Family resources and college enrollment

Bhashkar Mazumder

Introduction and summary

During the 1980s and early 1990s, the U.S. experienced a pronounced increase in income inequality. Associated with the rise in inequality has been a widening gap in earnings between those who have a college degree and those whose schooling ends in high school. According to census data, in 1975 men who completed four or more years of college earned 51 percent more than men who had completed four years of high school. The comparable figure in 2001 was 122 percent.[1] So, on average, college graduates now earn more than double what high school graduates earn.

Why has attending college become so much more important? Many economists argue that as the economy has become more technologically sophisticated, employers simply require a more educated and skilled work force. The rising demand for skilled workers has outpaced the increase in supply, resulting in a sizable premium for college-educated workers.

College attendance is an important issue for other reasons in addition to the growth in income inequality. Clearly, a more educated work force should enhance the productive capacity of the economy and promote faster economic growth (Aaronson and Sullivan, 2001). There are also likely to be important social externalities to promoting greater college attendance, such as greater involvement in the duties and responsibilities of citizenship (for example, higher voting rates). Finally, greater access to college might help foster greater *intergenerational income mobility*, namely a child's ability to achieve economic success irrespective of their parents' economic circumstances. Recent studies have shown that on average, at least 40 percent, and perhaps as much as 60 percent of the earnings differences between families persist from one generation to another (Bowles and Gintis, 2002). Clearly, any policies that might be successful at bridging the divide in educational attainment and, thereby, reduce earnings differences might also help reduce the persistence in income inequality over generations.

For these reasons, policymakers are interested in what determines college enrollment and completion and how best to promote higher education. This is a particularly salient issue now, given the current fiscal problems facing the federal and state governments, which have already led to cutbacks in financial support for higher education.

An analysis of national trends in college enrollment shows that overall college enrollment among young adults has risen steadily over the last 30 years. However, only about 35 percent of 18–24 year olds currently attend college. There is currently a major divide in college attainment by race and ethnic group. In fact, these gaps are higher today than they were 25 years ago. The sharp differences in college enrollment rates suggests that perhaps the key factors underlying these trends are economic variables such as family income and college costs. Indeed, an examination of enrollment levels by income level appears to bear this out. Adolescents from families in the lowest income strata are far less likely to attend college than their better-off peers.

However, the idea that family income and tuition costs largely explain enrollment patterns is not as clear cut as it might appear at first glance. There are many different types of colleges with a wide range of costs, and there are many potential sources of financial aid and loan programs. Indeed, it is not unreasonable to speculate that anyone who truly wants to attend some

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type of college can find a way to finance it. Traditional economic theory suggests that in the absence of market imperfections such as borrowing constraints, those who find it *optimal* to invest in their human capital through postsecondary schooling will in fact do so, irrespective of their family's current income level. The key determinants in this model are the expected financial returns to attending college, the interest rate, and the costs of attending college.

The fact that existing government financial aid and loan programs do not cover the full costs of going to college suggests that the existence of borrowing constraints is certainly plausible (Keane and Wolpin, 2001). Whether individuals actually do not enroll in college because of the inability to borrow is a point of contention in the economics literature. While many studies have found that there is a strong association between family income and college enrollment, Cameron and Heckman (2001) argue that this is because family income captures the *long-run* factors that determine whether an individual has the prerequisite skills to be successful in college. They argue that there is very little role for policies such as college subsidies that influence the *short-term* financing considerations of attending college.

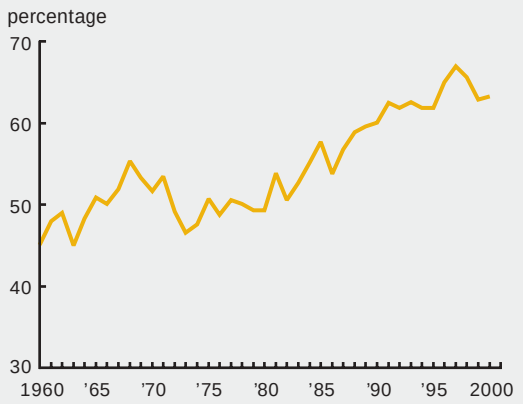
Various other studies (for example, Kane, 1994; Dynarski, 2003) find either that college costs are an important factor or that college subsidies have an important effect on enrollment. While a sensitivity to price is not what economists would call "borrowing constraints," it does imply a potential role for public policy in subsidizing college costs for those on the margin of attending, particularly if there are important social benefits to increasing college enrollments. In fact, there is some common ground in this literature, in that all of these studies find that an increase in college costs of $1,000 in 2001 dollars is typically found to translate into a decline in enrollment of about 4 percentage points. On the other hand, it is not at all clear whether lowering college costs would reduce the *disparities* in enrollment across income or racial groups.

