HUMAN CAPITAL

EE 471

Introduction

- People bring into the labor market a unique set of abilities and acquired skills known as human capital.
- Workers add to their stock of human capital throughout their lives, especially via job experience and education.

- Why some workers obtain a lot of schooling and other workers drop out at the early age?

- How does the rate of return to schooling compare with the rate of return on other investments?

- What is Human capital?
  - Education level
  - Formal and Informal On the job training programs

- We will assume that worker chooses the level of human capital investments that maximizes the present value of lifetime earnings

Education in the Labor Market: Some Stylized Facts

- Education is strongly correlated with:
  - Labor force participation rates
  - Unemployment rates
  - Earnings

Present Value

$$PV = \frac{y}{(1+r)^t}$$

r is the rate of interest (rate of discount)

The Schooling model

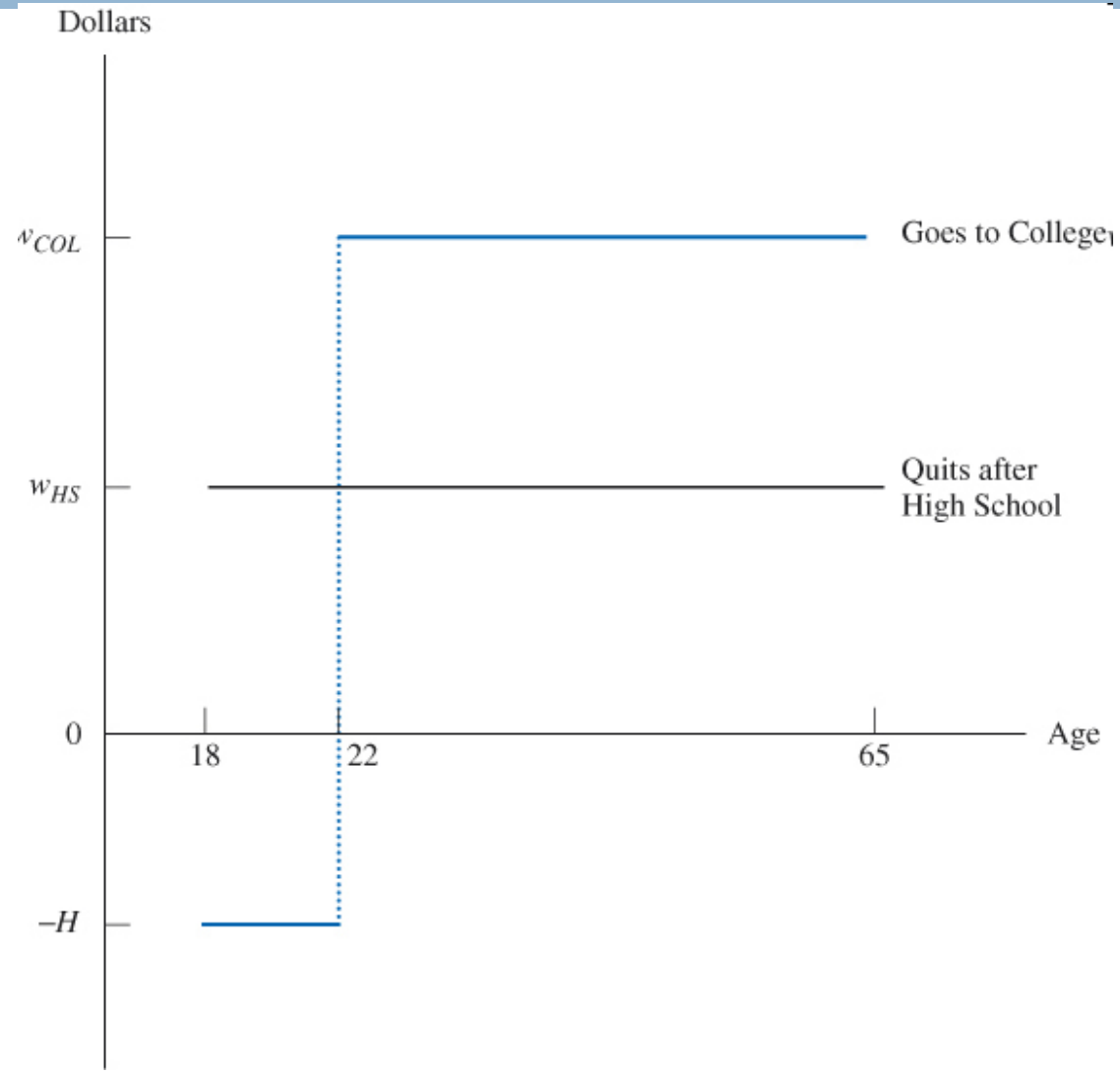
- Education is associated with lower unemployment rates and higher earnings.
- What factors motivate some workers to get professional degrees while other workers drop out before they finish high school?
- Assume that workers acquire the education level that maximizes the present value of lifetime earnings

Consider the situation faced by an 18-year old man who just received his high school diploma and who is contemplating whether to enter labor market or attend college and delay labor market entry by an additional four years

