Lecture 6: Human Capital

Labor Economics, Fall 2025

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Human Capital Investment

Very brief review of the previous lecture

- Labor market outcomes:
  - Wages and employment
- Why do wages and employment vary across workers?
  - Because of the labor supply and labor demand
- The only difference between workers is the amount of hours they are willing to work.
- In reality, workers are not identical in terms of their productivity.
- Why? Because of the **human capital investment**.

Opening Questions

- Why you chose to study economics in Nanjing University?
- What are you going to do after graduation?
  - Find a job in a company or government agency
  - Pursue a advanced degree
  - Start your own business
- What are the most important factors that influence your decision?
- All these decisions are also related to a core concept in labor economics: **human capital investment**.

Human Capital Investment

- Investment: an act of spending money now to gain future benefits.
    1. Incur an initial cost
    2. Expect to recoup in some future period
- Human Capital Investments
    1. Education and training
    2. Health
    3. Migration
    4. Job search
- Special feature: investment embodied in people

Human Capital Investment

- **Theodore Schultz**,Professor of Economics at University of Chicago.
- **1979 Nobel Prize Winner**
- The most contribution to the field of labor economics is his work on human capital.

H.C. in The Wealth of Nations

- Stock of physical capital:
  - natural resources, buildings, machines
- Stock of human capital:
  - accumulated investments in education, training, migration, health and technology
- Even H.C.is more important than P.C. on the economics
  - Germany / Japan after WWII

Three Stages of H.C.Investment

- Early childhood
  - Skill acquisition determined by others
  - Parental resource and guidance
  - Environment
  - Early school experience
- Teenagers and young adults as full-time students
  - Formal schooling
- Adults, after entering the labor market
  - On the job training

The typical questions

- Why some guys obtain a lot of schooling and others drop out at early age?
- How does the rate of return to schooling compare with the rate of return on other investments?
- How workers make their investments decisions and investigates how these choices influence the evolution of earnings over the life cycle?

Position in Labor Economics

- It is one of the most important ideas in labor economics.
- The perspective is important in understanding both investment incentives and the structure of wage and earnings.

Structure

- Schooling decision
  - College vs. high school
  - Continuous schooling choice
- The signaling model
  - Is the investment socially worthwhile?
- Post-school investment(OJT)

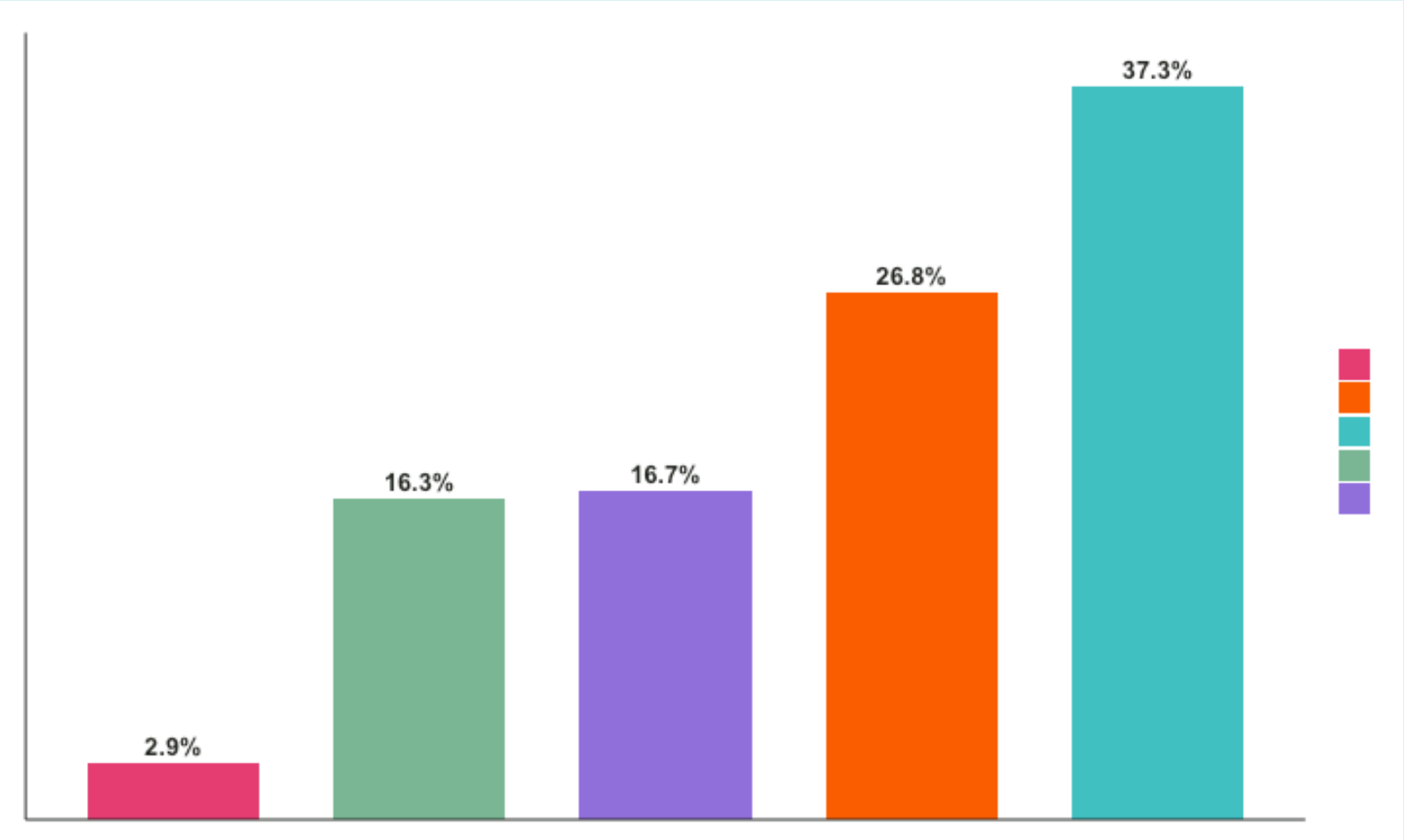
The distribution of education in U.S.

TABLE 6-1 Educational Attainment of U.S. Population, 2007 (Persons Aged 25 and over)

Source: U.S. Bureau of Labor Statistics, *Annual Demographic Supplement of the Current Population Surveys*, March 2007.

	Highest Grade Completed (Percentage of Population in Education Category)					
Group	Less Than High School	High School Graduates	Some College	Associate Degree	Bachelor's Degree	Advanced Degree
All Persons	12.7%	33.2%	16.7%	8.6%	18.9%	9.9%
Gender:						
Male	13.3	33.4	16.1	7.7	18.7	10.8
Female	12.2	33.0	17.3	9.5	19.0	9.0
Race/ethnicity:						
White	8.3	33.4	17.4	9.1	20.8	11.1
Black	15.0	38.6	18.9	8.8	13.1	5.7
Hispanic	36.6	31.4	13.0	6.2	9.4	3.3

The distribution of education in China



Labor Market Characteristics in U.S.

TABLE 6-2 Labor Market Characteristics, by Education Group, 2007 (Persons Aged 25–64)

Sources: U.S. Bureau of Labor Statistics, *Annual Demographic Supplement of the Current Population Surveys*, March 2007.

