LISBON
SCHOOL OF
ECONOMICS &
MANAGEMENT
UNIVERSIDADE DE LISBOA

# Economics II

**Lecture 05**
2018/2019, 2nd semester

# Lecture 05

3. Economic Growth, Productivity and Living Standards

3.1. Economic growth and living standards ; empirical analysis

3.2. The importance of the growth rate

3.3. The crucial role of average labor productivity

Readings:

Frank, R. and Bernanke, B. (2011, Brief Ed.), *Principles of Macroeconomics,* McGraw-Hill. Chapter 7

Louçã, Caldas (2010), Ch 9

# After this lecture
# the student should be able to:

- ✓ recognize industrialization as a time of unparalleled economic growth
- ✓ Understand the concept of real convergence
- ✓ Define and calculate growth rates
- ✓ Understand why accumulated small differences in growth rates have a very large impact on value
- ✓ Understand the crucial role of average labor productivity on determinant of GDP per capita growth rate.

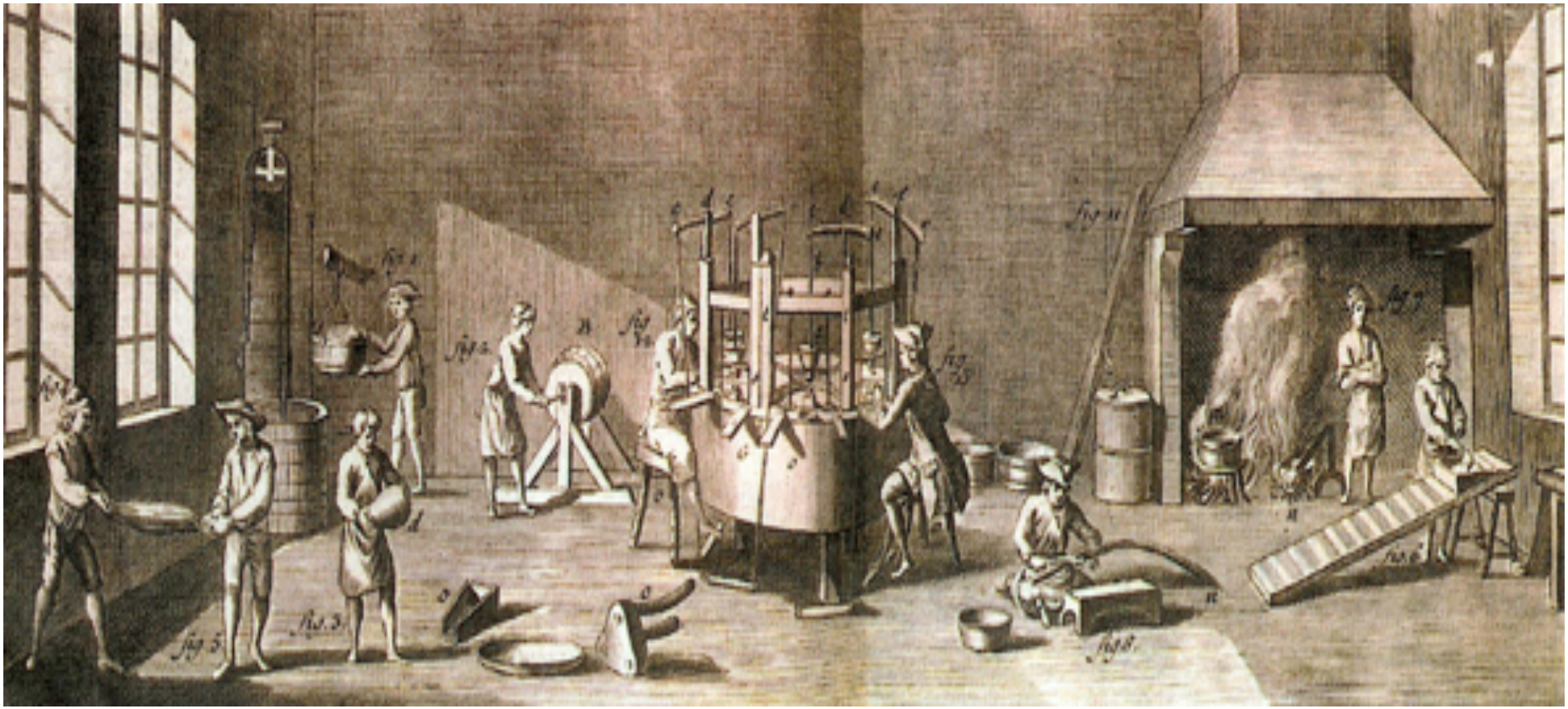
# 3. Economic Growth, Productivity and Living Standards