Interestingly, none of the studies in the literature investigate the empirical importance of family *wealth* as opposed to *income* to college attendance. The omission of wealth in the literature is no doubt due to the fact that the survey data used by previous researchers do not contain very good information, *if any*, on families' assets and liabilities. This is an important omission since for many families, a sizable fraction of college expenses are covered by longer-term savings reflected in financial assets. Families with high levels of wealth are much less likely to be borrowing constrained. One might expect that families with more wealth are better able to borrow against their assets. Therefore, data on wealth would seem to be particularly useful for testing the borrowing constraints hypothesis implied by theoretical models. In addition, financial assets are an important part of most financial aid formulas, so higher wealth can potentially lead to higher college costs *net* of this aid and possibly lower enrollment levels, all else equal.

This article begins to address this gap in the literature by using a data source that has highly detailed information on family assets and liabilities, as well as information on the enrollment decisions of adolescents. A preliminary empirical investigation of this data offers some suggestive evidence that income might be an especially important factor for families who have modest amounts of wealth. This may be due to some combination of borrowing constraints and higher actual costs due to lower financial aid. Certainly, this evidence suggests that further investigation of the role of wealth in college enrollment is in order.

FIGURE 1

College enrollment over time



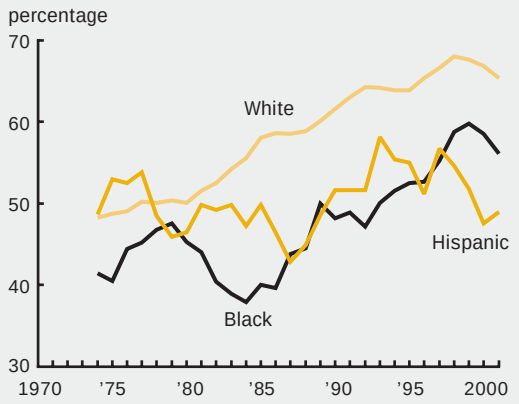
Source: U.S. Department of Education, National Center for Education Statistics (2003), *Digest of Economic Statistics.*

Trends in college enrollment

In recent decades there has been a clear upward trend in the percentage of high school graduates between the ages of 16 and 24 who enroll in college within a year of finishing high school, according to data assembled by the National Center for Educational Statistics.[2] As figure 1 demonstrates, from 1960 until the 1980s, the percentage enrolled in college fluctuated around 50 percent. Since 1980, however, the rate has risen sharply from 49 percent to 62 percent in 2001, reaching a peak of 67 percent in 1997. The rise has been slightly more pronounced among women,

FIGURE 2

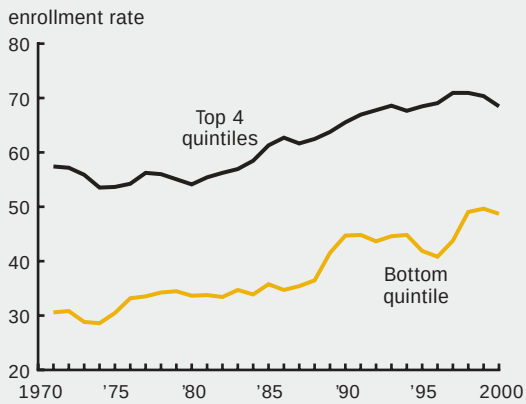
College enrollment rates by race



Source: U.S. Department of Education, National Center for Education Statistics (2003), *Digest of Economic Statistics.*

FIGURE 3

College enrollment, bottom quintile vs. top four quintiles



Source: U.S. Department of Education, National Center for Education Statistics (2003), *Digest of Economic Statistics.*

whose enrollment rate briefly eclipsed 70 percent in the late 1990s.

These figures, however, paint an overly positive picture of college attendance because they only show the rates among those *16–24, who finished high school within the last year*. In contrast, the college enrollment rate among *all 18–24* year olds in 2001 was just 36 percent. While this is still a significant improvement over the 25 percent rate recorded in 1979, despite recent positive trends, college enrollment remains more the exception than the rule.

The gap in enrollment rates between whites and minorities has been a focal point of some recent studies on college enrollment (for example, Kane, 1994; Cameron and Heckman, 2001). Figure 2 shows the enrollment rates among recent high school completers aged 16 to 24 across racial/ethnic groups. (Three-year moving averages are shown so as to reduce the large sampling variance in the survey data.) The difference in the enrollment rates between blacks and whites was only a few percentage points in the late 1970s but surged in the 1980s, reaching a peak of 19 percentage points in the mid-1980s. This sharp rise spurred the debate over the impact of economic factors, such as rising college costs, declining financial aid, and slow real income growth on college enrollments. This was also a motivating factor for studies that used econometric models to understand more broadly the determinants of the propensity to attend college.

