Labor Economic

Lecture 10: Human Capital III

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Human Capital

I. Theory of human capital as an investment

II. Is education a good private investment?

   A. Basic facts for U.S.

   B. Empirical Estimate of Returns to Education

   C. **Heterogeneous Benefits and Costs of Education**

III. Is education a good social investment?

Homogeneous Treatment Effect (Returns to Educ.) $\equiv \theta$

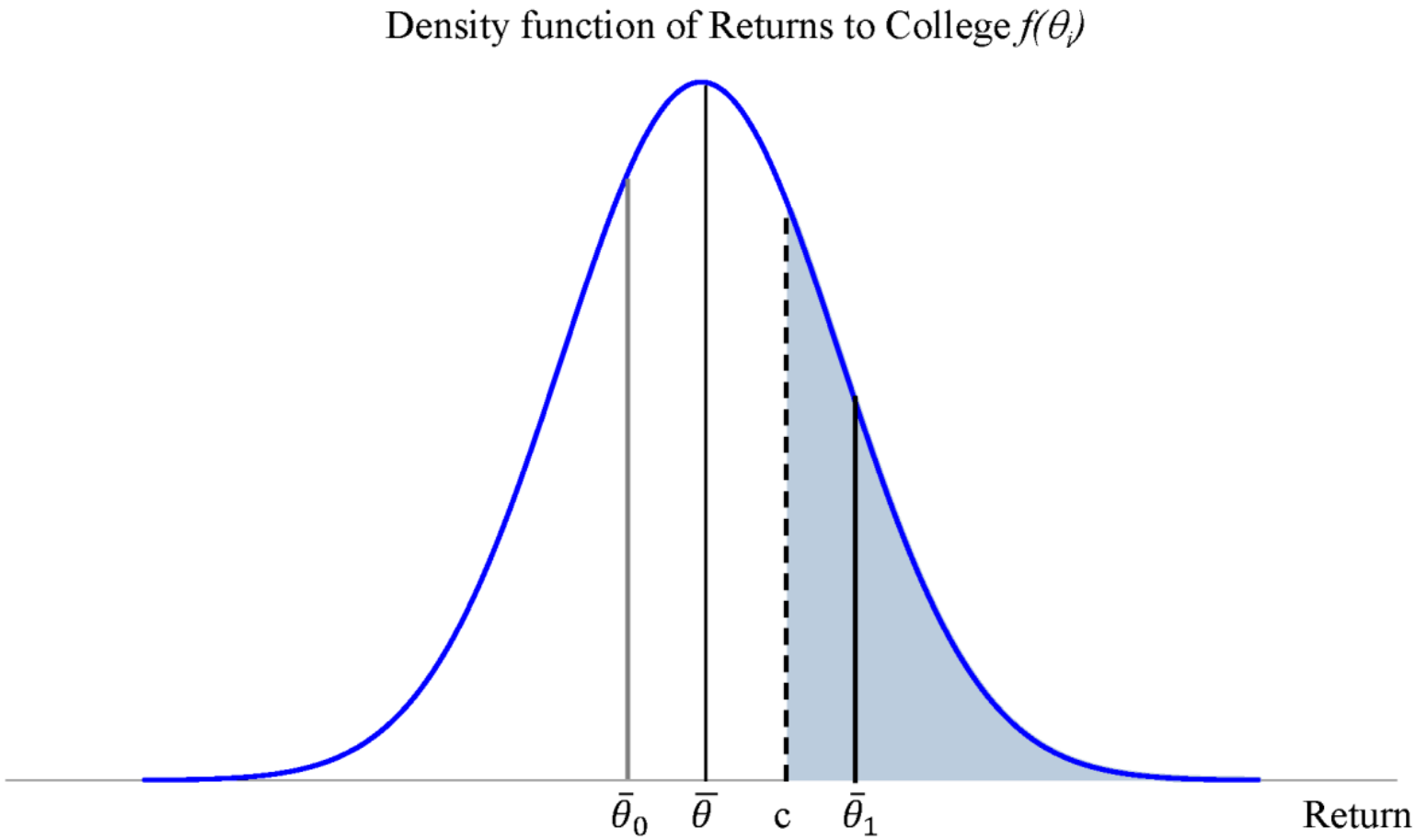
$$Y_i = \alpha + \theta \cdot T_i + U_i \tag{1}$$

