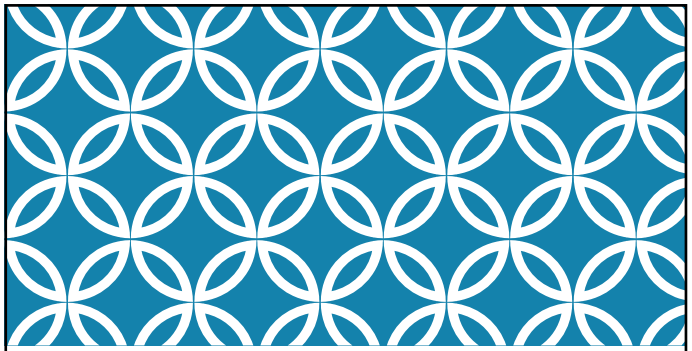


HUMAN CAPITAL | EE473

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?

HUMAN CAPITAL

- The intrinsic productive capabilities of human beings
- These capabilities can be increased through investment in things such as education, on-the-job training, and health
- Human capital is viewed as an asset that generates a flow of services, most often measured as earnings

- Adam Smith in *The Wealth of Nations* (Smith, 1776) set the stage for the study of human capital
  - Although he does not use the phrase human capital, he identifies the acquired and useful abilities of individuals as a fundamental source of wealth and economic progress of a country

The modern study of human capital coincides with two developments in economics

1. A resurgent interest in understanding why economies grow
   - It was apparently to researchers that national output was growing at a much faster rate that the rates of growth of inputs – land, labor, and physical capital (Denison, 1962) – A leading hypothesis to explain the anomaly was that labor was mismeasured: a day of work from a typical worker in 1950s was substantively different than that of a worker in the 1920s
2. The availability of large datasets that allowed exploration of worker productivity and earnings and how they related to characteristics such as the years of education and age
   - The data revealed that education levels were increasing dramatically and that the higher levels of education might explain rising productivity and wages

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

PRIVATE RETURNS TO EDUCATION

Human capital theory uses the same construct: an individual invests in education with an expectation that the investment will provide a benefit in the form of higher earnings

Human capital theory assumes that individuals take actions that will likely increase their future earnings and overall well-being

Such investment are costly: they might involve direct costs such as tuition and fees for school, and indirect costs such as foregone earnings during the period spent in school

Theses investments result in some expected future benefits

The benefits might include a higher wage, but can be anything that the individual values, for example, better working conditions or a longer life

Human capital theory typically models investment decisions such as those resulting from an optimization process: an individual will invest in such activities in order to maximize well-being over the course of a lifetime

Observed outcomes in the marketplace will be the result of an equilibrium process where the demand for specific skills and abilities is balanced with its supply

- Using human capital theory, the explanation of this empirical observation is that a rational individual would only be willing to incur the costs of tuition and lost earnings during the training period if that investment has sufficiently high rate of return in the form of higher earnings post training

- This insight also suggests that lifetime earnings is a more appropriate measure when evaluating inequality: two individuals, one who invests in professional training and one who does not, can have identical lifetime earnings, but very different earnings at each point during their lives

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?

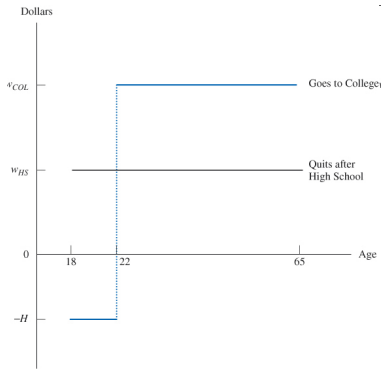
Assume that workers acquire the education level that maximizes the present value of lifetime earnings