In the late 1980s and through most of the 1990s, the black–white gap progressively narrowed, falling back into the single digits. However, since 1998, black enrollment rates have fallen in each year, and the racial gap has begun to widen once more. The enrollment gap between whites and non-white Hispanics is actually larger and has widened considerably since the 1970s.

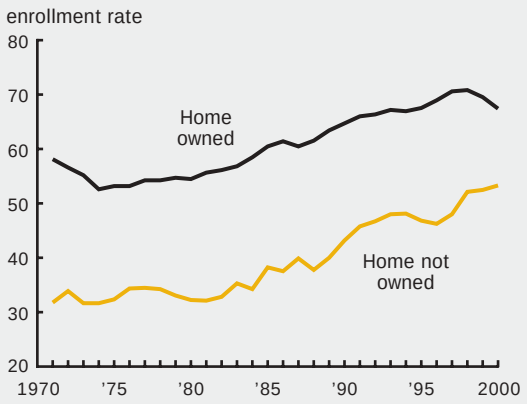
An important question is to what extent these minority enrollment gaps are merely reflecting disparities in enrollment by income level that can be addressed by tuition subsidies targeted to low-income families. Figure 3 compares the enrollment rate of the bottom income quintile versus the top four quintiles using data from the October *Current Population Surveys* (CPS) conducted by the Census Bureau. This chart illustrates that enrollment rates have risen even among families at the bottom of the distribution, but that the gap in enrollment with other families has narrowed only slightly over the last 30 years. This evidence certainly fits a story that emphasizes income differences as a critical factor in college enrollments.

While the CPS surveys typically used by researchers to investigate enrollment patterns do not collect information on wealth, they do collect information on homeowner status. Since housing equity is often the largest share of a family's wealth, tracking enrollment rates by family homeownership might offer a glimpse as to the importance of wealth considerations. Figure 4 shows that historically there has been a large gap in enrollment rates by homeownership status but that this gap has narrowed quite a bit in recent years.

These figures suggest that while progress has been made in achieving higher rates of college enrollment among young adults, the disparities by race and income are wider today than they were 25 years ago. Looking forward, the current fiscal problems facing many state governments are expected to lead to large cuts

FIGURE 4

College enrollment by family home ownership



Source: Author's calculations using October CPS supplements.

in college subsidies and tuition increases at public colleges, which raises the prospect of a further widening of these gaps in higher education. However, these predictions depend critically on the extent to which short-term financial considerations actually influence the propensity to attend college.

Evidence from a sample of econometric studies

The literature on college financing is large and cannot be given a thorough treatment here. I discuss a small sample of recent studies to provide a general sense of how economists have approached this question and their results.

As with many research questions in economics, it is risky to rely exclusively on data that are based on changes over time in aggregate statistics in order to identify behavioral patterns such as those shown in the last section. Economies are constantly in flux, with many variables changing simultaneously. For example, the causal relationship between college costs and enrollment rates may be difficult to discern from "time-series" data. In the 1980s, both variables were increasing, but it is unlikely that an increase in tuition could lead to an increase in enrollment. Aggregate enrollment was probably also influenced by other economic incentives, such as the rising payoff to attending college.

Therefore, economists have estimated econometric models using micro-level data on individuals and their enrollment decisions at a point in time to infer the underlying behavioral relationships that are typically obscured in the national data. These "cross-sectional" studies have generally found that college costs and family income have a statistically significant and economically important effect on enrollment decisions. In a review of a number of studies predating 1990, Leslie and Brinkman (1989) argue that a consensus view is that a $1,000 (2001 dollars) increase in net college costs results in about a 4 percentage point decline in the probability of enrollment.

A more recent study by Kane (1994), which examines the decline and subsequent rise in the black college enrollment rate during the 1980s, uses data from the October CPS and includes a wide range of variables such as parental educational attainment, family income, homeownership, and local labor market conditions. Kane studies the effects of these variables separately for blacks and whites and by income quartiles. He also controls for state "fixed effects," thereby correcting for the potential problem that states with low tuition levels might support enrollment in other ways. Kane concludes that college costs exerted downward pressure on the enrollment rate for blacks in *all* income groups. Kane speculates that the sensitivity of even *high-income* black families to college costs might be explained by the fact that despite their high income, these families have little wealth and, therefore, might also be constrained from borrowing. Given the lack of data on wealth in Kane's sample, he cannot pursue this further.

Overall, Kane finds that a $1,000 (2001 dollars) change in tuition costs lowers the probability of enrollment by around 4 percentage points. However, he finds that these costs explain only about one-third of the drop in enrollment for blacks during the first half of the 1980s and that most of the rest of the decline cannot be explained by his model. One somewhat puzzling finding is that Pell Grant eligibility appears to have a negligible effect on college enrollment. Pell Grants are a federal means-tested program that provides grants to qualified students for postsecondary education. An earlier study based on aggregate time-series data by Hansen (1983) also showed little effect of the program on enrollment levels. Kane speculates that his finding may be due in part to measurement error, since Pell Grant eligibility is estimated based on available survey data. He also suggests that perhaps low-income students are less aware of their eligibility for the program. Nonetheless, the lack of any strong effect of Pell Grants on enrollments is a reason to remain somewhat skeptical about the effectiveness of tuition subsidies.

