Ευρωπαϊκή Οικονομική Πολιτική

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Τμήμα Οικονομικής Επιστήμης (ΟΠΑ)

Ιανουάριος 2020

Outline of the Presentation

- Main Topic: **Integration through Growth**
- Questions
- Definitions
- Data
- Introduction of main mechanisms of growth theory - A Parable

Methodology of Answering

- Define economic variables
- Study the empirical facts about the *living standards* and *economic growth* of different countries
- Build a model: Find ways to explain the evolution of world's income per capita and growth performance
- Replicate the facts using the model and if it works well!!! then ....
- ... policy prescriptions

GDP per capita

- A country's standard of living depends on its ability to produce goods and services (GDP).
- GDP measures a society's well being
- But, most important, **GDP per capita** (GDP/Population) measures how much income the average person enjoys.
  - Example: In economy A, GDP=200 and there are 2 people, then, the income per capita is 100 (200/2). In economy B, GDP=300 and there are 20 people, then, the income per capita is 15 (300/20).
- GDP per capita is an important measure to compare countries. We choose to work in a country that on average our income will be higher. i.e. in the previous example country A is rich while country B is relatively poor.

GDP per capita

Rank	Highest GDP per Capita		Largest Economies		Most Populous Countries	
	Country	GDP per Capita ($)	Country	Total GDP ($ trillions)	Country	Population (millions)
1	Qatar	159,469	United States	12.62	China	1,320
2	Luxembourg	84,525	China	10.08	India	1,160
3	United Arab Emirates	52,946	Japan	3.81	United States	307
4	Bermuda	52,090	India	3.76	Indonesia	240
5	Macao	51,057	Germany	2.66	Brazil	199
6	Norway	49,945	United Kingdom	2.07	Pakistan	181
7	Singapore	47,373	Russia	2.05	Bangladesh	154
8	Kuwait	46,639	France	1.98	Nigeria	149
9	Brunei	46,229	Italy	1.68	Russia	140
10	Australia	41,304	Brazil	1.62	Japan	127
11	United States	41,099	Mexico	1.29	Mexico	111

- GDP per capita can account better for differences in living standards.

GDP growth

- GDP growth rate (annual) measures how much income has changed as a percentage relative to the previous year $\frac{Y_2 - Y_1}{Y_1}$.
- Example 1. If in 2015 GDP is 100 and in 2016 is 105, then, the growth rate of GDP is 105-100/100=0.05 or 5%.
- Example 2. If in 1950 GDP is 100 and in 2016 is 150, then, the trend growth rate of GDP is 150-100/100=0.5 or 50%.

Some Insights

- Economic growth means producing more and more every year.
- European leaders have long emphasized the pro-growth aspects of European integration: it affects growth mainly via its effect on investment in human capital, physical capital, and knowledge capital.
- Growth effects fall naturally into two categories: medium term, like 'induced physical capital formation'; long term, involving a permanent change in the rate of accumulation, and thus, a permanent change in the rate of growth.

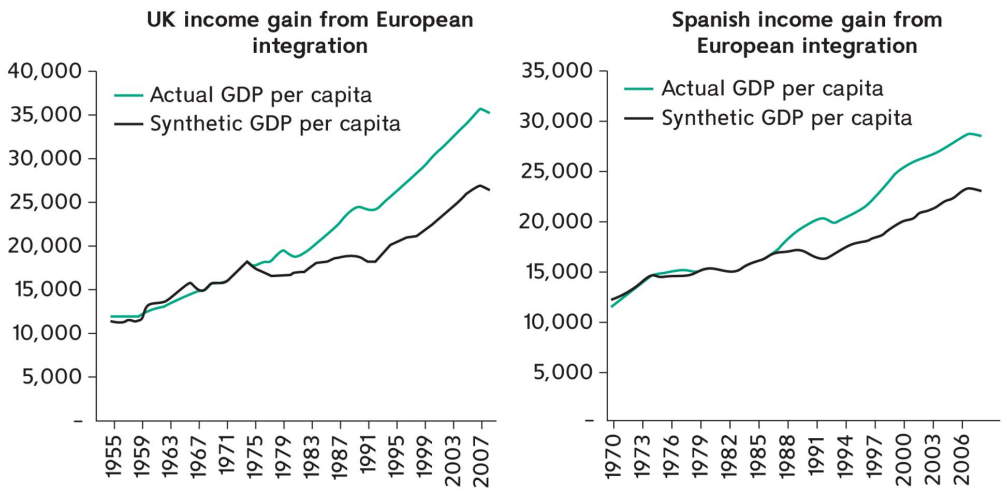
Some Insights

- Schematically: European integration (or any other policy) $\rightarrow$ allocation effect $\rightarrow$ improved efficiency $\rightarrow$ better investment climate $\rightarrow$ more investment in machines, skills and/or technology $\rightarrow$ higher output per person. Also, institutional and cultural changes/incentives.
- Under medium-run growth effects, the rise in output per person eventually stops at a new, higher level.
- Under long-run growth effects, the rate of growth is forever higher under an endogenous growth perspective.

Intergration and Growth

- Are growth and European integration related? $\rightarrow$ Statistical evidence shows sizeable medium-run effect of integration:

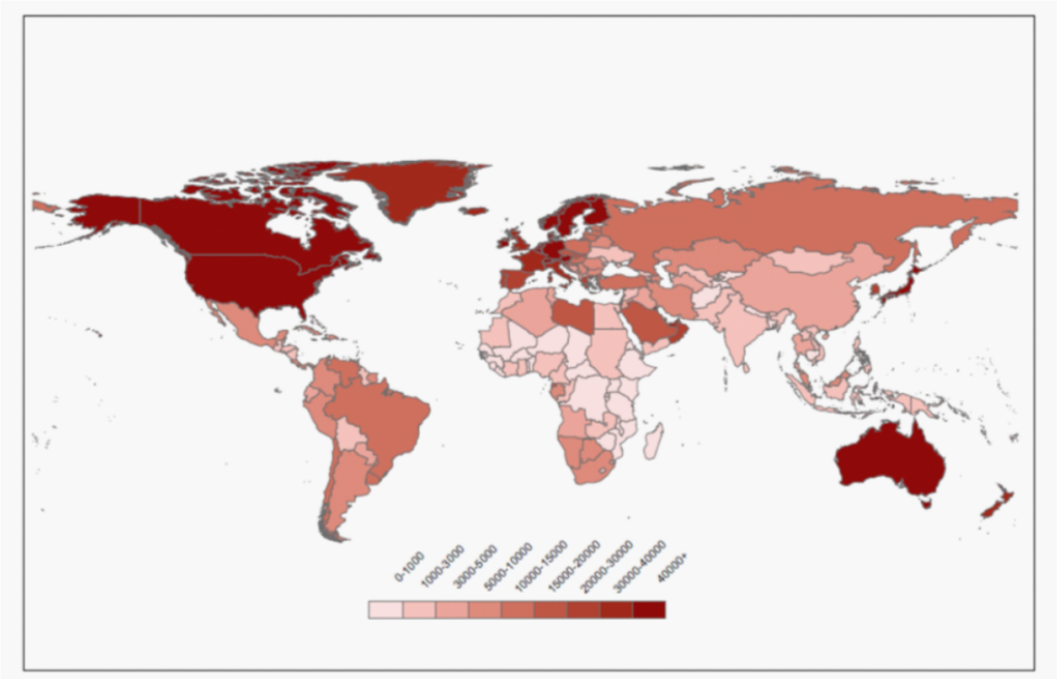
Figure 7.2 Empirical evidence on the medium-run growth effect



Note: Measured in US international dollars in purchasing power terms, see text for explanation of 'synthetic'.

