Economic Policy and Business Activity

Academic Year 2017-2018

2nd Semester

Chapter 5

Growth policies

5. Growth policies

5.1 Some key concepts and issues

5.1.1 Stylized facts about growth

5.1.2 Catching up

5.1.3 Productivity differentials

5.2 Theories

5.2.1 Capital accumulation models

5.2.2 Endogenous growth models

5.2.3 Beyond the production function

Theory Lecture 14

Learning outcomes for lecture 14

- Explain the five main stylized facts about economic growth
- Explain the limitations of GDP pc as a measure of well-being
- Explain the differences between output per capita and labour productivity

5.1. Some key concepts and issues

5.1.1. Five stylized facts about growth

5.1.2. Catching up

5.1.3. Productivity differentials

Recall that:

- FP and MP can be successful at minimizing cyclical fluctuations in the short(er) term, but they are not the appropriate means to create longer term economic growth process

- That is, **FP and MP aim to minize the output gap** (i.e. deviation of actual output from potential output) **without generating inflationary pressures**, while **growth policies aim at increasing the potencial output**

- Remember the diagram of the three functions of governments: allocation,stabilizastion, redistribution

5.1 Some key concepts and issues
How can we measure economic growth and development?

- As discussed in chapter 1, well-being can be assessed through the use of social well-being functions, e.g. Betham vs Rawls

- Betham's view is concerned about the evolution of average income, while Rawls' view is concerned with the evolution of the income of the poorest group in society (i.e. *maxmin* principle)

- The most common indicator of economic growth used is GDP per capita – this is a Benthiam type indicator because it is an average of economic outcome and/or income

5.1 Some key concepts and issues
How can we measure economic growth and development?

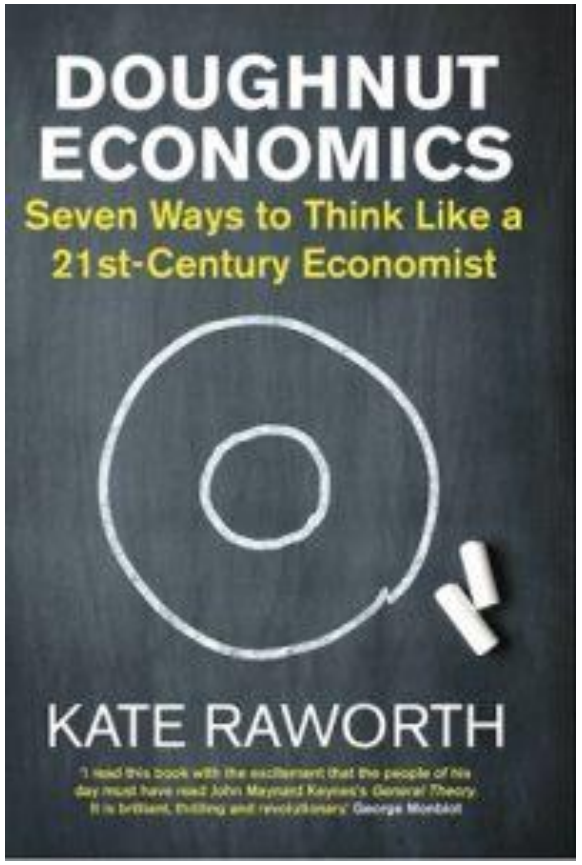
- Remember that **to make intertemporal cross-country comparisons of GDP pc (or any other monetary measure)** you need to:
  - Use constant prices (i.e. take account of inflation)
  - Use exchange rates to convert to the same currency and take account of differences in purchasing power (i.e. **use Purchasing Power Parity**)

5.1 Some key concepts and issues
How can we measure economic growth and development?

- There are several limitations associated with the use of GDP pc, which make it a poor measure for sustainable development:

Can you think about some limitations?

Food for thought



[Doughnut economics]

[Why growth is not enough]

5.1 Some key concepts and issues
How can we measure economic growth and development?

- There are several limitations associated with the use of GDP pc, which make it a poor measure for sustainable development:
  - It doesn't take account of externalities (positive or negative)
  - It is a very limited indicator of well-being and does not consider many important dimensions: e.g. health, environment, quality of public services, inequality, human rights, etc.
    - To capture these domains we need to look at other indicators, e.g. UN’s indicators such as the Human Development Index (HDI), OECD’s Better Life Index, etc.

5.1 Some key concepts and issues
How can we measure economic growth and development?

- GDP per capita is not the same as labour productivity. **WHY?**

5.1 Some key concepts and issues
How can we measure economic growth and development?

- GDP per capita is not the same as labour productivity. **WHY?**

GDP per hour worked (labour productivity)

$$\frac{Y}{H} = \left(\frac{Y}{d(1-u)xPop}\right) = \left(\frac{1}{d(1-u)x}\right)\left(\frac{Y}{Pop}\right)$$

GDP per capita

where:

Y: GDP

x: participation rate

u: unemployment rate

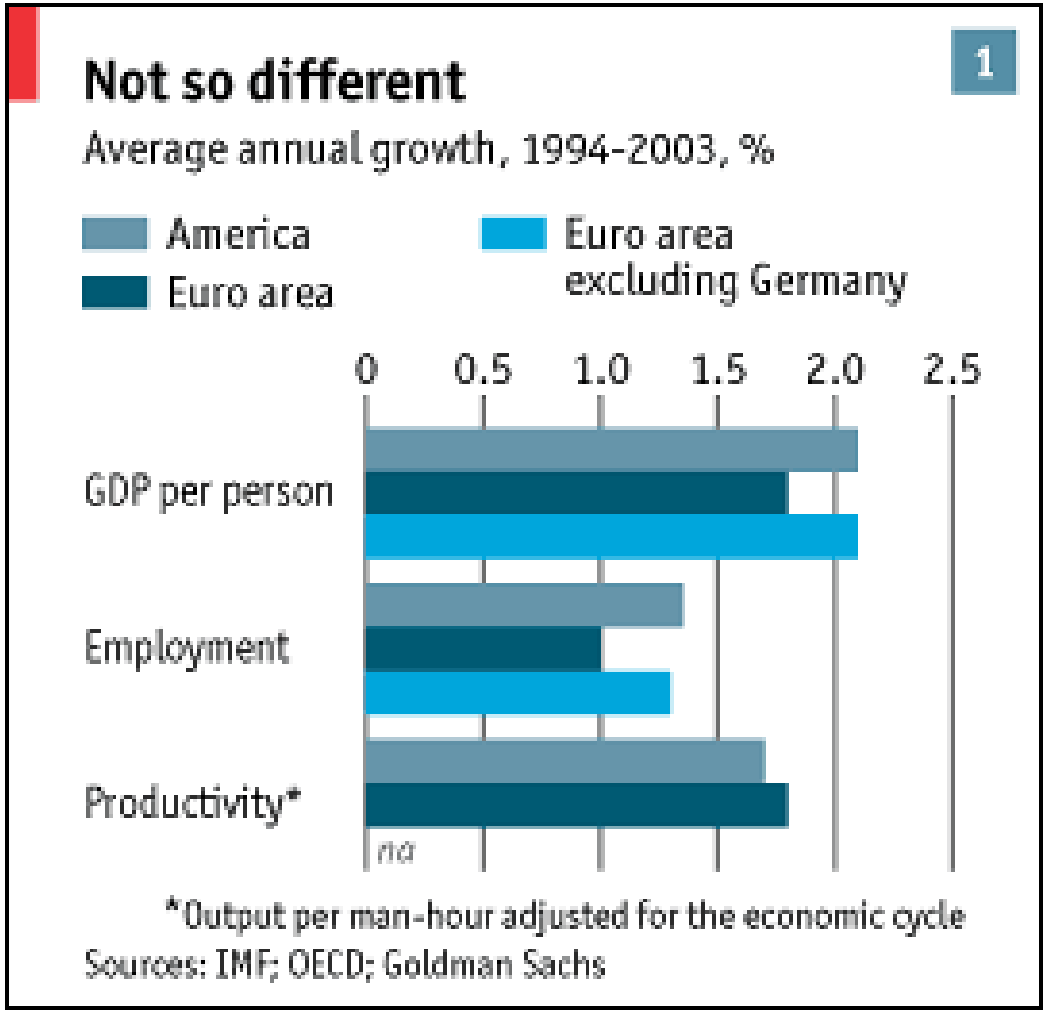
d: average hours worked

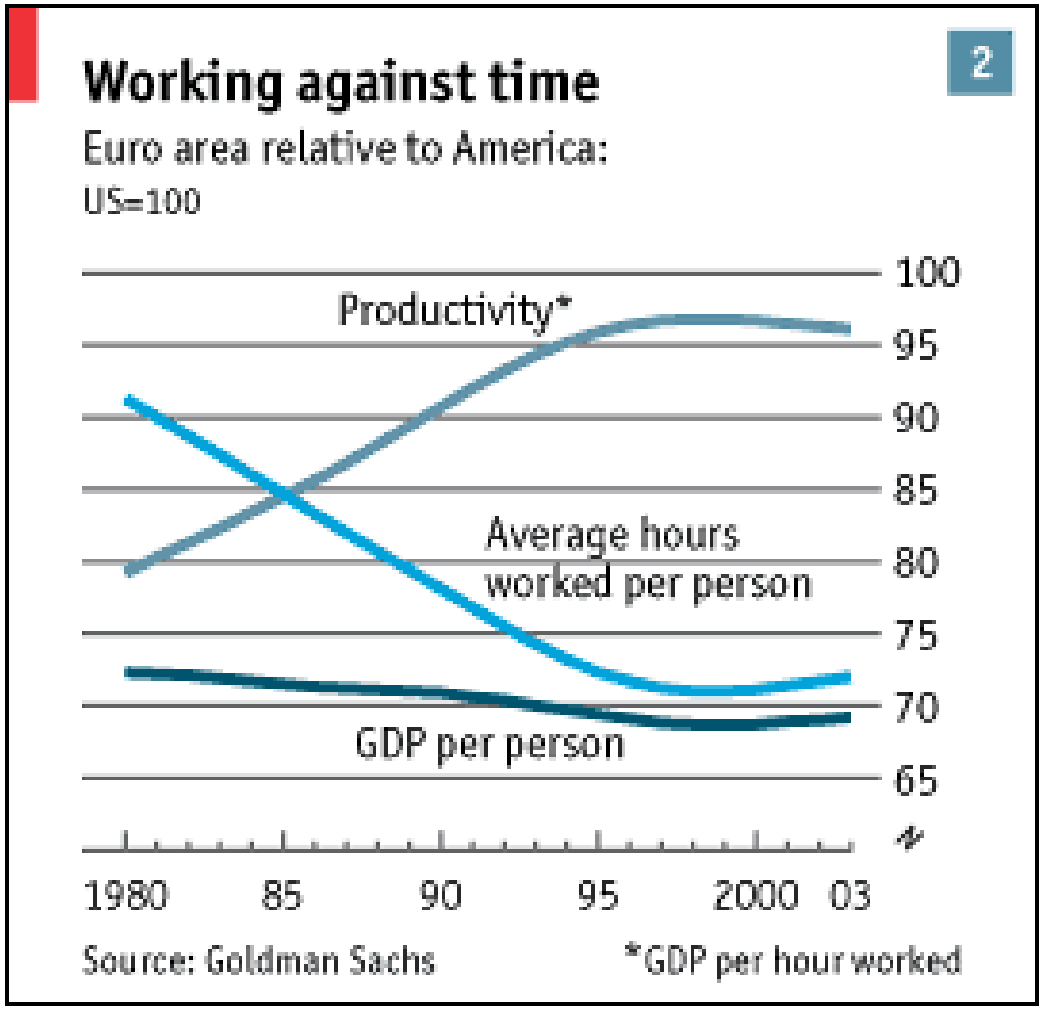
L=xPoP is the labour force

N=(1-u)xPoP is the employment

H=dN=d(1-u)xPoP is the total number of hours worked

5.1 Some key concepts and issues
How can we measure economic growth and development?

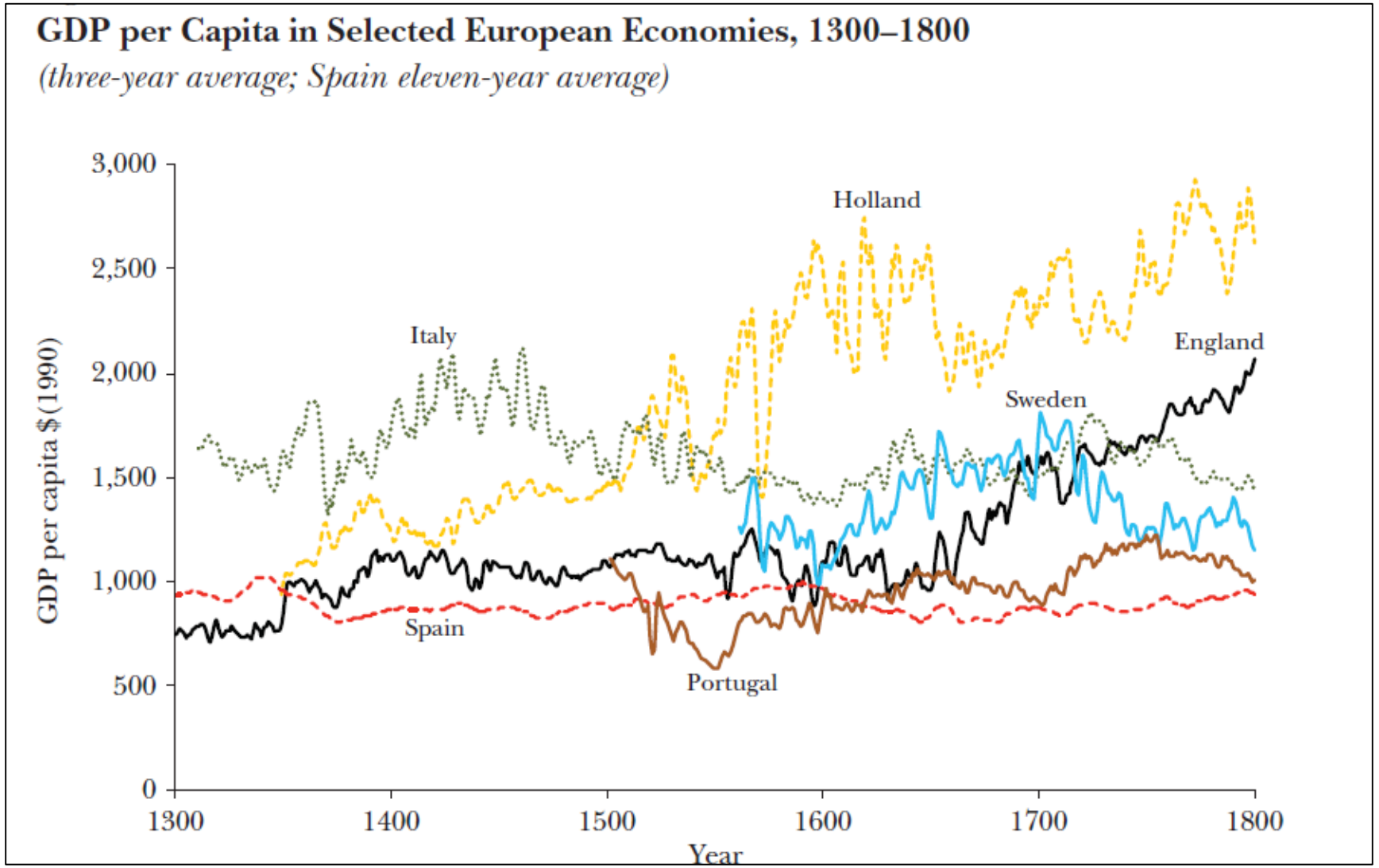




Source: https://www.economist.com/node/2765877

5.1.1. Stylized facts about growth (#1)

1. By historical standards, fast growth in income pc is a recent phenomenon



5.1.1. Stylized facts about growth (#1)

1. By historical standards, fast growth in income pc is a recent phenomenon

Table 1

LEVELS OF GDP *PER CAPITA* AND INTERREGIONAL SPREADS, 1000-1998

(1990 international dollar)

