PROCESS OF CONVERGENCE IN EU

ENDOGENEOUS GROWTH MODELS

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*Slides adapted from teaching materials produced by dr hab. Joanna Wolszczak-Derlacz

CRITICISM OF THE NEO-CLASSICAL GROWTH MODEL

- **In neoclassical growth models (Solow), the long-run rate of growth is exogenously determined.** In other words, it is determined 'outside of the model'

- This does not explain the **origins of growth**, which makes the neo-classical model appear very unrealistic. **Endogenous growth theorists** see this as an **over- simplification.**

NEOCLASSICAL EXOGENOUS GROWTH MODELS VS ENDOGENOUS GROWTH MODELS

Neoclassical Exogenous Growth Models:

- technological progress is the engine of growth
- technological improvements are automatic and unmodeled (exogenous)

Endogenous Growth Models:

- Try to explain the engine of growth
- It is important to understand the economic forces underlying technological progress

CHANGE IN THE ASSUMPTIONS CONCERNING PRODUCTION FUNCTION AND TECHNOLOGY

- Neoclassical Solow model was based on the assumptions of constant returns to scale and descreasing marginal product of factors of production

- **Endogeneous growth models** assume that we can have **non-decreasing (e.g.constant or increasing) marginal product** and, **increasing returns to scale**

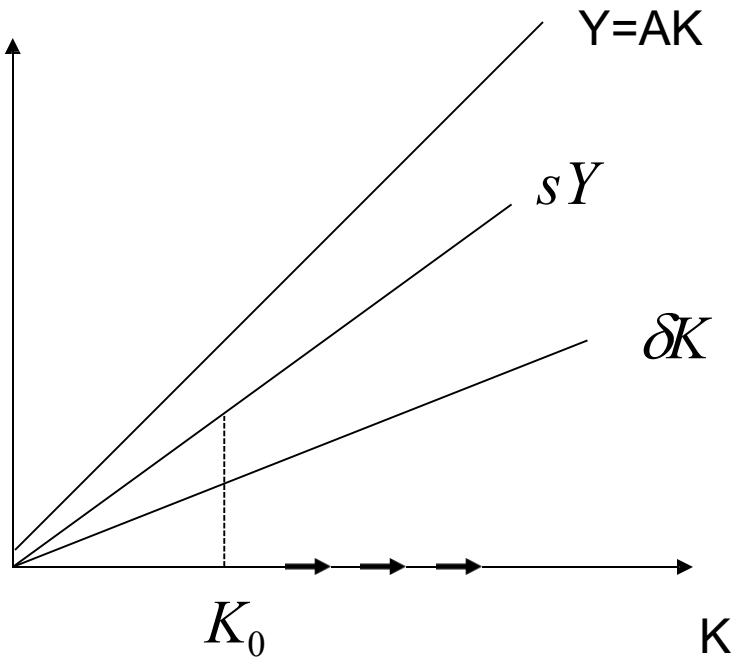
  → **change in the form of the production function**

EXAMPLE: SIMPLE ENDOGENOUS GROWTH MODEL „AK MODEL"

$$Y = AF(K, L) = AK^{\alpha}(L)^{1-\alpha}$$

if $\alpha = 1$ then

$$Y = AK \qquad (1)$$



Growth in the model never stops

$$\dot{K} = \Delta K = I - \delta K = SY - \delta K$$

Divide both sides by K

$$\frac{\dot{K}}{K} = s\frac{Y}{K} - \delta$$

From the „AK" production function

$$\frac{Y}{K} = A$$

$$\frac{\dot{K}}{K} = sA - \delta \qquad (2)$$

$$Y = AK$$

Using our trick (ln+derivate)

$$\frac{\dot{Y}}{Y} = \frac{\dot{A}}{A} + \frac{\dot{K}}{K}$$

Growth rate of output equals

growth rate of technology+growth rate of capital

If there is no technological progress $\frac{\Delta A}{A} = 0$ then

$$\frac{\dot{Y}}{Y} = \frac{\dot{K}}{K}$$

Growth rate of output equals
growth rate of capital

and $$\frac{\dot{Y}}{Y} = \frac{\dot{K}}{K} = sA - \delta$$

ENDOGENOUS GROWTH MODELS (1)

New growth theories (1980s – 1990s), called also endogeneous growth theoreis emphasise different factors which act as the source of growth:

- physical capital (with '**learning by doing**' or **complementarities**)
- **human capital**
- **technology** (**research and development**), **innovations**
- or **infrastructure** and **public services**

Source: Acemoglu D. Growth Theory Since Solow and the Poverty of Nations: Daron Acemoglu World Bank, April 26, 2006 http://econ-www.mit.edu/files/970 :

ENDOGENOUS GROWTH MODELS (2)

Thus, growth is explained as **driven by technical change** which in turn may be ***endogenously*** brought about by a variety of reasons:

- **learning-by-doing** (*Romer* 1986);
- external effects of **human capital formation** (*Lucas* 1988);
- production externalities of **public expenditures** (*Barro* 1990);
- and **quality improvements** through the **invention of new products** – quality ledder models (*Grossman and Helpman* 1991).

Source: Acemoglu D. Growth Theory Since Solow and the Poverty of Nations: Daron Acemoglu World Bank, April 26, 2006 http://econ-www.mit.edu/files/970 :

OTHER ENDOGENEOUS FACTORS OF GROWTH COVERED BY ENDOGENEOUS GROWTH THEORIES

- Research and development (**R&D**)
- The role of **externalities (positive spillovers)**
- **Impact of policies and governance on growth**
- Transfer of knowledge through **trade** liberalisation and international cooperation (→trade theories)

ELEMENTS OF ENDOGENEOUS GROWTH THEORIES THAT WILL BE DISCUSSED

1. Innovation
2. Transfer of technology
3. Human capital
4. The role of government
5. Trade and growth

1. INNOVATION

"the opening up of new markets, foreign or domestic, and the organizational development […] illustrate the same process of ***industrial mutation, that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one"***
- "creative destruction"

"Capitalism, Socialism and Democracy"

Joseph Schumpeter

Innovation is a multi-dimensional issue

- innovation can be described **by type** (process, product, service, business model, value, market *etc.*) and **degree** (incremental, semi-radical, radical, transformational *etc.*)

EXAMPLES: MEASURES OF INNOVATION PERFORMANCES ACROSS THE EUROPEAN UNION IN THE EUROPEAN INNOVATION SCOREBOARD (EIS)

FRAMEWORK CONDITIONS

Human resources

1.1.1 New doctorate graduates
1.1.2 Population aged 25-34 with tertiary education
1.1.3 Lifelong learning

Attractive research systems

1.2.1 International scientific co-publications
1.2.2 Top 10% most cited publications
1.2.3 Foreign doctorate students

Innovation-friendly environment

1.3.1 Broadband penetration
1.3.2 Opportunity-driven entrepreneurship

INVESTMENTS

Finance and support

2.1.1 R&D expenditure in the public sector
2.1.2 Venture capital expenditures

Firm investments

2.2.1 R&D expenditure in the business sector
2.2.2 Non-R&D innovation expenditures
2.2.3 Enterprises providing training to develop or upgrade ICT skills of their personnel

