Chapter 6: Human capital

Human capital is the human input into the production. The quality of human capital can vary widely across individuals. These differences can explain the differences in incomes across countries. Investment in human capital is a major expense for an economy.

Health

The health of a population improves when a country develops. This improvement indicates that people are having better lives. People who are relatively healthy can worker harder and longer than less healthy people. Thus, better health leads to a rise in the level of income.

Evidence suggests that when a country develops its people will get bigger. The main explanation for this is that development leads to better nutrition which will lead to bigger people.

Height can be used as a good indicator of malnutrition. Shortness is often linked to low food supply because short people will need less calories to survive. People with malnutrition are less healthy. This leads to lower abilities as a worker. In some countries one can obtain a relationship between the height and the wage.

Nutrition affects the ability to do physical work and has an effect on mental capacity. Research has shown that villages that received a food supplement scored significantly higher on reading tests as well as nonverbal cognition.

In most developing countries malnutrition is a great issue while in developed countries most people are well nourished. One can obtain a relationship between GDP per capita and the number of calories available for consumption per day. This relationship is positive; in rich countries the number of calories available for consumption per day is higher than in poor countries.

Even in rich countries where there is enough food on average there is a part of the population that is malnourished. This part consists of the poorest people of the population in that country.

There is also a relationship between life expectancy and GDP per capita. In poor countries the life expectancy is often below 60 years while in rich countries the life expectancy lies between 75 and 82 years. So there is a positive relationship between life expectancy and GDP per capita.

The large variations in health among countries contribute to the differences in incomes between countries.

As stated before; improvements in nutrition lead to an increase in income per capita. But better nutrition is also the result of higher income. This is because people in richer countries can afford more and better food.

Richer people are more able to pay for inputs into health like vacancies, clean water and safe working conditions. In developed countries the amount of doctors per thousand people is much higher than in developing countries.

To understand the interaction between health and income it is important to note that both are endogenous variables. The interaction can be shown in a graph with income per capita on the horizontal axis and health on the vertical axis.
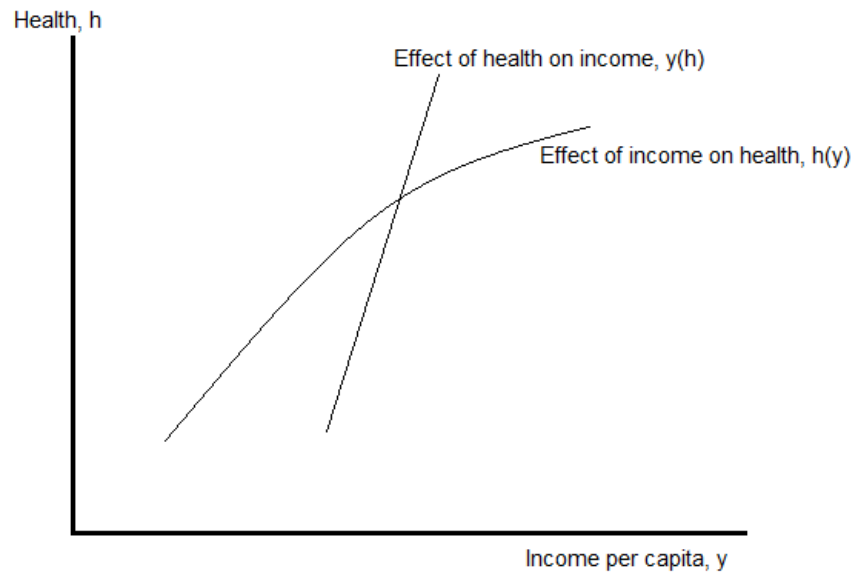
The h(y) curve becomes flatter at high incomes. This is because beneficial effects of income on health are more pronounced at lower levels of income.