- Omitted Variable Bias: $Cov(T_i, U_i) \neq 0$
- Conventional wisdom: OLS biased up due to positive ability bias
  - Angrist and Krueger (1991) use instruments (quarter-of-birth) to reduce ability bias
  - Ashenfelter and Krueger (1994) use twin differences to reduce ability bias, and use cross-reports as IV to reduce measurement error bias
- Findings: IV estimates are greater (often 30% or more) than OLS estimates: $\widehat{\theta}_{IV} > \widehat{\theta}_{twin} > \widehat{\theta}_{ols} \approx 8$ 10%
- Why? Heterogeneous benefits/costs of educ.? (Heterogeneous T.E.?)

Heterogeneous Treatment Effect (Returns to Educ.) $\equiv \theta_i$

$$Y_i = \alpha + \theta_i \cdot T_i + U_i \tag{2}$$

- θ_i varies over i (allows for the return to educ. to vary across people)
- Can we identify the Average Treatment Effect: $E[\theta_i] = \theta$
- Example: Returns to college for individual $i = \theta_i$
  - $f(\theta_i)$ population density function
  - c = constant marginal cost of going to college
  - If $\theta_i \geq c$, go to college ($T_i = 1$)
  - If $\theta_i < c$, don't go to college ($T_i = 0$)



- $\overline{\theta} = E[\theta_i]$: Average Treatment Effect (ATE)
- $\overline{\theta}_1 = E[\theta_i | T_i = 1]$: Average Treatment Effect on the treated (ATT)
- $\overline{\theta}_0 = E[\theta_i | T_i = 0]$: Average Treatment Effect for untreated (ATU)
- c = Marginal Treatment Effect (MTE) i.e., effect on the marginal person

Heterogeneous Treatment Effect (Returns to Educ.) $\equiv \theta_i$

- Implication: people with higher benefit of education get more educ. $Cov(\theta_i, T_i) \neq 0 \Rightarrow$ **Selectivity Bias**

- $T_i = \mathbf{1}\{\theta_i > c\}$: Pure "Roy" model
  - All variations in choice due to heterogeneous benefit (θ_i)
  - CANNOT identify the T.E. of going to college w/o strong assumptions
  - Can't find even two people with different educ. but otherwise identical

- $T_i = \mathbf{1}\{\theta_i > c_i\}$: Generalized Roy model
  - some variations in choice due to heterogeneous cost (c_i)
  - If costs are uncorrelated with θ_i(and other unobservables), one can identify treatment effect using c_i as instrumental variable
  - Can find people with different levels of education but same benefits

Heterogeneous Effect of Education

$$Y_i = \alpha + b_i \cdot S_i + U_i \tag{3}$$

Y_i: log of earnings
S_i: years of education schooling
b_i: return to education for person i

- $Cov(S_i, U_i) \neq 0 \Rightarrow$ omitted variables bias
- $Cov(S_i, b_i) \neq 0 \Rightarrow$ selectivity bias