		Less Than High School	High School Graduates	Some College	College Graduates
All workers:	Labor force participation rate	62.9	76.0	81.3	85.9
	Unemployment rate	8.6	4.9	3.7	1.8
	Annual earnings (in $1,000)	22.8	33.0	39.3	68.2
Gender:					
Men	Labor force participation rate	75.6	83.6	87.4	92.5
	Unemployment rate	8.4	5.6	3.9	1.9
	Annual earnings (in $1,000)	26.2	39.6	47.2	84.8
Women	Labor force participation rate	48.1	68.1	76.1	79.7
	Unemployment rate	8.8	3.9	3.5	1.8
	Annual earnings (in $1,000)	16.8	25.0	31.9	50.6
Race/ethnicity:					
White	Labor force participation rate	57.7	76.6	81.2	86.2
	Unemployment rate	8.8	4.4	3.2	1.7
	Annual earnings (in $1,000)	26.1	35.2	49.9	70.7
Black	Labor force participation rate	53.7	71.8	80.9	88.2
	Unemployment rate	14.9	7.8	5.6	2.4
	Annual earnings (in $1,000)	19.3	28.0	34.3	55.3
Hispanic	Labor force participation rate	69.8	79.1	82.9	85.7
	Unemployment rate	7.3	3.9	4.4	2.1
	Annual earnings (in $1,000)	21.6	28.8	35.2	55.7

The Schooling Model

The Schooling Model

- Objective: Maximize the present value of lifetime earnings
- Benefits of education and training only come from the investment aspect
- "Side effects"of education in increasing utility are ignored in the model
  - Consumption aspect
  - Advantage in the marriage market

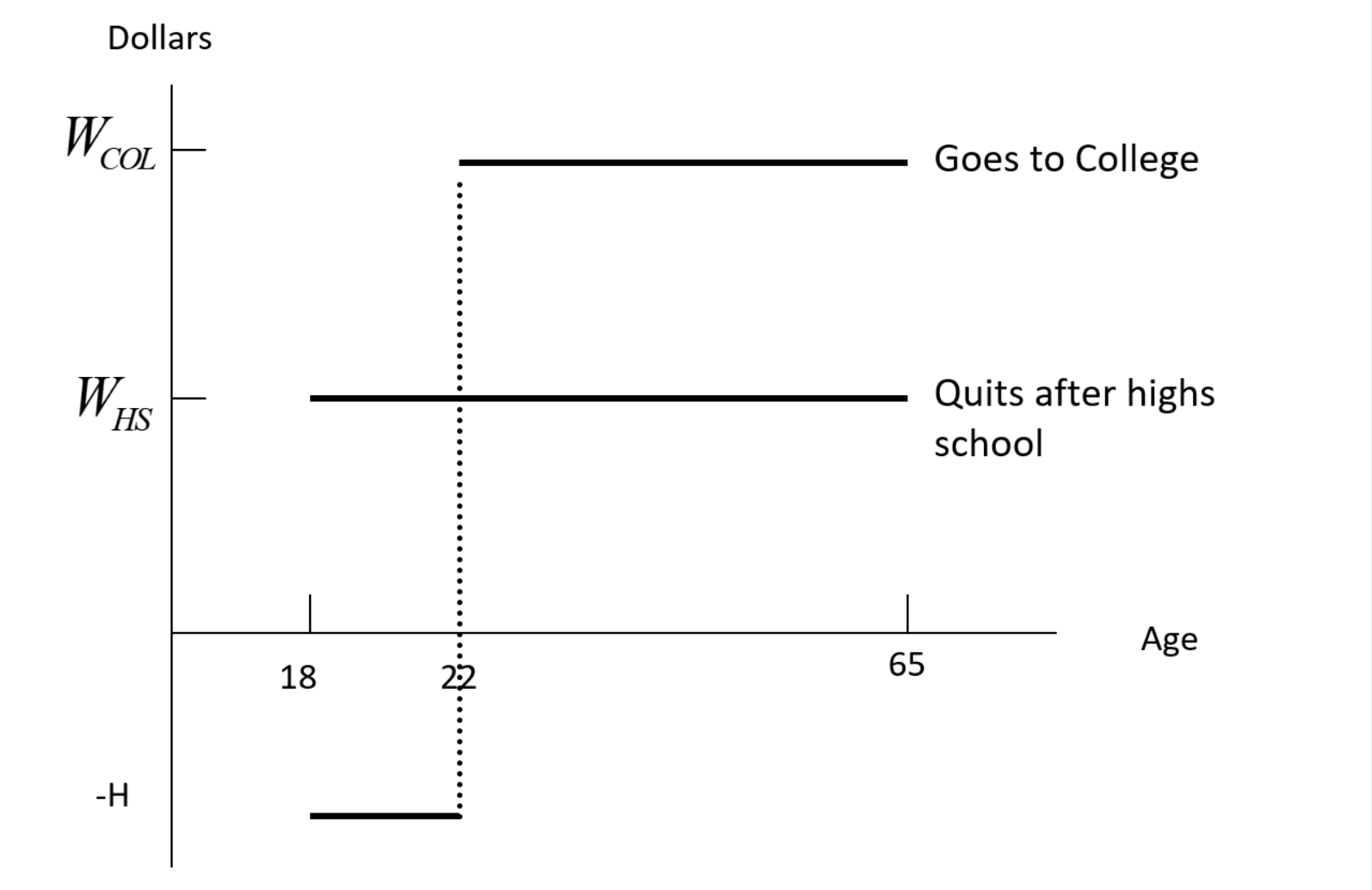
Costs of Education

- Direct expenses:
  - Tuition
  - Expenditure on books and school supplies
- Foregone earnings:
  - Opportunity cost of time
- Psychic costs

Consider the Decision of College

- Consider a high school graduate at 18 years
- He earns W_{HS} if quitting school after high school
- If he goes to college,
  - pays direct cost H
  - delays labor market entry by 4 years
  - earns W_{COL} after college

Potential Earnings Stream



Consider the Decision of College

$$PV_{col} = -H - \frac{H}{(1+r)} - \frac{H}{(1+r)^2} - \frac{H}{(1+r)^3} + \frac{W_{col}}{(1+r)^4} + \frac{W_{COL}}{(1+r)^5} + \ldots + \frac{W_{cot}}{(1+r)^{41}}$$

$$PV_{HS} = W_{HS} + \frac{W_{HS}}{(1+r)} + \frac{W_{HS}}{(1+r)^2} + \ldots + \frac{W_{HS}}{(1+r)^{41}}$$

- A person chooses to go to college only if

$$PV_{COL} > PV_{HS}$$

Benefits and Costs of College

- Benefits of College

$$PV\,B_{COL} = \frac{W_{COL} - W_{HS}}{(1+r)^4} + \frac{W_{COL} - W_{HS}}{(1+r)^5} + \ldots + \frac{W_{COL} - W_{HS}}{(1+r)^{41}}$$

- Costs of College

$$PV\,C_{COL} = (H + W_{HS}) + \frac{H + W_{HS}}{(1+r)} + \frac{H + W_{HS}}{(1+r)^2} + \frac{H + W_{HS}}{(1+r)^3}$$

