Chapter 6

A third proximate determinant of long-run growth: Human Capital

Introduction

- ✓ Role of capital
- ✓ Role of population growth
- ➢ Role of other production factors:
  - ➢ Human Capital
- ➢ Role of world trade
- ➢ Role of productivity
  - ➢ Technology
  - ➢ Efficiency

Human capital

- Up to now, we assumed that a unit of labor was identical among all workers everywhere.
- This implies that labor efforts have the same effect everywhere in their ability to produce wealth.
- This is not realistic. The "quality" or "effectiveness" of a worker's efforts depends on his/her
  - physical strength
  - health
  - education level
- We would like to know up to what point those differences can explain economic growth and income differences.

Human capital

- We use the word "capital" to refer to such differences in labor quality because it bears resemblance with "physical capital":
  1. productive
  2. produced (investment)
  3. yields a return to its owner
  4. depreciates
- An interesting difference:
  - In order for human capital to produce a return to its owner, he/she must work.
- Two important types of human capital to consider:
  1. health
  2. education

1. Human capital as "health state"

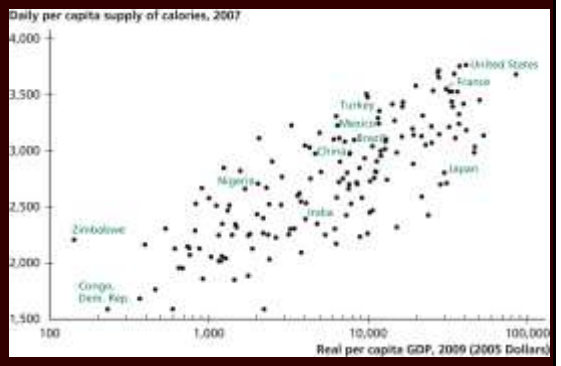
- Healthier people are more productive because they can work harder, longer, think more clearly, etc.
- Between 1775 and 1975, the average English man has gained 9.1 cm in height.
- In 1855, 2/3 of the young Dutch men measured less than 5'6" (168cm). They are now less than 2%.
- Those changes are not due to genetics.
- Similar changes are observed in LDCs, but more recently and rapidly.
  - South Korean men gained 5cm between 1962 and 1995.
- Those changes are largely attributed to better nutrition.

Nutrition, health, and economic growth

- Undernourishment causes worse health and thus lowers workers' abilities.
- Economic-historian Robert Fogel has tried to quantify the contribution of better nutrition to UK economic growth between 1780 and 1980.
- He first points out that better nutrition:
  1. Allows some to work who could not have worked before
  2. Allows those who already work to work better
- 1780: 20% of adults cannot even work 1 hour a day due to malnourishment.
- Today: Problem eradicated. Estimated to increase output per worker by 25%.
- Among those who work, better nutrition increased effective work by 56%.
- Resulting increase in output per worker by a factor of 1.25*1.56=1.95 simply due to better nutrition.

Nutrition, health, and economic growth

- Spread over 200 years, this represents a yearly increase of 0.33% on average.
- Compared to the total average yearly growth of 1.15%, better nutrition would explain almost a third of all economic growth in the UK between 1780 and 1980!
- Differences in nutrition levels in the world today are large:



Explaining Health-Income correlation

- Two-way causality:
  - Better nutrition (health) causes higher income.
  - Higher income causes better nutrition.
- Both variables are endogenous.
- (skip graphical example)
- Suspected multiplier effect from productivity growth.

Case study: Hookworm parasite in USA South

- Causes anemia, exhaustion, affects physical and mental development,…
- 1910: 42% of population in USA South is affected.
  - Salaries cut by half for those affected.
- 1930: Total eradication with public health program.
- Similar effects from malaria reductions across the world due to DDT invention during WWII.

2. Human capital as education

- In today's developed countries, intellectual abilities play a much bigger part in explaining income differences than physical abilities.
- This suggests that investments in education have a large role to play in explaining economic growth.

