Module 2: Education and Labor Markets

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Introduction

In Module 1 we showed how human capital theory filled a historical gap in economic explanations of the relation between capital accumulation and economic

growth. Crucial to the notion of human capital is that a person who has more academic skills—the kind one learns in school—is able to produce more goods and services, hence is worth more to employers than a person who has fewer academic skills. Thus, an important part of the economics of education is to understand why more education is worth more to employers and how much it is worth.

In this module, we study the relationship between individuals' education and where they are likely to end up in the labor market—particularly in terms of how much they earn. In order to study this relationship, we have to understand how markets work and the rationale behind the way economists link skill acquisition through education and job training to wages. At the end of this module, the student should be able to explain why education contributes to higher wages, and should be able to estimate whether some investments in education are worth more than others.

Learning Objectives

Upon completing this module, you should be able to do the following:

1. Understand the meaning of markets and supply and demand.
2. Describe how economists explain the relationship between skills acquired in school and the earnings of workers in the labor force.
3. Understand age-earnings profiles and their meaning for human capital theory.
4. Understand why age-earnings profiles are shaped the way they are—why people earn more as they get older and earn more with more education.
5. Understand the meaning of rates of return to the investment in education.
6. Describe various theories of labor markets.

Work Plan

To reach the learning objectives listed above, you should read each section and then undertake the activities listed at the end of each section. The activities, necessary steps, approximate time, and resources you will need are listed below

Activity	*Steps*	*Estimated Time*	*Necessary Resources*
Section 1 Questions	Read and answer questions at the end of Section 1.	1 hour	1. Section 1 of this module
Section 2 Questions	Read and answer questions at the end of	1 hour	1. Section 2 of this module

	Section 2.		
Section 3 Questions	Read and answer questions at the end of Section 3.	3 hours	1. Section 3 of this module. Additional data from statistical annuals.
Section 4 Questions	Read and answer questions at the end of Section 4.	1 hour	1. Section 4 of this module
Section 5 Questions	Read and answer questions at the end of Section 5.	1 hour	1. Section 5 of this module
Section 6 Questions	Read and answer questions at the end of Section 6.	1 hour	1. Section 6 of this module

1. Markets

People want more material goods in the aggregate than can be produced and do not desire a good many things that can be produced. So goals must be established to determine who gets what is produced and how much of each good is produced. These goals are expressed in terms of the "value" that societies place on each good and service.

Values determine the goods that should be made and the quantity of each good to be made. Second, resources at the disposal of society have to be allocated among the products and the production units in such a way, given the state of technological knowledge, as to obtain as much as possible of the desired outputs. Third, aggregate output of the economic system must be divided among the members of the society. Fourth, the economic system must be capable of change and growth. Systems should be capable of producing new commodities, of catering to changes in the desired composition of output, of adopting new productive techniques, and of finding new resources.

The institution that establishes values is the market. In consumer goods markets, entrepreneurs sell goods and services to consumers in exchange for money. Consumers obtain their incomes as owners of productive services. In an enterprise economy, the sale of productive services is the only source of income.

In the market, consumers use the wages they earn from selling their labor (productive resources) to business enterprises to buy goods and services. Business enterprises, in turn, buy resources, including labor services, and transform them into goods and services that they sell to consumers (Figure 2-1). Neo-classical economists introduced the idea of consumer sovereignty, which means that consumer values

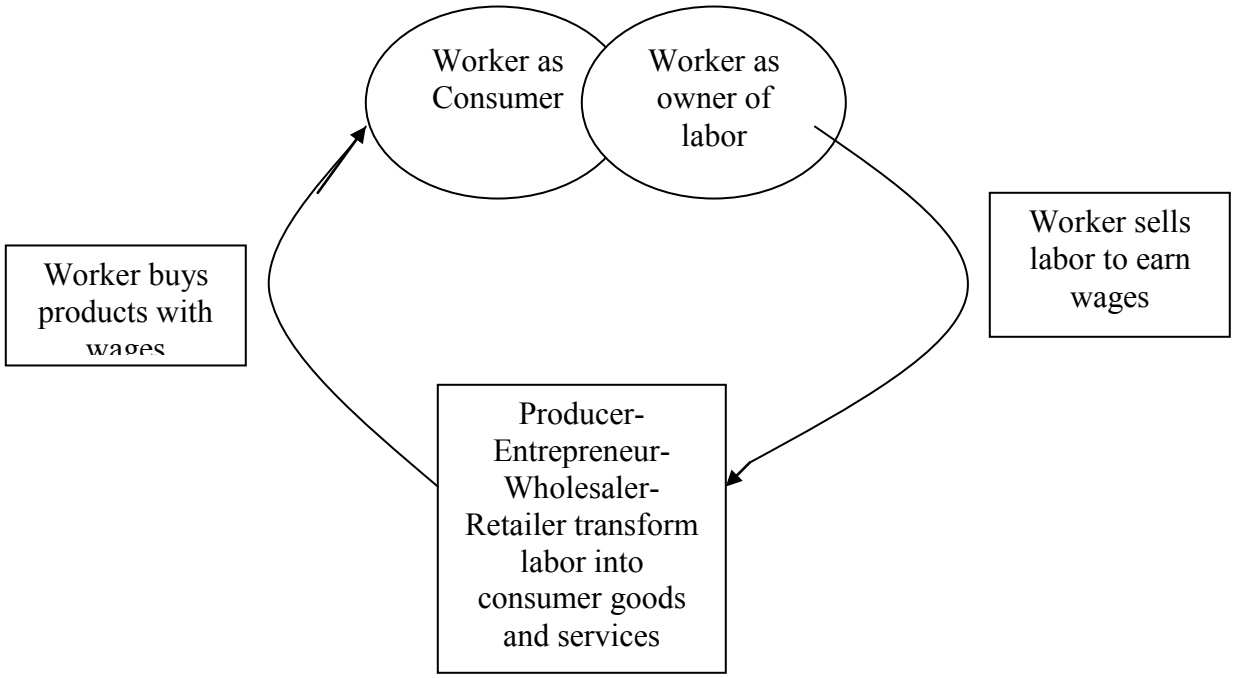


Figure 2-1. Markets and the Wheel of Production-Consumption

determine with is desired in the economy. Producers produce the desired goods and services that are most profitable to produce. Individual consumers' control over production is limited by the size of their income, which, in turn, is defined by the value of the productive services they have to offer to business enterprises. A dollar or euro or yen of spending is a vote for the goods and services desired. So the composition of annual output in an economy is partly determined by the distribution of the ownership of goods and services.

Prices play a key role in this process. They govern the allocation of resources at three levels: among industries, among firms (more efficient firms can pay higher prices for productive resources), and within firms (entrepreneurs want to find the cheapest combination of productive services to produce a given product, so use prices of inputs to allocate resources to production).

Through this pricing mechanism, markets establish the "right" or "optimum" value for each product and service—this optimum value is the value at which all the product or service that is being sold finds buyers, and all buyers who are willing to pay that price find the product or service. In order for this to happen, markets require certain conditions:

- Competition among buyers and sellers—production and consumption units have to be small enough that no single unit or group can influence prices by their actions or buying or selling;

- There are no obstacles to the movements of resources;
- Information about prices and the specifications and quality of the products and services is available to all buyers and sellers;
- Contracts can be enforced.
- The good has no "social" value (positive or negative) beyond its "private" value.

Do these assumptions typically hold in markets? Although we generally observe considerable competition in markets, there are some markets in which very large production units may influence prices. The oil cartel, for example, often acts like an oligopoly that tries to manipulate prices. Another problem is the amount of information readily available to consumers. Information is not readily available to consumers on many products and services, and even if available, may require a sophisticated analysis to understand. Education and health care, for example, are services that are difficult for consumers to evaluate.

On the other hand, the Internet has made possible much more access to information about prices and quality assessments. Web sites such as www.cnet.com, which evaluates thousands of electronic products and allows consumers to compare prices, have greatly increased the amount of information available and made markets much more competitive.

The enforcement of contracts is also an important problem in markets. If I purchase a service from you—to paint my house, for example—and after you have painted my house, I feel that you did not do the job that you represented to me, I may not want to pay you the price that we agreed on. We have a contract dispute. Such disputes occur often and everywhere in markets. They are expensive to adjudicate.

In education, the issue of contract enforcement is central to the delivery of educational services, yet is incredibly complex. Teachers have a great deal of autonomy in the classroom, and in many countries, insist on that autonomy. How does the educational system enforce the contract between teachers and the public administration for the delivery of a particular package of educational services? A teacher may have one interpretation of what it means to deliver educational services, and the school or central administration may have another. Traditionally, inspectors from the central administration have traveled to schools to check on teachers, but these visits were and are infrequent.

The teacher contract also implicitly exists between teachers and parents as taxpayers or payers of tuition. This contract is even more difficult to enforce, particularly if the parents have relatively little experience with measuring the quality of schooling or have a vague measure of quality. The most complex feature of the parent-teacher contract is that the education of children is the *joint responsibility* of parents and teachers, so each

can blame the other for the child's performance in school. The contract implicitly assigns tasks to the contracting parties, but the interpretation of tasks is usually very broad. For example, how much homework should teachers be allowed to require from pupils? The more homework assigned, the greater the parent responsibility. If a pupil does not understand an assignment or a concept, is this the teacher's or parent's responsibility under the contract?

In order to enforce contracts, school systems are increasingly turning to testing pupils using national tests. Schools are then required to be *accountable* for improving their students' performance over time at a certain rate or face sanctions. But these accountability systems are subject to the same problems outlined above: teachers and schools claim that they cannot be entirely responsible for student progress; parents' demographics and motivation also play a role. There is a great deal of truth to these assertions. If schools are not able to overcome initial gaps in pupils' learning, is this the fault of the schools? Should teachers be held accountable under their contracts for making up gaps in learning that can be attributed to family or social problems? In Module 3 and 4, this question will be dealt with in more detail.

Education is also an example of a service that may have value above and beyond its "private" value. Each one of us may benefit beyond the positive effects of our own education because *all* of us have more education. If this is the case, the price that the market establishes for buying education would be too low compared to its "true" value to society A too low value would mean that too few (less than optimal) resources would be allocated to education. Economists say that there would be "underinvestment" in education because the market underestimates the true price of this output. The demand for education is less than it should be optimally because individuals cannot capture for themselves the benefits of education that accrue to society as a whole.