A person chooses to go to college only if:

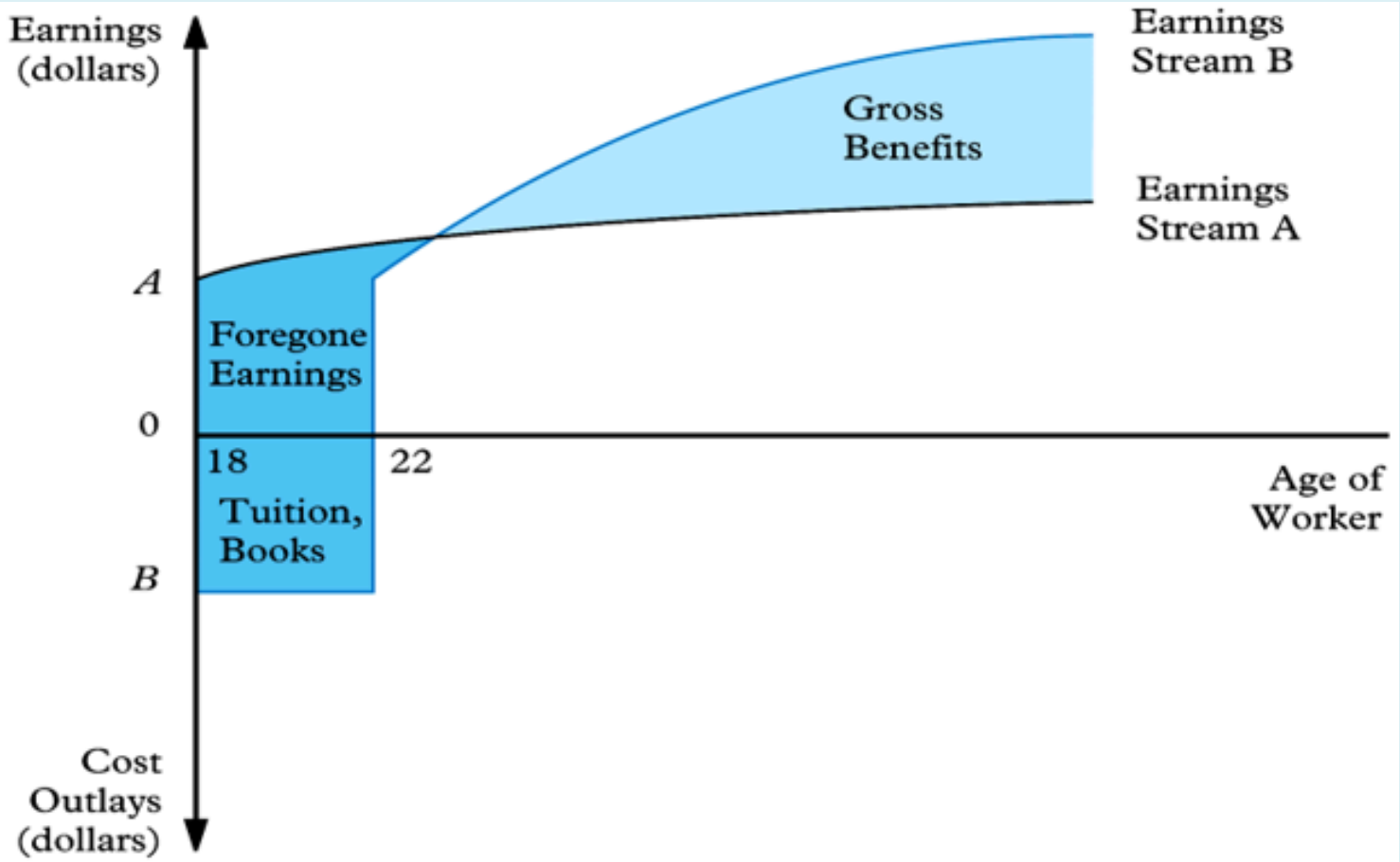
$$PV\,B_{COL} > PV\,C_{COL}$$

The College Decision in General

- The income flow may not be flatted, but a increasing profile.
  - The earnings streams are not constant
- When there are more than two schooling options.
- The "stopping rule" tells the individual when it is optimal to quit school and enter the labor market.