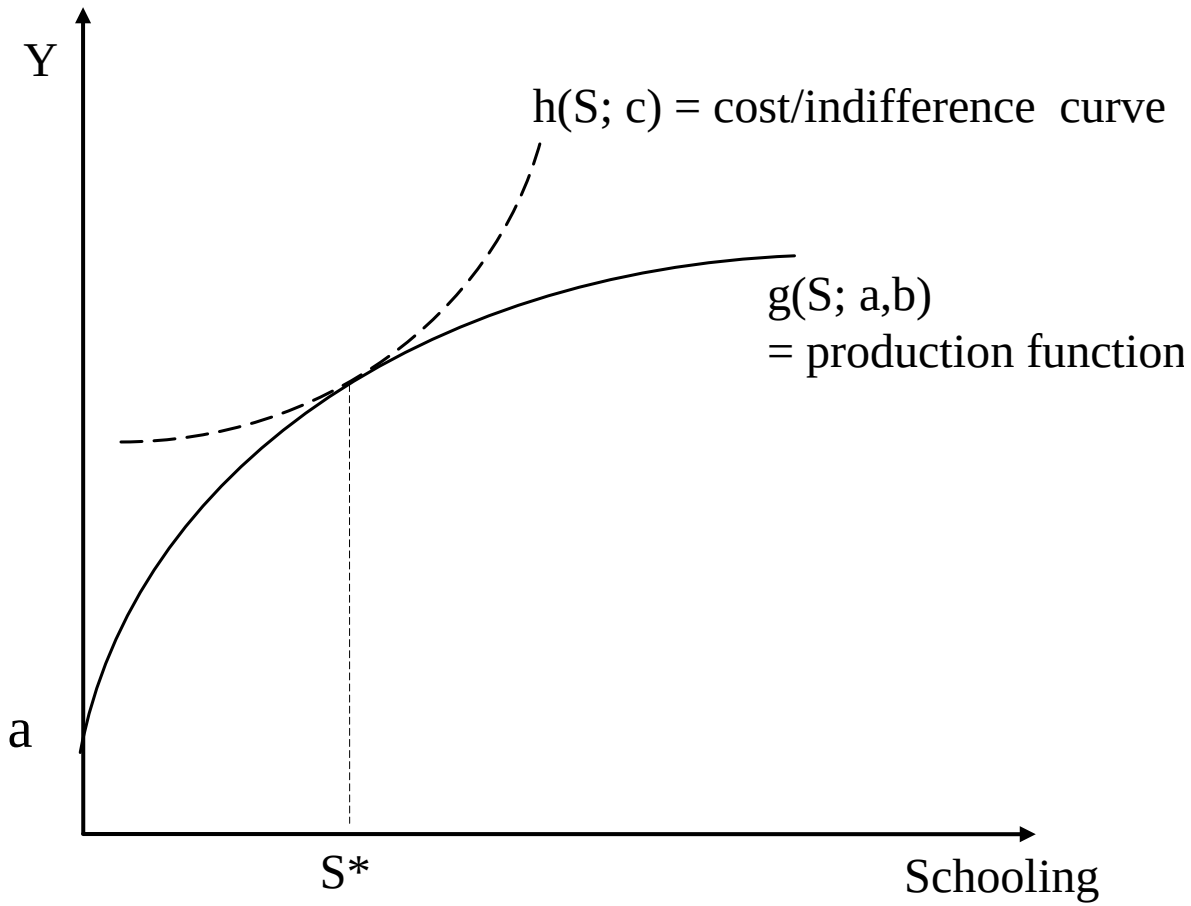
C. Heterogeneous Benefits and Costs of Education

(simple graphical analysis)

- What causes variation in educational attainment in the population?
  - Ability (a_i), Marginal benefits (b_i), Marginal costs (c_i)
- Earnings production function: $g_i(S_i; a_i, b_i)$
  - Higher $a_i \Rightarrow$ higher Y_i at each level of S_i (higher y-intercept at $S_i = 0$)
  - Higher $b_i \Rightarrow$ steeper relation between Y_i and S_i
  - b_i falls as S_i increases $\Rightarrow$ concave production function: $g_i(S_i; a_i, b_i)$
- Cost function $\approx$ "indifference" curves: $h_i(S_i; c_i)$
  - Prefer higher Y_i and less S_i (education is costly and painful)
  - Higher $c_i \Rightarrow$ steeper relation between c_i and S_i
  - c_i rises as S_i increases $\Rightarrow$ convex cost function: $h_i(S_i; c_i)$

C. Heterogeneous Benefits and Costs of Education

(simple graphical analysis)