Another aspect of such market imperfections is that the production of many goods and services creates social costs that are not included in the market price. For example, the price of energy produced by burning coal may be too low because it does not include the health costs associated with the pollution of the atmosphere caused by unregulated coal burning. This means that the market establishes a price of that good or service that is too low compared to its social value for a different reason than in the case of education. In this case, the costs of production are too low rather than the demand for the product. The costs of production do not reflect the "true cost" of the good.

In such situations, government as the representative of *public interests* needs to intervene in markets in order to establish social value. In those situations where the market-established value of the good is not as high as it should be to induce sufficient demand, government needs to subsidize the cost of the good or service so that more of it is consumed and produced than in an unregulated, totally private market. In the situation where too much of the good is being consumed than socially desirable, government needs to tax producers of the product (or consumers) to increase its cost so that it reflects "true social cost." This would reduce coal energy production—at the same time, the tax revenue generated would help offset the health costs associated with polluted air.

Alternatively, the government could require strong anti-pollution controls on coal energy plants in order to greatly reduce pollution. Again, this would effectively raise the costs of production, reduce consumption, and simultaneously reduce pollution.

Later in this module, we discuss market imperfections in labor markets, mainly those associated with discrimination against certain groups. If discrimination results in inefficiencies (for example, men may be as or less productive than women in certain jobs but are paid more), then the government should intervene to eliminate such inefficiencies by regulating hiring practices.

Much of the argument about discrimination revolves around whether current hiring and pay practices or different groups are the result of discrimination or differences in their productivity. For example, some economists have argued that the reason that women get paid less or are not hired into certain jobs is because women's productivity is lower, mainly because they are more likely to leave the labor force for periods of time. Some economists have argued that African-Americans (males) are paid lower wages than white males because African-Americans with the same levels of schooling as whites have lower academic performance, hence are likely to be less economically productive. If these arguments are correct, the market is allocating resources efficiently, and no government intervention in labor markets is necessary.

1.1 Supply and Demand

Before discussing education and labor markets, we need to spend a few paragraphs working through simple concepts of supply and demand. Economists use the concepts of supply and demand to describe market activities by consumers (demand) and producers (supply). The demand curve is the sum of all individual demand curves for a product. The individual demand curve describes how much a particular individual would be willing to buy of a product at each price. This reflects the individual's preference for this product versus other products that are substitutable. For example, the lower the price of beef compared to, say, fish, the more beef the consumer will buy. The aggregate of all these individual preferences is the aggregate demand curve for the product.

Movement along the demand curve describes how much more or less product consumers buy for give changes in prices. In effect, at a lower price for product X, more consumers would be willing to buy X (see Figure 2-2, demand curve D). At a higher price, some consumers will cease to buy X; others will buy less. Implicit in the demand curve is that consumers have a certain amount of resources with which to buy goods and certain tastes. Thus, aggregate income and tastes are fixed along the demand curve. Should income rise (say from economic growth), the demand curve would shift to the right (see Figure 2-2, demand curve D*), and vice-versa if income falls. If consumer preference (taste) for a product increases, they would be willing to boy more at each price. That implies that the demand curve shifts to the right.

The supply curve is the aggregate of all the cost functions of individual firms producing a product. The higher the price of the product (the more to the right is the

demand curve), the larger the number of producers willing to produce the product, and the more each producer is willing to produce (Figure 2-3). The technology used to produce a given product is fixed along the supply curve, as are the prices of inputs used to produce the product. If, say, a new technology appears that allows producers to produce all quantities of the product or service at a lower price, the supply curve would shift to the right (S*). Similarly, if the price of an important input, such as airplane fuel in the production of airline services, rises, the supply curve of airline services would tend to shift to the left.

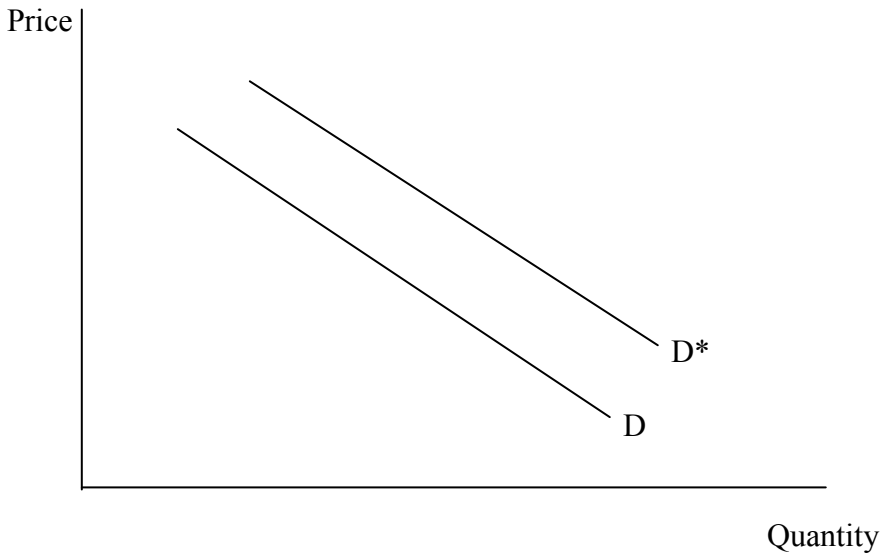


Figure 2-2. The Demand Curve

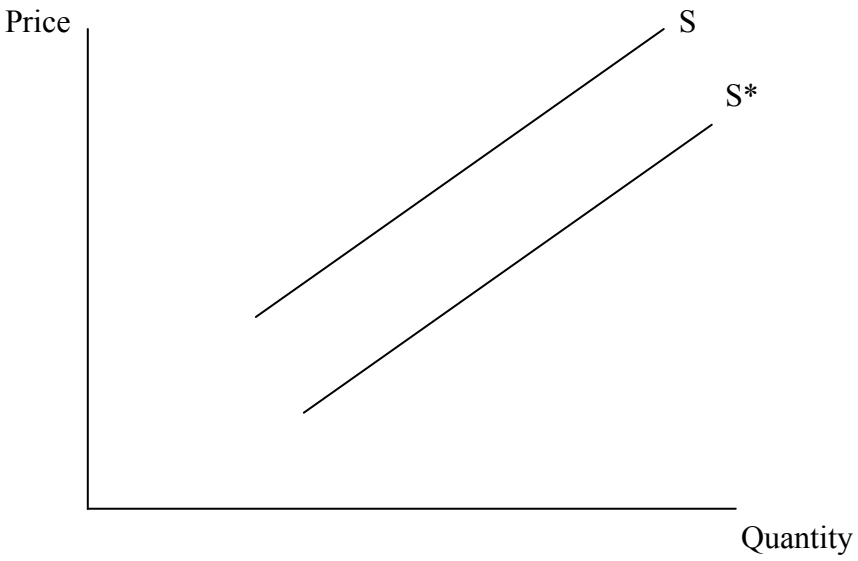


Figure 2-3 The Supply Curve

The theory of markets predicts that supply and demand will tend to move to equilibrium. In equilibrium, the demand for goods will equal supply, meaning that at the equilibrium price (P in Figure 2-4), all those willing to pay that price will find the amount of product or service they desire, and, at that price, producers will be willing to produce the amount of good or service desired by consumers. At a price higher than the equilibrium (P*), suppliers would be willing to produce more than consumers want to buy; at a price lower than equilibrium, the opposite would occur: consumers would be willing more goods and services than producers are willing to produce (P**).

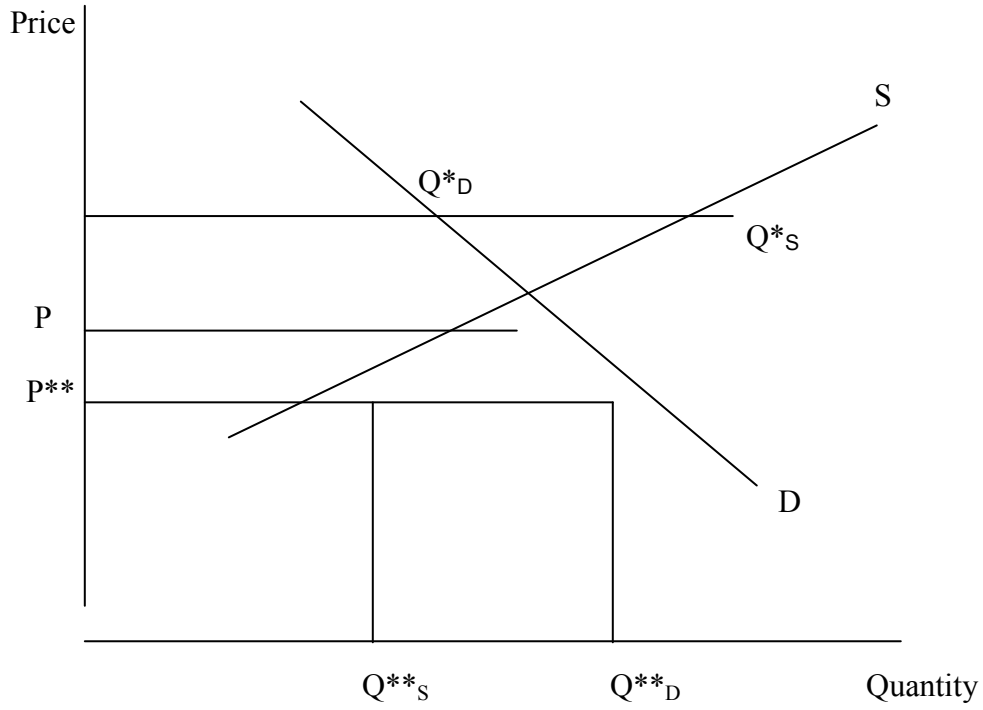


Figure 2-4. Supply and Demand Equilibrium

One supply-demand example of special importance to education is the market for teachers. The price in this market is teacher wages, and the quantity of teachers could simply be the number of teachers or the number of teachers weighted by some measure of quality, such as teacher content knowledge or teaching skill. Since the primary market for teachers is in the public sector, and, in many countries, teachers are unionized, there may be many reasons why teachers wages might be set too high or too low to clear the market. If the unions are successful at negotiating a higher than equilibrium wage, more people with appropriate skills would want to be employed as teachers than there are jobs available. This might stimulate the creation of private schools paying lower than public sector wages to their teachers. In some countries, government pays wages that are lower than the equilibrium wage for "good" teaching. In that case, fewer qualified teachers than

needed to staff classrooms would offer themselves to teach, and there would be a shortage. The school system might have to recruit unqualified teachers, or raise wages to attract sufficient qualified teachers.