The College Decision in General

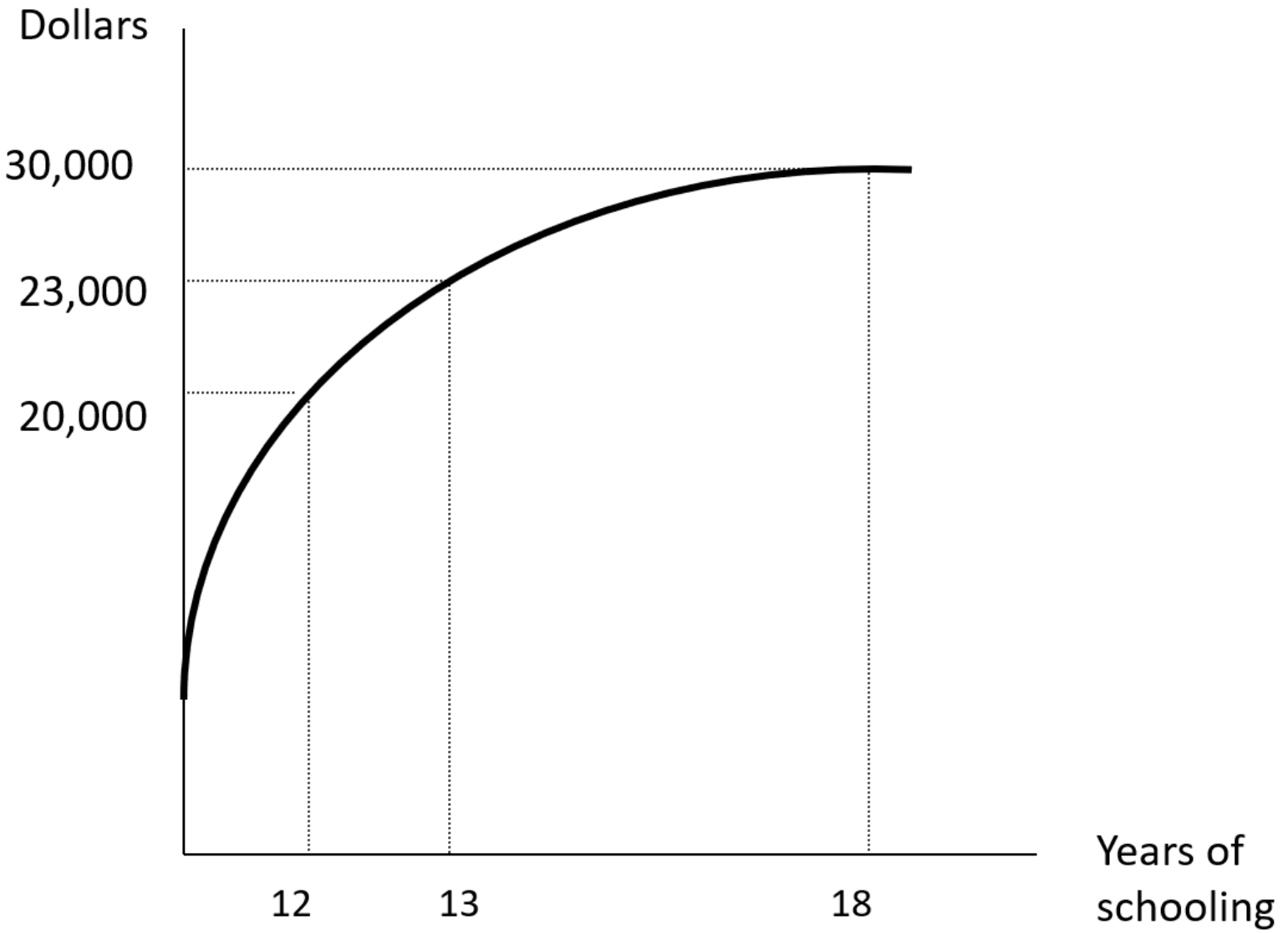
- The earnings streams are not constant



Continuous Schooling

- The Wage-Schooling Locus
- Three Properties:
  - a) Upward sloping
  - b) The slope is dy/ds: additional (annual) earning from an additional year of schooling
  - c) Concave: Diminishing marginal returns to human capital accumulation

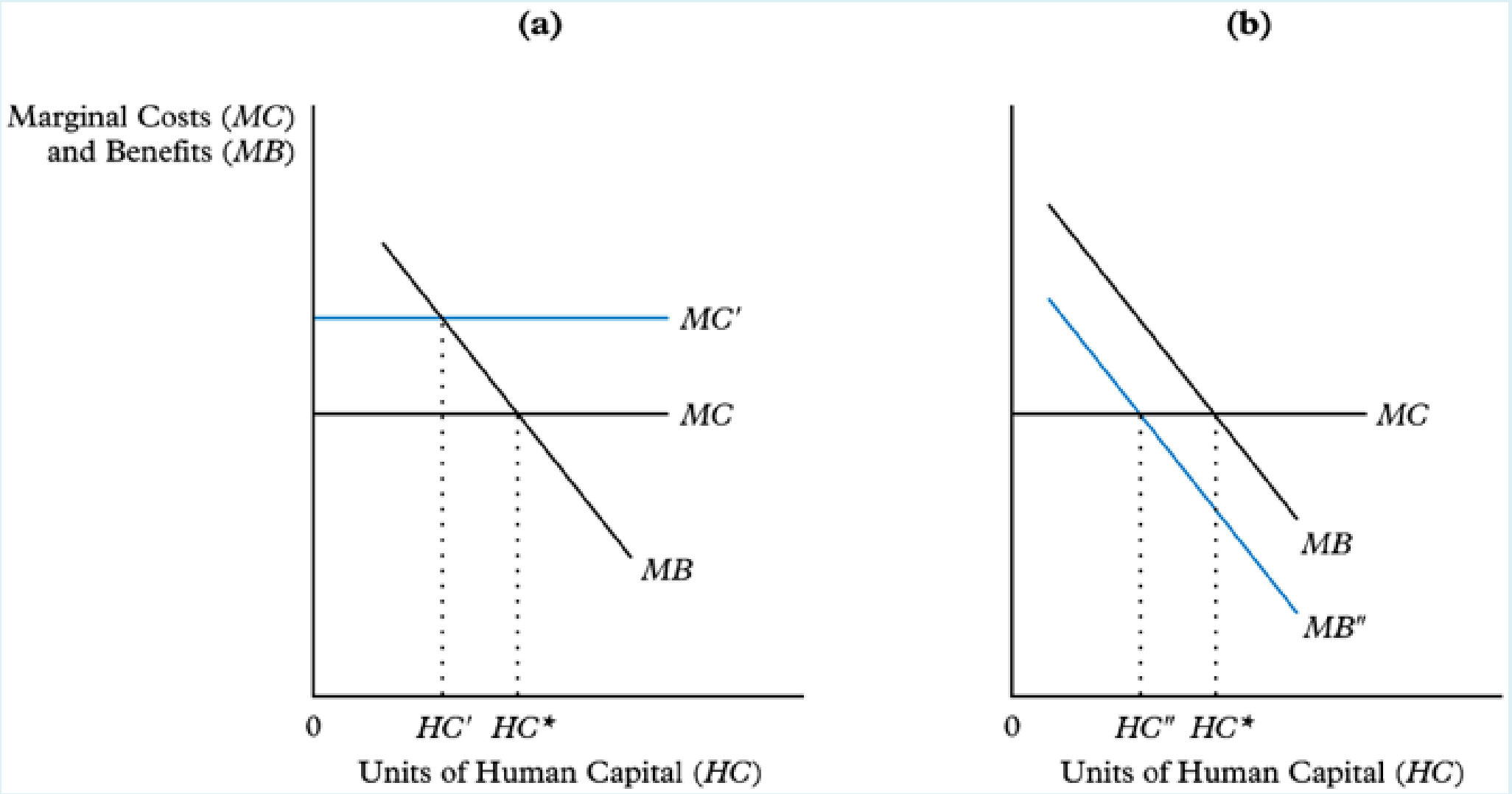
The Wage-Schooling Locus



Optimal Acquisition of Schooling

- Consider an additional year of schooling
- MB: Present value of a stream of extra annual earnings from the extra schooling
- MC: costs of an extra year of schooling
- Optimal schooling: MB=MC
  - Higher MC reduces schooling
  - Lower MC reduces schooling