While cross-sectional studies such as Kane's avoid some of the pitfalls of time-series analysis, they are also subject to other potential deficiencies such as omitted variables and measurement error. The lack of a good measure of scholastic preparedness for college is a particular issue of concern. If the ability to succeed in

college is the key determinant of college enrollment but there is no good measure of this "ability" in the data (for example, test scores) and if family income is highly correlated with ability, then a cross-sectional analysis might mistakenly overemphasize the importance of family income.

This problem and other similar issues have led researchers to pursue alternative approaches to studying the issue. Cameron and Heckman (2001) exploit longitudinal data—repeated observations on the same individuals—to estimate a dynamic model of educational attainment. Through this approach they not only examine college enrollment but also analyze grade transitions prior to college enrollment, where financial considerations ought not to be as important. As part of their statistical model, they also directly incorporate heterogeneous ability. Perhaps most importantly, they use the *National Longitudinal Survey of Youth* (NLSY), a comprehensive dataset that contains not only all of the relevant variables typically used by researchers, but also a measure of scholastic ability, the Armed Forces Qualifying Test (AFQT).

The AFQT is part of the Armed Services Vocational Aptitude Battery (ASVAB) given to applicants to the U.S. military. The ASVAB consists of ten tests. The AFQT score is based on four of the tests that focus on reading skills and numeracy. The AFQT is a general measure of trainability in the military and is a primary criterion for enlistment eligibility. The test was administered to nearly all respondents in the NLSY in 1980 in order to provide new norms for the test based on a nationally representative sample. The AFQT is not viewed by the military or by most researchers as a measure of general intelligence or IQ. Indeed, it is well known that scores rise with additional years of schooling, so researchers typically use scores that are age-adjusted. Cameron and Heckman's sample does not include anyone who took the test after entering college.

Cameron and Heckman estimate their dynamic educational attainment model separately for whites, blacks, and Hispanics and estimate the probabilities of completing ninth grade by age 15; completing high school by age 24; and enrolling in college. The model is run both including and excluding AFQT scores. They use the results of the models to perform the following thought experiment: How much of the white–minority gaps would be eliminated if for each explanatory variable, blacks and Hispanics were assigned the same average values as whites. Using the model results without AFQT scores, they find that equating family income would reduce the expected gap in college enrollments by roughly half. However, they also find that simply equating other family background variables, such as parent education and family size, has an even larger effect on reducing these gaps. When they include AFQT scores, equating this variable alone more than eliminates the entire enrollment gap for both blacks and Hispanics, while income has virtually no independent effect.

Based on this result, they argue that college preparedness is the critical determinant of college enrollment and not any kind of short-term borrowing constraint. This conclusion is also bolstered by their finding that family income has an important effect on grade advancement only at earlier stages in a student's educational career (for example, reaching ninth grade by age 15), when short-term financing issues are presumed to be irrelevant.

While these results appear to be very strong and make a compelling case against the existence of borrowing constraints, they are still not fully satisfying. How is it that white and minority enrollment trends could diverge so rapidly in the early 1980s only to be followed by a period of rapid convergence later in the decade as figure 2 shows? It is possible that there were rapid and sudden shifts in minority college preparedness. But there is no evidence of this in test scores. So while the results appear to present repudiation of the idea that family income during the college-going years matters, the study does not provide a fully persuasive story to explain the trends in the data that motivated the model.

With regard to the broader question of whether public policy ought to subsidize college education, these results actually could be considered to provide some evidence in favor of such a policy. A common criticism of broad-based college subsidies is that they simply subsidize the costs of middle-class families, whose children would have enrolled in college anyway. Cameron and Heckman's results show that college enrollment is sensitive to tuition costs, so that lowering the costs for targeted families might turn out to be an effective policy. This is particularly true for two-year colleges. The authors estimate that a $1,000 (2001 dollars) increase in tuition at two-year colleges lowers black enrollments in two-year and four-year colleges *combined*, by 4 percentage points. For Hispanics, the decline is even larger, at 8 percentage points. Although college enrollments are less sensitive to changes in tuition at four-year colleges, the effect of a $1,000 (2001 dollars) increase in costs at *both* two- and four-year colleges would lower white enrollment by 5 percent—a figure right in line with the results of the previous studies. Finally, the study does not address the possibility that wealth may be a critical factor in determining the likelihood of enrollment, which is the question I turn to in the next section.