Activities for Section 1:

If tastes change in favor of eating vegetarian rather than eating meat, what would happen to the price of meat? How would you show this using the supply and demand curves for meat?

Suppose that using computers in classrooms would lower the cost of producing education quality. What would that do the quality of education and to the cost of education? How would you show that using supply and demand curves for educational quality?

2. Human Capital, Wages, and the Distribution of Income

In a market economy, how does the market determine how much individuals should be paid? The concept of human capital contends that workers are paid according to the demand and supply of skills embodied in workers. Skills are defined in the human capital model as those capabilities that help the individual worker produce more goods or services. Any worker skill that contributes to economic output is considered human capital. Is there evidence that certain identifiable skills contribute to higher productivity?

2.1 *Marginal Productivity and Wages*.

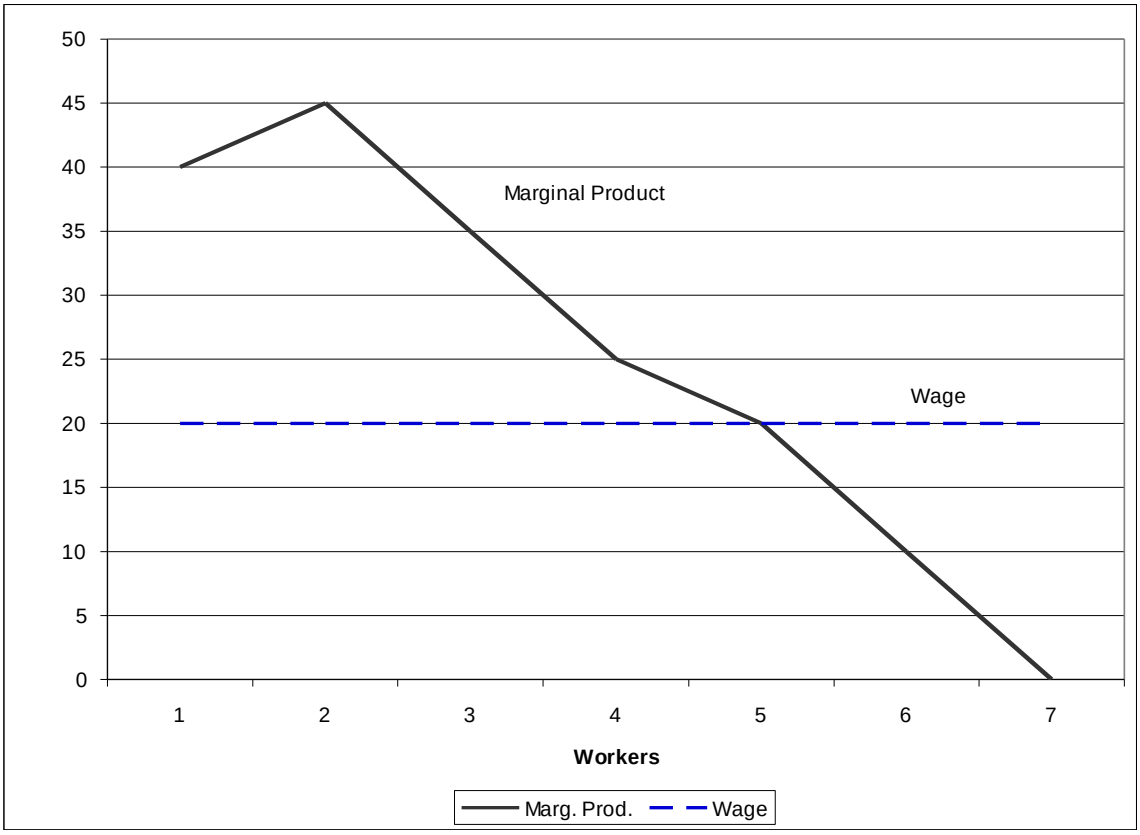
Although there is little direct evidence of a relationship between clearly identifiable worker skills and higher productivity, human capital theory argues that in competitive markets, a worker's wage is equal to his or her marginal productivity. To illustrate this, imagine that farmer produces wheat, and the competitive market values wheat at 5 euros/10 kilograms. Figure 2-5 shows that if the farmer hires one worker, he would be able to produce 80 kilograms per day, or 40 euros worth of wheat, more than his wage of 20 euros per day. A second worker might produce more wheat because of some complementarities with the first worker. Because the wage is still below what an additional worker produces, the farmer continues to hire workers until the fifth worker, who produces an additional 20 euros of wheat, exactly equal to the wages that farmers in the region are paying wheat workers. If the farmer hired a sixth worker, the additional wheat produced by that sixth worker would be worth less than the worker's wages. This would not be profitable for the farmer, so he would let that worker go. The farmer therefore hires workers up to the point that the last hire produces additional output (marginal product) equal to the market wage for that kind of worker.

Thus, though it is hard to prove that more skilled workers are more productive than less skilled workers, the fact that workers with certain types of skills, such as the discipline and problem-solving capability that academic success requires, earn higher wages than those who do not have these skills, suggests that employers value these skills and are willing to pay for them.

2.2 Specific and General Skills

Noble Prize winning economist Gary Becker identified two kinds of skills workers acquire that can contribute to higher productivity: specific skills and general skills. Specific skills are those that are particular to a firm and its specific production processes. Such skills are usually learned through training provided by the firm. A firm is willing to invest in such training because workers usually cannot transfer the skills learned to other firms—hence, they cannot turn these skills into higher wages elsewhere. Becker argues that although we do not observe higher wages associated with specific skills, they must result in higher productivity because firms are willing to invest in such skills. General skills, on the other hand, are those that are useful across firms. For

Figure 2-5. Marginal Product and Wages



example, a worker may have acquired computer skills in school and by working in jobs that required learning a number of computer applications. While some of these may be particular to the firm, many could be transferable to other jobs and enterprises. The firm that made it possible for the worker to acquire these skills can only persuade him or her from taking a job at another firm at a higher salary by matching the offer. Thus, firms are unlikely to invest in general skills. Even so, workers often acquire general skills just by gaining work experience. We observe higher wages for workers with greater general skills, so such workers, according to Becker, must be more productive.

The increased competition associated with economic globalization has reduced the likelihood that U.S. workers stay with the same firm for the entirety of their work lives (Carnoy, 2000). Young workers are now especially more likely to change jobs more often, choosing to work in firms where they can acquire general skills, then trying to parlay those skills into higher salaries by seeking jobs in other firms. Fifteen years ago, changing jobs every year would be considered a sign of an unstable employee—a negative trait. Today, a young employee who changes jobs often, moving into ever more demanding work with ever higher wages, is considered ambitious and resourceful—a positive trait. If greater job mobility becomes a dominant characteristic of more traditional European labor markets, we should expect to observe less investment by private companies in general skills, since companies are less likely to reap the benefits of that investment.

So, if under competitive conditions, marginal productivity equals wages, then we can argue that the wages that workers receive equals their marginal productivity, and that workers who receive higher wages are more productive than workers who receive lower wages. Workers who acquire more general skills are likely to perceive higher wages than workers who acquire only skills that are specific to the firm in which they work. We can also argue that the wage, or income distribution is the result of a market that pays a "just" wage to different types of workers because they have skills demanded in the market. Thus, income distribution is a result of skill distribution and the value the market places on those skills.

Other labor market models have alternative explanations for wage differences and income distribution. They reject the idea that skills alone explain wage differentials in labor markets. Some argue that human capital theory does not take account of market imperfections or the power relations between employers and employees. Others argue that wages are set by jobs conditions—mainly the amount or type of capital required for doing the work—more than by worker skills. In other words that workers with the same skills working with different amounts or types of capital will earn different wages. Other models claim that education is little more than a way to legitimize ability differences and that the earnings differences we observe in the labor market are the result of early developed ability differences. Later in the module, we will review these alterative theories of the relationship between education and wages. Before we do that, however, it is important to understand the human capital view that earnings distribution reflects the distribution of acquired skills.

Activity for Section 2:

Think of the skills you have learned in working in some job. Which of those skills can you characterize as general and which as specific to that job in that firm? Which of those skills did you pick up just working on the job and which did the company teach you as part of a job training program?

3. Age-earnings Profiles

One of the main ways economists have described the relationship between education and labor markets is "age-earnings profiles." Traditional age-earnings profiles are simple relations that demonstrate how the structure of earnings of individuals is distributed across age and level of education, and in some cases, over gender, race, and ethnicity. The typical age-earnings in Figure 1 present some characteristics which are common to age-earnings profiles computed in a number of economies with different levels of development and different institutional arrangements.

The main characteristics of a stylized age-earnings profile are:

- The absolute level of earnings at any point in time is higher for people with a higher level of schooling.

- Age-earnings profiles are concave in age. That is, earnings increase with age at a decreasing rate, up to a maximum (usually between the age of 45 and 55) and then flatten or even decline. This pattern is observed for all the levels of schooling. In recent years, we have found, at least in the United States, that the age-earnings profiles are somewhat less steep and turn down at a somewhat lower age, mainly because of higher worker turnover among those employees in their forties and fifties.

- The slope of the profile is positively correlated with level of schooling. Before the earnings peak is reached, the mean earnings of people with a higher level of schooling increases faster than those of people with a lower level of schooling. After the peak, the earnings of more educated people decline faster than those of less educated people.

- The maximum level of earnings tends to be reached at a later age for people with a higher level of education.

- The earnings differentials for differently educated people tend to increase with the level of education. In other words, at any given age, the differential earnings associated with a given differential in years of education increases with the absolute level of schooling. For example, the difference in earnings between people with 12 and 8 years of schooling is lower than the difference in earnings

between people with 16 and 12 years of schooling. This is particularly true at higher age.