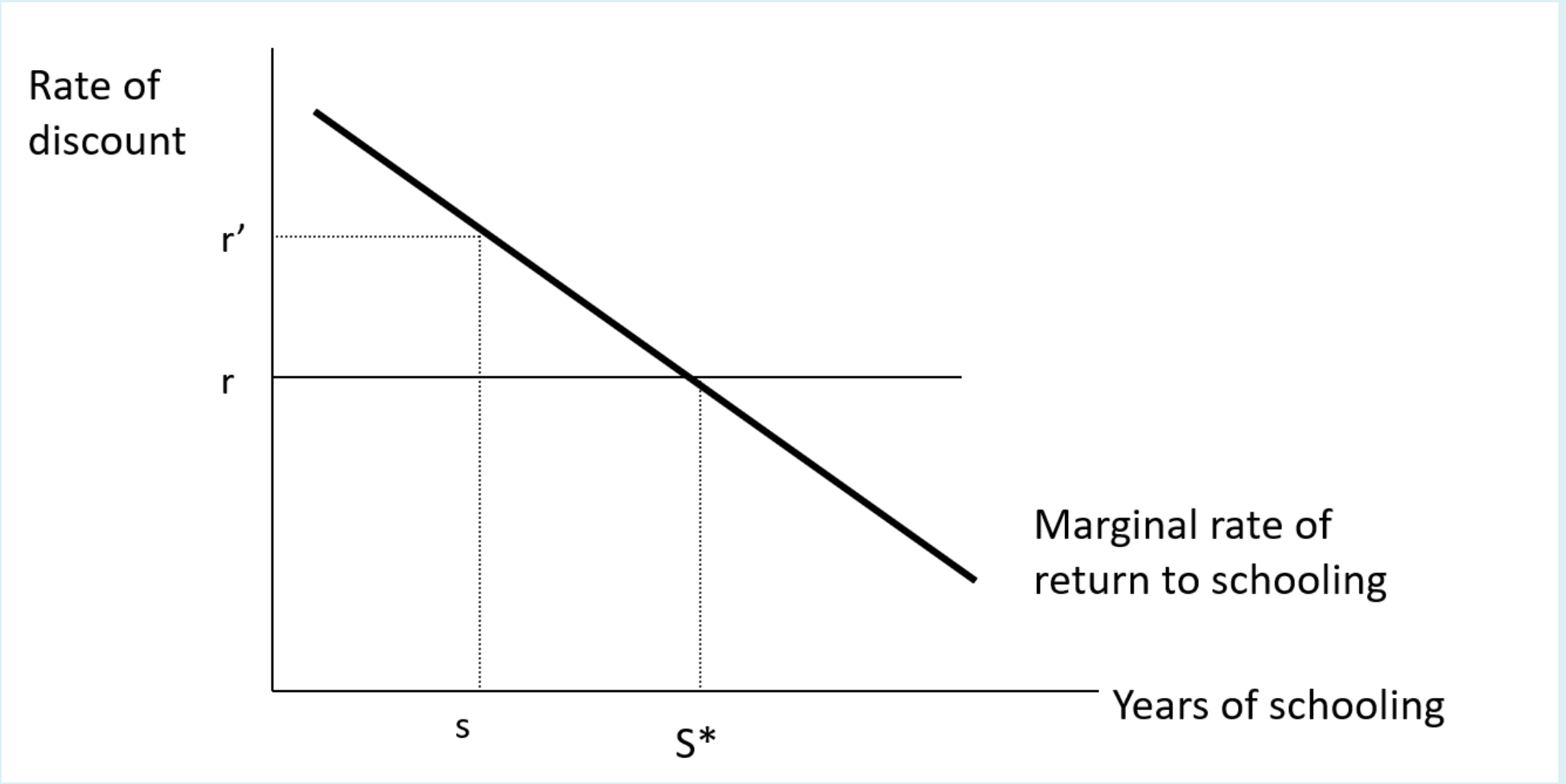
The Optimum Acquisition of Human Capital



The Rate of Return to Schooling

- Definition: d(lny)/ds: percentage change in earnings associated with an additional year of schooling
- Also called marginal rate of return to schooling
- On locus, it must decline as schooling increase
- A central concept in empirical research
- Often compared with the rate of return to capital to determine over/under investment in human capital

Optimal Schooling and the ROR



If the worker's rate of discount equals r, then it is optimal for the worker to choose S^*.

