

## 0 Introduction to Macroeconomics

### 0.1 Definition and questions of Macroeconomics

**Macroeconomics** = study of economy as a whole, where macroeconomists try both to explain economic events (positive) and to devise policies to improve or enhance economic performance (normative).

Basic questions it aims to answer (+ time horizon):

1. Long term: What are the factors behind the differences in economic growth, and how can we control them? => GROWTH theories
2. Short term: Why do countries observe periods of recessions and depressions and how can government reduce the severity of these episodes?  
=> BUSINESS CYCLE theories
3. Medium term problems: long period of unemployment in Europe, transition in Central and Eastern Europe - different nature of shocks (pace of technological progress, demographic evolution, changes in institutions)
4. Crucial question: How much government intervention is needed to achieve goals and mitigate problems? Examples:
  - Was the Great Depression a result of the market failure?
  - Was an extraordinary growth after WWII a result of a careful economic policy of the governments?
  - Was the state intervention responsible for the high US inflation in 60's, EU high unemployment till today or Japanese problems in the 90's?
  - Was the lack of market coordination, wrong policies and insufficient regulation of banking and financial sector behind today's sharp fall of output?

## 0.2 Models as basic analytic tool:

**MODELS** = simplified theories that show key relationships among economic variables. They explain how changes in the exogenous variables affect the endogenous variables.

- **exogenous** variables: variables that model take as given
- **endogenous** variables: variables that model wants to explain
- in different models, same variable can be endogenous as well as exogenous (e.g. saving rate in Solow versus Ramsey model)
- model is as good as its assumptions (think critically!)

## 0.3 Microfoundations

**Microeconomics** - studies how households and firms make decisions and how they interact in the marketplace

- main concept = **optimization**, e.g. doing their best given the objectives they have set for themselves and constraints they face
- e.g. household try to maximize their utility (happiness, satisfaction) which they derive from consumption + free time + ..., while facing the financial constraints

**Macroeconomics** - studies how decisions of households and firms aggregate into the whole economy

- modern macroeconomic models: define agents (HHs, firms, governments, banks, etc.) + define their decision problems (consumption, work, taxes, profits, etc.) + define existing markets + study interaction and aggregation

# 1 Economic Growth - Introduction and Stylized Facts

## 1.1 Motivation

### Importance of sustained economic growth:

Great **absolute differences** in the standards of living measured by GDP per capita: <sup>1</sup>

- GDP p.c. of USA in 2007 (in 1996 prices) was \$42,897 (10<sup>th</sup> highest in the world)
- Russia - \$13,401, South Africa - \$10,483, China - \$8,511, India - \$3,825, Dem. republic of Congo - \$390, Liberia - \$386 (i.e. \$1.06 a day)
- corresponding differences in nutrition, literacy, infant mortality, life expectancy and other measures of well-being
- Czech Republic - \$21,929, Slovak Republic - \$17,284

Small **differential in growth rates** implies huge differences in final outcomes when compounded over long periods of time (centuries):

- With GDP p.c \$3,300 in 1870, US was growing at average rate 1.886% per year in period 1870 - 2007<sup>2</sup>
- Though experiment 1: If the growth rate would be 0.886%, then GDP p.c. would be \$11,049 (i.e. 26% of the actual value)
  - similar GDP p.c. level to Cuba, Mexico and Turkmenistan
- Though experiment 2: If the growth rate would be 2.886%, then GDP p.c. would be \$162,664 (i.e. 3.8 times the actual value)

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<sup>1</sup>Data are from version 6.3 of Penn World Tables, <http://pwt.econ.upenn.edu>.

<sup>2</sup>Let  $y_0$  be the GDP p.c. at year 0,  $y_T$  the GDP p.c. at year  $T$ , and  $x$  the average annual growth rate over that period. Then,  $y_T = (1 + x)^T y_0$ . We can compute  $x$  by taking logarithms, getting  $\ln y_T - \ln y_0 = T \ln(1 + x) \approx Tx$ , or  $x \approx (\ln y_T - \ln y_0)/T$ .