Economists have measured age-earnings profiles in many countries of the world and in different historical time periods, from the 1930s to the 1990s. Generally, the characteristics of age-earnings profiles listed here seem to hold across countries at different levels of economic development, different institutional settings, and through economic cycles (recessions and booms). But there are important variations. For example, in countries with more equal income distributions, such as those in Scandinavia and the former socialist countries of Eastern Europe, the differences in earnings profiles – shape and height—are smaller than in countries such as the United States and Great Britain. The differences between Western European countries and developing countries, such as Mexico, Chile, and Brazil, are also quite pronounced, with age-earnings profiles for university graduates relatively much higher in the developing countries, and the age-earnings profiles for basic education graduates even flatter and turning down earlier than shown in Figure 1. Those differences aside, economists tend to regard the above characteristics as structural, so they can be used to understand a great deal about how labor markets reward human capital and how individuals might respond to the incentives offered by labor markets to invest in more schooling.

We have to remember that these age-earnings profiles are estimated by observing the income earned by workers of different ages and different levels of education *at a certain point in time*. For example, we might use census data for the year 2000 to estimate the average annual earnings of workers by age group and education level as shown in Table 1. The census asked whether the person worked full time or not and their annual income in the previous year, 1999. The data are presented by group of age in most census tables, and that is how it is shown in Table 1.

Table1. *Median Income, Full=time Employed Males, 1999*

	Level of Education				
Age	*< High School*	*High School Graduate*	*Some College*	*College Degree*	*Advanced Degree*
21-24	17,170	21,078	22,088	30,258	30,618
25-34	21,470	28,262	32,063	41,854	50,888
35-44	25,345	34,002	40.855	56,923	69,764
45-54	26,687	36,634	42,852	57,663	71,239
55-64	27,980	36,519	43,036	59,420	70,990
65-74	20,450	26,396	32,524	49,109	65,264
Source: U.S. Census Bureau, 2000 Census, Earnings by Occupation and Education					

The data in Table 1 are only for males fully employed in the labor force all year around, so the earnings are higher than if we had presented data for all males in the labor force, including those that worked part year or less than 35 hours per week. The earnings curves would also turn down at an earlier age. The earnings curves are also much higher than had they included the earnings of women working in the labor force, since women earn much less. For example, full-time employed college graduate women 25-34 years

old earned $32,860, 35-44 year-old female college graduates earned $40,072, and 45-54 year-old college graduate women earned $39,939. So fully-employed women with college degrees earned less than 80 percent of men's median income at 29 years-old, but this falls to less than 70 percent of male median income at 49 years old. Thus, it is important to make clear whose earnings are being used to estimate the age-earnings profiles. Depending on who is included, the shape of the curves and the distance between the earnings of those with different levels of schooling will differ.

These differences are important because age-earnings profiles represent the single best measure of how young people view the payoff to investing in the next level of schooling. Certainly young men are more likely to look at the earnings curves for men than for those that combine the earnings of men and women. Should young people consider their potential future earnings as those of full-time employed workers or all workers together? This is a difficult question to answer. It depends on how easy it is to get full-time work. If full-time work is readily available and taking part-time work is a choice rather than a necessity, then the full-time earnings profiles are probably a good estimate of how much more a young man thinking of going, say, to university. In 1999 in the United States, getting a full-time job was no problem, so these earnings were a good estimate of what a college graduate could earn relative to a high school graduate.

Let's assume that an 18 year-old young man living in the United States in 1999 was thinking about going to university. How much more could he have expected to earn over a high school graduate? At 29 years-old, according to the numbers in Table 1, he would earn, on average, $13,000 more annually if he graduated college, but less than $4,000 more if he did not graduate. By 39 years old, his expected payoff to finishing university would rise to $22,000, but if he did not graduate, he could expect to earn only $7,000 more. Thus, he could have expected to earn much more from investing in university education if he completed his degree.

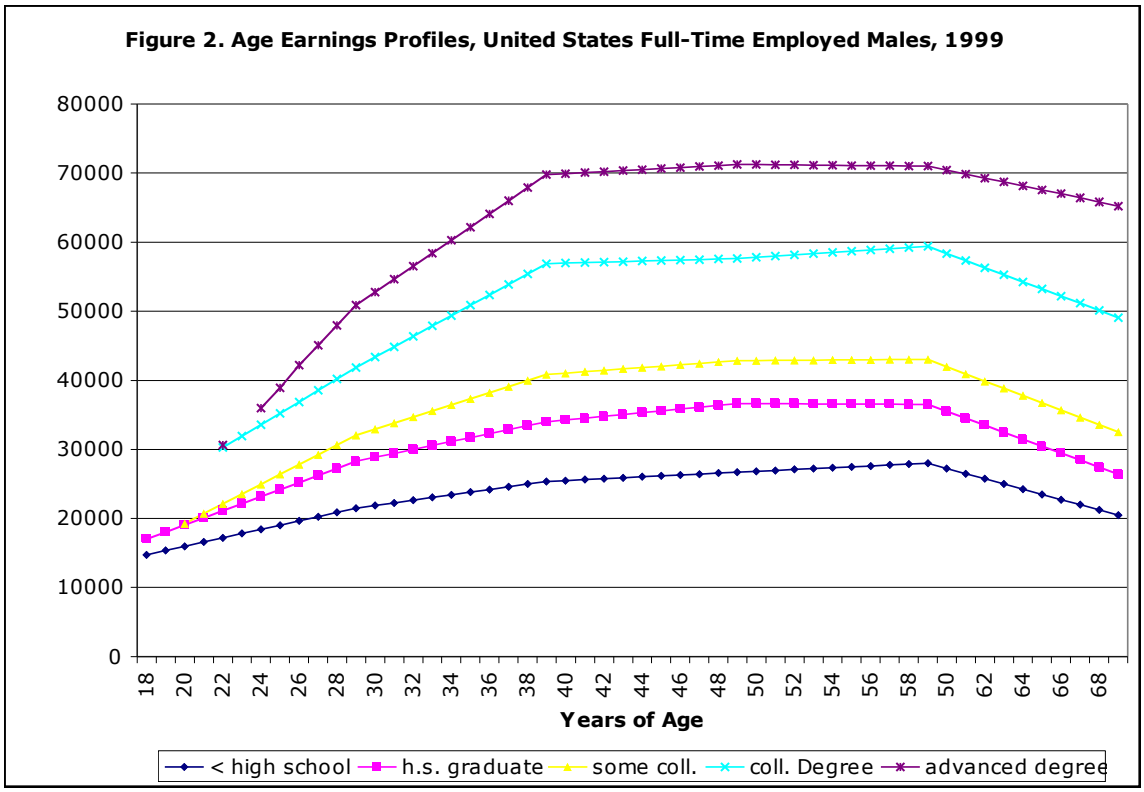
The full age-earnings profile can be calculated from Table 1 by locating the earnings of the first age-group (21-24) at 22 years old, putting the earnings of the 25-34 year old age group at 29 years old, etc., and then interpolating between the age groups. The results are shown in Table 2. The earnings "streams" in Table 2 are the typical age-earnings profiles that we discussed earlier. The graph of these earnings streams are shown in Figure 2.

Table 2. *Median Income, Full-time Employed Males, 1999 (current dollars),*

	Level of Education				
Age	*< High School Complete*	*High School Graduate*	*Some College*	*College Degree*	*Advanced Degree*
18	14713	16973			
19	15327	17999			
20	15941	19025	19238		
21	16,556	20,052	20,663		
22	**17,170**	**21,078**	**22,088**	**30,258**	**30,618**
23	17784	22104	23513	31915	33,318
24	18399	23131	24938	33571	36,000
25	19013	24157	26363	35228	38896

26	19627	25183	27788	36884	42201
26	20241	26209	29213	38541	45097
28	20856	27236	30638	40197	47992
29	**21,470**	**28,262**	**32,063**	**41,854**	**50,888**
30	21,858	28,836	32,942	43,361	52,776
31	22,245	29,410	33,821	44,868	54,663
32	22,633	29,984	34,701	46,375	56,551
33	23,020	30,558	35,580	47,882	58,438
34	23,408	31,132	36,459	49,389	60,326
35	23,795	31,706	37,338	50,895	62,214
36	24,183	32,280	38,217	52,402	64,101
37	24,570	32,854	39,097	53,909	65,989
38	24,958	33,428	39,976	55,416	67,876
39	**25,345**	**34,002**	**40855**	**56,923**	**69,764**
40	25,479	34,265	41,055	56,997	69,912
41	25,613	34,528	41,254	57,071	70,059
42	25,748	34,792	41,454	57,145	70,207
43	25,882	35,055	41,654	57,219	70,354
44	26,016	35,318	41,854	57,293	70,502
45	26,150	35,581	42,053	57,367	70,649
46	26,284	35,844	42,253	57,441	70,797
47	**26,419**	**36,108**	**42,453**	**57,515**	**70,944**
48	26,553	36,371	42,652	57,589	71,092
49	26,687	36,634	42,852	57,663	71,239
50	26,816	36,623	42,870	57,839	71,214
51	26,946	36,611	42,889	58,014	71,189
52	27,075	36,600	42,907	58,190	71,164
53	27,204	36,588	42,926	58,366	71,139
54	27,334	36,577	42,944	58,542	71,115
55	27,463	36,565	42,962	58,717	71,090
56	27,592	36,554	42,981	58,893	71,065
57	**27,721**	**36,542**	**42,999**	**59,069**	**71,040**
58	27,851	36,531	43,018	59,244	71,015
59	27,980	36,519	43,036	59,420	70,990
50	27,227	35,507	41,985	58,389	70,417
61	26,474	34,494	40,934	57,358	69,845
62	25,721	33,482	39,882	56,327	69,272
63	24,968	32,470	38,831	55,296	68,700
64	24,215	31,458	37,780	54,265	68,127
65	23,462	30,445	36,729	53,233	67,554
66	22,709	29,433	35,678	52,202	66,982
67	**21,956**	**28,421**	**34,626**	**51,171**	**66,409**
68	21,203	27,408	33,575	50,140	65,837
69	20,450	26,396	32,524	49,109	65,264

Source: Table 1. incomes interpolated between midpoints of age groups and projected backwards from 22 years old down to 18 years old using growth rate of earnings between 22 and 29 years old.