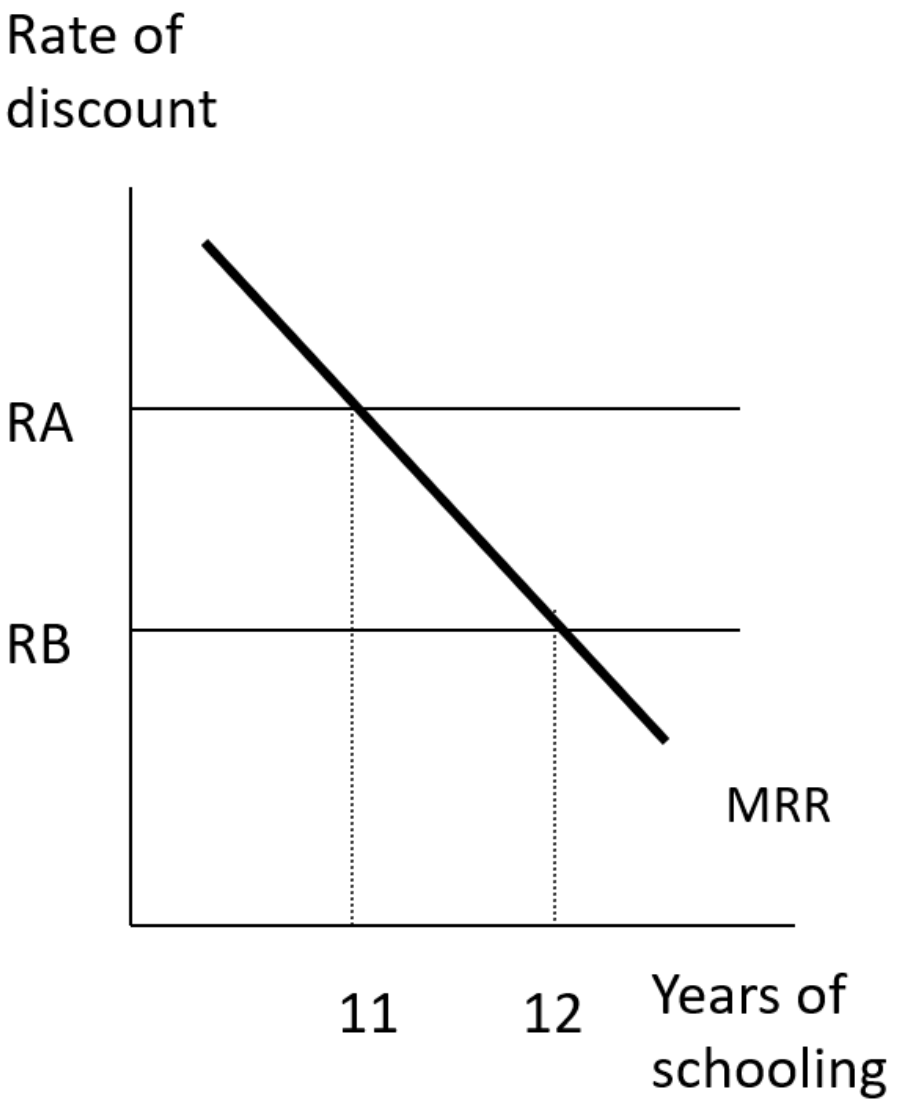
Education and Earnings

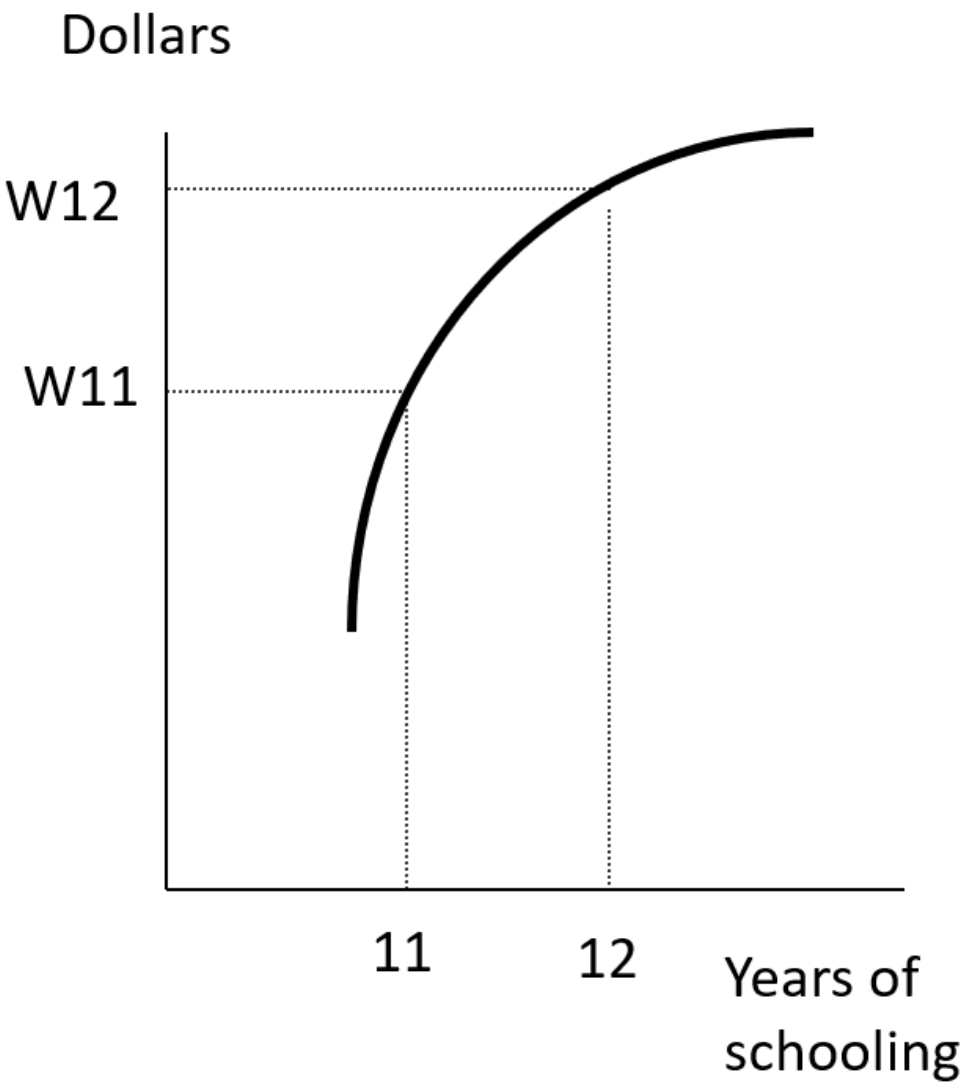
- Workers have different levels of schooling for two reasons:
  - Different rates of discount
  - Different marginal rates of return
- Different educational levels lead to different incomes
- Can we calculate rates to education based on observed differences in wages and schooling?

Differences in the Rate of Discount

- A and B's marginal rates of return to schooling are the same
  - Face same wage-schooling locus
- A faces a higher discount rate than B due to
  - more present-orientedness
  - credit constraint (higher borrowing cost)
- Result: A choose 11 years of schooling; B chooses 12 years of schooling
- The wage differential lets us estimate the rate of return to education

