cause some to skip college altogether. But in the case of fuzzy constraints, it is important to realize that students have more than one means of adjustment: they could decrease their discretionary consumption rather than (or at least in addition to) reallocating some of their school-time to paid employment. The economically optimal solution will depend on each student's intertemporal consumption preferences, i.e. the extent to which the student is willing to trade consumption now for consumption later. Either way, this tradeoff unambiguously decreases students' utility compared to a world with perfect credit markets, but the sacrifice of current consumption may be preferred by policymakers (or parents, who are often the primary providers of financing). This is particularly true if students form their consumption expectations in part based on their access to credit.

I have thus far described "credit constraints" as an inability to borrow funds; the term generally refers to constraints that are externally imposed. But internally-imposed constraints, also known as debt aversion, can have similar consequences. Even when students are able to borrow to finance their educational investment, they may not want to. This aversion may result from purely psychological, "non-rational" discomfort with debt; it may result from a semi-rational rule-of-thumb that leads students to avoid financial transactions they don't fully understand; or it may result from purely rational risk aversion (even if trading school for work is expected to be a good investment, it may not pay off for everyone, at least within the time frame of loan repayment). Such internal constraints may have similar consequences, but very different policy implications in comparison with external constraints.

In sum, while policymakers have generally been concerned with strict, externally imposed credit constraints, any of these types of credit constraints could lead individuals to work more or forego schooling altogether. Students from low-income families are more likely to face strict credit constraints because they are more likely to need to borrow in the first place (all else equal), but even relatively wealthy students may face some types of constraints (particularly if, for example, students base their consumption expectations on the standard of living in their parents' household). When the costs of schooling rise, students across the income spectrum are more likely to face constraints. Finally, it is important to note that while differences in student employment by income are suggestive of credit constraints, the absence of such differences does not prove the absence of credit constraints. Students facing the tightest constraints may choose not to enroll in college at all.

In the following section I empirically evaluate the importance of each of these factors in explaining the dramatic increase in student employment over time, saving the evidence on credit constraints for last.

IV. Empirical evidence

Credit constraints, in combination with rising real tuition costs, provide perhaps the simplest hypothesis for the change over time. But with so many students working, and with so many factors potentially affecting students' employment decisions, it is important to consider alternative explanations for the trend. In this section I evaluate the evidence for these alternative explanations, based on the factors described above in Section III. I divide the possibilities into compositional versus structural changes. At the end of the section, I directly consider the evidence for tightening credit constraints.

A. Compositional changes

Many of the factors listed in Section III will vary depending on the individual. As college enrollments have expanded, it is possible that the composition of the student population has shifted in subtle ways not captured by the broad measures of the October CPS. These compositional changes may drive the increase in student employment even if there have been no deeper structural changes.

A particular limitation of the CPS is that it lacks any measure of student ability, which may correlate with student employment decisions for the reasons discussed in Section II. Also, the October CPS data on parental income and education are less than ideal because 1) they are only available for dependent students, and 2) family income is measured only in categories, which are somewhat noisy as category cutpoints shift from year to year. Although the samples are much smaller, the National Longitudinal Surveys of Youth of 1979 and 1997 afford the opportunity to more closely examine the role of student ability and family background (as well as other compositional changes) in explaining the increase in student labor supply over time.

Both NLSYs include Armed Forces Qualification Test (AFQT) scores as a measure of ability, as well as multiple measures of parental income.[15] To maximize the comparability of the two samples, I focus on individuals who were 14.3 to 17.3 years old at baseline. This represents the age-range overlap between the two sampling frames. I further limit the sample to those who were age 18 or19 in May of their first year of a four-year college.[16] Each survey has five cohorts of traditionally-aged first-time four-year college entrants: the NLSY-79 college cohorts entered

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[15] Family background variables are measured as of the year prior to college entry. Missing data were filled with data from previous waves if necessary. For 8 percent of the 1979 sample and 9 percent of the 1997 sample, parental income data were missing in all years. Moreover, while nearly all 1979 respondents took the AFQT, about 14 percent of the 1997 sample are missing these data. Rather than drop these individuals from the analysis, I imputed AFQT scores and parental income using linear predictions based on age, race, gender, parents' educational attainment, and parents' marital status.

[16] This provides a larger sample than looking at students in the second year of college or above. Those who attend college for the first time at age 20 or older are excluded, and if someone spent more than one year in the "first year" of college, only the first year of enrollment is considered (that is, no individuals are counted in the analysis more than once). I do not limit the data to full-time enrollees due to inconsistencies in how and when this information was collected between the two surveys.

in 1979-80 through 1983-84 and include 909 individuals; the NLSY-97 college cohorts entered in 1997-98 through 2001-02 and include 1,192 individuals.[17]

A complete table of survey means is provided in the appendix (Table A1). The mean of the main dependent variable, average hours worked per week during the first year of college, was 8.53 hours per week for the 1979 cohorts and 10.25 hours per week for the 1997 cohorts (for a raw increase of 1.72 hours per week). These averages are higher, and the difference somewhat smaller, than those found in the October CPS for similar students. The average weekly hours for 18 to19 year old four-year college enrollees across the same years in the October CPS data were 5.2 and 8.0 hours per week, respectively. The difference in levels is likely due to differences in the way the data are collected.[18]

Changes in the distribution of student ability over time, at least for these "traditional" undergraduates, are relatively minor although statistically significant. Slightly fewer students in the recent cohorts come from the 60th through 80th percentiles of the AFQT distribution, while slightly more come from the 40th through 60th percentiles. Changes in students' family income are more noteworthy: 15 percent of students in the recent cohorts come from the bottom quartile of family income, compared to only 10 percent in the 1979 cohorts. Other significant differences are that the recent cohorts are slightly older, include more females and more Hispanics, and have significantly more educated parents than their counterparts from the 1979 survey. Finally,

[17] The NLSY-79 began with 12,686 respondents. Dropping the military sample and limiting to age 17.34 or younger brings the sample to 4,415. Of these, 26% or 921 enrolled in a 4-yr college by age 19 (percentage reflects weights). Dropping observations missing key variables brings the sample to 909. The NLSY-97 began with 8,984 respondents. Limiting to those age 14.36 or older brings the sample to 5,406. Dropping those missing key variables brings the sample to 5,402. Of these, 25% or 1,192 enrolled in a 4-yr college by age 19 (percentage reflects weights).

[18] In the October CPS, respondents are specifically asked how many hours they worked last week. In the NLSYs, respondents report each job they held since the last interview, when the job started and ended, and how many hours they typically worked per week at each job. Weekly data on hours worked are then constructed. Also, the NLSY measures enrollment as of May, and it is possible that some students are not enrolled continuously throughout the school year.

students in recent cohorts are less likely to have lived with their parents in the year immediately prior to college enrollment.

Table 2 presents the results of regressions of average weekly hours of work during October of the first year of college on student, institutional, and family characteristics. The coefficients from these regressions are then used in a Oaxaca decomposition, the results of which are summarized in Table 3. In model (1), I add a set of eight dummies representing AFQT deciles (the bottom two deciles comprise the omitted category). The relationship between AFQT and average hours is not particularly clear: in the 1997 cohorts, the coefficients are generally small, not significant, and alternately positive and negative. In 1979, several coefficients are significant but the pattern appears to be wave-shaped, with students at the lower-middle and very top of the distribution working less than those from the very bottom or upper-middle. Given this strange pattern in conjunction with the fact that the distribution itself has changed little over time, controlling for ability does nothing to explain the increase in work over time. If the coefficients from 1997 are used, changes in ability explain only 2 percent of the increase; if coefficients from 1979 are used, we might have expected a 3 percent larger increase than actually observed.

In model (2) I add parental income quartiles. The relationship between parental income and work is relatively weak in the 1997 cohorts, but strongly negative in the 1979 cohorts, with those from the top quartile working about 3 hours less per week than others. Controlling for income in addition to ability explains 5 percent of the increase in work hours using the 1979 coefficients, but still only 2 percent using the 1997 coefficients.

In model (3) I add controls for the remaining demographic characteristics. Although there are significant differences between the two samples along many dimensions, the full set of covariates included in model (3) explains only 16 percent of the increase over time if 1979 coefficients are used, or 11 percent if 1997 coefficients are used. Consistent with the CPS analysis, two of the main explanatory factors in this specification are age and whether or not the student lived with his/her parents in the year prior to enrollment. Increases in enrollment by slightly older students and Hispanics also helps explain some of the increase in work over time. On the other hand, substantial increases in parental education would have predicted that student labor supply would fall. These results are also broadly consistent with an analysis of NLS-72 and NELS-88 college enrollees by Bound, Lovenheim, and Turner (2007), who find that changes in student demographics cannot explain more than a trivial amount of the increase in time-to-degree over time.

Even with all of these demographic controls it is still possible that the trends in student employment result from compositional shifts. Perhaps individuals who used to train on-the-job and thus be classified as "working only" now obtain some of their training in formal institutions instead, but continue to be more attached to the labor force than liberal arts students of the past. If this were the case we might expect to see changes in students' course-taking patterns.[19]

It first must be established that labor supply varies depending on students' course of study. Table 4 shows average weekly hours of work in 2003-2004 for full-time bachelor's degree students by major (data come from the 2003-2004 NPSAS). Students studying business or studying vocational, technical, or professional subjects (except health) work more than those in other fields, particularly those related to science, math, or health professions. The difference is statistically significant, if not dramatic: students in business and vocational, technical, and professional subjects average 15.9 hours of work per week (including zeroes for non-workers)

[19] Shifts in subject areas may be at least partly structural rather than compositional (i.e., may represent changing preferences rather than changing students), but I include it in this section to provide a sense of the maximum that compositional changes could explain.

compared to 14.2 hours in all other subjects, a difference of 1.7 hours per week. All of this difference comes from differences in conditional hours (22.1 versus 19.8) rather than employment rates (72 percent for each group).[20]

To investigate whether the distribution of students across subjects has shifted over time, I use historical data on bachelor's degrees conferred from the 2005 Digest of Education Statistics (DOE). The trend is illustrated in Figure 5. From 1971 to 1986, students shifted substantially away from education and social/behavioral sciences (from 45 percent to 24 percent) and into business and technical/professional subjects (20 percent to 36 percent). Since then the distribution has been largely stable.