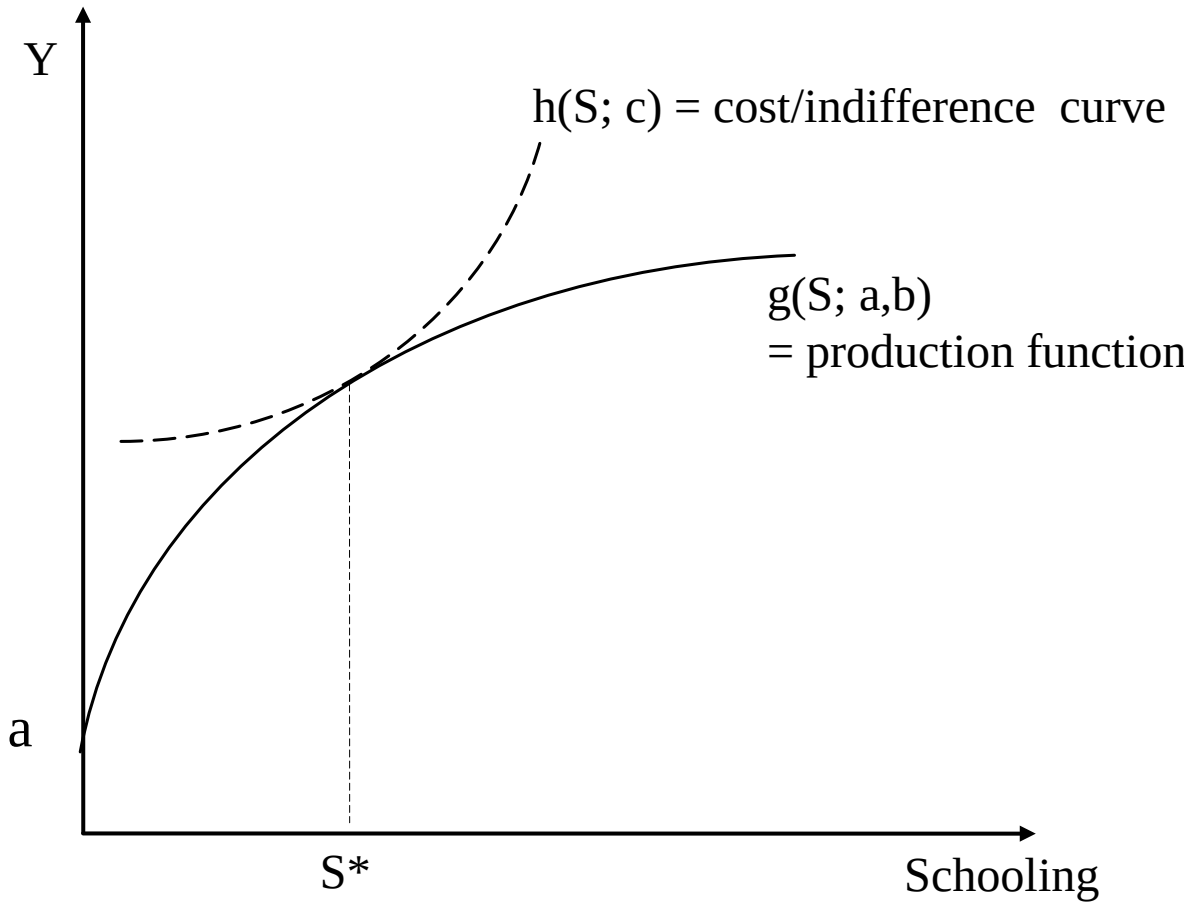
C. Heterogeneous Benefits and Costs of Education

(simple graphical analysis)

- Example: two types of people in population
  - type-j: (a_j, b_j, c_j)
  - type-k: (a_k, b_k, c_k)
- What kinds of MB's and MC's can explain the empirical findings?