# 3.1. Economic growth and living standards - empirical analysis

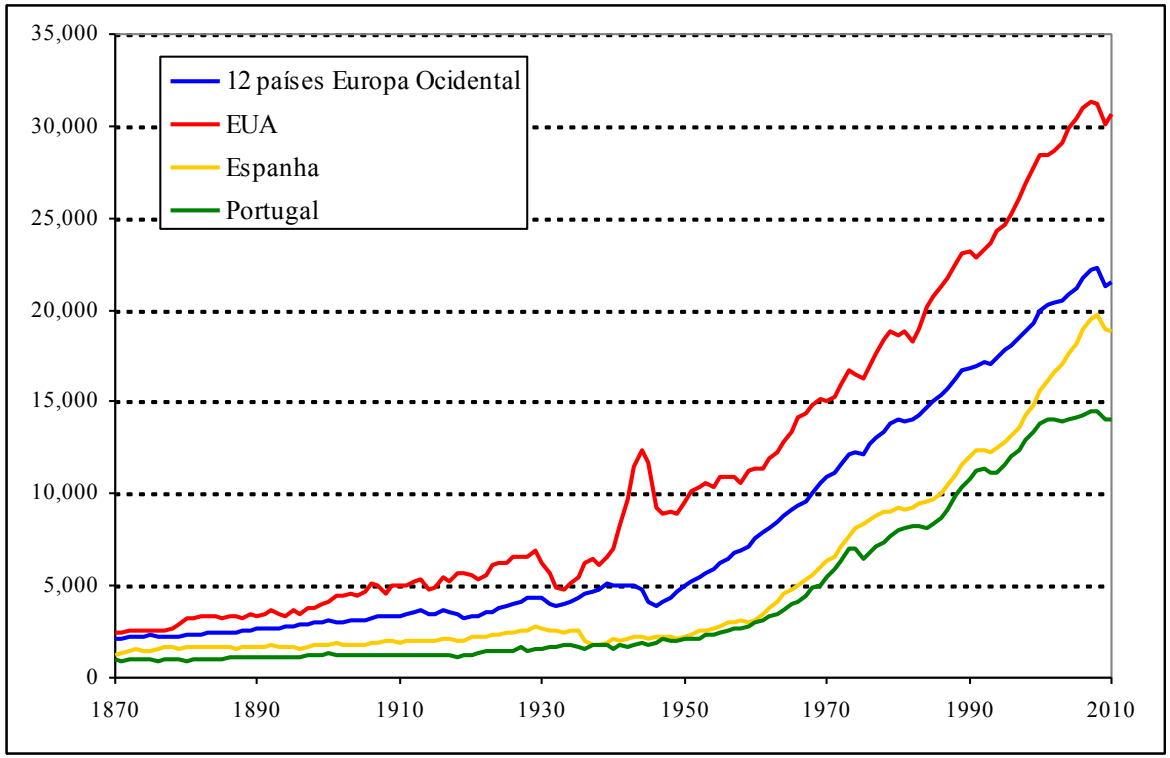
- During the last two centuries there was a dramatic increase on living standards in industrialized countries,
- The real GDP per capita mirrors that increase:
  - It measures the volume of final goods and services available for a average resident in a country during a certain period.

# Adam Smith and the industrial revolution in the UK

The pin factory ("The Wealth of Nations", 1774)



# PORTUGAL and U.S. Real per capita GDP
# (1990 prices, international dollars Geary-Khamis )




Sources: European Commission (2012) and GGDC (2012)

Legend:
**12 European countries (*)**
**US**
**Spain**
**Portugal**
(*)
Germany
Austria
Belgium
Denmark
Finland
France
Netherlands
Italy
Norway
UK
Sweden
Switzerland

# PORTUGAL and U.S. Real per capita GDP (1990 prices, international dollars Geary-Khamis )

- On the Figure, GDP per capita is measured in *real* and *international* terms.
  - *Real* ("1990 dollars") , because price level changes across time;
  - *"International* dollars" (Geary-Khamis: Roy Geary, 1958 & Hanna Khamis, 1970) because the prices change across countries, even when measured using the same currency.