Comparing this pattern to trends in student labor supply (refer again to Figure 3), the shifts in subject area do not correspond with a particularly steep increase in student work. From 1971 to 1986 average weekly hours for full-time four-year students increased at a rate of 0.12 hours per year, while from 1986 to 2003 the increase was approximately 0.17 hours per year. Thus, even if shifts in majors could explain the trend in the earlier period, they cannot explain increasing labor supply since 1986. Moreover, combining trend data from the Department of Education with hours-by-major data from NPSAS suggests that shifts in subject area alone would predict an increase of only 0.27 hours since 1971, or about 6 percent of the actual increase over this time period.

It is never possible to rule out compositional changes on other unobserved dimensions, but taken together, the analyses above suggest a relatively small role for compositional change in explaining the increase over time. Incorporating student ability, better measures of family

[20] Note, these employment rates are significantly higher than the rates found in the October CPS, but unlike the CPS, students in the NPSAS were asked how much they worked "during the school year" rather than how many hours were worked "last week," as the CPS question is phrased.

background, and the possible role of shifting majors only explains up to 22 percent of the change over time—no more than the CPS analysis with its gross measures of student demographics.

B. Structural changes

If changes in student composition are not the primary cause of the increase in student labor supply, what else beyond credit constraints might explain the trend? In this section I consider several possibilities suggested by the theoretical framework: increases in student wages, increases in the returns to work experience, decreases in educational quality, institutional crowding, and changes in students' preferences. In many cases, I will utilize data from the 2003-2004 National Postsecondary Student Aid Survey. This dataset includes self-reported average hours worked during the school year and reasons for working, as well as detailed data on student characteristics, family background, school costs and financial aid.

Student wages. If the wages students can command have risen over time, this would provide an incentive to work more while in school.[21] The October CPS Earner Study provides an estimate of hourly wages for workers beginning in 1981. Figure 6 plots mean and median wages for 18 to 22 year old full-time, four-year college enrollees. Non-enrolled high school completers with less than a bachelor's degree are plotted for comparison. The trends in wages and labor supply (refer to Figure 3) do roughly correspond since 1993, with both rising from 1993 until about 2001 and then falling off. However, average hours of work rose by just as much between 1981 and 1993, when wages were declining. Thus, changes in student wages are not a particularly compelling explanation for the long-term trend in student labor supply.

[21] As noted above, if students are also adjusting their leisure time and if these wage increases are expected to persist beyond the college years, income effects may work in the opposite direction.

Another consideration is whether work-study assistance has increased over time (although in theory, any increase in wages due to an increase in work-study should be reflected in the wages students report in the CPS). But work-study recipients represent less than 20 percent of the working student population, and this fraction has been stable at least for the last decade.[22] Moreover, real federal expenditures on work study have remained flat at about $1.1 billion per year since 1970 (College Board, 2006, Table 2).

Returns to work experience. Previous literature (Ruhm 1997, Light 1998) suggests that students' in-school work experience may have labor market payoffs after graduation. Even if students' wages have not increased, it is possible that the non-wage benefits of working while in school have increased over time.

Work experience does not appear to be a primary motivation for student employment in general: only 8 percent of working students surveyed in the 2003-2004 NPSAS reported work experience as their "main reason" for working. More students say that their jobs are related to their major (27 percent) or helped with career preparation (37 percent), but this is still far from a majority of working students. It seems unlikely that a factor playing such a small role in cross section could explain such a dramatic increase over time. Even if not a single student worked primarily for work experience in 1970, this would still only explain 8 percentage points out of the 17 percentage point increase in employment rates.

Moreover, if work experience were an increasingly important factor, we might expect to see students shifting towards higher-skilled jobs. This does not appear to be the case.

[22] According to the College Board (Trends in Student Aid, 2005) there were 700,000 work-study recipients in 1994-1995 and 826,000 federal work-study recipients in 2004-2005. If all of these recipients were 18-22 years old, they would represent slightly less than 10 percent of all college enrollees in this age group, or less than 20 percent of working students. This corresponds from statistics from the 2003-2004 National Postsecondary Student Aid Survey (NPSAS), showing that about 19 percent of working full-time four-year students received any work-study assistance.

Occupation and industry codes are available only back to 1987 in the October CPS, but since then there has been surprisingly little change in the types of jobs students hold. As shown in Table 5, service, administrative, and sales occupations have consistently accounted for about two-thirds of student employment. Similarly, retail is the dominant industry for student workers, consistently accounting for more than 40 percent of students' jobs. While there have been slight shifts into and out of other industries and occupations, they are trivial in magnitude.

Is it possible that work experience might have increased in value, even if students are still filling the same relatively low-skilled jobs? There are at least two possibilities: first, work experience may have higher signal value than in the past. Working may be a means of distinguishing oneself beyond just enrolling in college—and this may be more important when enrollment rates increase. It is difficult to evaluate this hypothesis empirically, but if true, we might expect to see an increase in other sorts of extracurricular signals, such as unpaid internships, volunteer activities, and club participation. Volunteerism, at least, does appear to have increased at least since 1984. The Higher Education Research Institute (HERI), in annual surveys of four-year college freshmen, find that 83 percent of those surveyed in 2001 had performed some volunteer work in the past year, compared with 73 percent in 1984 (Astin et al., 2002).

A second possibility is that work has increased in value because of an increase in the variability of returns to schooling. To the extent that returns to work experience and returns to formal schooling are not perfectly correlated for a given individual, some investment in work can reduce risk separate from any effect on average payoffs. This might be called a human capital "portfolio diversification" strategy. Although this hypothesis is also difficult to evaluate empirically, we do know that income inequality within educational subgroups has increased substantially since 1970 (Katz and Autor, 1999). Still, with only 8 percent of working students reporting work experience as the main reason for working, it seems unlikely that either signaling or portfolio diversification are driving the increase over time.

Returns to schooling and the possibility of declining educational quality. The lower the labor market returns to schooling, the higher the incentive to work while enrolled. But returns to (observable measures of) schooling are clearly not a good candidate explanation for the increase in student employment, since these returns have been increasing over time. There is less evidence about trends in educational quality, mainly because educational quality is so difficult to measure.

As described in Section III, it is not theoretically clear that declining educational quality should lead students to shift time from school to work, but it is certainly possible (particularly if students are approaching a flat part of the educational production function). It is difficult to evaluate educational quality directly, but recent research by Babcock and Marks (2007) does provide suggestive evidence that the "time-cost" of college is falling: using multiple sources of survey data, the authors find that full-time college attendance required 40 per week in 1961 but only 23 to 26 hours per week in 2004. Babcock and Marks have only fairly granular measures of student labor supply. They find that the decline in study time corresponds with an increase in work, but also that study time has decreased even among non-workers. One explanation they offer for the decline in study time is that today's students may be "free-riding" off of the hard work of previous generations of students who established the high returns to a college degree.

There are two problems with this as an explanation for the trend in student employment. First, relying only on time use data leaves the direction of causality unclear. Students might work more because they are spending less time on school, or they might be working more for some other reason, and spending less time on school as a consequence. Second, if a college degree requires less effort than in the past, this does not square with the trend that students are taking longer to finish their degrees (Turner, 2005).

Institutional crowding. If institutional capacity has not kept up with rising enrollments, students may not be able to take all of the courses they need in a given semester, and this would increase the incentive to work. Bound and Turner (2006), comparing outcomes between birth cohorts of varying sizes, find suggestive evidence that those in large birth cohorts within states take longer to finish their degrees, which they hypothesize may be due to institutional crowding. It follows that students whose degree progression is slowed would have more time to work while in school.

Institutions may have difficulty adjusting to large and rapid fluctuations in enrollment, and every year there are reports about overcrowded college classrooms and dorms. But this does not necessarily imply that institutional capacity has failed to keep up with rising enrollments over the long term. In fact, student-faculty ratios have fallen to about 14, compared to 18 in 1970 (NCES, Digest of Education Statistics 2005, Table 169), and expenditures per full-time equivalent student have risen, even at public institutions (NCES, Digest of Education Statistics 2005, Table 339). Nonetheless, recent work suggests that these aggregate data may mask important changes in the distribution of institutional resources. Bound, Lovenheim, and Turner (2007) find that while resources per student have increased for private and the most selective public institutions, they have stagnated or declined over time for the remaining institutions.

The increase in labor supply is certainly stronger for students at public institutions. Since 1970, labor supply has risen from 5.1 to 10.1 hours per week among full-time students at four-year public institutions. It has risen from 4.5 to 7.9 hours per week for equivalent private-college enrollees, a smaller but still substantial increase. If institutional crowding plays no role at these private institutions, but explains all of the difference in labor supply trends between public and private enrollees, then institutional crowding could explain up to 27 percent of the increase in labor supply over time.[23] This is a generous upper bound; the true effect will be smaller if other factors such as compositional change or credit constraints apply disproportionately to public enrollees.

Changes in consumption preferences. Student employment might be on the rise if students simply take less leisure time than in the past. There is some evidence that rising inequality may lead to the devaluation of leisure time, by increasing the marginal utility of consumption (MUC) for those at the middle and bottom of the income distribution. Bowles and Park (2004) posit that the MUC is influenced by what they call "Veblen effects," in reference to Thorsten Veblen's theory that individual consumption is driven by a desire to emulate the consumption standards of the rich. Their model implies that when inequality increases, the MUC increases disproportionately for those in the middle and bottom of the income distribution, and so they increase their hours of work.

Little is known about trends in leisure time among college students, but what evidence there is suggests leisure may have increased rather than decreased. Babcock and Marks (2007) do not have direct measures of leisure but conclude that given dramatic declines in study time among college students, leisure has likely increased. More reliable data are available for the broader population, and we might expect college students to mirror broader trends: Aguiar and Hurst (2006) find that leisure time has increased, not decreased, for working-aged adults in the U.S. since 1965. Using the same data plus additional earlier sources, Ramey and Francis (2006)

[23] This calculation assumes that institutional crowding explains the full difference-in-difference of hours worked between public and private enrollees (1.6 hours), weights this by the fraction of enrollees that are at public institutions in 2003 (77 percent) and divides by the total increase of 4.6 hours (1.6*0.77/4.6=27 percent).

find that "per capita" leisure time has remained roughly constant since 1900 when children and the elderly in the analysis. In any case, there is little evidence to suggest that students' increased labor supply corresponds with any broad decline in leisure time.

C. Credit constraints in combination with rising real tuition costs

None of the alternative hypotheses above can fully explain the dramatic increase over time in student labor supply. I now turn to an evaluation of the remaining hypothesis: credit constraints in conjunction with rising college costs. With over half of college students working in a given week, and with the increase in student labor supply evident among nearly all types of students, credit constraints would have to be pervasive in order to explain the trend over time.

