

# Investment in Human Capital: A Theoretical Analysis

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## Abstract

The key concept that we need to understand is the difference between “general” and “specific” trainings. The theory developed at 2.1, where the 2 concepts are explained, is applied in every other sections in this paper.

## 1 Introduction

Investing in Human Capital = activities that influence future real income through the imbedding of resources in people

## 2 Different kinds of investment

### 2.1 On the job

Many workers increase their productivity by learning new skills and perfecting old ones while on the job. On-the-job training is therefore a process that raises future productivity and differs from school training in that an investment is made on the job rather than in a institution that specializes in teaching.

Each employee is assumed to be hired for a specified time period. Markets are competitive. If there's no on the job training, wage rates will equal the marginal products,  $MP_t = W_t$ , which also means (receipts = expenditure). We can see that they depend only on the flows during that period.

Now consider training. Assume that training is done only in the first period, we have

$$MP_0 + \sum_{t=1}^{n-1} \frac{MP_t}{(1+i)^t} = W_0 + k + \sum_{t=1}^{n-1} \frac{W_t}{(1+i)^t}$$

where  $k$  is the outlay of training. Substitute  $G = \sum_{t=1}^{n-1} \frac{MP_t - W_t}{(1+i)^t}$  and we have  $MP_0 + G = W_0 + k$ . We further have

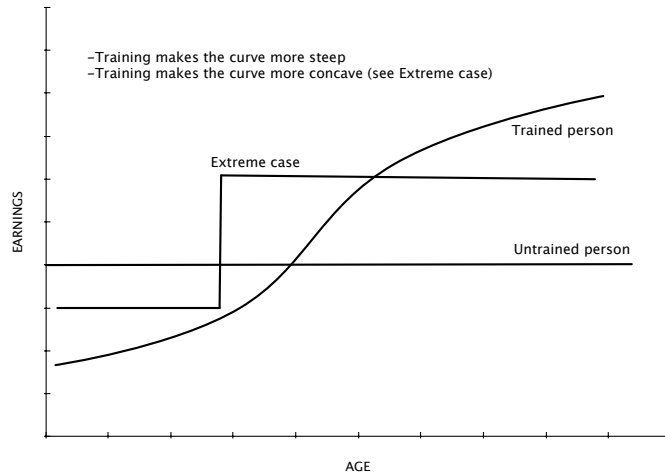
$$MP'_0 + G = W_0 + C$$

where  $MP'_0$  is the difference between what could have been produced and what is produced, which is the opportunity cost of time spent on training,  $G$  is the excess of future receipts over future outlays, which is the return to the firm from providing training.  $C$  is the opportunity cost of training plus  $k$ . Thus  $G - C$  equals the (return - cost) of training.

#### 2.1.1 General training

We now consider general training, a skill that can be useful in other firms (ex. doctors trained in one hospital find that skill usefull in other hospitals). Since in a competitive labor market, the wage rates paid by any firm are determined by marginal productivities in other firms, future wage rates as well as marginal products

Figure 1: Age/Earnings



would increase to firms providing general training. Consequently, wage rates would rise by exactly the same amount as the marginal product and the firms providing such training could not capture any of the return. Then why do firms provide training? They provide training only if they did not have to pay any of the costs. Persons receiving general training would be willing to pay these costs since training raises their future wages. So the cost as well as returns from training will be borne by trainees, not by firms. In this case,  $G = 0$ . Thus  $W_0 = MP'_0 - C$ , hence  $W_0 = MP_0 - k$ . The wage of trainees is not equal to their opportunity marginal products, but is less by the total cost of training. See Figure 1.

Income maximizing firms would not pay the cost of general training and would pay trained persons the market wage. If they pay for training costs, then too many trainees will come and labor costs will increase. If they do not pay trained persons as much as the market wage, they will have difficulty hiring trained persons and they will be less profitable to other firms. A good example is military. Military offers training and also pays. So for persons, they can receive much higher wages in the military during training. Well over 90% of US commercial airplane pilots received training at military.

### 2.1.2 Specific training

Training that increases productivity more in firms providing it will be called specific training. Completely specific training can be defined as training that has no effect on the productivity of trainees that would be useful in other firms. If all trainings were completely specific, the wage that an employee could get elsewhere would be independent of the amount of training he had received. Then the wage paid by firms would be independent of training. Then firms have to pay training costs. Firms would collect the returns from higher productivity in the future, and firms would provide training only if the return exceeds the cost. Long run equilibrium requires that the present value of the return equals costs.

