

Lecture 06

2018/2019, 2º semester

Economics II



LISBON
SCHOOL OF
ECONOMICS &
MANAGEMENT

UNIVERSIDADE DE LISBOA

Updated Planning of the Course

Feb 25 – lectures 3-4-5 (part of lecture 5 presented during exercise classes)

Mar 11 – lectures 6-7

Mar 18 – lectures 8-9

Mar 25 – lectures 10-11

Apr 1 -- lectures 12-13

April 9 – AI Exam

09/04/2019	10:00	ANFITEATRO 1 (FRANCESINHAS 1)
------------	-------	-------------------------------

April 15 – Easter Holidays

April 22 – Easter Holidays

Apr 29 – lectures 14-15

May 6 – lectures 16-17

May 13 – lectures 18-19

May 20 – lectures 20 & General Revision

May 27 – Interruption

June 12 -

Prova escrita final: Época Normal	12/06/2019	09:00
-----------------------------------	------------	-------

Note:

Dia 26/4 (friday): there will be no class (so to even out the exercise groups)/

Summary:

- 3.4. Determinants of average labor productivity**
- 3.5. Policies that promote economic growth**
- 3.6. Costs of economic growth**

Bibliography :

Frank and Bernanke (2011), Chapter 7

Louçã and Caldas (2010), Ch 9

After this lecture, the student should be able to:

- ❑ Identify and understand the main determinants of average labor productivity
- ❑ Identify the government policies that promote average labor productivity increase in the long run
- ❑ Understand that economic growth has costs
- ❑ Apply a Cobb-Douglas production function to the growth analysis

Question: Why did West Germany and Japan recover so successfully from the devastation of world War II? (F& B 2009 p. 199-200)



Many factors contributed to the economic recovery of Japan (F&B 2009 p.199-200)

- External aid after war to reconstruct **physical** capital
- High level of **human** capital played a crucial role (economists agree)
- Restructuration of the Japanese school system
- On-job training
- Life time employment system ((workers expected to stay with the same company their entire career)
- New managerial techniques (e.g. just in time)
- Technology and property rights
- (natural resources scarce for a 127,360,000 population)

3.4. Determinants of Average Labor Productivity

The average labor productivity depends on several factors:

- Physical capital
- Human capital
- Land and other natural resources
- Technology
- Entrepreneurship and management
- Political and institutional/legal environment

3.4. Determinants of Average Labor Productivity

- Physical capital**
- Human capital**
- Land and other natural resources**
- Technology**
- Entrepreneurship and management**
- Political and institutional/legal environment**

Physical capital (K):

- **Physical capital** includes the tools people have to work with (e.g., machines, factories)
- **Physical capital** is a stock variable
- **Physical capital** is related with Gross Fixed Capital Formation GFCF [**FBCF**] (GFCF is a flow variable, not a stock variable)

$$K_t = K_{t-1} + FBCF_t - \delta_t \cdot K_{t-1}$$


δ_t **depreciation rate during period t .**

Physical capital is related with
Gross Fixed Capital Formation (FBCF)

$$K_t = K_{t-1} + FBCF_t - \delta_t \cdot K_{t-1}$$

d_t depreciation rate during period t .

Remember:

Investment = gross fixed capital formation + inventory changes

$$I = FBCF + VE + ACOV$$

- Increasing the amount of capital
 - Will tend to increase the productivity of the workforce (we will see shortly the algebra)
 - But **law of diminishing returns** also applies to capital, “If the amount of labor and other inputs employed is held constant, then the greater the amount of capital already in use, the less an additional unit of capital adds to production.”
 - “the degree to which long-run productivity can be increased by an expanding stock of capital is **limited**” (F&B2009:202)

Diminishing Returns to Capital

Diminishing returns to capital:

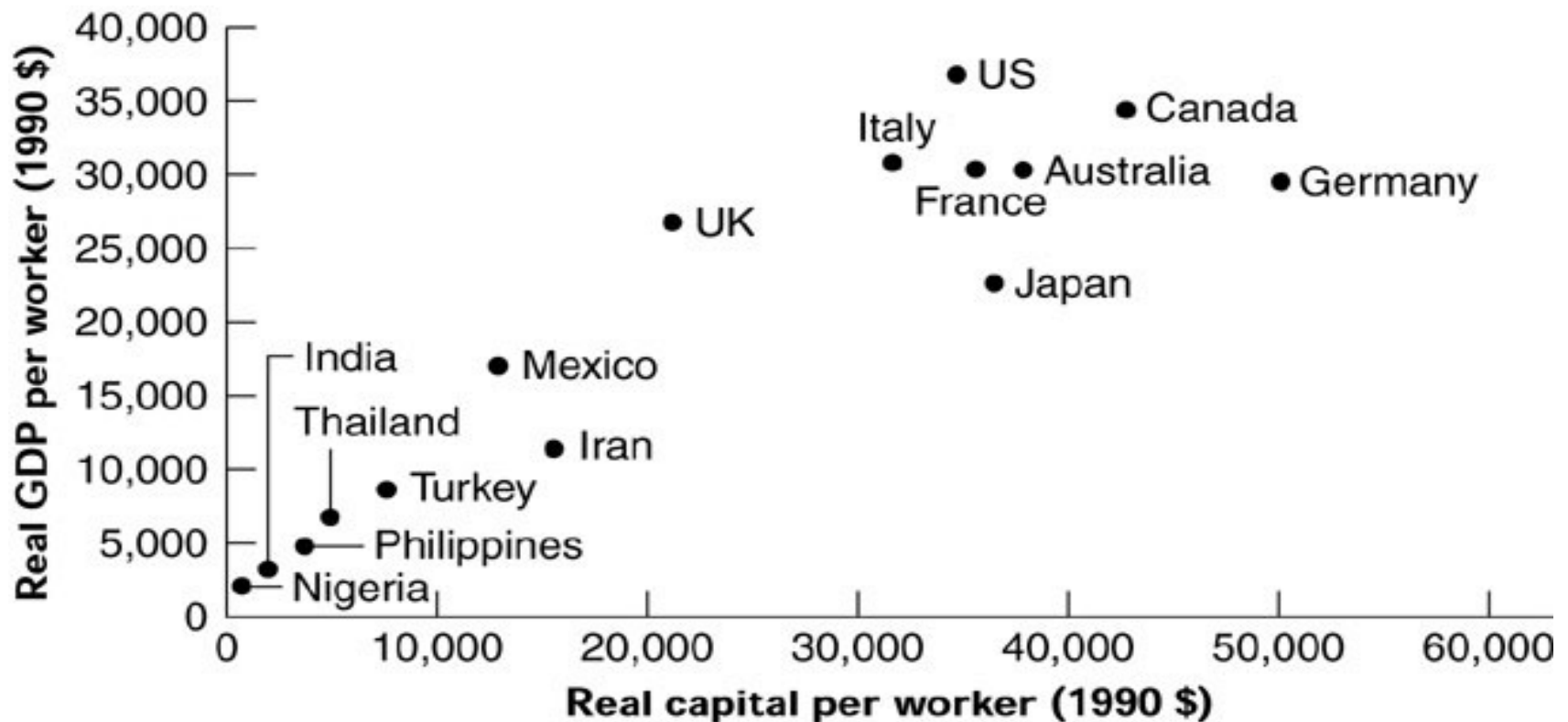
“If the amount of labor and other inputs employed is held constant, then the greater the amount of capital already in use, the less an additional unit of capital adds to production.” (F&B2009:201)

Does **the Law of diminishing returns** (to Capital, or to Labor, or to Land) hold in practice?

There is has been a lively discussion about this for a very long time

Is there empirical evidence that with more capital workers will be more productive?

Average Labor Productivity and Capital Per Worker in 15 Countries, 1990



Determinants of Average Labor Productivity

- Physical capital
- “Human capital”
- Land and other natural resources
- Technology
- Entrepreneurship and management
- Political and institutional/legal environment

“Human Capital” (H)

- “Human Capital” includes: knowledge, skills, education and training of workers.
- Human capital is “similar to physical capital” in that it is:
 - Acquired through the investment of time, energy, and money;
 - Acquired, for example, through going to school to learn new skills
 - But some essential differences. E.g. Human capital is physically more mobile!
- Greater human capital results in higher productivity

Determinants of Average Labor Productivity

- Physical capital
- Human capital
- Land and other natural resources
- Technology
- Entrepreneurship and management
- Political and institutional/legal environment

Land and other natural resources

- Land and other natural resources:
 - Land, energy, and raw materials;
 - Modern manufacturing processes intensively use energy and raw materials
 - Many natural resources can be obtained through international trade:
 - e.g. [petroleum](#).

Quiz: Do more natural resource-endowed countries grow faster?

Determinants of Average Labor Productivity

- Physical capital
- Human capital
- Land and other natural resources
- Technology**
- Entrepreneurship and management
- Political and institutional/legal environment

Technology

- Ability to develop and apply new, more productive technologies will increase productivity
 - Example: from the steam engine to the ...Internal combustion engine
- New technologies can improve productivity in industries other than the one in which they are introduced
- New technologies are the single most important source of productivity improvement

Quiz: Is technological progress faster in manufacturing than in services or agriculture/mining?