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

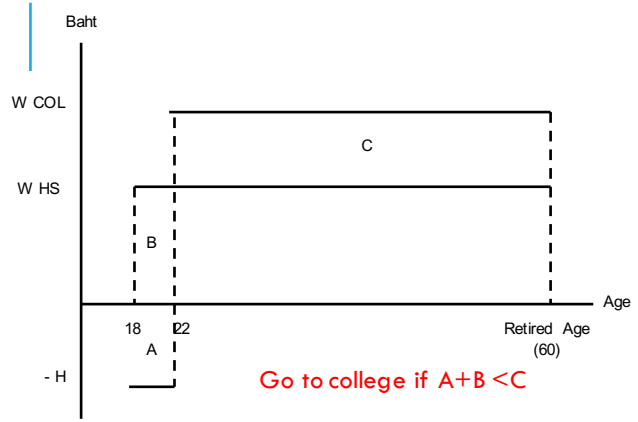
Suppose that there is no on-the-job training and the skills learned in school do not depreciate over time

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

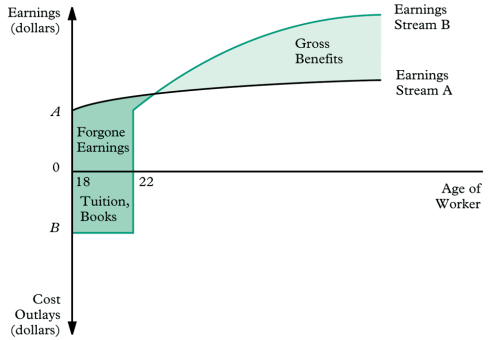


AGE – EARNING PROFILE (MINCER, 1974)



Go to college if A+B <C

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

$$PV_{COL} = -H - \frac{H}{(1+r)} - \frac{H}{(1+r)^2} - \frac{H}{(1+r)^3} + \frac{W_{COL}}{(1+r)^4} + \frac{W_{COL}}{(1+r)^5} + \cdots + \frac{W_{COL}}{(1+r)^{46}}$$

Direct costs of attending college — 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

SUPPOSE THAT THE RATE OF DISCOUNT IS 15 PERCENT

- 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)

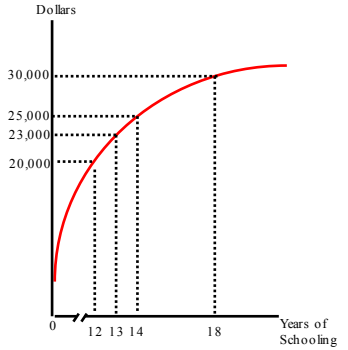
The discount rate depends on:

- 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

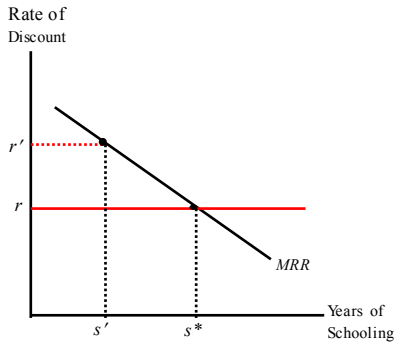
The slope of the wage-schooling locus tells us by how much earnings increase if the person stays in school one more year

The percentage change in earnings resulting from one more year of school as **the marginal rate of return to schooling**

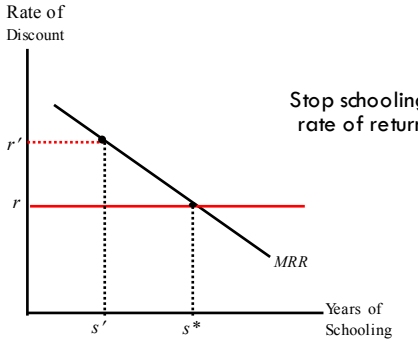
The marginal rate of return to schooling **must decline** as a person gets more schooling

$$\Delta w / \Delta s$$

THE SCHOOLING DECISION



THE STOPPING RULE, OR WHEN SHOULD I QUIT SCHOOL?

