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Changes in the wage structure, family income, and children's education

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Abstract

We exploit the changes in the distribution of family income to estimate the effect of parental resources on college education. Our strategy exploits the fact that families at the bottom of the income distribution were much poorer in the 1990s than they were in the 1970s, while the opposite is true for families in the top quartile of the distribution. Our estimates suggest large effects of family income on enrollments. For example, we find that a 10 percent increase in family income is associated with a 1.4 percent increase in the probability of attending a four-year college. © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

Wage inequality in the U.S. has increased dramatically since the 1970s (e.g. Juhn et al., 1993; Katz and Murphy, 1992). For most of the period, this also meant an increase in the return to observed skills. The standard theory of human capital implies that higher returns to skills should encourage investments in human capital. Many observers (e.g. Topel, 1997) have concluded that

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we do actually observe faster skill accumulation, and this increase in the supply of skills should eventually mitigate the increase in inequality.

Rising wage and income inequality affects not only the returns to education, but also the resources that families have available to finance education. Family income might matter for education decisions because of credit constraints, or because education is not a pure investment good. The change in the structure of wages during the 1980s, which reduced the wages of less skilled workers, may have made it harder for children from these families to attend college, despite the higher returns.[1] In fact, while there was a large increase in the college enrollment rates for children from richer families during the 1980s, there was a much smaller increase for children from the poorest backgrounds (McPherson and Schapiro, 1991; Ellwood and Kane, 1999; and Table 1).

In this paper, we exploit the changes in the distribution of family income that have taken place over the past 30 years to estimate the effect of parental resources on college education. Our strategy exploits the fact that families at the bottom of the income distribution were much poorer in the 1990s than they were in the 1970s, while the opposite is true for families in the top quartile of the distribution. This approach is attractive since it exploits variations in family income caused by changes in the U.S. income distribution, which are unlikely to be correlated with other (observed and unobserved) characteristics affecting education choices. Our estimates suggest large effects of family income on enrollments. For example, we find that a 10 percent increase in family income is associated with a 1.4 percentage point increase in the probability of attending a four-year college.

Although there are numerous studies investigating the impact of family resources on education outcomes, whether income truly matters is still a hotly debated issue.[2] Most studies in this area just relate schooling outcomes to family income in OLS equations. However, in OLS regressions, family income may be proxying for family characteristics affecting 'the education production function' (Lang and Ruud, 1986). In fact, many studies find that including parents' education and controls for type of school attended previously or test scores substantially reduce the effect of the family income on children's education (e.g. Cameron and Heckman, 1999; Ellwood and Kane, 1998, or Cameron and Taber, 2000). Nevertheless, such estimates of the income elasticity of education may be seriously biased downwards. First, there are substantial measurement errors and transitory movements in incomes measured at a point in time, attenuating the effect of income on education. This attenuation bias will be worse if other variables correlated with permanent income, like parents' education or the type of secondary school chosen, are included as controls. As a result,

[1] See also Acemoglu and Pischke (1999) for the argument that a higher return to human capital may reduce investments in training in the presence of labor market imperfections.

[2] The empirical literature has been surveyed by Haveman and Wolfe (1995).

the estimate of the income effect may be substantially understated. Second, test scores and previous schooling experience are likely to be endogenous and also affected by family income, so their inclusion may lead to biased estimates. In fact, our strategy which does not suffer from these problems leads to substantially larger estimates of the effect of parents' resources on children's education.

Our strategy is more closely related to studies exploiting exogenous variation in parents' income. The negative income tax experiments provide the only experimental study of the effect of income on schooling, but they confound the effect of income with changes in marginal tax rates affecting the decisions of youths to work (see e.g. Venti, 1984). A few recent studies have made other attempts to address the possibility that income may also be correlated with unobserved factors which predict schooling outcomes of the child. Duncan et al. (1998) use sibling differences arguing that family income varies while other family characteristics remain the same. Shea (2000) uses industry and union wage differentials and income changes due to job displacement as instruments for family income and argues that these proxy 'luck'. He finds no effects of parental resources on education, but his estimates are quite imprecise. Both of Shea's instruments are also not entirely convincing, since they are likely correlated with parental attitudes towards education.[3] Mayer (1997) uses a variety of approaches to argue that unobserved family characteristics affecting education are relatively unimportant. She uses variation in income induced by state welfare rules, compares the impact of different sources of income, and compares the effect of income before and after a child's education takes place. Using her estimates, she also tries to assess whether changes in income inequality predict the enrollment patterns for children from different income groups over time. This comes closest to our strategy of using changes in income inequality as an instrument for family income.

