

Lecture 5b: Higher Education Finance (cont'd)

Reference: “The Dynamics of Educational Attainment for Black, White, & Hispanic Males,” Cameron & Heckman JPE 2001.

Figure 1 shows college enrollment rates for males classified by race/ethnicity for 1970-2000.

White males' rates increased following the rise in returns to schooling in the 80s. Black males' rates responded later & less. Hispanic males' rates did not respond at all.

Figure 2 does the same with enrollment rates by family income quartile.

The lower two quartiles respond to the rise in schooling return with a lag as well.

This has been attributed to educational liquidity constraints (see Hauser 93, Kane 94).

The policy suggestion based on this (aside: and other) evidence has been that public aid for higher education will allow lower income & minority students to take advantage of the increased returns to schooling.

Short-run and long-run factors

Cameron and Heckman distinguish between short-run and long-run factors in schooling choices.

Short-run financial factors at the time of the college decision are parents' income and wealth while children are approaching college age. If parents have limited resources at this time, children may make credit-constrained college attendance choices.

Long-run factors include parents' permanent income. The profile of child investments arguably depends on the household's permanent income from the time that the child is very young.

This paper v. previous lit

Prior research by Hauser and Kane was based on the CPS.

College-aged CPS respondents' parents' information is available only if the respondents live with their parents or in a dormitory/institutional setting. Independent students' information is excluded.

Cameron & Heckman (1998) find that this biases the estimated effect of family income on college attendance *downward*.

C&H list 4 points of departure from prior research:

- (1) Their data have family income for all children, whether dependent on a parent or independent.
- (2) They estimate a dynamic schooling choice model that accounts for high school drop-out.
- (3) They begin this estimated model from an early age.
- (4) They divide college attendance into 2- and 4-year categories.

Data

C&H use the NLSY79's 1979-1991 waves. The youngest observed children in the sample are 14.

They model & estimate the decisions of young men aged 15 (before which few drop out of HS) to 24 (after which few attend college).

Given concerns about the CPS, it's worth noting that the NLSY79 also only reports parental income for dependent children. C&H deal with this standard problem by measuring parental income when the child is aged 15-16.

Figure 3a is a histogram of highest grade completed for black, Hispanics, and whites at age 15. We see that a gap emerges well before college.

Figure 3b is the same histogram for 24 year olds, and Table 1 shows age 24 college entry. High school graduation and college entry gaps between blacks and Hispanics and whites are evident.

Schooling transition dynamics

C&H find that uninterrupted schooling paths are the norm.

Most students who drop out do not return to school:

2-6% of eventual dropouts ever left and returned; 6-12% of eventual graduates ever left & returned.

Similarly, most HS grads who will ever go to college do so within a year of graduation.

Among HS grads 82% of whites & Hispanics and 73% of blacks who ever go to college go within 1 year of graduation.

5 to 8 percent wait > 3 years. [Aside: Given age 18 graduation, a graduate would have to wait 5-6 years for independent U.S. financial aid calculation.]

C&H argue that this rarity of delay in order to obtain financial aid suggests that federal aid is not what's driving the college attendance gap.

The family income-schooling connection

Panel b of Table 1 shows college attendance rates (among HS grads) for blacks, Hispanics & whites after making a particular adjustment for parents' income.

How? Table footnote *: "These predictions are based on family income quartile-specific attendance rates. Family income is measured at ages 15-16 except as noted in App. A [a sample construction appendix]."

This step closes 9 of an 11 percentage point college attendance between blacks and whites, and 5 of an 8 percentage point gap between Hispanics and whites.

So the assertion is that family income when the child is 15-16 accounts for the great majority of race/ethnicity college attendance differences in the U.S.

The academic debate that this paper establishes is over the interpretation of this finding.

An Econometric Model of Schooling Attainment

The objective is to “sort out age-by-age influences of variables such as family income in a general way”.

This is accomplished by looking at 10 age-specific (15-24) schooling decisions.

Age $a \in [\underline{a}, \dots, \bar{a}]$, Age a schooling j_a , Schooling choice $c \in C_{a,j_a}$

Let $D_{a,j_a,c} = 1$ if $c \in C_{a,j_a}$ is chosen. $\sum_{c \in C_{a,j_a}} D_{a,j_a,c} = 1$.

Individual's problem

$$\hat{c}_{a,j_a} = \arg \max \{V_{a,j_a,c}\}.$$

Recursivity: $c \in C_{a,j_a}$ determines j_{a+1} , or $j_a = \hat{c}_{a-1,j_{a-1}}$.

Approximate the value of the discrete choice using a linear in the parameters model (after Heckman 1981 and Eckstein & Wolpin 1989):

$$V_{a,j_a,c} = Z'_{a,j_a,c} \beta + \varepsilon_{a,j_a,c}.$$

Since the choice sets are determined endogenously, the model admits the possibility that $Z'_{a,j_a,c}$ is endogenous in any period.

Assumptions on the error distributions

Assume $\varepsilon_{a,j_a,c}$ follows factor structure

$$\varepsilon_{a,j_a,c} = \alpha_{a,j_a,c}\eta + v_{a,j_a,c}$$

where $\eta \sim N[0,1]$.

[A1] η independent of $v_{a,j_a,c}$ for all a, j_a, c & i (i index suppressed).