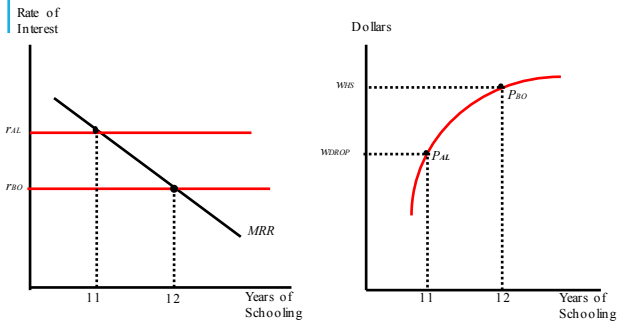


Stop schooling when the marginal rate of return to schooling = r

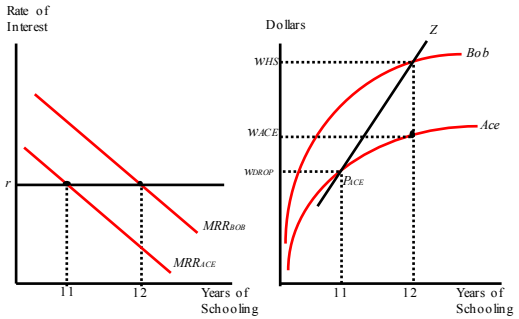
EDUCATION AND EARNINGS

- 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

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

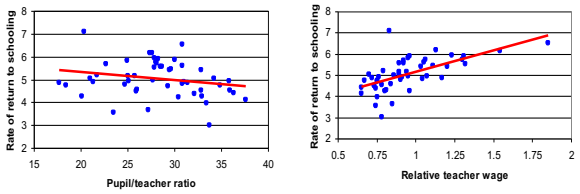
POLICY APPLICATION: SCHOOL QUALITY AND EARNINGS

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.

POLICY APPLICATION: SCHOOL CONSTRUCTION IN INDONESIA

In Indonesia, children typically go to school between the ages of 7 and 12

In 1973, the Indonesia government launched a major school construction program (INPRES) designed to increase the enrollment of children in disadvantage areas

By 1978-79, more than 61,000 new primary schools had been built, approximately two schools per 1,000 children

The typical school was designed for three teachers and 120 students

This construction program cost almost $700 million (2002 US dollars), representing 1.5 percent of the Indonesia GDP as of 1973

It has been reported that INPRES was the fastest primary school construction program in world history

The results were immediate: enrollment rates among children aged 7 to 12 rose from 69 percent in 1973 to 83 percent in 1978

Duflo (2001) study uses data drawn from Indonesian labor market in 1995 to determine if the huge investment increased the educational attainment and earnings of the targeted Indonesians, and also to calculate the rate of return to schooling in Indonesia

The program attempted to equalize education opportunities across the various regions of Indonesia, building more schools in those parts of Indonesia that had relatively low enrollment rates

THE IMPACT OF SCHOOL CONSTRUCTION ON EDUCATION AND WAGES IN INDONESIA

	Years of education			Log Wages		
	Persons Aged 12-17 in 1974	Persons Aged 2-6 in 1974	Difference	Persons Aged 12-17 in 1974	Persons Aged 2-6 in 1974	Difference
Low-construction area	9.40	9.76	0.36	7.02	6.73	-0.29
High-construction area	8.02	8.49	0.47	6.87	6.61	-0.26
Difference in differences	-	-	0.11	-	-	0.03

Duflo, E. (2001). Schooling and Labor Market Consequences of School Construction on Indonesia. American Economic Review, 91(September), 795 - 813

The difference in differences methodology to calculate the impact of the construction on the educational attainment of the targeted population

In the low-construction area, the educational attainment increased by 0.36 year between the older and younger cohorts, while in the high-construction area, the educational attainment rose by 0.47 year

The difference in differences approach suggest that the additional construction increased education attainment by 0.11 year

The earnings of the younger cohort living in the high-construction area rose by an additional 3 percent

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.