The intersection between the two curves determines the equilibrium levels of income per capita and health. When there is an exogenous effect on income then the y(h) curve will shift. For instance, when there is an improvement in technology the y(h) curve will shift right. This is shown in the following graph with the movement from point A to point B.
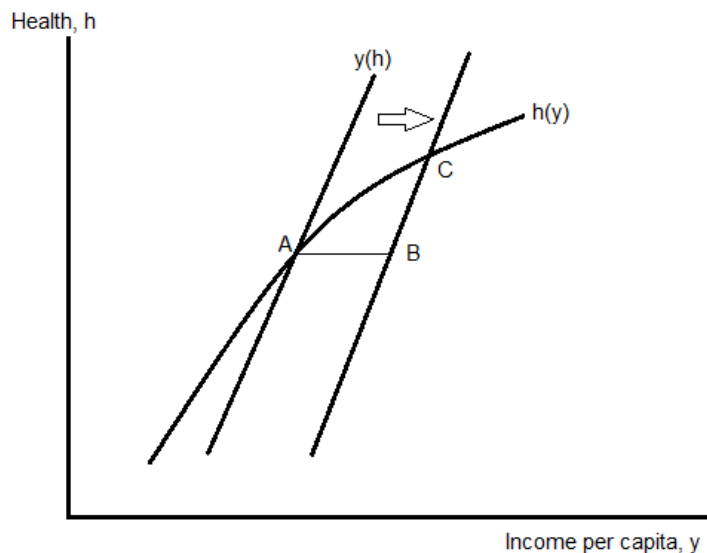

Due to the change, output will increase which will lead to improved wealth of workers. This will increase output even more leading to a shift from point B to point C. It is called a multiplier effect.

There are two possible views on health and income per capita:
1. **The health view:** assumes that differences between countries originate from countries' health environments. So there are only differences in the health functions, h(y), of the two countries.

2. **The income view:** assumes that differences between countries originate from aspects of production that are unrelated to health. So there are only differences in the income functions, y(h), of the two countries.

We assume that there are two countries, A and B, where A has higher income and higher wealth. The two views can then be shown graphically:

(a) The Health View

(b) The Income View
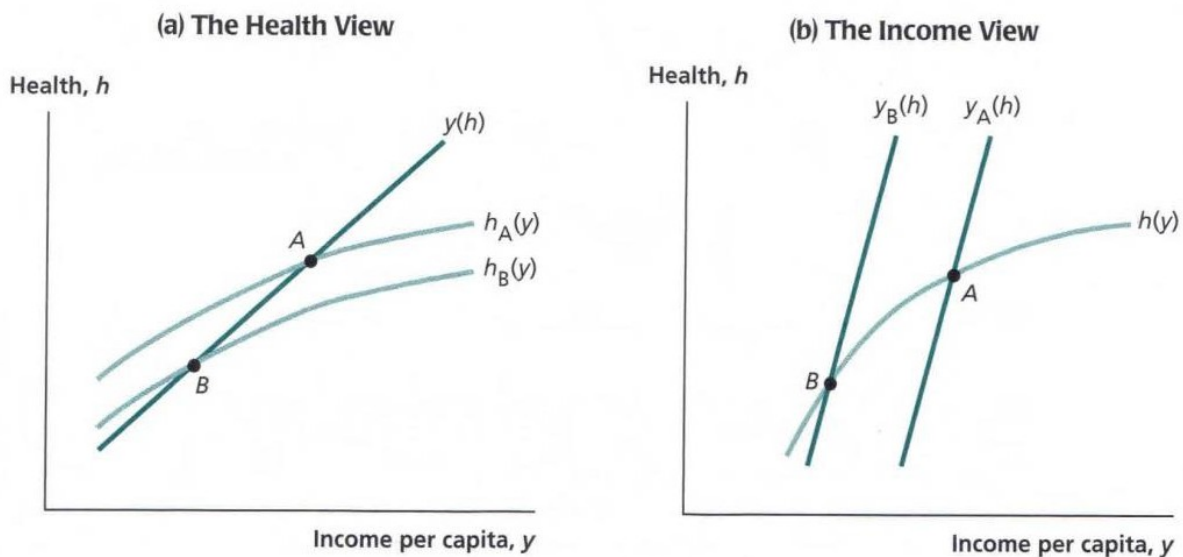
Education

In developed countries we see that the intellectual ability is more important than physical ability in determining the wage. An investment that improves the intellectual ability is the most important investment in human capital. Education is an investment in human capital.