INNOVATION ACTIVITIES

Innovators

3.1.1 SMEs with product or process innovations
3.1.2 SMEs with marketing or organisational innovations
3.1.3 SMEs innovating in-house

Linkages

3.2.1 Innovative SMEs collaborating with others
3.2.2 Public-private co-publications
3.2.3 Private co-funding of public R&D expenditures

Intellectual assets

3.3.1 PCT patent applications
3.3.2 Trademark applications
3.3.3 Design applications

IMPACTS

Employment impacts

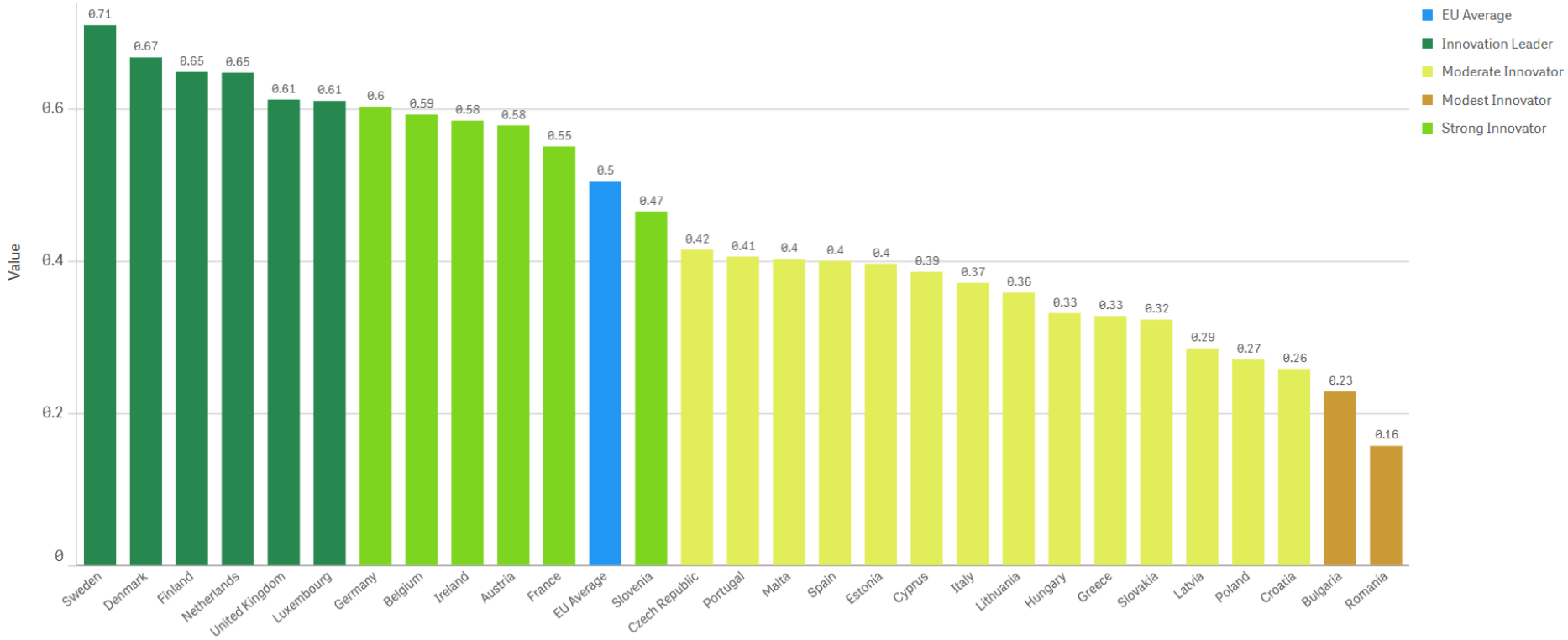
4.1.1 Employment in knowledge-intensive activities
4.1.2 Employment fast-growing enterprises of innovative sectors

Sales impacts

4.2.1 Medium and high-tech product exports
4.2.2 Knowledge-intensive services exports
4.2.3 Sales of new-to-market and new-to-firm product innovations

Source: European Innovation Scoreboard, 2018

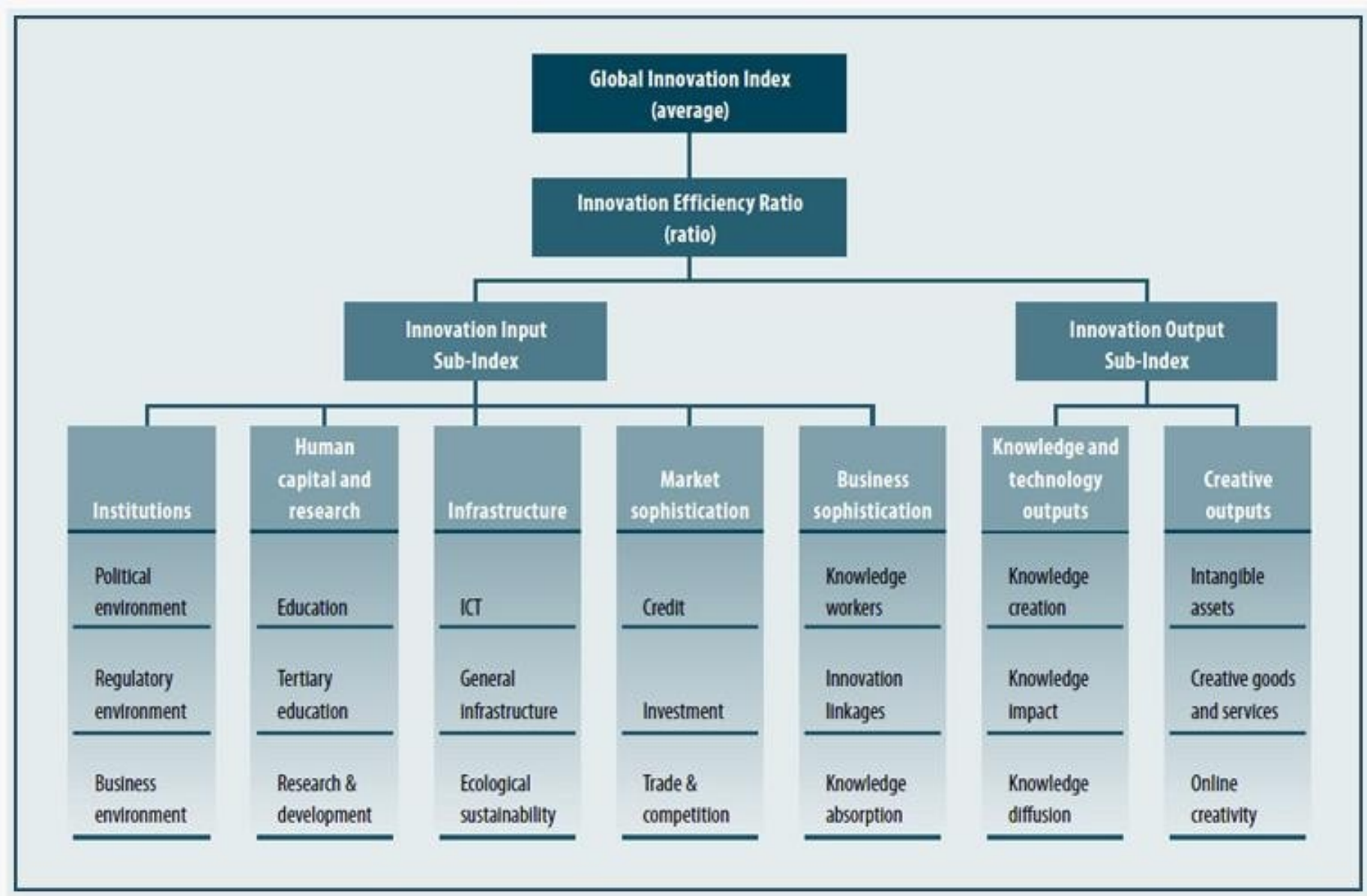
EUROPEAN INNOVATION SCOREBOARD (EIS), 2018