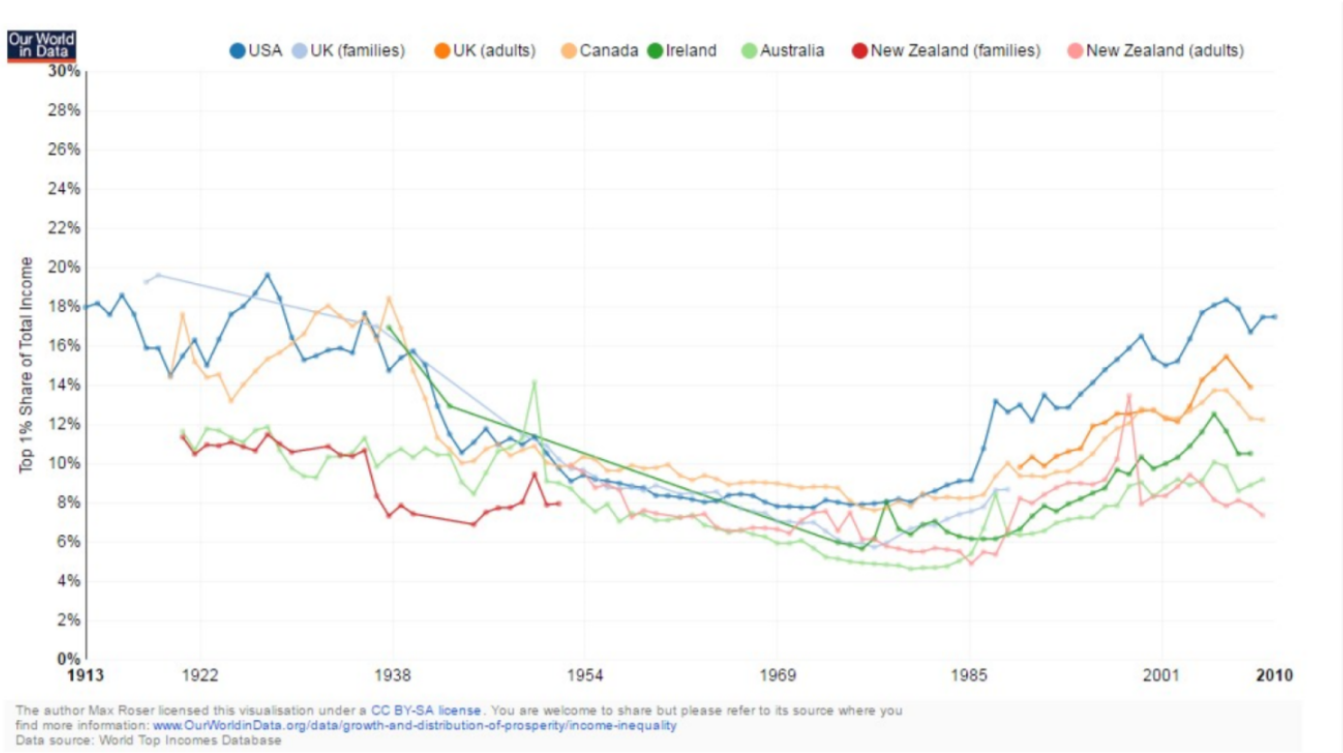
Source: Authors' elaboration of data from 2018 research by Nauro Campos, Fabrizio Coricelli and Luigi Moretti, used with permission.

Το κατά κεφαλήν εισόδημα σήμερα



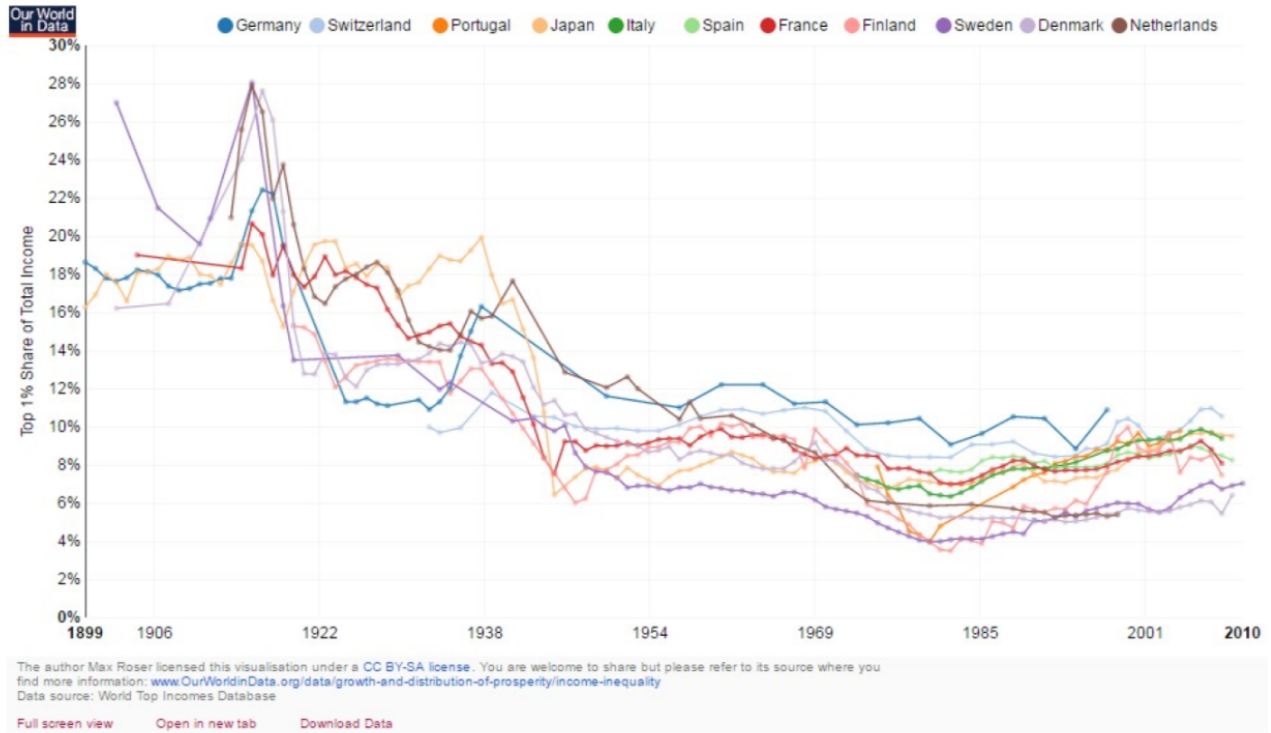
Το κατά κεφαλήν εισόδημα σήμερα απο ψηλά