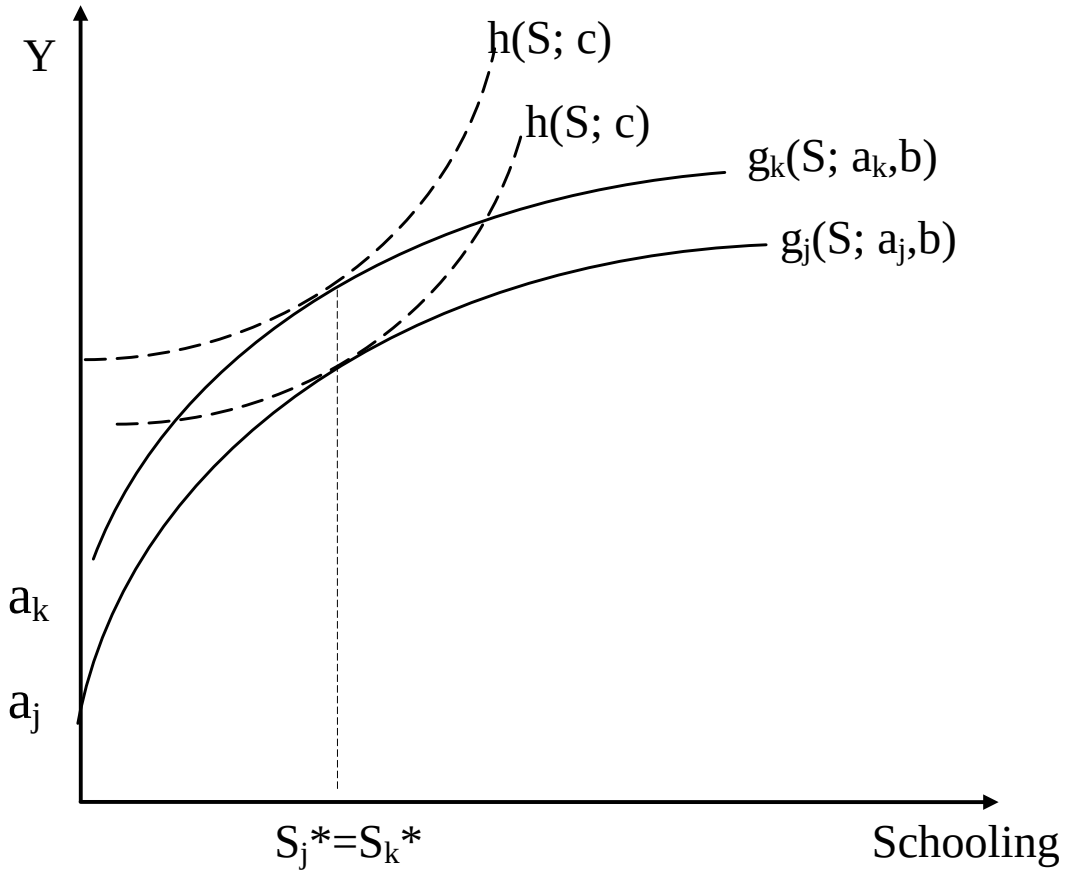
Case I: No heterogeneity in a, b, and c across people