If trainings were not completely specific, productivity would increase in other firms, and the wage will increase in other firms. Such training can be looked as the sum of a completely general training and a completely specific training, with the former being relatively larger, the greater the effect on wages in other firms relative to the firms providing training. Since firms do not pay any of completely general costs and only part of completely specific costs, the fraction of costs paid by firms would be negatively related to the importance of the general component, or positively related to the specificity of the training.

Rational firms pay generally trained employees the same wage and specifically trained employees a higher wage than they could get elsewhere. The reason is that firms are not concerned about turnover of employees with general training and have no incentive to offer premiums, but they are concerned about turnovers with specific training, and premium is offered.

Employees with specific training have less incentive to quit, and firms have less incentive to fire. Thus quits and layoffs are inversely related to the amount of specific training.

Consider a firm that experiences an unexpected decline in demand of its output. The marginal product of employees (initially equal to wages) with general training and their employment will be reduced. The marginal product of specifically trained employees (initially higher than wages) will be reduced, but as long as they were reduced by less than the initial difference of wages, firms will not fire them. Even if the decline in the demand were greater so that marginal product were pushed below their wages, firms would still not fire them, since there is an incentive for firms not to lay off workers since they might gain in the future if the decline in demand proved temporary.

But if decline of demand were permanent, all workers would be laid off when their marginal product became less than their wage.

A discrepancy between marginal product and wages is frequently taken as evidence of imperfections in the competitive system, but it would occur even in a perfectly competitive environment where there is investment in specific training.

## 2.2 Schooling

Schools and firms are often substitute sources of particular skills. Since students don't work (or work only in holidays), earnings are usually lower than if not in school. Net earning  $W$  can be defined as  $W = MP - k$ , where  $MP$  is actual marginal product (earnings) and  $k$  is direct costs (tuition etc). If  $MP_0$  is the marginal product that could have been received,  $W = MP_0 - (MP_0 - MP - k) = MP_0 - C$ , where  $C$  is the sum of direct and forgone costs and where net earnings are the difference between potential earnings and total costs.

Schooling would have the same kind of implication as general on the job training. Thus schooling would steepen the age-earnings profile.

## 2.3 Other Knowledge

For example, information about prices charged by different sellers would enable buyers to select the cheapest option. Information about the political or social system could also significantly raise real incomes. Now consider the info on employment opportunities. A better job might be found by spending cost on "search". If workers spent this cost and collected the return, an investment in search would have the same implications on general on the job training and schooling. If firms paid the costs and collected the return, search would have the same implications as on the job specific training.

## 2.4 Productive Wage Increases

Emotional and physical health is an important determinant of earnings. Firms can invest in the health of employees through medical examinations etc. An investment in health that increased productivity to the same extent in many firms would be a general investment in health and would have the same effect as general training, while an investment in health that increased productivity more in the firms making them would be a specific investment. But many health investment is made outside the firms (in households etc), so we now look at the relationship between on-the-job and outside human investments.

A firm would be willing to pay for investment in human capital made by employees outside the firm if it could benefit from the resulting increase in productivity. The only way to pay, would be to offer higher wages. When a firm gives a productive wage increase (an increase that raises productivity), outside investments are converted into on the job investments. Firms would benefit more from on-the-job investment, the more specific the productivity effect. For example, a wage increase spent on a better diet with an immediate impact on productivity might well be granted, but not one spent on general education with a very delayed impact.

An investment in human capital would usually steepen age-earnings profiles (as seen before), lowering reported earnings during the investment period and raising them later on. But an investment in an increase

in earnings may have precisely the opposite effect, raising reported earnings more during the investment period than later and thus flattening age-earnings profiles.

### 3 Relation Between Earnings, Costs, and Rates of Return

Since this section was focused on the methods on how to investigate the titled relations in empirical research (and also because I didn't quite understand what he was doing), I will not go as far.

Some general relations between earnings, investment cost, and rates of return are derived. They permit one to distinguish, among other things, a change in the return from a change in the amount invested. And the rate of return, amount invested, and the investment period can all be derived from information on net earnings alone.

### 4 The Incentive to Invest

#### 4.1 Number of periods

The young commit themselves in activities for investing in themselves, and this is because they have more incentive to invest than the old. They have more incentive, because they can collect the return over more years.

The time spent on one activity is determined not only by age, but also by the amount of switching between activities. Women spend less time in labor force and therefore have less incentive to invest in market skills, tourists spend little time in one area so have less incentive to invest in any knowledge of specific consumption opportunities. Those people like to find investments that increase productivity in several activities. But such investments are less available than more specialized ones, therefore specialists have greater incentive to invest in themselves than others do.