**During last two centuries the Portuguese per capita GDP :**

- had a dramatic increase
- in 2011 value = approximately 15 x 1820
- it was always less than Western Europe, Spain and US per capita GDP .

## Real convergence

- approximation of the average standard of living in Portugal in terms of living standards that characterizes richer economies (e.g. Western Europe, USA).

# Real Convergence

**Real convergence can be measured by 2 ways:**

- analyzing the average annual growth rate;
- analyzing the relative per capita GDP.

**Convergence period :**

- depends on the difference between the Portuguese growth rate and the US and Europe growth rate;
- between 1950 and 2001 the Portuguese growth rate was higher than US and Europe

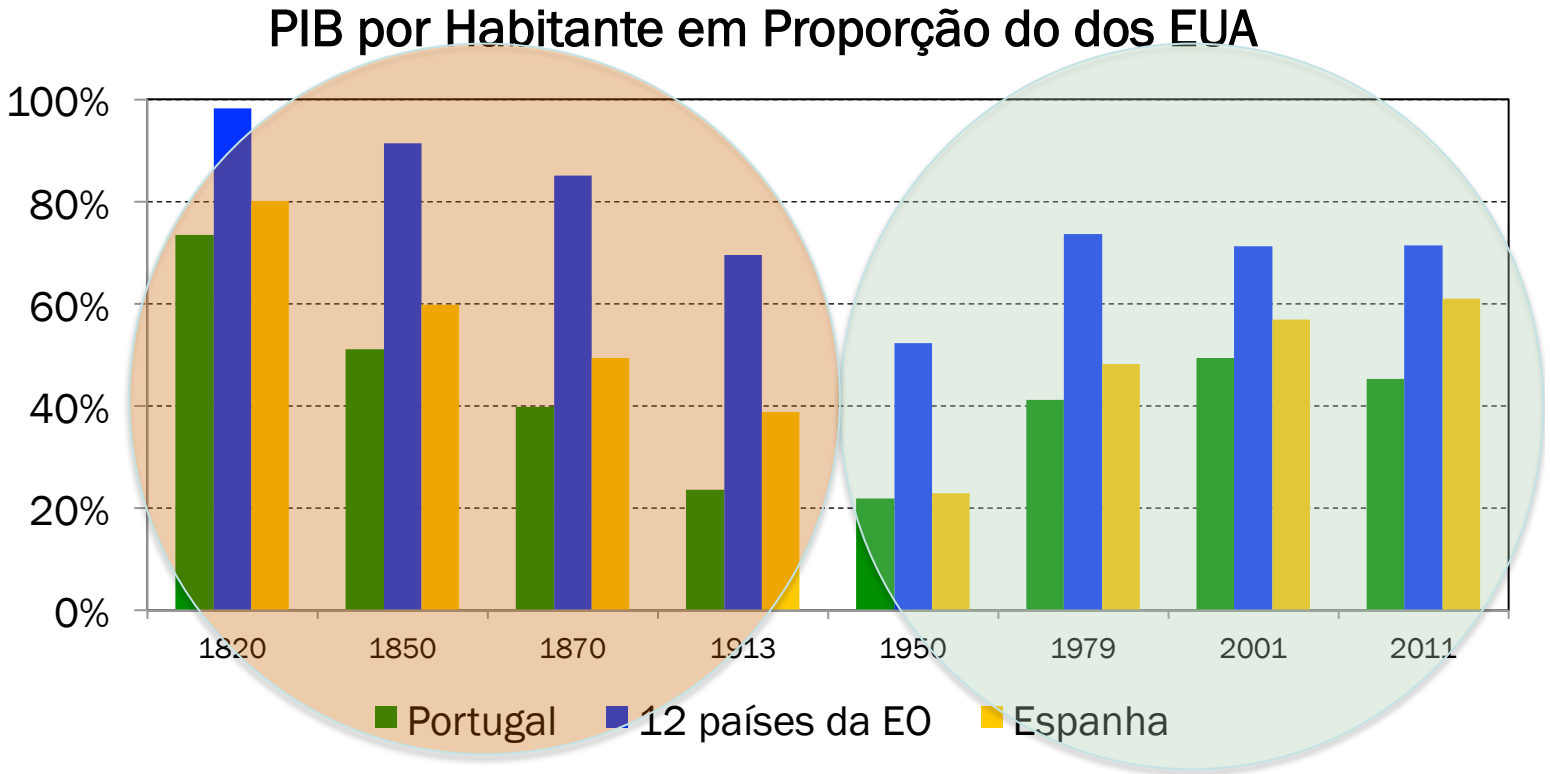
# Average annual growth rate of per capita GDP, before the recession