Differences in the Rate of Discount

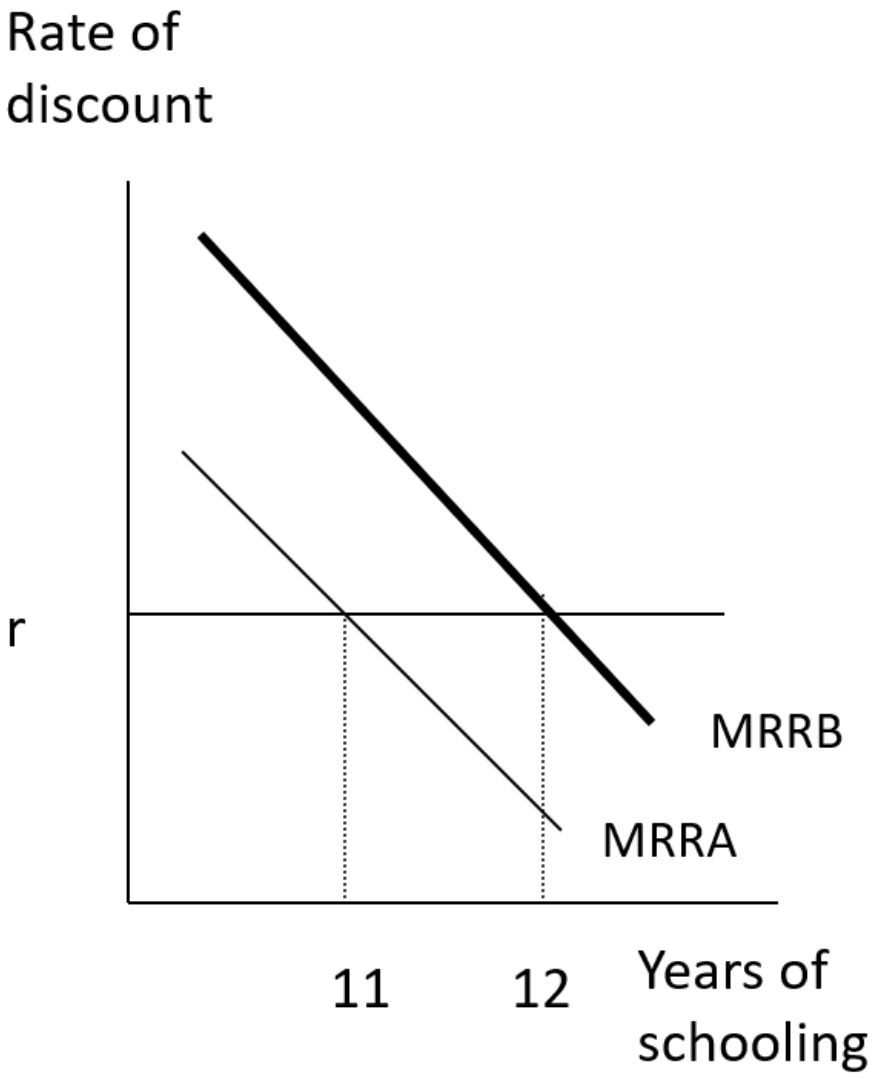


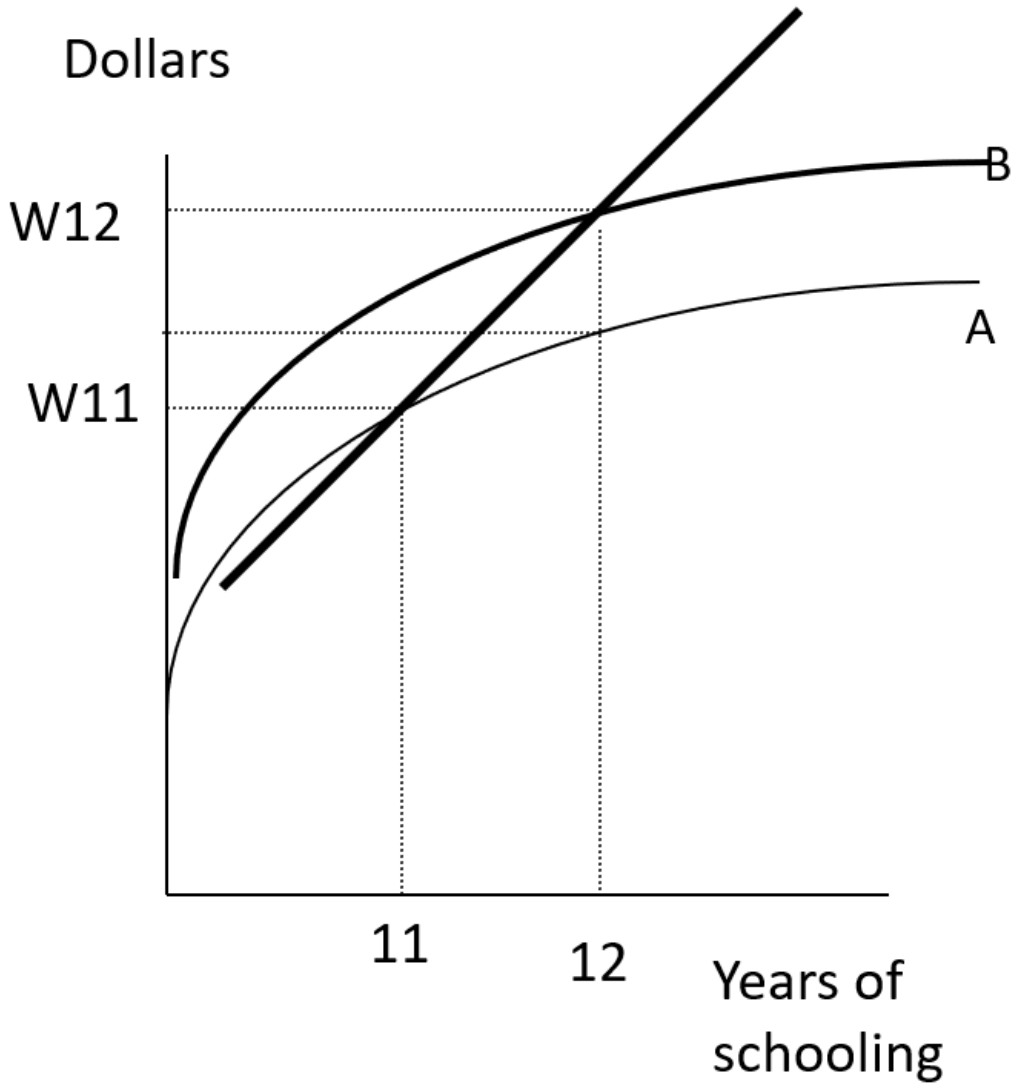


Different Ability

- All workers have the same discount rate
- Face different wage-schooling locus
  - Different marginal rate of return to schooling
  - High ability person (B) has higher marginal return from schooling
- Result: B chooses 12 years, A 11 years
- The wage differential over-estimates the true rate of return to schooling

Different Ability





Why Do We Care About the Bias

- Individuals base their schooling decisions on the estimates
- Accurate estimates are needed to evaluate government intervening policies in education for the purpose of addressing poverty and wage inequality
  - Subsidize schooling
  - Mandatory education

Why Care About the Bias

- If differences in discount rate cause the wage gap, then we can correctly predict the benefits of the policy
- If differences in ability cause the wage gap, then the benefits of government programs could be over stated
- We will discuss how to solve these empirical problems in the next lecture.

Some critical views

- Investment or consumption
- Non monetary benefit
- Education is a signal

Schooling As a Signal

Schooling As a Signal

- The signal model assumes that education does not increase the productivity.
- Employers have imperfect information about the productivity of potential employees thus they don't know if they are hiring a highly productivity worker or not.
- Education simply serves as a signal of the individuals' innate ability.

Schooling As a Signal

- Setting:
- 2 groups of applicants:
  - a) high productivity or wage: 2
  - b) low productivity or wage: 1
  - c) Equal proportions
- The employer can't tell them apart
- 2 types of jobs:
  - a) Requires high skill
  - b) Does not require high skill

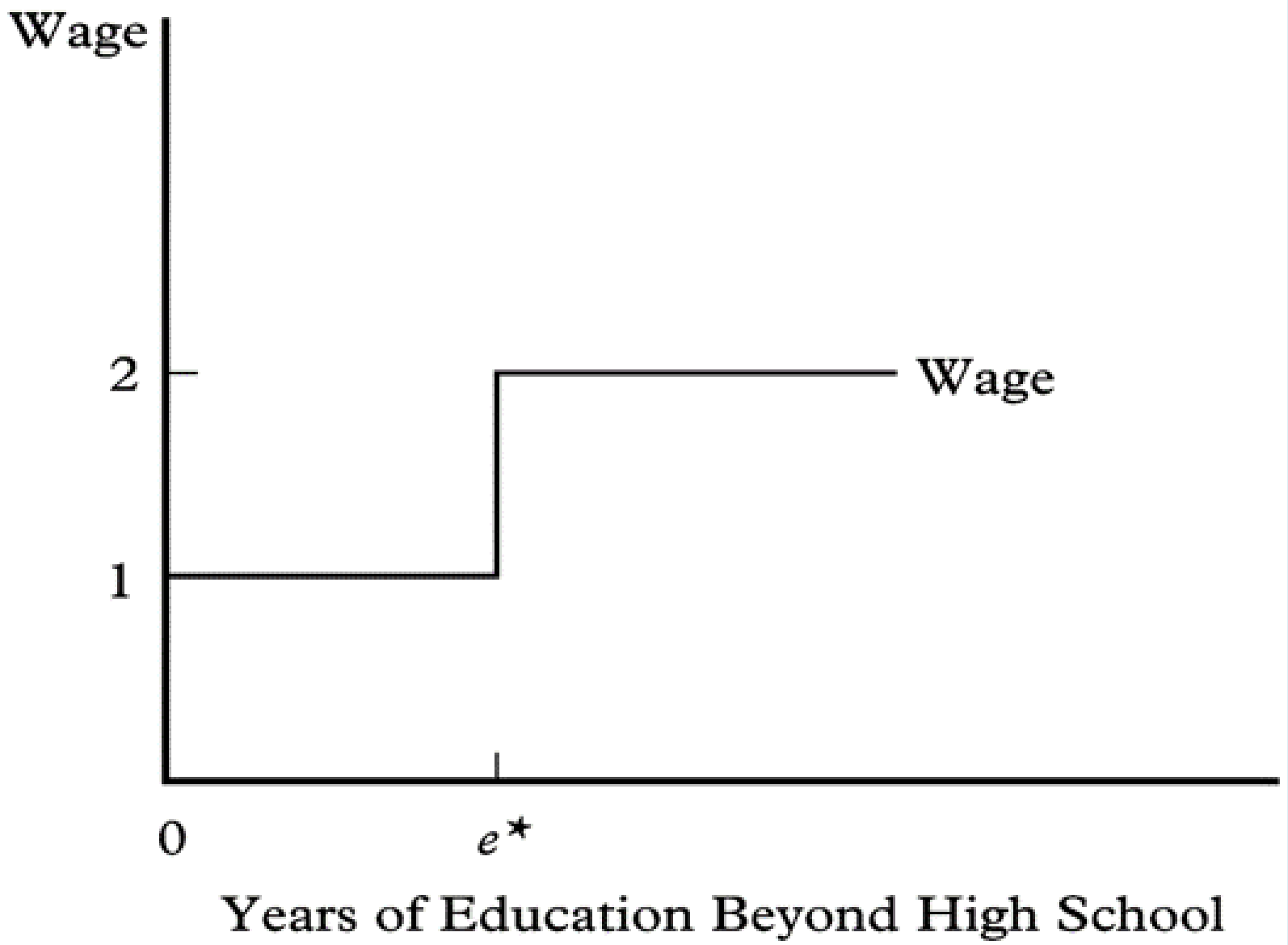
Pooled Equilibrium

- Assign workers randomly between two jobs
- Average salary: $1/2 \times 2 + 1/2 \times 1 = 1.5$
  - Under-paying high productivity workers
  - Over-paying low productivity workers
- Undesirable for high prod. workers and firms
  - Firms are mismatching workers and jobs
  - high productivity workers work at low-skill jobs and vise versa
  - High productivity workers have an incentive to distinguish themselves from low productivity workers

