Chapter 9 Investments in Human Capital: Education and Training

Chapter 9 introduces students to the concept of human capital and treats in detail education and training investments. The chapter begins with a section on the demand for education by workers, in which a theory of human capital investment is formulated and a formal model of choice is presented. Implications of this model for both individual and aggregate (market) behavior are then derived.

The second section of the chapter analyzes the relationship between education and earnings. We introduce age/earnings profiles and discuss the reasons for their convexity. Included in this section is an analysis of the differential convexity among such profiles for men and women.

Next, we consider the question of whether education is a good investment. We analyze this question from both an individual and a social perspective. The major findings of the literature with respect to the individual rates of return to education are summarized, and we discuss possible biases (including selection biases) inherent in these findings. When discussing education as a social investment, we introduce both the traditional answers of the "human capitalists" and the more agnostic views of those who see education as purely a signaling device. In this context of evaluating education and training as investments, we devote a section to evaluations of government job training programs.

Appendix 9A presents and explains a "cobweb" model of labor market adjustment, in which the need for educational investments slows down the supply response to changes in market demand.

List of Major Concepts

- 1. Investments in human beings are part of the general category of investments.
- 2. Investments entail costs in the current term with returns flowing in over later periods.
- 3. Costs of human capital investments include out-of-pocket expenses, forgone earnings, and psychic losses.
- 4. Because investment returns flow in over several years, an analytical tool to convert future sums to present value is required (the concept of present value and discounting future sums is explained in some detail).
- 5. Human capital investments are more likely to be made by people who are not present oriented, by people who are young, in situations in which the costs of human capital investments are lower, and in situations in which the returns to these investments are larger.
- 6. Variations in the returns to human capital investments call forth supply responses by individuals, affecting college enrollments in predictable ways.

- 7. Because education is costly, jobs that require more education or training must pay a higher wage to attract workers (that is, to compensate them for the cost of investment).
- 8. Age/earnings profiles are flatter for less educated workers, reflecting smaller human capital investment costs in their early years and lower growth of productivity.
- 9. Post-schooling investments in on-the-job training can help account for both the convexity and the fanning out of age/earnings profiles.
- 10. Post-schooling investments reduce actual earnings below potential earnings, and as such investments decline over age, one's actual earnings approach potential.
- 11. Some differences between men and women in the acquisition of education and training (including university majors) can be explained by lower rates of return to some human capital investments among "traditional" women, who expect interrupted labor market careers.
- 12. Evaluations of whether education is a good *individual* investment typically present rate of return estimates that involve three sets of biases: *upward biases* associated with the correlation between education and ability, *downward biases* associated with the failure of monetary earnings to reflect all the benefits of a college education, and *selectivity biases* arising from the fact that people who choose one career may be more productive in that career than a comparably trained person who does not choose that career.
- 13. Evaluations of whether education is a good *social* investment must consider the hypothesis that education acts as a screening device, rather than an activity that enhances productivity.
- 14. If the full cost of education is inversely related to ability, and if ability is positively related to on-thejob productivity, then firms can use educational attainment as a screening device (workers will sort themselves out according to ability in choosing their level of educational attainment).
- 15. Public sector job training programs have created demonstrable earnings gains only for adult women, and the present value of these gains typically exceeds program costs.
- 16. (Appendix 9A) Delays in supply responses associated with the long gestation periods of some human capital investments can create periods of oversupply followed by periods of shortage (the "cobweb model" as it applies to the labor market).
- 17. (Appendix 9B) The hedonic model implies that those who obtain the most education are least averse to learning and probably most able to learn quickly.

Answers to Even-Numbered Review Questions

- 2. "The vigorous pursuit by a society of tax policies that tend to equalize wages across skill groups will frustrate the goal of optimum resource allocation." Comment.
 - Answer: As indicated in Chapter 1 and elsewhere, the optimum allocation of resources requires that all mutually beneficial transactions be accomplished. If wages are forced toward equality by government fiat, potentially beneficial human capital transactions may be discouraged. That is, because the acquisition of training and education is costly, human capital investments will not be undertaken unless there is a future return to them. These returns normally are in the form of higher wages paid to those with the higher skill levels, and if these higher wages cannot be paid, human capital investments that might have been made will be discouraged. Thus, the pursuit of wage equalization across skill levels will discourage human capital investment and may result in too few workers entering skilled occupations.

