

HUMAN CAPITAL:

AN OVERVIEW.

**Human Capital:
An Overview.**

by

**NASRI HARB
(051487)**

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Supervisor: Professor Camilo Dagum.

ECO 7997

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To the spirit of

A. R. M. K.

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INTRODUCTION

Until around the 50's of this century, economic theory seemed to be unable to explain accurately the growth of income by the accumulation of capital. In 1954, Leontief noticed that the United states, a country with a high capital to labour ratio, exported labour intensive goods and imported capital intensive ones, which contradicted the comparative advantage theory. This contradiction could not be solved unless an American man year was equivalent to about three foreign man years. In 1956, he concluded that American exports were made from high skilled labour. This illustrates the importance of skills in economic analysis.

The concept of skills is not new in economics, as it goes back to hundreds of years ago. Indeed, Plato (in Thurow 1970, pp. 2) said:

" What I assert is that every man who is going to be good at any pursuit must practice that special pursuit from infancy.

...Besides this, they ought to have elementary instruction in all necessary subjects, the carpenter, for instance, being taught the use of rule and measure."

The idea has improved throughout history to the concept of human capital which in recent years has been modeled as a new field of study. Many contributions by economists have been made to make this concept operative. What was the results? They were astonishing. Most studies on human capital show very significant relationships between earnings and education, experience, and age

regardless of the place where these studies are performed, from the very developed countries (such as the U.S.A.) to the very poor countries (such as Pakistan).

The concept of human capital includes, in addition to experience and education, migration and health. This paper is an exploration on the theory of human capital, its development through the years, its generality and applications.

Chapter I contains a historical overview of the concept of human capital, describing the main initial contributions until recently.

Chapter II classifies human capital into three main forms which are Knowledge, Health, and Migration. Knowledge is the main capital, and its main components are education and training. This chapter deals with some empirical findings about the relationship between the human capital and earnings.

Chapter III is the main part of the paper, as it treats human capital in the context of income distribution. Also it shows how human capital affects earnings and earnings distribution through four different models.

Chapter IV is a conclusion of preceding discussion.

CHAPTER I

A HISTORICAL LOOK

There were, throughout the history of economic thought, two main initiatives to deal with the value of human capital:

- Some economists included human skills and abilities in their definition of capital but they did not attempt to estimate it .

- Other economists attempted to estimate the value of human capital for special purposes (like the loss due to the war, insurance business, public finance,...). This monetary value was estimated using two approaches: that is, the retrospective approach and the prospective approach.

The economists of the first group, who included human beings into their analysis of the concept capital, had the following arguments:

- 1-The cost of rearing and education of human beings is a real cost.
- 2-The product of their labour adds to the national wealth.
- 3-An expenditure on a human being that increases its product

is a real addition to the national wealth.

Adam Smith (1769, in Kiker 1964, pp. 57) believed that skills may be regarded as a machine that has a genuine cost and returns profit. He treated skills and abilities as a part of fixed capital, even though he did not use the term capital for skills.

Jean Baptiste Say (1821, in Kiker 1966, pp. 57 - 58), considered that skills and abilities should be regarded as capital since there is a cost to increasing workers productivity.

Nassau Senior (1836, in Kiker 1966, pp. 58 - 59) considered that human beings can be treated as capital.

Generally, he included skills and acquired abilities in his discussion; although, he treated the human being himself as a capital with a maintenance cost.

"There is a little difference between the value of a slave and a free man's one. The essential one is that the latter sells himself for a given period, the other is sold for his lifetime."

J. S. Mill (1848) asserted:

"The human being himself - I do not class as wealth. He is the purpose for which wealth exists. But his acquired capacities, which exist only as a means, and have been called into existence by labour fall rightly, as it seems to me, within that designation."

(See Kiker, 1966, pp. 58)

Contrary to Say and Mill who considered only skills and abilities as considerable part of the nation's capital, some economists as J. R. McCulloch (1870, in Kiker 1966, pp. 58) did consider the entire human being as a part of the capital.

McCulloch stated:

"Instead of understanding by capital all that portion of the produce of industry existing to man, which may be

applicable to his support, and to the facilitating of production, there does not seem to be any good reason why man himself should not and very many why he should not be considered as forming a part of the national capital."

He asserted that there is a close analogy between conventional and human capital.

Moreover, Leon Walras (1874, in Kiker 1966, pp. 59 - 60) included all human beings - productive or not - in the concept of capital, and considered its price to be fixed like any other good. He said that in pure theory "it is proper to abstract completely from consideration of justice and practical expediency" and to regard human beings "exclusively from the point of view of value in exchange". He recognized the reluctance of economists to treat human beings as capital.

For Irving Fisher (1897, in Kiker 1966, pp. 60) the skills of an individual is not an additional capital to the individual himself. It is the skilled individual who should be considered in capital. He included human being in the concept of capital since it is "useful appropriated material object."

Friedrich List (1922, in Kiker 1966, pp. 58) as Mill and Say, stated that skills and acquired abilities of human beings were the most important component of a nation's stock of capital. He asserted that in both production and in distribution, the contribution of the human capital to output must be considered .

In **THE NATIONAL SYSTEM OF POLITICAL ECONOMY** (1922), he stated:

"Certainly those who fatten pigs or prepare pills are productive, but the instructors of youths and adults, virtuosos, physicians, judges and administrators are

productive in a much higher degree. The former produce values of exchange and the latter productive powers, some by enabling the future generations, to become producers, others by furthering the morality and the religious characters of the present generation, a third by ennobling and raising the powers of the human mind, a fourth by preserving the productive powers of his patients, a fifth by rendering human-rights and justice secure, a sixth by constituting and protecting public security, a seventh by his art and by the enjoyment which it occasions fitting men the better to produce values of exchange." F. List (1922, in Thurow 1970, pp. 4).

The second group of economists, who tried to estimate the monetary value of the human being, used some scientific methods. They had many purposes, such as taxation, measuring the wealth of a country, and justice,...

Johann H. Von Thunen said:

"...For here...one will sacrifice in a battle a hundred human beings in the prime of their lives without a thought in order to save one gun." Because "the purchase of a cannon causes an outlay of public funds, whereas human beings are to be had for nothing by means of a mere conscription decree." (Thunen, 1875, in Shultz, 1961, pp. 5)

In recent history, two approaches (Postner 1989) have been used to estimate the value of the human capital:

1- The retrospective approach that uses the same conventional ways to deal with physical capital. This approach considers costs of the formation of the human capital (like rearing, schooling, health care, etc...) as the value of human capital.

2- The prospective approach is another way to look at the same human being: Instead of calculating costs, this approach consists of calculating the expected earnings during the life time, then capitalizing this value (calculate the present value of a series of earnings by using a given rate of

return).

Of those who used the prospective approach was Sir William Petty (1691, in Johnson 1964, pp. 26 - 27) who was also one of the first who tried to estimate the money value of a human being. He found that the human capital stock of the United Kingdom (England) was 250 millions pounds. (see Johnson, 1964). His method consisted of capitalizing the wage bill to infinity, using the market interest rate. His interest in estimating monetary human value was due to his interest in public finance. Human resources are much more important than natural resources because the latter are exhausted and subject to scarcity.

For him, labour was the "Father of Wealth." He used the human capital notion to demonstrate the power of England, and to measure the monetary value of loss due to war, death, etc...

William Farr (1853, in Kiker 1966, pp. 58), through his interest in public finance, claimed that the capitalized value of earnings capacity should be taxed as properties were, since they are both productive. He used the same approach of Petty, but he calculated the individual net future earnings. He extracted the personal living expenses.

The interest of Dublin and Lotka (1930, in Kiker 1966, pp. 55 - 56) in estimating the value of the human being was due to their life-insurance business. They capitalized the net individual earnings (earnings minus consumption or maintenance). Their initiative was to know the impoverishment of a family, when the wage earner died.

Alfred Marshall (1890, in Kiker 1966, pp. 60) believed in the useful way to capitalize net earnings (earnings minus consumption). But he thought that the concept is "unrealistic" since human beings are not marketable.

Since returns for certain human beings could not be determined (like Newton, Goethe, B. Franklin ...), Ernest Engel (1883, in Kiker 1966, pp. 53), used the prospective approach for estimating the value of human beings. Since rearing costs are borne by the parents, they might be estimated. They incur until the age of twenty six, after this, Engel assumed the individual to be "fully produced". However, it is thought that the cost of production does not have necessarily a relationship with the economic value of the product, especially when talking about human capital.

Theodor Wittstein (1867, in Kiker 1966, pp. 54 - 55), estimated what a compensation from loss of life should be. He used Farr's capitalized value and Engel's cost-of-production, with no justification, then he assumed that both estimations are equal.

In the last decades, both the retrospective approach and the prospective approach have been used to calculate the rate of return due to human capital investments and, especially education and training.

T. W. Shultz (1971) proposed that investments in people - education, training, and health - are great sources of human prosperity by the fact that these investments increase the value of time of the corresponding individual. Natural resources are not

the decisive players in the human betterment. This proved in Japan, which lacks any endowment of natural resources. For T. W. Schultz, the concept of human wealth does not contradict Mill's idea that people are who wealth exists for. Investing in themselves, people get more opportunities available to them. It's one way free men can enhance their welfare.

According to Mincer (1974), education and work experience explain more than 50% of the inequality of earnings. He used the "overtaking" year (see Mincer's model in chapter III) to calculate the rate of return over the investments costs which he calculated by direct costs of education, training cost and forgone earnings.

G. Becker (1975) distinguished between general and specific training and how this would be reflected in the wage rate path shape. He stated that the human capital acquired during a lifetime depends on a demand and supply curves model. Where the demand for human capital is an increasing function of its rate of return and the supply is a decreasing function of its marginal cost.

CHAPTER II

CLASSIFICATION OF HUMAN CAPITAL.

The existing social stock of human capital decreases as a result of depreciation as well as the increase in deaths among people, and increases due to the investment decision of people and the new entrants. This may be an individual decision or a collective one.

Upon making the investment decision, four players are identified (Shaw Bell, 1984, pp. 430 - 435):

1-**The investee:** The investee is defined as being the person to which human capital is enhanced. He is the passive vaccinated child, or the active child learning in a hockey club. He is the student attending elementary, secondary, or any other school level. Furthermore, he is the individual acquiring higher productive capacity, either intellectual or not, which leads him to a better and higher satisfaction. In the first two examples, the investee has no calculation about returns on investments, however rates of return arise in higher education, training or migration.

2-**The investment initiator or the entrepreneur:** he is the

person who envisages investments and initiates their formation process. Rearing, education, and health care of children are mostly a parent's responsibility.

3-The private financier: the private financier pays direct and /or indirect cost, he might be the investee, the investor-entrepreneur (the parents) or the private firm.

The individual who spends time on training or higher education is giving up the income that could be earned by his actual human capital. The parents buy special services, club subscription, games, and education to enjoy their children's improvement. For instance, the wives who support their husbands during their training period serve as a good illustration. (That is why divorce courts allow some of the husband future earnings for such wives.)

It should be noticed here that it is always possible for an individual to take over the three cited roles: a student knowing what satisfaction he may get from higher education, would go for it, using his own savings.

4-The public financier of human capital formation may be the government, a community association, union or any social league...

Much of the government's spending on education and health is not considered as investment because society does not benefit directly of any physical capital increment; indeed, much of this spending is contributed to building a stock of human capital. Eventhough, politicians have recently referred to social programs as investment, they have not developed any complete rigorous costs and benefits analysis for social spending.

Thurow (1970, pp. 103 - 111) cited nine reasons in which the government has interests in order to intervene in the investment in human capital:

i - Human capital has some of the characteristics of a pure public good. A highly educated society makes better decisions (political, economical, social...) whenever faced with such problems.

ii - Society may also have preferences about the desired income distribution. Human capital plays a major element in determining the level of income. Therefore it is a decisive instrument in income distribution.

iii - The equity of the market allocation mechanism depends on the assumption that society has already achieved the desired distribution of income. When income distribution is perfect, so would be the distribution of purchasing power, thus in order to achieve an equity in the purchasing power, social investments in human capital would be a main tool.

iv - Human capital may be considered a merit want. Individuals are forced to attain a minimum level of education because society believes that benefits from an educated population are so important.

v - Human capital may be associated with external economies or diseconomies. Although externalities exist, as we will see later in this chapter, they not incite individuals to invest in human capital, even if they are of benefit to the society. Moreover; these externalities may be very

important so that society will use its resources to have a higher cultured population. Therefore; society will replace individuals in making such a decision.

vi - Society's knowledge of the future stream of costs or benefits from a human capital

investment may not be the same as those of individuals and firms. Due to statistics and forecasting models, governments predict disequilibrium in the market of any professional occupation, thus, to achieve the equilibrium position, the government invests more or less in the given sector corresponding to any excess or shortage in any given occupation.

vii - Market imperfection may also lead to wrong private decisions.

"If the price system is not working efficiently - if prices do not reflect marginal products - society may wish to make investment decisions based on marginal productivities rather than market prices. Shadow prices are calculated to reflect the real contribution and costs of human investment. Shadow prices rather than market prices are used to evaluate the investment project. While governments may use shadow prices, individuals and firms will always use market prices. Only market prices influence private returns and costs. Shadow prices reflect returns and costs to society, market prices reflect returns and costs to private groups. Because they use shadow prices to compensate for market imperfections, governmental investment decisions may differ from the decisions made in the market place. Government human capital investments are made to offset privately rational but socially irrational decisions." (Thurow 1970, pp. 108).

viii - Society's risk and uncertainty premiums may differ from those of individuals or firms.

Most of the educated people get higher earnings in return to their education, but some of them do not. The society, by statistics and

experiences, should then be more informed about the probabilities of success or failure in a macro view. Therefore; risk preference may differ between society and individuals. Society may be a risk taker while the individual may be a risk averter. If the individual has a large expectancy of losses, he would be reluctant to invest. But in general, a society (a wealthy society), can sustain losses more than an individual can.

ix - Private and public investment decisions may also differ because of differences of interest rates. When it comes to making decisions, the individuals' decision

is a function of current interest rate. While for society, the situation is different because there are two social interest rates:

1 - the social rate of time preference: because the society's time horizon is longer than the individual's one, the time preference will be different.

2 - The social opportunity cost: if the marginal utility of income decreases as income increases, the future marginal utility of income will be less than the one in the present. Therefore; there are limits to sacrificing today's income for higher future income.