| | 1820-1850 | 1850-1870 | 1870-1913 | 1913-1950 | 1950-1979 | 1979-2001 | 2001-2011 |
|---|---|---|---|---|---|---|---|
| Portugal | 0.0% | 0.3% | 0.6% | 1.4% | 4.6% | 2.7% | -0.1% |
| 12 Oc Europe | 1.0% | 1.2% | 1.3% | 0.8% | 3.6% | 1.7% | 0.8% |
| US | 1.2% | 1.5% | 1.8% | 1.6% | 2.4% | 1.9% | 0.8% |
| SPAIN | 0.2% | 0.6% | 1.2% | 0.2% | 5.0% | 2.7% | 1.5% |

Sources: European Commission (2012) and GGDC (2012)

- **In period 1950-2001** the per capita GDP of Portugal was closer the richer countries.
  - This happened, because the Portuguese per capita GDP growth rate was higher (compared with other economies)

- **In period 2001-2011**, the Portuguese per capita GDP moved away from the per capita GDP of the richest countries.
  - This happened because the Portuguese per capita GDP had a slightly decrease , despite the richer countries per capita GDP have grown slightly
  - This is considered a 'lost decade' in the Portuguese growth .




Fontes: Comissão Europeia (2012) e GGDC (2012)

# 3.3. The importance of growth rate

**What is the annual growth rate (of a variable *y*)?**

$y_t$ = is the value at year *t*

$y_{t-1}$ = is the value at year *t-1*

? $yt = yt - yt\text{-}1$ = is the change on year *t*

Annual growth rate is computed as:

$$g_{y,t} = \frac{\Delta y_t}{y_{t-1}}$$

NOTE: Presentation slides do not substitute the BIBLIOGRAPHY

From the previous relation:

$$y_t = (1 + g_{y,t}).y_{t-1}$$

Therefore, by replacing successive we have:

$$y_t = (1 + g_{y,t}).(1 + g_{y,t-1})...(1 + g_{y,t-n+1}).y_{t-n} =$$

$$= y_{t-n}.\prod_{s=0}^{n-1}(1 + g_{y,t-s})$$

- ***n*** is the number of years between ***t*** and ***t-n***
- ***t*** is the last year; ***t-n*** is the initial year

The same final end (final) value $y_t$ can be obtained from the same initial value ($y_{t-n}$) if the variable had grown at a constant growth rate $g_y$.

(Initial value $y_{t-n}$ and final value $y_{t)}$

$$y_t = y_{t-n} . \prod_{s=0}^{n-1} \left(1 + \bar{g}_y\right) = (1 + \bar{g}_y)^n . y_{t-n}$$

Consequently, solving in order to gy:

$$\bar{g}_y = \left( \frac{y_t}{y_{t-n}} \right)^{\frac{1}{n}} - 1 = \sqrt[n]{\frac{y_t}{y_{t-n}}} - 1$$

This growth rate is called Average Growth Rate of variable *y* in period between *t-n* and *t*.

Observation: This is different from the simple arithmetic mean of the rates for each year ( a wrong way of computing growth rate).

# Small differences in average growth rates have large effects in the long run

| To double GDPpcapita in: | The required average growth rate must be equal to: |
|---|---|
| 5 years | 14.9% |
| 10 years | 7.2% |
| **15 years** | **4.7%** |
| 20 years | 3.5% |
| **25 years** | **2.8%** |
| 30 years | 2.3% |
| 40 years | 1.7% |
| 50 years | 1.4% |
| 60 years | 1.2% |
| 70 years | 1.0% |