[A2] $v_{a,j_a,c} \sim$ extreme value; $v_{a,j_a,c}$ independent of all $v_{a',j_a',c'}$.

Then we have a McFadden 1974 conditional logit model.
Conditioning on η ,

$$\begin{aligned} \Pr(D_{a,j_a,c} = 1 | Z_{a,j_a}, \eta) &= \Pr(\arg \max_c V_{a,j_a,c} = c' | Z_{a,j_a}, \eta) \\ &= \frac{\exp(Z'_{a,j_a,c'} \beta_{a,j_a,c'} + \alpha_{a,j_a,c'} \eta)}{\sum_{c \in C_{a,j_a}} \exp(Z'_{a,j_a,c} \beta_{a,j_a,c} + \alpha_{a,j_a,c} \eta)} \end{aligned}$$

where Z_{a,j_a} are stacked $Z_{a,j_a,c}$.

Since estimating an η for each person is infeasible in the DDC model, we add

[A3] The $Z_{a,j_a,c}$ are independent of η for all a, j & all choice sets.

However note that $Z_{a,j_a,c}$ conditional on all past choices need not be independent of η ; in general they're not & this is the point of modeling the dynamics.

Initial Conditions

Let $D_{\underline{a},c}$ be the initial schooling attainment at age \underline{a} , which is modeled

$$\Pr(D_{\underline{a},c} = 1 | Z_{\underline{a}}, \eta) = \frac{\exp(Z'_{\underline{a},c} \beta_{\underline{a},c} + \alpha_{\underline{a},c} \eta)}{\sum_{c \in C_{\underline{a},j_{\underline{a}}}} \exp(Z'_{\underline{a},c} \beta_{\underline{a},c} + \alpha_{\underline{a},c} \eta)}$$

Building up from here, the probability of any sequence of life cycle schooling histories is

$$\begin{aligned} & \Pr(D_{\underline{a},c'} = 1 | Z_{\underline{a}}, \eta) \cdot \Pr(D_{\underline{a}+1,c',c} = 1 | Z_{\underline{a}+1,c'}, \eta) \\ & \cdot \Pr(D_{\underline{a}+2,c_{\underline{a}+1},c} = 1 | Z_{\underline{a}+2,c_{\underline{a}+1}}, \eta) \cdots \Pr(D_{\underline{a},c_{\underline{a}-1},c} = 1 | Z_{\underline{a},c_{\underline{a}-1}}, \eta) \end{aligned}$$

The η 's in the above expression are integrated out using $F(\eta)$. Much more detail on the evaluation of the likelihood of a schooling choice profile is in App. B.

C&H emphasize that this model is a generalization of previous models in which one or more of the following apply:

- The individual choice set is independent of age
- There is no individual heterogeneity, and so no selection in grade progression
- The role of the individual effect does not depend on age

Results

The model estimates schooling decisions at ages 15-24 & their dependence on:

- family income, family background, scholastic ability, tuition costs, & opportunities in unskilled labor

[See p 471 for estimation details. The main estimation issue is the proliferation of possible education transition patterns as the child ages, of course. The paper details several coefficient restrictions to deal w/ this. I'm also skipping detail on model fit, pp472-3.]

The estimation is used to answer 3 questions.

(1) Which variables have the most influence on schooling attainment at various ages?

Not discussed here, left for independent reading. Table 4 in the paper compares effects on the gap of equating characteristics across groups variable by variable.

(2) Can difference in personal endowments and family characteristics explain gaps in white-minority schooling attainment?

A: (i) Estimate model separately by race & compare coefficients. Result: strongly reject H_0 that coefficients are common across races.

(ii) Simulate schooling outcomes when minorities have the entire bundle of variables possessed by whites.

Table 3 simulations of several measures at different ages of white-minority education gaps excluding the AFQT show the extent to which giving minority students white students' covariates diminishes the gap.

To Table 3—

(3) Is this estimated influence of family income on college attendance primarily a consequence of long-run family environment or short-term family borrowing constraints during the adolescent years?

A: Compare estimated effects of family resources (i) controlling for ability via AFQT & (ii) not controlling for ability. If controlling for AFQT absorbs family income effects, C&H will infer that long-run factors predominate.

In table 3, characteristics of white students given to minority students when predicting minority students' educational outcomes first exclude and then include the students' AFQT scores.

Controlling for ability in this way, C&H find that in many cases minority students' schooling attainments actually exceed those of whites.

To Table 3--

Policy conclusions

Given these results, can we expect a college tuition subsidy to close the educational attainment gap? Can we expect increasing the incomes of parents of college-bound teenagers to close the gap?

Table 5 shows the predicted responses of college entry by HS grads to a \$10,000 increase in family income at college entry.

The results indicate that without controlling for AFQT, there is a significant positive effect of the \$10,000 income increase.

However, this gain disappears when using the estimates that include AFQT.

Further, the gain in entry to two year colleges is not significantly greater than zero. The authors infer from Table 5 results that the relationship between family income and college entry is largely about 4-year college entry.

This is followed by some sensitivity analysis on measurement error in parents' incomes.

Table 6 performs a tuition experiment: Gross 2- and 4-year tuition is increased on college entry by \$1000 for HS grads of each race/ethnicity group.

Findings are that black students are relatively unresponsive to tuition.

Community college students are highly responsive to tuition and significantly decrease enrollment in response to the tuition hike.

4-year college students do not respond significantly to the tuition hike.