Of course, twenty years from 1999, in 2019, when our 18 year-old student is in the labor force and reaches 39 years old, a great deal may have changed. That $22,000 difference between what a high school and college graduate earns could turn out to be much more, or it could turn out to be less. If we want to estimate the age-earnings profiles of cohorts—say, the cohort that had to decide about entering university in 1968 and turned 29 years old in 1979, 39 years old in 1989 and 49 years old in 2999, we could do so, but we could not have known in 1968 what we know today about the performance of that cohort. The student deciding about going to college in 1968 could never have known how earnings would behave over the next ten or twenty or thirty years. The best he or she could do is observe the cross section of earnings in 1968.

Economists have estimated that in the U.S. labor market the college earnings premium of recent labor market entrants is much more volatile than the premium of people with a comparable level of skill but in the middle of their career. This means that downturn periods will have a greater effect on new entrants than on people already in the market. Thus, cohorts that enter in slow growth periods will be disadvantaged for their entire career since the next expansion period will alter their wages much less than those of new entrants.

3.1 How Does the Human Capital Model interpret These Age Earnings Profiles?

Age-earnings differences mean that there is a positive return to investment in education. Without the possibility of earning more money as a result of spending more

money on education, economists would argue that there is a positive return to the investment in education, Without earnings differences associated with more schooling, *by definition there is no human capital* associated with the investment in that education. This is completely analogous to purchasing a machine that doesn't, say, produce any more ball bearings than someone without the machine. The value of that capital is essentially zero. The definition of human capital is the value placed on the capital by the increased earnings it produces in the market.

What else do economists learn from the age-earnings profiles?

3.1.1 *Why is the level of earnings different for groups with different levels of education*? Gary Becker, one of the main theoreticians of the human capital model defined schools as institutions that specialize in the production of training. Students attend school to acquire skills that, in turn, are rewarded by the market with a higher level of wages and earnings. However, as we discussed in Module 1, the relation between skills and earnings is still not perfectly understood. Even among human capital theorists there is no generally accepted explanation for why skills learned in school are rewarded by the market.

Some economists claim that the skills taught in school raise individuals' productivity. Thus, workers with a higher level of education produce more than those with a lower level of education regardless of the specific task they are performing. Other economists argue that skills taught in school have value because they are costly to acquire. Thus, the supply of skilled workers is less than the supply of unskilled workers because a skilled worker can enter the market for unskilled labor, but an unskilled worker cannot enter the market for skilled workers. Thus, the higher wages paid to more educated people is simply a premium to the scarcity of skilled (as taught in school) labor.

3.1.2 Why are the age-earnings profiles concave (the age-earnings profile rises, then turns down at higher ages)? If schools were the only channel through which individuals could acquire skills, and skills did not depreciate, the age-earnings profiles would have a different shape from the one observed. If schooling were the only source of skills, individuals would acquire all their work skills by the time they finished schooling. Let us assume that those acquired skills are the total of their capital investment and that capital does not depreciate. If that capital yields a fixed return (like investing in a government bond), the age-earnings profile shown in Figures 1 and 2 would be a step function with value zero from birth to graduation age and a constant value Y from graduation age to retirement age (Figure 3). People with higher education would have a higher Y. Indeed, in the absence of post-schooling investment and depreciation, the human capital acquired during the schooling period would be constant with respect to age. Thus, earnings would be constant with respect to age since earnings are flows generated from the stock of human capital at a fixed interest rate.

For earnings to rise with age, individuals must be investing in skills (human capital) after they leave school. Older workers must be acquiring more skills as they work, either through formalized training associated with certain kinds of jobs, or through learning-by-doing as they work (experience). Thus, workers must continue to invest in

skills and to increase their stock of human capital well beyond the formal schooling period. Earnings keep growing with age because the human capital stock keeps growing with age. However, human capital depreciates over time, very much like physical capital, mainly because of the problem of obsolescence. Over time, new knowledge becomes available and often replaces or complements existing knowledge and a worker's stock of human capital loses market value over time.

In summary, the two variables that influence the evolution of the human capital stock over time are the *gross investment* that workers make in themselves through work and training, which depends mainly on the kinds of jobs they take (some jobs give workers the opportunity to acquire more skills, and others, less skills), and the *depreciation of the stock of human capital*, which increases over time if the stock is increasing and decreases if the stock is decreasing, This second variable declines over time for two reasons. The first is related to the fact that time is an input for the production of human capital and the price of time (wage rate) increases when human capital increases. Hence, as workers age and their stock of capital increases, they will invest less and less in acquiring additional human capital. The second reason for the decline of investment in human capital is that the later in life the investment occurs, the shorter the period in which the yield of the investment can be enjoyed by the investor. Thus the difference between gross investment and depreciation declines over time and even becomes negative. Therefore, the pattern we observe for the stock of human capital is one which first increases at a declining rate, and then declines. In human capital theory, this explains why the earnings curve first rises with age and then declines.

3.1.3 Why do more highly educated people have a steeper age-earnings profile? This characteristic of the age-earnings profile is a consequence of the fact that time spent in acquiring post-school skills declines with age. Indeed, the price effect discussed under makes it relatively more convenient for the consumer to substitute time spent in training with time spent in market activities as the human capital stock and, hence, the wage increases. This price effect is stronger for people with higher levels of education. Thus the earnings profile will be steeper for the better educated as a result of the greater amount of time spent in the labor market. The slope would be even greater if the wages rate were a convex function of the human capital.

3.1.4 Why does the peak in the age-earnings profile occur later in life for those workers that have higher levels of education? This characteristic can be explained by stressing that experience, not age, is the variable which increases the human capital after the school period. Assuming that the maximum human capital stock is achieved after a period (years of experience) which is independent of the level of human capital acquired in school, then the age-earnings profile of more educated people peaks later in life simply because more educated people enter the labor market later. Hence, it is only later in life that more educated people attain the years of experience required for the human capital stock (and the earnings profile) to reach the maximum.

3.1.5 Why do earnings differentials appear to increase with higher levels of schooling? If we compare the age-earnings profiles of workers with completed basic schooling,

secondary schooling, and university education, the differences between university and secondary earnings are generally greater than the differences between secondary and primary, particularly for workers in their thirties, forties, and fifties. Columbia University economics professor Jacob Mincer explained this phenomenon with a model that assumes that workers only have a fixed number of years that they can work in the labor force. Therefore, those who stay in school longer have less time to earn the payoff on their investment, and the difference in earnings with those in the next lower level of education would have to be higher in order to get the same return. However, the same result obtained by Mincer can be obtained simply by observing that people who enter the labor market later in life have an expected working life that is shorter than that of people who enter the labor market earlier.

However, if more education is associated with better health—and there is some evidence that this is the case—it may be that those with more education may be able to work *longer* than those with less education. Those with more education might be able to get the same return on their investment simply by being able to work more years in the labor force because more education helps them make decisions that make them healthier than workers with less education.

Activities for Section 3.

Collect data on the earnings of workers doing various kinds of jobs in any society you might be interested in. Also try to get data on how much women and men earn with the same amount of education. How large are differences in earnings? How can you explain these differences? If you can get data by ethnic group, try to explain differences between them as well.

4. Age-Earnings Profiles and the Value of Human Capital

Economists define education both as an investment good and a consumption good, as we explained earlier in this module. Human capital is the result of individuals' investing in education and training. When individuals go to school, they may enjoy the experience, so they get an immediate consumption value from the time they spend in school. They may also find the experience painful, so they would see schooling as a consumption cost. In addition, by attending school, they may acquire knowledge that enhances their enjoyment of books and music throughout their lives, or they may learn languages that help them enjoy traveling or to develop relationships that they would not have if they did not speak other languages. Economists consider this long-term increase in life's pleasures due to education as the *consumer durable* value of education.

The immediate and long-term consumer value of schooling is what educators tend to emphasize, and such value of education does not depend on the student's eventually working or earning income. Economists emphasize the investment value of education, and that does depend on the student's working. It also depends on an individual *earning more income* than he or she earned had they not taken the additional schooling. Thus, the

value of human capital is this investment value of education and training, and is measured by the difference in income a person earns from going to school or investing in training. If a person earns no more income by taking additional schooling, the *investment* value of that time and resources is zero. *Thus, the human capital value of education nor training is zero unless it results in an increase in earnings.* Strictly speaking, no human capital is created if the individual does not earn higher wages or more income as a result of taking additional schooling or training.

One of the major questions we still have to deal with is whether the earnings differences in Table 2 and Figure 2 represent the payoff to additional schooling or to some other differences between the individuals who complete, say, secondary schooling, and those who complete, say, university. We discussed the importance of distinguishing between the earnings of males and females, because women earn less than men. We also mentioned that full-time, full year workers may have different patterns of age-earnings than all workers, including those who work part-time, part year. We will discuss other "market failures" later in this module. We might find that certain groups, such as blacks in the United States, or Moslems in Spain, have lower wages for the same amount of education and the same age, and it is important to understand why the value of their human capital might be lower than that of the dominant group.

This leads us to the main issue; are the differences in income in Table 2 and Figure 2 the result of more education or the result of something else that we are not measuring? One possibility is that the individuals with higher "ability" are those take more schooling. How do we separate the returns to higher ability from the returns to the academic skills taught in school? Human capital theorists agree that individuals differ in ability, both because of innate ability differences or because of differences in the investment in human capital that families make before their children ever get to school, including in high quality pre-schools. Before they enter school, children are exposed to different, more or less stimulating learning environments. This is usually referred to as a student's socio-economic background or "cultural capital." Both innate ability and "cultural capital" may affect productivity independently of formal schooling. More important, they may affect the amount of schooling individuals take. Thus, the differences in earnings we observe in Tables 2 and Figure 2 reflect the differences in schooling among individuals but also the differences in ability and cultural capital among individuals with higher and lower levels of schooling.