Η Εξέλιξη της Οικονομική Ανισότητα στο Κόσμο

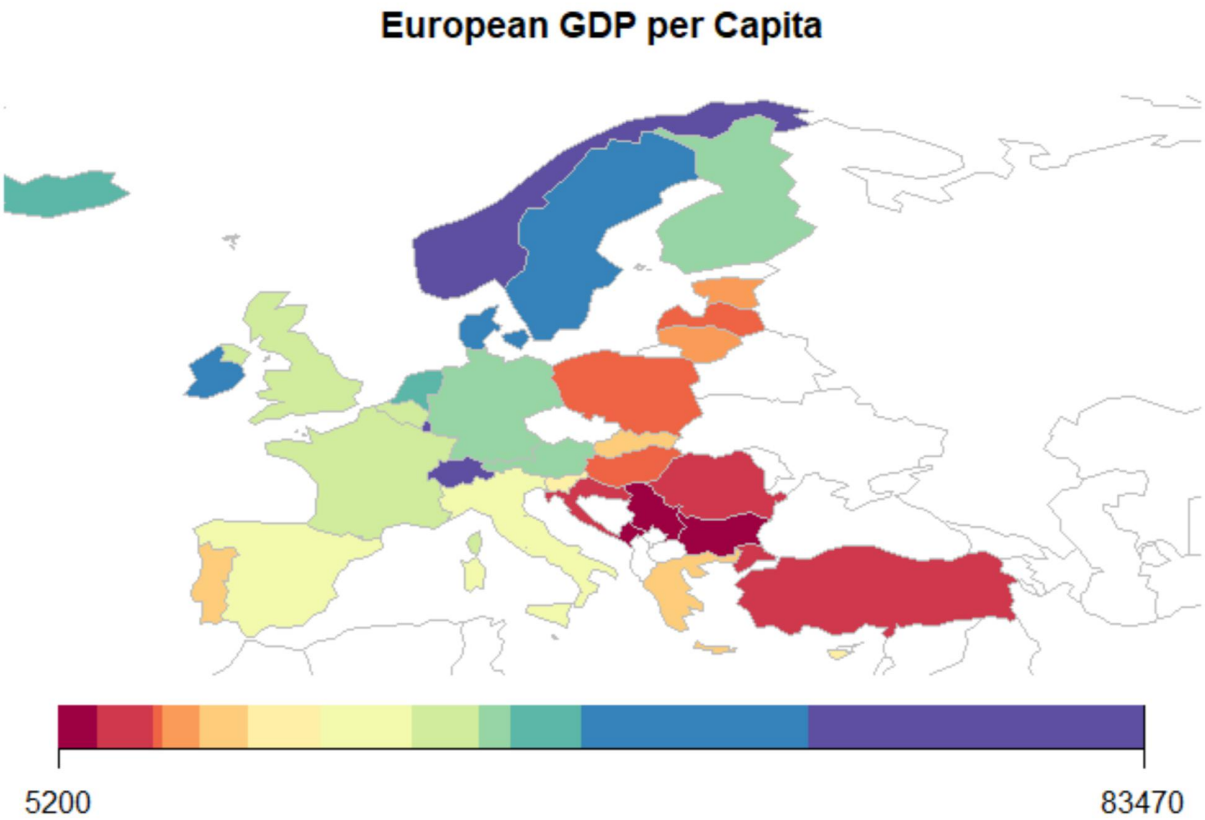


Η Εξέλιξη της Οικονομική Ανισότητα σε Ευρώπη και Ιαπωνία

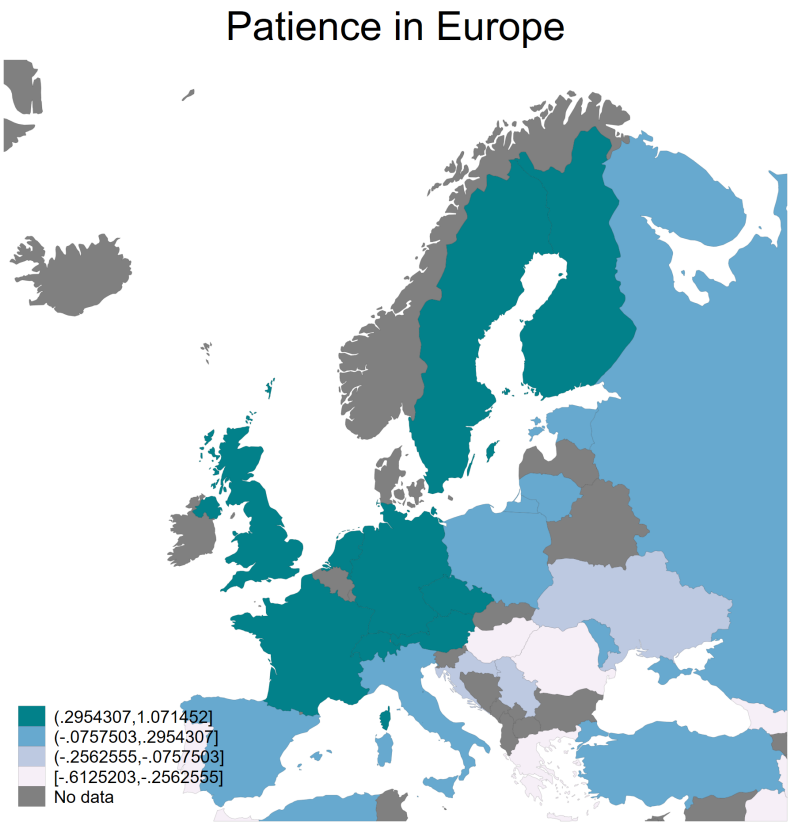
Top 1% share of total income – Europe and Japan (L-shaped), 1900–2012 – Max Roser[6]