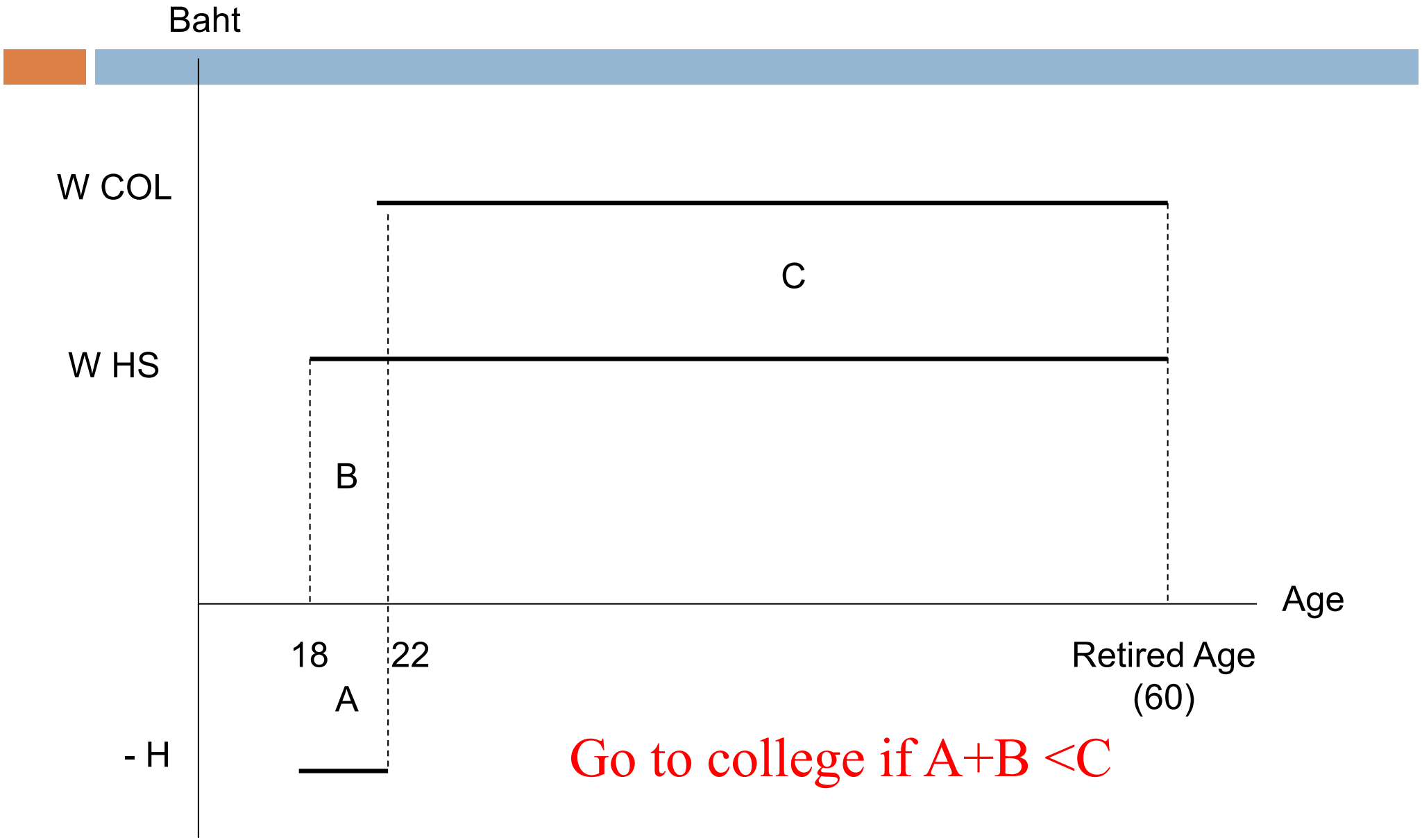
Suppose that there is no on-the-job training and the skills learned in school do not depreciate over time.

These assumption imply that the worker's productivity does not change once he leaves school, so that real earnings are constant over the life cycle

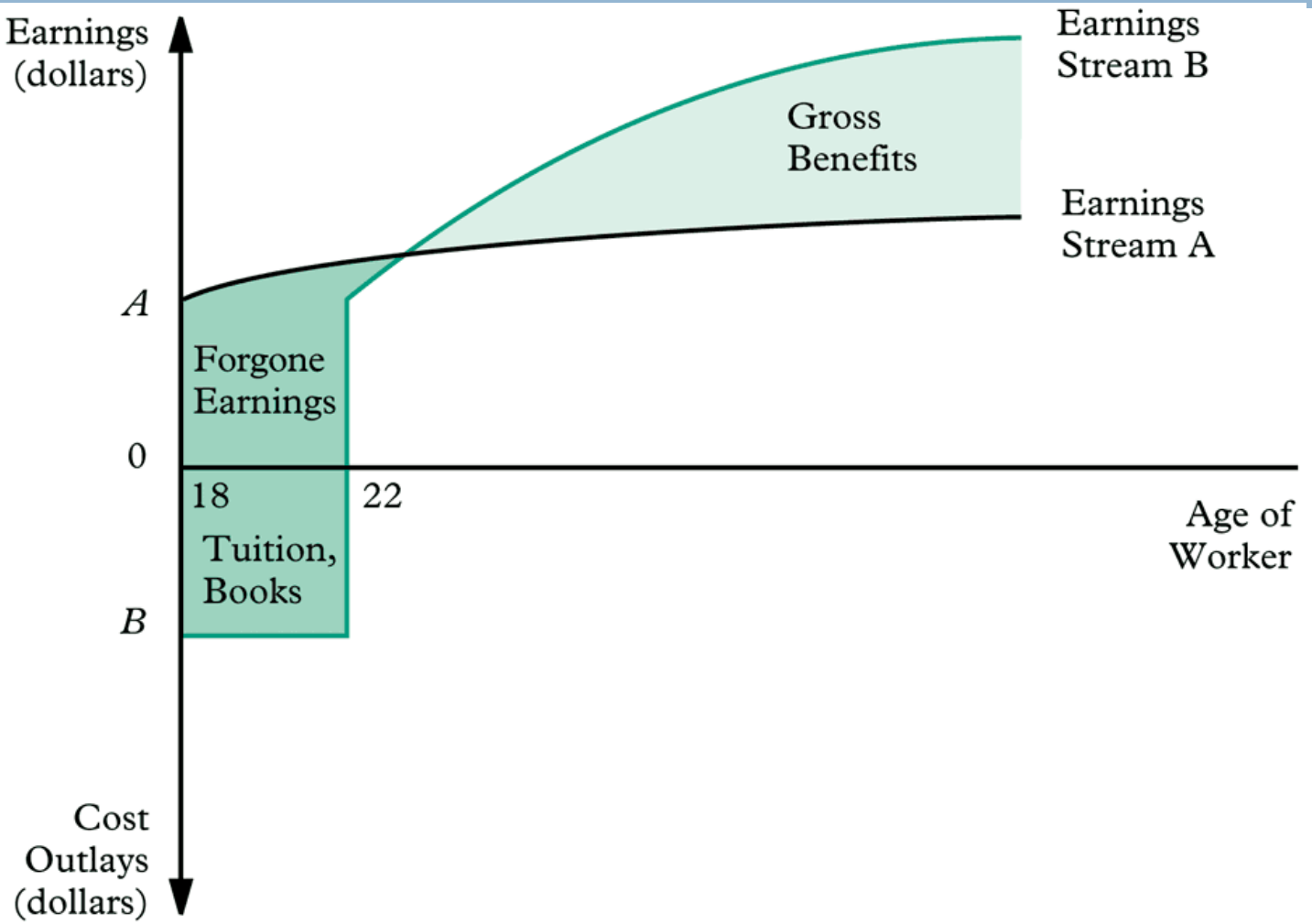
Potential Earnings Streams Faced by a High School Graduate



Age – Earning profile (Mincer, 1974)



Schooling Model



Present Value of Age-Earnings Profiles

- High School

$$PV_{HS} = W_{HS} + \frac{W_{HS}}{(1+r)} + \frac{W_{HS}}{(1+r)^2} + \ldots + \frac{W_{HS}}{(1+r)^{46}}$$

- College

$$PV_{COL} = \underbrace{-H - \frac{H}{(1+r)^1} - \frac{H}{(1+r)^2} - \frac{H}{(1+r)^3}}_{Direct\ Costs\ of\ Attending\ College} + \underbrace{\frac{w_{COL}}{(1+r)^4} + \frac{w_{COL}}{(1+r)^5} + \ldots + \frac{w_{COL}}{(1+r)^{46}}}_{Post-college\ earnings\ stream}$$

r gives the worker's rate of discount.