- 4. When Plant X closed, Employer Y (which offers no training to its workers) hired many of X's employees after they had completed a lengthy, full-time retraining program offered by a local agency. The city's Equal Opportunity Commission noticed that the workers Employer Y hired from X were all young, and it launched an age-discrimination investigation. During this investigation Employer Y claimed that it hired *all* of the applicants from X who had successfully completed the retraining program, without regard to age. From what you know of human capital theory, does Y's claim sound credible? Explain.
 - Answer: Y's claim is consistent with human capital theory in two respects. First, its own hiring and training costs appear to be negligible (we are told that it offers no training on its own, and that its hiring standards consist of taking successful graduates of another program). Because it makes no major investments in its workers, it therefore has no reason to prefer younger workers. Second, because the retraining program to which X's former employees had access was "lengthy," it may well be that only the younger workers from X decided to invest in this retraining. All workers have to decide whether a human capital investment opportunity will have expected benefits (properly discounted to the present) that are at least equal to the costs, and a shorter period over which benefits are received reduces these benefits. Thus, older workers are less likely to have decided to apply to Employer Y.
- 6. A study shows that, for American high school dropouts, obtaining a General Equivalency Degree (GED) by part-time study after high school has very little payoff. It also shows, however, that for immigrants who did not complete high school in their native countries, obtaining a GED has a relatively large payoff. Can signaling theory be used to explain these results?
 - **Answer:** Graduating from high school is more or less the expectation for American students, and those who drop out may be viewed as having a low aptitude (or low tolerance) for learning, even if they later obtain a GED. Immigrants may come from countries in which high schools are either more demanding or less available, so dropping out may not send the same signal of low aptitude or tolerance. If, though a GED, these immigrants are certified as knowing the equivalent of American high school graduates, employers may prefer them to American GED recipients, other things equal.
- 8. Many crimes against property (burglary, for example) can be thought of as acts that have immediate gains but run the risk of long-run costs. If imprisoned, the criminal loses income from both criminal and non-criminal activities. Using the framework for occupational choice in the long run, analyze what kinds of people are most likely to engage in criminal activities. What can society do to reduce crime?
 - Answer: Committing a crime like burglary is essentially the mirror image of a human capital investment, because with an investment costs are borne in the present and the returns come later. Characteristics that tend to reduce the expected costs of committing a crime are a high discount rate (a "present orientation") and relatively poor earnings prospects in the labor market (less to lose by being jailed).

To reduce crime, society needs to reduce the immediate benefits or increase the expected future costs of committing a crime. Reducing the benefits could be accomplished by installing protective devices that make burglaries less likely to succeed. Increasing the costs can be done by increasing the likelihood of catching thieves, increasing the length of incarceration, or raising the labor-market earnings potential of those currently with the least to lose.

- 10. The following statement was overheard at a party: "It is just not right that Joe, who never went to college, makes more than Ken, who has a master's degree. People with higher degrees deserve to earn more!" Use human capital theory to comment on this quotation.
 - Answer: Earnings are influenced by many factors other than education, including experience, compensating wage differentials for job characteristics or employee benefit levels, and luck. Those who make educational investments expect a return, in terms of either money or utility, and they will not invest if the expected returns are too low. However, actual returns are subject to both demand and supply forces, which cannot be perfectly anticipated. Expectations, then, are not always realized. Thus, Ken may make less than Joe for a variety of reasons. In any event, human capital theory addresses the issue of what is required for an investment to be made, not what people "deserve" in some moral sense.

Answers to Even-Numbered Problems

- 2. (Appendix) Suppose the supply curve for optometrists is given by $L_s = -6 + 0.6W$, while the demand curve is given by $L_d = 50 W$, where W = annual earnings in thousands of dollars per year and L = thousands of optometrists.
 - a. Find the equilibrium wage and employment levels.
 - b. Now suppose that the demand for optometrists increases and the new demand curve is $L'_d = 66 W$. Assume that this market is subject to cobwebs because it takes about 3 years to produce people who specialize in optometry. While this adjustment is taking place, the short-run supply of optometrists is fixed. Calculate the wage and employment levels in each of the first three rounds and find the new long-run equilibrium. Draw a graph to show these events.
 - Answer: a. Initial equilibrium W = \$35, L = 15. (Find this by setting $L_s = -6 + 0.6W = L_d = 50 W$ and solving for W.)
 - b. First round: *L* is still 15, so W = \$51. This is Point A in the figure below. (Find *W* by plugging L = 15 into the new L_d equation.)



Second round: Labor supply reacts to first round wage, L = 24.6, but this pushes W down to \$41.4 (at Point C). Find this by plugging W = \$51 into the L_s equation to find L = 24.6, and then plugging L = 24.6 into the new L_d equation.

Third round: Labor supply reacts to second round W, L = 18.84, but this pushes W up to \$47.16 (see Point E). Find this by plugging W = \$41.4 into the L_s equation to find L = 18.84 and then plugging L = 18.84 into the new L_d equation.

Long-run equilibrium, W = \$45, L = 21. (Find this by setting $L_s = -6 + 0.6W = L_d = 66 - W$ and solving for W.)