College costs have certainly risen dramatically over the past 30 years, even after accounting for inflation. As shown in Figure 7, average tuition and fee charges have risen substantially at all institution types since 1981. At public four-year institutions, which enroll the majority of 18 to 22 year old students, costs increased by 155 percent, from $2,000 in 1981 to over $5,100 in 2003. Costs have also more than doubled at two-year and private four-year institutions. Costs have increased even after accounting for increases in financial aid: the College Board estimates that just since 1996, net prices have increased by 29 percent (in real terms) at public four-year institutions and 22 percent at private four-year institutions.

Even wealthier families can feel pinched by these cost increases. Wealthy students tend to attend significantly pricier schools in the first place (College Board, 2006) and are more likely to have siblings enrolled at the same time (author's calculations using NPSAS:04). Among the wealthiest quartile of full-time four-year enrollees, the median net cost of attendance as a percentage of family income (tuition, fees, room and board minus grant assistance, divided by family income) was 18 percent in 2003-04.[24] Still, poor students are clearly the worse off: the same statistic for the poorest quartile of students was 52 percent in 2003-04.

It is tempting to try to break this trend down further, to see whether periods of particularly rapid tuition increases correspond with steeper increases in student employment (they do not). Unfortunately, the interpretation of such an exercise is complicated by the strong relationship between tuition increases and economic conditions. The effect of economic conditions on student employment may dwarf any effects of rising tuition, and tuition and fees at public institutions increase fastest when economic conditions are poor (see Figure 8). Schools are likely responding to a combination of increased enrollments and tight state budgets during these periods. Because public tuition and fees are set at the state level, looking at trends within states does nothing to ameliorate this bias.

One is left then to evaluate more circumstantial evidence for and against the role of credit constraints. Despite rising costs, much of the previous economic literature concludes that either that credit constraints do not exist, or that they apply only to relatively few students. For example, Cameron and Taber (2004) utilize several strategies including an instrumental variables approach to conclude that borrowing constraints are quantitatively unimportant. Their empirical analysis, however, is based on the questionable assumption that foregone earnings need not be financed. They argue that increases in the opportunity cost of schooling (as measured by foregone wages) thus should have similar effects for constrained and unconstrained students, while increases in direct costs should disproportionately affect constrained students.

On the contrary, as discussed above in Section III, for students to be truly unconstrained they must be able to finance the consumption level they would have enjoyed as a non-student,

[24] Author's calculations using NPSAS:04 data on dependent, full-time, full-year four-year college enrollees. Figure is adjusted to account for number of children enrolled.

including expenditures on clothes, housing, entertainment, and so on. If foregone wages rise, unconstrained prospective students faced with an increasingly cushy counterfactual lifestyle can simply borrow more (or dip further into savings) in order to ensure that they lead an equivalently cushy lifestyle as a student. But credit-constrained prospective students faced with an increasingly cushy counterfactual lifestyle may find this counterfactual increasingly difficult to resist when compared to life as a poor student. Thus changes in opportunity costs may differentially affect constrained and unconstrained students, just as changes in direct costs do.

Carneiro and Heckman (2002) compare college enrollment and completion across income groups using the NLSY-79, controlling for ability and demographic characteristics, and calculate that the differences in outcomes by income suggest that no more than 8 percent of the U.S. population was credit constrained in the late 1970s and early 1980s. This calculation is based on the untested assumption that students in the top quartile of family income are completely unconstrained. Belley and Lochner (2007) update this analysis using data from the NLSY-97 and conclude that borrowing constraints are worsening as measured by these income differentials. They concede, however, that they find large income effects on college enrollment even for the top half of the income distribution, evidence which they find "difficult to reconcile" with borrowing constraints.

Keane and Wolpin (2001) present simulation evidence that borrowing constraints are "severe," affecting a majority of students regardless of background, and they find that these constraints are much more likely to affect students' consumption and work decisions rather than college enrollment or completion. However, they also find evidence of significant parental transfers that could mediate these constraints for many students. They find that the children of the most educated parents receive transfers that are nearly twice the cost of college, and four times as large as the transfers received by students with the least educated parents. So the question remains: could credit constraints affect enough middle- and upper-class students to plausibly explain the employment trends even for these groups?

One way to measure credit constraints directly is simply to ask students, “Could you afford college without working?” A student who responds “No” to this question is almost by definition credit constrained. In this case perception equals reality: it matters little for behavior (though immensely for policy) whether the student actually has no access to credit, or simply perceives she does not. Table 6 presents employment statistics, along with responses to this question for 18 to 22-year-old full-time four-year working students in the 2003-04 NPSAS. The statistics are broken out by income quartiles, where quartiles are defined over this sample of dependent, full-time four-year enrollees.

The pattern of responses raises several points. First, about half of working students say they could not afford school without working. This suggests that credit constraints are a significant factor in students’ employment choices, even if they are not the only factor. Second, responses clearly correlate with family income, but the biggest gap on this “affordability” question is between the top two income quartiles: working students in the upper-middle quartile are 16 percentage points more likely to say they could not afford school without working than those in the top quartile. The difference between the middle two quartiles is 9 percentage points, and between the bottom two quartiles, less than 3 percentage points. Third, even among working students in the top quartile (with a median family income of $143,000), nearly one in three responded that college would be unaffordable without a job. This suggests that credit constraints may be a significant factor in student employment decisions, even among the rich.

Unfortunately, the "affordability" question was not asked in earlier iterations of the NPSAS.[25] However, an annual survey of four-year college freshman by the Higher Education Research Institute (HERI) has asked general questions about students' ability to pay for college as well as the role of financial considerations in choosing a college since 1966 (Astin et al., 2002). The percentage of students reporting major concern about ability to pay ("not sure I will have enough funds") was 12.4 percent in 2001 compared with 8.3 percent in 1966, although the trend has not been steadily upward.[26] The percent reporting "financial assistance" or "low tuition" as important factors in the college decision has risen steadily and dramatically since the mid-1970s, although it has fallen somewhat since 1997 (see Figure 9).

Table 6 also sheds light on the types of constraints facing different families. Working students from the bottom quartile are almost twice as likely as those in the top quartile to say that their primary reason for working is to pay tuition and fees (62 percent versus 35 percent), and half as likely to say they work primarily to pay "living expenses" (27 percent versus 50 percent). This supports the hypothesis that low-income families are more likely to face strict constraints while the rich are more likely to face fuzzy constraints. Finally, the third panel of Table 6 indicates that both external and internal constraints may be important for those who report they couldn't afford school without working. About half of these students took out the maximum student loan, an indicator that they may face binding external credit constraints. On the other hand, half did not, suggesting an internally-imposed constraint. Interestingly, among those eligible for a subsidized student loan, poor students were slightly *more* likely than eligible rich students to decline these loans.

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[25] The question first appeared in 2000, allowing little opportunity to look at long-term trends.

[26] The proportion reporting "major concerns" rose between 1966 and 1973, was relatively flat between 1973 and 1989, increased between 1989 and 1995, and has fallen since then.

To summarize, the case for tightening credit constraints is admittedly circumstantial, but rests on these two facts: 1) recent data suggest that such constraints are a primary driver of student employment in cross-section, even for wealthy students, and 2) trends in college costs provide a clear reason for why these constraints may have worsened over time. Time trends in students' reported financial concerns are consistent with this hypothesis.

V. Discussion and Policy Implications

This paper has documented and attempted to explain the large increase over time in student employment. Demographic changes, including shifts in ability, income, and family background can explain no more than 16 to 22 percent of the increase. Shifts in students' major choices may explain an additional 6 percent of the increase. Institutional crowding may explain up to 27 percent, but this is a very generous upper bound, one that assumes that compositional shifts and credit constraints explain none of the difference in trends between public and private institutions.

Tightening credit constraints is one explanation that is both powerful enough to explain the change over time, and is consistent with the available evidence. But these credit constraints may not be the strict, externally-imposed constraints traditionally envisioned by economists and policymakers. As a result, broadening credit access may not be a complete solution.

When the full opportunity costs of college attendance are considered, even wealthy students may face "fuzzy" constraints. Since the opportunity cost of college is inherently unobservable, it is unclear whether expanding credit access would improve efficiency in this case. Expanding credit may simply increase students' consumption expectations. For example, Cadena and Keys (2006) develop a model and provide suggestive evidence that students who suffer from self-control problems may avoid credit in order to constrain their consumption while in school.[27] Further research in this area is needed to determine how students set their consumption expectations and to what extent these expectations may be influenced by available funding.

Strict credit constraints are much more plausible for students lower in the family income distribution, especially given the diminishing purchasing power of federal need-based aid. But even for strictly constrained students, expanding credit access may not be a panacea. As shown above, most working students in the bottom quartile of family income say that the main reason they work is to pay their tuition and fees, and they cannot afford school without working (refer to Table 7). Yet about 40 percent of these students declined to take out the full federally-subsidized interest-free student loans for which they were eligible. This suggests that credit constraints may be due in part to debt aversion rather than a lack of credit access. Recent research by Field (2006) provides strong evidence that law school students experience significant disutility from holding educational debt; presumably undergraduates do as well.

Finally, it is worth noting that all debt is not made equal. If credit is available, but only on risky or confusing terms, students may rationally avoid it. For example, federal student loans typically must be repaid in equal monthly installments within ten years following graduation. Students' repayments are highest (in real terms) immediately after graduation, when income is lowest and most variable. Taking a larger loan may allow students to work less while in school, but even if this is a positive tradeoff on average, it is not without risk. Students may perceive the risks as even higher if they have trouble understanding the terms of the loan, and thus may prefer

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[27] The paper estimates the difference-in-difference in loan take-up between on-campus and off-campus students at schools where loans would and would not cover room and board charges (i.e. the loan exceeds tuition and fees). Off-campus students are more likely to decline loans when they attend schools where the loan exceeds tuition and fees. The authors attribute this to the fact that such students would receive part of their loan in cash, rather than having the full amount paid to the school.

simpler loans (e.g. credit card debt) even when they are more expensive. Further research is needed to evaluate the sources and prevalence of debt aversion, as well as whether it is sensitive to the particular form and framing of the loan.