Source: https://interactivetool.eu/f/extensions/a5/a5.htmlt

For further analysis see: **EIS interactive tool**
https://interactivetool.eu/f/extensions/DGGROW4/DGGROW4.html

GLOBAL INNOVATION INDEX - FRAMEWORK



GLOBAL INNOVATION INDEX – 2018

THE FIRST 10 COUNTRIES IN THE RANKING

1. Switzerland
2. Netherlands
3. Sweden
4. United Kingdom
5. Singapore
6. United States of America
7. Finland
8. Denmark
9. Germany
10. Ireland

Poland place 39th (out of 126)

2. TRANSFER OF TECHNOLOGY: MEASURES OF TECHNOLOGICAL PROGRESS

Apart from standard **measures of productivity** (**GDP per hour worked or GDP per hour worked**), the following measures are used:

- **R&D** (Research and Development) **expenditure** as a share of GDP→ one of the key factors of growth
- % of people employed in R&D sector
- % of employment in **high-tech sector**
- Number of patents per mln inhabitants

THE ROLE OF EXTERNALITIES IN ENDOGENOUS GROWTH

- ***externality*** is an effect from one activity which has consequences for another activity but is not reflected in market prices
- Externalities can be either **positive,** when an external benefit is generated, or **negative**, when an external cost is generated from a market transaction.

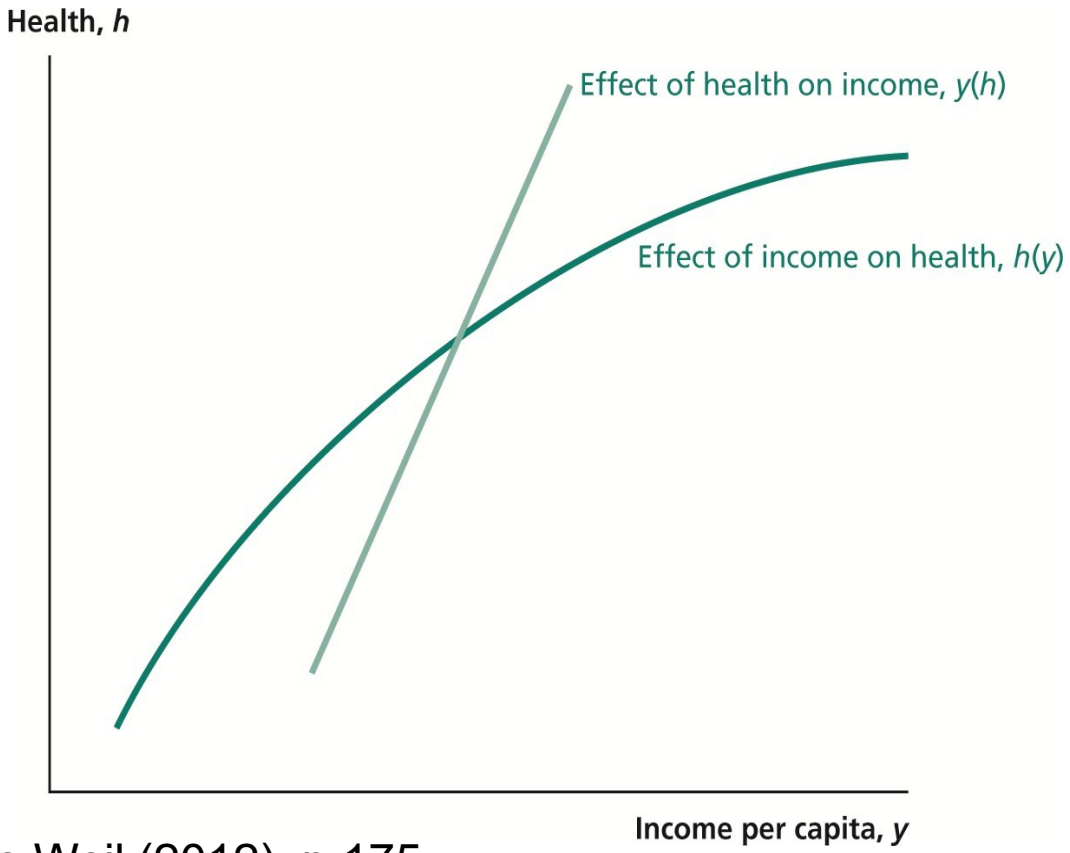
+ education, culture, network effects of technology use

- pollution, extensive use of public goods ('tragedy of commons')

3. HUMAN CAPITAL IN ENDOGENOUS GROWTH MODELS

- (Rebelo 1987, Lucas 1986) – clear distinction between **material capital and human capital**, and different roles played by the two in the growth process and convergence
- The term human capital was first discussed by Arthur Cecil Pigou : "There is such a thing as investment in human capital as well as investment in material capital"
- Measures of human capital (indirect – proxies!): health indicators, literacy rates, school enrolment, tertiary education enrolment, test scores