Economists have tried to measure the component of earnings attributable to education and that attributable to ability. In the 1960s, they estimated that a certain percentage of the difference in age-earnings profiles was due to education alone. They called this the "alpha coefficient." Thus, an alpha coefficient of 0.6 means that 60 percent of an individual's earnings is attributed to her or his level of education. The standard way economists have estimated the alpha coefficient is by multivariate regression analysis of the log of earnings on schooling and some proxy indicating the ability of the individual. Thus the coefficient of the ability variable should indicate the contribution of ability to earnings. Using this technique, Gary Becker found that the a coefficient is about 0.8 when only ability is used in the analysis. However when some indicator of social

background is used, then the coefficient drops to 0.65 percent. World Bank economist George Psacharopoulos, reviewed several U. S. studies and found an average alpha coefficient of about 0.77. This suggests that only 23 percent of the difference in earnings between, say, college and high school education is due to ability, and 77 percent to skills learned in school.

More recently, economists have taken a different approach to estimating the relative impact of ability and schooling on earnings differences. Since ability influences both earnings and years of schooling acquired by an individual, this new body of literature attempts to build a structural model that describes all the interactions among years of schooling, human capital acquired in school, ability, and earnings. In general, the approach specifies a set of equations that describe the relation between students' achievement in school and their ability measured at an early age plus family socio-economic level, a second relationship between the amount of schooling that individuals take and their achievement in school and family socio-economic level, and a third relationship between earnings in the labor market, the level of education taken experience in the labor force, and other variables. The result of such studies suggest that the "alpha coefficient" estimates, which just use ability as a variable in the earnings equation, overestimate the contribution of education to earnings. Thus, in this more complex formulation, the effect of ability on earnings is larger and the impact of schooling smaller than the 0.6 to 0.77 estimated earlier.

In summary, the age-earnings profiles shown in Table 2 and Figure 2 overestimate the "true" payoff to investing in higher levels of education. Part of the return we observe is to the higher academic ability of young people who take more schooling. This higher ability is defined as including innate ability and family socio-economic differences, and should not include skills taught in school. This means that high ability individuals might earn more income even if they were not to continue on to higher levels of schooling. It also means that lower ability individuals who somehow do complete, say, college do not earn as much as the average differences shown in Table 2. If it were possible to develop an experiment in which students who finish secondary school are selected randomly to attend university and we followed them for fifteen years as they worked in the labor force or completed their studies and then worked in the labor force, we would be able to say a lot more about the separate effects of ability and of years studied in school. But since we cannot do that, the main problem in measuring the effect of schooling on earnings is that there is considerable bias in our estimate of school effects. In our estimate of earnings differences associated with level of schooling, we are including not only school effects but also the fact that more able and socially more well-connected students bring academic skills to school from home, make more informed academic choices while in school, and are able to access higher paying jobs through their social networks once they complete their schooling. This makes very complex the estimation of how much the skills taught in school actually contribute to earnings.

Activities for Section 4.

Do you think human capital theory is consistent with what you observe about labor markets in Catalan society? What would be some facts that would support human capital theory? Facts that would make you doubt the validity of human capital theory?

5. Measuring the Value of Investment in Education According to the Human Capital Model

5.1 *Education as a " durable good" that requires time and resources to produce*

The age-earnings profiles shown in Table 2 and Figure 2 represent the average amount that individuals with different amounts of education earn at a certain historical point in time. Let us assume, for the moment, that these earnings differences are the best estimate that a young person or a family has for predicting how much an investment in additional education is worth. For example, if a young man in 1999 in the United States, just completing secondary school, were thinking about whether to invest in a university education, he could consider the difference in median income between a male university graduate and a male secondary graduate in Table 2 as the best single estimate of the average gain in earnings if he were to complete university.

The most notable feature of the earnings streams in Table 2 and Figure 2 is that they occur over a long period of time. Even in today's world of universal secondary education, many people work from the time they are 18 to retirement at 65 years old or older. In Europe, high youth unemployment rates may postpone entering the work force until the early twenties or later, but longevity has increased, so average work life and earnings streams may still be more than forty years long, as long as at any time in history. The differences in earnings over this long work life are the expected economic benefits that a person taking more schooling will receive because of the time and resources he or she invests in the additional schooling. Because the benefits are received over a long period of time, education is considered a "durable good," and because the benefits are in the form of additional income, education is considered a "capital" or "producer" durable.

A popular way that the media present this stream of benefits is to add up all the earnings of a university graduate from 23 years old to, say, 65 years old, and subtract all the earnings of a secondary school graduate from 19-65 years old. In 1999 in the United States, that difference was $2.25 million dollars minus $1.49 million dollars, or $760 thousand dollars. So *El Pais* might report that a male university graduate in the United States earns $760 thousand dollars more during his lifetime than a secondary school graduate.

The problem with this popular way of presenting the value of additional schooling is that it omits two important aspects of economic value:

- The cost of the additional education; and

- The fact that many of the differences in earnings occur far in the future.

In order to estimate the real value of investing in that university education, the young man should compare *the value to him at the time he intends to make the investment* (in 1999) of earnings differences that he will receive *in the future* with the amount that he has to invest (which he may also be investing over several years and not all at once). Accountants call this estimating *the present value* of future net gains.

5.2 The concept of present value

The underlying principle of present value is that individuals prefer to consume today rather than in the future. If we offered someone a choice between a gift of a new laptop computer today or a year from now, almost everyone would choose to get the laptop today rather than later. Only those who considered computers a negative factor in their lives would choose to postpone the gift. If an employer offers to pay someone for work done either as soon as they finish or a month later, every worker would insist on being paid right away.

However, we could convince individuals to postpone receiving their laptop or being paid by paying them to postpone. For example, we could offer the worker to be paid immediately or to be paid 10 percent more a month from now. We can induce people to postpone consumption by paying them a rate of interest. The rate of interest required to convince someone to postpone consumption varies, depending on their preference for present over future consumption. Some groups, such as the Japanese, are much more willing to postpone consumption than Europeans or, especially, Americans. If someone is more willing to postpone consumption, they are said to have a "low discount rate," or low implicit interest rate. Since Americans seem to have developed a preference for immediate consumption over savings, they are said to have a "high discount rate" or high implicit interest rate. This simply means that we would have to pay Americans a higher interest rate to get them to save than we would have to pay Japanese. At the same time, we could conclude that the payoff to additional education would probably have to be higher in the United States than in Japan in order to convince young people and their families to invest in further education.

In order to model this behavior, we need to develop a formula for estimating the present value of the earnings differences between two levels of schooling. The present value is expressed as the sum of the earnings difference in each year of work *discounted* by the interest rate that a person could get for, say, investing in a government bond or a somewhat more risky type of bond. Discounting means that each year's income is "weighted" to reflect how many years the young person would have to wait to get that gain in earnings after completing the additional schooling. The present value formula for the earnings differences between university and secondary education for someone just graduating from college at 22 years old would be:

$$PV = (Eu–Es)_1/(1+r)^1 + (Eu–Es)_2/(1+r)^2 + (Eu\text{-}Es)_3/(1+r)^3 + \ldots.. + (Eu–Es)_n/(1+r)^n$$

Where:

$(Eu\text{-}Es)_1$ = the difference in earnings between a university graduate and a secondary school graduate in the first year after graduation, say at 23 years-old;

$(Eu\text{-}Es)_2$ = the difference in earnings between a university graduate and a secondary school graduate in the second year after graduation, say at 24 years-old;

and so forth;

r = the prevailing interest rate, or "discount rate."

From the formula, we can see that earnings differences earlier in the person's work life are "discounted," or weighted, by a much smaller (negative) weight than earnings differences later in working life. For example, if the prevailing interest rate is 5 percent, the first year or earnings differences (age 23) would be divided by 1.05 and the twentieth year (42 years old) would be divided by $(1.05)^{20}$, or 2.65. This means that the earnings difference at 42 years old would be worth to a 22 year old just graduating from college about 0.38 (1/2.65) of any earnings difference at 23 years old, the year after he graduated from college. If we take the earnings differences in Table 2, we can see that the $22 thousand dollar difference between a college graduate at 42 years old actually has a lower present value to someone 22 years old than the $10 thousand dollar difference at 23 years old. If the discount rate is higher, say 10 percent, the present value of earnings differences twenty years into the future gets even smaller. We would divide the earnings difference at 42 years old by $(1.10)^{20}$, which is 6.73, so (1/6.73) equals 0.15. The present value of the earnings difference at age 42 would be only $3,300, much less than the present value of $9,000 at 23 years old.

Now, let us calculate the net present value of the earnings differences in Table 2 between university graduates and secondary school graduates. First, we subtract the earnings of secondary school graduates from the earnings of university graduates year-by-year. Using a discount rate of 5 percent, and assuming that the university graduate will work until 65 years old, the present value at age 22 of that stream of earnings differences over the next 43 years is $300 thousand, less than half of the undiscounted differences that would usually be presented in the media as the value of additional education. If we use a discount rate of 10 percent, the present value is much smaller, $147 thousand dollars.

5.3 Costs of education

So far, we have not discussed the costs of education. We assumed that the present value of earnings differences associated with graduating from university should be estimated at age 22 when a person graduates. However, we should really estimate present value of the investment including the cost of investing in university and begin the present

value estimate at age 18 when the individual is deciding whether to attend university or not. The present value formula would now include costs:

$$PV = C_1/(1+r)^1 + \ldots + C_4/(1+r)^4 + (Eu–Es)_5/(1+r)^5 + \ldots. + (Eu–Es)_n/(1+r)^n$$

Thus, now the first four periods are costs (which are negative numbers), and the returns to investing in additional education begin in period 5.

What are the costs of education? Economists divide the costs of education into "private costs—those borne by the individual student or the student's family—and those borne by the public sector—public costs. Private plus public costs equal "social costs"—the total cost of education.

From the individual's or family's standpoint, the most important "private" costs of education are the earnings foregone by students while they attend school or other educational activities, the additional expenditures associated with taking education, such as uniforms, books, transportation, and fees, and possibly a negative consumption effect of sitting in classes.

Since costs occur early in the temporal stream of costs and returns (payoffs) to education, they necessarily have a much greater weight both in the educational investment decision process and in the estimated present value. However, private costs are much more difficult to measure than the potential benefits from additional schooling. For example, we are not nearly as confident in estimating earnings forgone by teenagers in a country with a high youth unemployment rate than we are in estimating the earnings differences among adults in the labor force. Direct private costs of schooling to families are also difficult to measure, and are usually significantly underestimated. Families in many countries bear a large proportion of the total cost of even public primary school because they have to pay for uniforms, books, school supplies, and transportation to an from school.