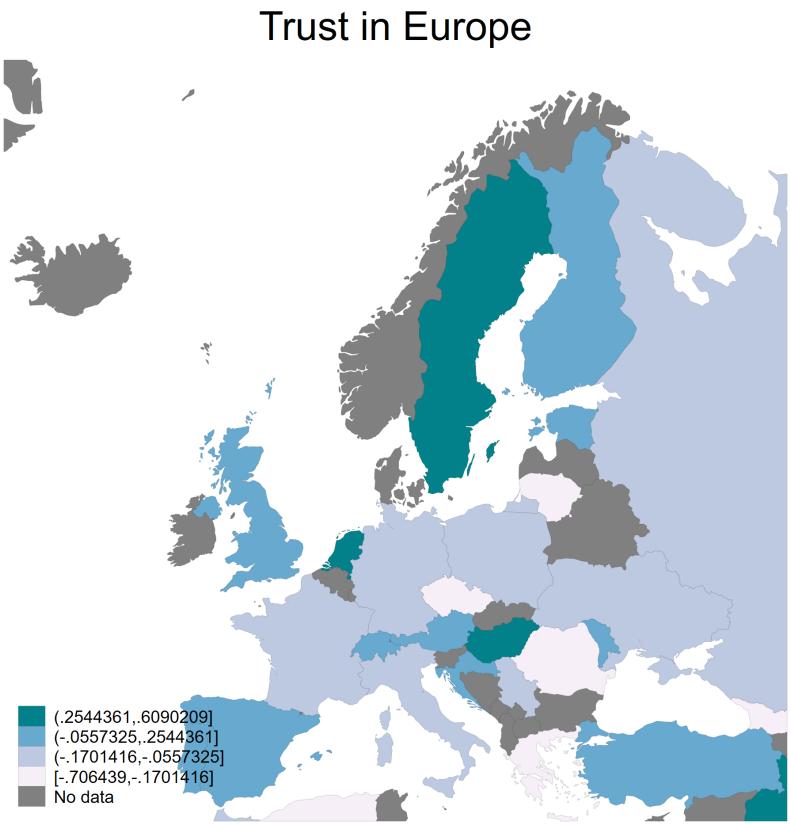
Κατά Κεφαλήν Εισόδημα στην Ευρώπη



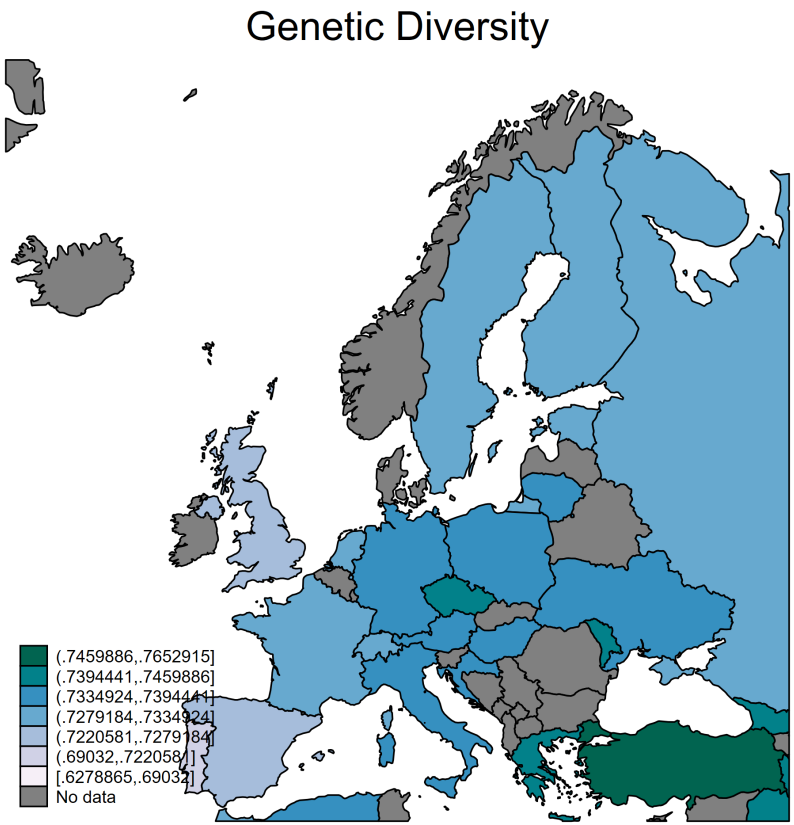
Βαθμός υπομονής στην Ευρώπη



Βαθμός Εμπιστοσύνης στην Ευρώπη



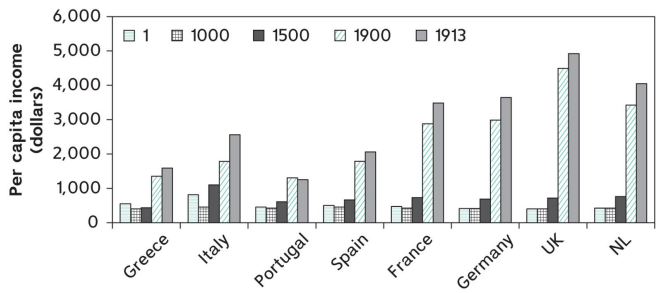
Γενετική Ποικιλομορφία



Η Ιστορική Πορεία του Κατά Κεφαλήν Εισοδήματος

- By historical standards, continuous economic growth is a relatively recent phenomenon. Before the Industrial Revolution, which started in Great Britain in the late 1700s, European incomes had stagnated for a millennium and a half.

Figure 7.1 European incomes, Year 1 to 1913



Note: Measured in 1990 dollars.

Source: Maddison online dataset.

Η Ιστορική Πορεία του Κατά Κεφαλήν Εισοδήματος

- With industrialization, incomes began to rise at a respectable rate of around 2 per cent per year. Growth rates, however, were hardly constant from this date:

Table 7.1 European growth phases, 1890–1992

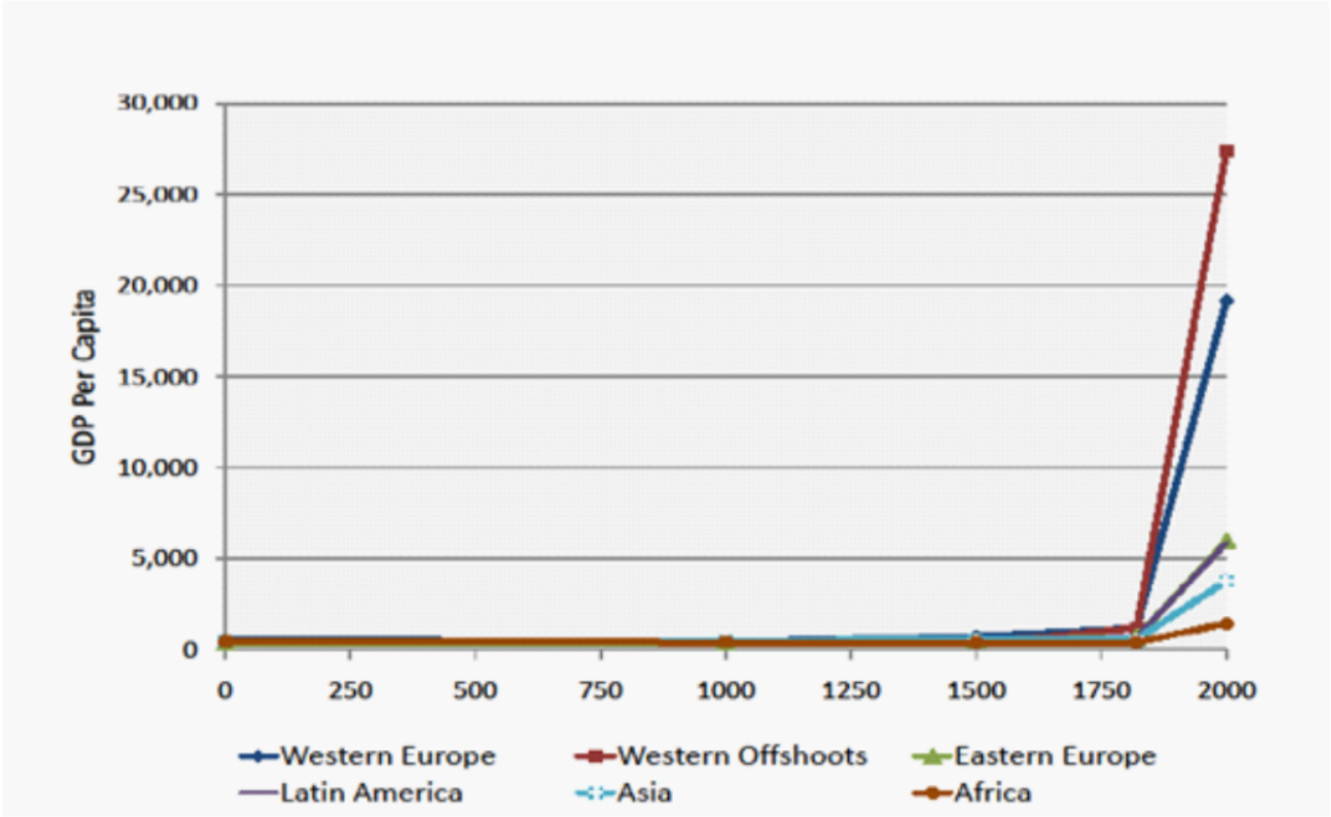
Period	Real GDP	Real GDP per capita	Real GDP per hour
1890–1913	2.6	1.7	1.6
1913–1950	1.4	1.0	1.9
1950–1973	4.6	3.8	4.7
1973–1992	2.0	1.7	2.7
Whole period 1890–1992	2.5	1.9	2.6

Notes: Figures are annual average percentages for 12 nations (Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Sweden, Switzerland and the UK, all adjusted for boundary changes).

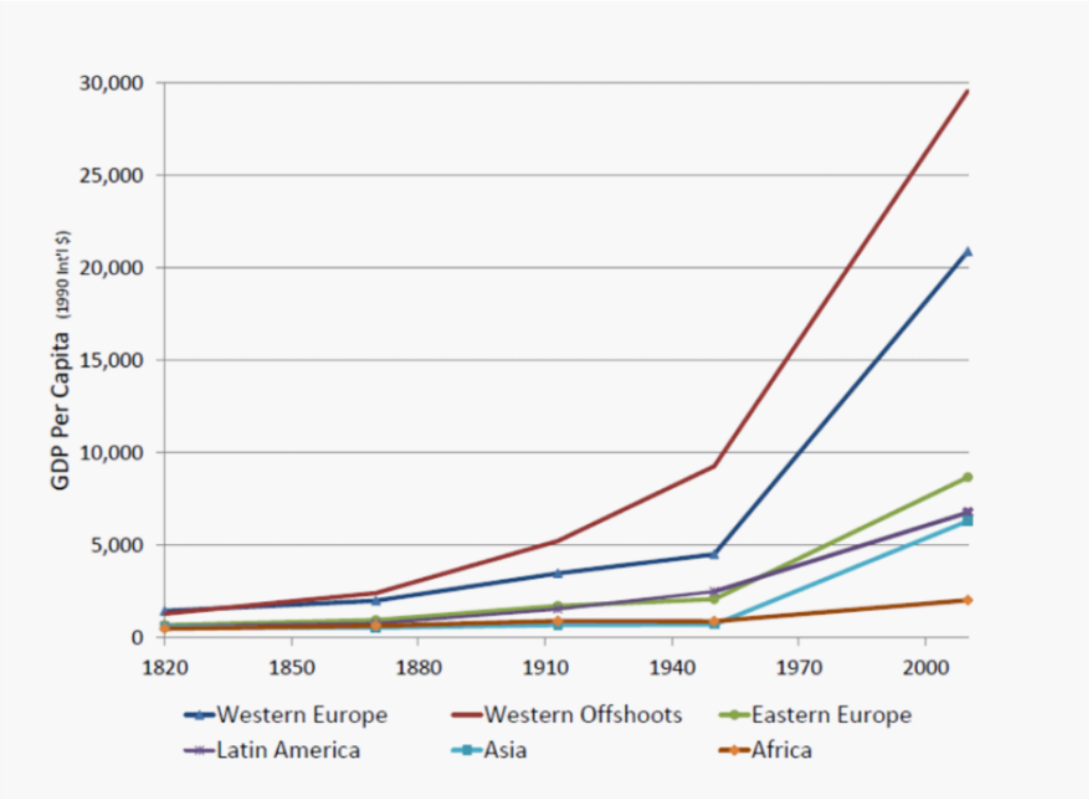
Note that the 1950–73 period is the aberration. Both before and after this period, growth rates were just under 2 per cent per annum (excluding the unusual 1913–50 period). The Golden Age was also the most intensive period of European integration and it was this correlation that first started economists thinking about the growth effects of European integration.

Source: Crafts and Toniolo (1996) © Centre for Economic Policy Research 1996, published by Cambridge University Press, reproduced with permission.