Determinants of Average Labor Productivity

- Physical capital
- Human capital
- Land and other natural resources
- Technology
- Entrepreneurship and management
- Political and institutional/legal environment

Entrepreneurship and Management

- **Entrepreneurs:** Are people who create new economic enterprises; are critical to invest and introduce new technology
- **Managers** are people who run businesses on a daily basis to organize the business
- Healthy financial management of firms is known to be key to investment and economic growth
- **New production and management methods** increase productivity
- There is substantial evidence from empirical studies that firms that are financially unhealthy (e.g. highly indebted) invest less.

→ This was one reason for the low growth problem in the EU following the last financial crisis. Too many highly indebted (high-leveraged) firms

Political and Institutional Environment

- **Institutions** are important for agents motivation
 - Political stability
 - Macroeconomic stability
 - Law system (e.g. well-defined property rights)
 - Free and open exchange of ideas (Increases development of new technologies and products)
- Many studies find that the quality of the institutions of a country is a key explanatory factor of differences in long-term growth across countries.

3.5.Policies for Promoting Economic Growth

- Policies that promote economic growth:
 - Increase **human capital, or educational capacities**:
 - education
 - training
 - Promote **investment (I) and saving (S)**, such as:
 - Fiscal Policy
 - Public investment (e.g. infrastructure)
 - Research and development Policy (R&D)
 - Changing the institutional environment (e.g. productive **legal and political framework** (difficult))

3.6. Growth Costs

A higher growth rate imposes social costs:

- **Trade-off** between production of equipment goods (capital) and production of consumer goods:
 - more physical capital may mean more future productivity and consequently higher future production
 - however, the resources to produce consumption goods are scarce
 - the same happens with human capital (reduced leisure time; reduced health and safety)

Quiz: Can economic growth continue indefinitely given that we have a finite world of natural resources?

- Economic growth can mean newer, better, and perhaps cleaner and more efficient goods and services.
- Sometimes, pessimistic view of economic growth ignores market responses:
 - Higher prices reduce quantity demanded and people tend to seek out substitutes
- But, still, global environmental problems that are hard for the market to solve:
 - Global warming
 - Rain forest destruction
 - Pollution
- Those **environmental constraints** probably will define the limits of growth in the future more than with other natural resource “limitations” of the past (when economists like Malthus thought that the limited food supply relative to the growth of population would kill growth)

The Easter Island case: can a civilization die?



A quantitative review of some concepts

□ Aggregate Production Function

- Mathematical relation between product (Y: output) and the use of factors (inputs)

$$Y_t = F(N_t, K_{t-1}, H_{t-1}, A_t, \dots)$$

□ Average Labor Productivity:

$$PMeL_t = \frac{Y_t}{N_t} = \frac{F(N_t, K_{t-1}, H_{t-1}, A_t, \dots)}{N_t}$$

An example: **Cobb-Douglas function**, homogeneous function of degree one in capital and labor

$$Y_t = A_t K_{t-1}^\alpha N_t^{1-\alpha}$$

This function has **constant returns to scale** on capital and work.

If K and N times $\lambda > 0$ the result is product (Y) times

$$A_t (\lambda K_{t-1})^\alpha (\lambda N_t)^{1-\alpha} = \lambda^\alpha \lambda^{1-\alpha} A_t K_{t-1}^\alpha N_t^{1-\alpha} = \lambda Y_t$$

Average Labor productivity* depends positively on:

- Fixed capital by workers;
- Available technology;
- (Similarity with other additional factors (natural resources etc.))

$$PM_eL_t = \frac{Y_t}{N_t} = \frac{A_t K_{t-1}^\alpha N_t^{1-\alpha}}{N_t} = A_t \left(\frac{K_{t-1}}{N_t} \right)^\alpha$$

* *The Average Capital Productivity is computed by a similar way*

Marginal Productivity of Capital

$$\frac{\partial Y_t}{\partial K_{t-1}} = \alpha A_t K_{t-1}^{\alpha-1} N_t^{1-\alpha} = \alpha A_t \left(\frac{N_t}{K_{t-1}} \right)^{1-\alpha}$$

The marginal productivity of capital decreases with the use of capital.

But how about the role of expanding A?

Role of Total Factor Productivity

A_t is called total factor productivity (TFP)

In empirical studies, it is found to explain up to 50% of the differences in per capita income across countries

It is a mathematical short-cut to capture the effect of technology and other factors (which we don't know much about) in explaining GDP growth.

It is **not** typically constant. It is believed to vary considerably over time as a result, e.g., of technology “shocks”