		Average Years of Schooling	Percentage of the Adult Population with: No Schooling	Complete Primary Education	Complete Secondary Education	Complete Higher Education
Developing Countries	1975	3.2	47.4	32.9	8.1	1.6
	2010	6.7	20.8	68.8	31.5	5.3
Advanced Countries	1975	8.0	6.2	78.8	34.9	8.0
	2010	11.0	2.5	94.0	63.9	16.6
United States	1975	11.4	1.3	94.1	71.1	16.1
	2010	12.4	0.4	98.8	85.4	20.0

Education and investment share in USA

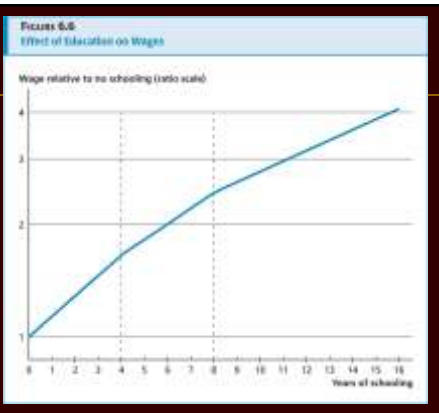
- Direct expenditures, public and private = 6,2% GDP (profs salaries, buildings, books, etc) (Canada is about 8%)
- Opportunity cost: Forgone salaries ≈ 6,2% GDP
- Education investment total 2010 USA ≈ 12,4% PIB
- Investment total physical capital 2010 USA ≈ 12.4% GDP
- Through 20th C., education investment as share of GDP has multiplied by factor of 5.
- IN LDCs, this is a very high burden given the large relative size of the young.

The returns to education

- The value of human capital is difficult to measure because it cannot be rented separately from its owner.
- Proposed Solution: Measure returns to education as the increase in salary due to one additional year of education.
- Global estimates of salary increases on average:
  - years 1 to 4: 13,4%/yr
  - years 5 to 8: 10,1%/yr
  - years 9 and +: 6,8%/yr

An example

- Suppose that the return to the 7th year is 10%.
- This implies that for two otherwise identical workers, the one with 7 years of education will receive a salary 10% higher than the one with only 6 years.



How to use this data

- (see notes)

1. Suppose one has 3 years of education:
   - His salary will be 1.134X that another with two years of education;
   - and $(1,134)^3 = 1,458X$ the salary of someone without any schooling.
2. Univ. Bach. = 16 years
   - $(1,068)^5 = 1,39X$ the salary of someone with only a high school degree (11 years).

Estimating the share of human capital in salaries

- Since physical capital accounts for 1/3 of national income, labor must account for the rest, i.e. 2/3.
- But how can we separate the share that pays for raw work from the share that pays for human capital?
- Salary pay slips and income tax returns do not make the difference.
- NB We do not account for the health part.

General idea of calculation

- Suppose that workers without any schooling receive a salary of $1
- Then the salary of a worker with 5 years of schooling is $(1{,}134)^4$ X 1,101 = $ 1,82.
- $ 0,82: share of income due to his education, i.e. 82/182 = 45 % of total salary.
- $1: share of income due to raw work, or 55% of total salary.

The share of human capital in salaries

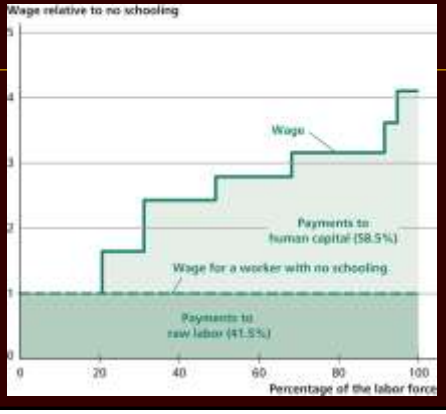
- If we do the same exercise for all the workers of a country, we can estimate the share of aggregate salaries due to human capital.
- The data from Table 6.2 makes use of the returns shown before and allow us to make such calculations.