- 4. Prepaid college tuition plans, also known as Prepaid Education Arrangements (PEAs), allow you to prepay college tuition at present-day prices. The value of the investment is guaranteed by the state to cover college tuition, regardless of its future cost. You are considering the purchase of an education certificate for \$25,000, which will cover the future tuition costs of your 8-year old daughter. You expect the tuition cost of your daughter's bachelor's degree to be \$50,000 in 10 years. What would your personal discount rate need to be in order for it to be worthwhile for you to make the investment and purchase the certificate?
 - Answer: For a PEA to be worthwhile, its present value to you now must be at least \$25,000. In 10 years, the PEA will be worth \$50,000, and its present value to you now is $50,000/(1 + r)^{10}$ where r is your personal discount rate. Thus,

$$50,000/(1+r)^{10} = 25,000, \text{ or}$$

 $50,000/(25,000) = (1+r)^{10}$
 $2 = (1+r)^{10}$
 $(1+r) = (2)^{1/10}$
 $(1+r) = 1.0718$
 $r = 0.0718$

Your personal discount rate needs to be 7.18% or less for the PEA to be worth investing in.

Suggested Essay Questions

- 1. A recent report by the "Lisbon Council" concluded that eastern European (formerly Communist) countries were experiencing a significant "brain drain," with university-educated workers migrating from the east to western European countries. The report also noted that these eastern countries were investing less in human capital than countries in the west, and it concluded that the eastern countries should substantially increase their investments in university education. Using economic theory, comment on the consistency between these two conclusions, explaining your reasoning in detail.
 - Answer: If workers in eastern Europe are leaving for western Europe, it is likely that the returns to educational investments captured by workers (the "private" returns) are lower in the east. As noted in Chapter 9, societies will want to invest their scarce capital resources in projects that yield the highest returns, and if educational investments are yielding relatively low returns, higher levels of investment are not indicated. Thus, unless the "private" returns to education are much less than the overall ("social") returns, the Lisbon Council's recommendation is not justifiable.

2. Some politicians in countries that are the recipients of large numbers of immigrants advocate adopting laws requiring immigrants to learn the local language within a specified period of time. One economist, commenting on such a proposed law, said the following: "These laws are unnecessary, as the market provides incentives to learn the local language."

Use economic theory to describe the likely mechanism provided by the labor market to learn the local language. Analyze the characteristics of immigrants who are most likely to learn the new language.

Answer: Learning a new language requires an investment. Costs (of tuition, books, effort, and time) are spent in the present and the benefits are realized later. These benefits are most likely to be in the form of higher wages (as more occupations become open to the immigrant), although there are other gains from being able to communicate for social or consumption purposes. The immigrants likely to realize the largest benefits are those who want to be in jobs requiring more than just simple communication with natives.

Using human capital theory, we can theorize that immigrants more likely to invest in learning the language are those for whom the yearly benefits are larger (those living and working outside of immigrant enclaves), those who intend to remain in their new country, those who are younger, those who learn more quickly, and those who have a lower personal discount rate.

SOLUTION TO EXTRA CREDIT

Peter lives for three periods and has three alternative education-work options. He can start working immediately, earning \$100,000 in period 1, \$110,000 in period 2, and \$90,000 in period three. Alternatively, he can spend \$50,000 to attend college in period 1 and then earn \$180,000 in periods 2 and 3. Finally, he can receive a doctorate degree in period 2 after completing his college education in period 1. He will not have to pay and tuition and book costs, because he will have a fellowship. After receiving his doctorate, he will earn \$400,000 in period 3 as a professor in the business school. Peter's discount rate is 20 percent each period. What education path maximizes the net present value of his lifetime earnings? Does Peter's education path change if his discount rate is 5 percent? Show all work.

n=0.20

ALT. 1 NAV =
$$*100,000 + \frac{810,000}{1.20} + \frac{90,000}{(1.20)^2} = \frac{8254,167}{1.20}$$

ALT. 3 NPV = - (
$$\frac{450,000}{50,000} + \frac{100,000}{1.20} + \frac{4400,000}{(1.20)^2} = \frac{4-22,282}{-22,282}$$

$$\frac{\Lambda = 0.05}{A \perp 7.1} = \frac{\#}{100,000} + \frac{\#}{100,000} + \frac{\#}{100,000} + \frac{\#}{100,000} = \frac{\#}{100,000} = \frac{\#}{100,000}$$

$$\frac{A \perp 7.2}{A \perp 7.3} = \frac{(\#50,000 + \#100,000)}{NPV} + \frac{\#}{100,000} + \frac{\#}{180,000} + \frac{\#}{180,000} = \frac{\#}{185,065}$$

$$\frac{1005}{1005} = \frac{(\#00,000)}{1005} - \frac{\#}{180,000} + \frac{\#}{400,000} = \frac{\#}{40,107}$$

AT P=0.05 Alternative 1 1 stil Dest citorice