SIX

Human Capital

Investing in Oneself and One's Family

Fully 25 percent of the U.S. population, 72.7 million people, were enrolled in school in 1999. Of those in school, 6.3 percent were in nursery school, 52.7 percent were enrolled in kindergarten or elementary schools, 20.5 percent were enrolled in high schools, and 20.5 percent were enrolled in institutions of higher education (U.S. Bureau of the Census 2000b, Table 239, p. 151, and Table 259, p. 162). These numbers exclude the millions of people who took private lessons in everything from sewing to music, from religion to skiing and hang gliding. The United States devoted 6.7 percent of its gross national product, $601 billion, to schools and schooling in 1999. Of this sum, $372 billion was spent on elementary and secondary schools, and $239 billion was spent on colleges and universities (U.S. Bureau of the Census 2000b, Table 240, p. 151). These figures ignore the billions of dollars of potential income students chose not to earn by virtue of their being in schools and colleges.

Turning to the nation's investment in and maintenance of their health stock, Americans spent $1113.7 billion on health services and medical facility construction in 1998 and $19.3 billion on medical research in 1998, an amount totaling 13.5 percent of GDP (U.S. Bureau of the Census 2000b, Table 151, p. 108). This excludes all of the expenditures on recreation equipment and lessons that build and maintain healthy bodies. Also excluded is the value of the time Americans spent in maintaining their health. The facts show that Americans spend great amounts of time and money investing in themselves.

What goes on under one's nose is frequently noticed and dealt with long after things more remote. So it is with human capital. Although people (and even economists) have been investing in themselves and

their children for as long as there have been people (or economists), economists have paid serious attention to the fact only in the past forty years. Although economists have striven to understand households' saving behavior, they neglected until lately the process by which people invest in themselves, one of the most important ways of saving.

We do not yet have a full grasp of the magnitude of the nation's capital stock held in human form. Nor are the implications of saving by investing in oneself or one's family fully understood. It is clear, however, that the concept of human capital has been and is central to the understanding of the economic organization of the household. Consequently, this chapter is devoted to an introduction of the concept and to some of the ways that it has shed light on family behavior.

Most introductory treatments of human capital focus on the demand for education and the roles that schooling and experience play in influencing the labor market behavior of individuals. Because of the focus of this text on the household and the recognition that its behavior in the labor market is only one of its many activities, some of the nonlabor market implications of human capital will also be addressed.

HUMAN CAPITAL AS SAVING

In Chapter 4 we dealt with a two-period model (today and tomorrow) in which the household balances the demands for consumption today against the demands for future consumption. Depending on the household's time preference (i.e., the marginal rate of substitution of today's consumption for tomorrow's), the market rate of interest, and expected changes in prices (i.e., the expected rate of inflation or deflation), the household puts aside a fraction of its current income for use in the future. The equilibrium condition expressing this decision is that the household equates the rate at which it is willing to exchange present for future consumption with the rate at which it can do so in the marketplace. This is expressed concisely by the equilibrium condition

$$u_1/u_2 = (1+r)/(1+g) \tag{6.1}$$

where u_t $(t = 1, 2)$ denotes the marginal utility of consumption in period t, and therefore u_1/u_2 represents the household's marginal rate of substitution of present consumption for future consumption; r is the rate of interest, g is the expected rate of inflation (deflation), and therefore $(1+r)/(1+g)$ is the market rate of exchange of present consumption for future consumption. You will recall that u_1/u_2 is the slope of the highest

indifference curve attainable by the family with the resources it has available, and $-(1+r)/(1+g)$ is the slope of the household's intertemporal budget line (see Figure 4.4).

The process just summarized determines the total amount that the household plans to save but it leaves unanswered the question of what forms the saving will take. Will the household augment its savings account, buy added stocks and bonds, buy a house or improve one it owns, pay off some of its debts, or invest in family members?

Investing in family members – that is, investing in human capital – can take many different forms. The most recognized way to invest in human capital is through formal schooling. Additional education usually means additional study for a degree or for a high school diploma, but there are, in fact, a bewildering array of ways to augment one's formal schooling and an equally bewildering array of purposes for which formal schooling is relevant. These range from added schooling to complete requirements for a degree to a two-week class in word processing, knitting, painting, or ways of saying no.