2. A simple model of schooling with credit constraints

We now outline a simple model of investment in schooling based on Becker and Tomes (1986).[4] Our objective is to obtain a simple estimating framework for our empirical work. The economy lasts two periods. In period 1, an individual

[3] Duflo (2000) exploits the expansion of old-age pensions in South Africa to analyze the effect of family resources on child health. She finds positive effect of resources on health, though given the differences in the level of development across South Africa and the U.S., it is not clear whether these results can be generalized to the U.S. context.

[4] This model is also related to the large macroeconomic literature on credit constraints. See, among others, Galor and Zeira (1993), Benabou (1996), Durlauf (1996), and Fernandez and Rogerson (1996) on the effect of credit constraints on human capital investments, and Acemoglu (1997) on the interaction between credit and labor market imperfections in determining human capital investments.

(parent) works, consumes c, saves s, decides whether to send their offspring to college, $e = 0$ or 1, and then dies at the end of the period. The cost of schooling for family i is $\exp(\theta_i)$. We assume that the distribution of θ_i is $G_q(\theta)$, where q denotes the income (ability) quartile of the family, so that in the empirical work below we can allow for different distributions of unobserved characteristics across households in different parts of the income (ability) distribution. The fact that there is a distribution of education costs captures that there is heterogeneity among children or among the attitudes of families towards education. Skilled individuals (those with education) receive a wage w_s and an unskilled worker receives w_u.

All families have utility given as

$$\ln c + \beta \ln \hat{c}, \tag{1}$$

where $\hat{c}$ is the consumption of the offspring. β is a parameter that measures how important future (offspring's) consumption is relative to current consumption.

Consider a family with income y. In the absence of credit market problems, this family would simply maximize net present discounted value of income. We assume no discounting, which implies that this family should invest in education as long as

$$\theta \leq \bar{\theta} \equiv \ln[w_s - w_u]. \tag{2}$$

The important point is that, because education is a pure investment good, income does not matter. If θ is very high, but still less than $\bar{\theta}$, then the family will borrow pledging the future earnings of their offspring in order to achieve consumption smoothing.

Instead, here, we assume that all families face credit market problems, and cannot borrow pledging the future income of their offspring. More formally, the problem of parent i is to maximize (1) by choosing c, $\hat{c}$, s, and e subject to

$$\begin{aligned} & c + \exp(\theta_i)e + s \leq y_i, \\ & \hat{c} = s + w_u + (w_s - w_u)e, \\ & s \geq 0. \end{aligned} \tag{3}$$

The first condition is the budget constraint for the family. The second determines the consumption of the child, and the final one is the "credit constraint". This constraint implies that investment in education comes at the cost of consumption smoothing (low consumption in the first period, and high consumption in the second period).

If the level of income is high enough, so that parents would like to leave positive bequests ($s > 0$) to their offspring, credit market problems will not matter in the maximization problem in (3) (Becker and Tomes, 1986). Such a family already has high enough income, and consumption smoothing would mean transferring resources to their offspring. They will do so using the most efficient combination of human capital investment and monetary bequests. The condition guaranteeing that we are in the positive bequest region is

$$y \geq \bar{y} \equiv w_s + \exp(\bar{\theta}) = 2w_s - w_u.$$

In this case, income is high enough that even at the maximum cost of education (consistent with optimal investment in skills), parents would leave positive bequests.

Hence among families with income $y \geq \bar{y}$, the fraction investing in education is

$$G_r(\bar{\theta}) = G_r(\ln[w_s - w_u]), \tag{4}$$

where G_r is the distribution of education costs among 'rich' (unconstrained) families. The main point to note is that the fraction investing depends only on skilled–unskilled wage premium, and not on income.