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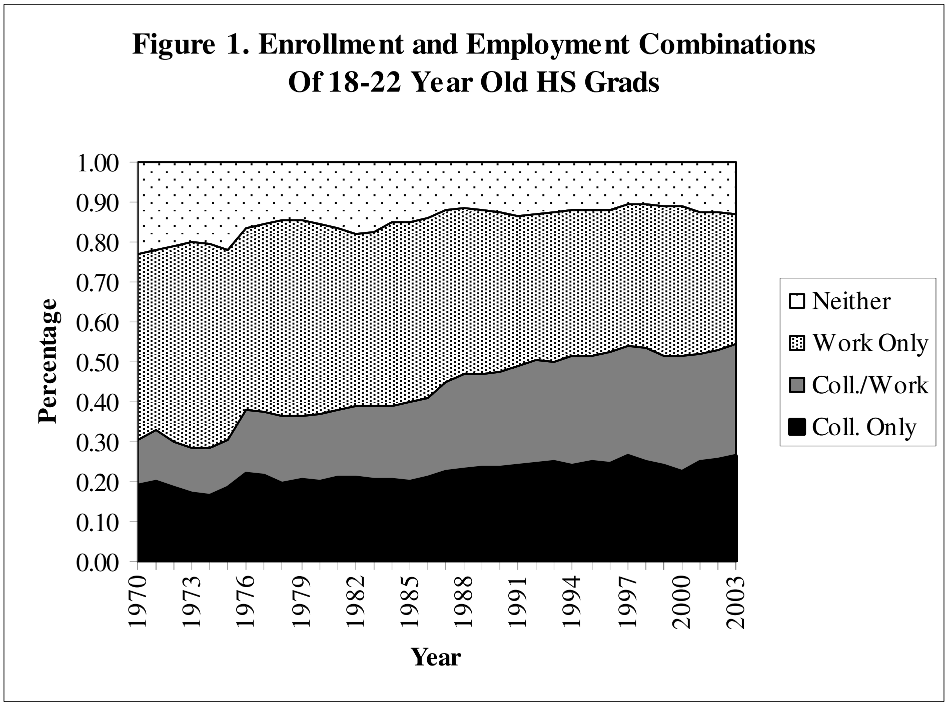
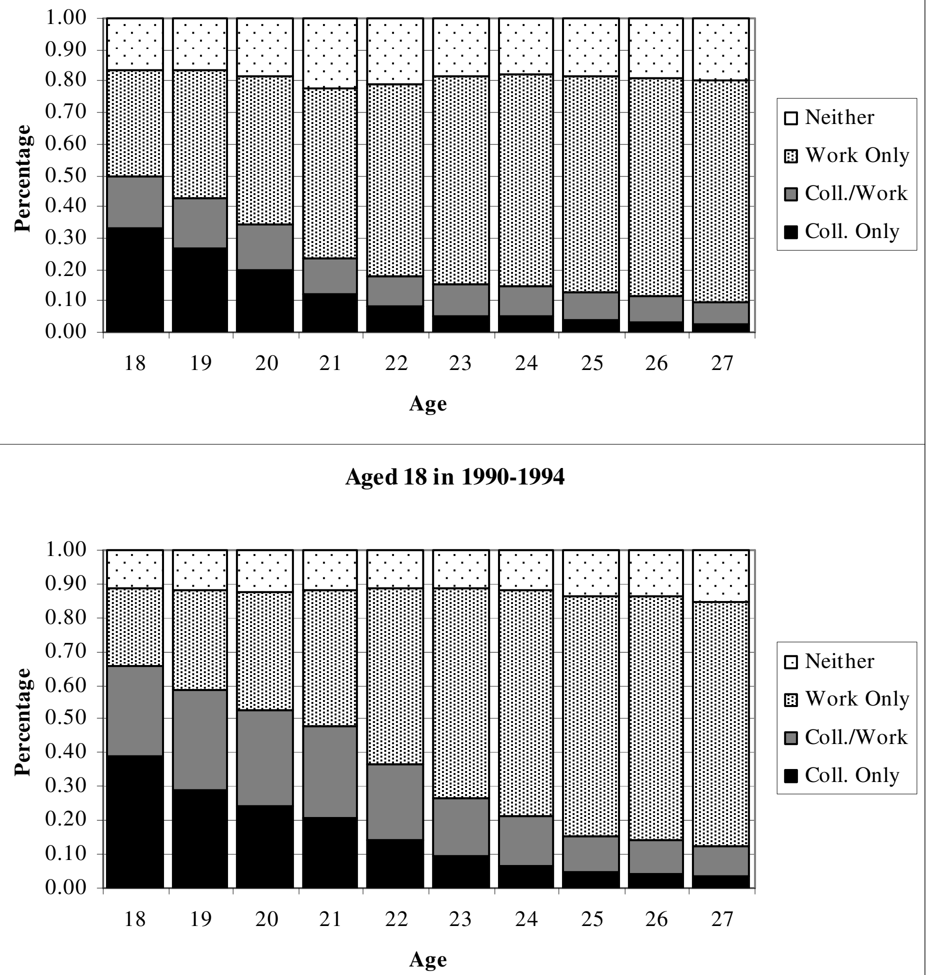
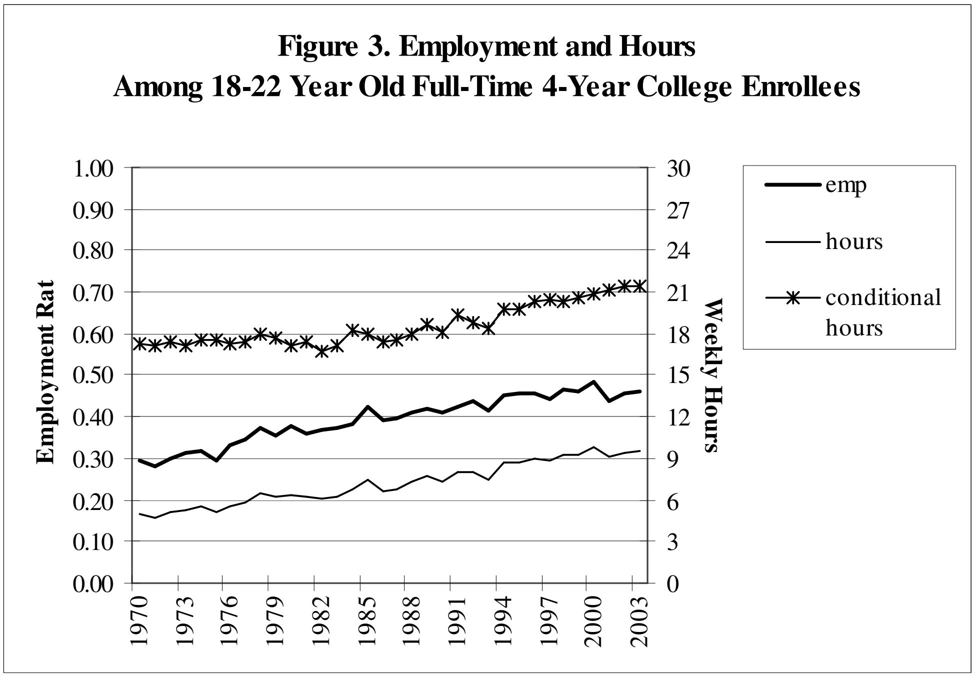


Source: Author's calculations using October Current Population Survey, 1970-2003, compiled by Unicon Corp.
Notes: College refers to part- or full-time enrollment in a two- or four-year institution. Employment refers to part- or full-time paid employment in the past week.

Figure 2. Enrollment and Employment Combinations
Over Time of Those Aged 18 in 1970-1974

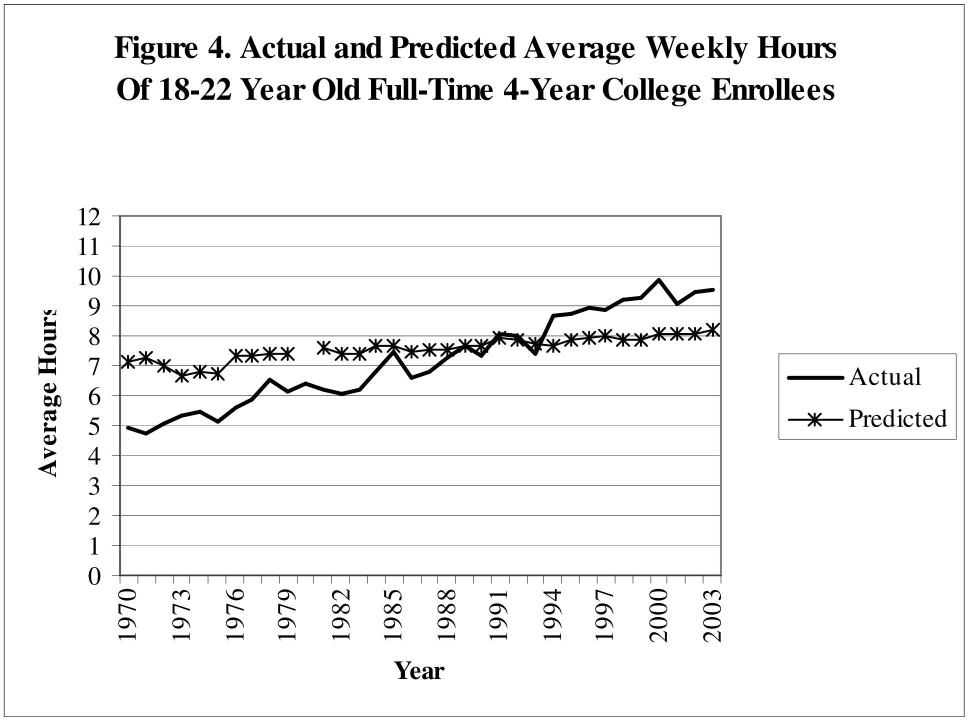


Source: Author's calculations using October Current Population Survey, 1970-2003, compiled by Unicon Corp. Simulated cohorts are generated by linking those aged 18 in 1970 with those aged 19 in 1971, 20 in 1972, and so on.
Notes: College refers to part- or full-time enrollment in a two- or four-year institution. Employment refers to part- or full-time paid employment in the past week.



Source: Author's calculations using October Current Population Survey, 1970-2003, compiled by Unicon Corp.

Notes: Average hours include zeroes for non-workers. Conditional hours represent averages among working students only.



Source: Author's estimates using October Current Population Survey, 1970-2003, compiled by Unicon Corp.

Notes: Average hours include zeroes for non-workers. Predictions are based on parameter estimates from a regression of average hours on race/ethnicity, gender, age, region, family income quartile, parental education dummies, dependency status, and public/private enrollment status. Public/private enrollment status is missing for all students in 1980 and is thus omitted. Family income and parental education are available only for dependent students; for other students these variables are set to zero and the dependency dummy serves as the missing data indicator.

