The Demand for and Return to Education When Education Outcomes are Uncertain

Joseph G. Altonji (1993). Journal of Labor Economics

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Bledi Taska (NYU)

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Motivation

- In most of the literature education outcomes are certain
- No role for uncertainty
- However education choices are sequential in their nature
- Uncertainty may be important

Motivation

Why modeling uncertainty is important

- Many people who plan to complete college, drop out
    - Students change their college major
- Ex-post returns to one year of college are non-linear in the years of education
    - Hence ex-ante returns may be different from ex-post returns
    - The effect of different characteristics on ex-ante returns may be understated

Aim of the paper

- Develop a simple model of education choices under uncertainty
  - Students differ in ability, preferences and other characteristics
  - When enrolled in college students receive new information
- Use the theoretical model to setup an empirical framework to estimate ex-ante returns to one year of college

Main empirical results

- Ex-post returns to one year of college for men are slightly negative
- Ex-ante returns are 2.8%
- For women returns are 8.5% and 7.4%
- If we allow for returns to experience, the ex-ante returns increase substantially
- Ability and other characteristics increase ex-ante returns

The Model

- Two-period model: s ϵ $\{0, 1, 2\}$
- In period 0 students choose to enroll in college or not, and their major c ϵ $\{m, \ h\}$
- Their state is knowledge: $K_0 = \{K_{m0}, K_{h0}\}$
    - and ability $A = \{A_m, A_h\}$

The Model

- At the end of first period they may drop out or change their field of study.
- $K_{s+1} = f(K_s, \ A)_c + v_{s+1}$
- g_{2c} is the probability of graduating in field c
- $F_{hm}(g_{2m}, \ g_{2h} | \ K_0, \ A, \ c_1)$ is the joint distribution of graduation probabilities.

The Model
(Earnings)

- High school graduate : Y_0
- College drop-out after one year: $\mathrm{Y}_1 = \frac{Y_0(1+r_1)}{1+R}$
- College drop-out after two years: $\mathrm{Y}_2 = \frac{Y_0(1+r_1)}{(1+R)^2}$
- College graduate: $\mathrm{Y}_c = \frac{Y_0(1+r_c)}{(1+R)^2}$
- $\mathrm{Y}_c > \mathrm{Y}_1, \mathrm{Y}_0$

The Model
(Preferences)

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- U(Y_h, 1) >U(Y_m, 1) does not change his major to m
- U(Y_h, 2) =U(Y_m, 2) > U(Y_0, 2) may change his major
- Students do not know their type in period zero

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- for type 2 :
  $V_2(g_2, 2) = \max\{(g_{2h} Y_h + \frac{(1-g_{2h})Y_1}{1+R}),\ (g_{2m} Y_m + \frac{(1-g_{2m})Y_1}{1+R}),\ \ \ Y_1\}$

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Ex-ante returns to starting college

$$Y_0 = \frac{P_{1c1} Y_0 (1 + r_1)}{1 + \rho} + \frac{P_{1c2} Y_0 (1 + r_1)}{(1 + \rho)^2} + \frac{P_{1c2_h} Y_0 (1 + r_h)}{(1 + \rho)^2} + \frac{P_{1c2_m} Y_0 (1 + r_m)}{(1 + \rho)^2}$$

- Ex-ante return ρ is increasing in : $r_1,\ r_{2h},\ r_{2m},\ A,\ K_0$ *and* $\frac{\theta_2}{\theta_2 + \theta_1}$
- It is decreasing in θ_0

Ex-ante returns to starting college

$$Y_0 = \sum_{s=1} \sum_{c} P(X,\ Z)_{1,sc} Y(X, Z, \rho)_{sc} + P(X,\ Z)_{1,1} Y_0(X, Z, \rho)$$

- Estimate $P(X,\ Z)_{1,sc}$ and $P(X,\ Z)_{1,sc}$ from data with a probit model
- Estimate $Y(X, Z, \rho)_{sc}$ and $Y_0(X, Z, \rho)$ from data with a Mincer regression
- Find ρ that solves the equation

Wage equation

$$\ln w_t = XB_1 + ZB_2 + r_{sc} + a_{st} + \Psi_t$$

$$Y(X, Z, \rho)_{sc} = Y_0(X, Z) \exp^{rs-\rho}$$

Data

- Panel: NLS72
- Data on education outcome
  - College major
  - Aptitude and achievement measures (Z)
  - Family characteristics (X)
  - Hourly wage rates

Education outcome	*Pooled*	*Men*	*Women*
College less than 2	0.037	−0.0076	0.085
College 2	0.129	0.057	0.194
College nontechnical	0.238	0.298	0.152
College technical	0.441	0.404	0.394

Empirical Results

Ex-ante returns

Returns to experience	*Pooled*	*Men*	*Women*
$a = 0$	5.1	2.8	7.4
$a = 0.001$	6.2	4.1	8.4
$a = 0.05$	9.0	7.3	10.8

Empirical Results

Ex-ante returns

Ability	*Pooled*	*Men*	*Women*
High	6.4	4.2	8.8
Low	3.6	0.5	5.9

Empirical Results

Ex-ante returns

Family backround	*Pooled*	*Men*	*Women*
Favorable	5.4	3.3	7.3
Unfavorable	4.8	1.9	7.6

Conclusions

- Develop a theoretical model of college enrollment under uncertainty
- Set up an empirical framework to estimate ex-ante returns to education
- Ex-ante returns to one year of college for men are substantially higher than ex-post returns
- The effect of ability and family background on returns to education is understated if we only consider ex-post returns