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

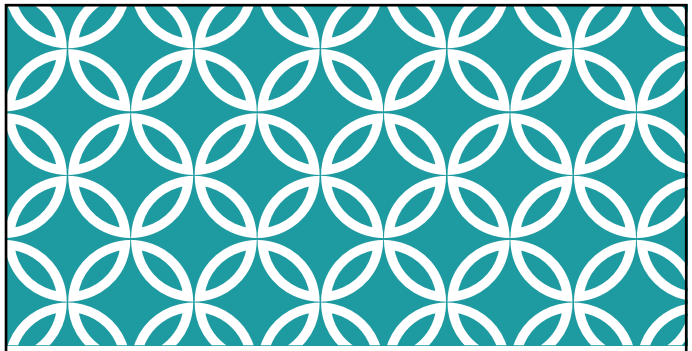
SUMMARY

- 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



SIGNALING IN THE LABOR MARKET

THE SIGNALING MODEL

❖The signaling model of education, usually attributed to Michael Spence (1973), is distinguished from the human capital theory of education by its premise that individual workers' innate productivity levels are identified by their years of schooling rather than enhanced by them

❖An implication of the model is that more-educated workers receive higher pay because education provides them with a credential, rather than because of acquired skills

❖The terms signaling, screening, and sorting are often used interchangeably to describe variants of the same basic model

SIGNALING THEORY

Signaling theory is based on the following assumptions:

1. Individuals have different innate levels of productivity, which are not affected by their education
2. Additional education incurs additional costs, which differ for high and low productivity workers
3. There is asymmetric information with respect to workers' productivity: individual workers know their skill level, but potential employers do not
4. Schooling levels can be observed without incurring a cost

The model is based on the premise that individuals are rational and that they invest in education as long as the benefit of an additional year of schooling exceeds the cost

The benefit of an additional year of schooling is the same for high- and low-productivity workers, but the costs are higher for low-productivity workers

If the wage gain associated with education is sufficient for high-productivity workers to select into more schooling but not large enough for low-productivity workers to select more schooling, then education may sort differently skilled workers so that the employers' beliefs are ratified and equilibrium exists

The signaling model hinges on the assumption that worker productivity is negatively related to the cost of acquiring the signal

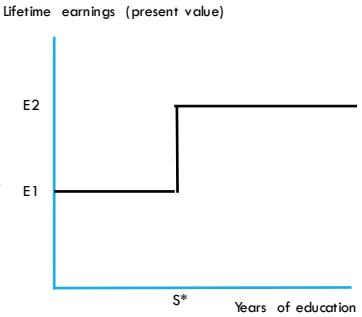
Michael Spence (1973)

Suppose that there are two types of workers: more-productive workers have a productivity level equal to 2, and less-productive workers have a productivity level equal to 1

Further that employers believe that job applicants with schooling levels equal to or greater than S* will be type 2 workers and that those who have less than S* years of education will be type 1

Firms pay workers according to their expected productivity level: so those with S* ore more years of schooling are paid a wage equal to 2, and those with less than S* years of schooling are paid a wage equal to 1

THE RELATIONSHIP BETWEEN LIFETIME EARNINGS AND SCHOOLING



Workers care about the (present discounted) value of lifetime earnings, which is E1 for those with less than S* years of schooling and E2 for those with more than S* years of schooling

Lifetime benefits associated with education. Adapted from Spence, A.M. (1973). Job market signaling. Quarterly Journal of Economics 87, 355-374.

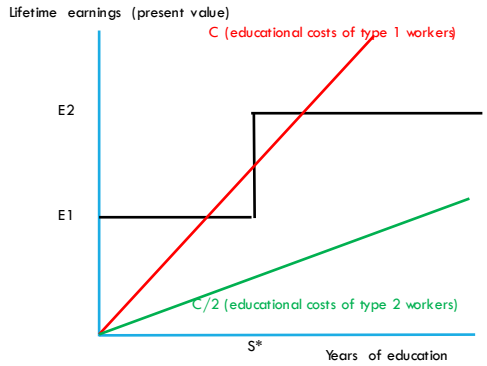
Individuals will choose to invest in the level of education that maximize their net benefits (total benefits minus total costs)