Each of the studies so far described exploits the observed variation in a number of variables (for example, enrollment or family income) across a sample of the population to infer the basic statistical relationships under certain simplifying assumptions. This approach can lead to misleading inferences about causality if there are other factors that are not captured by the statistical model. In an ideal setting researchers would prefer to design an experiment where individuals could be *randomly assigned* different levels of family income or tuition costs. Differences in enrollment rates between the treatment and control groups would reveal the behavioral responses. Randomization would eliminate the need to have a full set of control variables. Of course, in the real world, such experiments are close to impossible. In recent years, however, economists have increasingly employed research strategies that take advantage of real world situations that mimic random assignment. These "quasi-experiments" allow researchers to infer behavioral relationships that might otherwise be difficult to identify through standard statistical models.

Dynarski (2003) provides one such example in a study of the effects of a particular tuition subsidy on college enrollment. In 1982, Congress eliminated the Social Security student benefit program that offered monthly financial support to full-time students whose parents were deceased, disabled, or retired. Dynarski uses the NLSY to implement a quasi-experimental design that compares the college enrollments of those who were eligible for the aid due to the death of a parent before the program was eliminated with a later cohort who would have been eligible for the program had it not been eliminated. The enrollment probability of those with a deceased parent fell by more than 20 percentage points compared with a drop of just 2 percentage points for the rest of the sample. Incorporating figures on the size of the program's benefit and the costs of tuition, Dynarski calculates that a $1,000 (2001 dollars) increase in aid increases enrollment by nearly 4 percentage points.

While Dynarski's results are in line with much of the previous literature, the quasi-experimental design of the study makes it more credible than those of standard cross-sectional studies. The quasi-experimental design, however, still has some drawbacks. It is difficult to know if the behavioral response that is estimated from the subgroup of the population affected by the legislative change, generalizes to the broader population.

The findings of Cameron and Heckman and other research not discussed here[3] makes many economists skeptical that borrowing constraints are a critical factor in limiting college enrollments. Indeed in a more recent paper, Carneiro and Heckman (2003) estimate that only about 8 percent of the population faces borrowing constraints to attending college. Still, there appears to be reasonably strong evidence that public policy can influence enrollment levels.

In any case, there are several issues that deserve more attention in future research. The first, which I address below, is examining the role of wealth. It might be the case that, for example, the sharply lower wealth levels of blacks has been a major impediment to college attendance. In fact, the economic literature on consumption has often used levels of wealth to detect the presence of borrowing constraints among low-wealth families (for example, Zeldes, 1989).

A second question, which has not been examined thoroughly, is the extent to which financial resources and costs affect college *completion*.[4] Perhaps the access to college financing is available, but over time financial difficulties overwhelm some families and prevent college completion. Finally, to what extent do financial resources affect the kind of school or quality of school one attends? There is growing evidence that fewer low-income students are attending private universities and four-year colleges (McPherson and Schapiro, 1998). Therefore, there is reason to believe that there is not only a college enrollment gap but there are also likely to be disparities in educational quality.

Wealth and college enrollment

This article begins to address one of the shortcomings in the literature by using a data source that has been neglected in the existing literature. The Census Bureau's *Survey of Income and Program Participation* (SIPP) contains extremely detailed data on assets and liabilities in addition to the full set of variables that have typically been used to study the determinants of college enrollment. The SIPP surveys began in 1984 and are two- to three-year panels that allow for multiple measurements of all the variables of interest. The SIPP surveys approximately 20,000 households every four months on income, labor market activity, and participation in a wide range of federal government programs, such as food stamps and Social Security.

The surveys also ask about school enrollment and sources of financial assistance. Special topical modules once a year collect information on housing equity, vehicle equity, business equity, a range of financial assets, unsecured debt, real estate property, individual retirement accounts (IRA), and other retirement plans. The panel aspect of the data enables one to construct a sample of 11th and 12th graders and determine college enrollment over the next two years.

I estimate a linear probability model (ordinary least squares—OLS) of the likelihood of enrollment.[5] The dependent variable is equal to 1 if a 12th grader begins college by the following school year and 0 otherwise. Similarly the variable is set to 1 if an 11th grader starts college two years later and 0 otherwise. I pool the 1984, 1985, 1986, 1987, and 1990 SIPP panels and use both men and women. The sample for which all the key information, including log wealth, is available is 4,123. Of these, about 37 percent enrolled in college.

The description of the sample is given in table 1. The key explanatory variables that are the focus of this study are family income, tuition costs, and wealth. Family income is averaged over the two calendar years that are available in each of the SIPPs and includes earnings from up to two jobs, two businesses, and any income from other sources. Since ideally I want to measure tuition for those at the margin of attending college, I opt for two-year colleges. Tuition costs are measured by using the average tuition at two-year colleges in the individual's state of residence.[6] Unlike Cameron and Heckman (2001), I cannot measure this at the county level so there is likely to be considerable measurement error. In this analysis, I have not adjusted tuition for Pell Grant eligibility as some previous studies have done.