Even in the horizon of **2 generations**, growth rates matter:

- If the Czech Republic would grow at the same average rate as throughout the period 2000-2007 (i.e. 3.9%), in 30 years it would triple its real GDP p.c.
- However, if the Slovak Republic would grow at the same average rate as throughout the period 2000-2004 (i.e. 4.7%), in 30 years it would attain 4 times its real GDP p.c. and it would "catch on" the Czech Republic.

## 1.2 World Distribution of Income and Growth Rates

High **cross-country dispersion** in the level of income - GDP p.c., persistent with time

- **Figure 1** distribution of GDP p.c. in 1960 across 113 countries from the Penn World Tables 6.1.
  - richest country - Switzerland (\$15,000), poorest - Tanzania (\$381)
  - wealthiest countries: OECD + Latin America (Venezuela, Argentina); poorest countries: Africa (Tanzania, Uganda) and Asia (China, India, Indonesia)
- **Figure 2** - distribution of GDP p.c. in 2000 across 150 countries from the Penn World Tables 6.1.
  - richest country - Luxembourg (\$44,000), poorest - Tanzania (\$482)
  - wealthiest countries: OECD + East Asia (Taiwan, Japan, Singapore); poorest countries: sub-Saharan Africa (Tanzania, Uganda); Latin America + Asia: mid-range
- **Comparison:**
  - similar cross-country dispersion of income over this period
  - mean of GDP p.c. in 2000 was 2.5 higher than in 1960 (compare \$8,490 and \$3,390)
  - change of relative position of countries (drop of Argentina, Venezuela, Israel or RSA; rise of China, India, Singapore) due to **differences in the rate of economic growth**
- **Figure 3** - distribution of growth rate of GDP p.c. from 1960 - 2000.
  - range from  $-3.2\%$  for the Democratic Republic of Kongo to  $6.4\%$  for Taiwan
  - growth miracles: Singapore ( $6.2\%$ ), South Korea ( $5.9\%$ ), Hong Kong ( $5.4\%$ ), Thailand, Japan (after WWII), China, Ireland
  - growth disasters: sub-Saharan Africa (Niger, Angola, Madagascar, Nigeria, Rwanda) + Latin America (Venezuela, Bolivia, Peru, Argentina)

**Convergence: Do the poor countries catch up rich countries, i.e. do they tend to grow faster?** (+ rationale)

- **Unconditional convergence:**  $\Delta \ln y_{2000-1960} = \alpha + \beta \ln y_{1960}$

– Figure 4, based on Penn World Tables data, shows that average growth rate over the period 1960-2000 has little (and slightly positive) correlation with initial level of GDP p.c.

- **Conditional convergence:**  $\Delta \ln y_{2000-1960} = \alpha + \beta \ln y_{1960} + \gamma \mathbb{X}_{1960}$ , where  $\mathbb{X}_{1960}$  is a set of country-specific controls (education, fiscal and monetary policy, competition level, etc.) - we compare countries with similar starting characteristics

– After conditioning on the underlying characteristics, the countries with lower initial income tend to grow faster than their rich counterparts. For illustration, see Figure 5 for evidence of convergence within OECD countries and Figure 6 for the convergence among US states (both with apparent negative correlation).

**What are the factors behind the differences in economic growth, and how can we control them?**

- government policies with effects on long-term growth
- evaluation framework = models

### 1.3 Stylized Facts - Building Blocks of Models

Stylized facts = empirical regularities which we observe in the data and want to simulate by the model => assess the fit

**Kaldor (1963) - balanced growth in the long run**

1. Output per worker  $Y/L$  (GDP p.c.) grows over time and the growth rate does not tend to diminish
2. Physical capital per worker  $K/L$  grows over time
3. The capital to output ratio  $K/Y$  is nearly constant  $\Rightarrow$  capital and output grow at the same rate
4. The return to capital ( $r$ ) is roughly constant
5. The income shares of labor and capital ( $wL/Y$  and  $rK/Y$ ) stay roughly constant
6. The level as well as the growth rate of output per worker differs substantially across countries.