Next, consider a 'poor' family with income $y < w_u$, and suppose that it does not invest in schooling. Then their lifetime utility will be $U(e = 0) = \ln y + \beta \ln w_u$, since in the first period, they consume the income y, and in the second period, their offspring consumes the unskilled earnings, w_u. If, in contrast, they send their child to school, they obtain utility $U(e = 1) = \ln(y - \exp(\theta_i)) + \beta \ln w_s$. Now, their first period consumption is $y - \exp(\theta_i)$, but their offspring obtains consumption w_s.

Comparison of these two expressions implies that there is a cutoff level of ability, θ^*, such that only poor parents with children who have ability $\theta \leq \theta^*$ invest in schooling, with

$$\theta^* \equiv \ln\left[y\left(\frac{w_s - w_u}{w_s}\right)^{\beta}\right] \approx \ln y + \beta \ln r,$$

where $r \equiv (w_s - w_u)/w_u$ is the college premium. Therefore, the fraction of poor families investing in education is

$$G_p(\theta^*) \approx G_p(\ln y + \beta \ln r), \tag{5}$$

where G_p is the distribution of education costs among poor families. Unlike in Eq. (4), the fraction now depends not only on the college premium, but also on family income.

3. Empirical strategy

The above model is easily translated into a simple linear estimating equation. If we could identify in the data who the unconstrained and the constrained families were, we should run equations of the following form:

For unconstrained families: $s_{ijt} = \delta_{\mathrm{r}} + \delta_j + \delta_t + \alpha_{\mathrm{r}} r_{jt} + \varepsilon_{ijt}$,

For constrained families: $s_{ijt} = \delta_{\mathrm{p}} + \delta_j + \delta_t + \alpha_{\mathrm{p}} r_{jt} + \beta_{\mathrm{p}} \ln y_{iqjt} + \varepsilon_{ijt}$,

where i denotes individual family, j denotes region, and t denotes time. s_{ijt} is a 0–1 variable which denotes whether the individual in question attends college. ε_{ijt} is an individual specific error term. These expressions follow from our theoretical model above, and allow both the effect of the college premium and family income to differ across rich and poor households.

Since we do not observe which families are constrained, we think of a more general model where the effect of family income on enrollments varies across income quartiles. Such a model would also allow the relationship between income quartile and enrollments to be non-monotonic. This is useful because the poorest households may be relatively unconstrained thanks to need based financial aid, while middle-class households, who do not qualify for financial aid, may be constrained, especially if they wish to send their children to private colleges. This gives us the following model:

$$s_{iqjt} = \delta_q + \delta_j + \delta_t + \alpha_q r_{jt} + \beta_q \ln y_{iqjt} + \varepsilon_{iqjt}, \tag{6}$$

where q denotes income quartile, and as before j denotes region, and t denotes time. Expression (6) nests our model above when $\beta_q = 0$ for rich families, and $\beta_q = \beta > 0$ for poor families, but allows more general heterogeneous effects of income and the college premium across income quartiles. We will also present results restricting the effects across income quartiles by setting $\alpha_q = \alpha$ and $\beta_q = \beta$ in order to make better use of the limited variation in our data.

Note that Eq. (6) includes main effects of income quartile and time effects. The latter will capture the effects of aggregate conditions like the college boom related to the Vietnam era, changes in federal financial aid and the like. In addition, we have written the relevant college premium as r_{jt}, which implies that families look at the college premium that applies in the region at the time of schooling. Both of these assumptions appear reasonable: Most people work in the same region as they completed schooling (see Acemoglu and Pischke, 2000), and the existing time-series evidence suggests that current returns, not expected future returns matter most for schooling decisions (Freeman, 1976). In any case, we show below that the income elasticity of college enrollments is insensitive to how we control for the effect of returns to college.

Eq. (6) can be aggregated across individuals to be written in a more compact form:

$$S_{qjt} = \delta_q + \delta_j + \delta_t + \alpha_q r_{jt} + \beta_q \ln Y_{qjt} + \varepsilon_{qjt}, \tag{7}$$

where S_{qjt} is the fraction of students attending college among those who completed high school (or among those in the right age bracket) in region j, income quartile q, and time t who attend college, and $\ln Y_{qt}$ is the log average income of family is in region j, income quartile q, and time t.