Specialization in an activity would be discouraged if that market is small, so the incentive to specialize and to invest in oneself would increase as market gets bigger.

#### 4.2 Wage differentials and secular changes

Marginal productivity analysis relates the derived demand for any class of workers to the ratio of their wages to those of other inputs, so wage ratios are more appropriate in understanding forces determining demand. On the other hand, the return on investment skills and other knowledge is determined by absolute wage differences, so wage differences are better in supply studies.

Consider technological progress. If progress were uniform and neutral, initially all wages would rise by the same proportion, and the prices of all goods would be unchanged. Wage ratios will not change, so firms would have no incentive to alter their factor proportions. Wage differences would however rise, and there would be an incentive to invest more in human capital, and thus to increase the relative supply of skilled persons. The increased supply would in turn reduce the rate of increase of wage differences and produce an absolute narrowing of wage ratios.

#### 4.3 Risk and Liquidity

A rational man only invests if the expected rate of return was greater than the sum of the interest rate on riskless assets and the liquidity and risk premiums associated with the investments. Since human capital is a very illiquid asset, a positive liquidity premium would be associated with such capital.

There is a lot of uncertainty about the return to human capital (length of life, ability etc). The longer the average period between investment and return, the less knowledge is available.

## 4.4 Capital Markets and Knowledge

It is very difficult to use the capital market to finance investments in human capital, for the following reasons. (1) Large expenditures are more difficult to finance, so investment in college education is more difficult than short term migration. (2) Internal financing would be common, so wealthier families invest more. (3) Since specific skills can be offered as collateral along with tangible assets, capital would be more available for specific than general investments.

However, otherwise equivalent investments in physical capital is also difficult. Consider a 18 year old trying to finance for a firm he is starting, rather than to finance for college. Will that be easy? No. A recurring theme is that the young are especially prone to be ignorant of their abilities etc, thus harder to raise capital. But investors in human capital are younger partly because of the cost in postponing their investment to older ages (see 4.1). Since an investment in human capital is more costly to postpone, it would be made earlier. So the young will postpone their investment in non-human capital.

## 5 Some Effects of Human Capital

### 5.1 Examples

- Most studies show that age-earnings profiles tend to be steeper among more skilled and educated people. As analysed earlier, on-the-job training will steepen the age-earnings profile.
- Studies show that US exports relatively labor-intensive commodities and imports relatively capital intensive commodities, though it is said that US have relative scarcity of labor and abundance of capital. An interpretation is that US has an even more abundant supply of human capital. An increase in human capital would show up as an apparent increase in labor intensity since earnings are gross of the return on such capital. Thus export industries might pay higher wages than import competing ones primarily because they employ more skilled or healthier workers.

### 5.2 Ability and the Distribution of Earnings

Human capital not only explain differences in earnings over time and among areas, but also among persons or families within an area.

Suppose that the amount invested in on-the-job training, health, and other human capital etc are held constant. A reasonable first approximation would say that if two persons have the same investment in human capital, the one who earns more is demonstrating greater economics talent. Earnings can be approximated by  $Y = X + rC$ . Where  $C$  measures total investment costs,  $r$  the average rate of return, and  $X$  the earnings when there is no investment in human capital. Assume that distribution of  $X$  is ignored,  $Y$  would depend only on  $r$  when  $C$  was held constant. Thus “ability” would be measured by the average rate of return on human capital,  $r$ . Persons receiving high marginal rate of return would have an incentive to invest more than others, so there would be a positive correlation between ability and the investment in human capital.

The main implication of this is that the amount invested is a function of the rate of return expected, and this can explain several well known properties of earnings distributions. If everyone invested the same amount, and if ability of people were symmetrically distributed, earnings would also be. And if all people had the same ability, earnings would be the same for everyone. If ability and investment both varied, earnings would tend to be skewed even when ability and investment were not. But the skewness would be small as long as the amount invested and ability was independent with each other. But as seen above, people with more ability will invest more, and the two are not independent, thus the skewness of earnings will be more skewed.

The degree of skewness will differ among the skilled and unskilled. Since the unskilled have smaller  $rC$  relative to  $X$ , the distribution of  $rC$  would not dominate  $Y$ . The opposite argument is made for the skilled. Thus if abilities were symmetrically distributed, earnings would tend to be more symmetrically distributed among the unskilled than among the skilled. Hence we can say that there will be smaller skewness at younger than older ages.