We classify investments in human capital in three parts:

- A - Investments in knowledge.
- B - Migration.
- C - Investments in health.

A - INVESTMENTS IN KNOWLEDGE.

There are four kinds of investments in knowledge.

- a - Acquired from family environment.
- b - Acquired from education.
- c - Professional investments (or training).
- d - Information about the labour market.

a - HUMAN CAPITAL ACQUIRED FROM FAMILY ENVIRONMENT.

Influence of family in the stock of human capital could be either by the transfer of knowledge to the children or by the transfer of attitudes and motivations.

Parents have a high influence on human capital of children for they watch them; the higher the education of the parents (especially the mothers) and the more they devote time to the children, the better this will be reflected in the path of children's human capital formation.

Dr. James P. Comer, professor of child psychiatry at the Yale Child Study Centre (U.S.A.), says that children of uneducated parents are less likely to have skills and abilities that prepare them for school. He found that 60% of daughters of single mothers who spent at least 10 years on welfare would find themselves on welfare at least a year during adulthood. (Garland 1988, pp. 124).

In Japan, it has been found that students perform at least as well as American students at all levels. Japanese mothers are

highly involved in their children's schooling, teachers are respected and well paid - while janitors at New York City schools make more money than teachers do (Nussbaum, 1988, pp. 102) - The school year is longer, -243 days in Japan compared to 180 days in the U.S.A. (Barrett, 1990, pp, 80) and more homework is given.

Acquiring human capital is a function of its existing stock, in other words, whenever two children are in the same school level, we can not conclude they have the same stock of human capital due to their innate abilities and family environment.

Costs of these investments are supported by parents, especially the opportunity cost which consists of the foregone earnings of the mother whenever she leaves work to take care of her children. Another direct cost is the day care cost.

b - HUMAN CAPITAL ACQUIRED FROM FORMAL EDUCATION.

This is the main and the most important investment in human capital. It is the base for any society's betterment as well as the base of sciences and of the ever improving technology. It is very important when it comes to development and efficient productivity, since a higher educated society is expected to be more competitive; indeed,

"...In an eighth-grade match-up, among twenty school systems surveyed, the american students ranked tenth in arithmetic, twelfth in algebra, and sixteenth in geometry. **Japan our principal economic competitor, finished first in all three of these categories.**"
(Barrett, 1990. pp 84)

In order to figure out what might other returns to education

be, Weisbord (1971) elaborated on the concept of financial option returns on education, i.e. the value of the option opened to the investee whenever he attains a certain level of education. Upon graduation from high school, the investee has the option to continue his / her undergraduate studies and then to the graduate level. The value of these options therefore, decreases with higher education attainments. Add to this, that higher education permits, in general, a variety of choices among different positions. The earner then will have to choose what jobs to fill, depending on his preferred area of work, how secure the job is, and how satisfying it is,... These satisfactions may incite the investee to accept a less financially return position, and therefore underestimating the return to education whenever it is calculated by direct returns and costs. Moreover, higher education brings on a higher ability to adapt to jobs, especially in an era of a rapid technological change; Mincer's empirical research (1971) has led him to conclude that there is a positive correlation between the level of education and on-the-job training costs.

The relative costs of education is seen in a Psacharopoulos' survey of 14 countries that he classified into 3 categories: high, middle and low income countries. His results are shown in table 1 below. His findings were the same for both high and middle income country groups, i.e. at the secondary education level, the proportion of foregone earnings was about to 67% of total costs in the high income group and 66% in the middle income group; and at the higher education level, it was 53% and 50% respectively. But

in the low income countries, these proportions were about 53% for the lower secondary education and 34% for higher education.

Table 1

Forgone earnings as percentage of total social cost per student year by educational level and country.

<u>Country</u>	<u>secondary</u>	<u>Higher</u>
United states	62.4	63.4
New zealand	65.0	50.4
Great britain	72.4	44.3
Average	67	53
Israel	75.3	34.7
Mexico	62.0	64.9
Chile	66.4	48.6
Colombia	61.0	52.7
Average	66	50
Malaysia	38.5	19.5
Ghana	62.6	24.3
S. Korea	69.5	62.0
Kenya	43.6	23.0
Uganda	42.6	34.3
Nigeria	59.4	27.7
India	56.2	47.1
Average	53	34

Source: Psacharopoulos, 1973, pp. 126.

He explained: " ... That universities in african countries, especially those in ex-british and ex-french colonnial countries, are at the same level of quality as residential european universities, this has meant that buildings, equipment and teaching staff have been of the same quality and hence of at least equal cost, therefore, the actual direct cost per student year varies

little between universities in, say Ghana, and Britain, while foregone earnings are much lower in Ghana. Therefore, the proportion of direct costs is much higher in poor than it is in rich countries". (Psacharopoulos, 1973, pp. 126). Then, Psacharopoulos turned to measure the relative costs per student's year by education level. (See table 2)

table 2

Ratios of direct and total costs per student year by educational level and country.

country	Direct costs		total costs	
	second./ Primary	Higher/ primary	Second./ Primary	Higher/ primary
United states	1.2	3.7	2.9	9.5
New zealand	2.3	7.1	6.5	14.4
Great britain	2.9	16.1	10.5	28.9
Average	2.1	9.0	6.6	17.6
Israel	2.7	16.8	10.8	25.6
Mexico	5.1	9.0	5.7	11.0
Chile	1.5	7.9	4.4	15.5
Colombia	2.7	17.9	5.7	31.7
Average	3.0	12.9	6.6	20.9
Malaysia	1.9	13.0	3.1	16.1
Ghana	6.3	119.6	11.6	109.7
S.Korea	2.4	5.5	8.0	14.4
Kenya	12.3	167.3	21.9	217.0
Uganda	14.3	115.9	25.0	176.0
Nigeria	7.3	100.8	8.4	65.8
India	4.9	17.1	5.6	16.2
Average	7.1	77.0	11.9	87.9

Source: Psacharopoulos, 1973, pp. 127.

He calculated secondary / primary and higher education / primary direct costs and total costs, and then concluded that

- Both direct costs ratios are higher, the lower the country's income especially higher / primary ratio.
- Turning to total costs, these ratios increase, meaning that indirect costs ratios are larger than those of direct costs.

A university year's direct cost in a high income country is (in average) about nine times the primary year direct cost, the total is 17.6 times, but both ratios turn out respectively to 77 and 87.9 times in the low income countries. From this, Psacharopoulos concluded that low income countries should analyze the potential benefits of higher education before planning expansion.

Externalities

In calculating the returns for a private investor (parents or the investee himself), on his spending on education, to get his own goal as higher satisfaction, higher earnings, better position and so on, many other returns are neglected. These returns benefit other society's members: education of parents has a large impact in the formation of the children's human capital, (in Dagum's model below, parent's education is one of the 12 components of the vector that determine the human capital of the individual).

c - HUMAN CAPITAL ACQUIRED FROM PROFESSIONAL INVESTMENT.

This could be periods of apprenticeship, training or

professional experience. This accrues productivity, and hence increases income.

To what extent should the individual bear his training costs, which in general are indirect, is treated in Becker's analysis (1975) of general and specific trainings:

1- General trainings: many firms provide training which can be used in many other firms. Training increases the job marginal productivity, thus, increasing the wage payment in a perfect competitive labour market. In that case, - unless the trainee pays his own training costs - firms will be reluctant to provide such training for two reasons:

- Given the marginal productivity payment, expenses on training will not bring any return.
- Even at payments less than marginal productivity, the firm is not sure of keeping this trainee working for it until it gets back all the training costs.

If the firm is to pay wages that cover the costs of training, it will suffer losses. In the U.S.A, the military sector provides high skills programs that are useful in many other areas. Furthermore, it pays higher wages for those who are in training than those paid in civilian sectors. However, after the training is over, the trainee sees payments in the civilian sector higher than those of the military's. Thus, he is incited to work for the civilian sector, keeping higher wages, leaving the military sector with losses. For instance, more than 90% of pilots working for the private airlines have received - at least - a part of their

training in the army. (Becker 1975, pp, 25)

The fact that the trainee is to pay his own training costs is reflected in his earnings in two ways:

- he has to pay his direct training costs, so he has to reduce his expenditure in consumption, leisure and tangible assets...
- He has to forego a part of his earnings for he has to spend time on receiving training. The earnings that the trainee would have received if he were not in training are the "forgone earnings".

Therefore, this individual will see less net earnings than his other colleagues who have the same conditions but who are not in training. Later on, the trainee will have a higher marginal productivity, his earnings will exceed his colleagues' for he will be reaping returns of his investments.

2- Specific trainings:

As opposed to the general training, this one increases the productivity only in the firm that provides it such as astronauts and missilemen.

Most of the trainings are neither completely specific nor completely general, they mostly increase productivity in the firm that offers it more than in other firms. In a competitive market, trainings tend to be more general, but the more the market tends to be monopolistic, the more the trainings tend to be specific.

Because in a specific training, the productivity of the employee does not increase in other market activity, therefore, his elsewhere wage would stay equal to his initial marginal

productivity.

The firm that offers the training will reap its own expenditures by paying the trainee a wage equal to elsewhere wage which is less than his marginal productivity after being trained; the difference between the paid wage and the actual productivity is to be captured by the firm. But then, the firm might not pay the specific trainings for it does not guarantee that employee would quit after having collected all trainings expenditures. For the employee, he is reluctant to pay for specific training because he is not sure how long his employment period will last. Thus, the firm that pays for the training will be hurt by the possibility of quitting of a paid training employee; if the firm has to hire another new one, his wage would be the same, but his productivity would be less. For the employee who pays his training, he has to find another job with the same pay, which is not available because his productivity elsewhere is less.

To avoid this dilemma, what happens is that the firm pays its employee a higher wage than the market does, but less than his actual productivity, and letting him pay a share of the costs of trainings. Thus, receiving a higher wage, he is more reluctant to quit. Therefore, the more unspecific is the training, the higher is the tendency to let the employee pay a larger part of his trainings costs.

Given that general trainings are borne by employees, specific ones are partially borne by firms, thus in any case of depression or decreasing demand, there would be a tendency to lay off those

with general trainings more than with specific trainings, because

1- The firm has paid a part of the latter's trainings costs.
2- The general trainees are paid their marginal productivity, thus, when the demand decreases, firms are not interested in keeping as large a staff as before, but in the case of specific trainees, their wages are less than their marginal productivity. Therefore it is of the interest of the firm to keep these employees. If the decline in demand were enough to get a time when the marginal productivity of the specific trainee is less than his wage, we might distinguish between two cases:

a- if the decline were temporary, there would be a high probability of chances that he will not be laid off.

B- if the decline seemed to be permanent, his odds of being laid off are greater.

d - INFORMATION ABOUT THE LABOUR MARKET.

In some hypothesis, we considered perfect competition, i.e. homogenous prices for all products or factors of production that have the same qualities. However, this is not what we see in real life, especially in the labour market. Each individual has limited information about the labour market status.

To have complete information, a worker needs to know about all potential jobs:

- The salary.
- Employment conditions (non pecuniary advantages and

disadvantages).

- Stability of the job.
- Promotion chances.

Because of the limited information, we can see a distribution of salaries and employment conditions for individuals who have the same qualifications. The distribution is not always the same, but rather changing over time. Individuals' qualifications are changing, and business administrations change too. Loosely speaking, demand and supply conditions of labour forces are not constant.

Acquiring information about labour market conditions is an investment, which has costs; if it were not, it would be available to everybody so that we will have a perfect distribution of salaries and employment conditions.

Information about labour market conditions is of interest to the employer too. He needs information about potential workers. He can not spend lots of time looking for workers for a given position, e.g. Chemical bank in New York City must interview 40 applicants (high school adults) to find one that can be successfully trained as a teller. (Nussbaum, 1988, pp. 102).

Benefits:

-For the employee: it could be a higher salary, better job conditions or more stability. These benefits are functions of the intensity of search and of the prospective period employment. If one person visits 50 employers in a given period while another visits 10, it is more likely that the former has a bigger

opportunity than the latter. On the other hand, the lower the returns to the search are, the larger the dispersion of wages is, because in this case, individuals have less incentives for searching, and therefore, there is less information and more dispersion. Women generally, stay at work for a period which is shorter than men for homogeneous groups of men and women, thus it should be expected that the dispersion of the latter is larger than the dispersion of the former.

-For the employer: he is looking for the best employee, i.e. the most productive one, his profit is the difference in productivity. For a specialized position with high responsibility, they should use more time to get the right person. Lesser specialized positions are easier to fill.

On the other hand, employers are satisfied with less information given to employees. Having more information, the latter gets better alternatives, so that actual employers have to pay higher salaries to keep their staffs; otherwise, employees would quit to the higher paid job. Actually, they sometimes profit from the lack of information of their employees.

Society also benefits from investments in information. Its benefits consist of a more efficient allocation of the labour force because in a highly informed labour market, each worker's product is closer to its maximum.

COSTS:

They are opportunity costs, they depend on the difficulty to find the right employer or employee, and are function of time.

Because the production of information is uncertain, the cost may be expensive. An individual may find some information worthless, in contrast, society would find scarcely any information to have no value for any one.

B-MIGRATION

Migration happens within small or large geographic areas, it could be from one city to another, from rural to urban areas or from country to another. Its goal is to maximize the satisfaction of the immigrant:

-Retirees emigrate to a better weather area to enjoy their retirement age.

-Mostly, individuals emigrate to areas where jobs' opportunities are better, and immigrants try to maximize their own human capital returns.

It is important to observe the flows of immigrants, emigrants and the structure of each flow. If 10,000 immigrants landed in city A, and 10,000 emigrate from A, the net flow is zero, though income and distribution effects are not surely nil. What matters is the received stock of human capital and the one that has been lost.

Migration is an important factor of labour adjustment. People are always likely to migrate to where their earnings may be higher. Therefore, by this process they eliminate wage differential between different areas. They may yield profits by just moving.

Jasso and Rosenzweig (1986, pp. 77 - 80) worked out a model trying to show what initiates the decision to immigrate to the U.S.A

An individual will immigrate when

$$\delta^e = (v^{us} - v^h) > 0$$

where

- v^{us} is the expected well-being from emigration to U.S. v^{us} considers expected earnings in U.S., costs to immigrate and circumstances over there.

- v^h is the home's earnings and circumstances.