It is also useful to note that the estimation of Eq. (7) can be thought of as instrumental variables (IV) estimation of

$$S_{qjt} = \delta_j + \delta_t + \alpha_q r_{jt} + \beta_q \ln Y_{qjt} + \varepsilon_{qjt}, \tag{8}$$

using the full set of quartile-region–time interactions as the instruments for $\ln Y_{qjt}$. This IV interpretation clarifies why our empirical strategy is attractive. Family income is likely to vary with parental ability, labor supply or other reasons. As captured in the model, these factors may be correlated with the family's costs (attitudes) of educating their child, so that $\ln Y_{qjt}$ is correlated with the error term in Eq. (8). Our strategy avoids the bias that will arise from this correlation, because we are controlling for the parents' rank in the income distribution, which is close to a sufficient statistic for their unobservable characteristics. Identification is then achieved from the variations in $\ln Y_{qjt}$ conditional on this rank. The changes in the wage structure which have taken place in the United States during the 1970s and 1980s provide differential variation in the parental income distribution across quartiles.

In addition to using variation in the wage structure over time, our estimation strategy also exploits the fact that wage differentials have changed differently in different states or regions. By relying completely on within region variations we can control for the interactions of time and parental background group at the aggregate level in the college attendance equation. This allows us to also estimate models that control for other factors which might have affected the children of richer or poorer parents differently, like differential changes in tuition costs at private and public universities, or the changes in the availability of Pell grants and Guaranteed Student Loans.

4. Data

We study the effect of family income on college attendance, using the three longitudinal surveys of high school leavers sponsored by the U.S. National Center for Education Statistics (NCES): The National Longitudinal Study of the High School Class of 1972 (NLS-72), the High School and Beyond Survey (HSB), which started with high school seniors and sophomores in 1980, and the National Educational Longitudinal Study (NELS), which started with a class of 8th graders in 1988. These surveys roughly span the two decades of the 1970s and the 1980s in which returns to college first decreased and then increased.

Each of these surveys collected information on the educational background of the parents and on family income when the respondent was a senior in high school. Family income at various stages during the life of a child might affect its ultimate chance of attending college (see Duncan et al., 1998) because fewer resources at a young age may impede the cognitive development of a child.

Table 1
Means of fraction ever attending any college within two years of high school and family income by year and family income quartile, 1972–1992[a]

Year	Family income quartile 1	2	3	4
Attending any college				
1972	0.37	0.45	0.53	0.69
1980	0.45	0.52	0.60	0.72
1982	0.44	0.54	0.61	0.73
1992	0.56	0.66	0.75	0.87
Attending four-year college				
1972	0.22	0.28	0.34	0.51
1980	0.25	0.30	0.38	0.53
1982	0.26	0.33	0.39	0.53
1992	0.30	0.38	0.47	0.66
Family income (*in* $1000)				
1972	16.8	30.7	43.6	69.8
1980	16.6	28.5	40.9	81.4
1982	16.6	30.4	44.2	77.4
1992	13.7	30.0	48.4	92.2

[a]Cell level means for 4 Census regions. Data from the NLS-72, HSB Senior and Sophomore cohorts, and the NELS. Students left high school in 1972, 1980, 1982, and 1992.

Nevertheless, income during the senior year in high school seems to be the correct concept for our project because we want to focus on the role of income to cover the direct and opportunity costs of attending college. The schooling datasets record only bracketed variables for income, and there are 10–18 brackets. We overcome this problem by fitting parametric Singh–Maddala distributions to the incomes in the sample of college entrants and in the entire sample. From these two distributions, we derive the enrollment rate for each quartile in the income distribution and the average family income in the quartile.

Follow-up information after leaving high school was first collected two years after the respondents were in their senior year. From this follow-up wave, we construct measures of whether an individual ever attended any college in the interim, and whether the individual ever attended a four-year college. We derived information on returns from the 1970, 1980, and 1990 Censuses by calculating the average wages of those with exactly 16 and exactly 12 years of education (those with a college degree and a high school degree, respectively) among workers with 1–5 years of experience. Our definition of the return is $\ln(w_{16}/w_{12})/4$, which is approximately equal to the return to one year of college.