For simplicity, assume that the only benefit that workers care about is their earnings

The individuals will choose the level of education that produces the biggest difference between the (present) value of lifetime earnings and the cost of education

If education were costless then all workers would want to acquire the signal of S*, but the signaling model hinges on the assumption that costs vary across individuals

LIFETIME BENEFITS AND COSTS ASSOCIATED WITH EDUCATION



Lifetime benefits associated with education. Adapted from Spence, A.M. (1973). Job market signaling. Quarterly Journal of Economics 87, 355-374.

Suppose as in figure, that type 1 workers face a cost of C for each year of schooling but that type 2 workers, who find school easier, face a cost of C/2

It is easier to see that for type 1 workers the difference between lifetime earnings and C is maximized when they choose 0 years of education

For type 2 workers, the difference between lifetime earnings and C/2 is largest at S*

Thus, type 1 and type 2 workers sort into different levels of schooling that are consistent with the employers beliefs, and S* works as a valid signal

Note that not all years of education necessarily provide valid signal

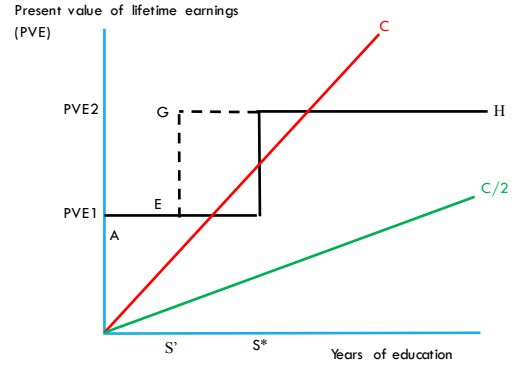
Employers use S' years of education instead of S* to differentiate between high- and low-productivity workers

Therefore, the earnings structure is now depicted as the distance AEGH

Here, both type 1 and type 2 workers maximize the difference between lifetime earnings and the cost of education by choosing S'

Since all job applicants choose the same level of education, S' does not signal anything about worker's productivity

BENEFITS AND COSTS ASSOCIATED WITH ALTERNATIVE SIGNALS



Lifetime benefits associated with education. Adapted from Spence, A.M. (1973). Job market signaling. Quarterly Journal of Economics 87, 355-374.

As stressed by Weiss(1995), the human capital and signaling models of education are not necessarily mutually exclusive

Education may simultaneously enhance workers' productivity and act as a signal about their innate abilities

In such a case, signaling can be thought of as an extension of a human capital model in which some productivity differences that firms cannot observe are correlated with schooling costs

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.

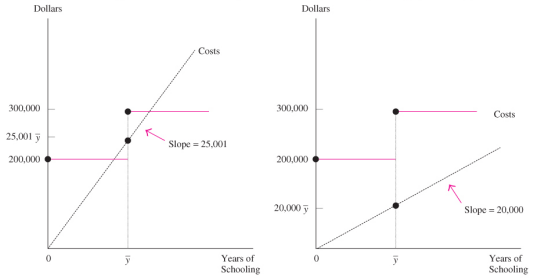
The average productivity and salary of the workers hired by the firm is then given by

$$Average\ salary = (200{,}000 \times q) + [300{,}000 \times (1 - q)] = 300{,}000 - 100{,}00q$$

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.



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

If a worker has at least $\bar{y}$ 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 $\bar{y}$ 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.

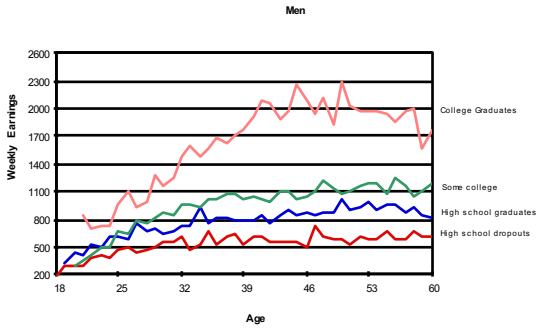
Social return to schooling (percentage increase in national income) is likely to be positive even if a particular worker's human capital is not increased.