HOW HEALTH INTERACTS WITH INCOME



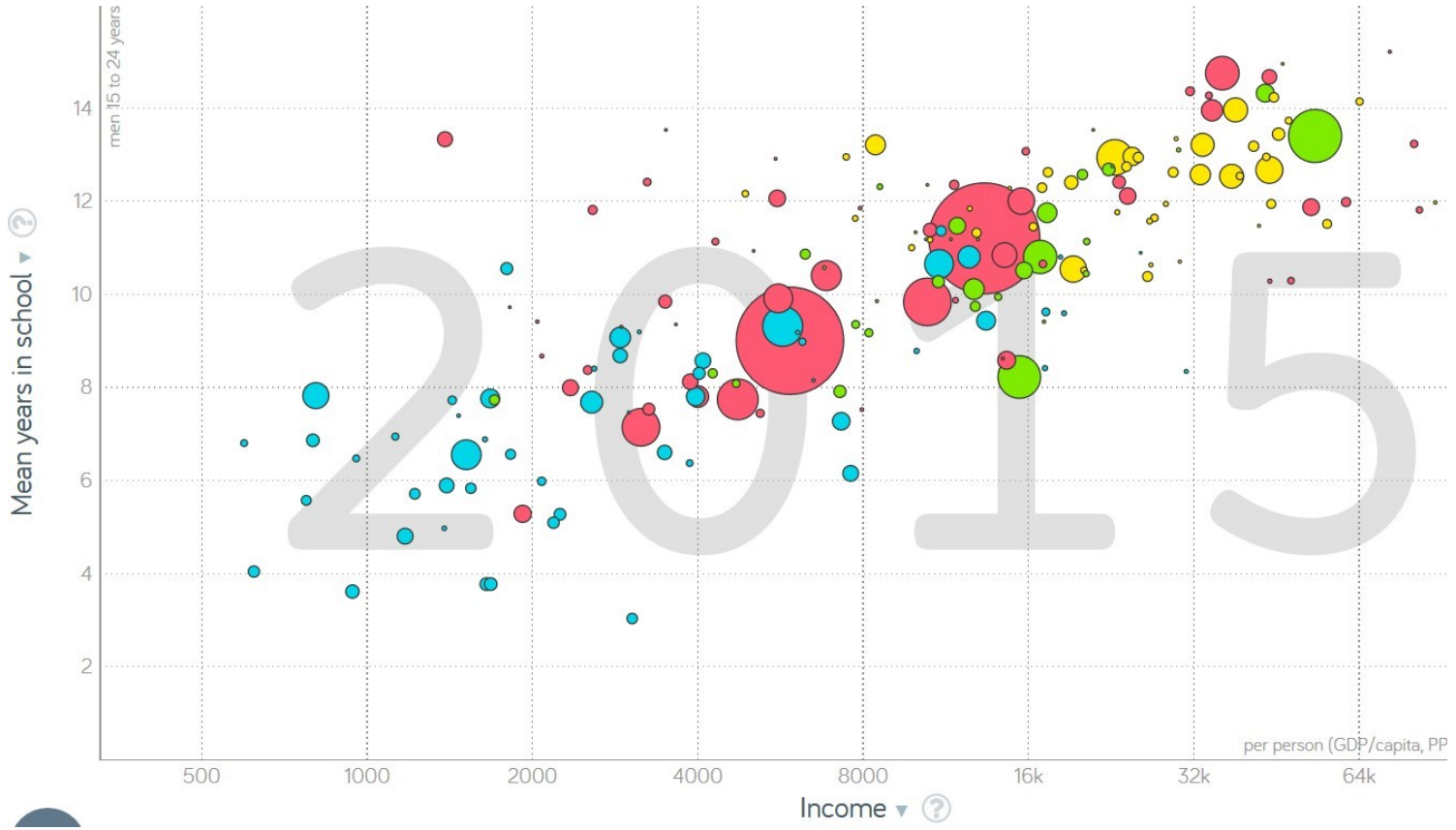
Source Weil (2012), p.175

EDUCATION AND HEALTH AS JOINT INVESTMENTS FOR DEVELOPMENT

- These are investments in the same individual
- **Greater health capital** may improve the *returns to investments in education*
  - Health is a factor in school attendance
  - Healthier students learn more effectively
  - A longer life raises the rate of return to education
  - Healthier people have lower depreciation of education capital
- **Greater education capital** may improve *the returns to investments in health*
  - Public health programs need knowledge learned in school
  - Basic hygiene and sanitation may be taught in school
  - Education needed in training of health personnel

Source: Todaro&Smith, *Economic Development*, 2012 Pearson Addison-Wesley, online resource centre

AVERAGE YEARS OF SCHOOLING VERSUS GDP PER CAPITA



Source Gap minder

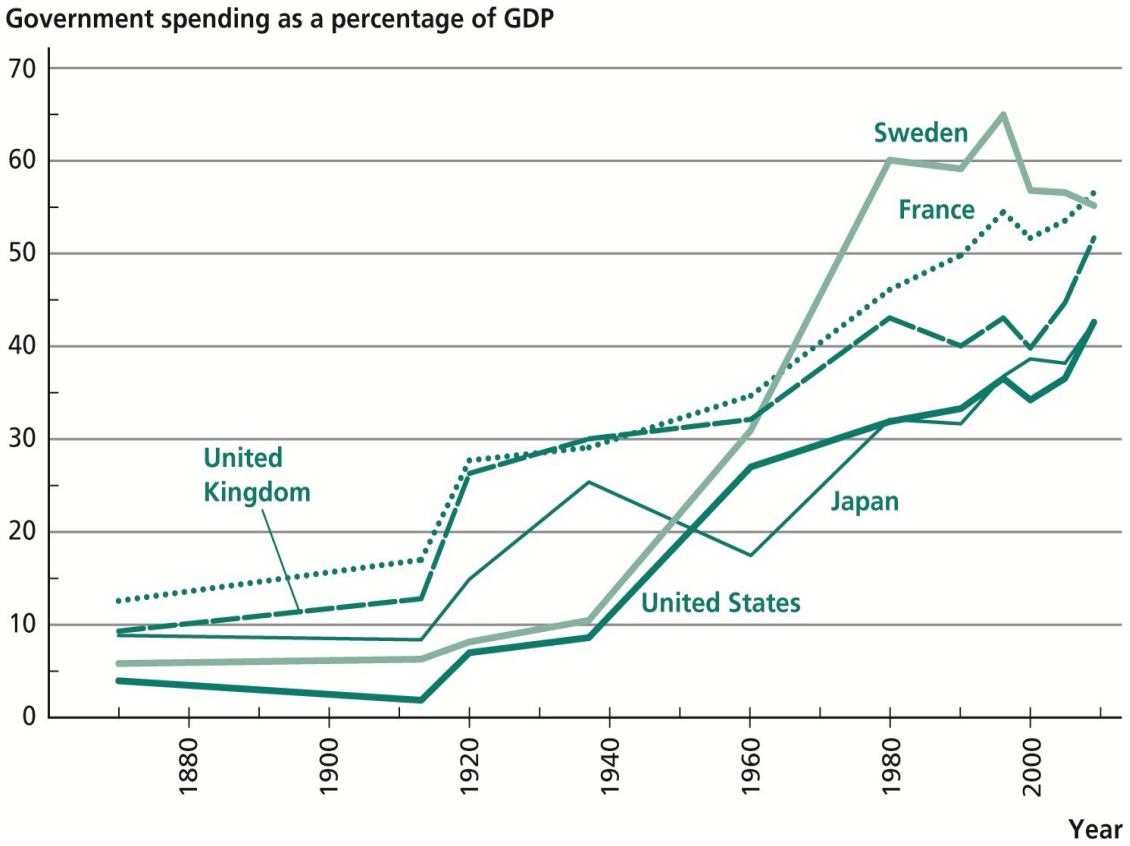
See https://www.gapminder.org/ for „movement”

4. IMPACT OF GOVERNMENT SPENDING, POLICIES AND GOVERNANCE ON GROWTH

1. Government spending - Models a'la Barro1990
   - Crucial assumption: government expenditures (**G**) affect the productivity of privately owned factors.
   - A possible interpretation is that G represents the infrastructure provided by the government. The better the roads are, the more efficient capital and labor will be.

