2 Human Capital

Introduction

Economic agents are utility maximisers. Every time we make a choice we select the alternative which yields the greatest utility, subject to the resources available. Sometimes the utility which we derive is enjoyed in the short run (like a take-away meal); sometimes it is enjoyed over a longer period (like household durable goods). In all cases, though, the decision is made on the basis of the discounted stream of expected utility over the period from the present up to the time horizon.

Education exists because it provides utility. If it did not, there would be no demand for it. Likewise, the student of education economics studies this subject because to do so gives her utility. Ideally, some of that utility is enjoyed in the short run: it is a pleasure to learn about the world. This may be described as the consumption element of education. Many courses, however, are worth more to the student than instant gratification; they equip her with knowledge and skills which will enhance her productivity at work for years to come. Since productivity in large part determines remuneration, education now can increase earnings later. In this sense, education may be regarded as an investment by the student in herself. This is the investment element of education.

Since both the consumption element and the investment element of education provide utility (now or later), they both contribute to the discounted stream of utility enjoyed by the economic agent. In this respect, education is little different from any other durable good.

In a number of other respects, however, education is unusual. First, the return to the investment element of education can easily be measured. Abstracting from the consumption element, we would expect that, other things being equal, the discounted present value of the lifetime earnings of a highly educated person would exceed those of a less educated person. This earnings differential provides a measure of the return to the gap between their education attainments. Second, the costs of education are borne over a long time. We cannot shop for a qualification in the same way as we shop for a car: the acquisition of qualifications necessitates an expenditure of time as well as of money. Third, the benefits of an education are especially durable. While most goods depreciate in value over time, knowledge and skills tend not to do so as long as they are regularly exercised.

These three characteristics of education have one feature in common: the role of time. In contrast with most other goods, the market for education cannot usefully be described by a static model in which only today's utility and costs matter. A longer view has to be taken. The discounted stream of future costs and benefits must be considered, just as a businessman must consider net present values when making an investment in a new piece of capital. This insight, due to Gary Becker (1964), led to the development of the theory of human capital. An investment in education is tantamount to an investment in a machine which can be fitted on to the human body and which improves one's performance in the workplace; the future returns to such a machine – or to the educated individual – are expected to exceed the outlay of time and money involved in its purchase.

The theory of human capital has greatly improved our understanding of the role played by education in the economy. In the remainder of this chapter, these improvements will be considered in greater depth.

The Basic Model

Consider an individual. Let C_i denote the cost of the marginal unit of education and training in period i, R_i the return to that training in the ith period, and r the interest rate. Suppose that education lasts t years and that the individual expects subsequently to work until year T. The base period, where $i=0$, is defined as the period in which education and training commences. Then the individual will invest

in human capital up to the point at which, for the marginal unit of education,

$$\int_o^t C_i e^{-ri}\, di = \int_t^T R_i e^{-ri}\, di \qquad (2.1)$$

This relatively simple model of educational investment has a number of implications.

1. The greater the gap between T and t, the greater the returns to education will be, other things being equal. This is so simply because the returns accrue over a longer period. The time horizon, T, is fixed by statutory retirement age or by death, but the worker's age when beginning education (that is, when $i=0$) is a choice variable. It follows that the returns are greatest when the investment in education is made early in life. This is one reason why, in general, we go to school when we are young and go to work when we are older.
2. The lower the sacrifice, C, involved in investing in human capital, the greater will be the investment. Older workers, who frequently enjoy relatively high levels of remuneration owing to their experience and seniority, generally invest little in education, since the sacrifice of time (and so also of wages) would generally exceed the benefits.
3. The greater the returns to education, R, the more investment will there be, other things remaining equal. Thus those individuals with a capacity to learn new material quickly and thoroughly tend to invest more in education than do others, since the returns are expected to be greater. Moreover, if the earnings differential between 'educated' and 'uneducated' groups of workers increases, we would expect the demand for education to increase.
4. The higher the rate of interest, r, the lower will be the demand for education, other things being equal. This is because the postponement of earnings potential implied by full-time education more severely reduces the net present value of future earnings when interest rates are relatively high.
5. Investment in education will occur so long as the marginal (discounted) benefits exceed or equal the marginal (discounted) costs. The net present value of the total benefits must therefore exceed that of the total costs. Put another way, there must be a

positive rate of return to education. Otherwise, education would not exist.

Dynamic Optimisation

While it is a useful starting point, the model described in the last section is restrictive in that it assumes that education and work are mutually exclusive within any one time period. A more general model should allow part-time education and training to occur simultaneously with part-time work. The individual should then be able to decide how much of her non-leisure time is devoted to each activity. Such a model has been developed by Ben-Porath (1967). Various extensions have been proposed by Haley (1973), Heckman (1976) and Rosen (1976). Here, we shall consider a particularly simple variant of the dynamic optimisation model.

Let the individual's stock of human capital in the ith time period be denoted by K_i. Let her hourly earnings depend on human capital stock; more specifically, it is convenient to let hourly earnings equal K_i. Let w_i denote the proportion of non-leisure time in the ith period spent at work. Hence

$$\int_o^T w_i K_i e^{-ri}\, di \tag{2.2}$$

denotes the net present value of lifetime earnings. For simplicity in the sequel we shall assume a zero rate of interest.

Clearly the rate of growth of the stock of human capital must equal gross investment in human capital net of any erosion of skills due to the passage of time. The time spent acquiring human capital in the ith period may be measured by $(1-w_i)$. Diminishing returns to human capital investment suggest, however, that as the worker ages, the time sacrifice required in order to gain a given amount of additional human capital increases. We may therefore suppose that the rate of growth of human capital stock is given by

$$\dot{K} = 1 - iw_i - \delta K_i \tag{2.3}$$

where δ represents the depreciation rate, and where a dot above a variable represents the time rate of change.