	1000	1500	1820	1870	1913	1950	1973	1998
Western Europe	400	774	1 232	1 974	3 473	4 594	11 534	17 921
Western offshoots	400	400	1 201	2 431	5 257	9 288	16 172	26 146
Japan	425	500	669	737	1 387	1 926	11 439	20 413
Asia (excluding Japan)	450	572	575	543	640	635	1 231	2 936
Latin America	400	416	665	698	1 511	2 554	4 531	5 795
Eastern Europe & former USSR	400	483	667	917	1 501	2 601	5 729	4 354
Africa	416	400	418	444	585	852	1 365	1 368
World	435	565	667	867	1 510	2 114	4 104	5 709
Inter-regional spreads	**1.1:1**	**2:1**	**3:1**	**5:1**	**9:1**	**15:1**	**13:1**	**19:1**

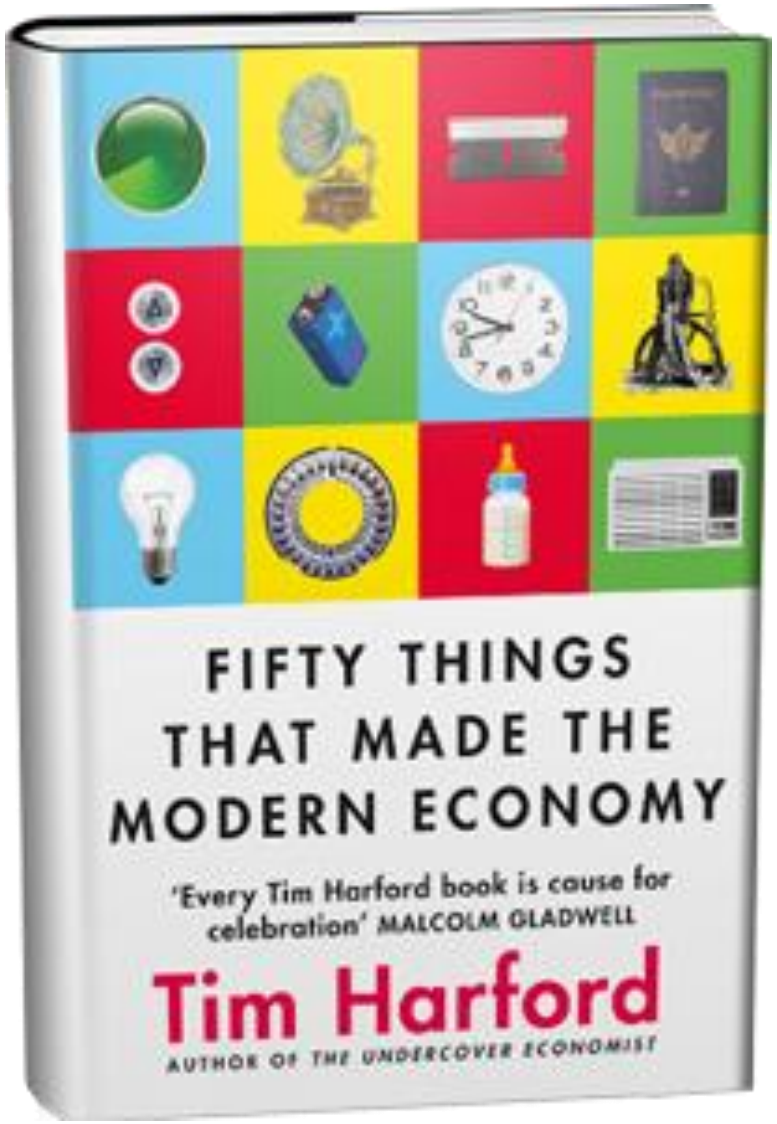
Source: Maddison, *The World Economy. A Millennial Perspective. Development Centre Studies*, Organization for Economic Cooperation and Development (OECD), (2001).

5.1.1. Stylized facts about growth (#1)

1. **By historical standards, fast growth in income pc is a recent phenomenon**

- Turning points are generally related to changes in the world economic system that are conducive to productivity and international trade. Some examples of such changes and revolutions include:
  - Improvements in productivity of agriculture
  - The “Discovery” period started in XV-XVI centuries, especially Americas and east Asia
  - Major technological innovations such as the steam engine, railways, electricity, ICT and internet
  - Urbanization
  - Globalization
  - …

- **Understanding these turning points involves the study of history as much as economics**



Shipping container
iPhone
Barcode
Banking
Antibiotics
Insurance
Contraceptive pill
Passports
Infant formula
Plastics
Welfare state
Radar
Paper Money
Tax havens
….
….

https://www.bbc.co.uk/programmes/p04b1g3c/episodes/downloads

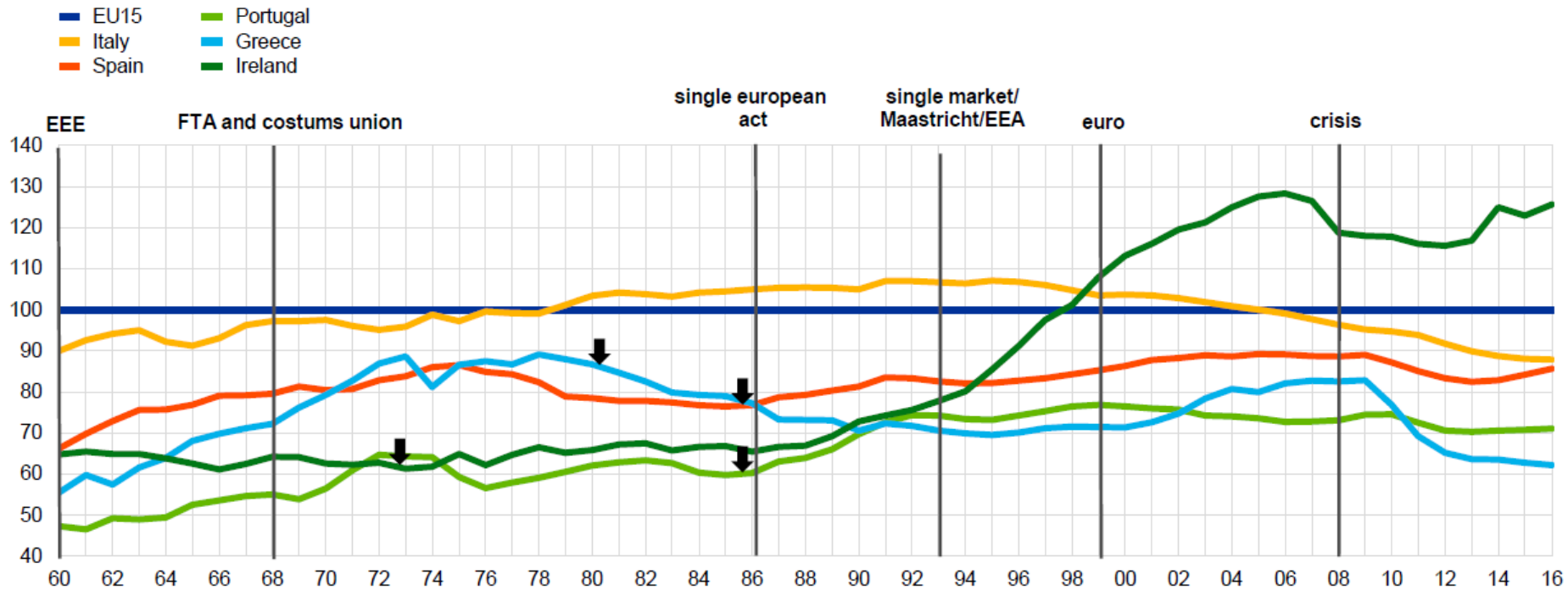
5.1.1. Stylized facts about growth (#2)

2. Along a growth path, **income per person and productivity can exhibit synchronous and asynchronous inflections, going through periods of convergence and divergence**

Chart 28

Historical developments in GDP per capita in some euro area countries

(GDP per capita in PPS; EU15 = 100)



Source: European Commission.
Notes: Arrows denote dates of EU entry. For Italy, no entry date is indicated as this country is a founding member. In the case of Ireland, data are adjusted to control for the exceptional GDP revision in 2015, which did not reflect any actual increase in economic activity.

Source: ECB Occasional Paper Series No 203 / December 2017

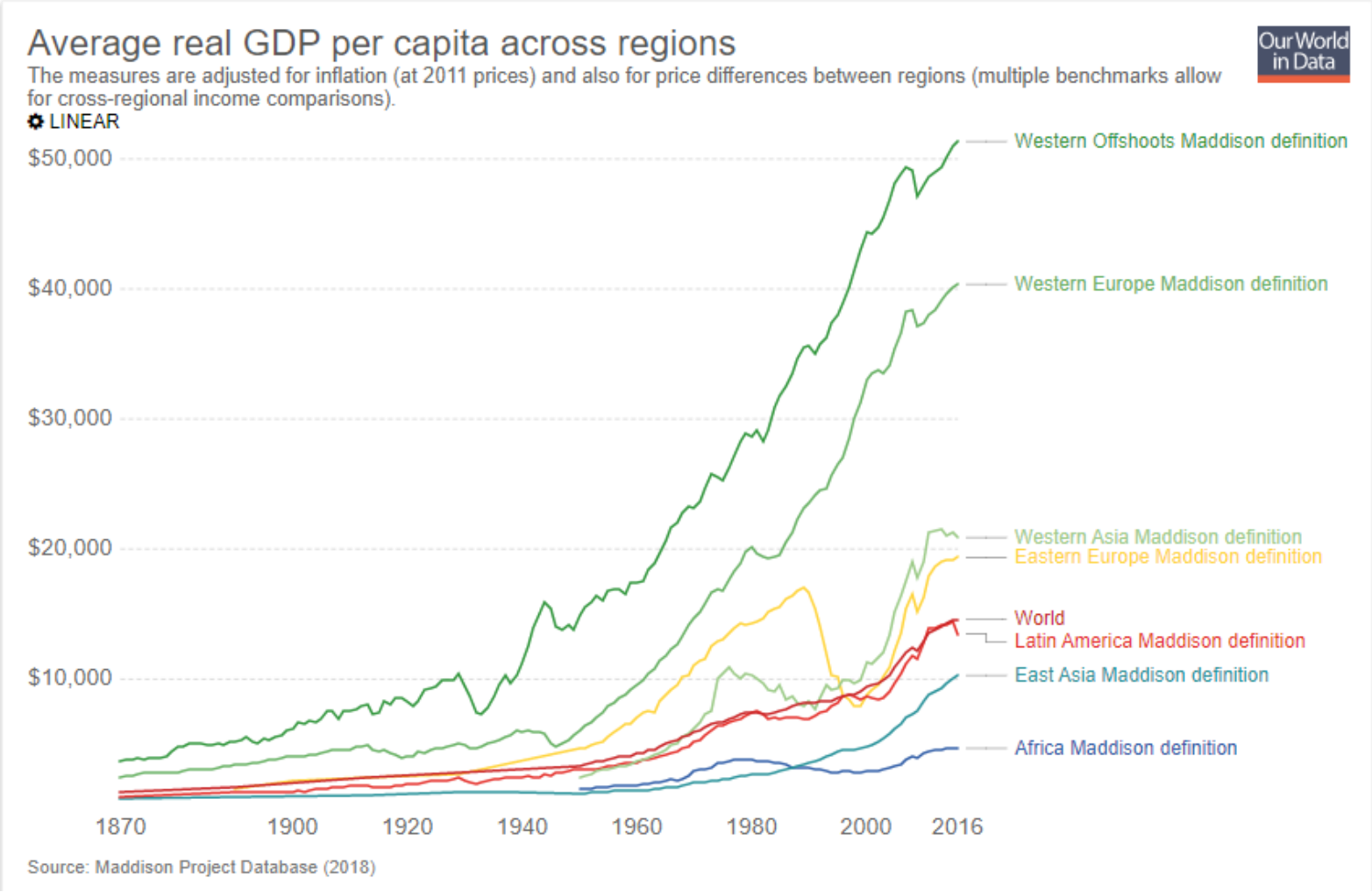
5.1.1. Stylized facts about growth (#3)

3. Convergence at the top is neither general nor unattainable:

- Convergence of GDP pc levels has taken place within certain groups of countries but is by no means a general phenomenon
- Some countries have kept out of the dynamics of convergence and even diverged
- In the last decades, income pc in some formerly underdeveloped countries, such as East Asian countries, has caught up with that of the most advanced ones, while other countries, including most sub-Saharan African countries, have further diverged.

5.1.1. Stylized facts about growth (#3)

3. Convergence at the top is neither general nor unattainable:



https://ourworldindata.org/economic-growth

5.1.1. Stylized facts about growth (#3)

Examples:

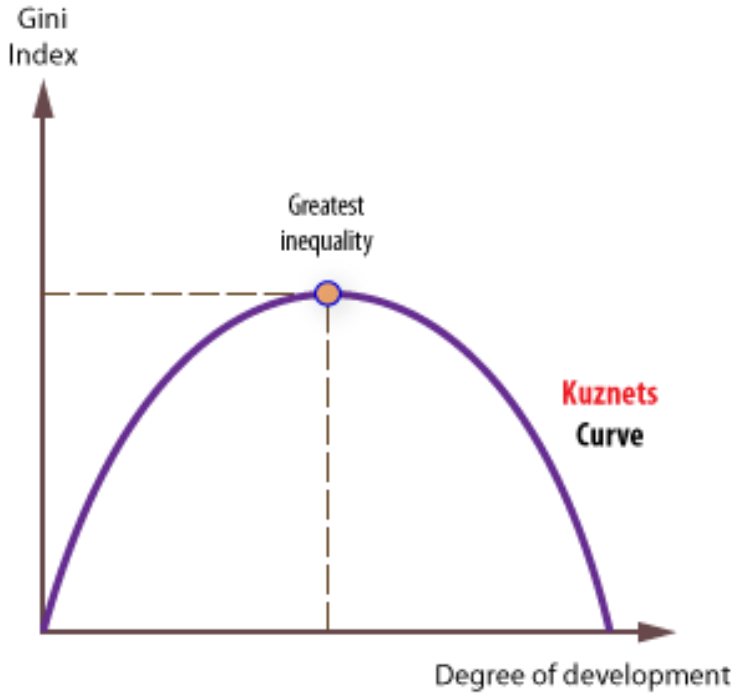
- Japan and Europe converged with USA in 2nd half of XXth century, but convergence stopped at around 80% of USA GDP pc
- Asian Tigers, China, India, Brazil, etc.
- Some countries stagnated or are even diverging, e.g. Sub-Saharan Africa.
- The 1st league of XXI century is very different form that of XXth century: example of this is **Argentina**, which had income pc levels above some European countries and now is a poor country

5.1.1. Stylized facts about growth (#4)

4. The relation between growth and inequality does not appear stable, not over time and not across space

5. Technical progress and growth can increase inequality within countries, including within rich countries

In 1955, Kuznets proposed there is an inverted U curve between the level of economic growth and income inequality – i.e. low inequality levels for both poor and rich countries and high inequality levels for emerging countries