Η Ιστορική Πορεία του Κατά Κεφαλήν Εισοδήματος



Κατά κεφαλήν εισόδημα απο το 1820 εως σήμερα



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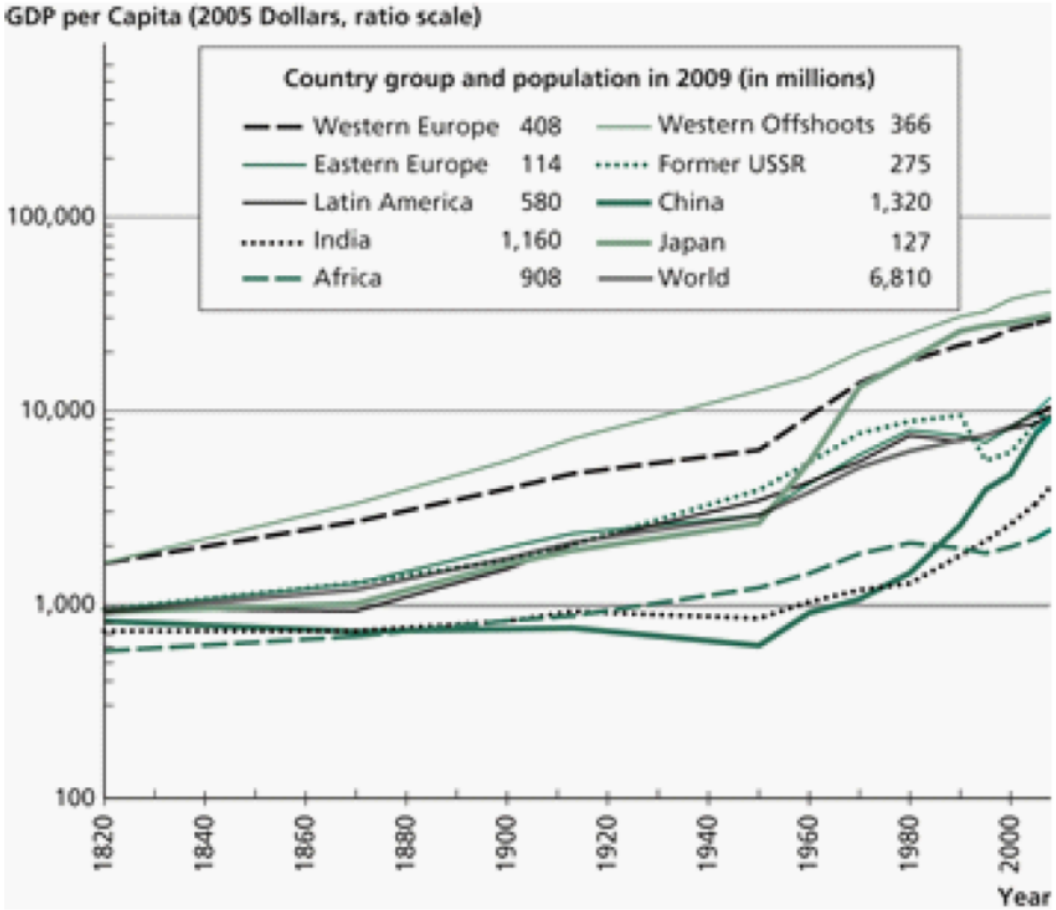
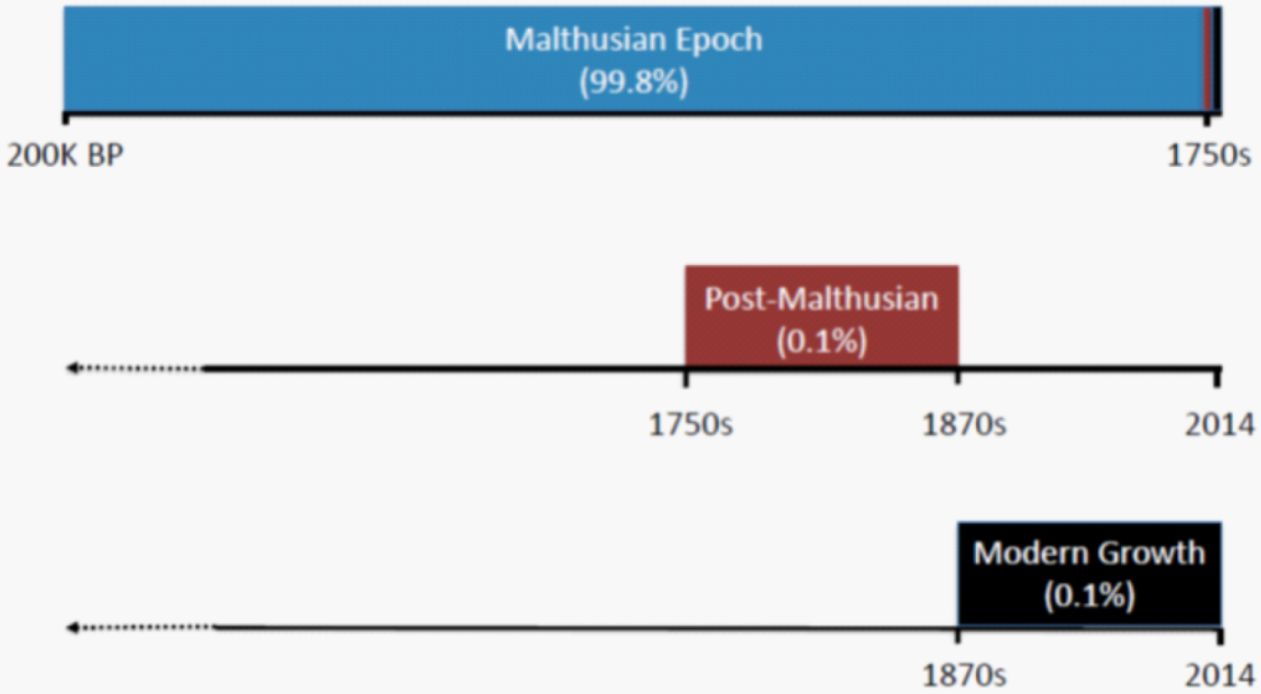


Οι τρείς φάσεις εξέλιξης του ανθρωπίνου εισοδήματος



These differences pose a mystery:

- Why some countries are poor while others are rich? Does have to be this way?
- Are there factors that we can change that lead to these gaps?
- Is enjoyment of the rich dependent on suffering of the poor?
- More population means more production and higher income per person?
- What can explain the divergence in income per capita between similar countries (South vs North Europe?)
- What policies should poor countries pursue to promote growth in order to join the developed world?

Questions about growth

- What differences between countries that have led to these divergent experiences?
- Will the richest continue to grow richer? Will the poor continue to trail behind?
- Poor or Advanced economies grow faster?
- Will limitations on resources prohibit the poor countries to catch up?
- What role will new technologies play in this process?

UGT - Comparative Economic Development

1. What accounts for the differences in GDP/capita in the malthusian equilibrium ?
   - **First divergence** leads to the **great divergence.**
2. What accounts for the take-off from stagnation to growth in some countries and the persistent stagnation in others?
3. What governs the differential timing of the demographic transition across the globe?
4. Reversal of Fortunes.

What this lecture does?