Table 1. Types of Credit Constraints

	Source of constraint	
Margin of constraint	External	Internal
Strict	Student cannot borrow the minimum required to pay tuition and basic living expenses. Likely to apply mainly to students from low-income families (or those estranged from their parents)	Students can borrow the minimum required to pay tuition and basic living expenses, but do not want to. May apply to anyone, but mainly becomes an issue for low-income students (or those estranged from their parents)
Fuzzy	Students can borrow the minimum required to pay tuition and basic living expenses, but not the full opportunity cost of attendance. Worse for lower-income students, but may apply across the income scale (particularly if parents' generosity is bounded).	Students can borrow the full direct and opportunity cost of attendance, but do not want to. May apply to anyone.

Table 2
NLSY-79 and NLSY-97 Regression Results
Dependent Variable: Average Hours of Work, First College Year (Four-Year Enrollees)

	NLSY-1979 Cohorts			NLSY-1997 Cohorts		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Variable	Coef. (S.E.)	Coef. (S.E.)	Coef. (S.E.)	Coef. (S.E.)	Coef. (S.E.)	Coef. (S.E.)
AFQT pctile: 20-29	-6.954 ***	-6.766 ***	-6.394 ***	1.301	1.517	1.124
	(2.245)	(2.245)	(2.221)	(2.471)	(2.475)	(2.461)
AFQT pctile: 30-39	-4.781 **	-4.364 *	-3.98 *	-1.367	-1.24	-1.275
	(2.229)	(2.241)	(2.222)	(2.391)	(2.395)	(2.390)
AFQT pctile: 40-49	-3.936 *	-3.529	-3.538	1.87	1.79	1.264
	(2.266)	(2.272)	(2.270)	(2.161)	(2.167)	(2.160)
AFQT pctile: 50-59	-1.521	-0.883	-1.712	-0.563	-0.292	-0.406
	(2.051)	(2.073)	(2.125)	(2.123)	(2.137)	(2.148)
AFQT pctile: 60-69	-0.327	0.475	-0.218	0.852	1.042	1.315
	(1.921)	(1.951)	(1.988)	(2.082)	(2.089)	(2.102)
AFQT pctile: 70-79	-2.976	-2.166	-2.989	-0.035	0.247	-0.02
	(1.824)	(1.862)	(1.940)	(2.006)	(2.015)	(2.031)
AFQT pctile: 80-89	-6.163 ***	-5.245 ***	-6.142 ***	-0.658	-0.323	-0.111
	(1.810)	(1.854)	(1.957)	(1.951)	(1.965)	(2.002)
AFQT pctile: 90-99	-4.88 ***	-3.95 **	-4.338 **	-1.754	-1.419	-0.838
	(1.773)	(1.814)	(1.936)	(1.927)	(1.944)	(1.980)
Parents' income: Q2		-1.457	-1.007		1.522	1.264
		(1.275)	(1.334)		(1.147)	(1.145)
Parents' income: Q3		-1.978	-1.755		1.032	2.000 *
		(1.238)	(1.389)		(1.060)	(1.103)
Parents' income: Q4 (top)		-2.958 **	-2.486 *		-0.574	1.401
		(1.181)	(1.398)		(1.002)	(1.095)
Missing parents' income		-0.852	-0.892		-0.943	-1.305
		(1.226)	(1.209)		(1.382)	(1.379)
Age 19			0.324			1.253
			(0.899)			(0.866)
Female			-1.786 **			1.26 *
			(0.713)			(0.723)

(continued)

Table 2 (continued)

Variable	NLSY-1979 Cohorts Model 1 Coef. (S.E.)	Model 2 Coef. (S.E.)	Model 3 Coef. (S.E.)	NLSY-1997 Cohorts Model 1 Coef. (S.E.)	Model 2 Coef. (S.E.)	Model 3 Coef. (S.E.)
Race: Black, non-hispanic			-2.343			-1.797
			(1.636)			(1.780)
Race: Hispanic			0.754			2.606
			(2.389)			(1.919)
Gender*Race: Black female			0.12			-0.699
			(2.017)			(2.184)
Gender*Race: Hispanic female			0.845			-1.597
			(3.296)			(2.706)
Region: North central			1.787 *			1.423
			(0.916)			(0.902)
Region: South			1.158			-0.416
			(0.920)			(0.944)
Region: West			5.352 ***			-0.729
			(1.184)			(1.078)
Central city			-1.749 **			1.218
			(0.832)			(0.829)
Outside MSA			0.361			-0.588
			(0.941)			(0.932)
Mother's ed: High school			0.691			-2.146
			(1.268)			(1.591)
Mother's ed: Some coll			1.512			-2.769 *
			(1.468)			(1.619)
Mother's ed: BA or above			-0.536			-3.637 **
			(1.416)			(1.644)
Missing mother's ed			1.283			-4.562 **
			(2.006)			(2.171)

(continued)

Table 2 (continued)

	NLSY-1979 Cohorts			NLSY-1997 Cohorts		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Variable	Coef. (S.E.)	Coef. (S.E.)	Coef. (S.E.)	Coef. (S.E.)	Coef. (S.E.)	Coef. (S.E.)
Father's ed: High school			1.314			0.568
			(1.188)			(1.611)
Father's ed: Some coll			0.493			0.548
			(1.392)			(1.672)
Father's ed: BA or above			0.278			-1.106
			(1.268)			(1.660)
Missing father's ed			0.108			-0.567
			(1.648)			(1.912)
Single parent family			-0.058			2.836 ***
			(0.962)			(1.044)
Family size			0.645 ***			-0.133
			(0.241)			(0.292)
Lives with one/both parents			-6.183 ***			-2.263
			(1.727)			(1.386)
Constant	12.423 ***	13.839 ***	9.788	10.672 ***	10.16 ***	-10.927
	(1.653)	(1.806)	(17.702)	(1.817)	(1.919)	(16.963)
N	909	909	909	1192	1192	1192
r2	0.04	0.05	0.12	0.01	0.02	0.07

Source: Author's calculations using NLSY-79 and NLSY-97 datasets.
Notes: Family background characteristics are measured as of the year prior to college enrollment. Missing data are filled with data from previous survey waves if available. For those missing AFQT and/or family income, these variables were imputed using linear predictions based on student's age, race, gender, and parents' educational attainment and marital status. Cutpoints for AFQT deciles and income quartiles are based on all members of an age cohort, not just those who attended college.

Stars indicate statistical significance: ***=p<.01, **=p<.05, *=p<.10.

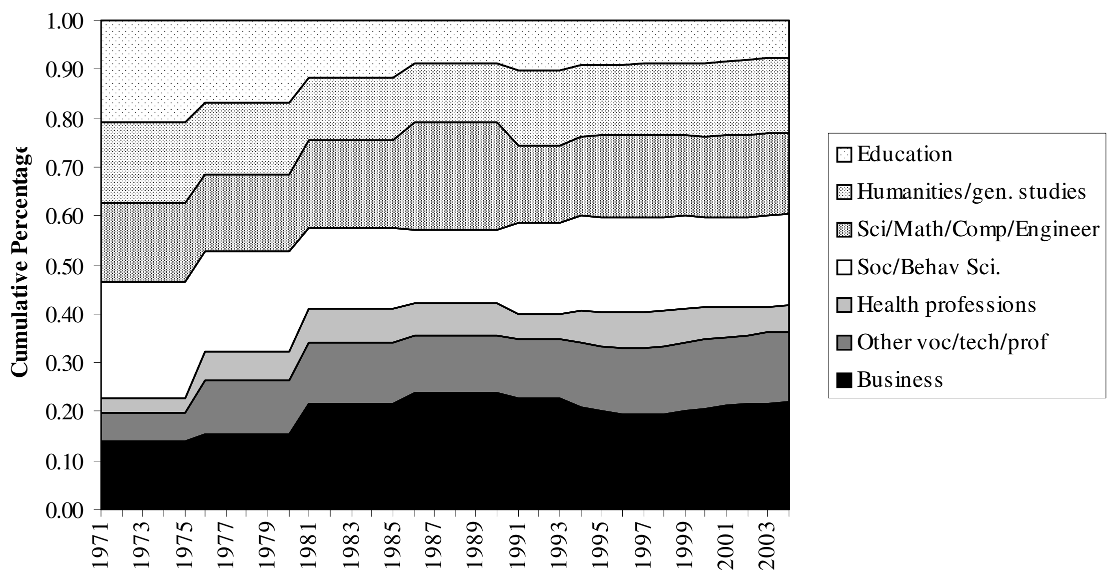
Table 4

Student Employment By Major

Major	Average Hours	Percent employed	Conditional Hours
Humanities	14.9	0.75	19.7
Soc/behav sci	14.9	0.73	20.3
Sci/math/comp/engineering	13.1	0.67	19.6
Education	14.9	0.75	19.9
Business	15.9	0.71	22.3
Health	13.8	0.71	19.5
Other tech/profe	15.9	0.73	21.8
Total	14.7	0.72	20.5

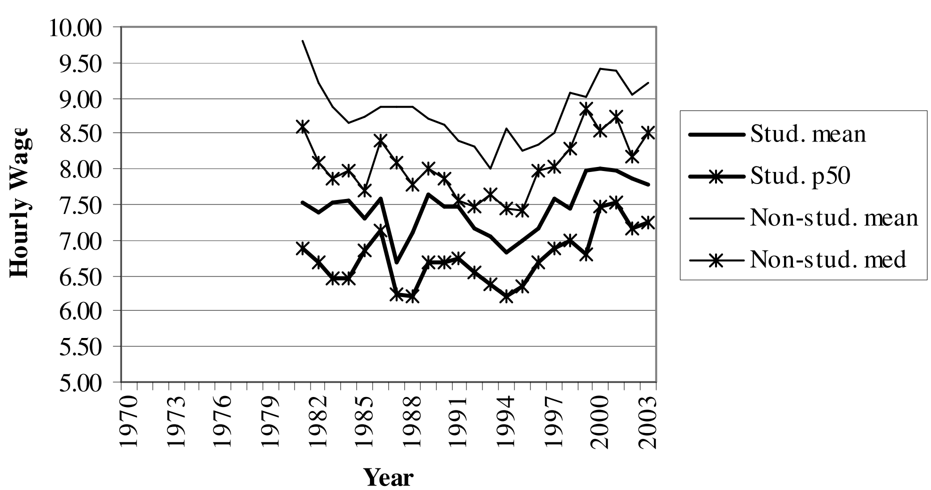
Source: 2003-2004 NPSAS student survey data for full-time four-year enrollees.