The public costs of additional education equal costs borne collectively through taxes or voluntary donations used for public spending on education.

In the lower levels of education, most of the costs are public, since almost everywhere, primary and secondary education are highly subsidized by the public sector. Even so, in developing countries, poor families may consider the work of children to be valuable, so may withhold their children from school if they do not think that the future benefits of schooling are as great as the value of their children's work. Low-income families may also, by necessity, have implicit high discount rates. This means that since they have so little, they necessarily place high value on present consumption.

At higher levels of education, earnings foregone play a more important role, so private costs rise relative to public costs. But public costs also rise with higher levels of schooling, and in some countries in Africa, the subsidies to university students are so high that they are greater than the earnings the students could have earned in the labor

market. It is also possible that just becoming a university student gives an individual a new status that helps them earn as much in the labor market when they work part time as a secondary school graduate can earn working full time. In that case, the university student might not give up any income by attending university.

The greater is the public subsidy to education, the lower the private share of the investment in education, and the higher the net present value to the private individual of taking additional education. One of the paradoxes of educational investment is that the higher the youth unemployment rate, the lower is the income foregone from going to school, so, again, the higher would be the net present value to private individuals from investing in additional schooling. This explains why we observe that in recessions, the demand for university education rises in the developed countries.

Another phenomenon that can be explained by the influence of private costs on the net present value of educational investments is the rise in demand for web-based university education by adults who are currently working. By pursuing university studies at home, by Internet, they can hold their current jobs and study at the same time. They give up leisure activities, so the investment is not costless, but it is lower cost than were these students to attend traditional university during the day.

Now, let us estimate the present value of investing in university for our 18 year old living in the United States in 1999. If we assume that he would be able to work during the summer in the four years he attended university full-time, he would only give up three-quarters of a year's earnings as his investment cost. If we also assume that he would have to pay about $5,000 tuition annually—this was a typical average tuition in four- year *public* universities in 1999—plus about $1,000 per year in books and other direct expenses, the total private cost for an individual to attend a four year college beginning in 1999 would be about $19 thousand dollars in the first year and would rise to $21 thousand by the fourth year. The student could work part-time while in school to reduce costs, but that might prolong the number of years required to complete university. Applying the present value formula to this stream of costs and benefits, we find that the present value equals about $177 thousand dollars when the discount rate used is 5 percent, and only $38 thousand when the discount rate used is 10 percent. For the private individual, this means that even with a relatively high discount rate of 10 percent, it did pay to invest in a university education, but barely so.

For an individual deciding whether to invest in a university education, there are other considerations. On the negative side, the individual has to take into account income taxes on the additional earnings gained. These would reduce the net gain below those we have estimated. On the positive side, the individual may realize consumption benefits from being a university student. He or she may get pleasure from attending classes and mixing with other students. The courses may be interesting and even inspiring. The knowledge gained may make the person's life more interesting in the future. Thus there are positive benefits in addition to monetary rewards.

If we want to include the public costs of higher education, we would have to add in another seven thousand dollars, since that is the difference between private tuition paid and the total cost of providing public university education. Once we do that, the present value of the total per student cost in university and the private earnings stream falls to $152 thousand dollars with the 5 percent discount rate and only $15 thousand dollars with a 10 percent discount rate.

These estimates represent the present value of the “social benefits” of more education. The social benefits measure the economic returns to the society from the total investment made in a given level of education—in this case university education. Yet, we have to remember that we only included the average increase in private income associated with the additional education. From society's point of view, the benefits of additional education are the additional productivity of those who have taken more schooling and engaged in other educational activities, the collective consumption value of the education, and the "externalities" of education accruing to society in nonmaterial forms, such as more civilized collective behavior, a more productive environment, and a wiser choice of political leadership. The social costs of additional education equal the private costs plus any costs borne collectively through taxes or voluntary donations used for public spending on education.

We have estimated the social benefits of education by using the same average earnings streams as in the private benefit estimates, but such approximations of social benefits are problematic. Earnings differences do not necessarily equal productivity differences, especially when a significant percentage of those with certain levels of education, such as university, work in the public sector or in oligopolized sectors of private industry and services. From a private individual's standpoint, it makes little difference what the additional earnings represent, since private investment decisions are based on expected returns. If employers pay higher salaries to those with more schooling, the benefits as seen by individuals are the additional wages, whatever the reason for paying them. Yet for society, the reason behind higher incomes makes a difference in assessing whether to invest in more education or not.

5.4 Estimating rates of return to education

The present value estimates of the value of education are an excellent way for understanding how high the payoff is to investing in additional schooling and how sensitive that payoff is to changes in assumptions about costs of education. But present value estimates do require assuming a discount rate. If we do not have a good idea of what that discount rate should be, we can find the *implicit discount rate* that would make the present value equal to zero. This is called the “internal rate of return” (IRR). The internal rate of return is that discount rate which would make the present value zero. The IRR can be then compared to rates of return to other investments either by private individuals or the public sector to determine whether education has a higher or lower yield than they do. The rate of return to investing in education is therefore a measure of profitability and as such, it is equivalent to the interest paid on savings or the rate of

return to investing in a machine, real estate, or any other form of capital that requires a stream of investment over time and an income return over time.

The private rate of return is estimated using private costs as we described earlier and the stream of earnings differences that are associated with taking additional schooling. Normally the net earnings stream should be corrected for taxes to determine the private rate of return. Using the present value formula we developed above, and returning yet again to our male secondary school graduate trying to decide in 1999 whether or not to invest in a college education, we can now estimate the private internal rate of return, We do not make the correction for taxes, but this means we are probably overestimating the private rate of return. In our present value estimate, we found that at a 10 percent discount rate, there was only a small positive present value (about $38 thousand dollars). This suggests that the internal rate of return must be somewhat larger than 10 percent (since the IRR is the rate that would make the present value equal to zero). Using Excel, we estimate that the private IRR of investing in college in 1999 is 14 percent.

We can also estimate the social rate of return by adding in the extra $7,000 of public costs that subsidizes university education over and above private tuition contributions. The social rate of return we estimate is lower than the private rate, although if we had taken account of taxes, that may not have been the case. We estimate that the social rate of return is 11.3 percent. Now this may be an underestimate of the true social IRR because we have not included externalities (the benefits that other workers and citizens may realize because more people decide to go to college).

5.5 Implications of rates of return for explaining investment decisions regarding education

Rates of return to investment in education are a measure of the value of education. They should tell us something about how individual investors will behave. If we observe high private rates of return, we should also observe a high level of investment by families in education and pressure on the public sector to expand access to more education.

In Eastern Europe before 1989, the rate of return to university education—especially graduate education—was very low because the communist governments of those countries tended to fix salaries of professions associated with university training not much higher (or in many cases, lower) than the salaries of skilled workers and technicians. Thus, it was not surprising that the demand for university education was relatively low, and that the demand for graduate education was minimal. In the United States, the rate of return of getting a Ph.D in physical sciences or engineering is also relatively low, but for foreign students it is a way to enter the U.S. labor market and earn much more than they would at home. Thus, a high fraction of Ph.D students in those fields is foreign students.

As we discussed in Module 1, economic globalization and the knowledge society are associated with increasing demand in the labor market for university graduates. In

many economies this has been associated with increasing inequality of incomes. The rate of return to investing in university education has therefore risen. In the United States, the increase in rate of return to university education has come mostly from the fall in earnings of workers with high school education, and very little from a rise in earnings of college graduates. But the rate of return has risen nonetheless, promoting increasing enrollment in universities. The proportion of high school graduates who enter post-secondary education has risen from about 50 percent two decades ago to more than 60 percent today.

We compared rates of return to secondary and higher education in three Latin American countries with rather different educational systems—Argentina, Chile, and Uruguay. Uruguay has a traditional European system: upper secondary school serves as a filter that chooses students for university, and university education is free for all students who complete secondary school. Argentina has a similar system but a much higher fraction of students completes secondary education and attends university than in Uruguay. Chile's higher education system is mainly publicly administered, but all students pay high tuition fees. Seventy percent of the cost of university education in Chile is borne by students and their families through these fees. There is also a secondary school exit test. The score on that test determines whether a student is eligible for university. Although financial loans for attending university are available to students, they are limited to those who score the highest on the entrance test.

The rates of return in the three countries in two years—1987 and 1996—are shown in Table 3. We estimated two rates for secondary education, one assuming that students in secondary education could work during the summers, so only gave up income for three-fourths of the year; and the second assuming that students assuming that secondary students could earn no income during the year. The only case where this made a large difference was in Uruguay. All the private rates of return assume that individuals pay taxes on the additional income they earn from the investment in higher levels of education. The social rates of return include the public spending per pupil at each level (in addition to tuition fees paid in Chile).

Table 3. *Rates of Return to the Investment in Secondary and University Education, 1987 and 1996, Men and Women (percent return per year of education)*

Country	Year		Private Rate of Return			Social Rate of Return		
			High School	High School (no earnings foregone during school)	Higher Educ.	High School	High School (no earnings foregone during school	Higher Educ.
Argentina	1987	Varones	14	12	15	12	11	14
		Mujeres	15	13	9	12	11	7
	1996	Varones	14	12	19	12	10	15
		Mujeres	17	14	12	13	11	9
Chile	1987	Varones	22	18	24	17	15	18

		Mujeres	16	13	17	13	11	12
	1996	Varones	17	14	25	14	12	21
		Mujeres	15	12	16	11	10	13
Uruguay	1987	Varones	21	5	18	21	5	16
		Mujeres	17	4	19	17	4	15
	1996	Varones	39	15	10	32	14	8
		Mujeres	33	11	14	27	10	11

Source: Gayle Christianson (2001), "Rates of Return to Education in Argentina, Chile and Uruguay: An Education Policy Analysis," Stanford University School of Education (mimeo). High School in Argentina is 5 years (grades 8 a 12); High School in Chile is 4 years (9-12), and High School in Uruguay for this calculation is the second cycle and is 3 years (10-12).