There are 47 terms in this sum, one term for each year that elapses between the ages of 18 and 64.

A person's schooling decision maximizes the present value of lifetime earnings.

The worker attends college if the present value of lifetime earnings when he gets a college education exceeds the present value of lifetime earnings when he gets only a high school diploma

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

Example

Suppose a worker lives only two periods and chooses from two schooling options. He can choose not to attend school at all, in which case he would earn $20,000 in each period. The present value of earnings is

$$PV_0 = 20,000 + \frac{20,000}{(1+r)}$$

He also can choose to attend school in the first period, incur $5,000 worth of direct schooling costs, and enter the labor market in the second period, earning $47,500. The present value of this earnings stream is

$$PV_1 = -5,000 + \frac{47,500}{(1+r)}$$

Suppose that the rate of discount is 5 percent

$$PV_0 = 20,000 + \frac{20,000}{(1+0.05)} = \$39,048$$

$$PV_1 = -5,000 + \frac{47,500}{(1+0.05)} = \$40,238$$

The worker chooses to attend school.

Suppose that the rate of discount is 15 percent

$$PV_0 = 20,000 + \frac{20,000}{(1+0.15)} = \$37,391$$

$$PV_1 = -5,000 + \frac{47,500}{(1+0.15)} = \$36,304$$

The worker would not go to school.

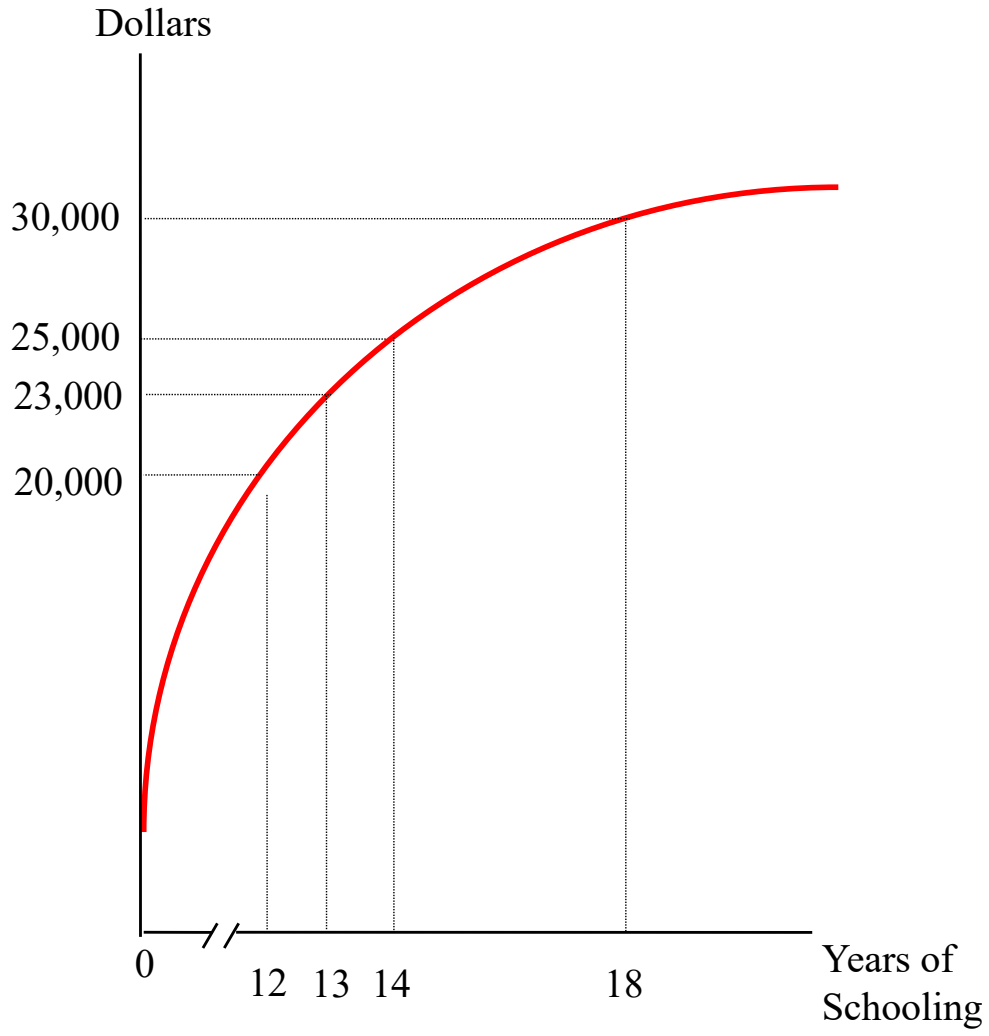
- The rate of discount r plays a crucial role in determining whether a person goes to school or not.
- The higher the rate of discount, the less likely a worker will invest in education.
- A worker who has a high discount rate attaches a very low value to future earnings opportunities.

- Real earnings (earnings adjusted for inflation).
- Age-earnings profile: the wage profile over a worker's lifespan.
- The higher the discount rate, the less likely someone will invest in education (since they are less future oriented).
- The discount rate depends on:
  - the market rate of interest.
  - time preferences: how a person feels about giving up today's consumption in return for future rewards.

The Wage-Schooling Locus

- The salaries firms are willing to pay workers depends on the level of schooling.