POST-SCHOOL HUMAN CAPITAL

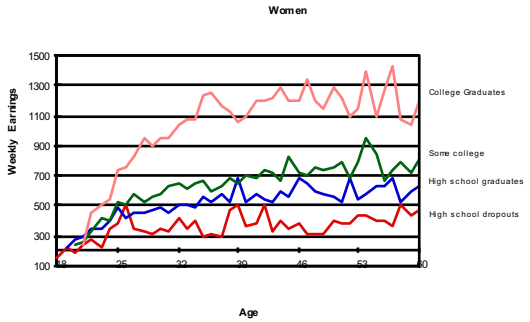
Three important properties of age-earnings profiles:

- 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



AGE-EARNINGS PROFILES OF FULL-TIME WORKERS, 2010



ON THE JOB TRAINING

Skill acquired on the job

General human capital vs. specific human capital

General training is the type of training that enhances productivity equally in all firms.

Specific training is the type of training that enhances productivity only in the firm where it is acquired and the productivity gains are lost once the worker leaves the firm

Consider a simple framework where the employment relationship between a competitive firm and the worker lasts two periods.

Suppose that in the first period, the total labor costs equal TC_1 dollars, and in the second period the, the costs equal TC_2 dollars.

The values of marginal product of each of the two periods are VMP_1 and VMP_2, respectively.

Finally, let r be the rate of discount. The profit-maximizing condition giving the optimal level of employment for the firm over the two periods is

$$TC_1 + \frac{TC_2}{1+r} = VMP_1 + \frac{VMP_2}{1+r}$$

Suppose OJT takes place only in the first period. It costs the firm H dollars to put a worker through the training.

$$w_1 + H + \frac{w_2}{1+r} = VMP_1 + \frac{VMP_2}{1+r}$$

WHO PAYS FOR GENERAL TRAINING?

The type of training that enhances productivity equally in all firms

General skills such as typing, learning how to drive, etc.

Competitive firms provide general training only if they do not pay any of the costs

Workers pay for general training

In the posttraining period, the worker's value of marginal product increases to VMP_2 in all firms. The firm that provided the training must either follow suit and increase the wage to VMP_2 or lose the worker.

Therefore, the second period wage, w_2 will equal VMP_2

As a result

$$w_1 = VMP_1 - H$$

WHO PAYS FOR SPECIFIC TRAINING?

A labor contract in which the worker's posttraining wage, w_2, is set such that

$$\bar{w} < w_2 < VMP_2$$

where $\bar{w}$ is the alternative wage

This contract implies that the worker and the firm share the returns from specific training

IMPLICATIONS

Firms only provide general training if they do not pay the costs.

In order for the firm to willingly pay some of the costs of specific training, the firm must share in the returns to specific training. Engaging in specific training eliminates the possibility of the worker separating from the job in the post-training period.

ON THE JOB TRAINING AND THE AGE-EARNINGS PROFILE

Efficiency units

- Are standardized units of human capital
- Can be rented out in the labor market, and the rental rate per efficiency unit is R dollars
- The market for efficiency units is competitive, so the per-unit rental price is R dollars regardless of how many efficiency units a worker has

Assume that all training is general and that there is no depreciation of the human capital stock over time.

Therefore, an efficiency unit of human capital generates R dollars per year from the date when it is acquired until retirement, which occurs at age 65.

Suppose that the worker enters the labor market at age 20 and plans to retire at age 65.

The marginal revenue of acquiring once efficiency unit of human capital at age 20 is

$$MR_{20} = R + \frac{R}{(1+r)} + \frac{R}{(1+r)^2} + \frac{R}{(1+r)^3} + \ldots + \frac{R}{(1+r)^{45}}$$

where r is the discount rate.