5.1.1. Stylized facts about growth (#4)

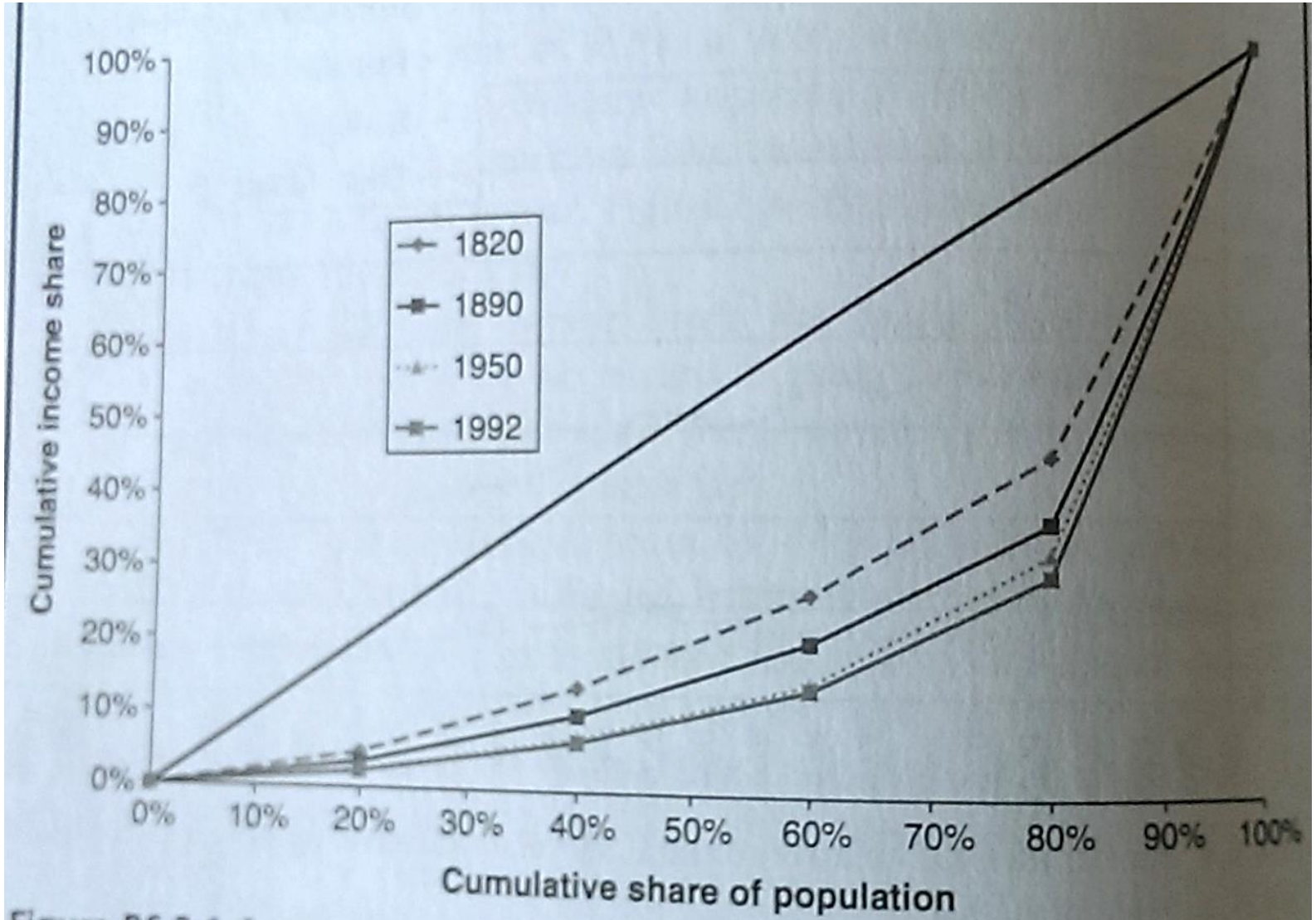


Figure B6.2.1 Lorenz curve of world income.
Source: Bourguignon and Morrison (2002), table 1.

5.1.1. Stylized facts about growth (#4)

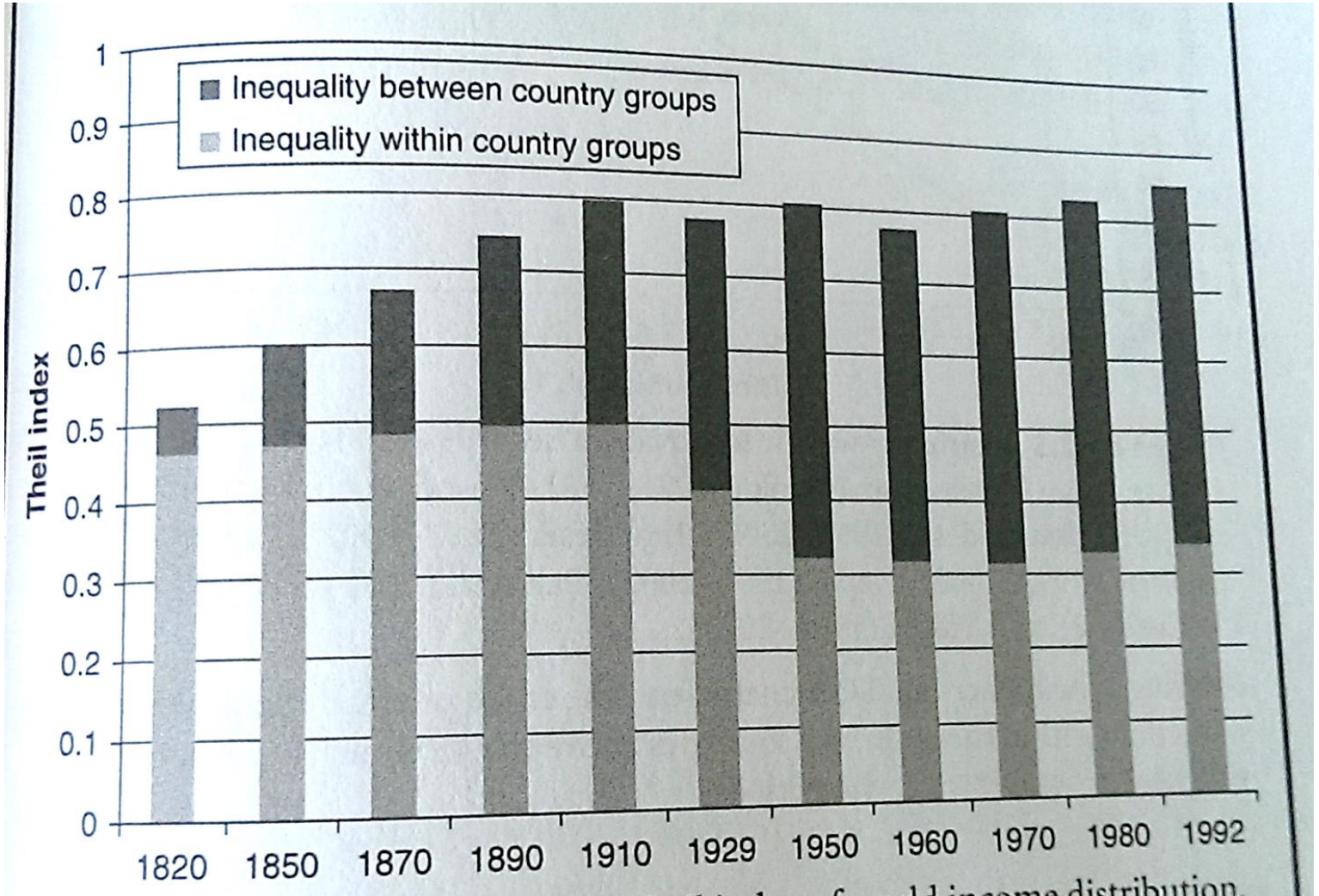
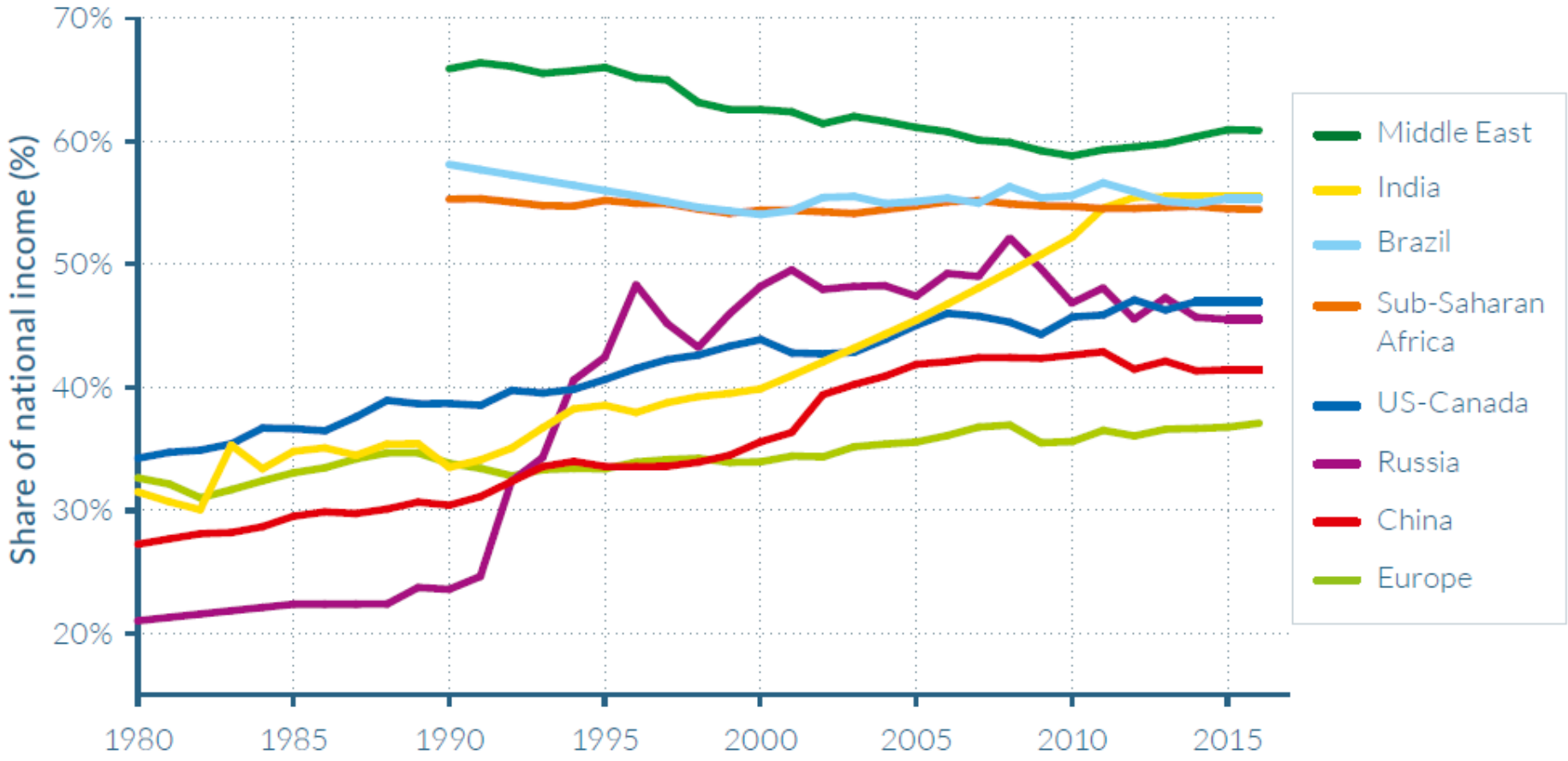


Figure B6.2.2 Decomposition of the Theil index of world income distribution.
Source: Bourguignon and Morrison (2002), table 2.

5.1.1. Stylized facts about growth (#4)

Figure E2b

Top 10% income shares across the world, 1980–2016: Is world inequality moving towards the high-inequality frontier?



Source: WID.world (2017). See wir2018.wid.world for data series and notes.

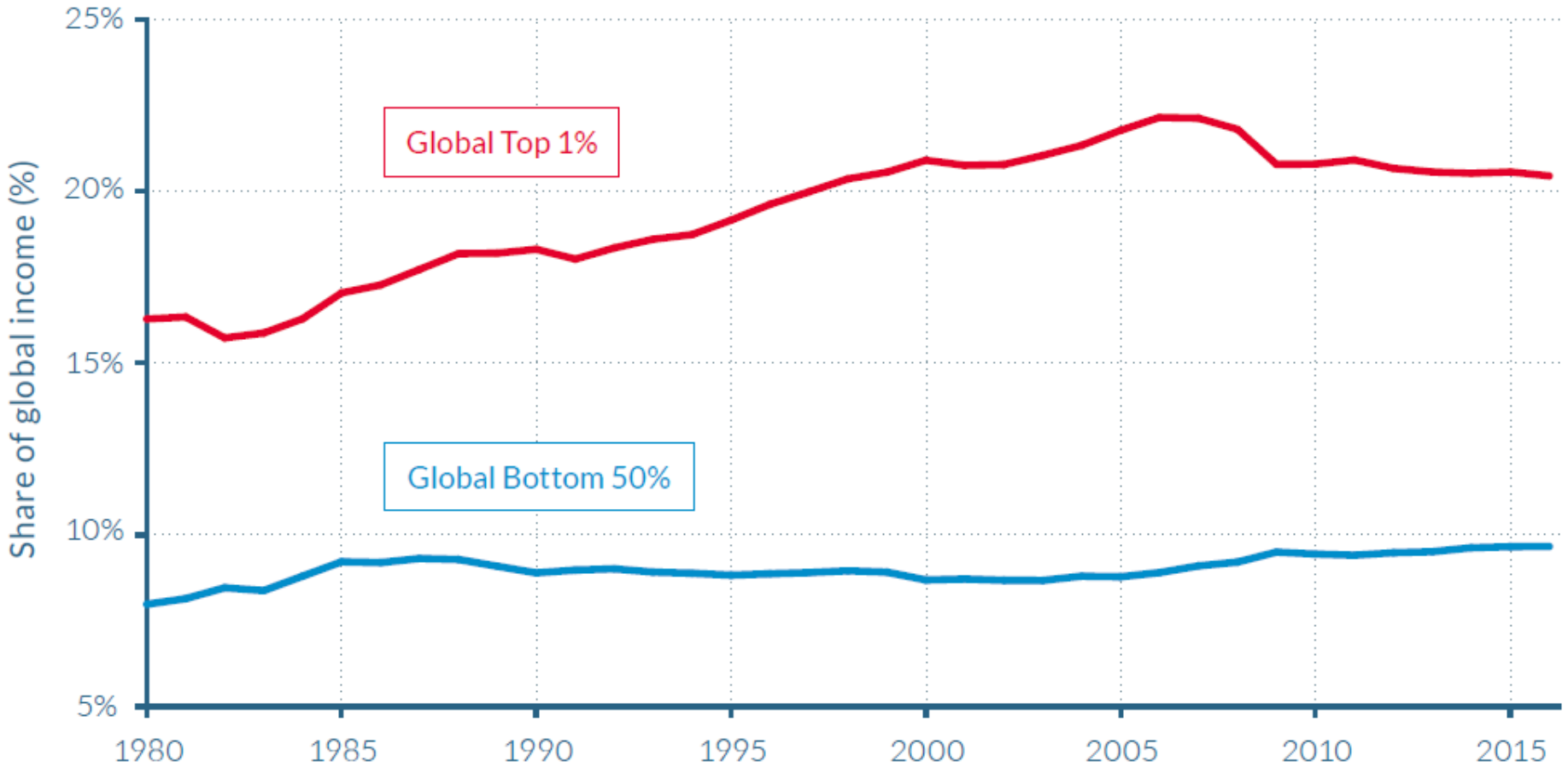
In 2016, 55% of national income was received by the Top 10% earners in India, against 31% in 1980.

Source: world inequality report, 2018 http://wir2018.wid.world/

5.1.1. Stylized facts about growth (#4)

Figure E5

The rise of the global top 1% versus the stagnation of the global bottom 50%, 1980–2016



Source: WID.world (2017). See wir2018.wid.world for data series and notes.