When δ^e (the expected difference) is positive, individual is expected to migrate.

The model states that

1- For the same marginal costs of migration and home country's characteristics, individuals receiving high earnings at home would receive high earnings when they immigrate. Therefore, it is expected that immigrants from high income countries are likely to receive higher earnings.

2- For a fixed income at home country, those with higher immigration costs would receive higher earnings as to cover their higher costs.

3- Those immigrants from more attractive countries (attractive circumstances) are likely to receive higher earnings.

Opportunity costs of migration, its direct costs and the quality and quantity of information available about U.S.A are crucial in the migration decision.

In their empirical work, Jasso and Rosenzweig concluded:

"In particular, those migrants from high-GNP countries and from distant countries appear to be in high earnings occupations, suggesting the importance of both opportunity and indirect migration costs in migration decisions. Moreover, migrants from countries receiving VOA (Voice of America) broadcasts appear to be in higher

earnings occupations, suggesting the possibility that such broadcasts provide useful information about the U.S. Finally, there is marginal support for the hypothesis that migrants from less attractive centrally planned, authoritarian countries have lower occupations earnings." (Jasso and Rosenzweig, 1986, pp. 92 - 93)

COSTS:

-Direct costs: They are the out-of-pocket expenses of moving, transportation for the migrant and his family. These expenses increase with the family size, distance between origin and destination.

Indirect costs: They are essentially the opportunity costs, such as the unemployment period between leaving and starting jobs. Added to this are the costs of knowledge that the immigrant may incur, such as a new language, exclusive laws, updating of his knowledge... and if the immigrant has to accept a new kind of job, costs would be higher. In calculating return to migration, one should be careful to distinguish between increments in earnings due to migration and increments due to occupational change which may accompany migration.

The costs of a change in occupation depend on the age of the immigrant. Getting a new job, a new training, means receiving a new kind of human capital; the older he is, the less are returns to this new acquired human capital because of the shorter period of return. Moreover, within the occupation, he would get less earnings than the other individuals of the same age group due to their larger experience.

The lower the utility from the previously received human

capital is, the less is its influence on the the new job. Thus, the more the two jobs are distinct, the higher will be the forgone earnings due to migration, i.e. the higher the costs of migration.

Young persons do not get the same high costs because their -already- accumulated human capital is not as high as the older people. To forgo their previous human capital is not too costly, and getting a new kind of human capital is worthwhile because of the large period of return.

Sjaastad (1971, pp. 470, table 1) shows that the net out-migration from rural areas in the upper Midwest of U.S. (in 1950-1960) was 44.5% for the age group of 10-14 years, and 9.1% for the 20-24 years age group.

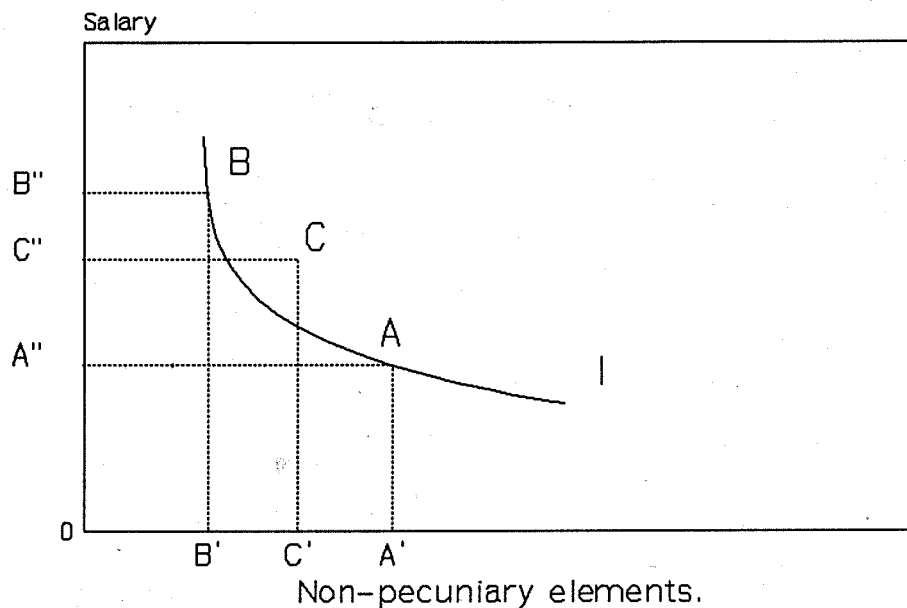
Included in these costs, are the non pecuniary costs, i.e. the psychological costs. They are essentially the difficulties of leaving family, friends, customs, culture, language...

The costs depend on the difference of social structure between both destination and origin. British immigrants to Canada have less psychological costs than do immigrants from India. The costs are higher when there is a social discrimination and hostility in the country or the city of destination.

M. Riboud (1978, pp. 16 - 17) and many economists do not consider these psychological costs as investments in human capital when it comes to a decision. When an individual decides to immigrate, the expected salary in the destination should not be merely higher but rather high enough to compensate for the psychological loss due to immigration. To explain that using an

indifference curve, A and B are on the same indifference curve. If immigration moves the individual from A to B, he might not decide to immigrate, but from A to C, he will. A'C' are the non-pecuniary costs which are at least compensated by C"A" (addition to salary).

Fig. 2.1



These costs are a sort of loss for the immigrant surplus. Suppose for a given distribution of incomes, there exists a minimum level "I", whereby the individual is indifferent between whether to migrate or not. Therefore, any higher level would be a surplus for this individual. This surplus may be taken away keeping him with no incentive to migrate. Therefore, these costs may not be included as a part of investment in migration.

RETURNS

Money returns: They consist of the increments in the salary,

a change in costs of employment and a change in prices or all three together. These advantages are expected to last for the whole employment period; thus it is the capitalized value of the flow of these advantages that should measure the real return. A longer employment period means a higher return, therefore one should expect higher flows of migrants from younger groups. Inflation should not be neglected, if higher costs of living are as high as new earnings (in the sense to match all increments of salary), then money returns are expected to be nil.

As in costs, economists should be careful when they calculate money returns to migration, because migration may be accompanied by new skills and training. Therefore, increments in earnings are not completely due to migration.

Non-money returns: They are essentially the new job satisfaction and the new life in the new environment. The decision to emigrate is based on the ex-ante satisfaction.

SOCIETY'S COSTS AND RETURNS.

Costs due to migration are not merely completely supported by migrants, because society has its own share. Costs borne by society depend on many factors: the longer the time required to get a migrant substituted by other factors of production, the larger the costs would be. However, these costs decrease whenever the period of retraining replacement is shorter. Therefore, we can expect that highly skilled persons are more costly than less skilled ones.

If the society benefits from the individual other than his

paid job like if he is: a) a volunteer in social work, b) an active society member who fights alcoholism or c) a large participant in the syndicats or the union movement, the society's cost increases. However, these losses are difficult to measure.

Many services provided by the government, such as education, health services, transfers, and many other kinds of services which increase the individual's human capital constitute social costs because they are publicly financed services. Therefore, unless the contribution to the tax system of a person is equal or greater than the value of his received services, his migration is a loss for society.

The country from which migration comes may get some returns from this act like remittances, influence of immigrants in the policy of the new residency toward the native country, the progress in sciences that occurs by the facilities that the receiving country offers to the coming scientists is a return for everybody (not always), including the native country and so on.

C- INVESTMENT IN HEALTH

Normally, economists treat labour and capital as the only factors of production. Both of these elements determine the level of output. Health and health services used to be considered as consumer goods that should be picked by the individual according to his / her preferences, which are constrained by his budget. Therefore, any expenditure on health reduces savings, and consequently reduces the formation of new capital. However, it is known that having good health increases the hours of work and the productivity of work, thus it is an investment placement in this view since it contributes to the quality of labour. Therefore health is a major issue that should be focused on in both developed and developing economies. In particular, developing countries need to explore the health issue for they are labour intensive producers.

In order to realize how important the prevention policy against diseases, therefore, how important is to have a healthy population, a study by the House select committee on children, youth and families (U.S.A) concluded that \$1 invested in childhood immunization saves \$10.00 in later medical costs and \$ 1 invested in prenatal care for poor women saves \$3.38 in hospital care for low birth weight babies. (see Garland, 1988, pp. 123)

Costs of illness and diseases are often underestimated. Impacts of mortality and sickness on economy are much wider than

often expected. Some impacts are direct, others are indirect.

Direct costs of mortalities, morbidities and disabilities are the expenditures paid for health care. Health includes hospitalization, prescriptions, and health infrastructure, etc... In a macroeconomic view, direct costs consist of use of resources devoted to (Mushkin and D'a Collings):

- 1-Health services provided by physicans, hospitals and nurses,...
- 2-Medical supplies such as drugs and appliances,...
- 3-Public health programs.
- 4-Medical research.
- 5-A part of costs of training health personnel.
- 6-A part of capital expenditures for construction of health facilities.

Direct costs are financed either by sick people (or their relatives) or by the government (international and charity agencies may be included). In both ways, people eventually pay either directly or indirectly through taxes. It is important to mention here that as patients decrease their contributions to the tax system the government is likely to shift this burden to healthy contributors to cover this shortage of revenues. Moreover, the additional expenses to treat the unhealthy people are financed by a heavier burden of taxes.

Indirect costs are the present value of all missed net earnings due to death. Indirect cost of morbidities and diseases are the foregone net earnings in the recovering period.

Decades, Baker and Schumann (1988) studied a case in Brazil to compare direct and indirect costs of mortality, morbidity and disability. To calculate losses due to mortality, they used 3 discount rates: 4%, 7% and 10%. They classified death causes as shown below in Table 3.

Table 3
Premature mortality losses by group of diseases
at different rates of discount

Group of diseases	4% discount	%	7% discount	%	10% discount	%
Gastro-enteritis	2511.78	5.9	1019.53	4.6	500.51	3.5
Tuberculosis	294.55	.69	194.93	.88	195.69	1.4
Injuries	4870.84	11.5	3035.12	13.7	2142.12	15.0
Respiratories	1712.79	4.0	724.39	3.3	379.3	2.6
Perinatal	5908.13	13.9	2160.91	9.7	918.85	6.4
Ill-defined	19114.11	45.1	9452.37	42.6	5782.73	40.3
All-other	7953.95	18.8	5611.34	25.3	4423.92	30.8
All diseases	42366.15	100%	22198.59	100%	14342.92	100%

Source: J. Decades; T. D. Baker & D. Schumann, 1988, pp. 138.

This table shows what losses due to mortality in total population using an annual minimum salary unit (= Cr\$ 10422.00) and different discount rates.

From this table, the percentage of losses due to

Gastroenteritis and respiratory diseases show a decreases as the discount rate goes up, because these diseases occur more often in younger age groups.

The percentages of Tuberculosis and injuries increase with the discount rate, since as they occur scarcely in the younger groups. Losses due to perinatal death decrease sharply with the discount rate as may be predicted.

Table 4 shows the results of the study concerning the weights of the direct and indirect costs.(Values are in the same units used in table 3):

Table 4

Direct and indirect costs of diseases

<u>Group of diseases</u>	<u>Total direct</u>	<u>% of total</u>	<u>Total indirect</u>	<u>indirect morbidity</u>	<u>Indirect mortality</u>	<u>Total</u>
Gastro-enteritis	636	30.4	1506	22.4	47.2	2142
Tuberculosis	130	13.4	852	67.0	19.6	982
Injuries	708	6.0	11275	68.7	25.3	11983
Respiratories	1629	54.7	1365	21.3	24.0	2994
Perinatal	57	2.5	2161	0	97.5	2218
Ill-defined	451	4.0	10746	11.55	84.42	11197
All - other	2410	15.5	13082	48.22	36.22	15492
All diseases	6020	100%	40988			47008

Source: J. Decades; T. D. Baker & D. Schumann, 1988, pp. 140.

Respiratory diseases caused more direct costs than indirect

costs, since it is expected that the "common cold" entails the purchase of medicine without affecting morbidity and mortality. Injuries show a large indirect costs which is due to morbidity (injuries are mostly caused by occupation and road accidents).

Large indirect mortality costs show up in the ill - defined category. This means there is a shortage in the number of physicians to diagnose the cause of death.

Regarding poor countries, health programs could have the following four consequences (Sorkin 1975, pp. 123):

1-Increasing the number of man-hours of work available.

Until the 50's, life expectancy in low income nations was about 30 years. Large increases in life expectancy can be achieved quickly and with fairly small direct outlays: Immunization, penicillin treatment and spraying with D.D.T. . The introduction of these services have reduced mortality by dramatic rates.

After introducing some health programs, death rate in Ceylon fell from 20.2 per 1000 in 1946 to 10.1 per 1000 in 1954 (Frederiksen, H. in Sorkin 1975, pp. 123). Given that birth rate is still the same, this decrease of the death rate will be reflected in an higher rate of population increase.

An important point here is that in developing countries, the real costs of health programs include not only the direct expenditures on public health, but also the pressure of the increasing propulation due to the higher rate of population increase.

2-Increasing the quality and productivity of the existing work

force.

Kraut and Muller (1946) did many studies to show the relation between calorie intake and industrial output. They observed that after 1943's rations in Germany that workers could lower their calorie consumption when lowering their output so that to re-establish equilibrium between intake and output. Another observation was that when 20 workmen received 820 calories each, they dumped 1.5 tons of debris per hour from railed car. After a heavy industry diet, their output became 2.2 tons per hour i.e. an increase of 46%. Workers of the pits of Ruhr coal mine (Germany) needed 1,150 to 1,200 work calories per ton of coal (Kraut and Muller, 1946, pp. 496). When rations during world war II were cut, output decreased as expected.

Kraut and Muller concluded:

"Our results prove that rationing of food also means rationing of industrial production of a country. Control of production is diverted from management to those responsible for food administration, who often cannot see the consequences of this decision. Under existing conditions, the job of one man often had to be done by two or three men with a higher total wage cost." (Kraut and Muller, 1946, pp. 497).

3-Making feasible the development of previous unsettled regions.

The introduction of health programs may open a large way to develop regions that had been impossible to invest in because of very unhealthy conditions. For instance, the Rapti Valley of Nepal had been almost without habitants for centuries until the 1950's due to severe hyperendemic malaria of the Terai forests below the

Himalayan foothills. A widespread mosquito program during the 1950's opened the fertile valley to farmers. By late 1960's, the population of the valley increased ten times and there has been a rapid increase in agricultural and extractive industries. (Sorkin, 1975, pp. 125 - 126)

4-Changing the attitudes of persons toward innovation and entrepreneurship.