- Prediction: everyone gets same level of education
- Rejected by data



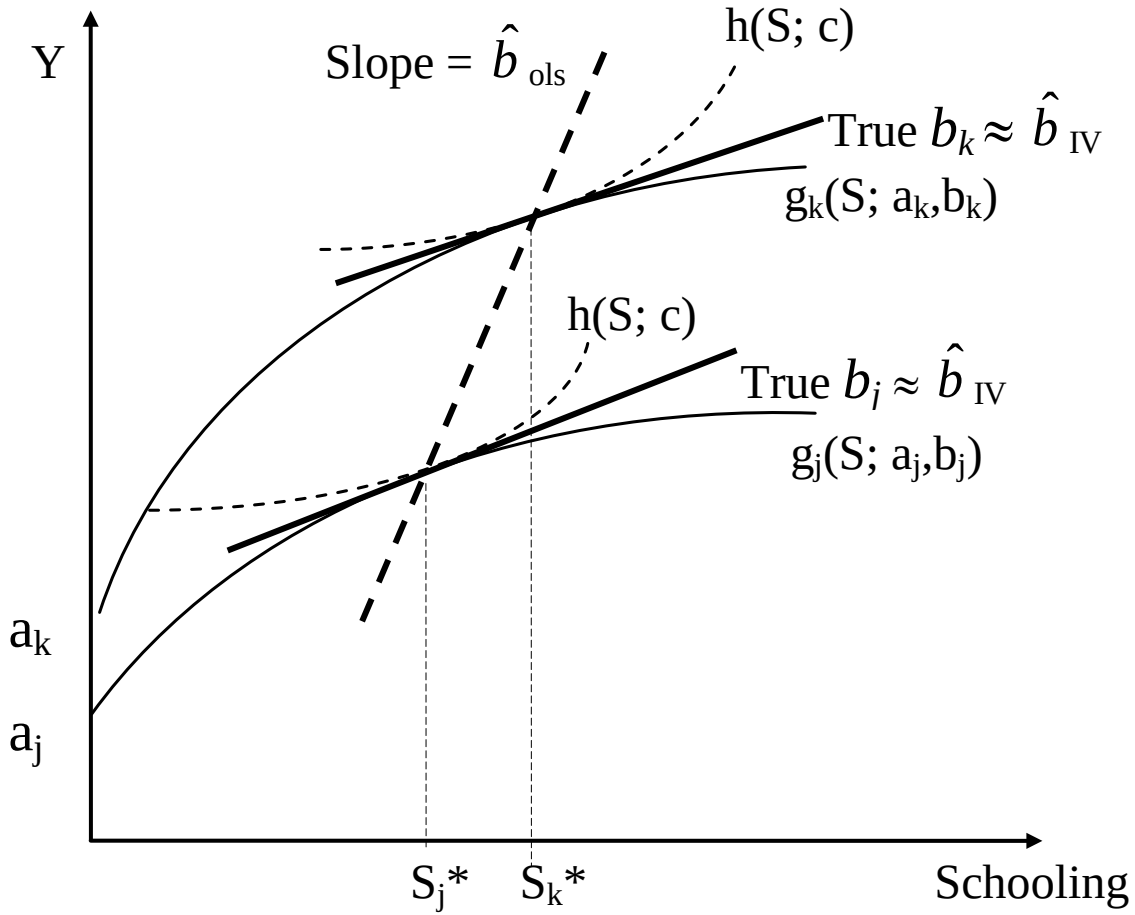
Case II: Only a varies across people

- $a_j < a_k$ (type-k has higher ability)
- Prediction: Prediction: everyone still gets same level of education
- Rejected by data



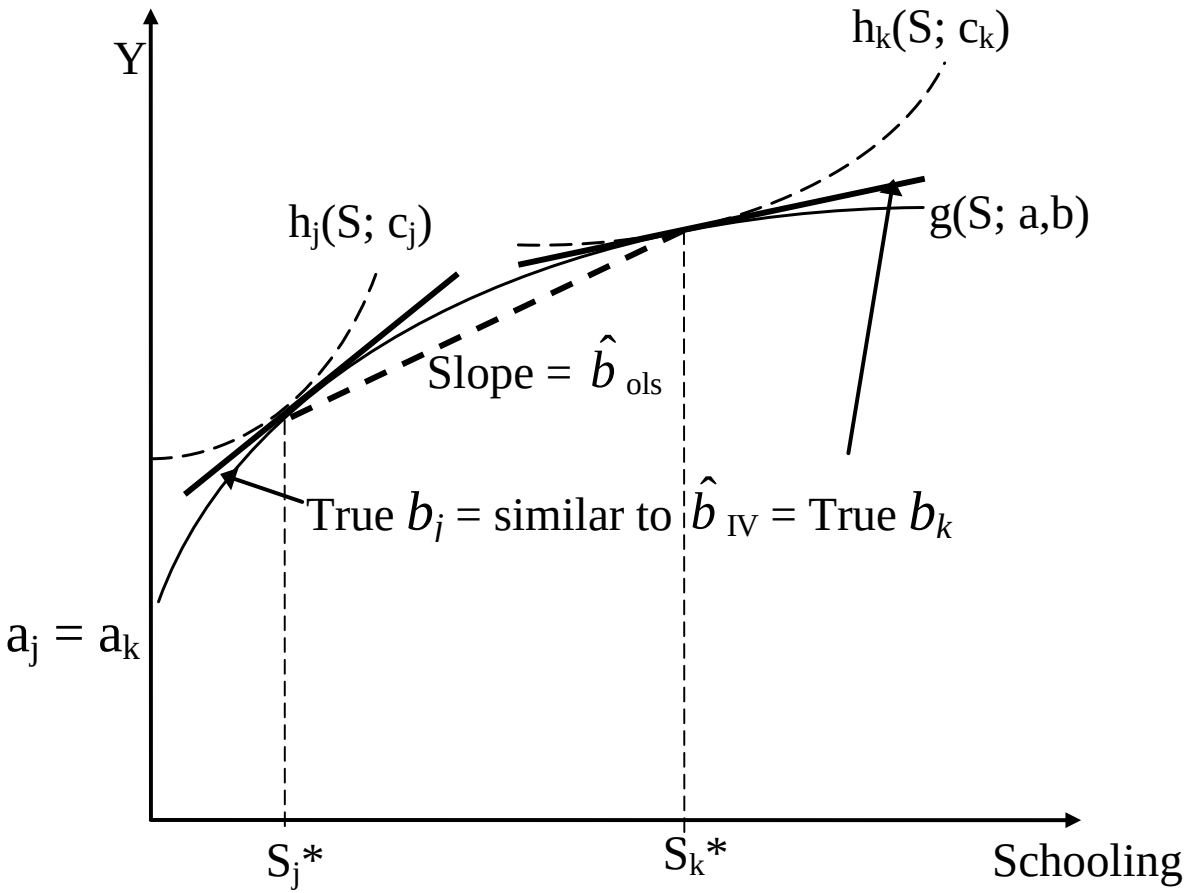
Case III: Only a and b vary across people