I use three different wealth variables, since it is not clear *a priori* what the appropriate measure ought to be. First, I consider housing equity, since this is the largest share of wealth for many families. Second, I construct a measure of liquid assets (for example, bank accounts, stocks, bonds) that might better capture the financial resources readily available to the family. The third measure I consider is net worth, which is a summary measure that incorporates a large array of assets and liabilities. A problem with wealth data is that the non-reporting for some variables can be sizable, so many values are imputed by the Census Bureau. As an additional check, I limit analysis to data that is not imputed, though this reduces the sample size.

Figure 5 shows how college enrollment differs by quartiles of family income and the three measures of wealth. It is immediately striking that the wealth measures do not appear to be appreciably different from each other in terms of how they affect enrollment at least unconditionally. Housing equity appears to show the smallest differences across the quartiles. Liquid assets shows the most striking difference between the first and second quartiles, while net worth looks closest to family income. I chose to use net worth, since it is the broadest measure and since the results are not much affected by the alternatives.

To the extent possible, I follow Kane (1994) and Cameron and Heckman (2001) in the choice of other covariates. These include family size, father's years of education, mother's years of education, black indicator, female indicator, indicator for whether a parent has a long spell of unemployment, state, and year effects. For measures of the local labor market, I use the unemployment rate and the average wage for those with a high school degree. Wherever possible these are both measured at the metropolitan statistical area level, otherwise they are measured at the state level. Again, compared with the county level measures used by Cameron and Heckman, my measures are likely to suffer from measurement error.

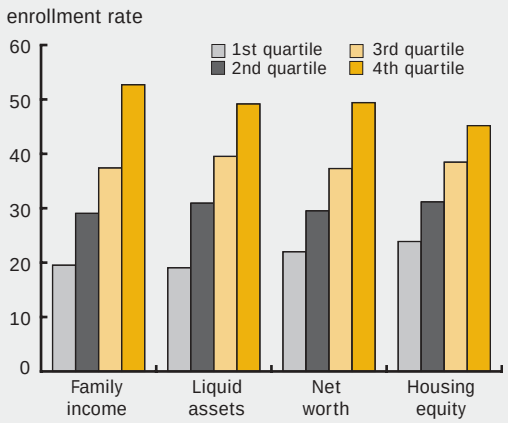
TABLE 1

Summary statistics

Variable	Mean	Standard deviation	Minimum	Maximum
Enrolled in college	0.37	0.48	0	1
Log family income	10.41	0.82	0	12.70
Family size	2.94	0.57	2	6
Father's years of education	10.47	5.84	0	18
No father identified	0.19	0.39	0	1
Mother's years of education	11.19	4.52	0	18
No mother identified	0.10	0.30	0	1
Female	0.51	0.50	0	1
Black	0.11	0.31	0	1
Parent unemployed > 3 months	0.25	0.43	0	1
Local area unemployment rate	0.07	0.02	0	0.19
Local wage for high-school grad (1984$)	7.94	0.70	5.73	10.16
Tuition (1984$)	741	376	30	1,641
Net worth (1984$)	92,463	117,158	38	1,285,442
Housing equity (1984$)	46,562	45,483	–2,385	251,519
Liquid wealth (1984$)	15,853	48,232	0	1,010,100
Sample size	4,123			

FIGURE 5

Enrollment rates by quartiles of family resources



Source: Author's calculations using 1984, 1985, 1986, 1987, 1990 SIPP panels.

The major limitation of the data, however, is that for most years they do not contain information on scholastic ability such as test scores. Therefore, the analysis is subject to Cameron and Heckman's criticism that other variables such as income and wealth may pick up the effects of this omitted variable. On the other hand, this dataset does contain information on the wealth of the parents, which is a critical omission in the NLSY, so the reverse criticism could be made of the existing studies.

There are several hypotheses one might make about how wealth could influence enrollment. First, one might simply imagine that wealth has a direct effect on the probability of attending college. Imagine two families with similar income but one has substantially larger assets to draw from. If we thought that an extra dollar of wealth simply acts the same way as an extra dollar of income, a reasonable first step would be to model wealth the same way as income and assume a linear relationship.

However, there are several reasons to think that the effects of wealth are nonlinear. One reason is that wealth might serve simply as an indicator of borrowing constraints. If there are market imperfections that prevent students from borrowing from their expected future income, they may be forced to rely on parents' wealth either directly or as a form of collateral. In this simple case, we might expect that additional financial resources, either income or wealth, might be important, but only for families below a certain threshold of wealth, for example, the bottom quartile of the wealth distribution.