Most of the poor, especially poor farmers, take poverty as predestined and inevitable. They have no initiatives, they are "ambition-less". When a health program is introduced and since it is highly visible, its effects would be reflected on other matters rather than health, especially in economic activities due to a more optimistic view towards life.

Malnutrition for a pregnant women is reflected on a deterred brain development of the unborn fetus. This damage may not be treated after the child is 2 or 3 year old (Sorkin, 1975, pp. 127). This bad brain development causes the child to procede to have a non rational behavior and will continue to do so until the end of life. Therefore healthy women will give birth to a healthy baby who possess a rational attitudes.

Finally, it should be mentioned that there are externalities from good health, i.e. by vaccination, not only those vaccinated people have less chance to get a disease, also those who were not are less likely to be seized by this disease for its narrow expansion by the effect of vaccination, i.e. reducing the contagious risk.

A: A CAUSAL MODEL FOR
INCOME DISTRIBUTION

C. Dagum (1978, 1989) included human capital in a causal model showing how it affects income and income distribution. If $A = \{a_1, a_2, \dots, a_n\}$ is a sample space of N economic units (individuals or households). Each unit, a_i , is characterized by a 12 component vector x_i , these components are:

1- Age: Earnings have been found to increase with age (see Mincer 1974 and Becker 1975). Increments to earnings are positive, but decrease with time, so that earnings are increasing by a decreasing rate until they peak at the age of 36 -40 years in Pakistan (see Guisinger, Henderson and Scully, 1984, pp. 240) and at the age of 45-50 years in U.S.A. (see Mincer 1974, pp. 70). The increments in earnings are due to a larger experience, which is partially offset by a given rate of depreciation of human capital. But Mincer's study has not shown a visible decline of weekly earnings at later age, so that the decreasing in earnings is due, he explained, to the decreasing time spent at work.

2- Schooling: The regression of Mincer's schooling model (see below), shows that the marginal rates of return to education were 17.4% after 8 years of schooling and 15.1% after 12 years and 12.8% after 16 years. (Mincer 1974, pp 93).

However, Mincer has concluded that the contribution of

CHAPTER III

HUMAN CAPITAL
AND INCOME DISTRIBUTION.

This chapter is concerned mostly with income distribution. In part A, a general model of income distribution is presented to serve as a frame of reference to see what is the position of human capital and its importance in the shape of society's income distribution. Part B is the presentation of Mincer schooling and post-school training model; this model has been chosen to show how the shape of investments changes over age. Part C presents the production function of Yoram Ben Porath, which shows the main factors in producing own human capital and how earnings shape changes over age. Part D deals with Becker approach of income distribution. His tools are demand and supply curves for human capital.

education to earnings decreases as the individual receives more experience. It explained about 25%, 27%, 30% and 30% of earnings when experience is (1-3), (4-6), (7-9) and (10-12) years respectively and then starts to decline until it gets 9% at the range of (37-39) years of experience. (Mincer 1974, pp. 57).

Guisinger, Henderson and Scully (1984) calculated the marginal correlation between earnings and education and found it to be in the range of 64.2 to 80.7%. (pp. 261).

3- Experience: Guisinger, Henderson, and Scully (1984) applied Mincer's model to a sample of the population in Rawalpindi (Pakistan). They found that Rawalpindi's employees get their maximum earnings after 38 years of experience and then they decline (pp. 268). The marginal correlations, R^2 s between earnings and experience was in the range of 13.7% to 28.1%.

4- Occupation: Occupation impacts on earnings are significant. Eventhough administrative workers, and professional and technical workers (in Pakistan) are both highly educated, the first group saw an increase of 1% over the period 1968 - 1975, in contrast, the second group saw a 78% increase.

With other occupations such as tailors, cooks, taxi drivers and manufacturers, the increase in earnings between 1959 - 1979 were completly heterogenous: 145, 297, 233 and 291% respectively. (See Guisinger, Henderson, and Scully, 1984, p.p. 264)

5- Sex: Renshaw's estimation of return to education (1971) showed a substantial difference in earnings between males and

females. Substantial differences were, also, observed within each group according to race subgroupings.

Becker (1975) said:

"Many women drop out of college after marriage, and college women are more likely to marry educated and wealthy men. Then well-known facts suggest that women go to college partly to increase the probability of marrying a more desirable man. If the marriage factor were important, the gain to women from additional schooling should be determined by family earnings classified by the wife's education rather than by personal earnings so classified, and the full money gain to women may be much higher than previous estimates have indicated." (Becker, 1975 pp. 179)

Becker proved this in his regression in the same book. Family earnings (parent's earnings) of men with a given level of education are less than those of women with the same level of education, especially at higher levels. My explanation of this data is as follows: Because of the intellectual level a woman attains by higher education, she becomes highly integrated with people of the same level of education through relationships she has to have at work, university, conferences, and so on. Therefore, her chances of marrying an educated man are higher, and, then a higher family earnings would be observed.

6- Market imperfection, (degree of market segmentation):

Filtering down is the hypothesis of Knight and Sabot (1983) to explain the high significance of the interaction between the levels of education and experience. The relationship between the level of education convenient to fill a given position, and the level of earnings varies along with the variations in labour demand and

supply conditions. An increase in the educated labour supply depresses the return to education. This depression is strengthened by the fact that the occupation of the individual is protected from market competition. Moreover, the downward effects on higher labour supply has been weakened by the security of tenure, so that the earlier employed have higher earnings, which is not adjusted.

7- Institutional constraints (such as discrimination, inheritance law...): Kiker and Roberts (1984) found, in an applied regression for series of data between 1966 and 1970 in U.S.A., that under some given conditions, a white young male's first year of experience will raise his wage by 11.2%, the second year by 7.3%, and the third year by 6.7%. Under the same conditions, a non white male receives for his first year of experience an additional 9.0% of his income, 5.2% for the second year and 4.6% for the third year. (Kiker and Roberts 1984, pp. 277)

8-Initiative: Which is a completely psychological factor affecting highly the abilities of receiving human capital and earnings.

9, 10, 11 & 12- Parental education, Parental occupation, Parental assets and Socioeconomic environment: These factors are highly involved in the growth of the individual. Highly educated parents are likely to be more consistent in their reaction against any wrong behavior of their children. Their occupation and relationships with society enhance the opportunity of better

positions for their children.

The sample space A is then mapped into a 12 dimension positive euclidean space R^+_{12}

$$\Phi_1: A \rightarrow R^+_{12}; \mathbf{x} = \Phi_1(a)$$

Each component x_1 of the vector \mathbf{x} , is mapped into another vector

$$(h_1, k_1, \theta_1)$$

where h_1 , k_1 , θ_1 represent the individual's human capital, his assets, and his indebtteness.

$$\Phi_2: R^+_{12} \rightarrow R^+_3; (h, k, \theta) = \Phi_2(\mathbf{x})$$

The vector $\Phi_2(\mathbf{x})$ is the main determinant of the level of income y the individual receives,

$$\Phi_3: R^+_3 \rightarrow R^+; y = \Phi_3(h, k, \theta)$$

This function may be represented by

$$y_1 = w_1 h_1 + \rho_1 k_1 + \lambda_1 \theta_1 + \alpha_1 k_1 h_1$$

which is **the income generating function.**

- w_1 is the rate of return on the individual's human capital h_1 .
- ρ_1 is the rate of return on the individual's assets k_1
- λ_1 is the percentage cost to pay on debt : $\lambda_1 < 0$.
- α_1 is the rate of return due to the interaction between human capital and assets.

Therefore, human capital is not the only source of revenue. Then whenever an explanation of income is to be presented, it should not ignore the other factors presented in the income

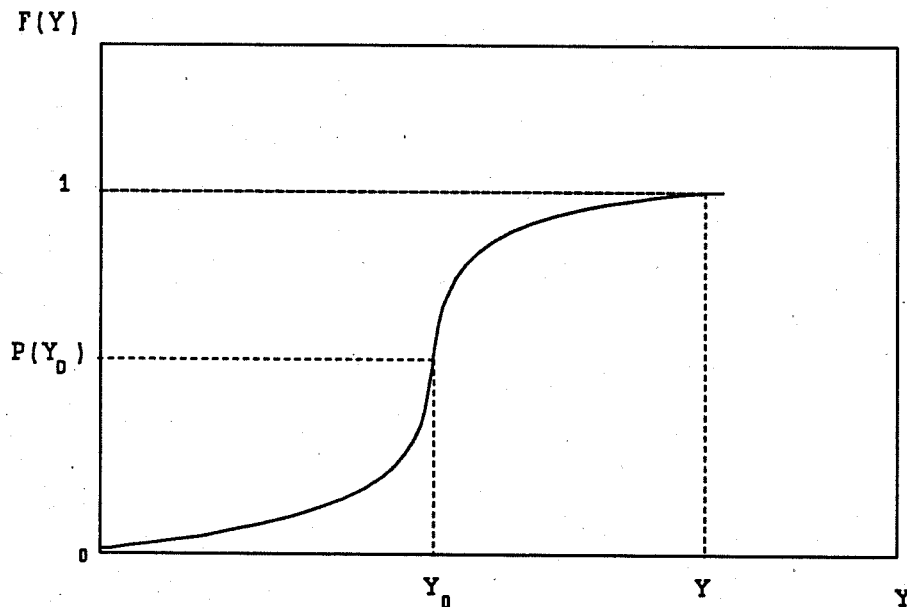
generating function.

Mapping R^+ into the interval $[0,1)$ to transform total income $Y = \sum_{i=1}^N y_i$ into a unit mass, is the F function, which is called **the cumulative distribution function**.

$$F: R_+ \rightarrow [0,1), F(y) = P(Y \leq y)$$

Graphically, F would have this shape:

Fig 3.1



$F(y)$ is the individual's probability to get an income less than or equal to y .

Lorenz curve is given by:

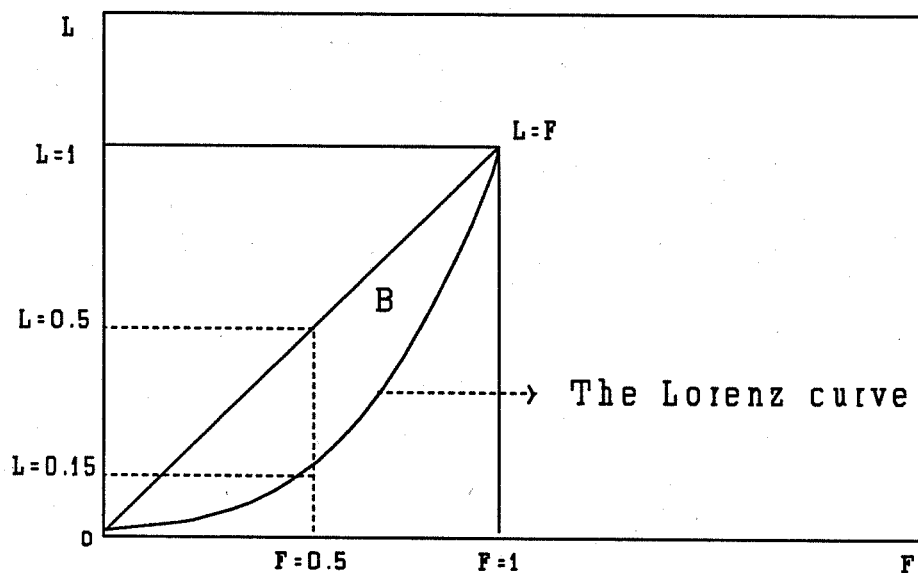
$$L: [0,1) \rightarrow [0,1): L(F) = \left[\int_0^F y(P) dP \right] / E(y).$$

It maps the cumulative probability distribution of the economic

units into their cumulative mass of income as a part of this unit mass.

$L(F)$ is the share of income that the first $F\%$ of the sample space receives. In a perfect equality, this corresponds to $F\%$ of income.

Fig. 3.2



The points of the Lorenz curve are given by:

$$(1/N, y_1/Y), (2/N, y_1+y_2/Y), \dots (i/N, \sum_{j=1}^i y_j/Y), \dots [(N/N), \sum_{j=1}^N y_j/Y] \\ = (1, 1)$$

A more convex Lorenz curve would imply that income distribution is more imperfect, and which is reflected by a larger area B between the diagonal ($L = F$) and the Lorenz curve. Given that the marginal

utility is a decreasing function of income, a transfer from a high income group to a low income group will increase the welfare of the society. A larger increase in society's welfare can be obtained if instead of transferring a given amount, it is invested in the educational system to raise the opportunities of higher earnings for the low-income groups. Besides, this is a permanent way of increasing social welfare by increasing the stock of human capital and decreasing the inequality in its distribution. Graphically, this is reflected by decreasing the area "B"; in the limit, this area is zero, when the following condition is satisfied:

$$L = F$$

which corresponds to the case of perfect equality.

B: MINCER'S MODEL. (1974).

Investment in human capital is related to psychological and social behavior much more than physical capital. Therefore, to manipulate the model of human capital, we should take into account some assumptions:

- All investment costs are foregone earnings: i.e. the earnings that the individual would keep by not investing. Mincer dropped the direct costs because summer and part time earnings may exactly offset these costs, also because training costs are mostly foregone earnings.
- Life span is given, or more accurately ^{ment}retire~~d~~ age is given, so that each additional year of schooling or in the job training reduces the span of the individual's working life.

Let

n = Working life + length of schooling.

= working life for persons with no schooling.

Y_s = Annual earnings for individual after s years of schooling.

V_s = Present value of individual lifetime earnings after s years of schooling.

r = Discount rate. (The rate used to actualize future values.)

$t = 0, 1, 2, \dots$ Time in years: continuous or discrete variable.

d = Difference in the amount of schooling.