- $a_k > a_j$ and $b_k > b_j$ (type-k has higher ability and higher MB)
- Prediction: type-k gets more education than type-j
- OLS estimate greatly overstates true return to educ. for both types



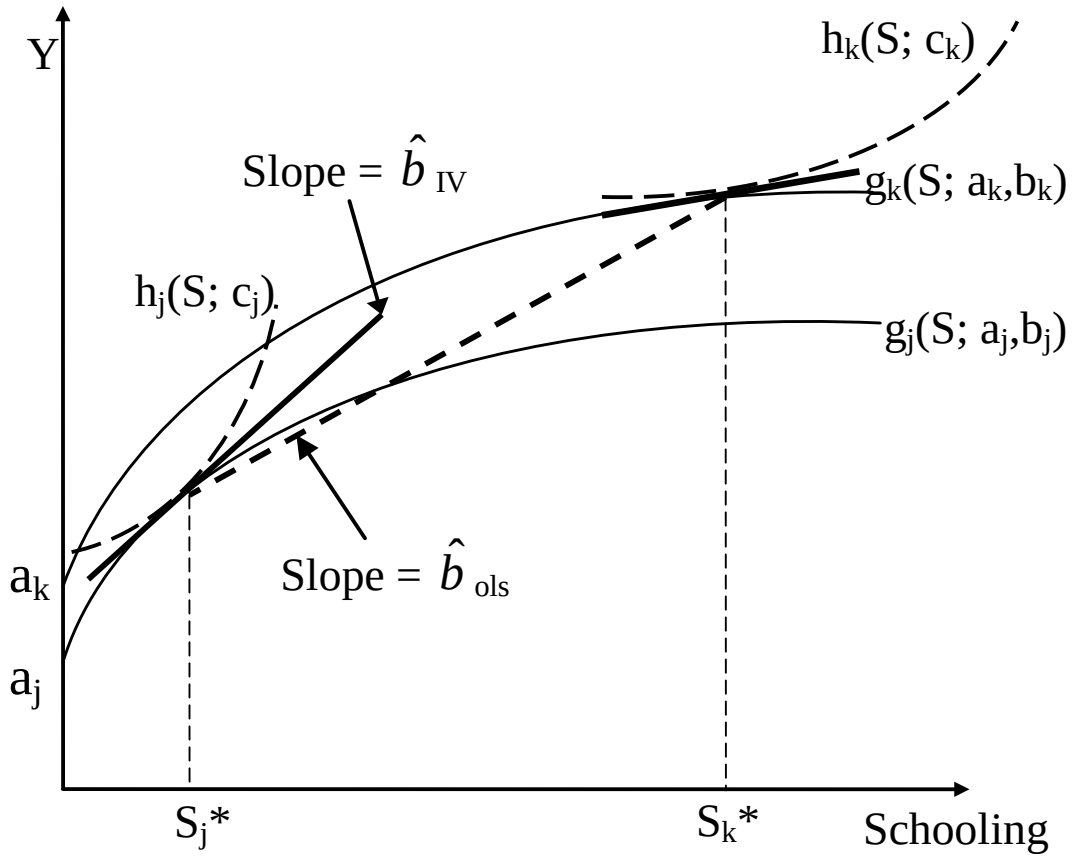
Case IV: Only c varies across people

- $c_k < c_j$ (type-j has higher MC and/or distastes for education)
- Prediction: type-k gets more education than type-j
- OLS understates true return to educ. for type-j, overstates for type-k,
- Can explain empirical findings