The Wage-Schooling Locus



Three important properties

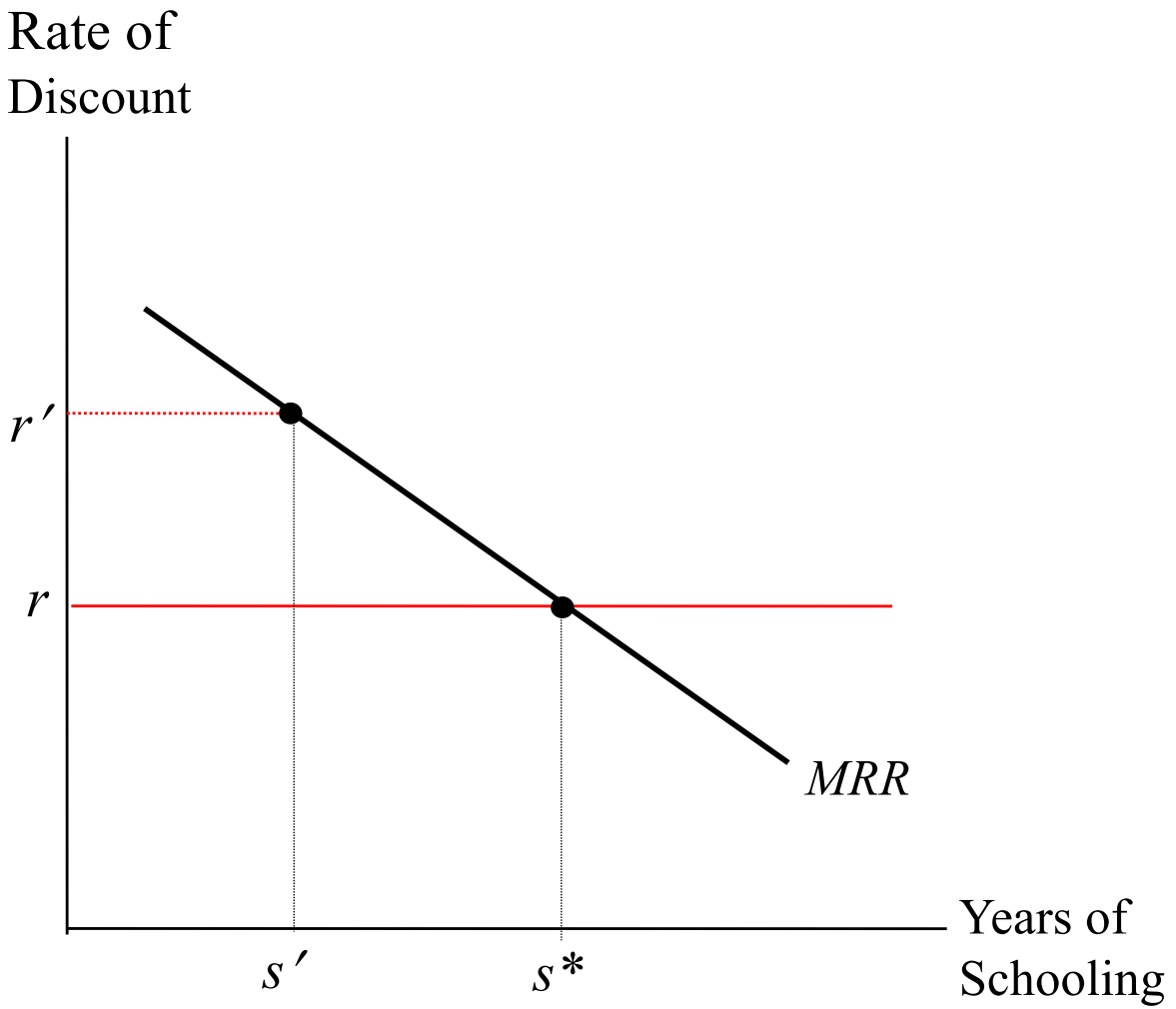
1. Upward sloping
2. The slope of the wage-schooling locus tells us by how much a worker's earnings would increase if he were to obtain one more year of schooling
3. Concave- The monetary gain from each additional year of schooling declines as more schooling is acquired. (Law of diminishing returns also applies to human capital accumulation)

The Marginal Rate of Return (MRR) to Schooling

- The slope of the wage-schooling locus tells us by how much earnings increase if the person stays in school one more year
- The percentage change in earnings resulting from one more year of school as **the marginal rate of return to schooling**
- The marginal rate of return to schooling **must decline** as a person gets more schooling

$$\Delta w / \Delta s$$

The schooling decision



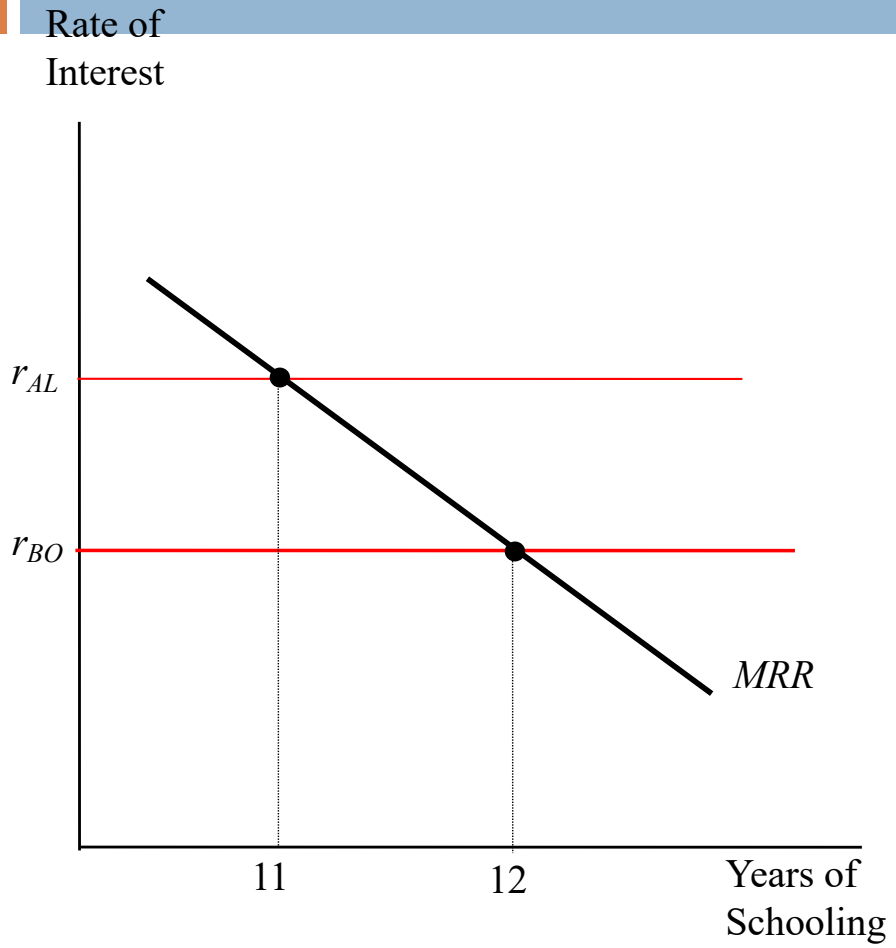
The stopping rule, or when should I quit school?