Then

$$V_s = Y_s \sum_{t=s}^n \left(\frac{1}{1+r} \right)^t \quad (1)$$

and if t is continuous, which is more convincing

$$V_s = Y_s \int_s^n e^{-rt} \cdot dt = \frac{Y_s}{r} (e^{-rs} - e^{-rn}) \quad (2)$$

The present value of the earnings of an individual after $s-d$ years of schooling is

$$V_{s-d} = Y_{s-d} \int_{s-d}^n e^{-rt} dt = \frac{Y_{s-d}}{r} (e^{-r(s-d)} - e^{-rn}) \quad (3)$$

and by letting

$V_s = V_{(s-d)}$, in order to get the rate of return,

then

$$\frac{Y_s}{r} (e^{-rs} - e^{-rn}) = \frac{Y_{s-d}}{r} (e^{-r(s-d)} - e^{-rn}) \quad (4)$$

The ratio $k_{s,s-d}$ is equal to

$$k_{s,s-d} = \frac{Y_s}{Y_{s-d}} = \frac{(e^{-r(s-d)} - e^{-rn})}{(e^{-rs} - e^{-rn})} = \frac{e^{-rn} (e^{-r(s-d-n)} - 1)}{e^{-rn} (e^{-r(s-n)} - 1)} \quad (5)$$

$$k_{s,s-d} = \frac{e^{r(n+d-s)} - 1}{e^{r(n-s)} - 1} \quad (6)$$

Now, $k_{s,s-d}$ is:

- An increasing function of r , which means that the higher the rate of return to schooling is, the higher the ratio in earnings due to difference in schooling is.

- A decreasing function of n : the longer the working life spans, the longer the period to catch up is.

- And it is greater than unity, i.e. people with higher schooling investments get higher earnings.

- An increasing function of s , i.e. the difference in earning between individual with 12 years of schooling and another with 10

years of schooling ($s=12$, $d=2$) is greater than the difference between other 2 individuals with respectively 5 and 3 years of schooling ($s=5$, $d=2$). For the time being, we will neglect this fact to simplify our work especially that,

$$\lim_{n \rightarrow \infty} \frac{\delta k}{\delta s} \rightarrow 0$$

$$\lim_{n \rightarrow \infty} \frac{\delta k}{\delta n} \rightarrow 0$$

(Both partial derivatives have very small values when r and n are in the neighbourhood of 0.1 and 40 respectively. See Mincer, 1974, pp. 10).

Therefore, we will treat k as a constant to simplify our analysis. Now, if we redefine n as the fixed span of working life, the assumption will be more realistic, then

$$V_s = Y_s \int_s^{n+s} e^{-rt} \cdot dt = \frac{Y_s}{r} e^{-rs} (1 - e^{-rn}) \quad (7)$$

$$V_{s-d} = Y_{s-d} \int_{s-d}^{n+s-d} e^{-rt} \cdot dt = \frac{Y_{s-d}}{r} e^{-r(s-d)} (1 - e^{-rn}) \quad (8)$$

for

$$V_s = V_{s-d} \Rightarrow$$

$$k_{s,s-d} = \frac{Y_s}{Y_{s-d}} = \frac{e^{-r(s-d)} (1 - e^{-rn})}{e^{-rs} (1 - e^{-rn})} = e^{rd} \quad (9)$$

supposing that $s = d$, i.e. $k_{s,0}$ is the ratio between earnings after s years of schooling and earnings with no schooling at all, then

$$k_{s,0} = \frac{Y_s}{Y_0} = e^{rd} = e^{rs} \quad (s=d)$$

$$\Rightarrow \log Y_s = \log Y_0 + rd$$

$$\log Y_s = \log Y_0 + rs \quad (10)$$

Therefore, the log of an individual's earning with s years of

schooling is an increasing function of the log of an individual's earning with no schooling at all, and an increasing function of the rate of return and the length of schooling.

POST-SCHOOL INVESTMENT:

In the above analysis, experience after schooling has been neglected. It was supposed that earnings are function of schooling, but not of after schooling activities. Since individuals continue to invest after schooling and after starting their working life, eq.(10) should be developed to include the experience and training costs and their corresponding returns. If we suppose that people start their working life just after their schooling is over, then j measures the years at work, and we suppose $j = 0$ for the first year. On the other hand, if C_j is the amount of the post-school investment in year j and its corresponding rate of return is r_j , then the net earnings in year j is

$$Y_j = Y_s + \sum_{t=0}^{j-1} r_t C_t - C_j \quad (11)$$

$$Y_s + \sum_{t=0}^{j-1} r_t C_t = E_j \quad (12)$$

$$Y_j = E_j - C_j \quad (13)$$

where E_j is the gross earning or earning capacity.

The variation of earnings with experience is shown by considering the annual increment of earnings:

$$\Delta Y_j = Y_{j+1} - Y_j = r_j C_j - (C_{j+1} - C_j) \quad (14)$$

$$\Delta Y_j > 0 \text{ if } r_j > \frac{C_{j+1} - C_j}{C_j}$$

That is, earning increases whenever investment costs decrease from one period to the next [$(C_{j+1} - C_j) < 0$], or when investment costs increase at a rate below r .

We should make the Yoram Ben Porath's assumption that human capital investment does not affect the individual's utility function. Otherwise, utility maximization of an individual may not be optimal at earnings maximization. People may get utility other than earnings from schooling and experience: one may like to learn because of his interest in learning per se.

As we have pointed out before, life span is fixed, and is divided into work time, during which individuals get their earnings, and human capital investment. The more the time devoted to training, schooling, or any activity that accumulates human capital is, the less the time during which the individual can earn from, but the higher the capacity to earn. Well, if working life span is n , would the individual invest in the n^{th} period? No, he will not since the goal of the individual is to maximize his utility. Any investment in period n means a loss, because its return is zero.

He will not invest any amount unless he makes sure that the increment in his earning capacity in the next working periods would cover the cost of investments plus the return expected. The earlier an individual invests, the larger the period of returns will be, and so will be the return (no depreciation has been assumed until

now). That is why schooling, the most intensive human capital investment, precedes training, which is much less intensive investment. Therefore, a fixed C_j is not conceivable for maximization reasons, since, rationally, higher investments should be undertaken earlier.

As long as investment is positive, gross earnings always increase,

$$\Delta E_j = r_j C_j \quad (15)$$

For simplicity, let us consider a fixed $r_j = r$.

Now, from the equation above

$$\Delta^2 E_j = r \Delta C_j < 0 \quad (16)$$

for the general case of a declining C_j .

On the other hand, net earning increasing profile is from eq.(13) and eq.(16)

$$\Delta^2 Y_j = r \Delta C_j - \Delta^2 C_j < 0 \quad (17)$$

if the decline in investments is a non_increasing function of time, Y_j would have a concave shape over time. However, if investments were declining strongly over time, so that $r \delta C_j$ is too small to compensate for $\delta^2 C_j$, Y_j would have a convex profile, which means that net earnings are increasing at an increasing rate over time.

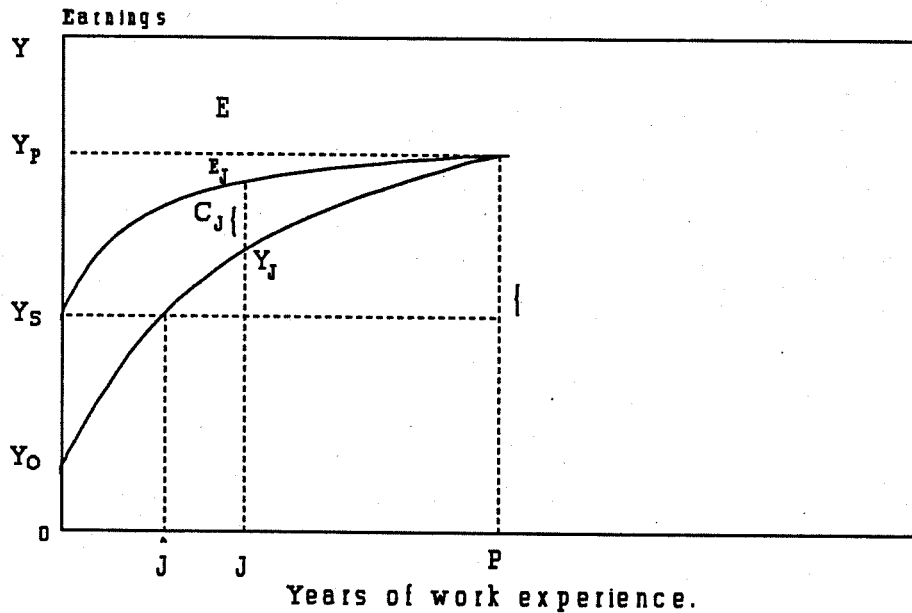
The slope of the net earnings profile is from (13)

$$\Delta Y_j = \Delta E_j - \Delta C_j > 0 \quad (18)$$

which is steeper than the slope of the gross earnings profile. Both earnings reach their maximum values whenever net investments are equal to zero. From eq.(13), while $C_j > 0$, Y_j is smaller than

E_j . Moreover, since the difference between both earnings is C_j , which is a decreasing function of time, both earnings' curves become closer and closer until they intersect at $C_j = 0$, at which point investments are no more undertaken.

Fig 3.3



At the beginning of the working life, the difference between both incomes is maximum (investments are higher in early life). As time is progressing, C_j is decreasing, the rate of increase of Y_j is higher than E_j 's. At \hat{J} , the observed earnings become equal to Y_s , i.e. the initial earnings capacity due to s years of schooling, \hat{J} is the overtaking year. (see Mincer, 1974)

Calculating \hat{J} opens a clear way to continue the analysis.

Using eq. (11) and $r_j = r$:

$$Y_j = Y_s + r \sum_{t=0}^{j-1} C_t - C_j = Y_s \quad (19)$$

therefore

$$r \sum_{t=0}^{j-1} C_t = C_j \quad (20)$$

and if investments are equal from $j=0$ to $j=J$, then

$$r \sum_{t=0}^{j-1} C_t = r J C \quad (21)$$

\Rightarrow

$$r J C = C \Rightarrow J = 1/r \quad (22)$$

but since C_j is decreasing, then from (20)

$$r = [C_j / \sum_{t=0}^{j-1} C_t] < (C_j / j C_j) \quad (23)$$

because

$$\sum_{t=0}^{j-1} C_t = C_0 + C_1 + C_2 + \dots + C_{j-1} > j C_j$$

and if C_t is not a decreasing function over time, then

$$r \leq (1/J) \Rightarrow J \leq (1/r) \quad (24)$$

This means that if r is higher than 8%, then it takes less than 12.5 years ($1/0.08$) for the trained person to overtake the untrained one once they start their working life with some initial earning capacity.

Because less schooled individuals enter the labor force earlier, they gain a longer period of experience than those of the same age with longer schooling period. Therefore, Mincer grouped his data depending on the length of the schooling period.

Referring to 1959 U.S. census of the population's earnings, Mincer estimated different overtaking years for different levels of schooling. It was found that the overtaking years are 7, 7 to 8, and about 8 to 9 for 0 to 8, 8 to 9, and more than 9 years of schooling, respectively.

The rate of return was 19.6 for those with 8 years of schooling, 13.2 for those with 12 years, 10.2 for those with 16 years, and 73 for those with more than 17 years of schooling.

C: THE PRODUCTION FUNCTION

In a nice description, Yoram Ben Porath (1967) explains the path of both the human capital acquired over a lifetime, and its earnings shape.

If α_0 is the rate of return of each unit of the homogeneous human capital K_t , then Y_t , the earnings capacity at time t , is

$$Y_t = \alpha_0 K_t \quad (25)$$

The human capital production function is

$$Q_t = \beta_0 (s_t K_t)^{\beta_1} D_t^{\beta_2} \quad (26)$$

where

Q_t = The quantity produced of human capital at time t .

D_t = Inputs used to produce human capital other than the enhanced human capital.

s_t = The fraction of human capital allocated to produce human capital. It is also the fraction of time devoted to produce human capital, assuming that there is no joint production of earnings and human capital.

$\beta_0, \beta_1, \beta_2$ are parameters, where $\beta_1, \beta_2 > 0$, $(\beta_1 + \beta_2) < 1$.

$(\beta_1 + \beta_2)$ must be less than unity; otherwise, the production frontier that describes the different possible combinations of earnings and human capital production would be a straight line, or convex from below (if $(\beta_1 + \beta_2) > 1$). (See Ben Porath 1967, pp. 1.17 - 1.27)

One's human capital contributes significantly to the human

capital production. It is due to my own studies in economics that I can write this paper, and it is my knowledge in econometrics that will help me do an empirical research. Uses of computers, my professors, knowledge, and library services are included in D_t .

s_t is a constraint: $0 < s_t < 1$, it cannot be greater than one, because when it is equal to unity, $Q_t = \beta_0 (k_t)^{\beta_1} D_t^{\beta_2}$. This is the case of students, and of everyone else, who devotes all his existing stock of human capital to acquiring more of it; that is of everyone else who is a fully devoted to acquire human capital.

Being rational, the investor should minimize the cost of production I (total investments in producing human capital), which is given by

$$I = (\alpha_0 s_t K_t) + (P_d D_t) \quad (27)$$

where P_d is the price of a unit of purchased input D_t , and α_0 is the price of a used unit of human capital. Minimizing I , which is constrained by Q_t (26), we get

$$\frac{\alpha_0 s_t K_t}{P_d D_t} = \frac{\beta_1}{\beta_2} \quad (28)$$

therefore

$$P_d D_t = \alpha_0 s_t K_t (\beta_2 / \beta_1)$$

then

$$I - \alpha_0 s_t K_t = P_d D_t$$

$$\rightarrow I - \alpha_0 s_t K_t = \alpha_0 s_t K_t (\beta_2 / \beta_1)$$

$$\text{then } I = [(\beta_1 + \beta_2) / \beta_1] \alpha_0 s_t K_t$$

$$\rightarrow \alpha_0 s_t K_t = [\beta_1 / (\beta_1 + \beta_2)] I_t \quad (29)$$

Ben porath distinguishes between three concepts of earnings:

-Earning capacity (cited above): $Y_t = \alpha_0 K_t$

-Observed earnings: $\acute{E}_t = Y_t - \alpha_0 s_t K_t$

and from (29) $\acute{E}_t = Y_t - [\beta_1/(\beta_1+\beta_2)] I_t$ (30)

-Disposable earnings: $E_t = Y_t - I_t$ (31)

where the observed earnings are what the earner receives as he works. They are an increasing function of his embodied human capital. The difference between earnings and observed earnings in each period is the forgone earnings of that part of human capital that has been devoted to the production function. Disposable earnings, are earnings devoted to consumption, investment in tangible capital, assets, leisure, etc... They differ from the observed earnings by the amount paid by the earner to get his purchased input into his human capital production function. Another way to express \acute{E} is

$$\acute{E}_t = \alpha_0 K_t (1 - s_t) \quad (32)$$

where s_t is the proportion of human capital devoted to produce more of human capital. Therefore, $(1-s_t)$ is the fraction of human capital devoted to earnings. \acute{E} differs from the earning capacity by the whole amount of indirect expenditures used to build up human capital. Therefore, whenever the earner is investing in his human capital, we have the relation

$$Y_t > \acute{E}_t > E_t.$$

Earnings capacity is an increasing function of time as long as investments are in progress, and as long as the additions to the stock of human capital are higher than depreciation. The profile

of earnings capacity could be detected by the first order derivative of Y_t .

$$Y_t' = \delta Y / \delta t = \alpha_0 K_t' = \alpha_0 (Q_t - \epsilon K_t) \quad (33)$$

where ϵ is the rate of depreciation of the human capital.