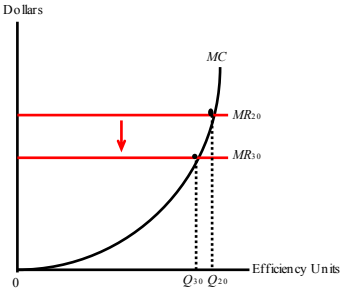
Suppose that the worker enters the labor market at age 30 and plans to retire at age 65.

The marginal revenue of acquiring once efficiency unit of human capital at age 30 is

$$MR_{30} = R + \frac{R}{(1+r)} + \frac{R}{(1+r)^2} + \frac{R}{(1+r)^3} + \ldots + \frac{R}{(1+r)^{35}}$$

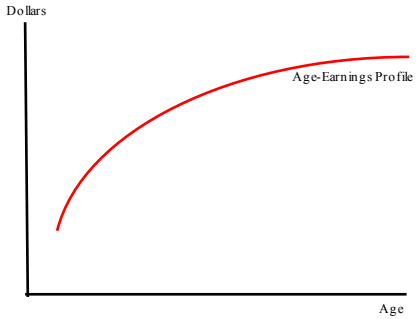
where r is the discount rate.

THE ACQUISITION OF HUMAN CAPITAL OVER THE LIFE CYCLE



The marginal revenue of an efficiency unit of human capital declines as the worker ages (so that MR_{20}, the marginal revenue of a unit acquired at age 20, lies above MR_{30}). At each age, the worker equates the marginal revenue with the marginal cost, so that more units are acquired when the worker is younger.

THE AGE-EARNINGS PROFILE IMPLIED BY HUMAN CAPITAL THEORY



THE MINCER EARNINGS FUNCTION

$$\log w = as + bt - ct^2 + other\ variables$$

w – the worker's wage rate

S – the number of years of schooling

t – the number of years of labor market experience

t^2 - a quadratic on experience that captures the concavity of the age-earnings profile

AGE-EARNINGS PROFILE

Upward sloping and concave

Older workers earn more because they invest less in human capital and because they are collecting the returns from earlier investments

The rate of growth of earnings slows down over time because workers accumulate less human capital as they get older

The age-earnings profile is concave so that the earnings increase over time but at a decreasing rate

POLICY APPLICATION: EVALUATING GOVERNMENT TRAINING PROGRAMS

The National Supported Work Demonstration (NSW) provides a good example of such a randomization scheme.

The key objective of the NSW was to ease the transition of disadvantaged workers into the labor market by exposing them to a work environment where experience and counseling could be provided.

In this experiment, eligible applicants were assigned randomly to one of two tracks

- The lucky workers who were treated by the program received all the benefits by the NSW
- Those assigned to the control groups received none of the benefits and were left on their own
- The NSW guaranteed persons in the treatment group a job for 9-18 months, at which time they had to find regular employment
- The program cost about $12,500 per participant (in 1998 dollars)

TABLE 6-4 The Impact of the NSW Program on the Earnings of Trainees (in 1998 dollars)

Source: Robert J. LaLonde, "Evaluating the Econometric Evaluations of Training Programs with Experimental Data," *American Economic Review* 76 (September 1986): 604–20, Table 2.

Group	Pretraining Annual Earnings (1975)	Posttraining Annual Earnings (1979)	Difference
Treatment group	1,512	7,888	6,376
Control group	1,481	6,450	4,969
Difference-in-differences	—	—	**1,407**

The NSW program cost about $12,500 per participant

It would take longer than a decade (if future earnings gains are discounted) for the program to reach the breakeven point, the point at which the per-worker training costs equal the present value of the benefits accrued by the worker

The rate of return to the investment is on the order of 10 percent

SOURCE

Borjas, G. (2012). Labor Economics. 6th ed. McGraw-Hill, USA.

Brewer, Dominic and Patrick J. McEwan (2010). *Economics of Education*. New York: Elsevier