1. Role of instititions for growth

GROWTH OF GOVERNMENT SPENDING, 1870–2009



Source Weil (2012), p.360

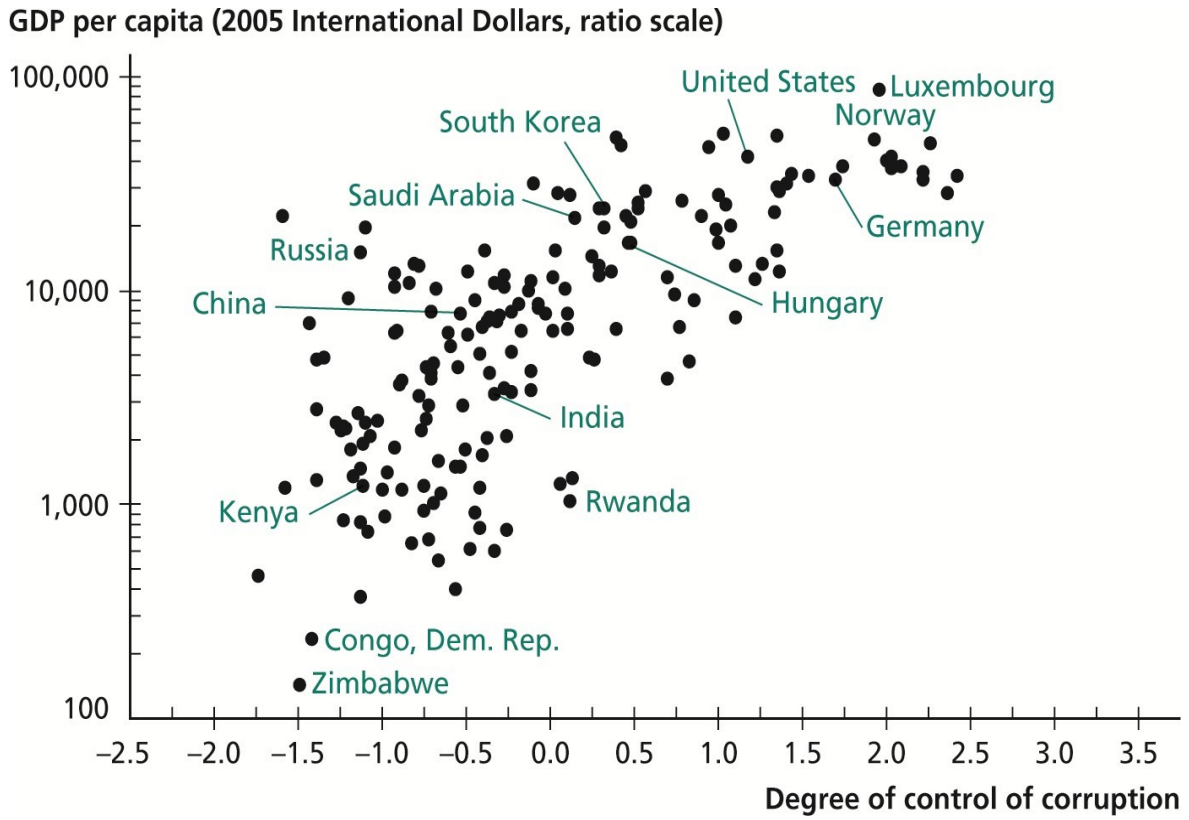
For the recent perspective see: https://data.oecd.org/gga/general-government-spending.htm

QUALITY OF INSTITUTIONS

- The quality of institutions can have a significant effect on economic growth and development in general. Poor institutions can hinder the effectiveness of development strategies →need to improve institutions and governance.

- Quality of institutions – hard to measure!
- Factors taken into account:
  - Political stability
  - Bureocracy
  - Rule of law
  - Ease of doing business
  - Corruption
  - …

GOVERNMENT CORRUPTION VERSUS GDP PER CAPITA,



Source Weil (2012), p.371

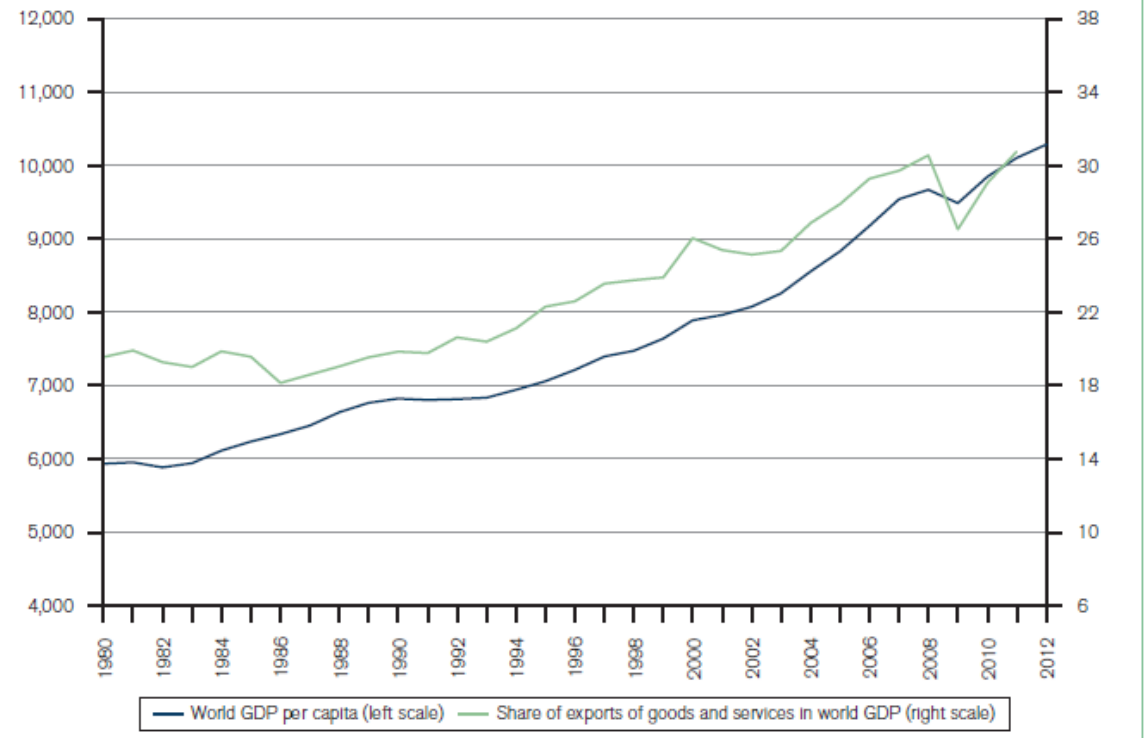
Check: Democracy score and Corruption Perception Index in Gap minder – what kind of conclusions can you draw?