1. This course address these questions of why countries differ in their *standards of living*
2. Why countries *grow, or fail to grow*, richer over time.
3. What are the determinants of income and growth?
4. What can we do?

Sum Up

- **Why countries differ in their levels of income?**
- **What about their growth prospects?**
  - We will introduce simple model cannot explain all of the phenomena we observe, but it is instructive to see how far the model can take us.

Observations from the data

1. **Poor** countries have **lower income per capita** than **rich**.
2. Many **Poor** countries seems to **grow faster than advanced** (convergence – catch up - reversal?)
3. Some **poor countries stagnate** and grow less than the advanced (e.g. Africa)
4. There are **differences in income per capita** among **neighbour** or **advanced** countries (e.g. south vs north Europe, US vs Europe)

Aim

- Goal: understand why some countries are rich and others poor ?
- Why countries become richer or poorer over time?
- What is the set of answers?

Factors of Production, Factor Accumulation and Preferences

- Source of differences in income between countries?
- Different quantities of labour and capital.
- Differences in other "factors of production".
- What determines the quantities of these factors that countries accumulate?
- Example: what determines the quantity of capital in a country: saving, foreign investment,
- Number of workers and how fast they grow.
- Other forms of capital: skills and knowledge of people

Consider A Parable

- Two Neighbour Countries, Sylvania and Fredonia
- Sylvania has GDP per capita=16000, Fredonia has GDP per capita=2000
- You are the president of a prestigious economic consulting firm in Sylvania
- The King of Sylvania employs you to explain why this happens?

Work on that (Production and Factors)

- Step 1. You set up a team that calculates the gap=14000, 8 times lower than Freedonia.
- Step 2. You measure the level population/labour in both countries. But, you find that are the same.
- Step 3. Then, you think about other **factors of production**. You find that both countries produce the goods and services with labour and capital (equipments, machines, tools)
- Step 4. You measure them. You find that Sylvania has less capital. Great, But **why?**

Working on that (Preference and Accumulation of Factors)

- Step 5. You dig more. **Why** more capital in Fredonia?
- Step 6. You measure that in Sylvania people consume more than what they save from what they produce.
- Step 7. Thus, in Freedonia the **save more** every year and they generate **more capital** (tools) that help them with the same labour to produce more
- *You think you found the smoking gun!!!*

Working on that (Productivity)

- Step 8. To test your theory you ask your staff to see that if you add the same amount of machines how much Sylvania income will be?
  - Unfortunately, Sylvania income will go from 2000 to 8000. Still another 8000 left to explain :(
- Step 9. You understand that something happens and the guys in Freedonia with the same numbers they produce more. This mean they more productive!!! You scratch your head!! **Productivity**!!! Yeah!!! This is it!!
- Step 10. Nice, lets see **why** they are more productive!!?

Working on that (Productivity=Technology and Efficiency)

- Step 11. Your staff is working hard and they find that
  - a) People in Freedonia combine better the existing tools and labour, in other word they have better ideas how to use them, or in other words they have better **Technology**!!
  - b) People in Fredonia have better way to combine Technology, Capital and Labour together (sometimes the ideas exist but we cannot materialize them). This means that have better **Efficiency**
- Step 12. You test if everything works. You combine everything and you find that a) higher savings (investment) b) more capital, c) better technology and efficiency explains the whole difference in income!!! You are extremely happy
- Step 13. You write the report to the King!!!

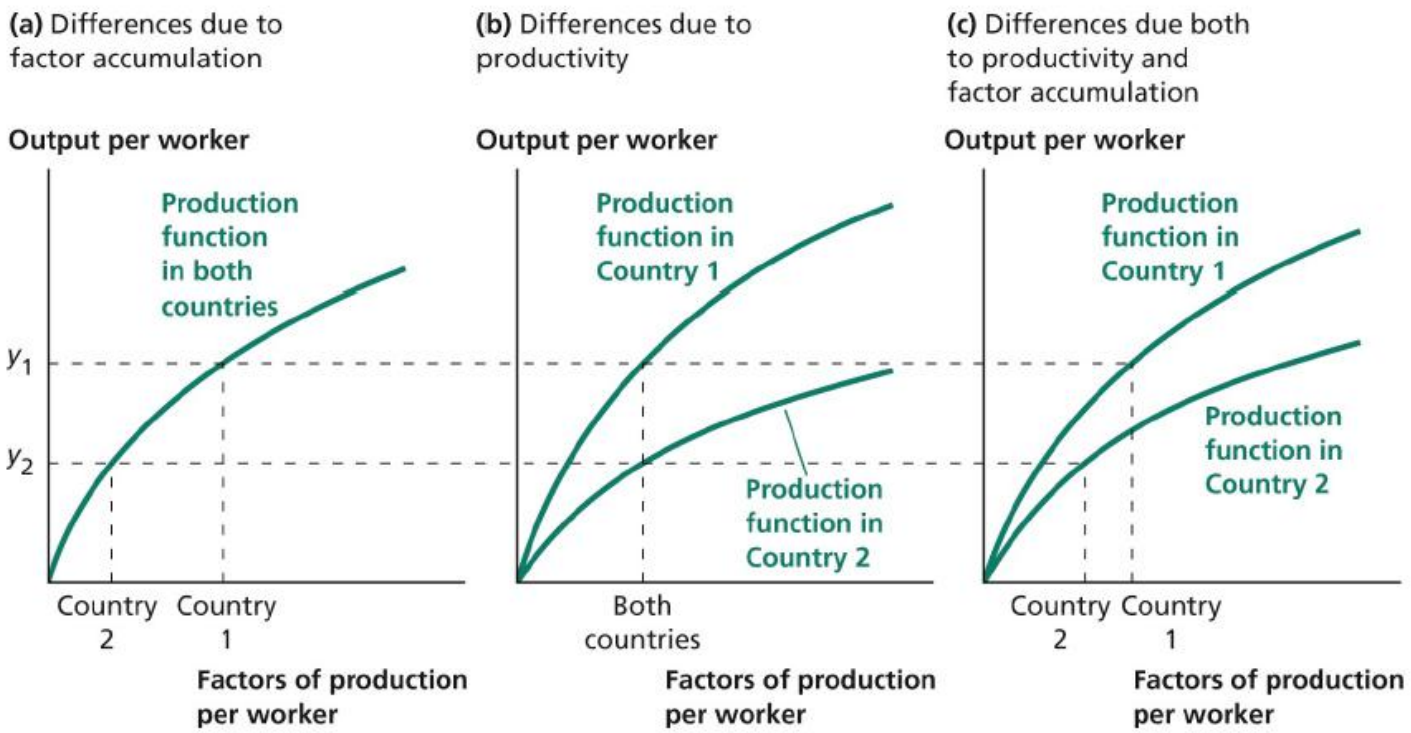
Almost Ready (Fundamentals)

- Step 14. The King reads the reports and ask you, What is the fundamental factors that can explain all?
- Step 15. You work more, you search in cultures, geography but those closed neighbour countries are the same
- Step 16. Yeah!!!Institutions!!!!You think more and you understand that in Sylvania there exists monarchy and in Freedonia, Democrasy!!!
  - In Sylvania guys want to save more but they know that if they save the King may expropriate their wealth
  - In Fredonia, clever investors think ideas about how to produce more output but in Sylvania more weapons. Thus, technology is less
  - In Sylvania to obtain Wealth and Status if you make happy the King's will. But in Freedonia you are appreciated if you are doing your job well. So, you are more efficient.