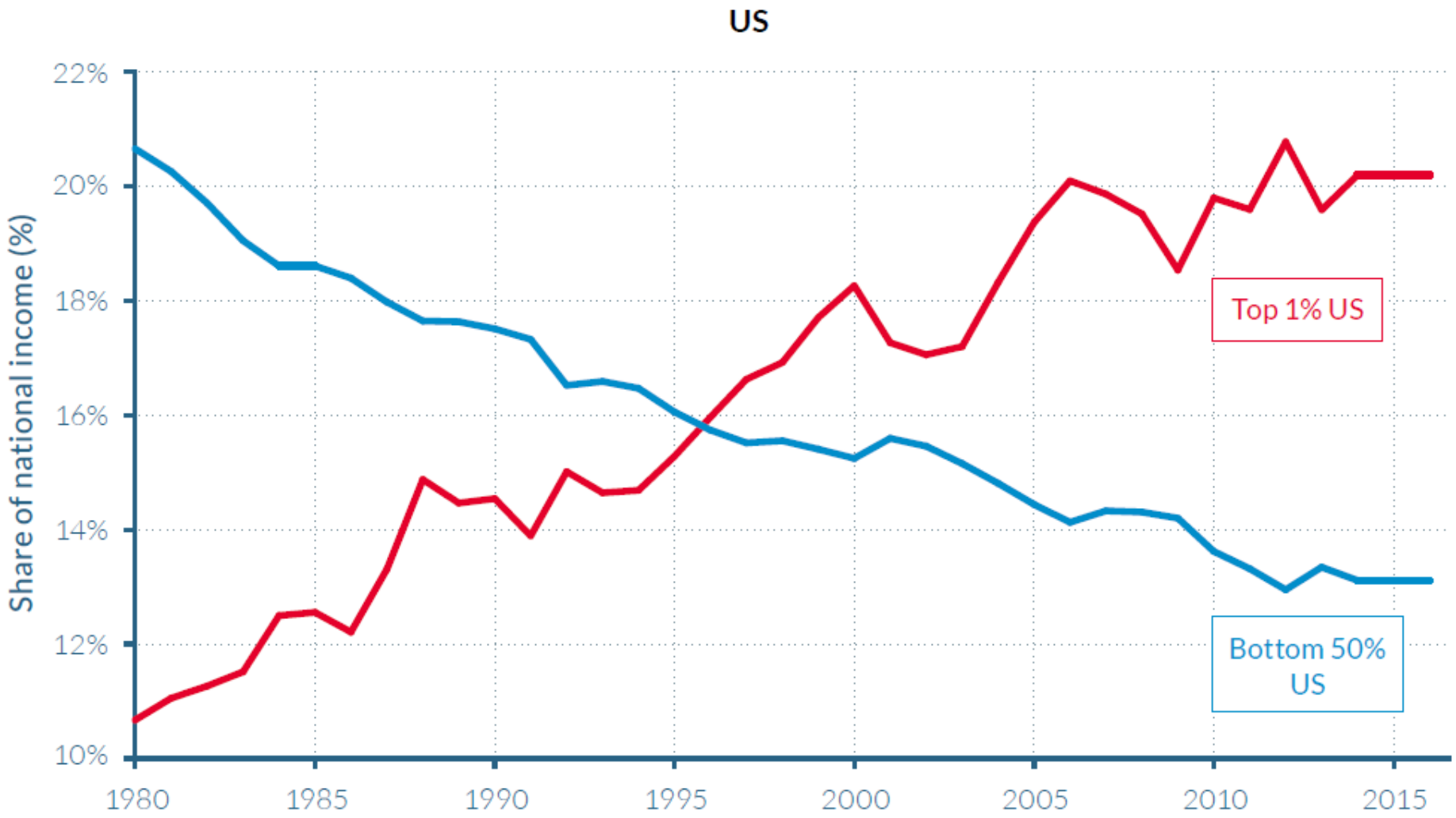
In 2016, 20% of global income was received by the Top 1% against 10% for the Bottom 50%. In 1980, 16% of global income was received by the Top 1% against 8% for the Bottom 50%.

Source: world inequality report, 2018 http://wir2018.wid.world/

5.1.1. Stylized facts about growth (#4)

Figure E3

Top 1% vs. Bottom 50% national income shares in the US and Western Europe, 1980–2016: Diverging income inequality trajectories



Source: world inequality report, 2018 http://wir2018.wid.world/

Theory Lecture 15

Learning outcomes for lecture 15

- Explain the catching up process, in particular the meaning of β convergence and σ convergence, and absolute vs. conditional convergence
- Explain the concepts of technical progress and Total Factor Productivity (TFP)
- Explain the growth accounting approach to measure labour productivity differentials into two main components (TFP, capital deepening)
- Explain the difference between labour productivity and TFP
- Explain the key features of neoclassical growth models (Solow model and Ramsey model)

5.1.2. Catching up

- Stylized fact #3 - i.e. that convergence is not a general phenomenon - is puzzling

- **Why do some countries (or regions) catch up with more advanced countries (or regions), while others don’t?**

- In section 5.2 we will look at some main growth models focusing on the convergence process

5.1.2. Catching up

- There are different measures of convergence, two popular measures are:

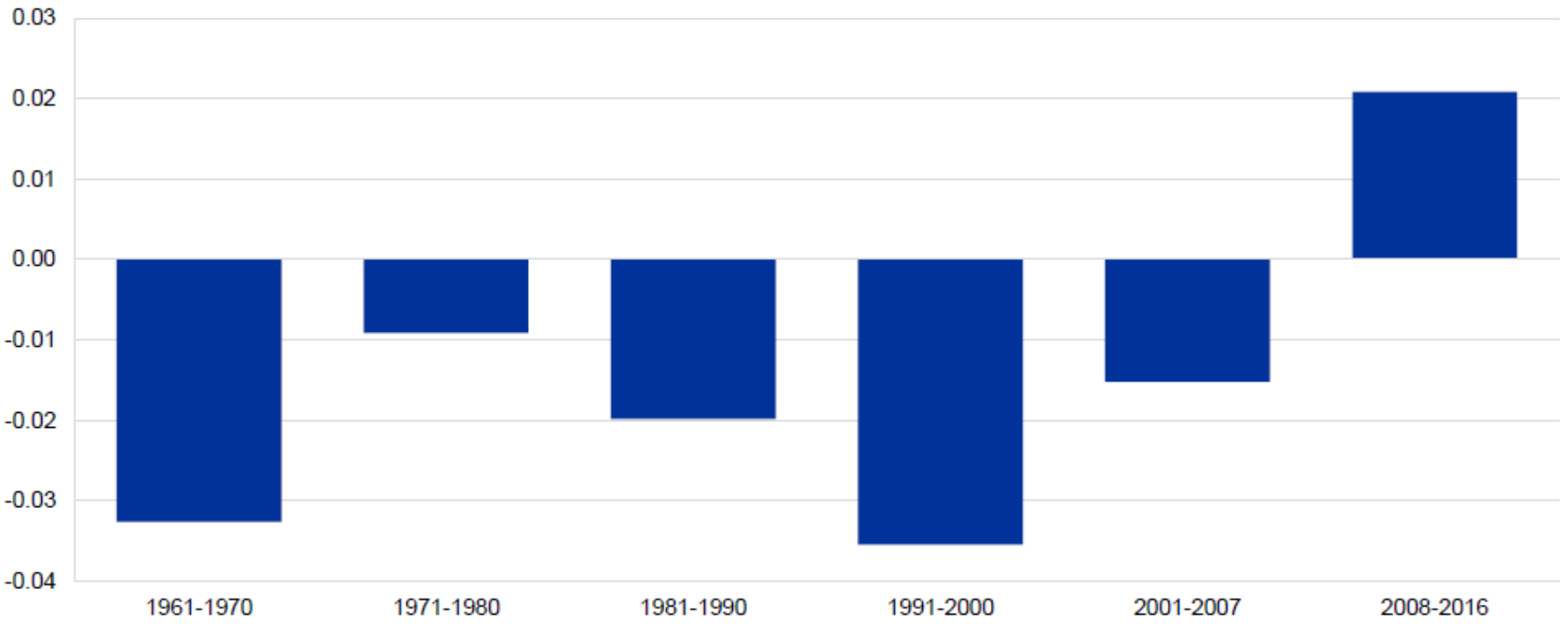
- **β convergence**: refers to the relation between the initial level of GDP pc and its growth rate for a given period. There is **β** convergence when poorer economies grow faster than richer economies (as predicted by neoclassical growth model)

- **σ convergence**: refers to the degree of dispersion (e.g. CV) of GDP per capita levels across countries or regions. There is **σ** convergence when dispersion reduces / is low

5.1.2. Catching up: β convergence

Chart A

β coefficients of the cross-country linear regression of the EA12 countries' per capita income growth on initial income levels in different sub-periods between 1960 and 2016



Sources: Eurostat and authors' calculations.
Notes: Based on the following regression: $\Delta y_{i,t+1,t+T} = \alpha + \beta y_{i,t} + \varepsilon_{i,t}$; where $\Delta y_{i,t+1,t+T}$ where $\Delta y_{i,t+1,t+T}$ refers to the average annual growth of per capita income levels between t+1 and t+T (approximated as log-difference); while $y_{i,t}$, refers to the initial income level in purchasing power standards and in a natural logarithm.
Luxembourg is excluded from the country sample. Data for Ireland are adjusted in order to control for the exceptional GDP revision in 2015, which did not reflect an actual increase in economic activity.
The test statistics and p-values reflect the results of the panel unit root tests conducted based on Im, Pesaran, Shin (2003), * refers to significance of the null hypothesis of "convergence" at a 1%, while *** at a 10% significance level. EA5: Estonia, Latvia, Lithuania, Slovakia and Slovenia.

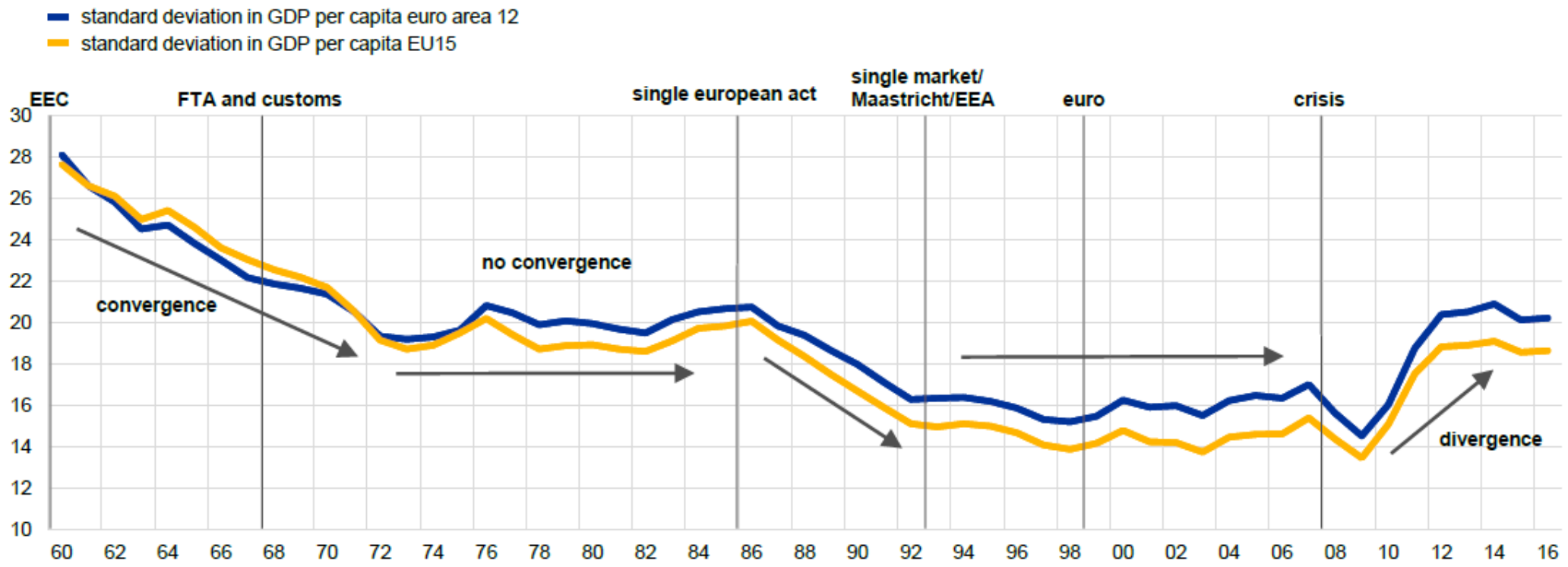
Source: ECB Occasional Paper Series No 203 / December 2017

5.1.2. Catching up: σ convergence

Chart 26

Sigma real convergence in the EA12 and the EU15: a long-term perspective

(standard deviation in GDP per capita)



Source: European Commission.
Notes: Sigma convergence refers to the degree of dispersion of GDP per capita levels across economies.GDP per capita in PPS. EA12 denotes the countries that had adopted the euro by 2002, EU15 the countries that had become EU members by 1995. Luxembourg is excluded from the country sample. Data for Ireland are adjusted in order to control for the exceptional GDP revision in 2015, which did not reflect an actual increase in economic activity. Data for Germany are approximated by data for West Germany over the period 1960-1991. EEC: European Economic Community; FTA: Free Trade Area; EEA: European Economic Area.

Source: ECB Occasional Paper Series No 203 / December 2017

5.1.2. Catching up

Absolute convergence vs. conditional convergence

- We cannot simply look at the bivariate relation between country's initial GDP pc and growth rate because this does not control for important factors that differ across countries. We need to take account of such factors (***Z***), i.e. convergence ***conditional*** on such factors

$$\Delta\%\left(Y_{t,t+k}\right) = f\left(Y_t, \boldsymbol{Z_{t+k}}\right)$$

Some important factors with expected effects on long term GDP pc include:

- Quality of human capital
- Functioning of markets (e.g. competition) and quality of institutions (e.g. corruption, rule of law)
- Macroeconomic stability, especially price stability
- Political stability

5.1.3. Productivity differentials

Angus Maddison proposed 4 main factors determining the GDP pc growth in the long run:

- Technical progress;
- Acumulation of capital;
- Knowledege, including human capital, better know-how, and better functioning labour markets;
- Increased international integration: tarde, investment, knowledge, etc.

Growth theory models try to measure the effect of these factors and their interactions on economic growth

5.1.3. Productivity differentials

"Growth accounting"

- Consider the production function: $Y_t = A_t F(K_t, L_t)$

Where **A denotes the effect of technical progress** on the productivity of capital and labour (i.e. **Total Factor Productivity, TFP**)

- Growth accounting **divides growth into two parts**:

1. Due to growth the input factors
2. Due to growth in the technical progress term

- It **does not explain why technical progress**, it just divides the observed output growth into proximate sources, given the observed growth rates of inputs

5.1.3. Productivity differentials

“Growth accounting”

$$Y_t = A_t F(K_t, L_t)$$

$$\dot{Y}_t = \dot{A}_t F(K_t, L_t) + A_t F_K(K_t, L_t)\dot{K}_t + A_t F_L(K_t, L_t)\dot{L}_t$$

$$\frac{\dot{Y}_t}{Y_t} = \frac{\dot{A}_t F(K_t, L_t)}{Y_t} + \frac{A_t F_K(K_t, L_t)\dot{K}_t}{Y_t} + \frac{A_t F_L(K_t, L_t)\dot{L}_t}{Y_t}$$

$$\frac{\dot{Y}_t}{Y_t} = \frac{\dot{A}}{A_t} + \frac{A_t F_K(K_t, L_t)K_t}{Y_t}\frac{\dot{K}_t}{K_t} + \frac{A_t F_L(K_t, L_t)L_t}{Y_t}\frac{\dot{L}_t}{L_t}$$

5.1.3. Productivity differentials

"Growth accounting"

$$\frac{\dot{Y}_t}{Y_t} = \frac{\dot{A}_t}{A_t} + \beta_t \frac{\dot{K}_t}{K_t} + (1-\beta_t)\frac{\dot{L}_t}{L_t}$$

$$\beta_t \equiv \frac{A_t F_K(K_t, L_t) K_t}{Y_t} \quad is\ Capital's\ Share$$

$$(1-\beta_t) \equiv \frac{A_t F_L(K_t, L_t) L_t}{Y_t} \quad is\ Labor's\ Share$$

Using the approximation for instantaneous growth rates: $\frac{\dot{Y}_t}{Y_t} \doteq \frac{\Delta Y_t}{Y_t} = \frac{Y_{t+1}-Y_t}{Y_t}$

We get:

$$\boxed{\frac{\Delta Y_t}{Y_t} = \frac{\Delta A_t}{A_t} + \beta \frac{\Delta K_t}{K_t} + (1-\beta)\frac{\Delta L_t}{L_t}}$$

TFP growth

5.1.3. Productivity differentials

"Growth accounting"

- TFP is **NOT the same** as labour productivity (*Y/L)*

- In a constant returns to scale context, the rate of **change in labour productivity** can be decomposed in the following **two components**:

1. Rate of change in **TFP**
2. Rate of change in **capital per worker** (k=K/L), also called **ratio of capital/labour** or **capital intensity** or **capital deepening** (i.e. substitution of labour by capital)

$$\frac{\Delta Y}{Y} - \frac{\Delta L}{L} = \frac{\Delta A}{A} + \beta\left(\frac{\Delta K}{K} - \frac{\Delta L}{L}\right)$$

Labour productivity growth **TFP growth** **Capital depeening**

5.1.3. Productivity differentials

“Growth accounting”

Growth accounting: Average annual growth rates between 2000-2004 (%)

Country	USA	EU15
GDP (1)	2.4	1.5
Total hours worked (2)=(3)+(4)	-0.4	0.4
Employment (3)	0.4	0.7
Hours worked (4)	-0.8	-0.3
Labour productivity (5)=(1)-(2)	2.8	1.1
Ratio capital / labour (6)	1.1	0.7
TFP (7)=(5)-(6)	1.7	0.4

- In the US, the main driver of labour productivity in the period was TFP growth, althought there was also a positive contribution from capital intensity.
- In the EU15 the contribution of capital intensity was stronger in relative terms

Past exam question on growth accounting:

Table 1 – Average annual growth rates (%) in 2000-2014.