# 3.3. The importance of average labor productivity

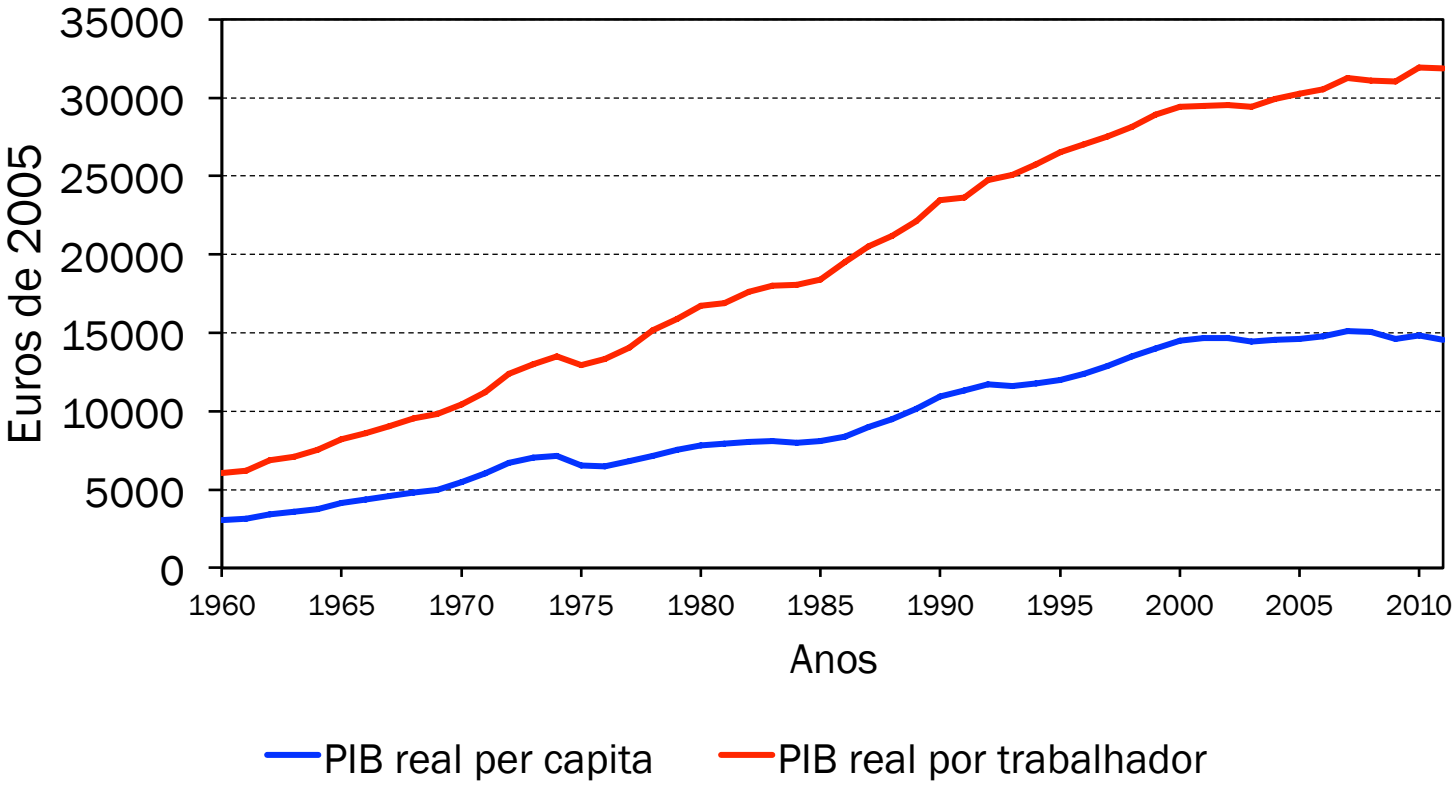
The average labor productivity is measured as the created value (at constant prices) by units of labor allocated.