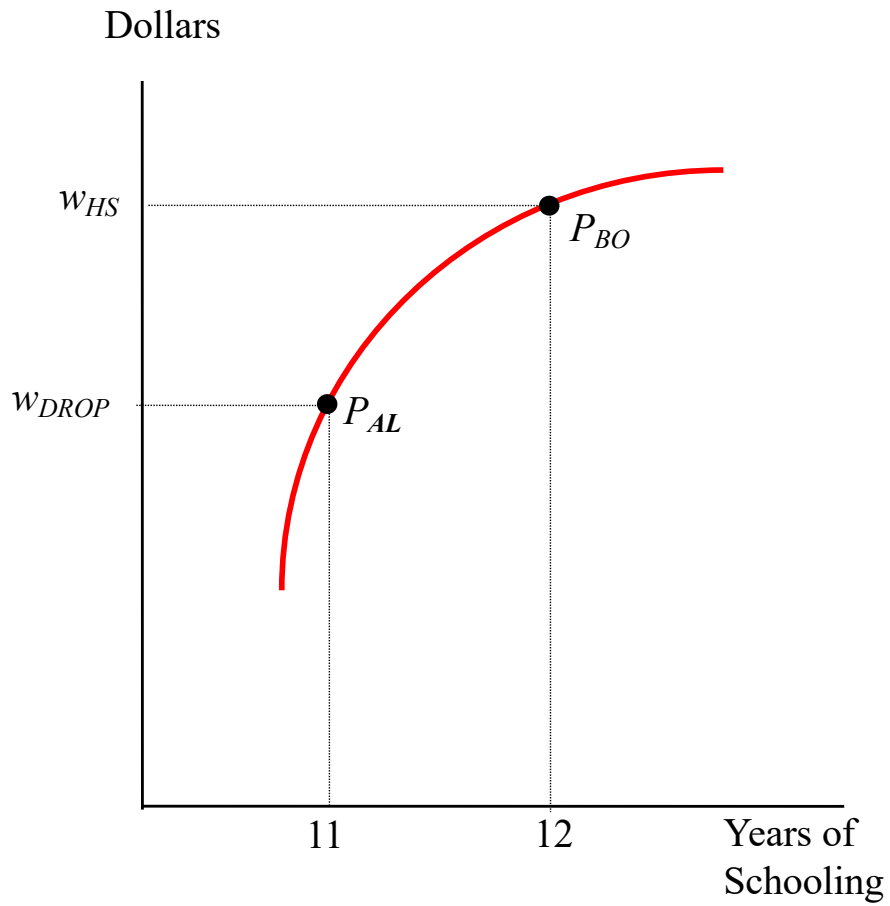
Stop schooling when the marginal rate of return to schooling = r

Education and Earnings

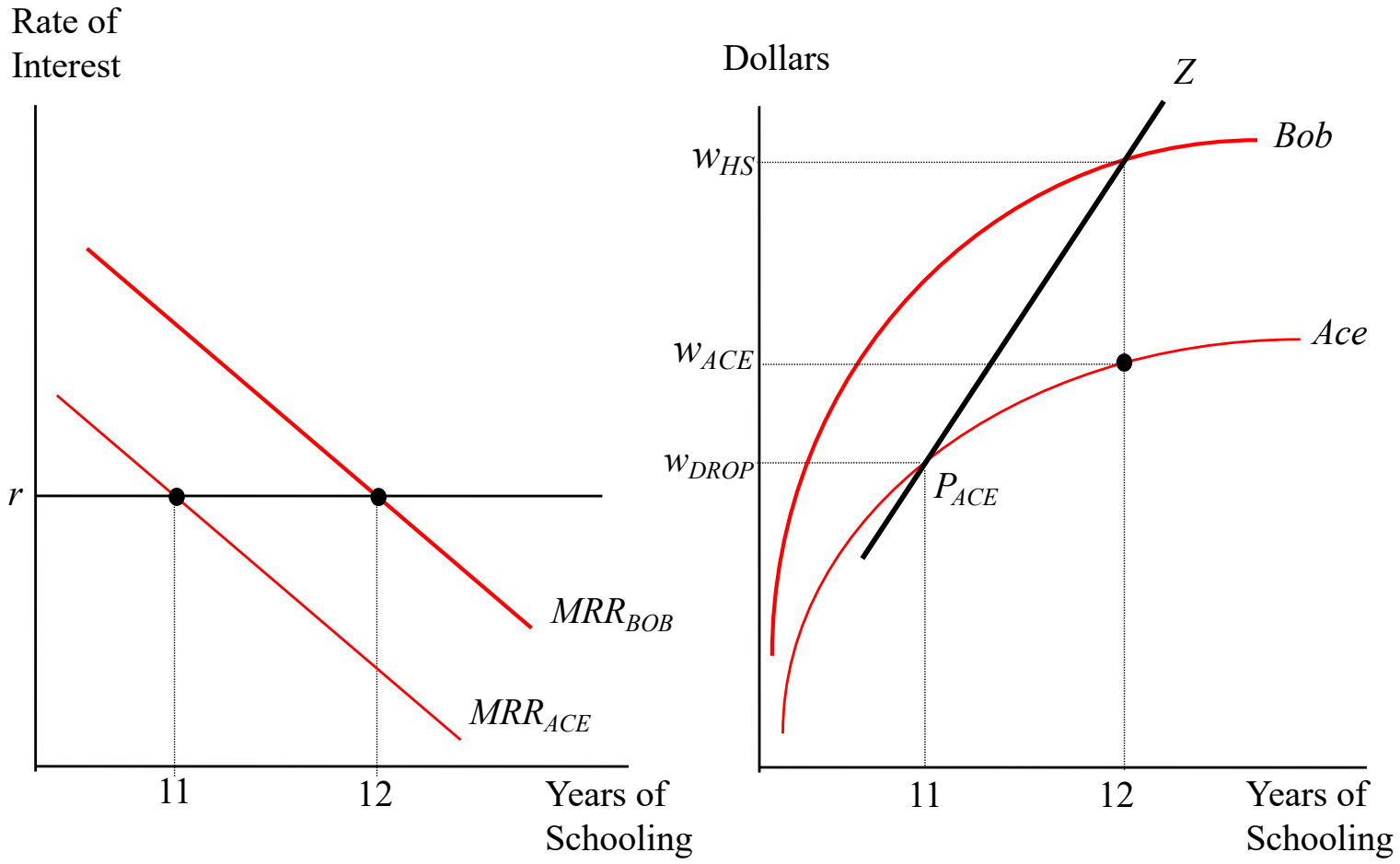
- Differences in the Rate of Discount
- Differences in Ability

Schooling and earnings when workers have different rates of discount





Schooling and Earnings when Workers have different abilities



- Observed data on earnings and schooling does not allow us to estimate returns to schooling.
- In theory, a more able person gets more from an additional year of education.
- Ability bias: The extent to which unobserved ability differences exist affects estimates on returns to schooling, since the ability difference may be the true source of the wage differential.