5. OPENNES AND GROWTH

- Measure of openness – trade in goods and services: export, import
- Foreign direct investments (FDI)
- Migration of labour

IS THERE RELATIONSHIP BETWEEN TRADE AND GROWTH?

Figure B.6: **World GDP per capita and share of exports of goods and services in world GDP**
(2005 international dollars and percentage)



Source: World Bank World Development Indicators.

Source: World Trade Report , 2014

FOREIGN DIRECT INVESTMENTS (FDI)

FDI is defined as cross-border investment by a resident entity in one economy with the objective of obtaining a lasting interest in an enterprise resident in another economy. The lasting interest implies the existence of a long-term relationship between the direct investor and the enterprise and a significant degree of influence by the direct investor on the management of the enterprise. Ownership of at least 10% of the voting power, representing the influence by the investor, is the basic criterion used.

Source: OECD

TYPES OF FDI

- Horizontal – when a firm duplicates its activities e.g. produces the same product/services that produced at home
- Vertical - refers to upstream or downstream movement of a firm in different stages in value chain in a host country
- Greenfield – building the company from scratch
- Brownfield (mergers and acquisitions) -firm purchases a portion or whole existing production

BENEFITS AND COSTS OF INWARD FDI

Host/recipient country

Positive effects:

- Resource-transfer effects
- Employment
- Balance of payments effects
- Spillover effects (new technology, know how)
- Effects on competition and economic growth

Negative effects:

- abuse of native labour
- adverse effects on competition;
- adverse effects on balance of payments.

BENEFITS AND COSTS OF OUTWARD FDI

Home/sending country

Positive effects:

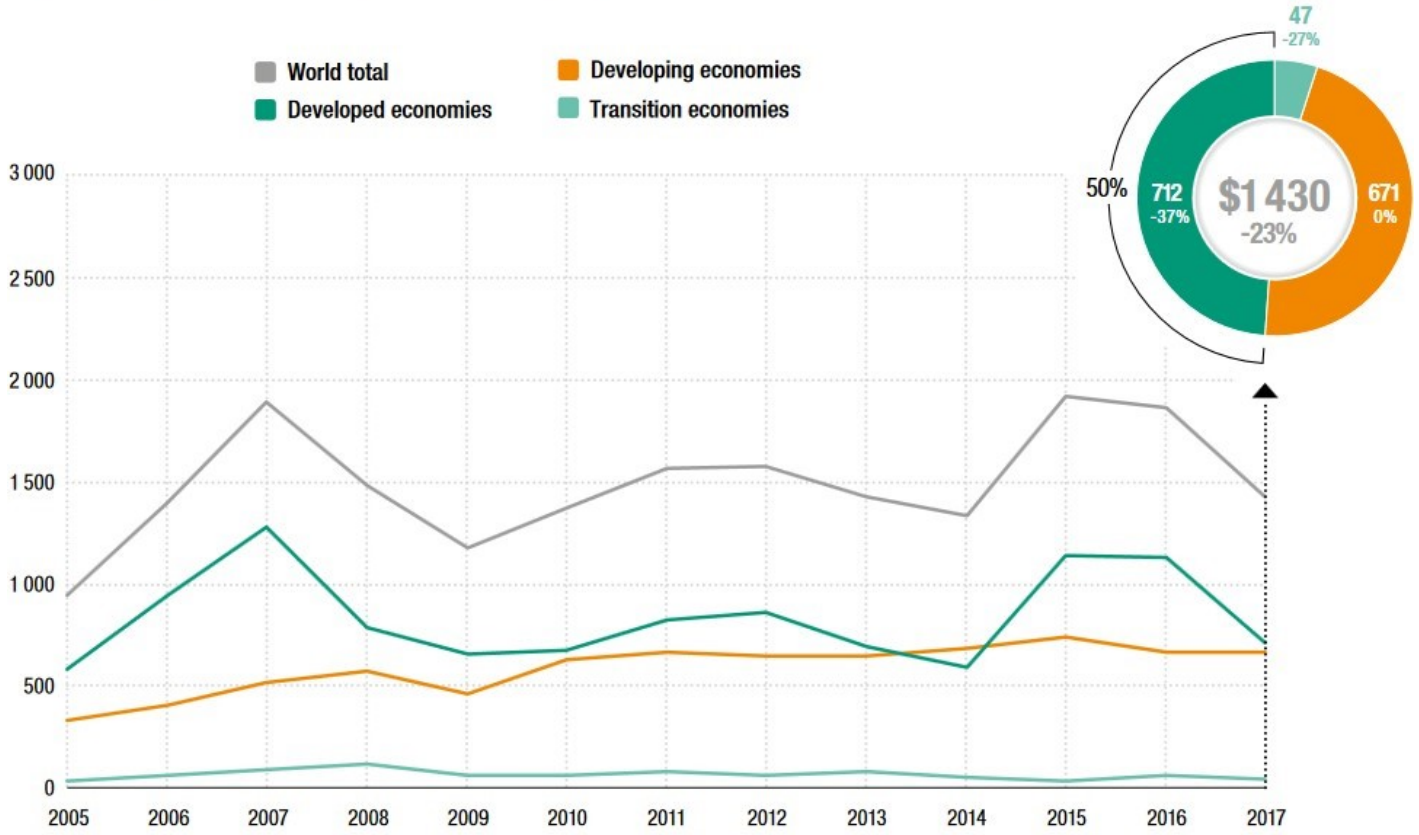
- reverse resource-transfer effect (e.g. cheap labour)
- balance of payments;
- employment

Negative effects:

- Decrease in employment of home workers
- Lose of taxes and other revenues

FDI INFLOWS, BY GROUP OF COUNTRIES

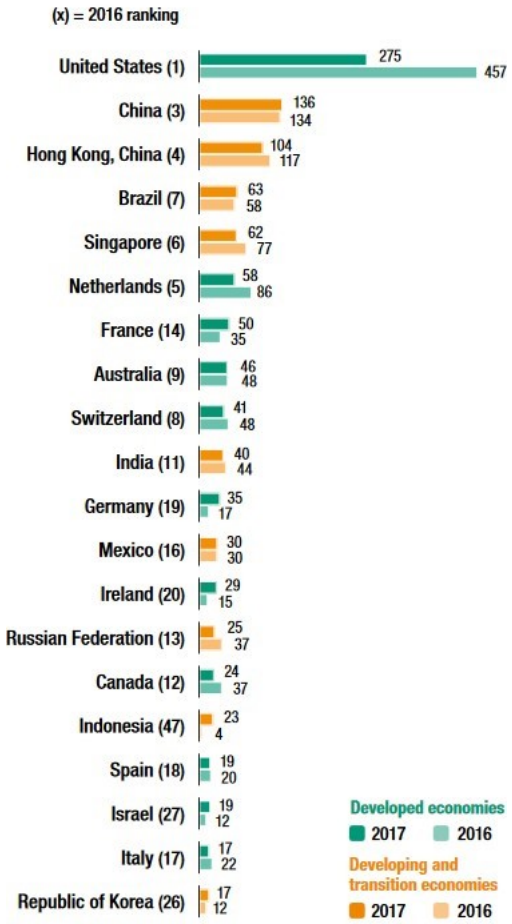
Figure I.1. | **FDI inflows, global and by group of economies, 2005–2017** (Billions of dollars and per cent)



Source: UNCTAD, FDI/MNE database (www.unctad.org/fdistatistics).