The first order derivative of the observed earnings is

$$\dot{E}' = Y_t' - [\beta_1 / (\beta_1 + \beta_2)] I_t' = \alpha_0 (Q_t - \epsilon K_t) - [\beta_1 / (\beta_1 + \beta_2)] I_t' \quad (34)$$

The first order derivative of disposable earnings is

$$E' = Y_t' - I_t' = \alpha_0 (Q_t - \epsilon K_t) - I_t' \quad (35)$$

$I_t' = \delta I / \delta t$ is negative (except for $t=T$), which means that investments are decreasing as a function of time. We have pointed out before that large investments precede little ones, due to the decreasing length period of earnings as t increases. From $I_t' < 0$, $Y_t' < \dot{E}' < E_t'$, that is, the rate of change of the observed earnings is larger than earnings capacity's rate of change and smaller than that of disposable earnings.

When the observed earnings reach their maximum, then $\dot{E}' = 0$, thus

$$\alpha_0 (Q_t - \epsilon K_t) = [\beta_1 / (\beta_1 + \beta_2)] I_t' \quad (36)$$

At this point of time, the rate of decline of the opportunity costs of the part of the stock of human capital devoted to its production is equal to the rate of decline of earnings capacity of human capital. This means that at this stage, earnings capacity has already reached its maximum because of the following:

$$\alpha_0 (Q_t - \epsilon K_t) < 0 \rightarrow Q_t < \epsilon K_t$$

Now, from the minimization condition in (28):

$$I = [(\beta_1 + \beta_2) / \beta_1] \alpha_0 [(\beta_1 P_d) / (\beta_2 \alpha_0)]^{\beta_2 / (\beta_1 + \beta_2)} (Q_t / \beta_0)^{(1 / \beta_1 + \beta_2)} \quad (37)$$

→

$$\delta I / \delta Q = MC_t =$$

$$(\alpha_0 / \beta_1) [\beta_1 P_d / \beta_2 \alpha_0]^{(\beta_2 / \beta_1 + \beta_2)} (1 / \beta_0)^{[1 / (\beta_1 + \beta_2)]} Q_t^{[(1 / \beta_1 + \beta_2) - 1]} \quad (38)$$

In a perfect competition model, $MC_t = P_t$, where P_t is the price of each unit of human capital. $(\beta_1 + \beta_2) < 1 \rightarrow MC_t$ is an increasing function of Q_t , so that costs rise with the speed of production.

The second order derivative of (38) is

$$\delta^2 I / \delta Q^2 =$$

$$[(1 / \beta_1 + \beta_2) - 1] [(\alpha_0 / \beta_1) (\beta_1 P_d / \beta_2 \alpha_0)]^{(\beta_2 / \beta_1 + \beta_2)} (1 / \beta_0)^{[1 / (\beta_1 + \beta_2)]} Q_t^{[(1 / \beta_1 + \beta_2) - 2]} \quad (39)$$

which is positive, so that the curve of I is convex from below.

This proves that the MC_t curve is an increasing function of Q_t .

$$\delta^3 I / \delta Q^3 =$$

$$\{[(1 / \beta_1 + \beta_2) - 2] [(1 / \beta_1 + \beta_2) - 1]\} [(\alpha_0 / \beta_1) (\beta_1 P_d / \beta_2 \alpha_0)]^{(\beta_2 / \beta_1 + \beta_2)} (1 / \beta_0)^{[1 / (\beta_1 + \beta_2)]} Q_t^{[(1 / \beta_1 + \beta_2) - 3]} \quad (40)$$

According to Y. Ben Porath assumption, $[(\beta_1 + \beta_2) < 1]$ the MC_t curve couldn't be known if it is concave, convex, or a straight curve. It depends on the value of $(\beta_1 + \beta_2)$:

$\beta_1 + \beta_2 > 1/2 \rightarrow$ the curve is concave.

$\beta_1 + \beta_2 = 1/2 \rightarrow$ the curve is a straight line.

$\beta_1 + \beta_2 < 1/2 \rightarrow$ the curve is convex.

If $\beta_1 + \beta_2 > 1/2 \rightarrow \lim MC_t(Q_t \rightarrow \text{inf}) = \text{constant}$

and if $\beta_1 + \beta_2 \leq 1/2 \rightarrow \lim MC_t(Q_t \rightarrow \text{inf}) \rightarrow \text{infinity}$

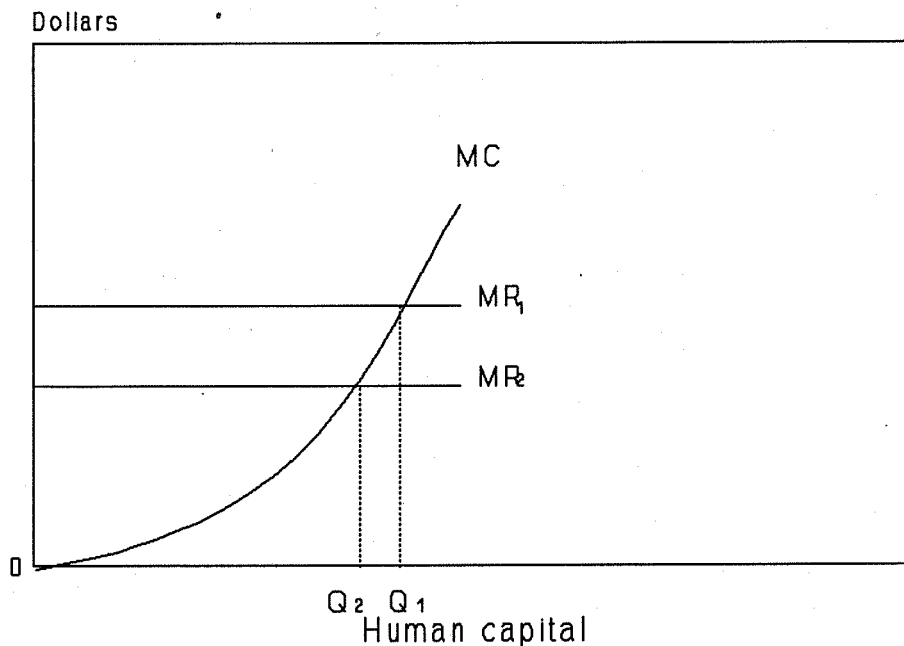
but in a slightly different model, Ben Porath (1970) has shown that the homogenous production function of human capital is of a degree close to one (about 0.9 or larger) .i.e. $\beta_1 + \beta_2 \sim 1$, therefore the

marginal cost curve is concave from below.

The interpretation of β_1 and β_2 is crucial, and we shall return to it later in this section.

On the other hand, the marginal revenue of each unit of human capital is not a function of Q_t , rather a function of the length of the period, during which this unit will add earnings to the investee. Therefore, given that working lifetime is fixed, each additional unit of Q_t will earn less, as it is produced later. Thus as t increases, marginal revenue will decrease. Note that the higher the rate of depreciation is, the lower the marginal revenue is.

Fig 3.4



From the graph, (see Mincer, 1974, pp. 15) it is clear that human capital production is an increasing function of MR_t and a

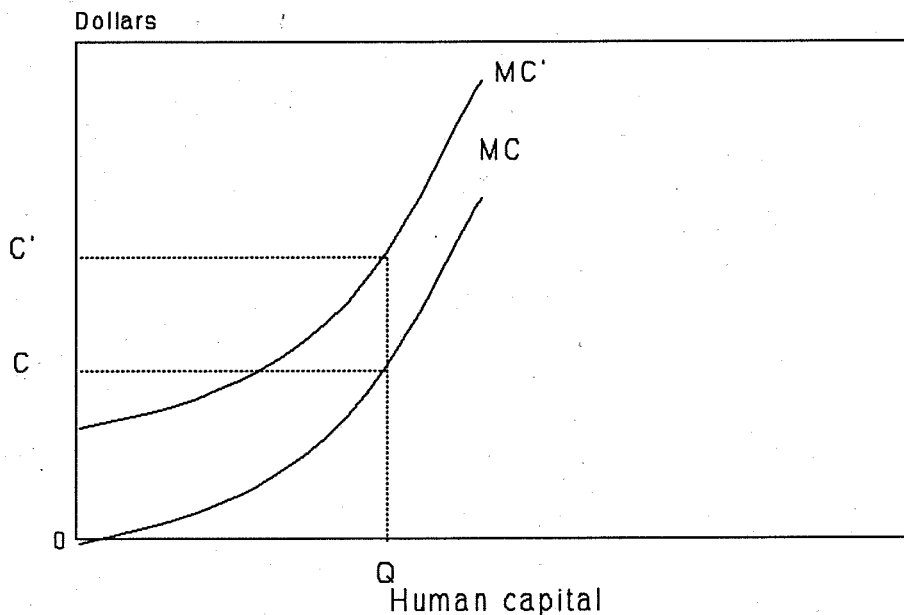
decreasing function of MC_t . Now, if we change the way in which we've written the MC_t , we get

$$\delta I / \delta Q = MC_t = (1/\beta_0 \beta_1) [\beta_1/\beta_2]^{(\beta_2/\beta_1+\beta_2)} (1/\beta_0)^{[1/(\beta_1+\beta_2)]} \alpha_0^{(\beta_1/\beta_1+\beta_2)} P_d^{(\beta_1/\beta_1+\beta_2)} Q_t^{[(1/\beta_1+\beta_2)-1]} \quad (41)$$

It should be clear from this equation how the marginal cost changes; whenever there is a change in the price of purchased input (P_d), or in the price of human capital. It depends on their relative importance: $\beta_1/(\beta_1+\beta_2)$ and $\beta_2/(\beta_1+\beta_2)$.

If one of both inputs gets a higher price, this will shift the MC curve upward. The degree by which it will shift depends on the importance of its corresponding parameter. At each stage, the quantity produced of human capital would be less, even though the marginal revenue is the same.

Fig3.5



The point, where the person doesn't devote all his stock K to reproduce human capital is when s_t becomes < 1 . When $s_t = 1$, MC_t of eq.(38) may not be the exact price, because at that time with a small stock of human capital (and given that both inputs into the production go together in the same direction), the investor may use more of the D_t , in a way that he doesn't minimize his costs. Therefore, the marginal cost given by eq.(38) represents only the lower limit of the shadow price of human capital.

As K goes up, the marginal cost of producing human capital should be affected, because it gives more of the "missed" input into eq.(37) which means a lower marginal cost. But if at the next period Q is to be increased, then both inputs must increase. Now if the previous increase in the human capital compensates at least this need, it would decrease the marginal cost or at least would keep it the same; otherwise, the marginal cost would increase.

The neutrality hypothesis

Suppose that in a period of time, s becomes equal to zero; that is the earner devotes all his human capital stock to the market. After a long period as this, the earner will get a higher income due to his long experience. It seems like a contradiction that $s = 0$, and K is not increasing (as we conclude from the model), but is decreasing due to certain degree of depreciation, indeed, earnings become higher.

Therefore, some kinds of market activities could in themselves increase the stock of human capital, some other activities do not contribute directly to earning capacities, but do increase the

ability of acquiring more skills, thus increasing indirectly the earning capacity.

In the early stage of education, the pedagogic purpose of schooling is to increase the efficiency of the student in producing human capital and to increase his ability of learning. In other words, the purpose is to decrease the investment costs in the future. This kind of education doesn't increase earning capacity by the same percentage that it does in learning power.

If at any time, the individual becomes more productive in market activities, his opportunity costs then would be higher, so his total, unless there is a change in the parameter of the equation that matches this change. In any case, holding constant the parameters of the production function is a strong hypothesis which is not expected to hold. (We have seen that with more education, larger choices and opportunities of learning are open to the individual.)

s_t changes during life periods: In schooling time, it is equal to one, i.e. all time and all human capital resources are devoted to the production of human capital.

The second period is when the individual starts his earning period, where time is devoted either to produce human capital or to earn, i.e. $0 < s_t < 1$

The last period, where no human capital is to be produced, because there's no need for it, but the stock of human capital exists; the higher the individual human capital stock, the higher is the value of his time, so the foregone earning is increasing,

thus the marginal cost of producing each additional unit of human capital is higher. We can imagine then that the marginal cost function is an increasing function of the quantity produced.

On the other hand, the present value of human capital is the price which Ben Porath proved to be independent of the quantity of human capital, but as time goes on, the total earnings from a given stock declines (because earning period declines). So we can imagine the demand function for the human capital function as horizontal lines (independent of Q), but sliding down with time.

Ben Porath's major empirical findings:

Ben Porath referred to the U.S. census of population regarding earnings in 1959. He found that the shape of the earnings profile of all levels of education is significantly steeper in the first decade; later on, the slope of this shape decreases. Moreover, the steepness of the first decade of earnings is higher the higher the level of education is, reflecting a higher level of human capital investments for the highly educated people.

For all levels of education, the median is lower than the corresponding mean. This gap increases absolutely and relatively with age; therefore, one sees that skewness of income distribution is to increase with the level of education.

The occupation is decisive in the shape of life-time shape of earnings. Those within the same occupation have a common shape of life-earnings profile, therefore other occupations have other shapes, even if the concerned individuals may have the same level

of education.

For all occupations, low educated individuals have a flatter shape of earnings profile than those who are highly educated.

He showed that the higher the level of education is, the lower would be the rate of depreciation.

Those with the same level of education, have their earnings positively correlated with their corresponding occupation MSY's (median school year). In other words, if 2 occupations have 2 different MSYs, and if 2 individuals are in the same age and education group, the one who works in the occupation with higher MSY receives higher earnings.