Estimation the Rate of Return to Schooling

- Estimation Model

$$\log w = \beta S_i + Other\ Variables$$

Some Evidence

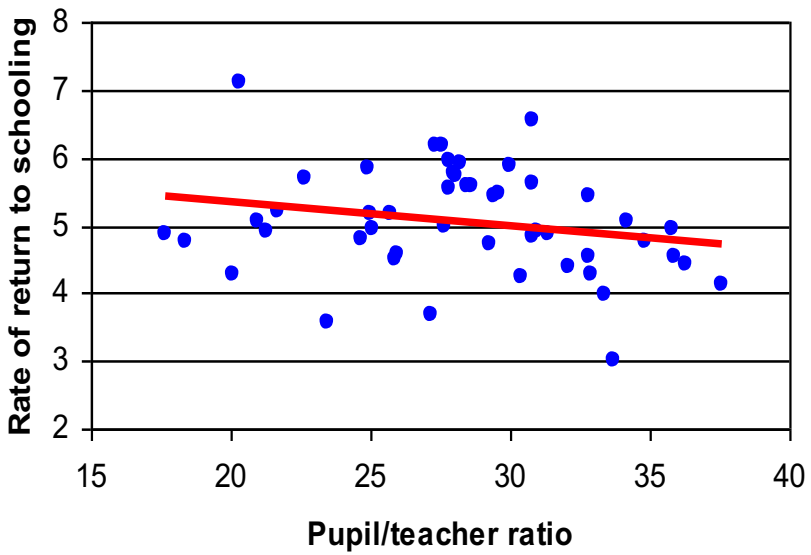
- In studies of twins, presumably holding ability constant, valid estimates of rate of return to schooling can be estimated.
  - Estimates range from 3% to 15% annual return to a year of education.
- Generally, the rate of return to schooling is higher for workers who were born in states with well-funded education systems.

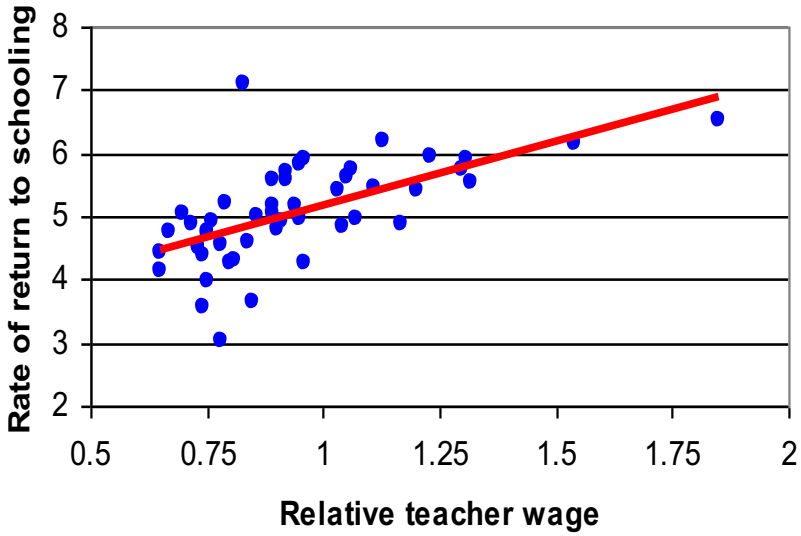
Policy Application: School Quality and Earnings

- David Card and Alan Krueger (1992) show that
  - school quality is positively correlated with the rate of return to schooling
  - the rate of return to schooling is negatively correlated with the state's pupil/teacher ratio

- Data on worker earnings from 1980 census to calculate the rates of return to schooling to cohorts of workers born in a particular state

School Quality and the Rate of Return to Schooling





Source: David Card and Alan B. Krueger, "Does School Quality Matter? Returns to Education and the Characteristics of Public Schools in the United States," *Journal of Political Economy* 100 (February 1992), Tables 1 and 2. The data in the graphs refer to the rate of return to school and the school quality variables for the cohort of persons born in 1920-1929.

- Card and Krueger concluded that children born in states that offered better schools had a substantially higher rate of return to schooling.

- Decreasing the pupil/teacher ratio by 10 students increased the rate of return by about 1 percentage point, whereas increasing the relative wage of teachers by 30 percent increased the rate of return to schooling by 0.3 percentage point.

Do Workers Maximize Lifetime Earnings?

- The schooling model assumes that workers select their level of education to maximize the present value of lifetime earnings.

- To test this hypothesis directly, we must observe the age-earnings profile at two points in time.
  - Unfortunately, once a choice is made, we cannot observe the earnings associated with the non-choice.
  - Thus, using the observed wage differential to determine if the worker selected the “right” earnings stream yields meaningless results.

Example

A simple numerical example with two workers, Willie and Wendy. Willie is particularly adept at “blue-collar” work, and this type of work requires no schooling. Wendy is particularly adept at “white-collar” work, and this type of work requires one year of schooling.

Suppose also that there are two periods in the life cycle. If a person does not go to school, he works in the blue-collar job in both periods. If the person goes to school , the person would go to school in the first period and work in the white-collar job in the second period.

The wage-schooling locus for each worker is summarized by these data:

	Earnings in Blue-Collar Job	Earnings in White-Collar Job
Willie	$20,000	$40,000
Wendy	$15,000	$41,000

Suppose that both Willie and Wendy have a discount rate of 10 percent.

$$\textit{Willie's present value if he does not go to school} = 20{,}000 + \frac{20{,}000}{(1+0.10)} = \$38{,}182$$

$$\textit{Willie's present value if he goes to school} = 0 + \frac{40{,}000}{(1+0.10)} = \$36{,}364$$

Willie will decide that he should not go to school and will be a blue-collar worker. The present values of Wendy's potential earnings streams are

$$Wendy's\ present\ value\ if\ she\ does\ not\ go\ to\ school = 15,000 + \frac{15,000}{(1+0.10)} = \$28,636$$

$$Wendy's\ present\ value\ if\ she\ goes\ to\ school = 0 + \frac{41,000}{(1+0.10)} = \$37,273$$

Wendy goes to school in the first period and works in a white-collar job in the second.

We observe the earnings of persons who do not go to school and work in blue-collar jobs (like Willie). The present value of their earnings is $38,182.

We also observe the earnings of persons who do go to school and work in white-collar jobs (like Wendy). The present value of their earnings stream is $37,273.

Self-Selection Bias

- Workers may select themselves into jobs for which they are better suited.
- Therefore, wage differentials may not be associated with education.

Schooling as a Signal

- Education reveals a level of attainment which signals a worker's qualifications or innate ability to potential employers.
- Information that is used to allocate workers in the labor market is called a signal.
- There could be a "separating equilibrium."
  - Low-productivity workers choose not to obtain X years of education, voluntarily signaling their low productivity.
  - High-productivity workers choose to get at least X years of schooling and separate themselves from the pack.