FDI INFLOWS, TOP 20 HOST ECONOMIES

Figure I.3. FDI inflows, top 20 host economies, 2016 and 2017 (Billions of dollars)

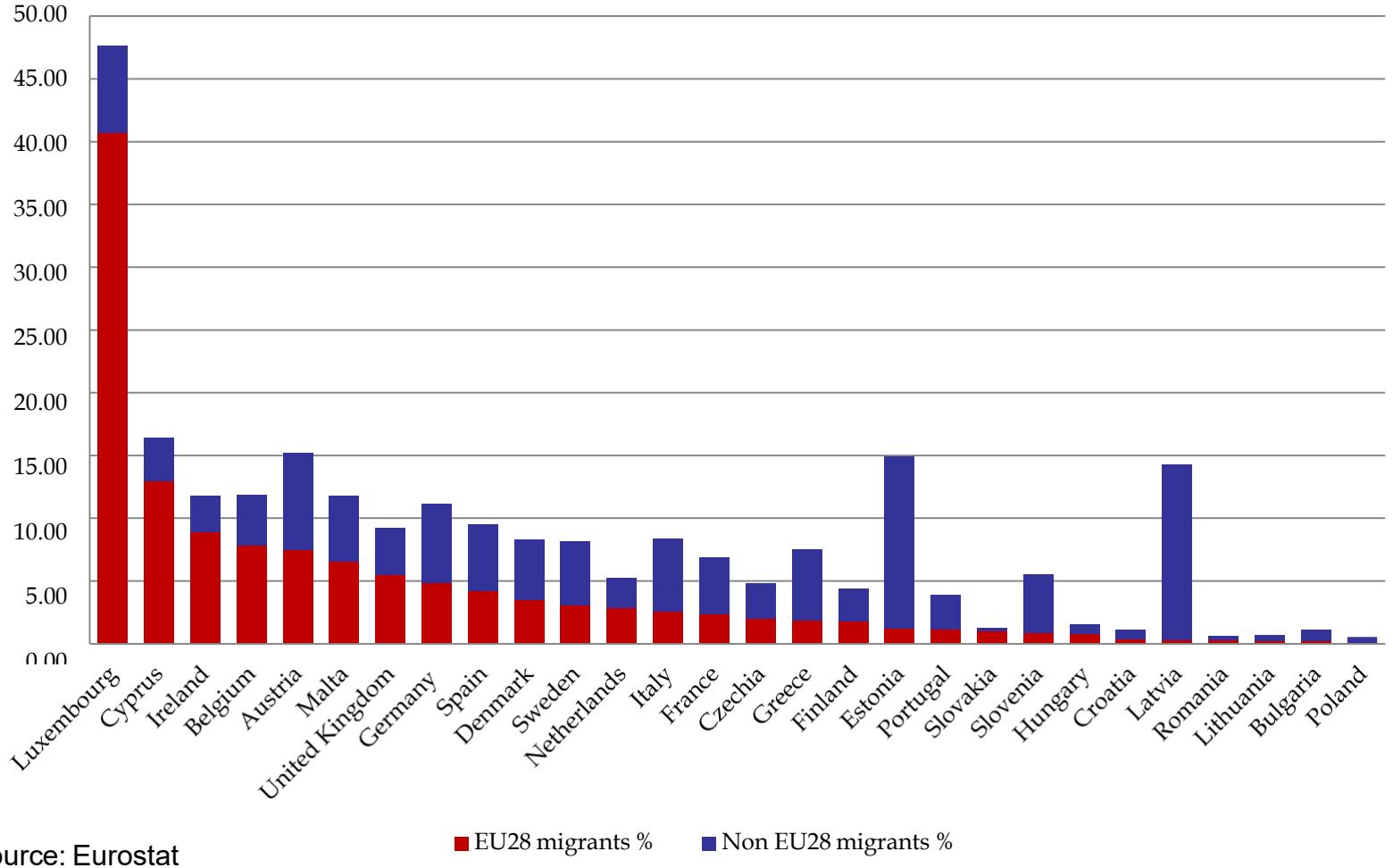


Source: UNCTAD, FDI/MNE database (www.unctad.org/fdistatistics).

LABOUR MIGRATION

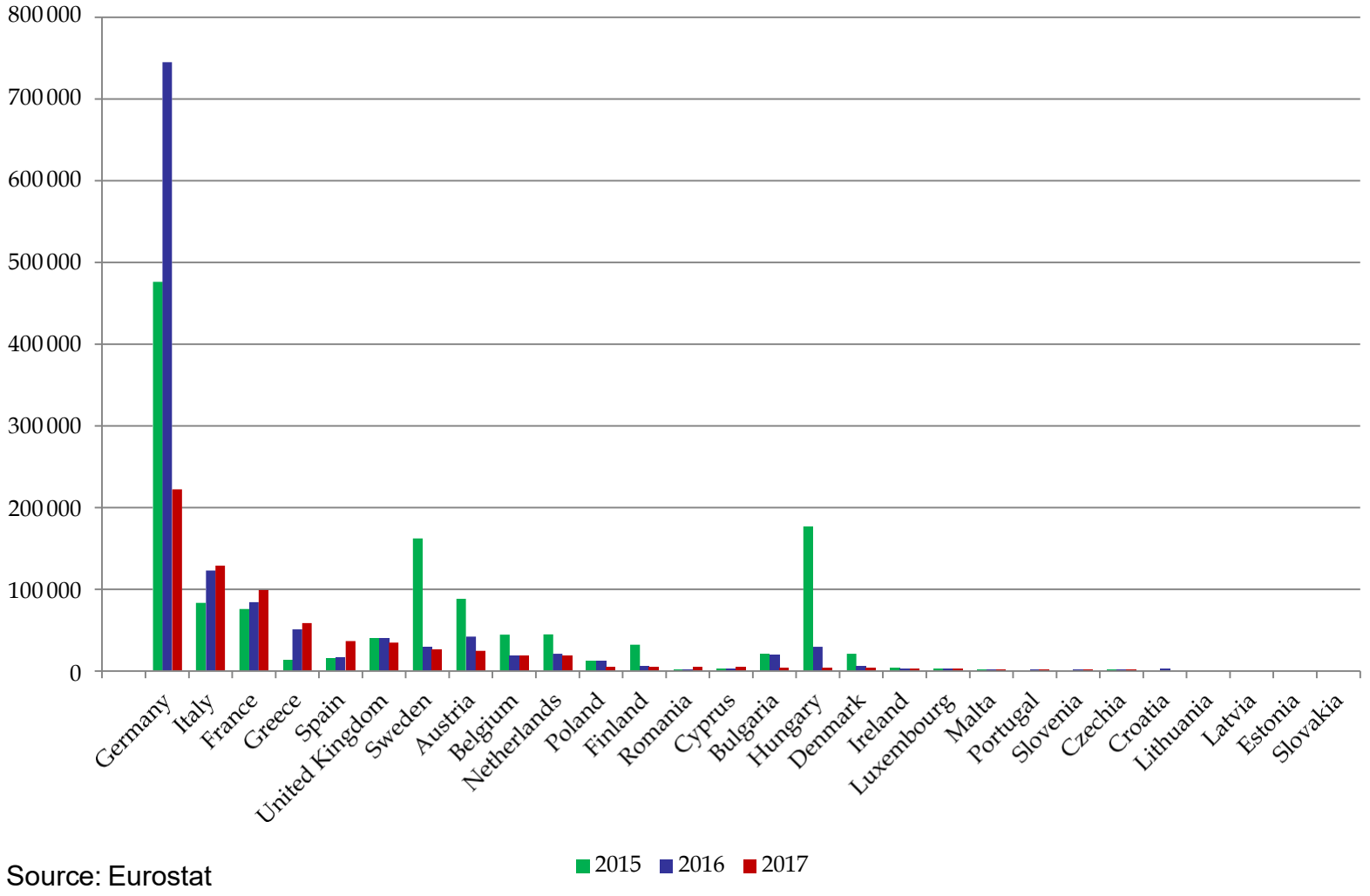
- Why people migrate from one place to another?: economical and political reasones
- Migration within countries and between countries
- Positive and negative effects on countries of origin and host country