However, if scholastic ability is a critical factor in determining college enrollment as Cameron and Heckman (2001) show, and if it is correlated with parents' wealth, then the story becomes more complicated. At the low end of the wealth distribution there might be very few families who would actually benefit from greater financial resources due to low levels of academic preparedness. It might be that as we move up the wealth distribution, there are more families for whom additional financial resources might matter. At some point along the wealth distribution, of course, families have sufficient financial resources and the effect might dissipate. In this case financial resources might matter most for families in the middle of the distribution. Corak and Heisz (1999) reported this kind of finding in their study of nonlinearities in intergenerational mobility using Canadian data.

A second reason that wealth might have a nonlinear effect is that it is typically an important variable in financial aid formulas used by colleges and universities, as well as government aid programs. In this case, greater wealth might actually increase the costs of college attendance over a particular range of the wealth distribution. This might produce a more complicated pattern, where income matters the most for families with modest amounts of wealth.

I use two simple approaches to estimate these potential nonlinear effects. First, I simply include indicator variables for quartiles of the wealth distribution. This tests whether the *direct* effects of wealth on enrollment have a nonlinear pattern. It allows us to see whether wealth matters most going from say the bottom quartile to the second quartile. Second, I stratify the sample by levels of wealth to see whether the effects of family income or college costs matter at a particular point of the wealth distribution as hypothesized above. This might help identify whether there is a particular point in the wealth distribution where borrowing constraints might bind and make income particularly important.

The first set of results is shown in table 2. In the first column, the results are shown without including any wealth measures and with no state effects. Here nearly all the coefficients are of the expected sign. The coefficient on log family income is .04 and is highly significant. Parent education is positive and significant. Women are slightly more likely to enroll in college and blacks are about 6 percentage points less likely to enroll even conditioning on these other variables. The one unexpected result is tuition, which has a positive sign. The lack of good geographic detail on tuition is probably the explanation. Local labor market conditions do not appear to be significant. The

addition of state effects appears to make no difference to the results (not shown) and does not improve the performance of the tuition measure.

In column 2, I add log of net worth to the model. This measure of wealth is significant with a coefficient of .02. Adding net worth lowers the coefficient on family income by about one-quarter to .032. Interestingly, most of the difference between whites and blacks is now eliminated.

In column 3, I take a simple approach toward estimating nonlinearities in wealth by using indicator variables for being in a particular quartile of the net worth distribution. I use the first quartile as a basis for comparison. After controlling for other covariates, being in the second quartile of net worth raises the probability of enrollment by only 3 percentage points. The larger jumps take place at the top 2 quartiles. I find a similar pattern when using housing equity or liquid assets instead of net worth (not shown). This provides suggestive evidence of nonlinearities in wealth. It appears from this evidence that having above median wealth is the critical threshold to overcome.

Finally in table 3, I test directly whether family resources are sensitive at particular points in the wealth distribution. Here the exercise is to stratify the sample by quartiles of net worth and compare the coefficients on family income. For quartile 1, the effects of family income are relatively small and only marginally statistically significant. Interestingly, the gap with blacks is small and statistically insignificant while the female enrollment advantage is quite a bit higher. In the second quartile of net worth, there is a dramatic rise in the importance of family income—the coefficient is .07 and highly statistically significant. Income appears

TABLE 2

The effects of adding net worth

Regression results where dependent variable is college enrollment

	1	2	3
Log family income	0.041 (0.008)	0.032 (0.011)	0.029 (0.008)
Family size	–0.036 (0.015)	–0.041 (0.017)	–0.034 (0.015)
Dad's education	0.025 (0.003)	0.025 (0.003)	0.023 (0.003)
Mom's education	0.024 (0.003)	0.024 (0.003)	0.022 (0.003)
Female	0.038 (0.013)	0.035 (0.014)	0.038 (0.013)
Black	–0.058 (0.020)	–0.026 (0.024)	–0.032 (0.021)
Parent unemployed	–0.019 (0.020)	–0.009 (0.022)	–0.014 (0.020)
Local unemployment rate	0.694 (0.378)	0.795 (0.408)	0.753 (0.377)
Local wage for high-school grad	0.011 (0.010)	0.007 (0.010)	0.004 (0.010)
State tuition	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Log net worth	—	0.021 (0.005)	—
Net worth quartile 2			0.034 (0.019)
Net worth quartile 3			0.083 (0.020)
Net worth quartile 4			0.135 (0.021)
Sample size	4676	4123	4676
R-squared	0.125	0.128	0.133

Note: Standard errors in parentheses.

to be twice as important in this range of wealth compared with the sample overall and three to four times as important compared with the lowest wealth quartile. In fact, for this group neither gender nor race appears to have any effect on enrollment rates. For the third quartile, the income effects are similar to what was estimated for the full sample in table 2. For the fourth quartile, as we might expect, income matters much less. In the upper half of the wealth distribution the black–white gap is only marginally significant.