GDP	1.5
Total hours worked	1.0
Employment	0.3
Working hours (by worker)	0.7
Labor productivity	A
Contribution of Capital/ Labor Ratio	B
Total productivity factos (TFP)	0.2

Look at Table 1: the value of A is:

a) 1.0%

b) – 1.0%

c) -0.5%

d) 0.5%

Look at Table 1 again: the value of B is:

a) 0.3%

b) 1.1%

c) – 1.1%

d) None of the above

Past exam question on growth accounting:

Table 1 – Average annual growth rates (%) in 2000-2014.

GDP	1.5
Total hours worked	1.0
Employment	0.3
Working hours (by worker)	0.7
Labor productivity	A
Contribution of Capital/ Labor Ratio	B
Total productivity factos (TFP)	0.2

Look at Table 1: the value of A is:

a) 1.0%

b) – 1.0%

c) -0.5%

d) 0.5%

Look at Table 1 again: the value of B is:

a) 0.3%

b) 1.1%

c) – 1.1%

d) None of the above

5.1.3. Productivity differentials

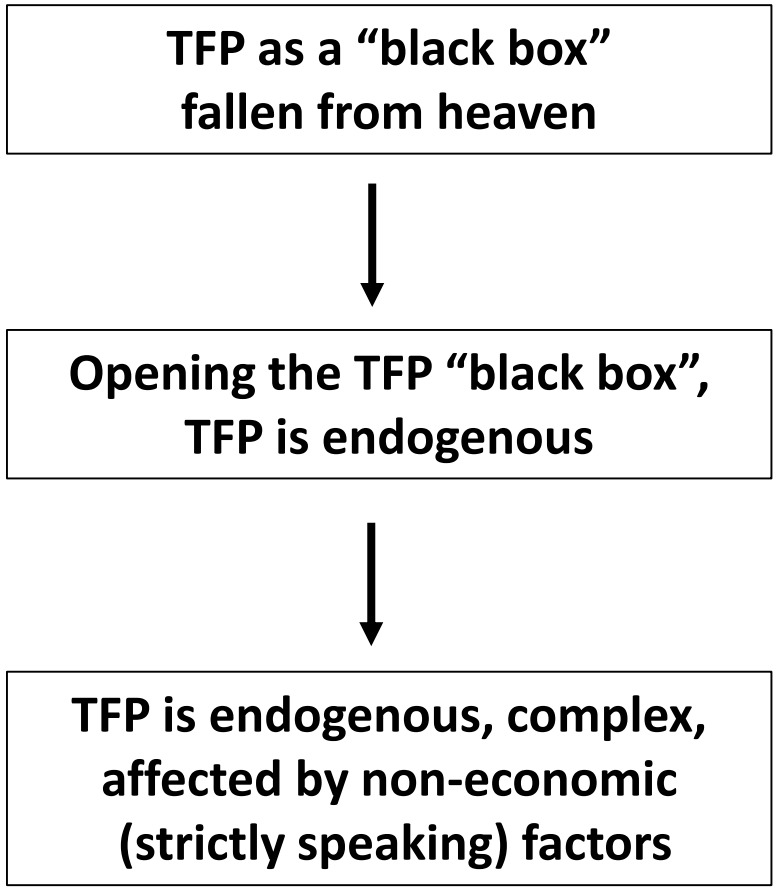
- TFP includes all the factors hypothesized to affect productivity
- Different growth models emphasize different factors, but there is consensus on the importance of some factors
- The breakdown of TFP typically includes: Human capital, Innovation, Technology (e.g. ICT)
- How does ICT impact on TFP?

5.1.3. Productivity differentials

- How does ICT impact on TFP?
  - By replacing labour with capital (i.e. increasing capital intensity or ratio of capital / labour)
  - Stock management, etc
  - Better use of inputs
  - Increase of high-skill labour intensity
  - …

5.2. Theories of economic growth

- **Neoclassical models of capital accumulation**
  - Solow model (exogenous savings)
  - Ramsey model (optimal savings)
- **Endogenous growth models**
  - Externalities
  - Innovation (creative destruction)
- **Beyond the production function**
  - International trade
  - Geography and history
  - Income distribution (inequality)
  - Institutions



5.2.1 Neoclassical growth models

- Solow (1956) model is a landmark for these models and marked the 2nd half of XXth century

- The key main assumption in these models is that econonomies converge to a **steady state equilibrium** characterised by a constant growth rate of labour productivity (Y/L) for a given capital-labour ratio (K/L)

- This means that growth policies can affect growth in the short and medium terms, but don't have long term permanent effects because once economies reach the equilibrium steady state they stay there (for ever and ever)

- It also means that the traditional neoclassical models assume a tendency towards convergence in income pc levels and growth rates, in particular the β convergence

5.2.1 Neoclassical growth models

- The neoclassical growth model developed in the 1950s by Solow and Swan is the starting point for almost all analyses of growth and for any attempt to understand the underpinnings of the old and new theories of economic growth

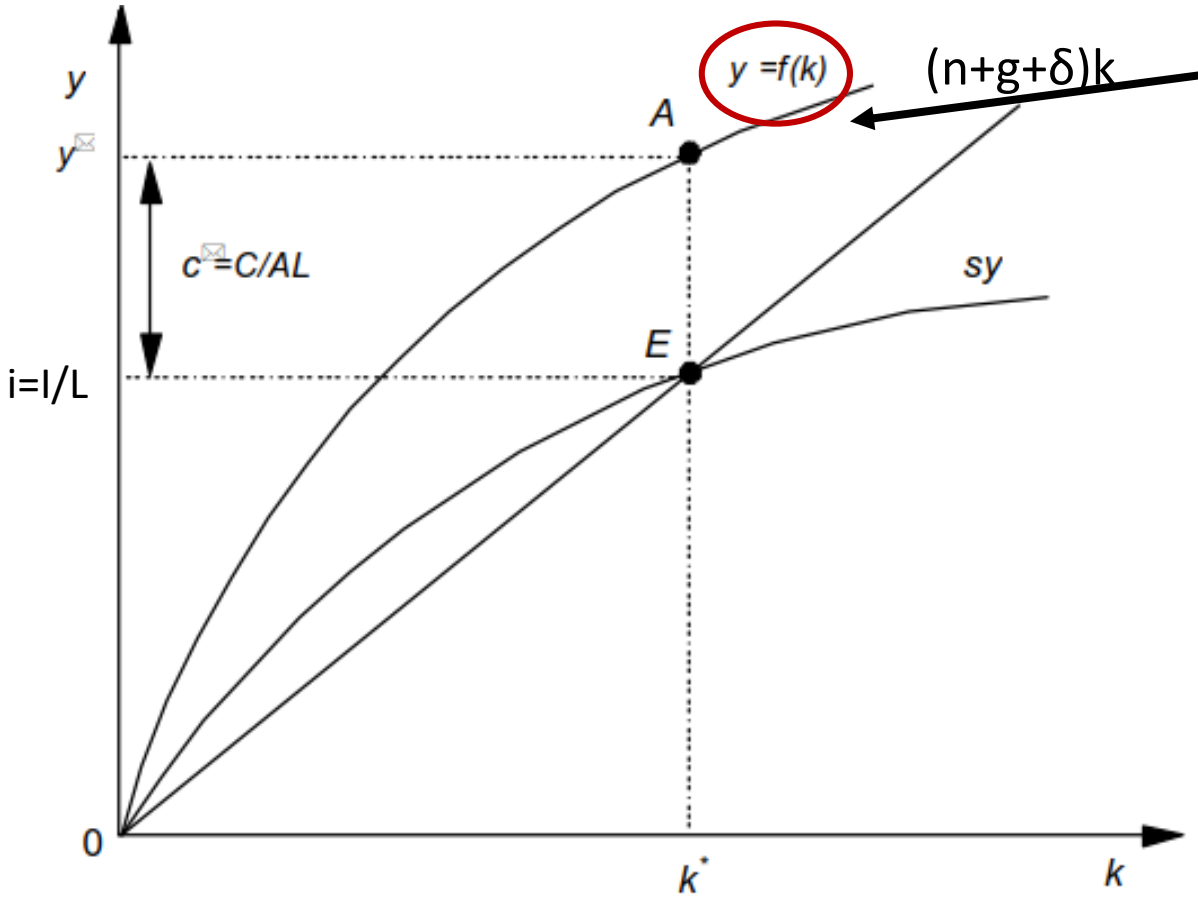
- Neoclassical growth theory focuses on **capital accumulation and its link to savings decisions**

- Output is a function of labour and capital and the production function exhibits **constant returns to scale and diminishing returns to individual factors of production**, and has a unitary elasticity of substitution between factors

- The **most important neoclassical feature is the assumption of diminishing returns to capital and labour**

5.2.1 Neoclassical growth models: Solow-Swan model

The Solow-Swan model:

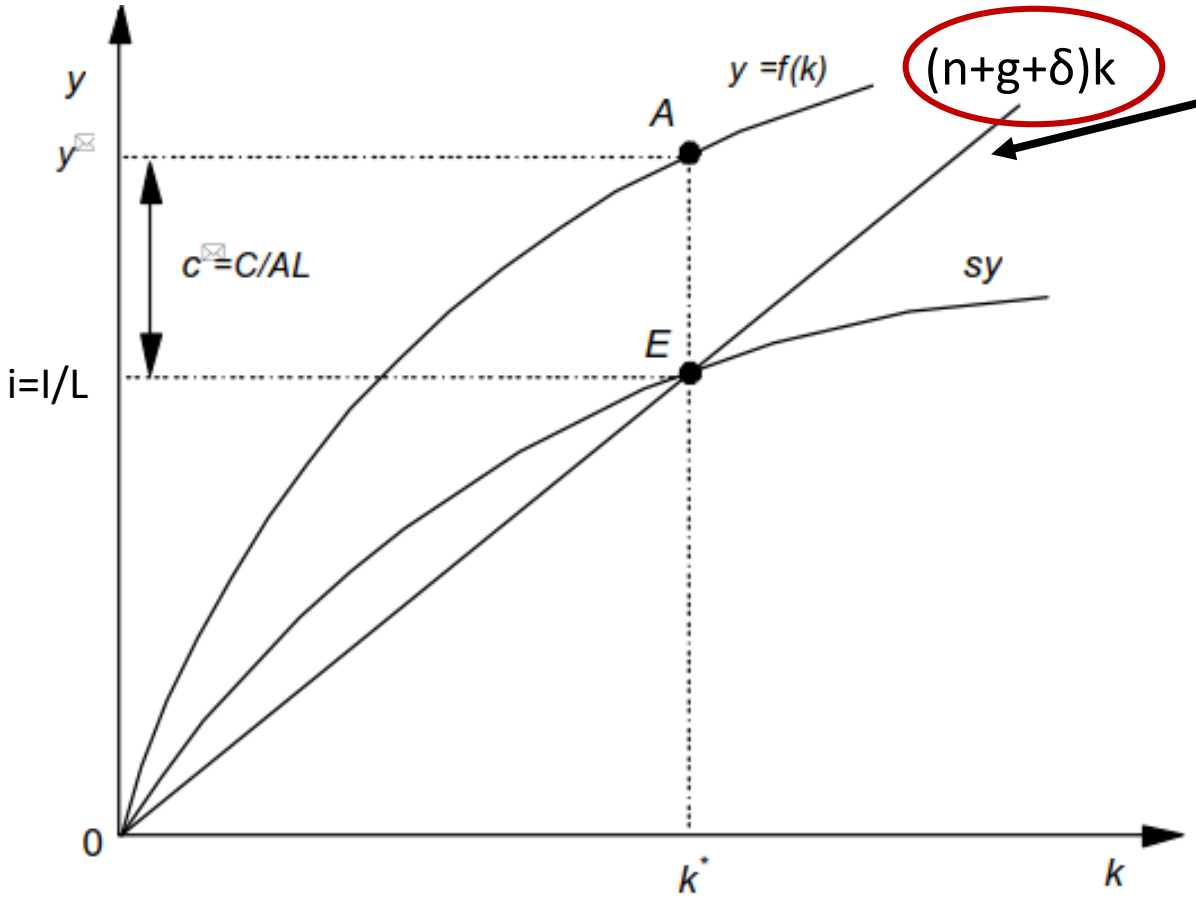


(1) **The production function is expressed in per capita terms, and assumes diminishing returns to capital and labour**

The diminishing marginal product is what explains in this model why the economy reaches a steady-state instead of growing forever

5.2.1 Neoclassical growth models: Solow-Swan model

The Solow-Swan model:

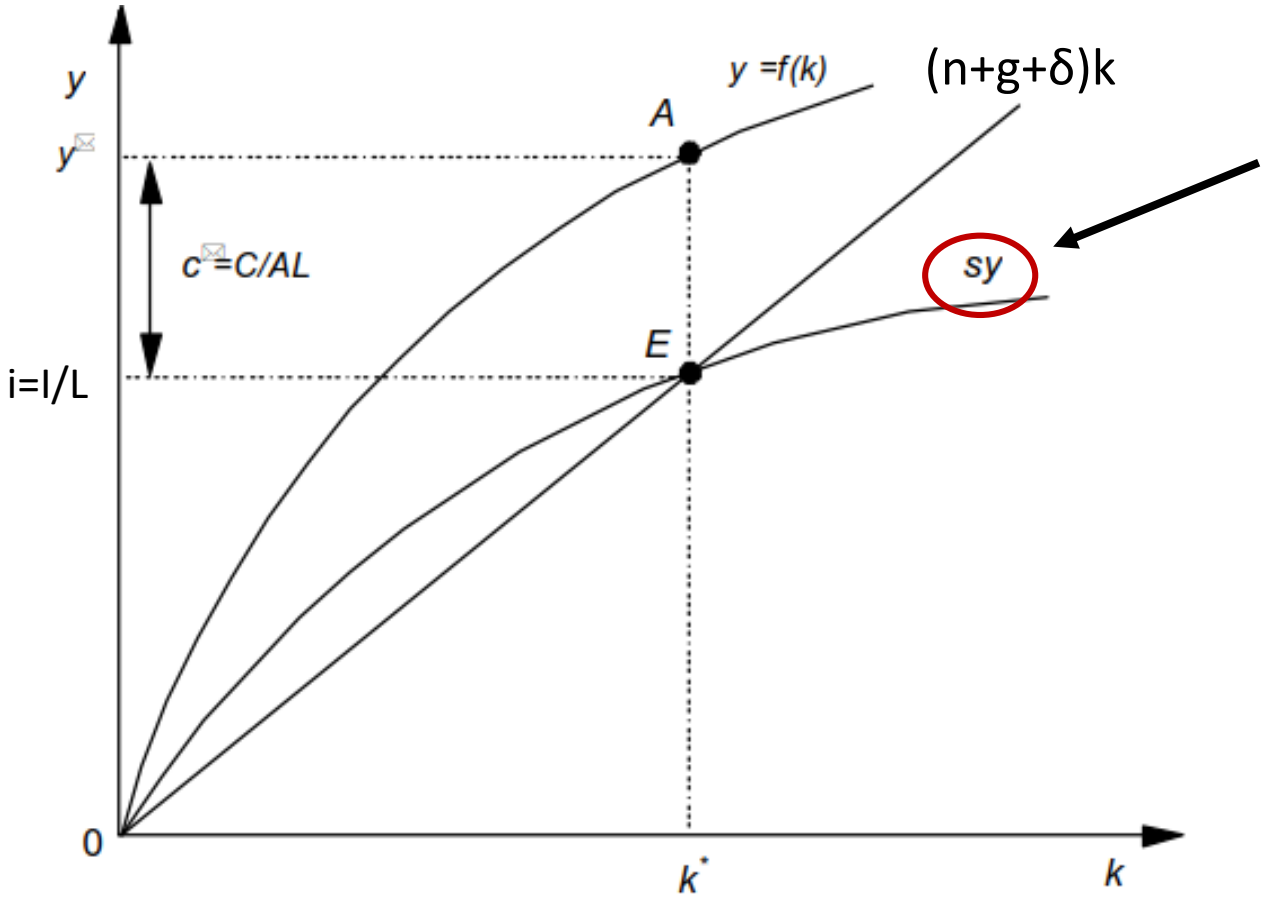


(2) capital accumulation function, **(n+g+δ)k**, with k=K/L: represents the amount of investment needed at each capital-labour ratio *k*