⇒ applies to **developed countries**  
⇒ explained by Solow model

### **Kuznets (1981)**

- *Structural transformation*: agriculture → manufacture → services
- *Urbanization*: family production → organized production; small villages → big cities
- *Formal education*: correlated with high levels of income (endogeneity); predictor of high growth performance ⇒ can explain cross-country differences in output  
⇒ role of human capital formation (Uzawa-Lucas)
- *R&D and IT*: powerful engines of growth, increase productivity of capital  
⇒ models of technological change
- *Openness*: international trade and financial integration promote trade
- *Government policies*: taxation, infrastructure, inflation, law enforcement, property rights and corruption as important determinants of growth performance.

### **Other stylized facts**

- *Short term fluctuations* in output, employment, investment and consumption - booms and recessions
- *Persistent differences versus conditional convergence*
- *Fertility*: fertility rates decline with increasing GDP p.c. following a Malthus curve, i.e. fertility rates initially increase and then fall as economy develops  
⇒ models of fertility choice

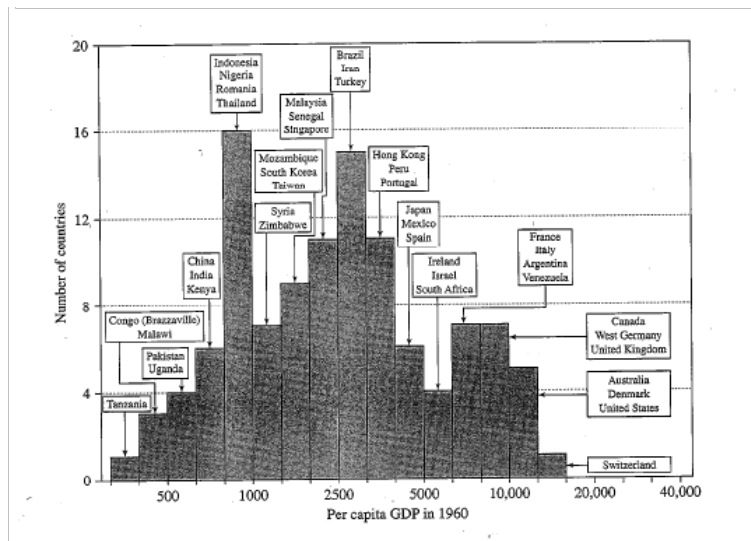


Figure 1: Histogram for GDP p.c. in 1960 (reproduced from Barro, 2003). The data for 113 countries are taken from Penn World Tables 6.1. Representative countries within each group are labeled.

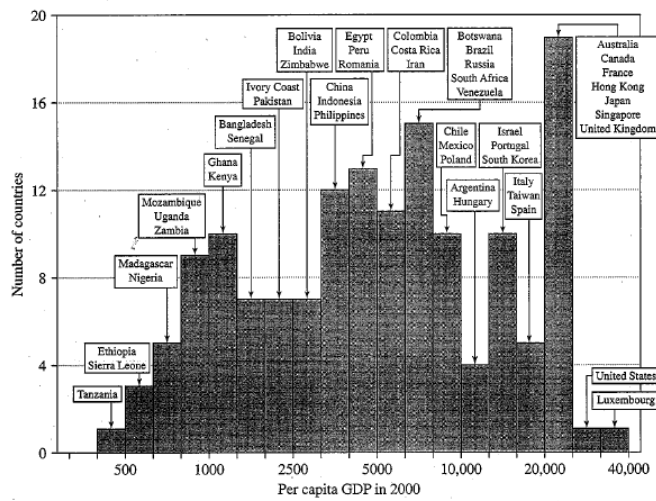


Figure 2: Histogram for GDP p.c. in 2000 (reproduced from Barro, 2003). The data for 150 countries are taken from Penn World Tables 6.1. Representative countries within each group are labeled.