What should we take away from this exercise? The results in table 3 raise the tantalizing possibility that there might, in fact, be a group of families for whom income matters and for whom financial aid or subsidies might promote college attendance. These are not the poorest families, but actually have wealth between the 25th and 50th percentiles. One hypothesis for this finding is that the children of families in the second wealth quartile have sufficient capability to perform well in college but that they do not enroll (at least not right away) because of insufficient financial resources. Under this view, income does not explain the enrollment rate for the poorest group of families (bottom quartile), because they are also the least likely to have children with the capability to succeed, so they would not have enrolled even with additional financial resources.

An alternative explanation for the importance of income for families in the second quartile of the wealth distribution is the extensive use of financial aid formulas in determining college costs. This formula essentially acts as a tax on wealth. Families with little or no wealth are unaffected. However, families with some, but not a lot, of wealth will face higher college costs. Since I do not measure the true *net* costs faced by families, this sensitivity is captured by family income. As we move higher in the wealth distribution, however, the penalty no longer matters since the wealthiest families are ineligible for aid. This makes additional income less important for families in the top two quartiles.

Further analysis

Additional research with other datasets may be necessary to validate these results. It would be useful to know whether this pattern of higher income sensitivity at the second quartile of wealth also affects earlier grade transitions, where we would not expect wealth to matter.

TABLE 3

The effect of income by quartiles of wealth

Regression results where dependent variable is college enrollment
(Samples are stratified by quartiles of the net worth distribution)

	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Family income	0.020	0.074	0.034	0.017
	(0.011)	(0.022)	(0.024)	(0.019)
Family size	–0.042	–0.058	–0.031	–0.012
	(0.025)	(0.029)	(0.035)	(0.037)
Dad's education	0.011	0.017	0.037	0.021
	(0.005)	(0.005)	(0.006)	(0.006)
Mom's education	0.017	0.026	0.014	0.034
	(0.005)	(0.007)	(0.007)	(0.007)
Female	0.072	0.011	0.024	0.037
	(0.024)	(0.026)	(0.027)	(0.028)
Black	–0.023	0.008	–0.086	–0.184
	(0.028)	(0.037)	(0.055)	(0.105)
Parent unemployed	–0.017	0.046	–0.028	–0.072
	(0.035)	(0.038)	(0.042)	(0.051)
Local unemployment rate	0.974	–0.253	0.978	1.598
	(0.738)	(0.736)	(0.740)	(0.823)
Local wage for high-school grad	0.018	–0.014	–0.003	0.018
	(0.017)	(0.020)	(0.021)	(0.020)
State tuition	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Sample size	1153	1169	1169	1159
R-squared	0.064	0.098	0.130	0.104

Note: Standard errors in parentheses.

It would also be interesting to see if these effects still hold up in other datasets where it is possible to control for ability by using test scores. Still, the findings here ought to prompt researchers to consider the possibility that all family resources, including wealth, should be analyzed.

Conclusion

The growing gap in earnings between college graduates and non-graduates has become an important feature of the economy. Promoting greater college enrollment might not only address the current earnings gap but also offer the potential to improve economic mobility for future generations. Other potential societal benefits include a more productive economy and a better-informed citizenry.

To date, economic research has produced only mixed findings for policymakers who wish to promote college enrollment for disadvantaged youth through greater access to financial resources. While there is some skepticism as to whether a large number of families are actually "borrowing constrained," there is more agreement that lower tuition costs and greater financial aid do appear to affect enrollment. Whether these policies will narrow the gaps in enrollment by race, ethnicity or income level is less clear.

Most studies, however, have neglected the potential role of wealth. The preliminary analysis here suggests that incorporating wealth might be a promising avenue for better identifying borrowing constrained families for whom additional financial resources might matter. Income appears to have a very large effect for families in the second quartile of the net worth distribution. Arguably, it is in these families that children are academically prepared for college but for whom additional financial resources make a big difference. This is an especially important area for further analysis, given the vast and growing educational divide.

NOTES

[1]This is based on Census Historical Income Tables, P32 and P35 available at the Census website at www.census.gov/hhes/income/histinc/incperdet.html. These figures are for men aged 35–44 who worked full-time and year round. The figures do not adjust for variables such as hours worked and work experience that are typically used by economists to estimate the "return to education" using a regression model.

[2]This is taken from U.S. Department of Education, National Center for Educational Statistics (2003), table 183.

[3]These include Cameron and Taber (2004) and Keane and Wolpin (2001).

[4]Dynarski (2003) and Carneiro and Heckman (2003) are exceptions to this.

[5]Using probit models produce exactly the same qualitative results. The coefficients from a regression produce results that are easily interpreted at any point of the distribution of the covariates.

[6]Data was provided by the Washington State Higher Education Group.

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