Figure 5. Distribution of BA Degrees Conferred



Source: Author's calculations using data from NCES, Digest of Education Statistics 2005, Table 249.
Notes: Data were collected annually beginning in 1994. Prior to 1994 data were updated only every 3-5 years.

Figure 6. Mean and Median Hourly Wages Of Employed 18-22 Year Old High School Graduates (College Students vs Non-Students)



Source: Author's calculations using October Current Population Survey Earner Study, 1981-2003, compiled by Unicon Corp.
Notes: Average hourly wages apply to workers only. Students here are full-time four-year enrollees. Non-students here are those not enrolled in any program and who have not already earned a bachelor's degree.

Table 5

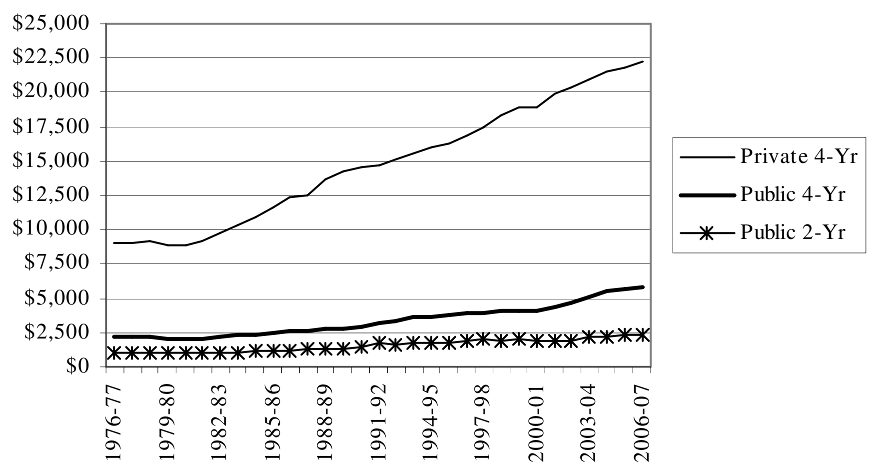
Occupation and Industry
18-22 Year Old Employed Full-Time Four-Year College Undergraduates, 1983-2002

	Time Period			
Detailed occupation:	1983-1987	1988-1992	1993-1997	1998-2002
Service, except protective and household	22.76	24.23	25.29	23.44
Administrative support including clerical	24.02	23.54	21.66	22.48
Sales	21.16	20.82	21.33	20.96
Professional specialty	8.81	9.23	8.95	10.55
Handlers, equip cleaners, helpers, laborers	6.24	5.16	5.53	5.05
Technicians & related support	3.61	3.37	3.62	3.62
Executive, administrative, and managerial	3.10	2.65	2.97	3.49
Precision production, craft, and repair	2.02	2.19	2.11	2.37
Farming, forestry, and fishing	2.05	1.82	1.93	2.32
Transportation & material moving	1.98	2.07	2.36	1.95
Protective service	1.75	1.99	1.61	1.56
Machine operators, assemblers, inspectors	1.41	1.77	1.77	1.42
Private household service	1.10	1.15	0.87	0.79

	Time Period			
Detailed industry:	1983-1987	1988-1992	1993-1997	1998-2002
Retail trade	39.15	38.48	39.28	38.38
Prof-Educational services	27.98	25.84	24.21	22.53
Entertainment and rec services	2.37	3.17	5.06	5.28
Business, auto and repair serv	4.04	3.60	3.55	4.45
Finance, insurance, and real estate	2.98	2.90	3.38	3.74
Prof-Other professional services	2.66	2.72	3.50	3.44
Prof-Social services	1.48	1.67	2.33	3.06
Prof-Medical serv, except hospitals	1.84	2.21	2.31	2.79
Personal services - private hholds	1.98	2.91	2.68	2.15
Prof-Hospitals	2.20	2.56	1.66	1.98
Agriculture	1.53	1.54	1.60	1.88
Manufacturing-Durable goods	1.69	1.70	1.73	1.70
Transportation	1.75	2.04	1.88	1.65
Wholesale trade	1.18	1.50	1.42	1.26
Construction	1.37	1.15	1.11	1.23
Manufacturing-Nondurable goods	2.10	2.25	1.86	1.20
Public administration	1.02	1.46	0.64	1.17
Communications	0.72	0.56	0.50	0.90
Personal services excl private hholds	1.55	1.34	0.95	0.83
Utilities and sanitary service	0.28	0.33	0.29	0.33
Mining	0.07	0.07	0.05	0.05
Forestry and fisheries	0.06	0.01	0.00	0.00
Number of observations	5,317	5,658	5,114	5,508

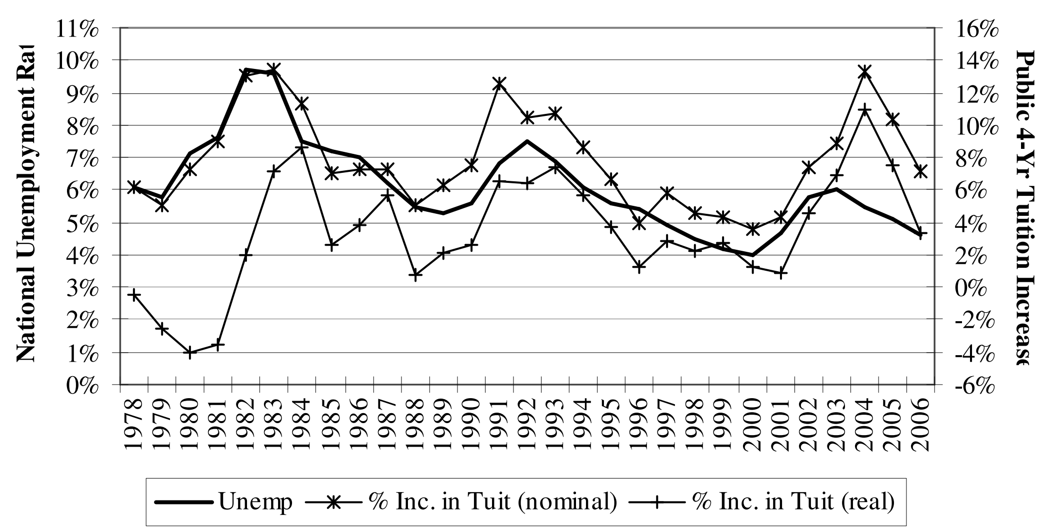
Source: Author's tabulations from October CPS, Unicon version, 1970-2003, using CPS final weights. Data from 1980 omitted in regression because of missing public/private status. Occupation/industry are sorted according to their frequency in 1998-2003.
Notes: Groupings provided by Unicon to enable consistent comparisons over time. This particular variable is only available from 1983-2002.

Figure 7. Tuition and Fees Over Time (2006$)



Source: College Board, Trends in College Pricing 2006, Pricing Tables. Original source for data 1987-88 through 2006-07: Annual Survey of Colleges, The College Board. Original source for earlier data: Integrated Postsecondary Education Data System (IPEDS), U.S. Department of Education.

Figure 8. Tuition Increases and Economic Conditions



Source: National unemployment rate from the Bureau of Labor Statistics. Annual tuition increases for public four-year institutions calculated using tuition and fees data from The College Board. Figures for the 1977-78 school year are compared with the unemployment rate for 1978, and so on.

Table 6

Employment and Reasons for Work, By Family Income
18-22 Year Old, Full-time Full-year Dependent Four-Year College Enrollees

Variable	All	Bottom Quartile	Q2	Q3	Top Quartile
Average weekly hours of work	14.00	15.18	15.14	13.86	11.82
Employed during school year	0.70	0.72	0.74	0.71	0.63
Conditional weekly hours of work	19.99	21.18	20.45	19.46	18.69
Received any federal work-study aid	0.19	0.27	0.22	0.16	0.10
Median income	$74,530	$21,200	$51,669	$81,119	$144,168
Sample size	17,045	4,431	4,209	4,116	4,289
Working students only*					
Main reason for employment					
Pay tuition and fees	0.50	0.62	0.56	0.47	0.35
Pay living expenses	0.38	0.27	0.34	0.40	0.50
Work experience	0.08	0.07	0.07	0.08	0.12
Cannot afford school without working	0.47	0.58	0.55	0.46	0.30
Median income	$74,003	$21,634	$51,703	$80,982	$142,631
Sample size	9,172	2,311	2,379	2,339	2,143
Students who "cannot afford school without working"					
Took out maximum federal student loan**	0.50	0.44	0.53	0.52	0.49
Took out loan, but less than maximum	0.10	0.14	0.10	0.09	0.06
Took out no loan	0.40	0.41	0.37	0.38	0.45
Eligible for any subsidized loan	0.77	0.98	0.94	0.62	0.27
Of these, took out less than max sub loan	0.55	0.57	0.55	0.52	0.54
Of these, fully declined a subsidized loan	0.39	0.41	0.40	0.36	0.34
Sample size	4,210	1,310	1,259	1,027	614

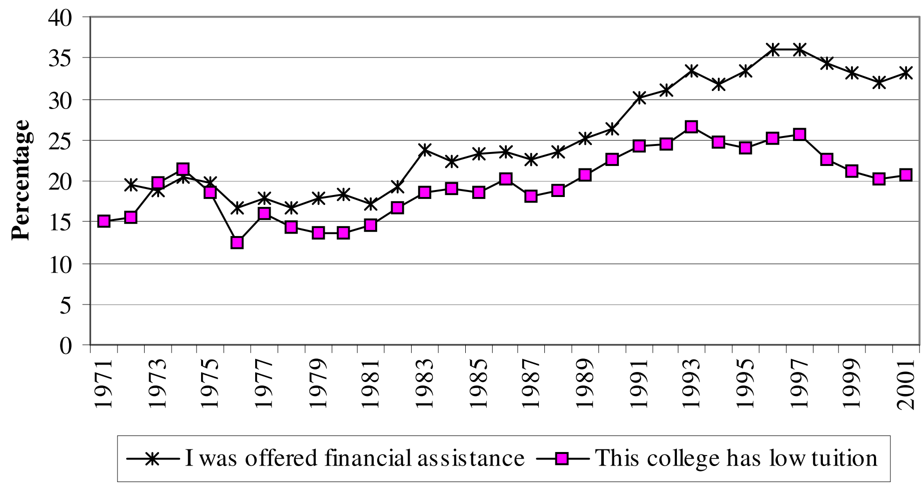
Source: Author's calculations using NPSAS:2003-04 data.