One can also invest in human capital through *on-the-job training and experience* either in one's market job or in a household activity. Here, one takes time out from one's job or from a household activity (or does it more slowly, deliberately, and reflectively) in order to learn how to do it better. In so doing, one may have to accept a somewhat lower current income or accept lower current output from the household activity in order to increase one's productivity in the long run. In the case of market work, the difference between the income earned while receiving on-the-job training and what would have been received if one had not engaged in the training is the amount saved or invested in human capital via experience. In the case of a household activity, the forgone output from the household activity constitutes the investment in human capital in the form of experience. None of these expenditures are reflected in the expenditures on education noted above.

Another way of investing in human capital is by spending time and money in maintaining and augmenting one's health. Just as one invests in a car or a house by repairing it and making improvements on it, one invests in health by maintaining and augmenting one's physical and mental health. Thus, aerobics classes, jogging, physician visits, annual dental checkups, and good nutrition are all means to invest in our health. The results are fewer days of sickness per year, longer life expectancy, and higher productivity on the job and in household activities.

Formal education, experience, and health are only the three most obvious types of human capital investments. Another is migration from one city, state, or country to another in search of a better job or a different life style. In such instances, one forsakes the opportunities in one location to exploit those in another. The millions of people – our parents, grandparents, and great-grandparents – who left home and families in other countries to carve out new lives in North America all were making large investments in human capital by migrating. So too were the millions of people who have migrated from farms to cities in search of better lives and livelihoods during the twentieth century.

But there are yet more subtle ways of investing in human capital. Having children and raising them in particular ways may, in part, be ways by which a couple can provide for economic security in old age. This motive is very minor or absent in developed countries, which have other ways of providing economic security for elderly people, but it cannot be dismissed if one is to understand fertility behavior in less developed countries. Fertility behavior – the demand for children – is discussed more fully in Chapter 7. Marriage has been described by a wag as one of the few gambles fainthearted people take. It is also one of the few ways by which very poor people can invest: one gives up the advantages of remaining single for the future benefits of being married. Marriage and divorce are analyzed in this fashion in Chapter 8.

Having surveyed the types of investments in human capital, we can return to the question of the form in which the household will save: will it save in the form of physical capital (a new car, a house), financial capital (bank accounts, stocks and bonds, or lowering of debts), or human capital? As usual, this decision is most easily understood through simplification. We simplify by assuming that the household can save only in the form of financial or human capital and the motive for saving is to maximize total wealth.[1] We will begin our discussion of human capital by examining it in the context of the labor market, and we will first consider only one type of human capital: formal schooling.

HUMAN CAPITAL AND THE LABOR MARKET

A major reason individuals invest in human capital through formal schooling is to augment their income in the future and so to increase their total

[1] Total wealth really represents the total amount of resources available to the household. Total wealth in this chapter is the analogue to the full income concept used in Chapter 5.

wealth. Recognize, initially, that additional schooling increases an individual's productivity in the labor market, and employers, recognizing this, pay higher wage rates to individuals with more formal schooling. Consider an individual concerned only with the monetary payoff to formal schooling. Such an individual will invest in added schooling only if the payoff to added schooling is higher than or, at the margin, is equal to the payoff in alternative investments. In the simple case being analyzed, the only alternative to formal schooling is financial investments (stocks, bonds, savings accounts, etc.) at the going market rate of interest, r. The individual will, then, compare the "rate of return" from added schooling with the market rate of interest, r, and invest in the opportunity with the higher rate of return. If formal schooling initially has the higher rate of return, the individual will maximize his or her wealth by continuing to invest in schooling until the rate of return on schooling has been driven down to the market rate of interest.

The Rate of Return on Education

What is the rate of return on schooling? Formally, it is the interest rate that equates the cost of the investment with the present value of the stream of future benefits from the investment. We can define the rate of return to the investment (the so-called internal rate of return) more precisely through an example.

Suppose that Bob is contemplating a final year of high school at age eighteen and expects to retire at sixty-five. Let Bob's annual earnings in year t without the added year of school be E_t, and his annual earnings in year t with the added year of schooling be E'_t, where $E'_t > E_t$.