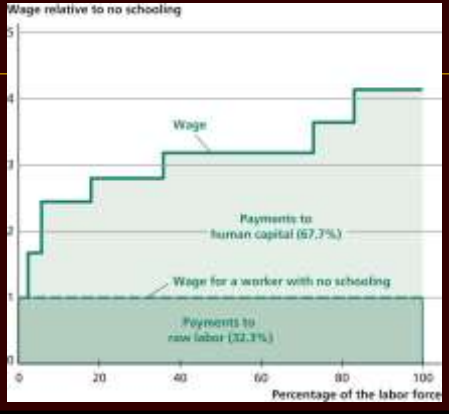
Highest Level of Education	Years of schooling	Wage Relative to No Schooling	Percentage of the Population: Developing Countries	Percentage of the Population: Advanced Countries
No Schooling	0	1.00	20.8	2.5
Incomplete Primary	4	1.85	10.4	3.4
Complete Primary	8	2.43	18.8	12.3
Incomplete Secondary	10	2.77	19.3	17.8
Complete Secondary	12	3.16	23.2	37.4
Incomplete Higher	14	3.61	2.8	9.9
Complete Higher	16	4.11	5.3	16.6

Source: Barro and Lee (2010).

Comparing ICs with LDCs

- See following Tables:



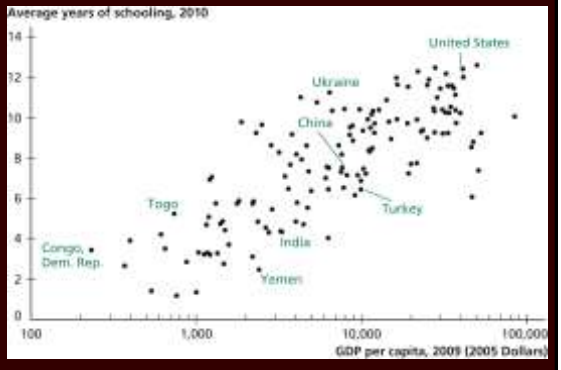


Share of human capital income

- LDCs:
  - raw labor: 41.5% of salaries
  - human capital: 58.5%
- Rich countries:
  - raw labor: 32%
  - human capital: 68%
- If salaries account for 2/3 of national income, then
  - human capital accounts for 2/3 X 58.5% = 39% of national income in LDCs;
  - and 2/3 X 68%=45% in rich countries.
- Human capital is now more important than physical capital in explaining wealth!

A wider definition of capital

- In the Solow model, we have seen that α=1/3 is too small to explain income differences between countries.
- α=2/3 gave better predictions concerning effect of population growth.
- If we include human capital with physical capital, α=2/3 corresponds much better to the share of accumulated capital in countries' total incomes.
- Up to what point can income differences be explained by differences in human capital? To answer, let us concentrate on education:



Human capital in the Solow model

- Assumption: Each worker does not produce the same quantity and quality of labor.
- Countries differ as to the quantity and quality of labor that a worker can produce.
- New variable:
  - h = quantity of "effective" labor input per worker.
- Effective labor: A worker with more schooling will produce more "wealth" in a month, all else equal, than a worker with less schooling.
- (take note)

Human capital in the Solow model

$hL \equiv$ effective total supply of labor

$$Y = AK^{\alpha}(hL)^{1-\alpha} = (h^{1-\alpha}A)K^{\alpha}L^{1-\alpha}$$

$$y^{ss} = hA^{\frac{1}{1-\alpha}}\left(\frac{\gamma}{n+\delta}\right)^{\frac{\alpha}{1-\alpha}}$$

For two otherwise identical countries:

$$\Rightarrow \frac{y_1^{ss}}{y_2^{ss}} = \frac{h_1}{h_2}$$

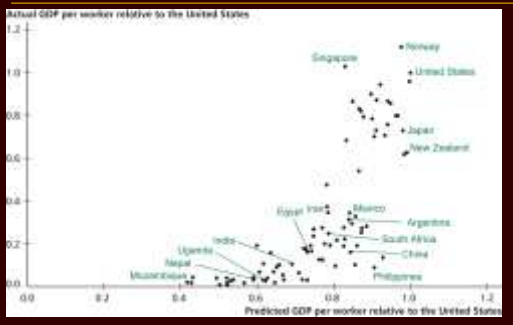
Measuring "h" for quantitative analysis

- Assumption: Each unit of effective labor receives the same wage rate.
- Interpretation:
  - If your daily wage is 10% higher than mine, it is because you effectively supply 10% more labor input per day than me.
  - If 1st year increases salary by 13.4%, then a worker with one year of schooling supplies 1.134X more labor input than one without any schooling.
  - NB This holds even though all workers work the same number of hours.