The earnings ratio (the ratio of earnings at 55-64 year old and 35-44 year old) depends on occupation and declines for major occupations.

D: BECKER'S APPROACH OF
DEMAND AND SUPPLY FOR HUMAN CAPITAL

G. Becker (1975) suggested that the individual's acquired human capital is an increasing function of this individual's rate of return. He made two assumptions:

1- The term Y_0 , the part of income which is not related to human capital, is so small that it could be neglected. This assumption would be more acceptable when health and child care are included in human capital investments.

2- The human capital is homogeneous; i.e. all units of human capital are perfect substitutes, and their rate of return is the same.

The demand curve

Both marginal returns and marginal production costs determine the marginal rate of return. Since human capital is enhanced to the investee, marginal benefits decline as more capital is added; this is because human physical and psychological capacity are limited; therefore, marginal production costs become higher. The more human capital is accumulated, the higher would be the value of each time spent on producing additional capital, because opportunity costs (indirect costs) are higher, which contribute to higher marginal production costs.

The decline in the marginal returns is due to:

1- Early investments are more profitable than later ones,

because the period of earning from early investments is larger and if we are in a country with a heavy adult mortality, this factor becomes more important.

2- Later returns (postponed due to present investments of time in producing human capital) have a less present value by just postponing them.

3- Because the human capital is enhanced to the investee, it is an input along all activities the investee is performing, especially when producing additional human capital; furthermore, as we've said above, this gives rise to higher forgone earnings, *ceteris paribus*, but one may propose that the productivity of time would increase with more capital. Then marginal costs may not be increasing if the increase in the productivity is to - at least - compensate for the effects of increasing marginal costs and decreasing marginal returns.

L. C. Thurow classified investments in human capital in two parts:

1- Investments made to increase the real embodied stock of human capital like schooling, training

2- Investments made to increase the price of the new or the existing human capital like migration, labour market information, and health care.

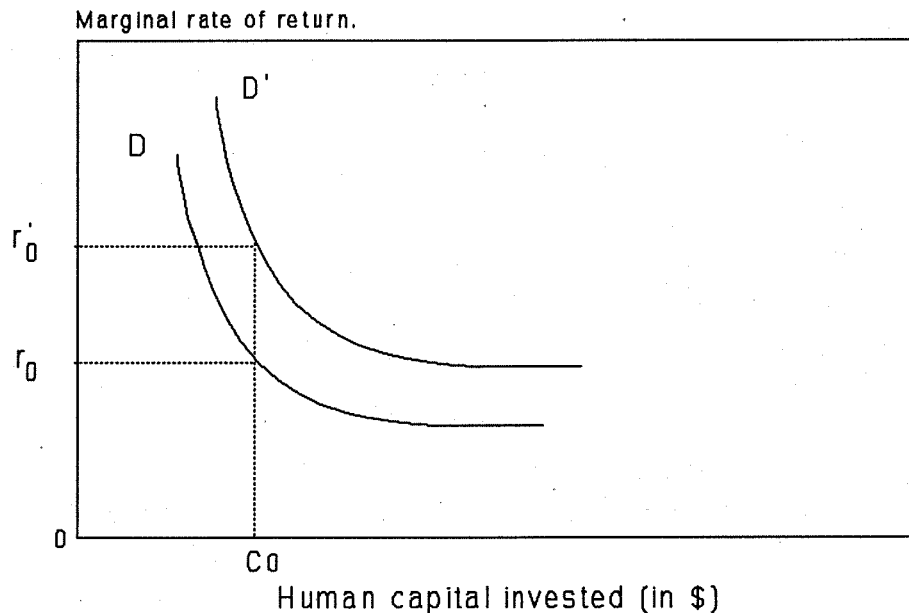
From now on, I shall be using human capital I for the first type and human capital II for the second type whenever I want to distinguish between the two of them.

To migrate from one city to another, or from one country to

another, where the individual may have better opportunities, is similar to the transportation of products from the factory to be sold at the best price; if not, supply would be higher than demand and price would fall.

Therefore, either immigration or more labour market information will increase the rate of return for each individual; moreover, for the same stock of human capital enhanced to the individual, the rate of return increases, so that the whole demand curve will shift up.

Fig3.6



The higher the job opportunities are, the higher would be the shifting in the demand curve. The immigration of an economist and a janitor may have the same effect in shifting the demand curve,

because the demand curve doesn't depend on the existing human capital but rather on the opportunities in the destination.

Persons with higher abilities find their demand curves originally higher, because for the same investment they get higher returns.

Minorities, usually, have their demand curve lower. Fighting against discrimination in the labour market in a society is a fighting to shift up the discriminated individual's demand curve.

Now, we distinguish between movement along the demand curve, or movement of the demand curve: The latter has just been discussed. It is caused by changing human capital II's stock explained by Thurow.

Increasing human capital by schooling or training means, going down in the demand curve. Health care increases the mental and physical potential power of individuals, so that with the same education, they will get better return.

Health care in poor countries has a higher marginal productivity than that of the rich countries, thus, a shift of the demand curve for a given investment in health care will be larger in poor countries than that of rich countries.

The supply curve

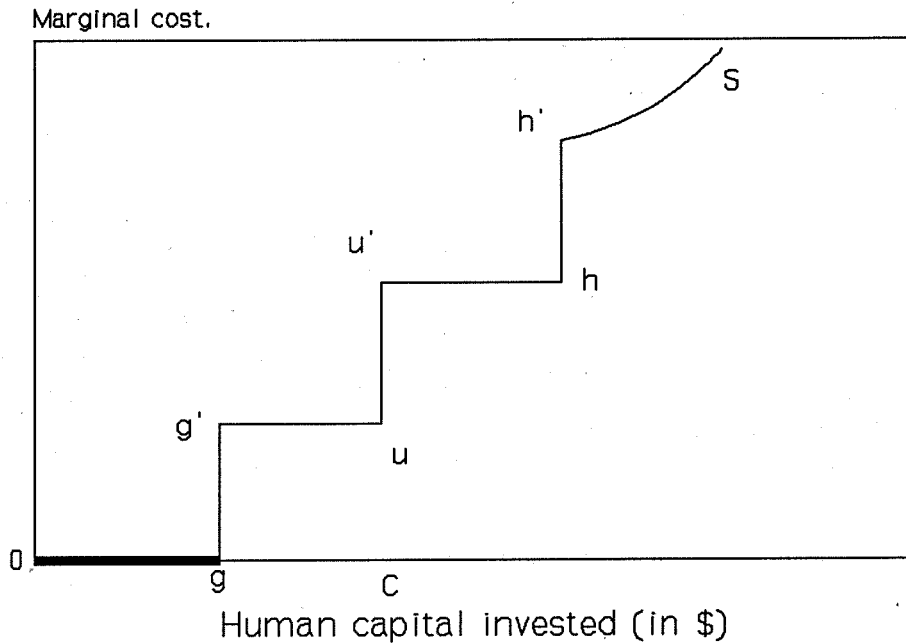
It represents the marginal costs of financing an additional unit of human capital. For simplicity, this marginal cost may be measured by the interest rate paid to finance this addition.

The market of resources to finance acquiring human capital is widely segmented, i.e. elementary, secondary and high school

education are likely to be completely subsidized, some awards are given to the most successful undergraduate and graduate students. Borrowed funds from federal and provincial financial governments and associations are available but under conditions and limitations. Thus, the investor is shifting from the cheaper to the more expensive funding when the former is completely exhausted. Therefore, we are expecting the supply curve to have a positive slope as the investee accumulates some capital. Acquiring more is more expensive in terms of costs of financing.

G. Becker presented a scaled supply curve as in figure 3.7

Fig3.7



where the first human capital acquired is Og , which is a gift from the parent (or a completely subsidised investment), its private costs are nil for they are free; then comes the highly subsidised but not free human capital investments $g'u$, the investor's own

funds are exhausted now, the costs here are the opportunity costs of these funds; after all these resources have been used, come the private loans which have higher and more rapidly rising costs.

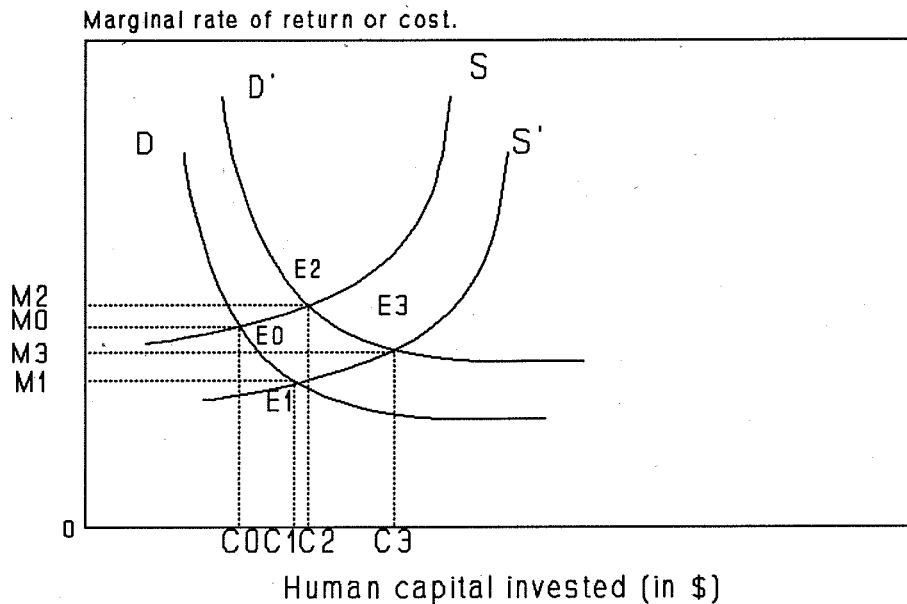
Social discrimination implies more expensive costs for the same stock of human capital, the discriminated against people may get the same "quantity" of human capital but with a lower quality for the same price. Therefore, for each given human capital "quantity", marginal cost is higher. The supply curve of those people is higher, and the success of movement against discrimination moves down the supply curve.

Moreover, the supply curve is rather an institutional curve in that it depends more on educational policy and on the firm's promotion and training policies.

The government's high support for schooling cost is translated by a downward shift of the supply curve. The more the schooling system is based on public finance support, the further would the supply curve shift to the right, and schooling fees would be lower. The inverse is also true: the higher is the private financial support, the further will the supply curve shift to the left indicating a higher private cost. Therefore, the area under the supply curve would be smaller and the area bounded by the demand and supply curves would be larger; thus net benefits would be higher.

Equilibrium:

For simplicity, the supply curve is - from now on - assumed to be smooth.

Fig3.8

From the graph, one may conclude that for a given stock of human capital, if D exceeds S , the individual would be interested in acquiring additional capital since his marginal rate of return is higher than that of his marginal costs. The opposite is true, i.e. if S exceeds D , his interest is to decrease his stock for he is losing out. However, it is not possible to decrease the one's human capital because it is enhanced to the individual; the only way by which this happens is through depreciation. In such a case as this, (where S exceeds D) the individual has the incentive to migrate to where he expects a higher marginal rate of return with respect to the corresponding marginal cost.

When both demand and supply curves intersect, equilibrium results; that is the area under demand curve gives revenue, and the

area under the supply curve gives costs. The aim of a person is to maximize the difference between both areas, which is satisfied by the intersection of both curves.

On one hand, any right shift of demand curve means a higher opportunity, thus increasing the area under the curve as well as benefits. On the other hand, any shift to the left on the supply curve is a decreasing cost of acquisition of human capital, and this can be shown by the decreasing area under this curve.

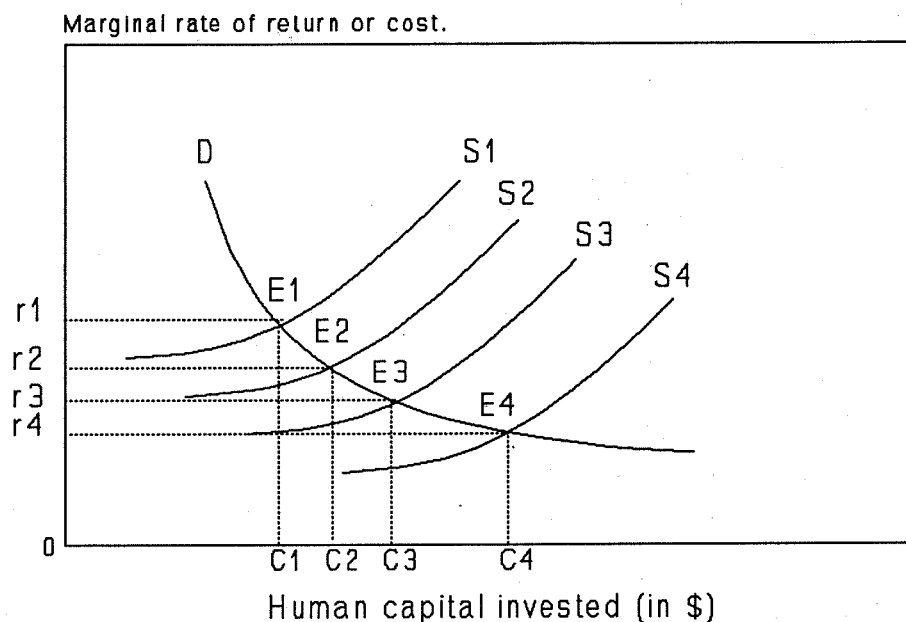
3 approaches to explain income distribution:

a: The egalitarian approach

This approach assumes that demand conditions are the same for all investors, thus the differences in earnings are due to differences in the supply conditions such as luck, parents wealth, government subsidies...

The cheapest funds are not available without limits, they are rationed, depending on how liberal the government is, it is education and training policies, status of parents...

The shape of the distribution would be as in figure 3.9

Fig3.9

Individual 1 has C_1 as capital, and his marginal rate of return is r_1 , individual 2 has C_2 and receives r_2 , and so on...

Given both income and human capital schedules, one may identify the schedule of the marginal rate and could; therefore, imagine the exact shape of the demand curve. Those who receive the cheapest funds find their supply curve as at S_3 , to the right, while others with less opportunity find their supply conditions more unfavorable and thus have their supply curve over to the left, as at S_1 ; therefore, their stock of human capital would be less.

Due to the negative slope of the demand curve, higher capital is to receive a lower marginal rate of return, then as C increases, r decreases. But if $E (= r C)$ increases, showing that the increase in C is more than enough to compensate the decrease in r , therefore

additional investments in human capital will be partially offset by a decrease in r , then the degree of skewness of C distribution would be higher than E's.