The cost of the added year of school for Bob has two components: the earnings Bob forgoes while he is in school for the final year rather than working at a paid job, E_0, and the out-of-pocket costs of the final year of school (such as tuition, fees, and books), C. Denote the cost of the added year of school by MC, standing for marginal cost. Then,

$$MC = E_0 + C \tag{6.2}$$

where $t = 0$ is Bob's eighteenth year.

The benefit to Bob from the added year of school is the difference between (1) the future stream of annual earnings Bob expects given he has the added year of schooling and (2) the future stream of annual earnings Bob expects if he does not have the added year of schooling. The stream of differences is

Year	1		t		n
Bob's age	19		$18+t$		65
Difference	$(E_1' - E_1)$,	...,	$(E_t' - E_t)$,	...,	$(E_n' - E_n)$

where n = the expected number of years until retirement.

Now find the interest rate, i, that equates the present value of the expected stream of benefits from the added year of schooling with the cost of the added year of school:

$$\sum_{t=1}^{n}(E_t' - E_t)/(1+i)^t = MC = E_o + C. \tag{6.3}$$

Then i is the rate of return on the investment in the added year of school. If i is greater than the market rate of interest on financial investments, r, Bob will increase his net wealth by getting the added year of formal schooling. If $i = r$, Bob will be indifferent between investing in financial capital or human capital.

Here, then, is the answer to the question concerning which form saving will take: it will take the form of the investment with the higher rate of return. In equilibrium, when the household is maximizing its total wealth, the rates of return on competing types of investment – financial, physical, and human – will all be equal.[2]

One can calculate the rate of return for each possible year of schooling Bob may take beginning with kindergarten. There are three prominent reasons why the rate of return to schooling, i, will decline with each added year of school. One raises the marginal costs, and the other two lower the marginal benefits of added schooling (see mathematical note 1).

First, each additional year of schooling increases the opportunity cost of any succeeding years of schooling, E_0, in the marginal cost formula, because the wage rates employers are prepared to pay employees rise with education. Suppose, for instance, that people with grade 11 are paid \$7.00/hour and high school graduates earn \$8.00/hour. On the basis of a 2000-hour work year, these translate into annual earnings of \$14,000 and \$16,000, respectively. Consequently, the individual who completes grade 12 forgoes \$14,000 whereas the individual who completes the first year of college forgoes \$16,000 for the added year of school. Clearly, then, the

[2] The rate of return is the only investment criterion for a wealth-maximizing household with perfect foresight, the case under discussion. There are other criteria, like the certainty of the rate of return if, in the more realistic case, the future is not foreseen perfectly. These added criteria are a major focus in standard finance theory texts.

marginal cost of schooling rises with additional schooling as E_0 rises, and this will depress the rate of return, i.[3]

Second, each additional year of schooling reduces the remaining years during which an individual works, shortening the expected stream of benefits of added schooling and reducing the marginal benefit. This can easily be seen in equation (6.3). With added years of schooling, the sum,

$$\sum_{t-1}^{n}(E_t' - E_t)/(1+i)^t$$

becomes smaller because the remaining working life becomes shorter. The smaller the marginal benefit, of course, the lower the interest rate must be that equates the present value of the benefits with the marginal cost.

Third, the principle of diminishing marginal productivity also operates to reduce the marginal benefits. Recall that the principle of diminishing marginal productivity states that, holding other inputs in a production process constant, the marginal product of a particular input will fall as more of the input is used. The particular application of this principle here is that additional years of education are applied to an individual who is in a real sense fixed. Consequently, an individual's productivity per hour in the labor market will rise with additional education but at a declining rate. If, as in the previous example, the twelfth year of schooling raises Bob's annual labor productivity from \$14,000 to \$16,000 (an increase of \$2000), the thirteenth year may increase it by only \$1500, to \$17,500. Thus, the more schooling an individual already has, the lower the marginal benefit of an additional year. Therefore, this, too, means that as the number of years of schooling rises, the rate of return to additional education falls.

The Demand Curve for Formal Education

The fact that the rate of return to schooling falls as the number of years of schooling rises allows one to plot an individual's demand for formal schooling as in Figure 6.1. The number of years of schooling demanded by the individual is plotted along the horizontal axis, and the rate of return to

[3] That is, as MC in equation (6.3) becomes larger, holding the stream of benefits, $E_t' - E_t$, constant, the rate of return, i, must fall in order to maintain the equality between marginal benefits and marginal costs.

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