- g: rate of change of technical progress
- n: rate of change of population
- δ: depreciation rate of capital stock

5.2.1 Neoclassical growth models: Solow-Swan model

The Solow-Swan model:



(3) Investment and savings function (I=S), **sy**, with y=Y/L

The curve **sy** shows saving as a constant fraction of output with the level of saving at each capital-labour ratio, where ***s* is the savings rate** and is assumed **exogenous** and **constant**

5.2.1 Neoclassical growth models: Solow-Swan model

The steady-state corresponds to $\dot{k} = 0$, that is:

$\dot{k}=0 \rightarrow sy=(n+g+d)k \rightarrow sy^* = sf(k^*) = (n+g+d)k^*$

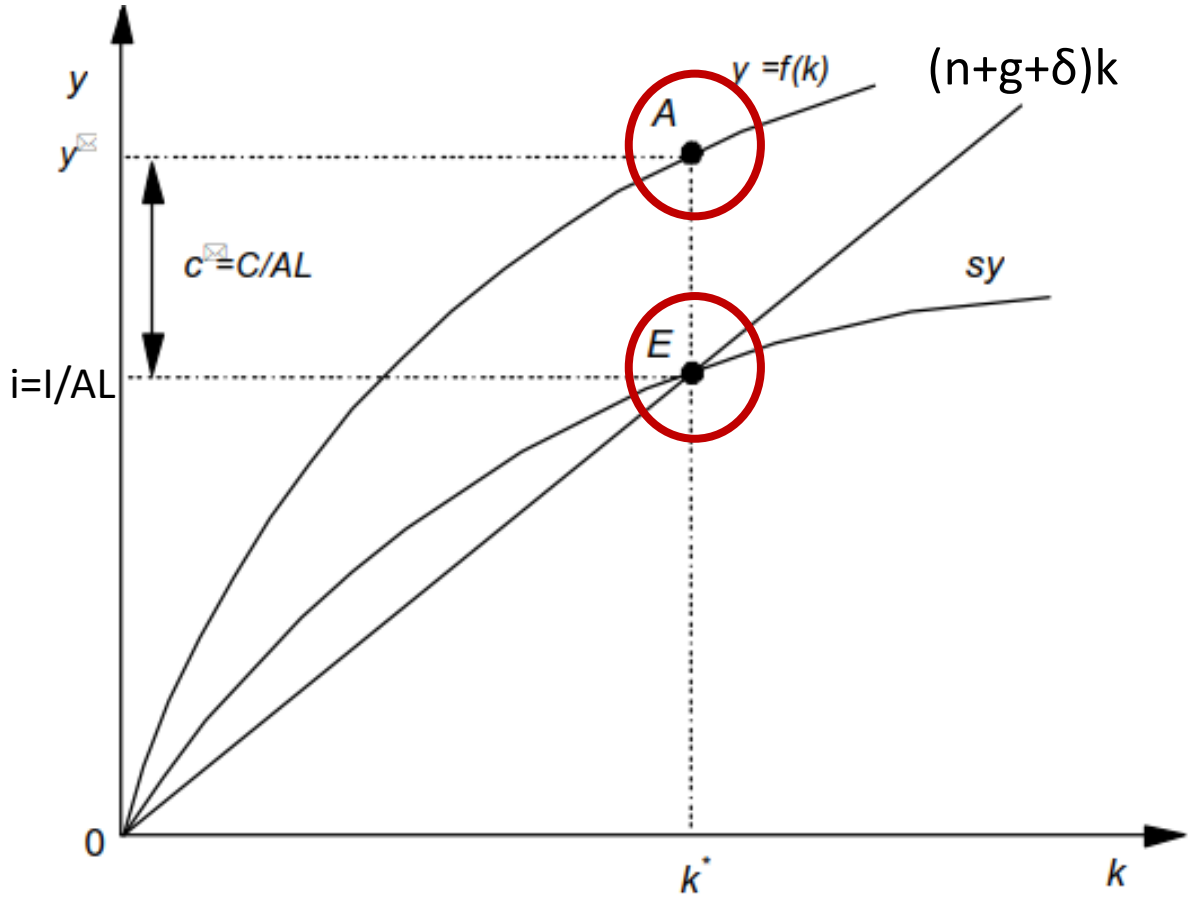
where:

$g=\dot{A}/A$ is the rate of change of technical progress

$n=\dot{L}/L$ is the rate of change of population

δ = depreciation rate

The intersection of the two lines, at point E, represents the **steady-state capital-labour ratio k*** and **steady-state income pc y*** at point A



5.2.1 Neoclassical growth models

- In the Solow-Swan model, technical progress is the driving force in long-run growth BUT is outside the model (i.e. **exogenous**) and thus cannot explain the growth process

- The per capita quantities k, y and c do not grow in the steady-state, but the variables K, Y and C in levels grow in the steady-state at a constant rate

5.2.1 Neoclassical growth models: Ramsey model

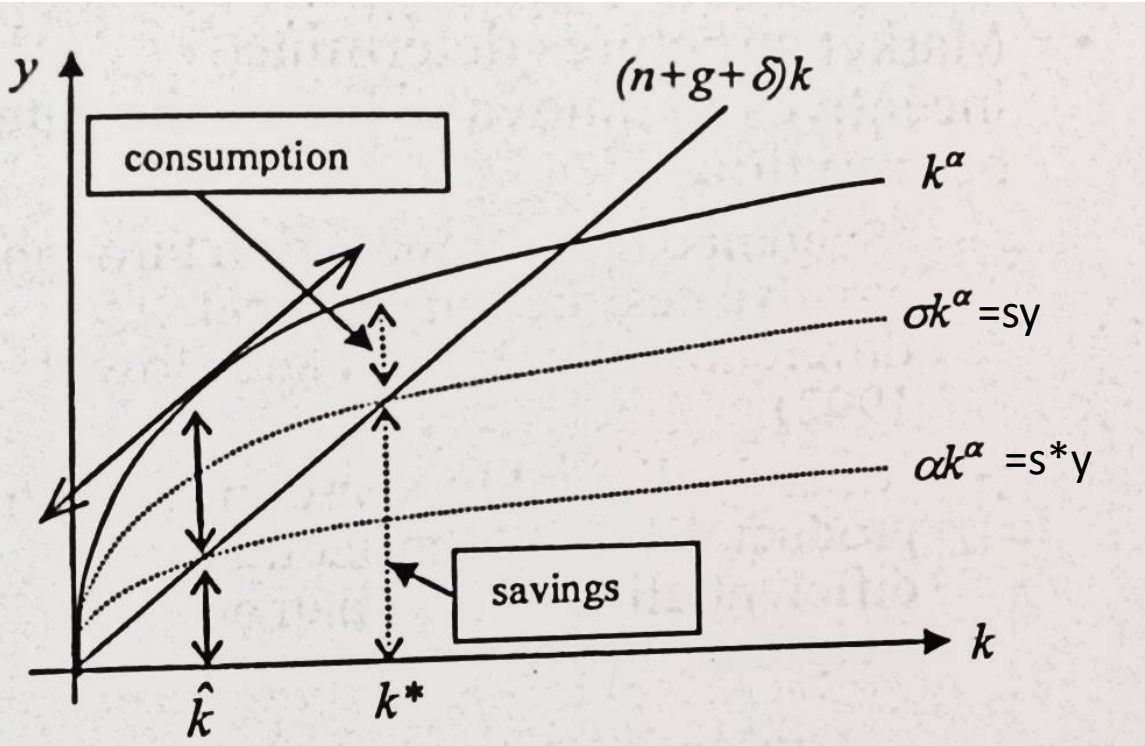
- The Ramsey model relaxes the assumption of an exogenous savings rate (i.e. Solow-Swan model) and sets out to find **the optimal saving rate**

- The **optimal savings rate s*** is the rate that **maximizes long-term consumption per capita c=C/L** - this is the **'golden rule' of capital accumulation**

- The optimal savings rate s* is obtained at the point where the marginal productivity of capital is equal to the growth rate of output

- The optimal savings rate s* is lower than the exogenous saving rate s of the Solow-Swan model

5.2.1 Neoclassical growth models: Ramsey model



The **optimal savings rate maximises consumption per capita**. The optimal level of capital per head and marginal productivity of capital so that:

r = n + g ('golden rule' of capital accumulation)

where:

g=$\dot{A}$/A is the rate of change of technical progress

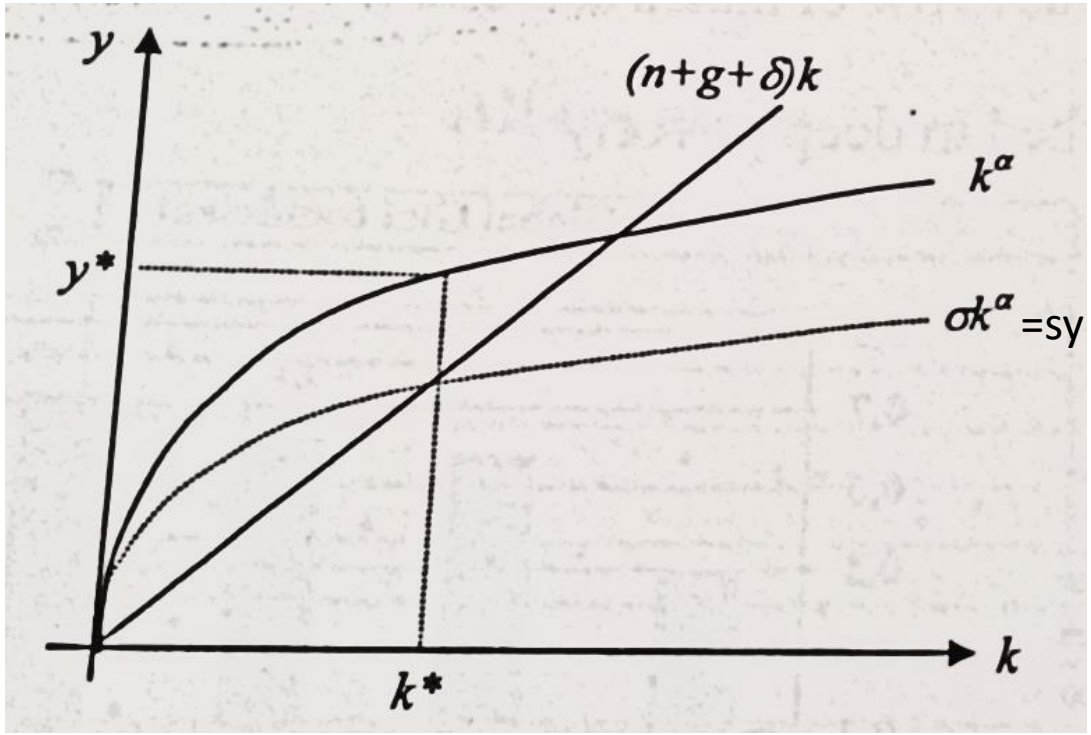
n=$\dot{L}$/L is the rate of change of population

(n+g) correspond to the growth rate of GDP

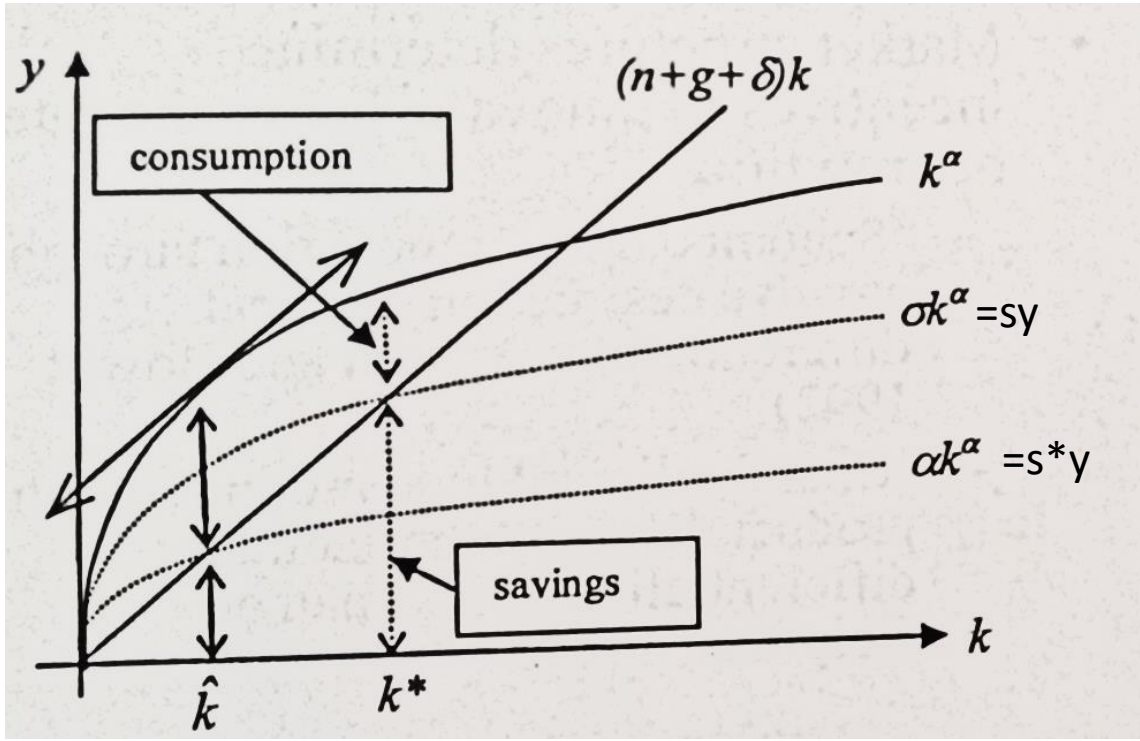
r = marginal productivity of capital or interest rate

5.2.1 Neoclassical growth models: Solow-Swan vs. Ramsey model

Exogenous saving rate



Endogenous 'optimal' saving rate



5.2.1. Neoclassical growth models: Extensions to traditional model

- These models attempt to go inside the ‘black box’ of exogenous technical change of the Solow-Swan model

- One of the most popular models is that of Mankiw, Romer e Weil (1992): They extend the Solow-Swan model such that technical change is not exogenous and is determined by human capital