If r is to change slightly with accumulated human capital (i.e. an elastic demand curve) C increases faster compared to E, the degree of skewness in C would not be much higher than E's.

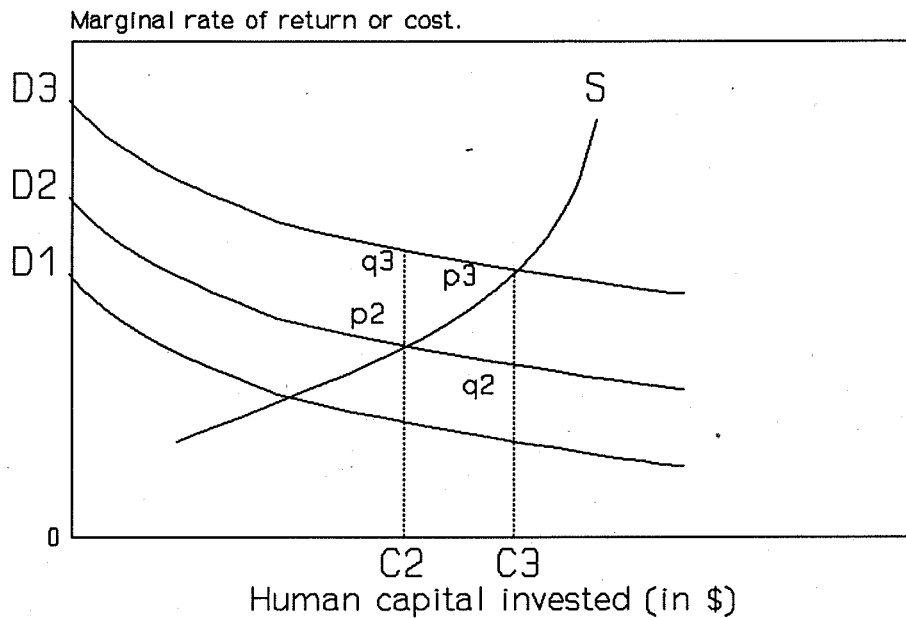
On the other hand, it is predicted that the distribution of the opportunities of favorable supply conditions are more skewed than those of earnings, because the decreasing r contributes to "smoothing out" the distribution.

b: The elite approach

As opposed to the first one, this approach considers that the supply conditions are common, but those of demand are not. The differences in demand conditions are due to the different abilities in benefiting from a given amount of human capital; those with higher abilities find their demand curve higher.

The shape of the distribution would be as in fig 3.10

Fig3.10



The same process used to deduce the unique demand curve in the egalitarian approach could not be used to draw out the unique supply curve in this case. Individuals with demand curve D2, would see their marginal rate changing in proportion to the area $p_2C_2C_3q_2$ when they increase their investments from OC_2 to OC_3 . While individuals with demand curve D3, would see their marginal rate changing in proportion to the area $q_3C_2C_3p_3$ when they increase their investments from OC_2 to OC_3 .

What we observe when we compare - in this case - the change in the earnings which is represented by $D_2p_2C_2C_3p_3D_3$ to the change in human capital. This area overestimates the return due to the difference in human capital. To get an exact estimation, the earnings of individual "2" must be upwardly adjusted by the area

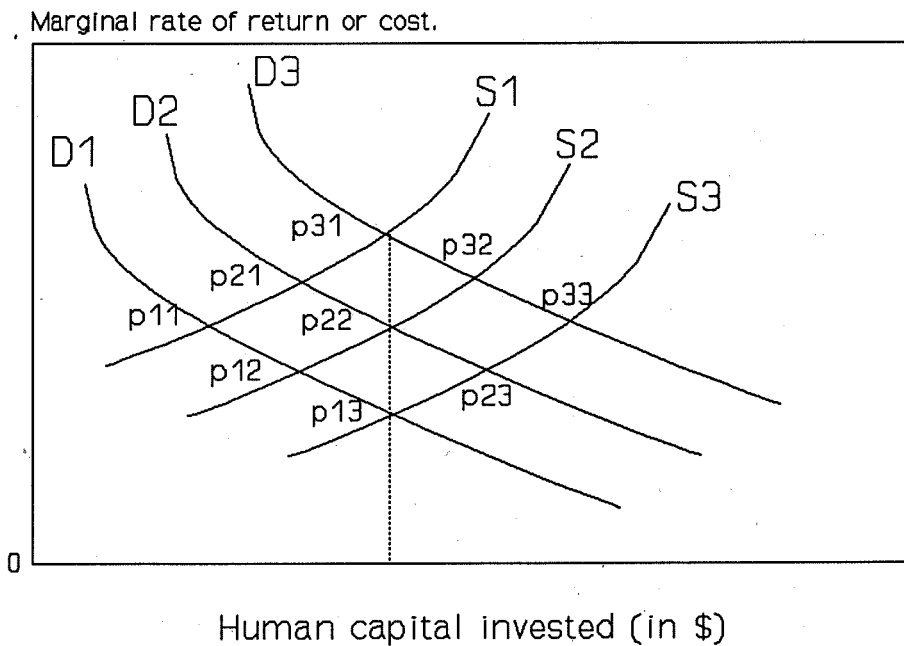
D3p2q3D3 or the earnings of individual "3" must be downwardly adjusted by the area D2q2p3D3.

The distribution of earnings will be more skewed as the elasticities of supply and demand get smaller, which leaves the earnings more skewed than capital; smaller elasticities are reflected in higher differences in the degree of skewness. In contrast with the egalitarian approach, it is predicted here that capacities are less skewed than earnings, because the effect of a higher capital is exponential.

c: The general approach

If neither demand nor supply curves are common, persons with the same amount of human capital will get different earnings as shown in fig.(3.11)

Fig 3.11



The knowledge of earnings and their corresponding rates of return will be insufficient to draw the supply and demand curves. The higher are the elasticities of the curves, the more unequal will be earnings and capital skewness.

There is a room to suppose a certain positive correlation between supply and demand curves. Those with higher abilities and higher IQs scores are more likely to receive less expensive financing funds such as awards and scholarships. In this case, the curve I shows the relation between capital and marginal rate of return and marginal cost.

To check the validity of this, the correlation between earnings and human capital will be studied. A perfect correlation explains the earnings completely by earlier investments. A narrow correlation implies that earnings are explained partially by human capital.

CHAPTER IV

CONCLUSION

Throughout history, experience has been considered an important factor in contributing to the productivity. This idea has been developed into the concept of human capital.

First, skills and abilities have been considered as a part of the nation's capital, (Mill). But this view turned then to consider the human being himself as a part of the nation's capital, because there are real costs to increasing an individual's productivity.

To calculate the value of human life, the prospective approach (Petty, Farr,...) - which consisted of capitalizing the expected earnings during a life time - was used more than the retrospective approach (Engel,...) - which consisted of calculating the total costs of the human capital formation.

Later, since the 1950's, both approaches have been used simultaneously by Shultz, Ben Porath, Mincer and Becker's models to see clearly what the impacts of human capital investments on productivity and economic growth are.

The human capital investment decisions are undertaken by four players: the investee, the investment initiator, the private financier, and the public financier.

Given that human capital is a decisive and helpful tool in

income distribution, and that a higher educated society makes a better decision, among other reasons, governments have large interests in financing their societies' stocks of human capital.

Investments in human capital have been classified into three parts:

A - Investments in knowledge which has four sources:

a) Family environment: i.e. by transferring knowledge, attitudes and motivations from parents and nearby society to the investee.

b) Formal education, which is the main component of the human capital. It is critical in technological improvement as well as in technological progress. Indeed

"...It is the 1851 industrial exhibition at the Crystal Palace in London. Britain is the dominant world power. The U.S. is number 2 in industry and catching up fast. Made-in-America reapers, muskets and tools are the marvels of the show. British businessmen are amazed at what they see. Products are assembled from completely interchangeable parts.... Worried delegations of British industrialists set sail to investigate. Their findings? American manufacturing prowess is in large part due to a highly educated work force.... Now, zip ahead a century or so to the 1980's. The U.S. is the dominant world power, and it is Japan that is number 2 and closing fast. American CEOs marvel at the quality of Japanese products flooding their markets. They make pilgrimages to Tokyo. Their findings? Manufacturing superiority is being forfeited to the Japanese. And yes, once again, behind the success in manufacturing prowess lies a better-educated work force."
(Nussbaum, 1988, pp. 100 - 101)

A positive correlation has been found between a country's level of education and its worldwide competitiveness.

Formal education has direct costs (tuition fees, school supplies,...) and indirect costs (foregone earnings). Both "direct costs / total costs" and "indirect costs / total costs" ratios have

been seen to vary depending on the national income level and the country's development level.

c) Professional investments: Training could be a general one, i.e. increases the trainee's productivity in many other firms, or a specific training, i.e. increases the trainee's productivity only in the firm which provides it.

Most of the trainings are neither perfectly general nor perfectly specific. The more specific the training is, the more it is supported by the firm that offers it, and less are the trainee's chances to be laid off. On the other hand, the more general the training is, the more it is supported by the trainee, and so he has greater chances to be laid off.

d) Information about the labour market: Individuals use information to know more about their employment opportunities, in order to choose the most satisfactory job in terms of earnings, environment, security,...

Employers are also interested in information to get the most productive employees since their benefits increase with the difference between productivities and wages.

B - Immigration

It happens usually from a low income and opportunity country or region to a high income and opportunity country or region. Immigrants from a high income country or a more attractive country are likely to receive higher wages. Costs of immigration include direct costs such as moving expenses and indirect costs which are the opportunity costs of the time spent between leaving and

starting jobs.

Returns to migration depends on the difference in earnings, and on the new job and place conditions. Whenever new earnings, new jobs and life conditions are at least compensating for the former earnings and conditions, the individual is expected to migrate.

C) Health

Health expenditures used to be treated as consumption expenditures. Later, they have been treated as investments since it has been shown that preventitive care save lots of cases, and that losses due to an early mortality are quite high.

The direct costs of sickness are those of medical treatments; its indirect costs are the present value of all missing work days' earnings.

Diseases are expensive because they decrease the man-hours of available work and decrease the productivity of the existing force.

Health investments prevent these negative effects; furthermore, these investments make feasible the development of previous unsettled regions and change the attitudes of persons toward innovation and entrepreneurship. These effects are mostly seen in developing countries.

Dagum's causal model for income distribution shows that a twelve component vector determines the individual's income and; therefore, the shape of income distribution. These components are: age, schooling, experience, occupation, market imperfection, institutional constraints, parental education, parental occupation,

parental assets, and socioeconomic environment.

This vector determines an individual's human capital, assets and indebtedness which in their turn are the variables of the income generating function. An interaction term between human capital and assets has been added to the equation.

It should be noted that in this paper, the only aspect that has been studied is the contribution of the human capital to the income. But, to have a complete view, and get an accurate interpretation of income, the income generating function should be viewed as the starting point and as a general frame work. This could be done later in another paper.

From the income generating function, we have got the cumulative distribution function which is the base of the Lorenz curve.

Mincer, Ben Porath and Becker introduced the earnings function with operative models.

The schooling model of Mincer shows a direct relationship between earnings and education; i.e.

$$\log Y_s = \log Y_0 + rs \quad (10)$$

and if the individual continue to invest after his schooling period, then his net earnings at any time j are:

$$Y_j = Y_s + \sum_{t=0}^{j-1} r_t C_t - C_j \quad (11)$$

The post school investments decrease with time, because as time goes on, the individual has less time to earn.

Mincer distinguished between gross earnings E_j and net

earnings Y_j . The difference between both earnings are the costs.

$$E_j - Y_j = C_j$$

To get the value of Y_s , Mincer used the overtaking year concept which is the year at which $Y_j = Y_s$. The overtaking year j is given by

$$j \leq (1/r) \quad (24)$$

Ben Porath used the production function

$$Q_t = \beta_0 (s_t K_t)^{\beta_1} D_t^{\beta_2} \quad (26)$$

Whereby he distinguishes between three concepts of earnings:

-Earnings capacity: $Y_t = \alpha_0 K_t$

-Observed earnings: $\dot{E}_t = Y_t - \alpha_0 s_t K_t$

or $\dot{E}_t = Y_t - [\beta_1/(\beta_1+\beta_2)] I_t \quad (30)$

-Disposable earnings: $E_t = Y_t - I_t \quad (31)$

The difference between earnings capacity and observed earnings are the foregone earnings. The difference between the observed earnings and the disposable earnings are the investments' direct costs.

Large investments precede the little ones, because the earnings' period decreases as t increases. Therefore, investments in human capital decrease with time at a decreasing rate as Ben Porath found in his 1970's model.

Further exploration in the Ben Porath production function should be done, especially the release of the constraint that fixes the value of β_1 and β_2 , because it is expected that both parameters are a function of time i.e. $\beta_1(t)$ and $\beta_2(t)$.

Becker presented the human capital demand and supply curves.

The demand curve is the curve that shows the relationship between the acquired human capital and the marginal rate of return, and therefore has a negative slope. It has been shown that the demand curve shift upwards with immigration because, immigration does not increase the potential human capital.

The supply curve is the curve that shows the relationship between investment expenditures and the marginal cost. The supply curve has a positive slope.

The individual's equilibrium is at the intersection of both curves.

Then Becker presented three approaches to explain the income distribution:

a - The egalitarian approach which proposes that the human capital demand conditions are the same for all individuals, therefore, the difference in earnings is due to the difference in the supply conditions. Knowledge of the schedule of the marginal cost, leads directly to discovering the shape of the demand curve.

b - The elite approach which proposes that supply conditions are the same for all individuals, but demand conditions are not. Therefore, the difference in earnings is due to the difference in demand conditions. In this approach, the supply curve could be drawn after some adjustments.

c - The general approach where there are no fixed conditions, neither on the supply side nor on the demand side. In this case, the difference in earnings is due to the difference in supply and demand conditions.

Human capital theory in itself can not explain the distribution of income, but partially. Education and experience are not the only factors to determine income. A larger analysis will be required to cover and to include all factors of income such as parents education, market imperfection and so on..., into the model. On the other hand, since the ability of an individual is changing over time, a dynamique factor must be included. Moreover, the fact that demand and supply conditions vary with time too, should be also incorporated into the model.

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