- A first approach is to compute to a country *X* and during a period *t*:

$$PMeL_t = \frac{Y_t}{N_t}$$

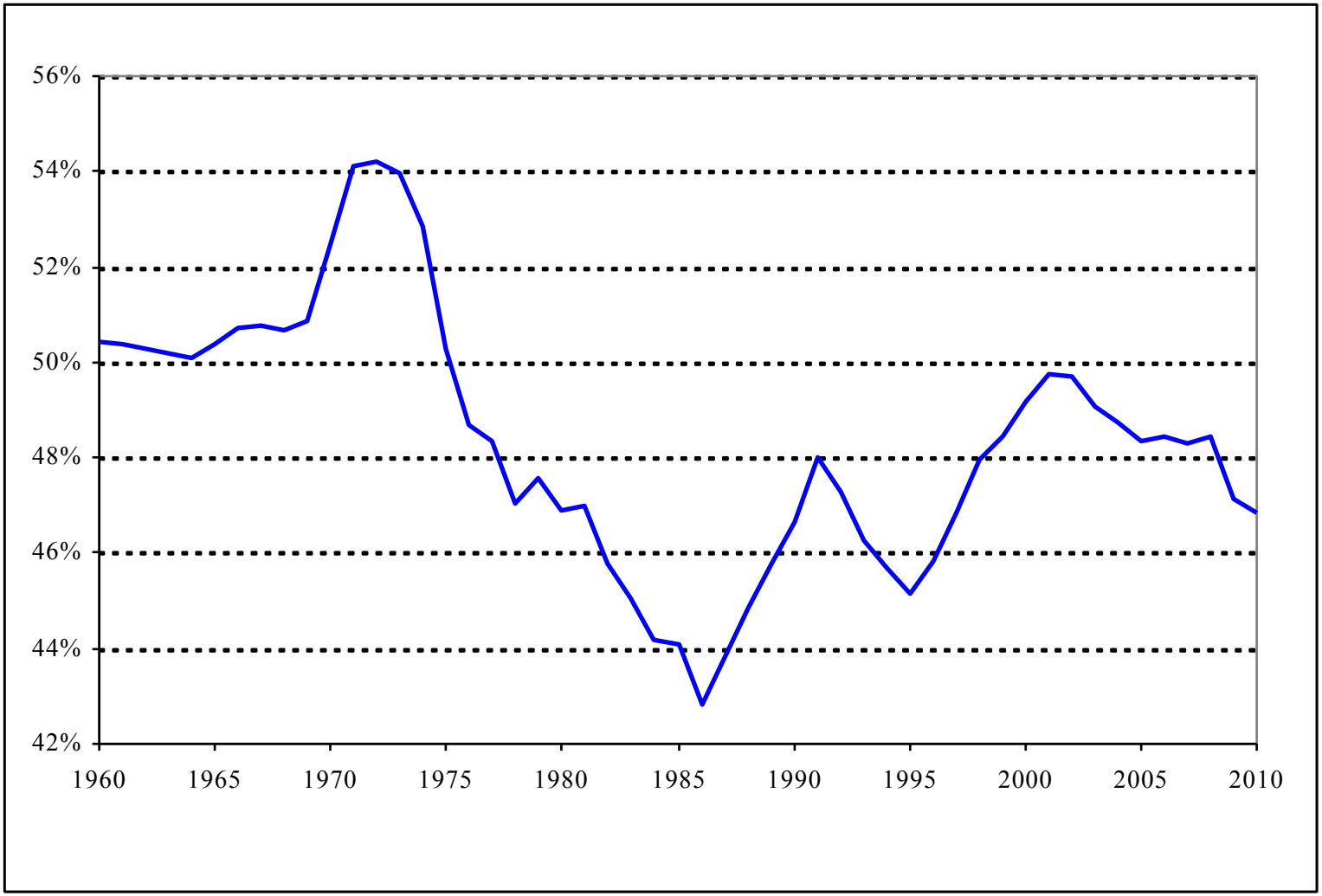
- Where *N* represents the Employment (stock) in the period.
- It would be better to measure *N* as the number of hours worked (flow), but it is difficult obtain them.

## PIB Real Anual por Habitante e por Trabalhador em Portugal: 1960-2011




Fonte: Comissão Europeia (2012)

# Share of the Portuguese Population Employed in Total Population Portugal 1960 - 2010




Source: European Commission (2012)

- The real per capita GDP can be represented as the product of multiplying two factors:

  the average labor productivity
  the percentage of the population that is working

$$\frac{Yt}{POPt} = \underbrace{\frac{Yt}{Nt}}_{PMeL_t} x \frac{Nt}{POPt}$$

$PMeL_t$
Average Labor Produtivity

**Real per capita GDP increases if :**

- average labor productivity increases;
- the percent of the population that is working increases.

– In the long run:

- increases in output per person arise mainly from increases in average labor productivity.