Signaling Equilibrium

- Use schooling: Years of schooling beyond high school
  - Applicants with at least e* years have high productivity
  - Applicants with less than e* have low productivity
- Equilibrium:
  - high productivity workers work at skilled jobs and receive 2
  - low productivity workers work at skilled jobs and receive 1

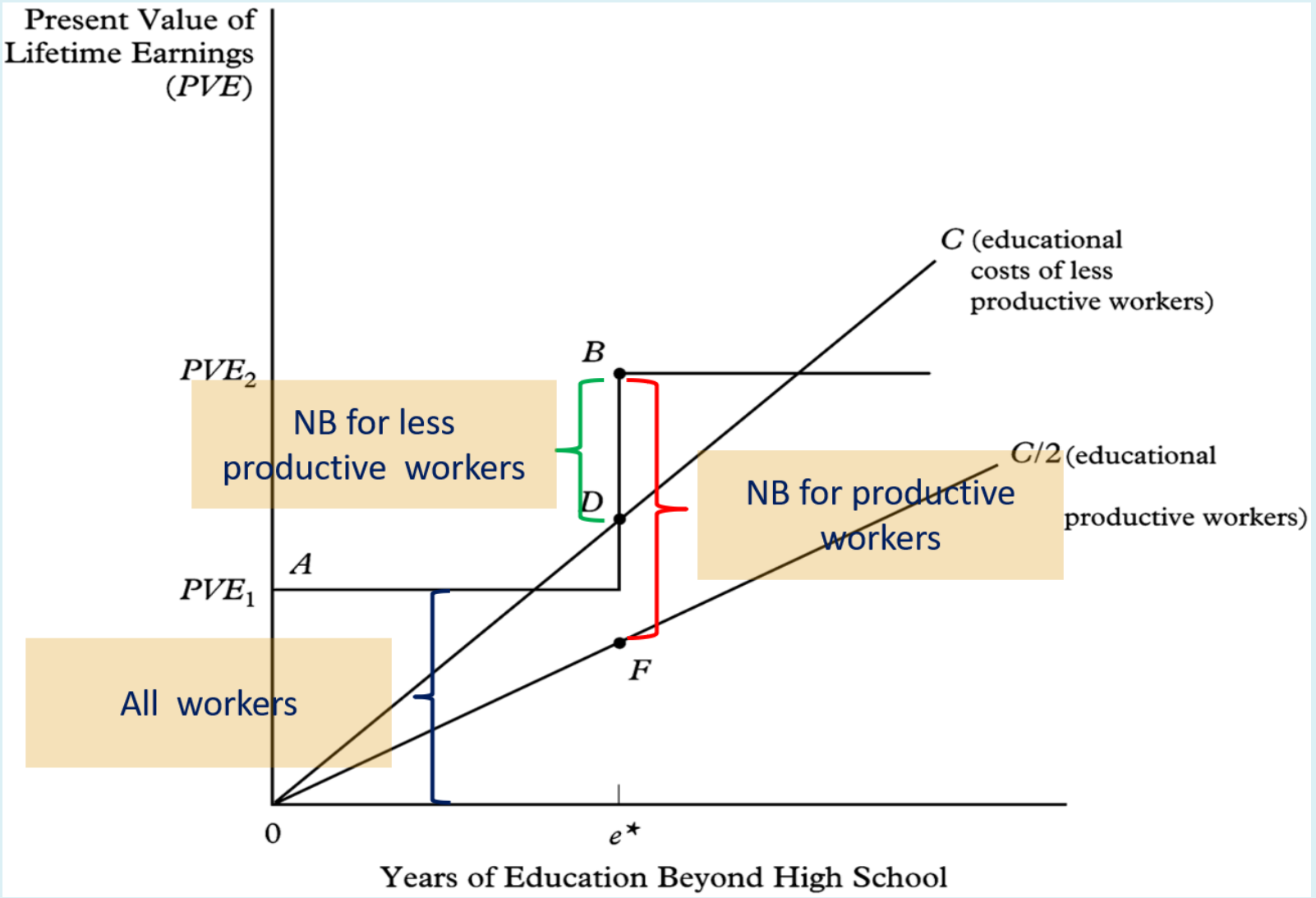
The Benefits to Workers



How Does the Signal Work?

- Costs of schooling
  - Low productivity workers have high costs of acquiring schooling: C
  - High productivity workers have low costs of acquiring schooling: C/2
- Net benefits of acquiring schooling e*:
  - Benefit: receive wage 2
  - Costs: pay C (low) or C/2 (high)
  - Net benefit: BD (low) or BF (high)
- Net benefits of not acquiring schooling e*:
  - receiving wage=1 (AO)

How Does the Signal Work?



Optimal Decision for Signal Acquisition

- Low productivity applicants: Because of $BD < AO$, so do NOT acquire schooling e*
- High productivity applicants: For $BF > AO$, Do acquire schooling e*
- A Separating Equilibrium make employers can tell worker ability from the "signal"

Signaling or Human Capital?

- Both signaling model and human capital model predict that more education leads to higher earnings
- It has been extremely difficult to establish empirically which source caused the positive relationship between earnings and schooling
  - GED vs. high school dropouts

Does the Debate Matter?

- Implications of the two theories are different
  - a) H.C. theory: government, by subsidizing education, provides a way out of poverty
  - b) Signaling: the expenditures do not increase productivity. Socially wasteful
- In the signaling model, education is still useful:
  - a) sorting workers into the right jobs
  - b) Education could have positive social rate of return even if it does not increase a particular worker's productivity

On the Job Training

Post-Schooling Investments in H. C.

- Motivation:
- Earnings continue to grow after schooling
- The growth rate is different over the life cycle and for different groups
- Explain the pattern by on-the-job training

General vs. Specific Training

- General training:

Once workers acquired, enhances productivity equally in all firms.

- a) English
- b) Computer Skill

- Specific training:

enhances productivity only in the firm where it is accquired and the value is lost once leaving.

- a) Drive a tank in the army
- b) Some specific computer languages

Who pays for

- Whether workers or firms pay the costs of OJT
- The worker will pay for general training through low wages during the training period.
- The firm must bear the cost of specific training.

Some Implications for Specific Trainings

- Neither workers nor firm want to terminate the employment contact.
- So ST can be explained some phenomenon as following
  - a) "Last hired, first fired"
  - b) Industrial transition and layoffs