We can obtain great differences in education among countries. In the period 1975 to 2010 there has been a great change in the educational level of the adult population. In this period there is a large increase in the number of years of schooling.

Both in developed and in developing countries the education of adults increased. There was especially a high increase in the fraction of adults that finished secondary school and in the fraction of adults that completed higher education.

Education can be very costly. Governments spend a lot of money on education. But this spending of the government does not reflect the true cost of educational investment. This is because there is another cost involved other than salaries; the opportunity costs. These are the costs that students pay in the form of wages they forgo while getting educated.

The increase in education over the years goes hand in hand with a large increase in the resources invested in human capital.

It is impossible to separate a person's education from its body to see how much rent is gives. Therefore it is much harder to measure the return to human capital than the return to physical capital.

The **return to education** is defined as the increase in wages that a worker would receive if he or she had one more year of schooling. Thus there is a positive relationship between extra years of schooling and the wage received by the worker.
Earlier years of schooling have higher returns than later years of schooling. This is because in these early years the most important skills, like reading and writing, are taught.

Before, we calculated that the physical capital's share of GDP was one third. The other two thirds of GDP consist of payments to labor. It is hard to investigate how much human capital accounts for in this payment to labor. There is a part that represents payment to human capital but there is also a part that represents payment to raw labor (what worker would have earned without any human capital).

Suppose that a worker has five years of education and that his wage will be 1.82 times as large as the wage of a worker without education. If the worker without education earns $1, then the worker with education earns $1.82.

The wage that results from human capital would be $0.82. The fraction of the wage attributed to human capital would be 0.82/1.82=45%. The other 55% is attributed to raw labor.

As the number of years of education increases, the fraction of the wages attributed to human capital will increase. Data suggests that we can make this calculation for each worker and then sum these values up to find the fraction of wages in the economy as a whole that represents returns to human capital from education.

The share of human capital in wages in developing countries can be shown with the next graph:
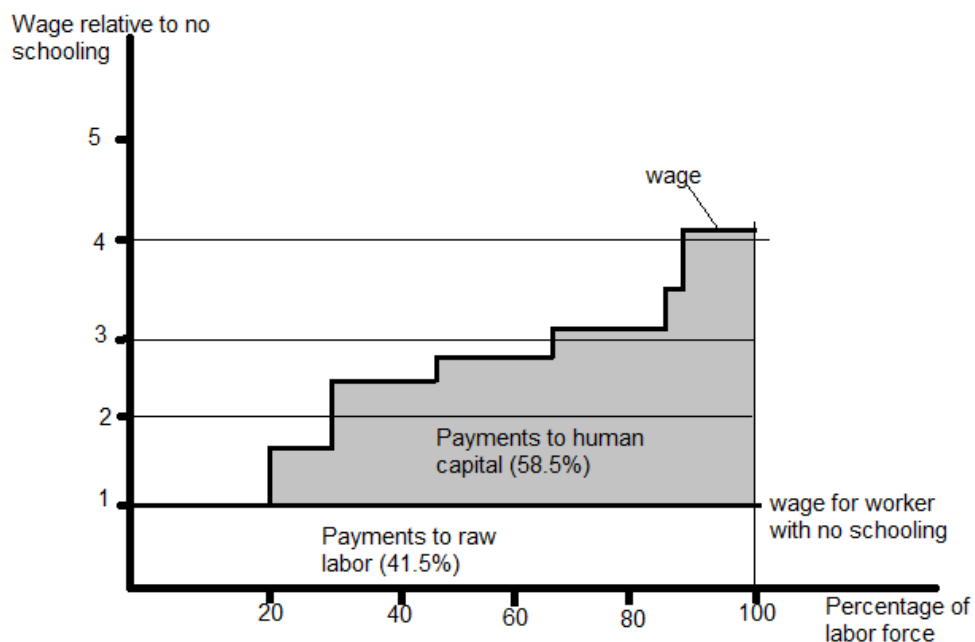
This share of human capital is 58.5% and the share of raw labor is 41.5%.