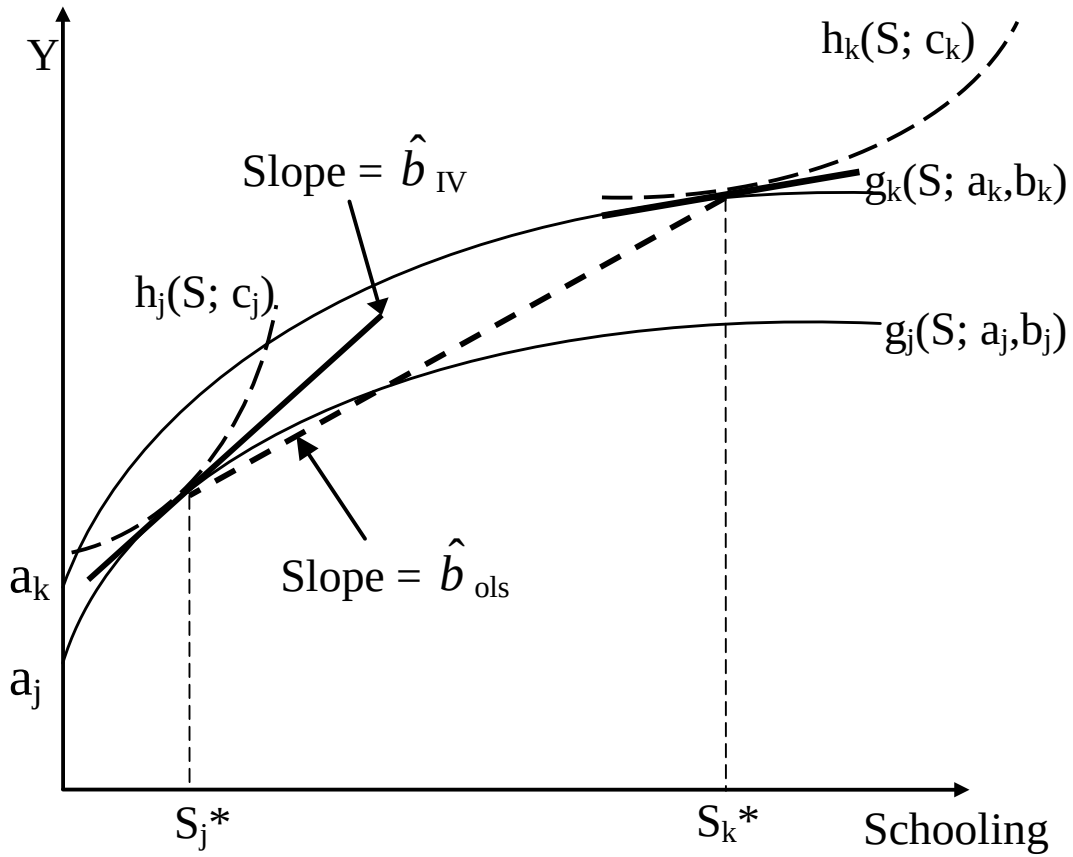


Case V: a, b, and c vary across people

- $a_k > a_j$, $b_k > b_j$, $c_k < c_j$ (k has higher ability& MB, but lower MC)
- Prediction: type-k gets more education than type-j
- If c varies enough, then $b_{IV} > b_{ols}$ for those with higher c (type-j)
- Can explain empirical findings



Case V: a, b, and c vary across people



- May imply that financial constraints matter in United States (i.e., imperfect lending markets or imperfect information)
- Likely to be even more important in developing countries

III. Is Education a Good Social Investment?

- Human capital theory $\Rightarrow$ education increases productivity of workers $\Rightarrow$ high estimate of return to education $\Rightarrow$ good **social investment**
- Signaling theory $\Rightarrow$ education is just a (costly) signal of one's ability (imperfect information on worker's ability) $\Rightarrow$ bad social investment; does not enhance productivity (just a label)
- Signaling? unlikely in studies we have covered
  - Compulsory law (quarter-of-birth) study: unclear how staying in school until age 16 is signal of ability
  - Twins study: ability held constant and education differences are small
- Signaling could be important for GED, MBA (credentials)

III. Is Education a Good Social Investment?

- School Quality?
  - Several studies find association between school inputs (class size, teacher quality) and wages later
  - Consistent with inputs having productive effect (quality of primary and secondary schools unobserved to employer – could not be signaling)
  - Could partially explain heterogeneity in estimated returns to education – i.e., people attending higher quality schools may have higher returns to education
  - Evidence that racial convergence in school quality in segregated South between 1920 and 1940 led to convergence in racial earnings gap in 1960s