Table 1 gives summary statistics for our sample by family income quartiles and year. The top panel gives the fraction of children from families of different quartiles ever attending any college within two years of high school. The second panel shows the same information for attending four-year college, and the bottom panel is for family income. Table 2 gives similar statistics by region and year, and the variation in the college premium across regions and time.

A number of patterns are clearly visible from Tables 1 and 2. There has been little increase in the fraction of children attending four-year college between 1972 and 1982. Between 1982 and 1992, there has been a substantial increase, but this increase is concentrated among the children in the upper two quartiles. The bottom panel in the table shows that family incomes have only risen for families in the top quartile over this period, stagnated for the middle two quartiles, and fallen slightly for families in the lowest quartile. These patterns are

Table 2
Means of fraction ever attending any college within two years of high school and family income by year and Census region, 1972–1992[a]

Year	Census region			
	North East	North Central	South	West
Attending any college				
1972	0.53	0.48	0.46	0.57
1980	0.58	0.55	0.52	0.63
1982	0.58	0.57	0.52	0.66
1992	0.76	0.70	0.68	0.69
Attending four-year college				
1972	0.40	0.36	0.33	0.28
1980	0.43	0.41	0.34	0.28
1982	0.43	0.41	0.34	0.34
1992	0.57	0.48	0.42	0.34
Family income (*in* $1000)				
1972	41.4	41.1	36.7	41.7
1980	47.5	41.7	36.0	42.2
1982	42.3	42.3	37.2	46.8
1992	51.4	46.2	41.0	46.0
Returns				
1972	0.125	0.098	0.113	0.079
1980/82	0.076	0.070	0.079	0.069
1992	0.114	0.115	0.116	0.114

[a]Cell level means for 4 Census regions. Data from the NLS-72, HSB Senior and Sophomore cohorts, and the NELS. Students left high school in 1972, 1980, 1982, and 1992. Returns are calculated from the 1970, 1980, and 1990 Censuses.

therefore consistent with substantial income effects on enrollments in the aggregate. It is also noteworthy that there is a much weaker contrast across quartiles when looking at the fraction ever attending any college. This is in line with our thinking. The difference between attending any college and attending four-year college is mostly made up by community colleges, which are very cheap, and pose a lower opportunity cost for families from poor backgrounds since the duration is shorter. Therefore, in the presence of significant credit market barriers affecting education choices, we would expect families to increase the rate at which they send their children to community colleges much more than to four-year colleges over this period. This observation also implies that there may be quite significant heterogeneity in the quality of colleges that children from poorer and richer families are attending within these broad categories of two-year and four-year colleges.

Table 2 reveals that there is substantial variation in the variables of interest across the four Census regions. Both income and college enrollment rates have grown the most in the Northeast and the least in the West. Returns have moved mostly in line during the 1980s but there is some heterogeneity across regions in the 1970s. This illustrates that the region variation will be quite helpful in identifying our models.

5. Results

We start in Table 3 with the regressions which do not control for quartile effects. This is equivalent to estimating (8) without instrumenting for family income. The coefficient on family income in these models therefore captures both the effect of income and any other effect of family background which is correlated with income.

In this and the following tables, the first four columns have the fraction attending any college in a region-income quartile-year cell as dependent variable, while the last four columns are for the fraction attending four-year college. The discussion above suggests that the last four columns are more important for our argument. It turns out that the coefficients on family income are very stable across specifications. The estimate of the effect of log income on enrollments, 0.18, implies that a 10 percent increase in family income is associated by a 1.8 percentage point increase in enrollments. This is a fairly large effect of family income on college enrollments.