Schooling as a Signal

Type of Worker	Proportion of Population	Present Value of Lifetime Productivity
Low-productivity	q	$200,000
High-productivity	1-q	$300,000

Pooling Workers

Because low-productivity workers will always lie about their productivity, the firm will disregard what anyone says about their own qualifications.

The average productivity and salary of the workers hired by the firm is then given by

$$Average\ salary = (200,000 \times q) + \left[300,000 \times (1-q)\right]$$

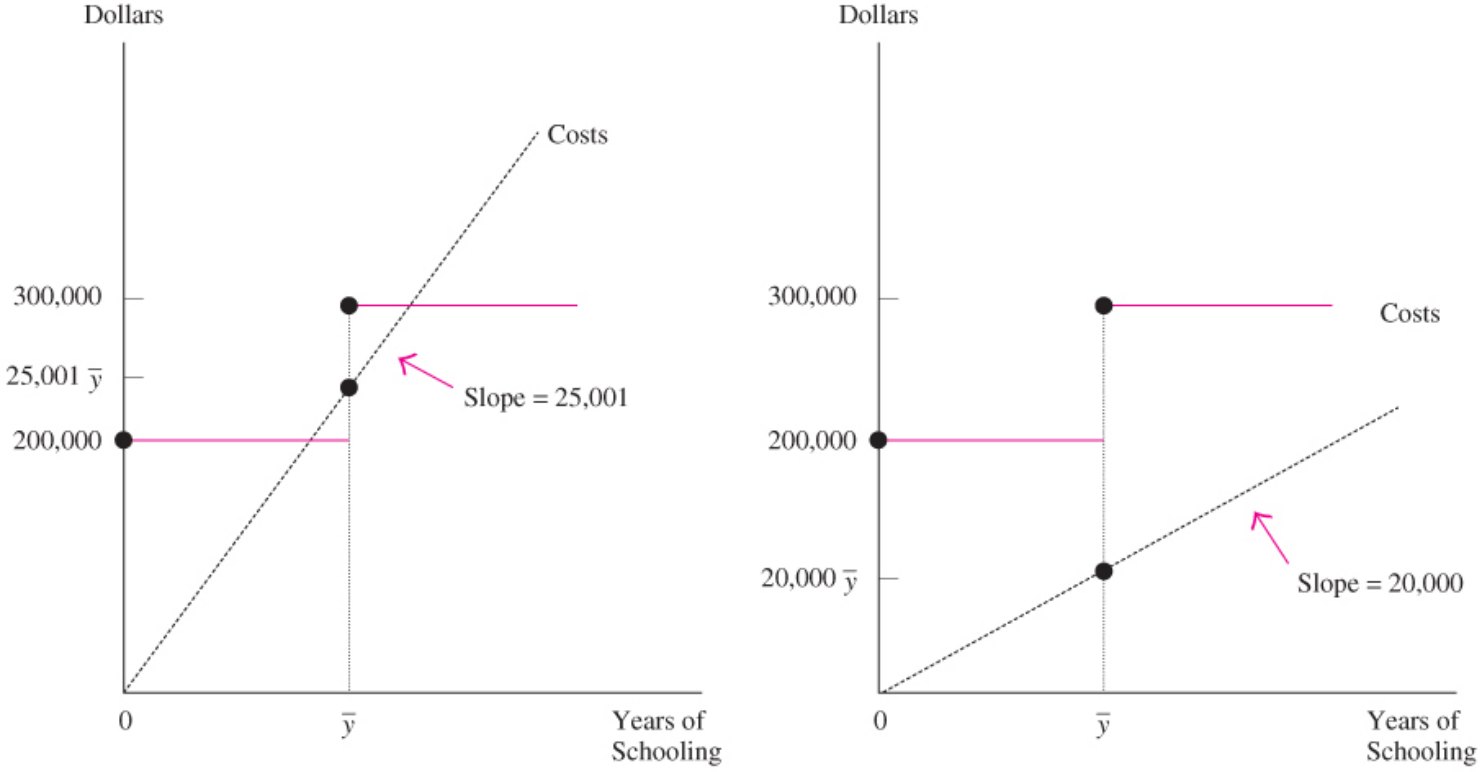
$$= 300,000 - 100,000q$$

The average salary is simply a weighted average of the workers' productivities, where the weights are the proportions in the population that belong to each productivity group.

Education as a Signal

FIGURE 6-7 Education as a Signal

Workers get paid \$200,000 if they get less than $\bar{y}$ years of college, and \$300,000 if they get at least $\bar{y}$ years. Low-productivity workers find it expensive to invest in college, and will not get $\bar{y}$ years. High-productivity workers do obtain $\bar{y}$ years. As a result, the worker's education signals if he is a low-productivity or a high-productivity worker.



(*a*) Low-Productivity Workers

(*b*) High-Productivity Workers

Suppose a firm chooses the following rule of thumb for allocating workers to the two types of jobs.

If a worker has at least $\overline{y}$ years of college, the firm assumes that the worker is a high-productivity worker, allocates him to a job that requires a high level of skills, and pays him a (life time) salary of $300,000.

If a worker has fewer than $\overline{y}$ years of college, the firm assumes that the worker is a low-productivity worker, allocates him to an unskilled job, and pay him a salary of $200,000.

We assume that obtaining credits is more expensive for less-able workers, a year's worth of college credits costs $20,000 for a high-productivity worker, but $25,001 for a low-productivity worker.