What do these rates suggest about the relative demand for graduates in these three countries? We know that Uruguay and Chile had relatively few university graduates in the mid-1990s, and Argentina had relatively many graduates. We also know that Argentina and Chile had many secondary graduates in the mid-1990s, but Uruguay had relatively few. Knowing this information about the supply of graduates, what does this tell us about demand, and about changing demand in the late 1980s and early 1990s?

The level of rates of return can tell us a great deal about the effects of changes in the supply and demand for graduates. In this case, the tell us that with the expansion of secondary education in Argentina and Chile in the 1990s, private and social rates of return stayed low in Argentina and fell in Chile in 1987-1996. However, in Uruguay, where enrollment fell in the beginning of the 1990s, the rate of return for *preparatoria* (upper secondary school) graduates rose sharply. To the contrary, the rates of return to investment in complete university rose between 1987 and 1996 in Argentina and Chile, especially for men, while they fell considerably in Uruguay, again, especially for men. In 1996 , the social rates of return were much higher in Argentina for men graduating from university than for secondary school graduates, but were lower for women investing in university than for women investing in secondary school. The Chile, 1996 rates were generally much higher for male investment in university than secondary school (but only slightly higher for women's investment in university, and much lower in Uruguay for investments in university than in secondary school.

The important point to remember in interpreting rates of return is that they not only depend on changes in income differences between those workers with one level of schooling and the level below it. The rates also depend on changes in the absolute level of earnings for workers with the lower levels of schooling, since this represents an important cost of schooling for students investing in additional education. For example, the difference in earnings between college and secondary graduates may stay the same as real earnings decline in a recession. So the benefit stream may change little. But declining earnings of secondary graduates means that attending university becomes cheaper for students, since they are giving up less income while taking classes at the university. Thus, the rate of return to investing in university can rise even if the benefit stream is unchanged. We would expect demand for university places to rise in that situation, and,

indeed, in economic recessions, we observe more students entering universities. The opposite can take place in an economic expansion: the benefit stream (income differences between university and secondary school graduates) may stay constant, but the absolute incomes of secondary graduates may rise, increasing the cost of attending university, hence reducing the rate of return to investing in university. We should observe a decline in demand for university places.

One of the major reasons why there is a demand for virtual university education is precisely because students taking courses in virtual universities do not forego much income. Even if the benefits are lower to graduates of virtual universities than to graduates of traditional universities, the rate of return to those taking virtual courses may be higher because of lower costs.

Activities for Section 5

Try to estimate the rate of return to your investment in a university degree. Include all costs and show how you would estimate your estimated earnings after you complete your degree.

How would you compare the rate of return to investing in an Internet (virtual) higher education with a traditional university education? What data would you need? How would you collect those data?

What would happen if tuition costs went up in a virtual university? How would you estimate whether it is still worthwhile to invest in a virtual university education compared to attending a traditional, largely free of tuition public state university?

6. Alternative Theories of Labor Markets and the Contribution of Education to Earnings

The main element of human capital theory is that investment in schooling and training *results in* higher productivity, hence higher wages. Thus, the cognitive and non-cognitive skills individuals acquire in family, schools, and training programs *result in* greater capacity to produce goods and services and therefore higher individual earnings in the labor market. This explanation of earnings distribution in the labor market argues that investment in human capital is a main determinant of who earns how much.

Other theories of labor markets question this relationship and provide alternative explanations of why some individuals earn more and some less. There are two main categories of such explanations:

- Explanations claiming that human ability is developed early and that schooling and training programs do little more than “legitimize” these abilities and provide a convenient way to “screen” the able from the non-able. These explanations argue

that productivity differences are largely attributable to ability differences, not to what is learned in schools and training programs.

- Explanations claiming that productivity differences are largely attributable to jobs, and the characteristics of those jobs determine productivity and earnings. However, access to jobs is in part a function of schooling, cognitive ability and non-cognitive ability, as well as innate characteristics, such as gender, race, and ethnicity.

6.1 Screening theories.

The first categories of challenges to human capital theories consist of those explanations of earnings differences based on the concept that early ability (cognitive and non-cognitive) is fundamental to economic productivity. A number of "screening" theories argue that schooling does little more than provide a socially and politically acceptable selection mechanism for children from families with higher educated, wealthier, and more motivated parents, who have the means and the capacity to invest human, cultural, and social capital in their children before they ever enter school, and also during their school years. French sociologists Pierre Bourdieu and Claude Passeron called this early and ongoing investment "cultural capital." They argued that the school curriculum and student evaluation system is organized to validate the knowledge easily available to children from better education, higher social class families, but not available to children from less educated, lower income families. This is particularly true of language usage, reading skills, and cultural interpretation of teacher-student interaction and school symbolic systems.

Economist Michael Spence formalized schooling as a "screening" institution in an economic theory he called "signaling theory." Spence argued that school diplomas serve as a "signal" to employers. For example, a regular high school diploma "signals" that a prospective employee was able to complete high school with his or her cohort. This suggests that the completer has the discipline and ability to complete a secondary school degree. A university degree sends another set of signals denoting greater ability, discipline, and other traits that are desirable in labor markets and predictive of higher productivity. Therefore, employers are willing to pay more to those with a university degree. In turn, Spence argues that acquiring these signals is "cheaper" for those students of higher ability, so students with higher ability are likely to acquire the signals associated with higher ability and higher productivity. For example, a higher ability students finds it easier to do well in school, hence will be more likely to go farther in school. Signaling theory predicts that schooling is an "efficient" mechanism for assuring that individuals with greater ability acquire signals valued in the labor market.

More recent arguments by James Heckman, Noble laureate in economics from the University of Chicago, seem to make a similar argument. He contends that the educational payoff to low ability students is low and to high ability students is higher. He also contends that the highest payoffs are to early childhood education, both in families and in early childhood education centers. Early childhood (before formal schooling) is a

period in which early abilities are formed. Implicitly, Heckman's ideas are consistent with theories that schooling provides a set of experiences that "confirm" student abilities formed mainly in the period before they enter school.

Thus, screening theories question the principal premise behind human capital theory—namely, that the cognitive skills acquired in school increase the economic productivity of individuals. At the extreme, screening theories argue that the contribution of skills acquired in school to productivity is negligible, and that the large expenditures on schooling serve only to legitimate a class-based distribution of income. The state spends taxpayers money to mystify a system in which the dice are fixed in favor of families with high levels of education and income—in Bourdieu and Passeron's words, schooling *reproduces* the class structure in a form apparently necessary to capitalist democratic society.

6.2 Internal labor markets, queuing theories and segmented labor markets.

The second set of theories that questions the premise behind human capital theory focus on the structure of production and the resulting labor market. The first of these theories, developed by MIT economists Peter Doeringer and Michael Piore, argued that job structures in large firms require constant selection of workers into jobs with greater responsibility because they necessitate working with more expensive and complex machines (more capital). These jobs are characterized by higher productivity because workers work with more capital, which is the source of higher productivity in capitalist production. These *internal labor markets* define which workers are more or less productive by the kinds of jobs they do. At the same time, Doeringer and Piore argue that access to these more productive jobs is allocated on the basis of educational attainment and non-cognitive skills, and that both education attainment and non-cognitive skills are class-based. In effect, then, more productive jobs in internal labor markets are allocated on the basis of social class.

A variant of internal labor market theory is queuing theory, developed by another MIT economist, Lester Thurow. Thurow also posits that productivity is a function of jobs, not worker traits. He focuses on how these jobs are allocated. He proposes that workers are characterized by two types of traits—inherent traits, such as gender, race, ethnicity, physical characteristics, and acquired traits, such as schooling, non-cognitive skills, and training. The place that individuals have in the queue for high productivity (therefore, high paying) jobs is determined by how the labor market values various traits, both inherent and acquired. Individuals can only change their acquired traits. Thus, women and individuals of certain ethnicities may be valued less, so they are farther back in the queue. Even with more education, they may not have access to the most productive, highest-paying jobs. Their earning will tend to be lower not because they are less productive individuals, but because they cannot get the higher productivity jobs.

A third variant of these job-based theories is the theory of segmented labor markets, which defines two tiers of the labor market—the primary market and the secondary market. The primary market is characterized by an internal labor market, with upward

mobility and the opportunity to attain highly productive, high-paying jobs with considerable responsibility and autonomy of decision-making. The secondary labor market is characterized by horizontal but not vertical mobility, a high level of job turnover, little or no autonomy in decision making, and jobs in which workers essentially follow very specific orders, such as laborers on construction jobs, service workers in retail, low-level security personnel, and clerks and typists. Once relegated to secondary labor market, this theory argues, workers have great difficulty in switching over to primary markets—hence, the notion of segmentation in the markets. Marxian versions of segmented labor market theory suggest that labor market segmentation has its origins in capitalism's need to create competition among groups of workers and the notion of dividing workers into a skilled labor aristocracy that is always under threat from an underclass of workers ready to take their place.

In sum, human capital theory is not the only explanation of how labor markets work or how income is distributed among members of the labor force. Ultimately, human capital theory is rooted in a particular theory of political economy. Competing theories of labor markets are rooted in other conceptualizations of the way the economy works and in other versions of the social relations of production. Human capital theory assumes that political-economic power in the labor market is equal among individuals, whether owners of capital, managers, or workers. The only measure of economic power in human capital theory is productive capacity, measured by embodied cognitive and non-cognitive skills available to all in public institutions such as schools and valued by the labor market. Other theories of labor markets disagree with this notion of economic power relations, putting much more emphasis on individual traits that are acquired mainly in families and particular socio-economic settings rather than public institutions, hence not available equally to all. Yet another group of theories put more emphasis on the power of owners and managers of capital to control the allocation of access to highly productive and high paying jobs. Schooling in both sets of alternative theories plays much less of a role in determining productivity and income. In these theories, formal education primarily plays a political role of making unequal access to higher incomes and economic power consistent with the rhetoric of meritocracy and democracy.

Activities for Section 6

How do you think the labor market is changing in the United States? Do you think that the rate of return to higher education is rising or falling? What is the evidence for your views?

Do you think that the rate of return to education for immigrants is higher or lower than to native born Americans? What are the reasons you think so?