The first and fifth columns do not control for time effects, so they effectively exploit the national changes in family income and in the college premium to identify the effects on enrollments. These columns also show moderate effects of returns of attending college. For example, the estimate of 0.82 for log returns in column (5) implies that a 4 log point increase in the college return, which is roughly the increase from 1980 to 1990, should lead to a 3.3 percentage point

Table 3
Fixed effects regressions for the probability of attending college within two years of high school no controls for income quartile region by income quartile cells, 1972–1992[a]

	Ever attending any college				Ever attending four-year college			
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log mean family income	0.186 (0.016)	0.183 (0.007)	0.183 (0.007)	0.182 (0.006)	0.184 (0.011)	0.183 (0.008)	0.183 (0.008)	0.182 (0.008)
Return to college	1.341 (0.485)	—	− 0.790 (0.667)	—	0.822 (0.351)	—	− 0.945 (0.751)	—
Region effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Region × Year effects	No	No	No	Yes	No	No	No	Yes

[a] Data are cell level means for 4 Census regions, 4 years, and 4 quartiles for the income of the student's family. Number of cells is 64. Dependent variable is the fraction of students enrolled in any college or in a four-year college within two years of high school graduation calculated from the NLS-72, HSB Senior and Sophomore cohorts, and the NELS. Students left high school in 1972, 1980, 1982, and 1992. Return to college is the relative wage of those with exactly 4 years of college to those with a high school degree (for workers with 1–5 years of experience) calculated from the Census for 1970, 1980, and 1990.

increase in college enrollments. In the remaining columns, we add year effects. In the second and sixth columns, we drop returns to college, while in columns (3) and (7), returns to college are included. In all cases, the estimates of the effect of family income on college attendance is unaffected. Interestingly, in columns (3) and (7), the effect of college returns is estimated to be insignificant and negative. Although this result may be because families consider only the national return in making college decisions, it sheds some doubt on the conventional wisdom that returns to education have a major effect on enrollment decisions (see also Acemoglu and Pischke, 2000).

Table 4 gives our main results. Here we add dummies for the income quartile. This should control for any invariant family background effects related to the rank of a family in the income distribution and isolate the true effect of family income on enrollments. The results in columns (1) and (5), which do not control for time effects, are very similar to those in Table 3. Nevertheless, there are many other aggregate trends, which might have affected college enrollments. Our preferred specifications, in columns (2) and (6) therefore include time effects and exploit only the within region variation. The coefficient for family income is lower than those in column (1) and in Table 3. That the effect of family income is smaller now implies that our strategy is eliminating some of the unobserved characteristics correlated with family income. Nevertheless, we find a significant effect of family income for both enrollment variables, and the effect is larger for

Table 4
Fixed effects regressions for the probability of attending college within two years of high school controlling for income quartile region by income quartile cells, 1972–1992[a]

	Ever attending any college				Ever attending four-year college			
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log mean family income	0.218 (0.101)	0.107 (0.044)	0.102 (0.044)	0.146 (0.107)	0.212 (0.065)	0.148 (0.041)	0.142 (0.040)	0.093 (0.108)
Return to college	1.336 (0.491)	—	− 0.887 (0.616)	—	0.817 (0.314)	—	− 0.994 (0.556)	—
Region effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Income quartile effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Income quartile × Region effects	No	No	No	Yes	No	No	Yes	Yes
Income quartile × Year effects	No	No	No	Yes	No	No	Yes	Yes
Region × Year effects	No	No	No	Yes	No	No	No	Yes

[a]Data are cell level means for 4 Census regions, 4 years, and 4 quartiles for the income of the student's family. Number of cells is 64. Dependent variable is the fraction of students enrolled in any college or in a four-year college within two years of high school graduation calculated from the NLS-72, HSB Senior and Sophomore cohorts, and the NELS. Students left high school in 1972, 1980, 1982, and 1992. Return to college is the relative wage of those with exactly 4 years of college to those with a high school degree (for workers with 1–5 years of experience) calculated from the Census for 1970, 1980, and 1990.

four-year college enrollment (although this difference is not significant). Adding returns to college in the region in columns (3) and (7) has little effect on the estimate of the income elasticity. Interestingly, in these specifications the estimates on the returns to schooling once again become insignificant. Finally, adding second level interactions of income quartile, region, and time in columns (4) and (8) changes the general magnitude of the estimates little, though, since these controls eliminate much of the variation in the data, the effects are no longer statistically significant.