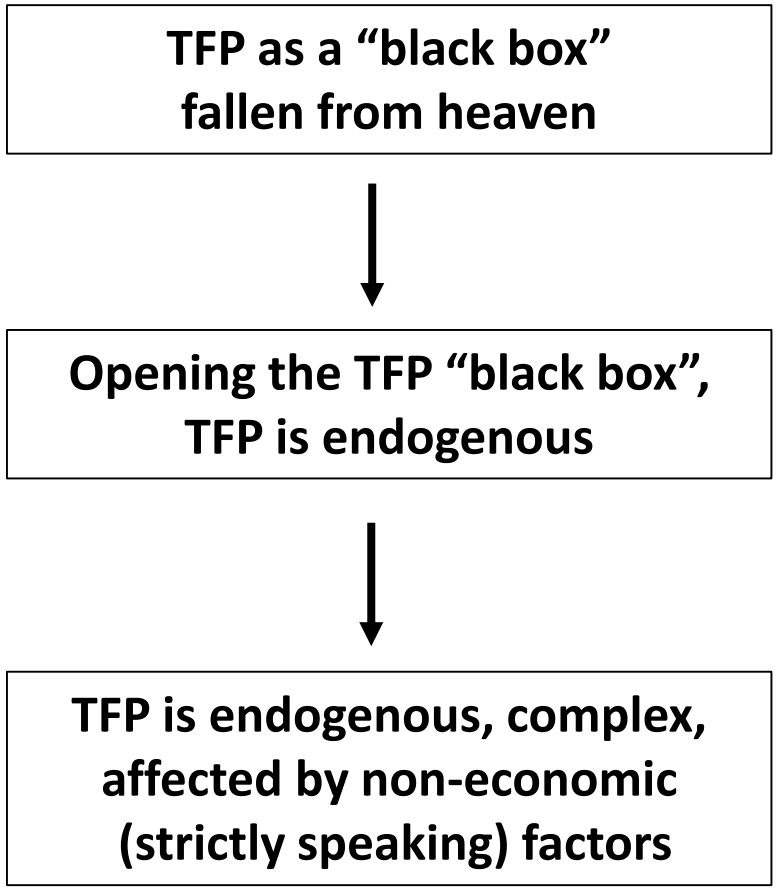
- This is done by allowing for part of the savings rate to be invested in education and qualification (i.e. human capital)

- The argument is that spending on education should be viewed as (productive) investment and thus is very different from spending on consumption

Theory Lecture 16

5.2. Theories of economic growth

- **Neoclassical models of capital accumulation**
  - Solow model (exogenous savings)
  - Ramsey model (optimal savings)
- **Endogenous growth models**
  - Externalities
  - Innovation (creative destruction)
- **Beyond the production function**
  - International trade
  - Geography and history
  - Income distribution (inequality)
  - Institutions



Learning outcomes for lecture 16

- Explain the key differences in the assumptions about technical change between neoclassical and endogenous growth models
- Explain the role of externalities, public goods and innovation in sustaining the technological change process and non-decreasing marginal returns to capital
- Identify some of the most well-know models of endogenous growth

5.2.2. Endogenous growth models

- Neoclassical growth theory, based on the assumption of diminishing returns to capital, attributes long-run growth to technical progress, but leaves it unexplained (i.e. ‘black box’)

- Neoclassical growth theory also predicted that once economies reached the steady state there would be no more room for growth policy

- Since the mid-1980s, there has been a burgeoning amount of literature attempting to explain the differences in output growth rates and per capita income across countries by the so-called “new growth models” theories or endogenous growth models

5.2.2. Endogenous growth models

- Paul Romer (1990) on the definition of the “endogenous growth” models approach:

> “The phrase “endogenous growth” embraces a diverse body of theoretical and empirical work that emerged in the 1980s. This work distinguishes itself from neoclassical growth theory by emphasizing that economic growth is an endogenous outcome of an economic system, not the result of forces that impinge from outside. For this reason, the theoretical work does not invoke exogenous technological change to explain why income per capita has increased by an order of magnitude since the industrial revolution. The empirical work does not settle for measuring a growth accounting residual that grows at different rates in different countries. It tries instead to uncover the private and public sector choices that cause the rate of growth of the residual to vary across countries.”

5.2.2. Endogenous growth models

- The endogenous growth models propose there are at least two main reasons for assuming that technical progress or TFP should be endogenous:

1. **TFP may be exogenous at the level of firms but endogenous at the aggregate level**: because interactions between firms can increase improve their efficiency through exchange of knowledge, sharing of resources, etc. This corresponds to a **form of external economies** and can be illustrated by the existence of industrial and geographical clusters

2. **TFP may be endogenous even at the firm level**: because firms invest in R&D and through innovation increase their productivity

5.2.2. Endogenous growth models

- Some of the more well-known models have focused on the role of externalities and public goods

- The idea is that positive externalities associated with some public goods (e.g. education, innovation) can be used to relax the assumption of diminishing returns to capital and to sustain technical progress

- The presence of externalities and public goods in the production process also provides a reasoning for government intervention (see Chapter 1) in order to ensure optimal levels of the factors affecting growth (e.g. education, R&D, infrastructure, etc)

5.2.2. Endogenous growth models

- **Paul Romer's (1986)** endogenous growth model emphasises the role of externalities as a reason for the non-decreasing marginal returns on physical and human capital

- The implication is that there need not be a limit to capital accumulation because the existence of externalities at the level of firms in the production process means that technological progress can be sustained over time

- Moreover, governments can influence the process by providing some of the key factors affecting TFP, e.g. public infrastructure (transport, health, education), subsidies to R&D and innovation, etc

5.2.2. Endogenous growth models

- **Barro e Sala-ì-Martin (1995)** endogenous growth model proposes that public goods such as public infrastructure (education, transport) can also entre the production function as input factors, which in turn can also avoid diminishing returns to capital

- However, there may be a limit to the ability of public investment and infrastructure to increase economic growth, i.e. after a certain threshold there may also be decreasing returns (e.g. transport network may not need to grow more after certain level of capacity)

- Moreover, because public infrastructure needs to be funded by taxation on private agents (firms and households), there may be a reduction in investment in the future. This raises important issues about the ways to finance these investments without creating a negative impact on the economy

5.2.2. Endogenous growth models

- Endogenous growth models also give importance to the role of innovation in sustaining technological change and hence economic growth

- The ‘Schumpeterian’ innovation through **creative destruction** is one such reference, putting emphasis on the entrepreneurial attitude of businesses to remain alive and growing in their sectors

- There are 5 types of innovation:
  - Product innovation
  - Innovation in methods of production
  - Demand-oriented innovation
  - Inovação nas matérias primas
  - Inovação na organização.

5.2.2. Endogenous growth models

- The ‘Schumpeterian’ i**nnovation-based creative destruction model** also has strong implications for public policy

- In particular, it argues that declining industries should not be protected by public policy

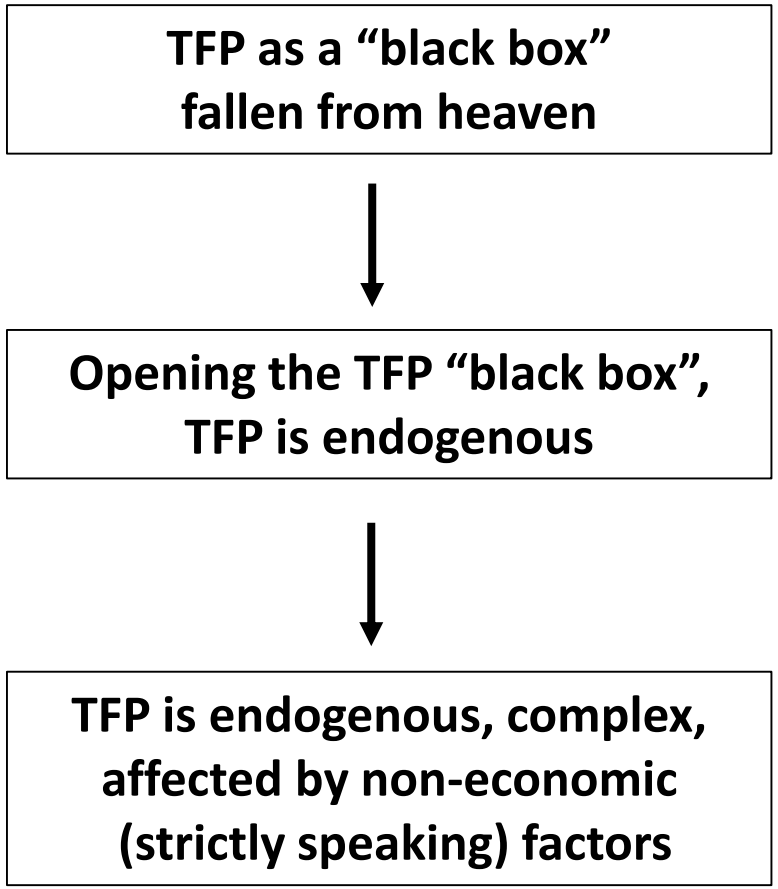
- On the contrary, policies should incentivise their replacement by new market players as a way to promote economic growth

- This approach, however, is problematic because it disregrads the negative effects on workers of declining industries, who most likely will not be able to find jobs in the ‘new’ industries easily as this requires changing their skill set

Theory Lecture 17

5.2. Theories of economic growth

- **Neoclassical models of capital accumulation**
  - Solow model (exogenous savings)
  - Ramsey model (optimal savings)
- **Endogenous growth models**
  - Externalities
  - Innovation (creative destruction)
- **Beyond the production function**
  - International trade
  - Geography and history
  - Income distribution (inequality)
  - Institutions



5.2.3. Beyond the production function

a) International trade
b) Geography and history
c) Inequality and growth
d) Institutions and growth

a) International trade theory

- The linkages between growth theory and international trade theory remained separate fields of economics for a long time

- Growth theories portrayed economies as closed economies, while international trade theories did not consider the issue of growth

- However, the efficiency gains resulting from trade specialisation proposed by international trade theories can be analysed in the context of growth theories through their effect on productivity levels – these effects can be explained through 3 dimensions – see next slide

a) International trade theory

- There are 3 dimensions to these effects between trade liberalisation and productivity levels:

1. Productivity gains resulting from increased competition following trade liberalisation: this leads to greater firm innovation and a darwinian selection process of the survival of the fittest (i.e. most competitive) firms
2. International trade promotes greater knowledge transfer, which in turn also increases innovation and productivity (for example between developed and developing countries, thus contributing to catching up process)
3. International trade increases market size which allows firms to enjoy economies of sclae in production

b) Geography and history

- The study of economic geography - that is, the location of factors of production in space – traditionally occupied a small part of standard economic analysis

- In the case of economic growth, the models studied before did not say anything about the spatial dimension of growth, that is, the distribution of wealth and income across space was largely ignored by economists

- It was only in the beginning of the 1990s that mainstream economics started addressing th elinks between growth and geography

- This stream of work is known as the ‘New Economic Geography’ (NEG), whose father is the Nobel laureate Paul Krugman

b) Geography and history

- It combines many features of international trade theory (i.e. ‘new trade theory’) with features of endogenous growth models (namely the existence of externalities)

- The main ingredients of the NEG include:
  a) Increasing returns to scale that are internal to the firm
  b) Imperfect competition
  c) Positive transportation or trade costs
  d) Endogenous firm location
  e) Endogenous location of demand through either mobile workers (Krugman, 1991) or firms using their sector output as intermediate inputs (Venables 1996, Krugman and Venables 1995)

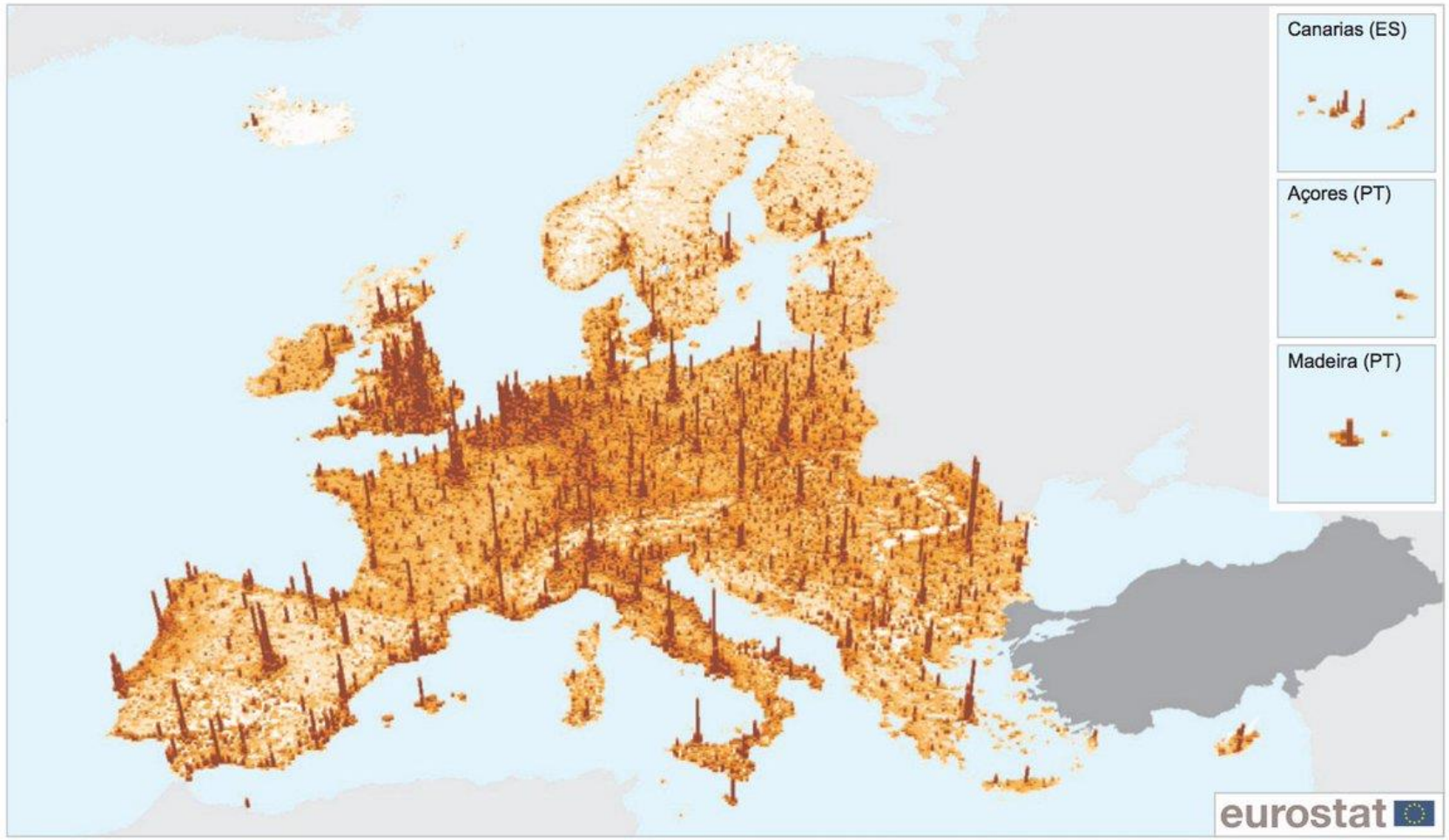
b) Geography and history

- The NEG explains how it is possible to have concentrations in space (e.g. cities) with intermediate areas with a smaller range of goods and services

- It generates a “spiky” landscape – larger cities tend to grow more rapidly in large part from exploitation of scale economies and the attractions to labour for living in areas with a greater variety of goods and services

- The tendency for larger regions to gain more enhance disparities between larger and smaller regions (*core-periphery model*)

Map 2: Population density based on the GEOSTAT population grid, 2011
(number of inhabitants/km²)



(number of inhabitants/10 km²)

Administrative boundaries: © EuroGeographics © UN-FAO © Turkstat
Cartography: Eurostat — GISCO, 06/2017

Data not available

Note: the GEOSTAT population grid is normally based on the number of inhabitants per 1 km²; for the sake of clarity in this 3D map it has been aggregated to show the number of inhabitants per 10 km². Guadeloupe (FRA1), Martinique (FRA2), Guyane (FRA3) La Réunion (FRA4) and Mayotte (FRA5): not available.