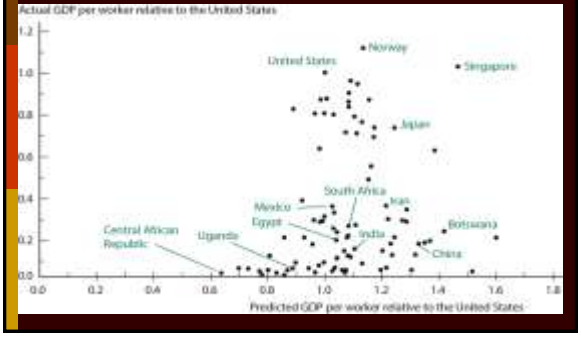
An example of application

- Let h_0 be the effective labor input per worker in a country where all workers have no education.
- Country A: average of 2 yrs of schooling/worker
- Country B: average of 12 yrs
- $h_A = 1.134^2 \times h_0 = 1.29 \times h_0$
- $h_B = 1.134^4 \times 1.101^4 \times 1.068^4 \times h_0 = 3.16h_0$
- The ratio of per capita incomes at the SS is thus $h_B / h_A = 3.16h_0 / 1.29h_0 = 2.47$.
- All else equal, country B is 2.47X richer due to schooling differences
- Applying this method to actual countries yields Fig 6.12

Quantitative Analysis: Human K



Quantitative Analysis: Physical K



Example 1: Uganda

- Physical capital: Predicted per-capita income is 80% that of USA.
- Human capital: Predicted per-capita income is 61% that of USA.
- Putting the two together, income is 80%x61%=49% of USA's.
- Including human capital gets us much closer to the reality of 3.3%.

Example 2: Mexico and Iran

- Human capital: Predicted per-capita income in Mexico is 7% higher than Iran.
- Physical capital: Predicted per-capita income in Iran is 18% higher than Mexico.
- In reality, both countries have similar levels of income per capita.
- Combining human capital with physical capital increases greatly the explanatory power.

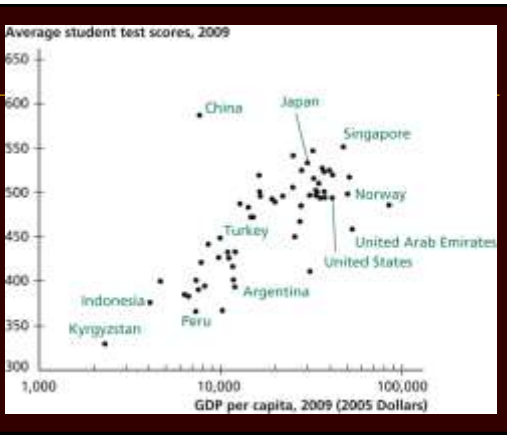
Two possible sources of bias

i. Quality of schooling is not uniform across the world.
ii. Positive externalities of education

1. Quality of education

- Inputs to education include more than just number of years:
  - Student/teacher ratios:
    - ICs 16
    - LDCs 42
    - SSA: 48
  - Mozambique: 70% of primary school teachers have only 7 years of education.
  - Availability of textbooks
  - Health of pupil

One year of school does not yield equal results everywhere.



Quality of education

- Not only do rich countries have more years of education but its quality is better.
- Our measures of differences in human capital under-estimate true differences.

2. Externalities to education

- Important difference between physical and human capital: The latter is suspected to generate significant positive externalities.
- **Externality:** When one person's activity affects another person without any explicit exchange, i.e. unintentionally.

Externalities to education

- When one person receives more education, it also increases the output level of other people around.
- More educated farmers tend to adopt new technologies earlier. Others around eventually mimic them.
- More generally, education gets transmitted to others through daily activities.

Externalities to education: Empirical implications

- The total, social benefits of education are more important than the direct, private benefits.
- Our previous calculations were based on private benefits from education, i.e. salary increases for a worker.
- Again, human capital probably plays a larger role than the one we calculated to explain income differences between countries.
- A typical research project for an economist would be to try to measure the importance of such missing effects.

Externalities to education
Policy implications

- From a social point of view, people will tend to under-invest in education as they do not account for the external benefits.
- That is one reason why governments often subsidize education.
- NB Each time there is a wedge between the private and the social benefit of an action, there "may be" a case for government intervention.