Notes: Income quartiles are defined over this sample of full-time dependent four-year enrollees.

*Students who exclusively worked at a work-study job were not asked the questions about the main reason for working or whether school could be afforded without working. Thus these students are excluded in the bottom two panels of the table.

**Students are eligible for federally-guaranteed loans regardless of need. Subsized loans are based on need, a combination of financial status and cost of attendance.

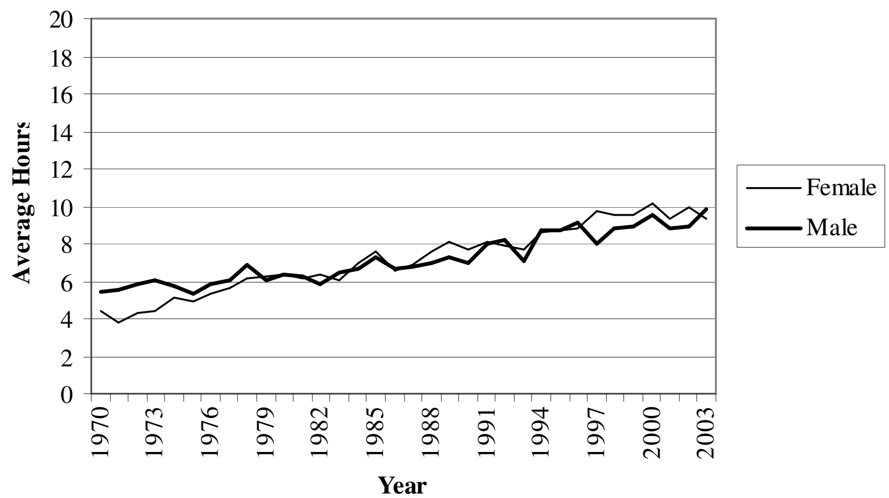
Figure 9. "Very important" reasons for choosing particular school



Source: Higher Education Resource Institute student survey data (Astin 2002).

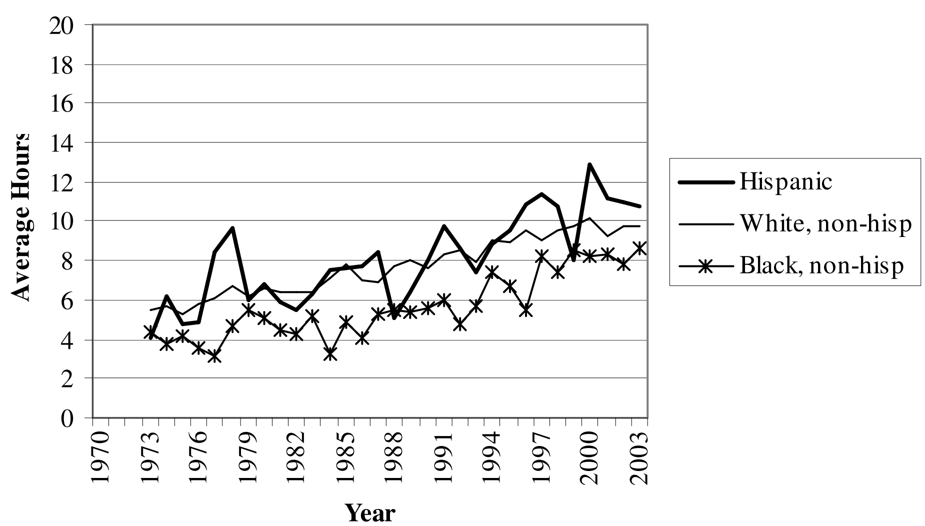
APPENDIX TABLES AND FIGURES

Figure A1. Average Weekly Hours Of 18-22 Year Old Full-Time 4-Year College Enrollees, By Gender



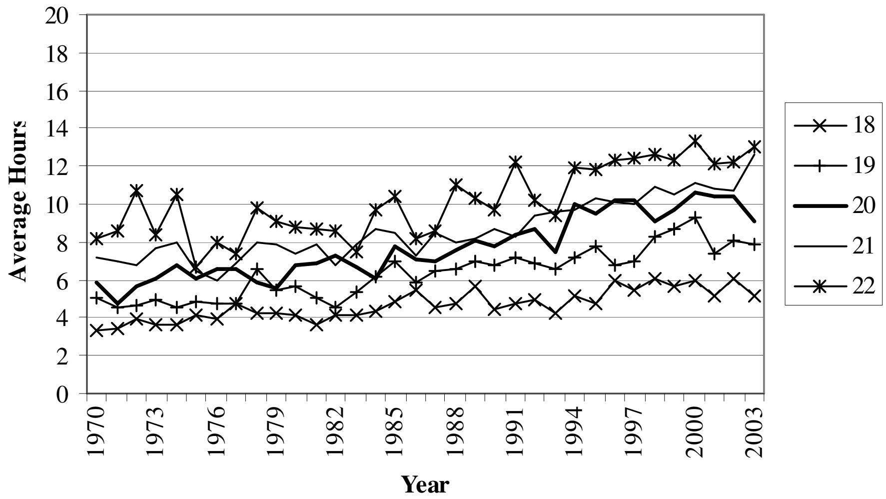
Source: Author's calculations using October Current Population Survey, 1970-2003, compiled by Unicon Corp.
Notes: Average hours include zeroes for non-workers.

Figure A2. Average Weekly Hours Of 18-22 Year Old Full-Time 4-Year College Enrollees, By Race/Ethnicity



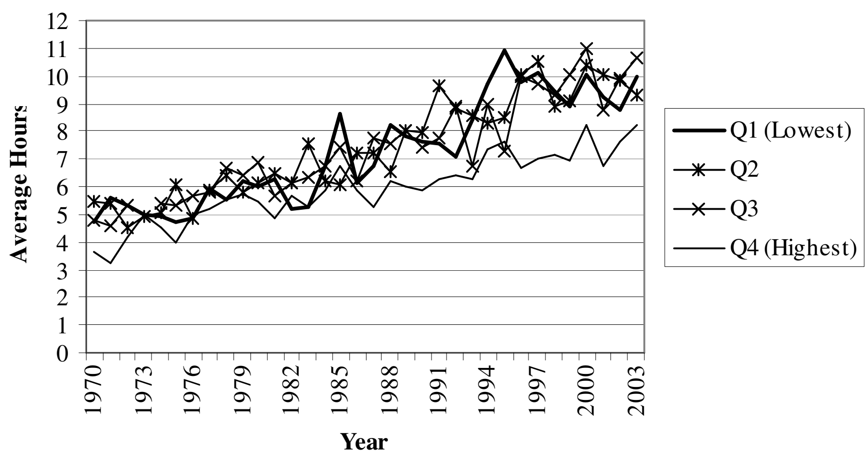
Source: Author's calculations using October Current Population Survey, 1970-2003, compiled by Unicon Corp.
Notes: Average hours include zeroes for non-workers. Hispanic ethnicity data not available until 1973.

Figure A3. Average Weekly Hours Of 18-22 Year Old Full-Time 4-Year College Enrollees, By Age



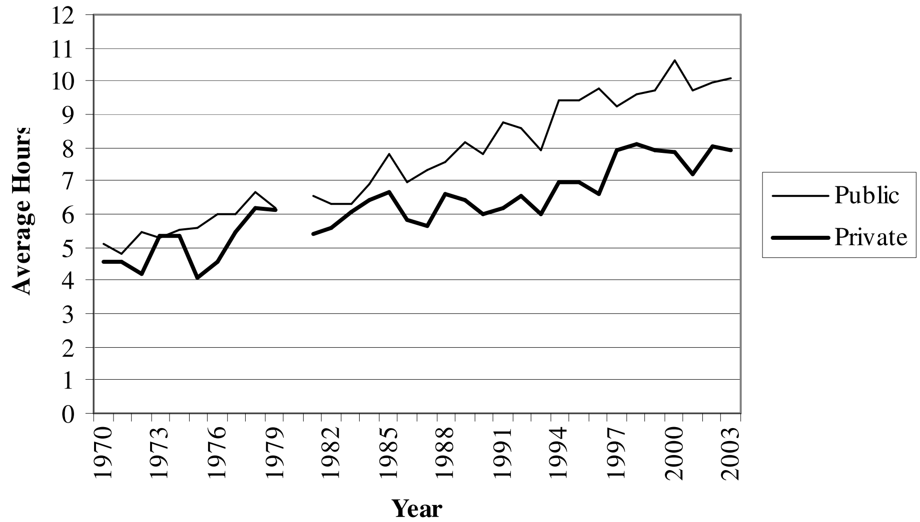
Source: Author's calculations using October Current Population Survey, 1970-2003, compiled by Unicon Corp.
Notes: Average hours include zeroes for non-workers.

Figure A4. Average Weekly Hours Of 18-22 Year Old FT 4-Year College Enrollees, By Family Income Quartile (Dependent Students Only)



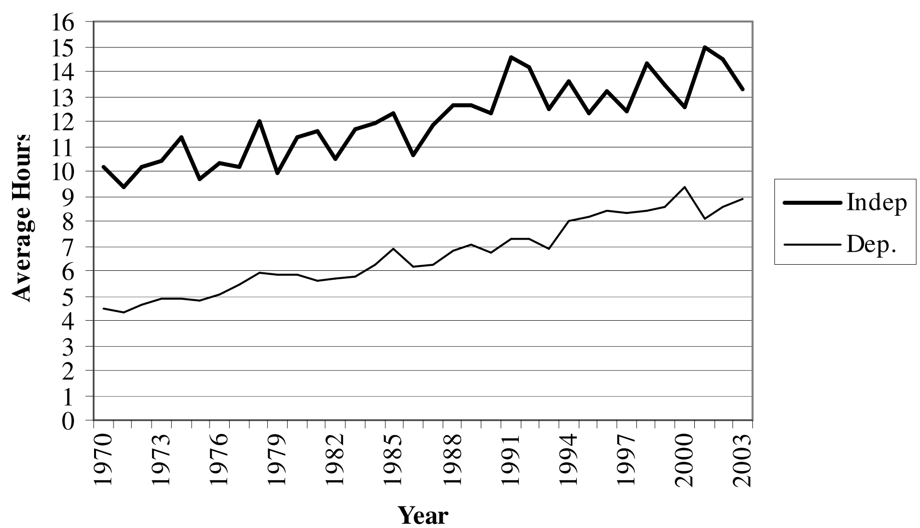
Source: Author's calculations using October Current Population Survey, 1970-2003, compiled by Unicon Corp.
Notes: Average hours include zeroes for non-workers. Family income quartile is defined over all households with any member between 16 and 30 years of age, regardless of college enrollment status. Because income data are collected via categories that shift over time, these quartile measures are somewhat noisy.