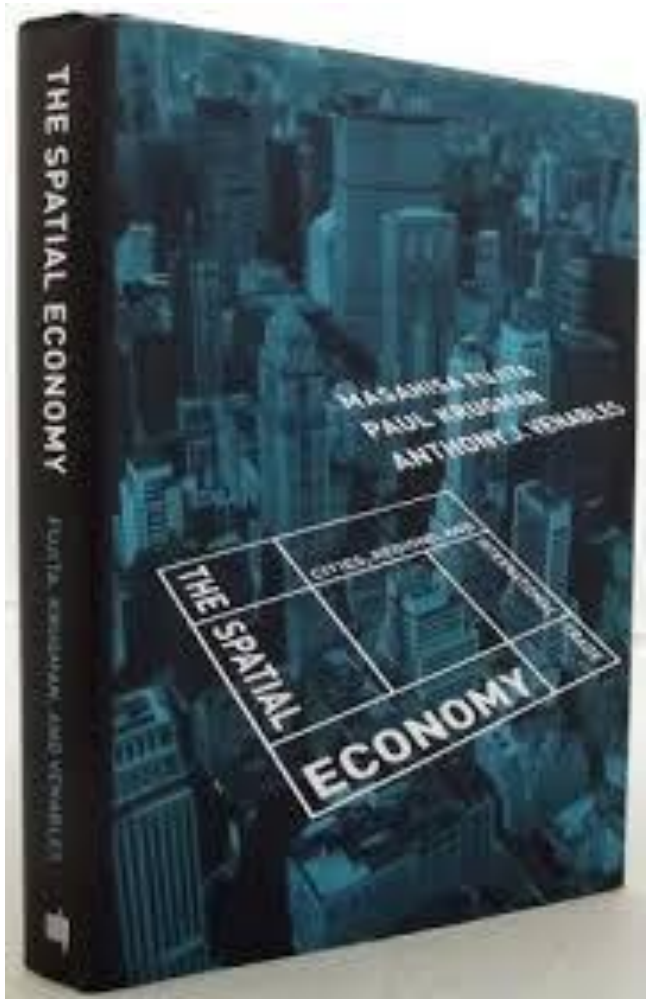
Source: JRC, Eurostat, GEOSTAT Population Grid 2011

b) Geography and history

- At the core of the NEG is the trade-off between agglomeration forces and dispersion forces; it determines the location of economic activities across space

- **Agglomeration forces**: result from the presence of external economies, e.g. input-output linkages, knowledge spillovers, thick labour market, low/medium transport costs

- **Dispersion forces**: result from the presence of immobile factors, high land prices, and external diseconomies (e.g. congestion, pollution, etc), high transport costs



c) Inequality-Growth Relationship

- The more standard approach, as proposed by Kuznets (1955) inverted U shaped curve, is that growth affects inequality (i.e. distribution of wealth)

- More recently, there has been much debate and work on the opposite direction of the relation, i.e. that inequality may hinder economic growth (Alesina and Rodrik, 1994)

- Two main types or arguments why progressive redistribution may enhance growth:

1. *Political economy arguments*: too much inequality may lead to political and social tension and conflict
2. *Economic arguments*: credit market imperfections may explain that redistributing capital from capital-rich businesses or individuals to capital-poor and credit constrained people increases efficiency, investment and growth

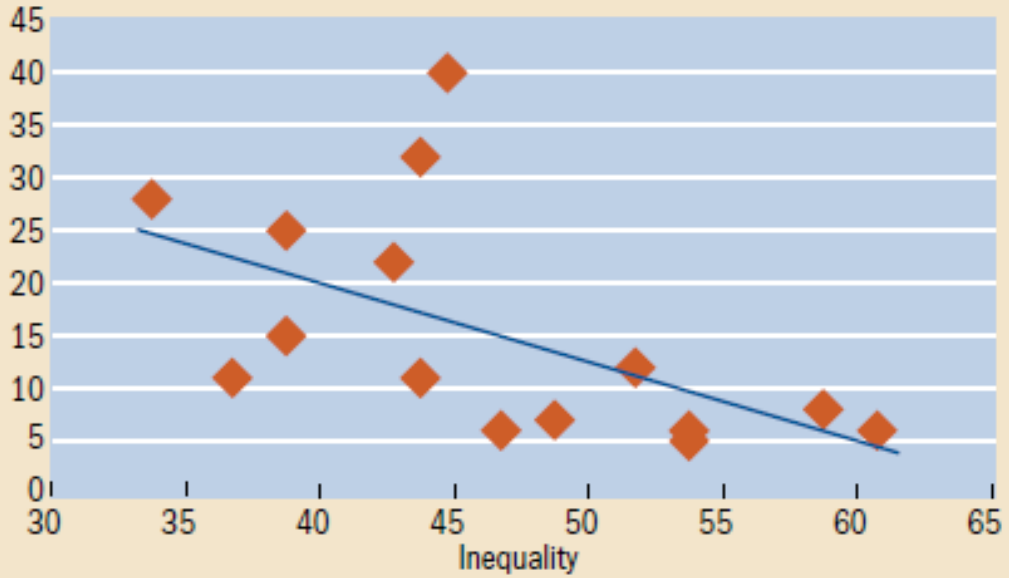
c) Inequality-Growth Relationship

Chart 3

Lasting effects

More inequality seems to spell less sustained growth.

(years in growth spell)



Sources: Penn World Tables; and Wide World Inequality Database.

Note: Inequality is measured by the Gini coefficient, which ranges from zero, where all households have the same income, to 100, where one household has all the income. All spells lasted a minimum of five years. No incomplete spells are included. The data cover the period from 1950 to 2006. Countries in the sample include Belgium, Brazil, Cameroon, Colombia, Ecuador, El Salvador, Greece, Guatemala, Jamaica, Jordan, Pakistan, Panama, Singapore, Thailand, and Zambia.

- The dominant view today is that inequality plays a central role in determining growth rates

- For more read the article "How does inequality affect economic growth rates?", *The Economist* https://www.economist.com/blogs/economist-explains/2015/06/economist-explains-11

Source: http://www.imf.org/external/pubs/ft/fandd/2011/09/pdf/berg.pdf

d) Growth and institutions

- **Institutions** reflect the organisation of society – socially, economically and politically-, and refer to rules, regulations, laws and policies that **affect economic incentives to invest in technology, physical capital and human capital**, **and thus economic performance and development** - i.e. they are the "enabling environment"

- Key features of institutions: humanly devised, set constraints, shape incentives

- These theories defend that the quality of institutions is also an important determinant of economic growth, besides the more standard economic factors relating to physical capital, human capital, innovation and technology

- Notable authors in this field: Ronald Coase e Douglass North

d) Growth and institutions

- **Economic institutions**: e.g., property rights, contract enforcement, etc. They shape economic incentives, contracting possibilities, distribution

- **Political institutions**: e.g., form of gov., constraints on politicians and elites, separation of powers, etc. They shape political incentives and distribution of political power

- Important distinction between:
  - **Formal institutions**: codified rules, e.g. the constitution
  - **Informal institutions**: related to how formal institutions are used, distribution of power, social norms

d) Growth and institutions

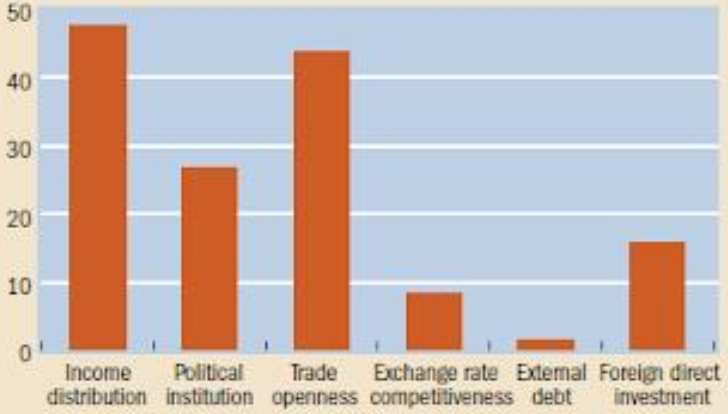
There is a positive association between good institutions & governance and economic growth

Chart 4

Growth spells

Factors have differing impacts on how long growth periods last. Income distribution appears quite important, whereas other factors are less so.

(change in expected growth duration, percent)



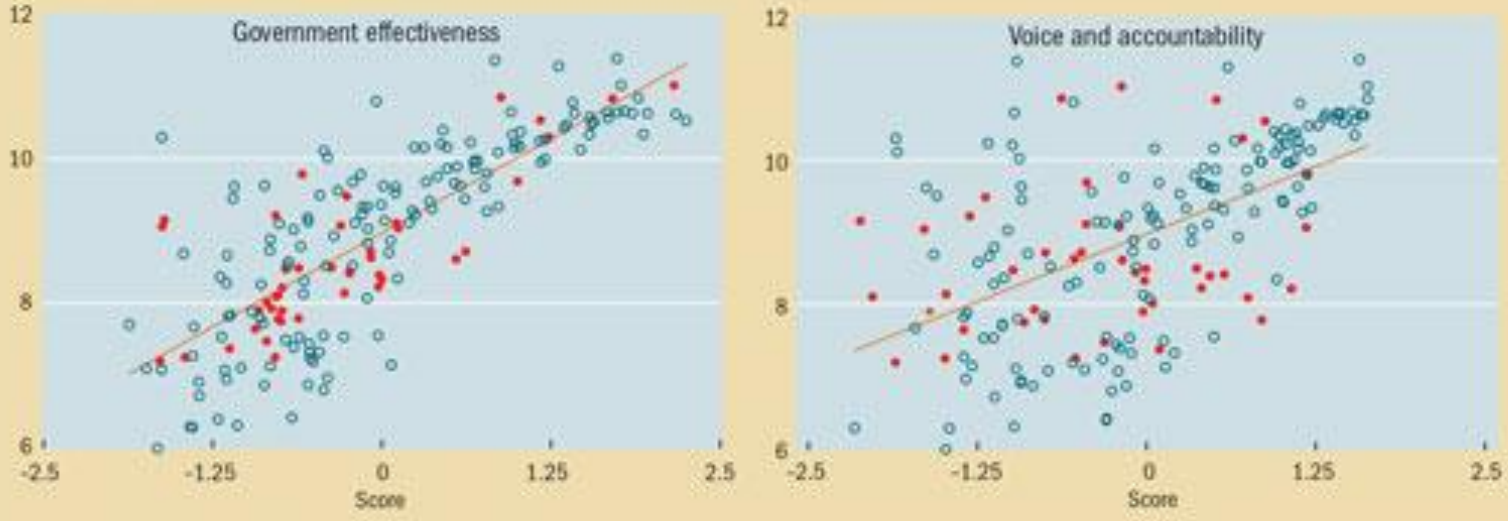
Sources: Berg, Ostry, and Zettelmeyer (2008); and authors' calculations.

Note: The height of each factor represents the percentage change in a growth spell between 1950 and 2006 when the factor moves from the 50th percentile to the 60th percentile and all other factors are held constant. Income distribution uses the Gini coefficient. The political institutions factor is based on an index from the Polity IV Project database that ranges from +10 for the most open and democratic societies to -10 for the most closed and autocratic. Trade openness measures the effect of changes in trade liberalization on year-to-year growth. Exchange rate competitiveness is calculated as the deviation of an exchange rate from purchasing power parity, adjusted for per capita income.

Chart 3

Government effectiveness rules

Asian economies with more effective governments have higher per capita GDP; voice and accountability has a lower correlation with economic development.



Sources: IMF, World Economic Outlook database; World Bank, World Development Indicators database and Worldwide Governance Indicators database.

Note: PPP = purchasing power parity. Red dots refer to developing Asia. Indicators range from -2.5 to 2.5, with higher numbers denoting better governance quality.

Source: http://www.imf.org/external/pubs/ft/fandd/2014/06/jha.htm

Source: http://www.imf.org/external/pubs/ft/fandd/2011/09/pdf/berg.pdf

Multiple choice questions from past exams

By β convergence we mean:
a) A negative correlation between the growth rate of the total productivity of factors and the initial K/N ratio.
b) A negative correlation between the initial GDP per capita and the GDP growth rate.
b) A negative correlation between the growth rate of the total productivity of factors and the initial GDP per capita.
d) None of the above.

By β convergence we mean:

a) A negative correlation between the growth rate of the total productivity of factors and the initial K/N ratio.

b) A negative correlation between the initial GDP per capita and the GDP growth rate.

c) A negative correlation between the growth rate of the total productivity of factors and the initial GDP per capita.

d) None of the above.

According to the data provided by the research of Angus Maddison, the part of Asia (except Japan) in the world GDP was 16.4% in 1973 and increased to 33.9% in 2003. Suppose that you want to study such growth of Asian countries through the Solow model. Which of the following hypotheses is not assumed for this model:

a) Technical progress and savings rate are exogenous.

b) Increasing returns of K and L.

c) Constant returns to scale.

d) K and L are perfect substitutes.

According to the data provided by the research of Angus Maddison, the part of Asia (except Japan) in the world GDP was 16.4% in 1973 and increased to 33.9% in 2003. Suppose that you want to study such growth of Asian countries through the Solow model. Which of the following hypotheses is not assumed for this model:

a) Technical progress and savings rate are exogenous.

b) Increasing returns of K and L.

c) Constant returns to scale.

d) K and L are perfect substitutes.

Which of the following would you consider the golden rule of capital accumulation?

a) $r = g + K/L$

b) $r > n - g$

c) $r = n + g + s$

d) None of the above

Which of the following would you consider the golden rule of capital accumulation?

a) $r = g + K/L$

b) $r > n - g$

c) $r = n + g + s$

d) None of the above

The catching-up process:
a) Is general and easily observable worldwide.
b) Is not clearly linked to technological advances in the country or region.
b) According to historical experience, at some point, tends to stagnation.
d) Is rather linear in its effects on income distribution along time.

The catching-up process:

a) Is general and easily observable worldwide.

b) Is not clearly linked to technological advances in the country or region.

b) According to historical experience, at some point, tends to stagnation.

d) Is rather linear in its effects on income distribution along time.

The intensification of the use of ICT (Information and Communication Technologies) is an important factor in improving labor productivity. This effect of ICT operates through several channels. Which of the following channels is not operational?

a) Substitution of undifferentiated L by skilled L.

b) Better access to credit for the acquisition of ICT equipment relative to other equipment.

c) Increase in the ratio K/L (substitution of L by K).

d) None of the above.

The intensification of the use of ICT (Information and Communication Technologies) is an important factor in improving labor productivity. This effect of ICT operates through several channels. Which of the following channels is not operational?

a) Substitution of undifferentiated L by skilled L.

b) Better access to credit for the acquisition of ICT equipment relative to other equipment.

c) Increase in the ratio K/L (substitution of L by K).

d) None of the above.

Which of the following items is not part of the hypotheses of the Solow growth model:
a) Increasing returns of the capital.
b) Constant returns to scale.
c) Savings rate is exogenous
d) None of the above.

Which of the following items is not part of the hypotheses of the Solow growth model:

a) Increasing returns of the capital.

b) Constant returns to scale.

c) Savings rate is exogenous

d) None of the above.

Observe o quadro 2. O valor de B é:
a) 1,0%.
b) -1,0%.
c) -1,5%.
d) Nenhuma das anteriores.

No quadro 2, o valor de A é:
a) 1,0%.
b) 1,1%.
c) -1,1%.
d) Nenhuma das anteriores.

Quadro 2 - Taxas de crescimento (%) anuais médias entre 2000 e 2014

PIB	A
Total de horas trabalhadas	0,0
Emprego	0,1
Horas de trabalho por pessoa	-0,1
Produtividade do trabalho	B
Rácio capital / trabalho	2,5
Produtividade Total dos Factores	-1,5

Observe o quadro 2. O valor de B é:

a) 1,0%.

b) -1,0%.

c) -1,5%.

d) Nenhuma das anteriores.

No quadro 2, o valor de A é:

a) 1,0%.

b) 1,1%.

c) -1,1%.

d) Nenhuma das anteriores.

Quadro 2 - Taxas de crescimento (%) anuais médias entre 2000 e 2014

PIB	A
Total de horas trabalhadas	0,0
Emprego	0,1
Horas de trabalho por pessoa	-0,1
Produtividade do trabalho	B
Rácio capital / trabalho	2,5
Produtividade Total dos Factores	-1,5