Implications of Schooling as a Signal

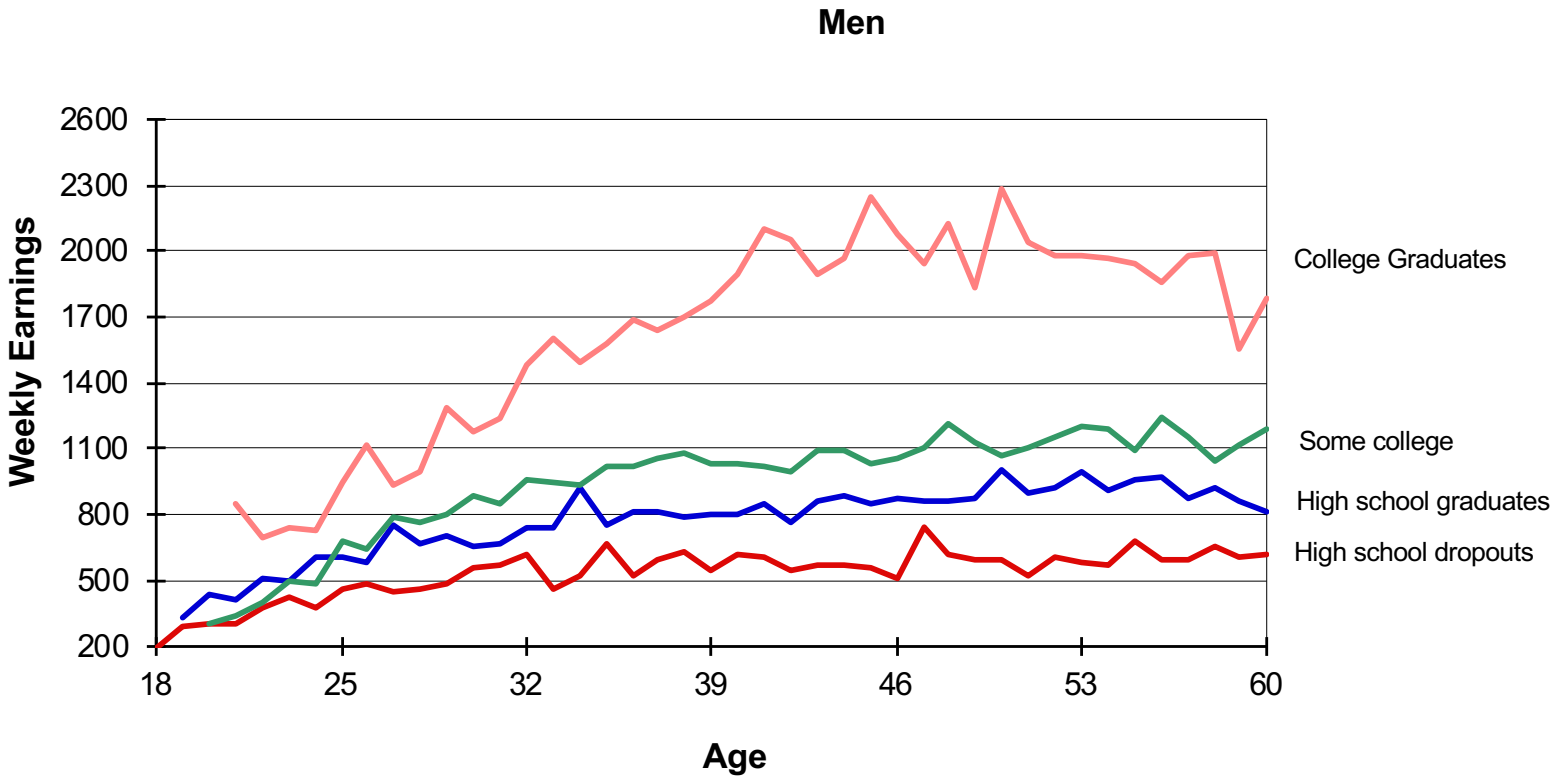
- Education is more than a signal, it alters the stock of human capital.
- Social return to schooling (percentage increase in national income) is likely to be positive even if a particular worker's human capital is not increased.

Post-School Human Capital

Three important properties of age-earnings profiles:

- High Educated workers earn more than less -educated workers
- Earnings rise overtime but at a decreasing rate
- The age-earnings profiles of different education groups diverge over time

Age-Earnings Profiles of Full-Time Workers, 2010



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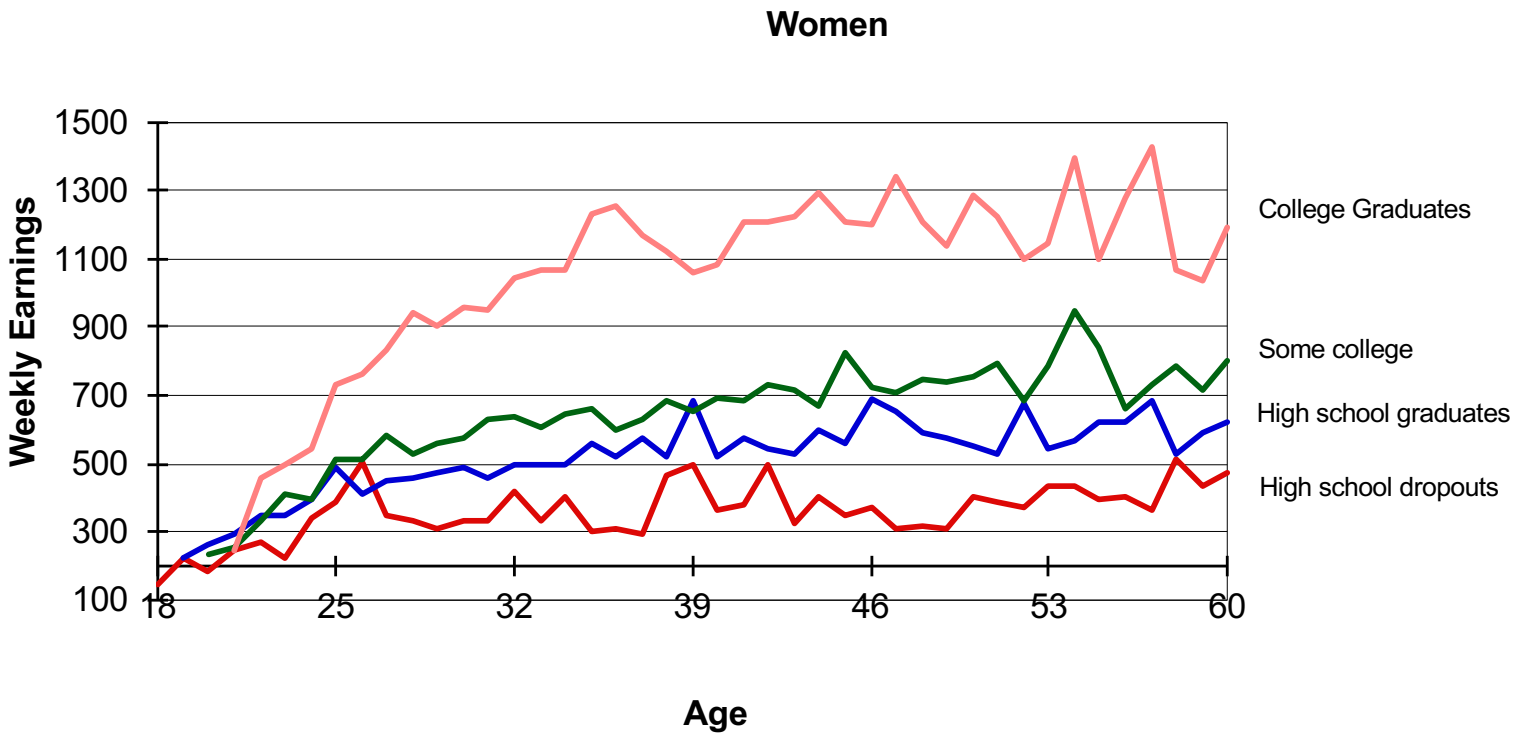

Source

Borjas, G. (2019). Labor Economics. 6th ed. McGraw-Hill, USA.