SHARE OF NON-NATIONALS IN THE RESIDENT POPULATION, (%), DATA AS OF JANUARY 2017

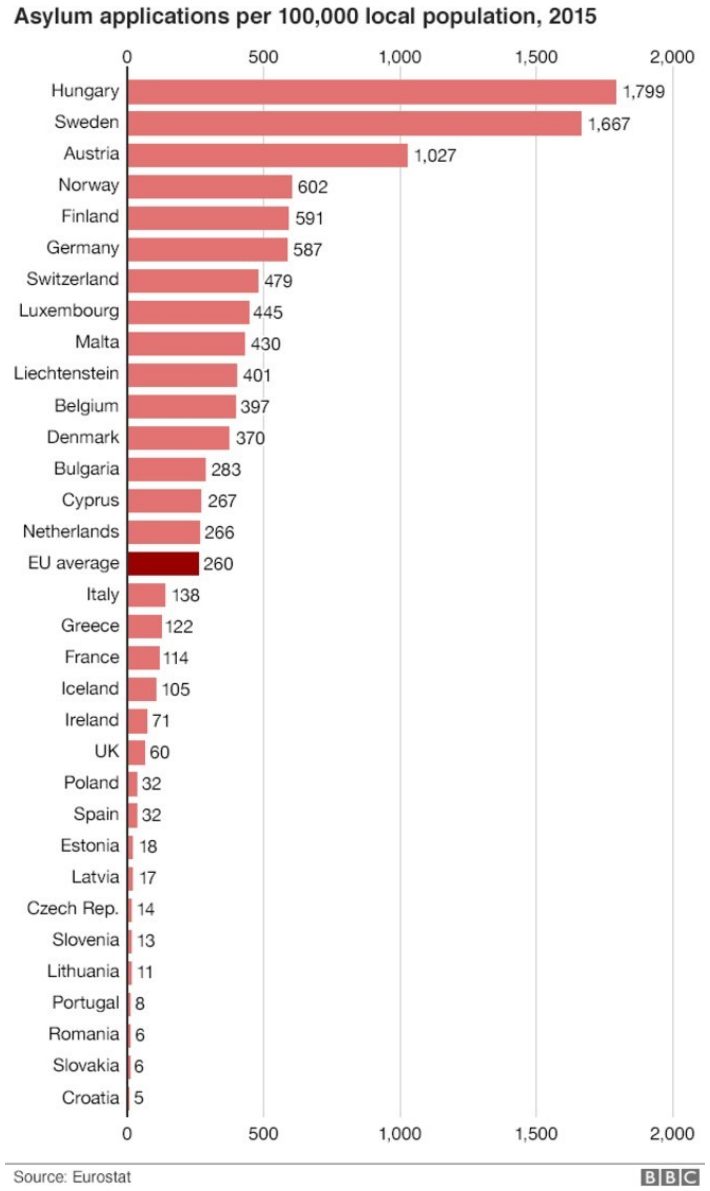


Source: Eurostat

NUMBER OF ASYLUM SEEKERS IN THE EU, 2015 - 2017



Source: Eurostat



Source:http://www.bbc.com/news/world-europe-34131911

NOT ALL EU COUNTRIES ARE AFFECTED IN THE SAME WAY BY THE RECENT MIGRANTION CRISIS

Although Germany has had the most asylum applications in 2015, Hungary had the highest in proportion to its population

Poland: only 32 asylum applications per 100,000 local population!

MIGRATION

- **While migration creates winners and losers in both nations, collectively both nations gain, thanks to increased efficiency.**

- Migration improves the overall efficiency of the whole economy and the gains from this are split between Home and Foreign.

Source: McGraw Hill Companies 2015

EFFECTS OF MIGRATION FOR COUNTRY OF ORIGIN

Positive effects

- drop of unemployment

-Transfer of incomes to the country of origin

-Cultural effect

-Investments

-Negative effects

-brain drain (skilled/unskilled)

-Demographic changes

-Fiscal drain

-Loss of GDP

EFFECTS OF MIGRATION FOR HOST COUNTRY

Positive effects:

-Transfer of knowledge

-Fiscal effect

-Cultural effect

-Demographic changes

-Gains in GDP

Negative effects:

-Using public education sysytem

-Cost of benefits and pension

-Transfer of income abroad

-Local workers worse off

-Social unrest

-Rise in house prices

-Decrease in the level of wage

-Social labelling „immigrants jobs“

KEY TERMS

- ❑ Endogenous growth models
- ❑ Externalities
- ❑ Learning by doing
- ❑ Innovation
- ❑ Transfer of technology
- ❑ Foreign Direct Investments

SOURCES:

- Weil D., Economic Growth, (2012) Economic growth, Pearson International Edition
- Todaro&Smith (2015) *Economic Development*, Pearson Addison-Wesley.
- Baldwin R. & Wyplosz C. (2015) *Economics of European Integration* Chapter 8, McGraw Hill Companies
- World Trade Report , 2018
- UNCTAD
- OECD