Figure A5. Average Weekly Hours Of 18-22 Year Old Full-Time 4-Year College Enrollees, By Institution Type



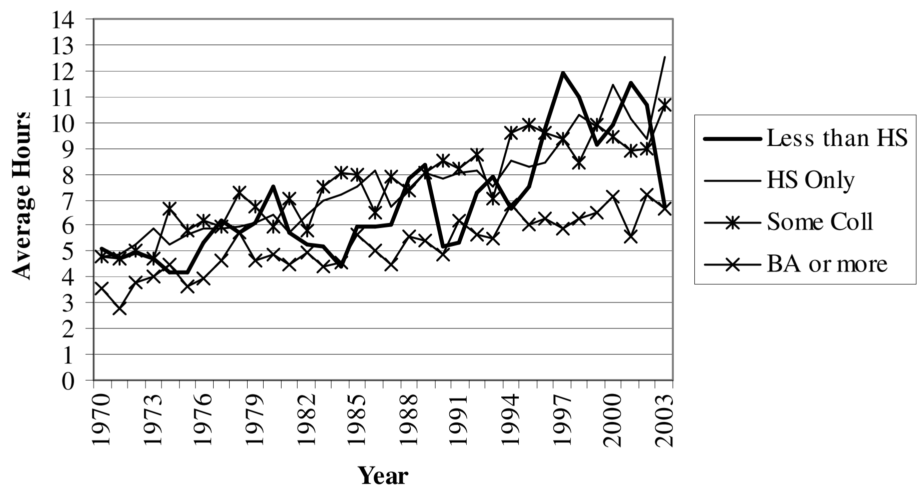
Source: Author's calculations using October Current Population Survey, 1970-2003, compiled by Unicon Corp.
Notes: Average hours include zeroes for non-workers. Public/private status is unavailable in 1980.

Figure A6. Average Weekly Hours Of 18-22 Year Old Full-Time 4-Year College Enrollees, By Dependency



Source: Author's calculations using October Current Population Survey, 1970-2003, compiled by Unicon Corp.
Notes: Average hours include zeroes for non-workers.

Figure A7. Average Weekly Hours Of 18-22 Year Old Full-Time 4-Year College Enrollees, By Father's Education



Source: Author's calculations using October Current Population Survey, 1970-2003, compiled by Unicon Corp.
Notes: Average hours include zeroes for non-workers. Father's education only available for dependent students.

Table A1
Means of Selected Variables,
NLSY-1979 and NLSY-1997 Cohorts of 18-19 Year Old 4-Year College Entrants

Variable	NLSY-79 Cohorts	NLSY-97 Cohorts	
Average weekly hours (Sept-May)	8.53	10.25	***
Percent employed at any time (Sept-May)	0.77	0.80	*
AFQT pctile: 1-9	0.02	0.01	
AFQT pctile: 10-29	0.02	0.02	
AFQT pctile: 20-29	0.05	0.04	
AFQT pctile: 30-39	0.05	0.04	
AFQT pctile: 40-49	0.04	0.08	***
AFQT pctile: 50-59	0.07	0.09	
AFQT pctile: 60-69	0.11	0.10	
AFQT pctile: 70-79	0.18	0.15	**
AFQT pctile: 80-89	0.20	0.21	
AFQT pctile: 90-99	0.26	0.26	
Missing AFQT	0.02	0.11	***
Parents' income: Q1	0.10	0.15	***
Parents' income: Q2	0.20	0.18	
Parents' income: Q3	0.27	0.27	
Parents' income: Q4 (top)	0.44	0.40	
Missing parents' income	0.08	0.06	
Age	19.03	19.14	***
Female	0.52	0.56	**
Race: Hispanic	0.04	0.06	**
Race: Black, non-hispanic	0.12	0.10	
Race: White, non-hispanic	0.84	0.83	
Region: Northeast	0.23	0.23	
Region: North central	0.32	0.32	
Region: South	0.33	0.29	**
Region: West	0.12	0.17	***
Central city	0.23	0.22	
Outside MSA	0.16	0.16	
Mother's ed: High school	0.43	0.25	***
Mother's ed: Some coll	0.16	0.26	***
Mother's ed: BA or above	0.27	0.38	***
Missing mother's ed	0.04	0.05	
Father's ed: High school	0.28	0.23	**
Father's ed: Some coll	0.13	0.20	***
Father's ed: BA or above	0.40	0.42	
Missing father's ed	0.06	0.09	**
Single parent family	0.20	0.26	***
Family size	4.46	3.98	***
Lives with family (year prior to enrollment)	0.96	0.90	***
Number of obs.	909	1192	

Source: Author's calculations using NLSY-79 and NLSY-97 datasets.
Notes: Family background characteristics are measured as of the year prior to college enrollment. Missing data are filled with data from previous survey waves if available. For those missing AFQT and/or family income, these variables were imputed using linear predictions based on student's age, race, gender, and parents' educational attainment and marital status. Cutpoints for AFQT deciles and income quartiles are based on all members of an age cohort, not just those who attended college.

Stars indicate the significance of a t-test of the difference in means: ***=p<.01, **=p<.05, *=p<.10.

THEORETICAL APPENDIX

Noting the dependence of h^* on the exogenous parameters, the first-order condition can be rewritten as an identity:

$$w(a) + \beta r^h \frac{\partial g(h(w(a), \beta, r^h, r^s, q^h, q^s, a); q^h, a)}{\partial h} \equiv \beta r^s \frac{\partial f(s(h(w(a), \beta, r^h, r^s, q^h, q^s, a)); q^s, a)}{\partial s}$$

Analyzing this equation will formalize largely intuitive implications regarding how h^* depends on wages, returns to school and work, ability, school quality, and other factors—even in the absence of credit constraints.

Student wages. As in any model of labor supply, wages matter. Higher base wages will increase the value of work relative to schooling:

$$\frac{\partial h^*}{\partial w} = \frac{-1}{\left(\beta r^h \frac{\partial^2 g(h(); q^h, a)}{\partial h^2} + \beta r^s \frac{\partial^2 f(s(); s^h, a)}{\partial s^2}\right)}$$

Since both *g( )* and *f( )* are concave, $\frac{\partial h^*}{dw}$ >0. Students shift time from school to work in the first period when wages rise, all else equal. The shift is smaller when β is large and/or when returns to human capital are high (in other words, when base wages are a relatively small piece of lifetime earnings).

Returns to work experience. Formally:

$$\frac{\partial h^*}{\partial r^h} = \frac{-\frac{\partial g(h(); q^h, a)}{\partial h}}{\left(r^h \frac{\partial^2 g(h(); q^h, a)}{\partial h^2} + r^s \frac{\partial^2 f(s(); s^h, a)}{\partial s^2}\right)}$$

Again due to the concavity of *g( )* and *f( )*, $\frac{\partial h^*}{\partial r^h}>0$. Students shift towards work in the first period when returns to work experience rise, all else equal.

Returns to schooling. Formally:

$$\frac{\partial h^*}{\partial r^s} = \frac{\frac{\partial f(s();q^h,a)}{\partial s}}{\left(r^h \frac{\partial^2 g(h();q^h,a)}{\partial h^2} + r^s \frac{\partial^2 f(s();s^h,a)}{\partial s^2}\right)}$$

Again due to the concavity of *g( )* and *f( )*, $\frac{\partial h^*}{\partial r^s}<0$. Students work less in the first period if returns to schooling increase.

Student ability. Intuitively, the relationship between ability and student work decisions is ambiguous. This ambiguity is reflected in the formal analysis:

$$\frac{\partial h^*}{\partial a} = \frac{\left(\beta r^s \frac{\partial^2 f(s();q^s,a)}{\partial s \partial a} - \beta r^h \frac{\partial^2 g(h();q^h,a)}{\partial h \partial a} - \frac{dw}{da}\right)}{\left(\beta r^h \frac{\partial^2 g(h();q^h,a)}{\partial h^2} + \beta r^s \frac{\partial^2 f(s();s^h,a)}{\partial s^2}\right)}$$

The denominator is negative, but the sign of the numerator is ambiguous. To the extent that ability affects the marginal productivity of school-based human capital more than it affects the marginal productivity of work-based human capital (and to the extent that returns to schooling are higher than returns to work experience), this will push higher-ability students to work less. If high-ability students also command significantly higher base wages, however, this creates an incentive to work more.

School quality. Intuitively, one might guess that when school quality is low students will have more time to spend working. However, this conclusion does not clearly follow from the formal analysis:

$$\frac{\partial h^*}{\partial q^s} = \frac{r^s \dfrac{\partial^2 f(s();q^s,a)}{\partial s \partial q^s}}{\left(r^h \dfrac{\partial^2 g(h();q^h,a)}{\partial h^2} + r^s \dfrac{\partial^2 f(s();s^h,a)}{\partial s^2} \right)}$$

I assume that $\frac{\partial^2 f(s();q^s,a)}{\partial s \partial q^s}$<0, in other words, that marginal productivity of observable school-based human capital is higher when school quality is lower. Intuitively, students need less time to produce the same number of courses completed when coursework is less demanding. This would imply that $\frac{\partial h^*}{\partial q^s}$>0 and that students work *less* when coursework is less demanding.

This result, however, relies crucially on the assumption that school quality affects only the cost of educational investment, not the returns on that investment. In reality, returns may be an increasing function of school quality—employers may not be completely blind. If this is the case, we would have:

$$\frac{\partial h^*}{\partial q^s} = \frac{\left(r^s(q^s) \dfrac{\partial^2 f(s();q^s,a)}{\partial s \partial q^s} + \dfrac{dr^s}{dq^s} \dfrac{\partial f(s();q^s,a)}{\partial s} \right)}{\left(r^h \dfrac{\partial^2 g(h();q^h,a)}{\partial h^2} + r^s \dfrac{\partial^2 f(s();s^h,a)}{\partial s^2} \right)}$$

The denominator remains negative but the numerator is now ambiguous. The first term in the numerator remains negative, but the second term is positive. The less that returns depend on school quality and the higher the levels of returns overall, the more likely that $\frac{\partial h^*}{\partial q^s}$ will be positive; that is, the more likely that low-quality schooling will induce students to work *less* rather than more.