We therefore conclude that there is a robust effect of family income on enrollments decisions. Our baseline estimate of 0.14 indicates an economically very significant effect of family income. It implies that family income, rather than other factors related to family background, explain 27 percentage points of the 36 percentage point difference in the enrollment rates of children from the bottom and top quartiles in 1992. This is large compared to other studies, which have found positive effects of income. For example, Ellwood and Kane (1999) find that family income explains only 9 percentage points of the 26 percentage

Table 5
Fixed effects regressions for the probability of attending college within two years of high school effects by income quartile region by income quartile cells, 1972–1992[a]

	Ever attending any college				Ever attending four-year college			
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log mean family income Quartile 1	0.018 (0.143)	0.154 (0.056)	0.139 (0.064)	– 0.039 (0.187)	0.010 (0.085)	0.108 (0.052)	0.064 (0.053)	– 0.016 (0.190)
Log mean family income Quartile 2	0.229 (0.258)	0.189 (0.113)	0.167 (0.117)	0.201 (0.334)	0.151 (0.153)	0.128 (0.105)	0.087 (0.101)	– 0.205 (0.339)
Log mean family income Quartile 3	0.617 (0.273)	0.161 (0.116)	0.148 (0.129)	0.328 (0.283)	0.428 (0.162)	0.174 (0.107)	0.150 (0.112)	– 0.039 (0.287)
Log mean family income Quartile 4	0.405 (0.152)	0.012 (0.071)	– 0.005 (0.072)	0.231 (0.132)	0.392 (0.092)	0.212 (0.066)	0.183 (0.063)	0.147 (0.134)
Return to college Quartile 1	0.691 (1.052)	—	– 1.049 (0.759)	—	– 0.053 (0.623)	—	– 1.577 (0.659)	—
Return to college Quartile 2	1.144 (0.938)	—	– 1.032 (0.726)	—	0.599 (0.556)	—	– 1.121 (0.630)	—
Return to college Quartile 3	0.481 (1.050)	—	– 0.963 (0.722)	—	0.171 (0.622)	—	– 1.115 (0.627)	—
Return to college Quartile 4	1.367 (0.952)	—	– 0.438 (0.723)	—	1.304 (0.564)	—	– 0.226 (0.627)	—
Region effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Income quartile effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Income quartile × Region effects	No	No	No	Yes	No	Yes	Yes	Yes
Income quartile × Year effects	No	No	No	Yes	No	Yes	Yes	Yes
Region × Year effects	No	No	No	Yes	No	No	No	Yes

[a]Data are cell level means for 4 Census regions, 4 years, and 4 quartiles for the income of the student's family. Number of cells is 64. Dependent variable is the fraction of students enrolled in any college or in a four-year college within two years of high school graduation calculated from the NLS-72, HSB Senior and Sophomore cohorts, and the NELS. Students left high school in 1972, 1980, 1982, and 1992. Return to college is the relative wage of those with exactly 4 years of college to those with a high school degree (for workers with 1–5 years of experience) calculated from the Census for 1970, 1980, and 1990.

points enrollment difference between the top and bottom quartiles in 1982 after introducing various controls.

The framework we outlined above suggested that the effects of family income might differ between rich and poor families. It is possible to estimate separate effects for family income and returns by income quartile. The results of this exercise are given in Table 5. These results are less clear-cut, mostly because the estimates become relatively imprecise once the effects are allowed to vary by income quartile. To the degree that there are any patterns, we do not find that family income is most important for the lowest income families (in fact in the case of four-year college, the opposite seems to be true). This might indicate that even relatively rich families may not be completely unconstrained. In addition, income may matter for reasons other than credit market constraints, for example, because college is, to some degree, a consumption good rather than a pure investment good. Since the estimates are imprecise, it is difficult to draw firm conclusions from the results in Table 5.

6. Summary

The income elasticity of education decisions is a key parameter for the labor and macroeconomics literatures. The importance of knowing how responsive college enrollments will be to family income may have become even more important with the increase in the returns to schooling, which is expected to encourage greater enrollments.

In this paper, we proposed a novel identification strategy for estimating this elasticity. We exploited variations in family income over time due to changes in the overall income distribution. We find reasonably robust and large income elasticities. A 10 percent increase in family income is predicted to increase college enrollments by 1–1.4 percentage points.

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