The share of human capital in wages is higher in the countries that are advanced. In these countries we find a share of human capital of 67.7% while the share of raw labor is 32.3%. The graph for advanced counties can be found on the next page.

From these two graphs we can conclude that in both developing and advanced counties, the share of human capital is greater than the share of raw labor, physical capital. Therefore we can say that workers are in effect capitalists because they are earning a return to their own previous investment in human capital.
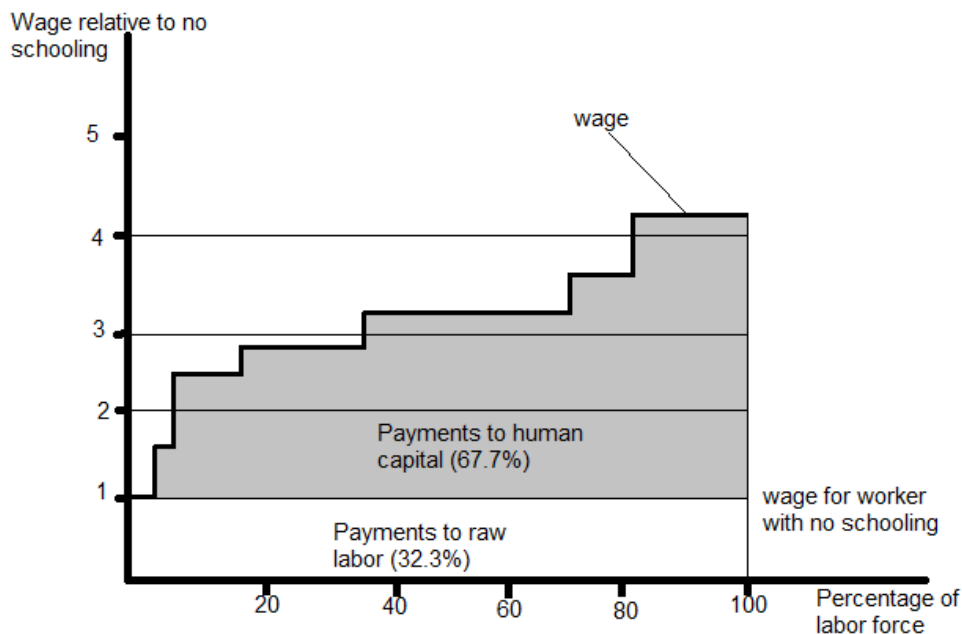
Variation in income explained by education

We have found that there are great differences in levels of human capital across countries. We will now examine how much these differences explain differences in income per capita among countries. The focus is on the effect of human capital via schooling.

There is a strong relationship between the average years of schooling and the level of income per capita. Richer countries are able to spend more money on education. This leads to the fact that even if education has no effect on income, we would still see a positive relationship.

To measure how much education explains income we use Cobb-Douglas production functions and we only look at differences in schooling as explanation for income differences. We introduce the symbol h, amount of labor input per worker, into the production function. This will lead to:

$$Y = AK^{\alpha}(hL)^{1-\alpha}$$

For simplification we rewrite this formula into:

$$Y = h^{1-\alpha}\ AK^{\alpha}L^{1-\alpha}$$

With investment rate γ, population growth rat n and depreciation rate δ we can determine the steady-state level of output per worker:

$$y^{ss} = (h^{1-\alpha} A)^{1/(1-\alpha)} (\gamma/(n+\delta))^{\alpha/(1-\alpha)}$$
$$= h \times (A^{1/(1-\alpha)} (\gamma/(n+\delta))^{\alpha/(1-\alpha)})$$

From this formula we can see that the steady-state level of output is proportional to h.