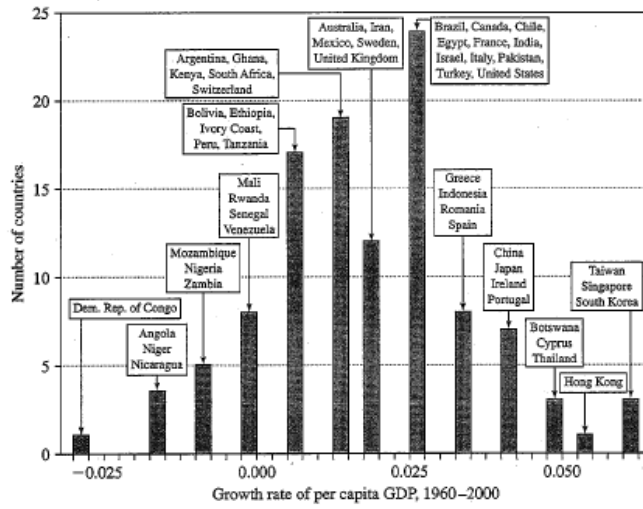


Figure 3: Histogram for growth rates of GDP p.c. from 1960-2000 (reproduced from Barro, 2003). The data for 150 countries are computed from the values of GDP p.c. shown in Figures 1 and 2. Representative countries within each group are labeled.

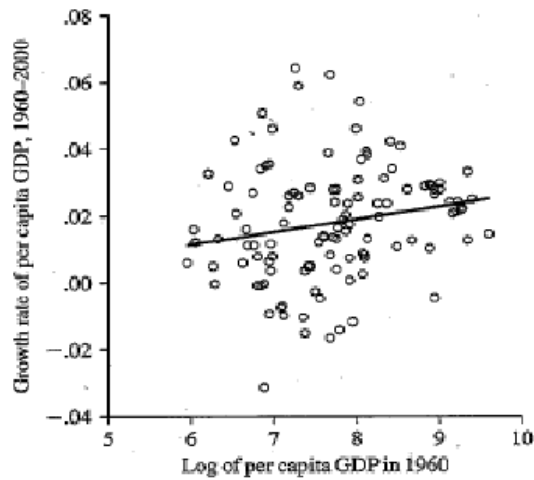


Figure 4: Convergence of GDP across countries: Growth rate from 1960 to 2000 over the initial level of real GDP p.c. for 114 countries (reproduced from Barro, 2003).



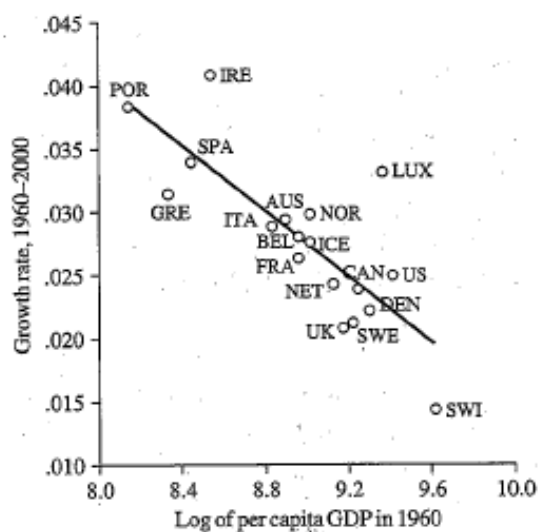


Figure 5: Convergence of GDP across OECD countries: Growth rate from 1960 to 2000 over the initial level of real GDP p.c. for 18 countries (reproduced from Barro, 2003).

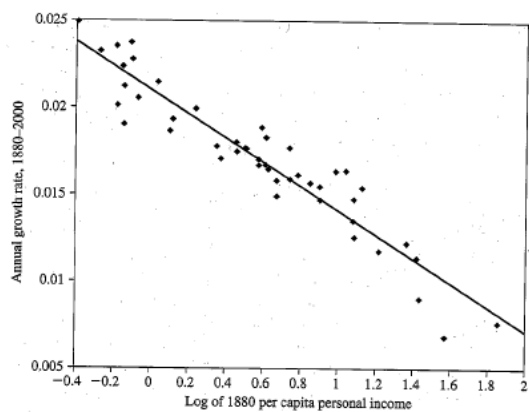


Figure 6: Convergence of personal income across US states: Growth rate of personal income from 1880 to 2000 over the initial level of personal income for 47 states (reproduced from Barro, 2003).