To determine how much h accounts for differences in output we rewrite this formula into a ratio of steady-state levels of output of two countries i and j. This formula says that the ration of output per worker in the steady-state will be equal to the ration of labor input per worker.

$$\frac{y_i^{SS}}{y_j^{SS}} = \frac{h_i \; x \; (A^{\frac{1}{1-\alpha}} \; x \; \frac{\gamma}{n+\delta}^{\frac{\alpha}{1-\alpha}})}{h_j \; x \; (A^{\frac{1}{1-\alpha}} \; x \; \frac{\gamma}{n+\delta}^{\frac{\alpha}{1-\alpha}})} = \frac{h_i}{h_j}$$

If the value of h in country i is twice as big as the value of h in country j, then the steady-state output per worker will also be twice as big in country i.

The predicted ratio of income per worker in each country can be plotted to income per worker in the United States based on data on average schooling. Such a graph will look like:
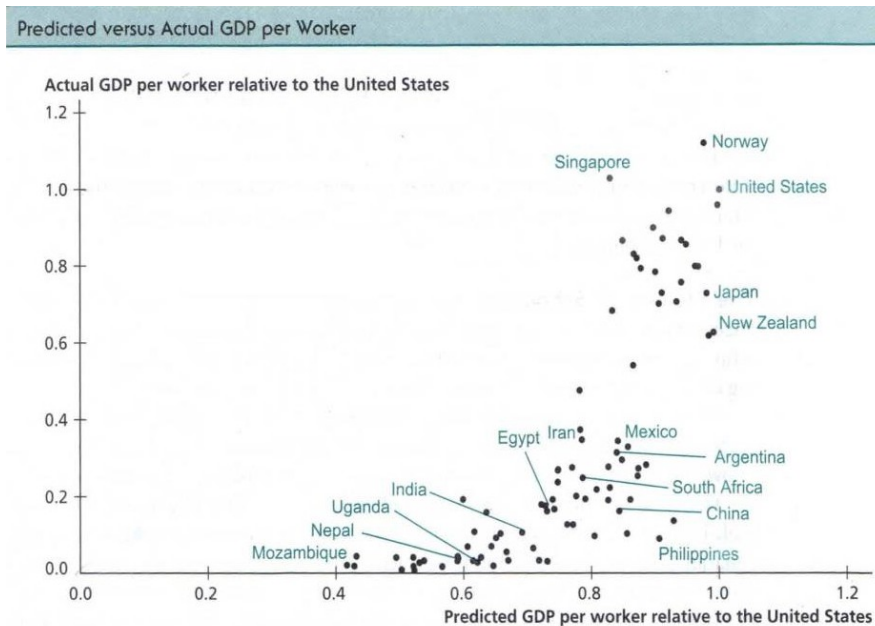
The actual ratio of income per worker is plotted on the vertical axis and the predicted ratio of income per worker is plotted on the horizontal axis. If differences in schooling would explain all differences in income per worker, then we would see a straight line of 45 degrees. However, as one can see in the graph this is not the case. But we do see some kind of pattern so it does explain some part of the differences in income per worker.

On average one can see in the graph that the poorer a country is predicted to be based on average schooling, the poorer it generally is. There are some outliers in the graph. An interesting to note is that differences in income predicted on average schooling tend to be smaller than actual differences in income among countries.

Our analysis is based on data on the average years of schooling each country. In this analysis we have assumed that the quality of schooling does not vary among countries. However, in practice there may be differences in quality.

The quality of schooling can be measured by looking at inputs such as teachers and textbooks. We can also look at the output of schooling, what students know.

With respect to inputs to schooling; there is strong evidence that richer countries are able to supply more inputs. In poor countries books are scare and students may be forced to share books. Also health may affect schooling. In poor countries where health problems are high students are able to learn less in a year due to sickness.

One way to measure the output of schooling is via test scores. Data suggests that students in rich countries tend to do better on tests. Overall, evidence suggests that richer countries do not only have more schooling than poorer countries but also have better schooling.

An important difference between human capital and physical capital can be found in the field of externalities. And **externality** is and incidental effect of some economic activity for which no compensation is provided.

Many economists argue that there are big externalities in the field of education. Giving a person more education raise both the output of the individual itself as the output of those around that person. Such positive externalities are often an explanation for why governments invest in human capital.