The End!!!

- Step 17. You complete your report. Your write to the King that the root is Monarchy.
- Racing toward the borders, pursued by the palace guard, you understand that your effort would be better rewarded in Freedonia.

Parable in Figures



Production, Factors, Accumulation

- Production. $Y = AK^a L^{1-a}$, where $a \in (0,1)$
- Factors of Production, K, L
- Factor Accumulation, $K_{t+1} = I(S) + K_t - \delta K_t$
- How Factors Accumulate: Preferences, Markets and others mechanisms we will deeply explain.

Productivity

- Productivity, A: a measure of how much output can be produced with a given quantity of factors of production.
- Productivity: technology (inventions) and efficiency.

Technology

- Why technology differs between countries?
- How new technologies are created and disseminated?
- How technological progress has contributed to growth historically?
- Extent differences in technology explain differences in income?

Technology

- Why technology differs between countries?
- How new technologies are created and disseminated?
- How technological progress has contributed to growth historically?
- Extent differences in technology explain differences in income?

Fundamentals

- Searching for "fundamental"determinants of income and development:form of government, geography and climate, institutions.
- The degree to which something is "fundamental"will vary from factor to factor, and will often be open to debate.
- The problem of the "endogeneity"of fundamental factors

What about growth?

- Turning the model of the determinants of income levels into a model of the determinants of income growth:
  - If two countries are the same in their fundamentals (or more generally, if we would expect them to have equal levels of income based on their fundamentals),
  - Then the country with a lower level of income will be expected to grow faster.
  - This could either be because the poorer country has income below the level that we would expect, given its fundamentals
  - Or because the richer country has income above the level that we expect from its fundamentals.

A Numerical Example

- $Y = K^{0.3}L^{0.7}$, where $s = 0.3$ in Freedonia and $s = 0.2$ in Sylvania. For both $\delta = 0.02$
- $K_1 = K_0 + I_0 - \delta K_0$ and $I = sY$
- Step 1. Each economy starts with $K_0 = 40$ and population every year is $L = 20$.
- Step 2. Plug K_0 into Y and obtain $Y_0 = 40^{0.3}20^{0.7} = 24.76$
- Step 3. Calculate savings and investment in Freedonia: $S = sY_0 = 0.3 * 24.76 = 7.42$
- Step 4. Using the formula above calculate $K_1 = 46.58$.Then, repeate this process 5 times (in Step 3 for Sylvania use $s = 0.2$).

Numerical Example

The growth process: The effect of **savings** on growth in the **short run**

Numerical Example: $Y = K^{0.3}L^{0.7}$, d=0.02

$K_0 = 40$ with high savings s=0.3

Time	Capital	Labour	Production	Income per capita	Growth rate
2000	**40**	20	24.6228883	1.231144413	-
2001	46.58686648	20	25.7750815	**1.288754074**	**0.046793585**
2002	53.3876536	20	26.8505538	1.342527689	**0.041725272**
2003	60.37506666	20	27.8598186	1.392990929	**0.03758823**
2004	67.5255109	20	28.8112009	1.440560044	**0.034148905**
2005	74.81836094	20	29.7114231	1.485571155	**0.031245564**

$K_0 = 40$ with high savings s=0.2

Time	Capital	Labour	Production	Income per capita	Growth rate
2000	40	20	24.6228883	1.231144413	-
2001	44.12457765	20	25.3585937	**1.267929685**	**0.029878925**
2002	48.31380484	20	26.0580774	1.302903868	**0.027583693**
2003	52.55914422	20	26.7248627	1.336243135	**0.025588431**
2004	56.85293387	20	27.3619384	1.368096922	**0.023838317**
2005	61.18826288	20	27.9718657	1.398593284	**0.022291083**

Higher savings, higher income per person and higher growth in the short-run (2000-2005)!!!

Summary 1

- Economic prosperity, as measured by real GDP per person, varies substantially around the world.
- The average income of the world's richest countries is more than ten times that in the world's poorest countries.
- The standard of living in an economy depends on the economy's ability to produce goods and services.

Summary 2

- Income per capita positively depends on how productive we are.
- Productivity depends on the amounts of physical capital, human capital, natural resources, and technological knowledge available to workers.
- Government policies and Institutions can influence the economy's growth rate in many different ways.

Summary 3

- Higher savings lead to higher income per person in the short-run and in the long-run.

Factors of Production

- **Factors of production** are the those inputs used in the production function to produce goods, e.g.
  - Physical capital (K)
  - Labour (L)
  - Technological knowledge (A)
  - Natural Resources/Land (X)
  - Human Capital (H)

Agricultural Land as a Fraction of Total Wealth in the United Kingdom

1688	64%
1798	55%
1885	18%
1927	4%
1958	3%

Five key characteristics of capital

1. **Capital is productive**: raises the amount of output that a worker can produce.
2. **Capital is something that has itself been produced**; it has been build or created. The process of producing capital is called investment. Needs sacrifice of consumption, thus, saving!!! Different from Land.
3. **Capital is rival in its use.** e.g. hammer. Opposite to ideas that are non-rival.

Five key characteristics of capital

4. **It can earn a return** and this is the incentive of its creation. Because capital is productive and its use is limited, it is often able to earn a return. If using a certain piece of capital will make a worker more productive, then the worker will be willing to pay to use it.
5. **Capital wears out**. The economic term for this wearing-out process is depreciation.
6. A large fraction of the investment that takes place in the economy serves only to replace capital that has depreciated.

The Production Function - Assumption 1

$$Y_t = AK_t^a L_t^{1-a}, where\ a \in (0,1) \quad (1)$$

where $L_t > 0$ is labour/workers/hours and $K_t > 0$ is capital, and $a > 0$.

- Assumption 1
  - a) L labour increases production, $MP_L \equiv \frac{\partial Y_t}{\partial L_t} = A(1-a)K_t^a L_t^{-a} = A(1-a)(\frac{K_t}{L_t})^a > 0$.
  - b) L labour increases production with decreasing rate, $\frac{\partial MP_L}{\partial L_t} < 0$.

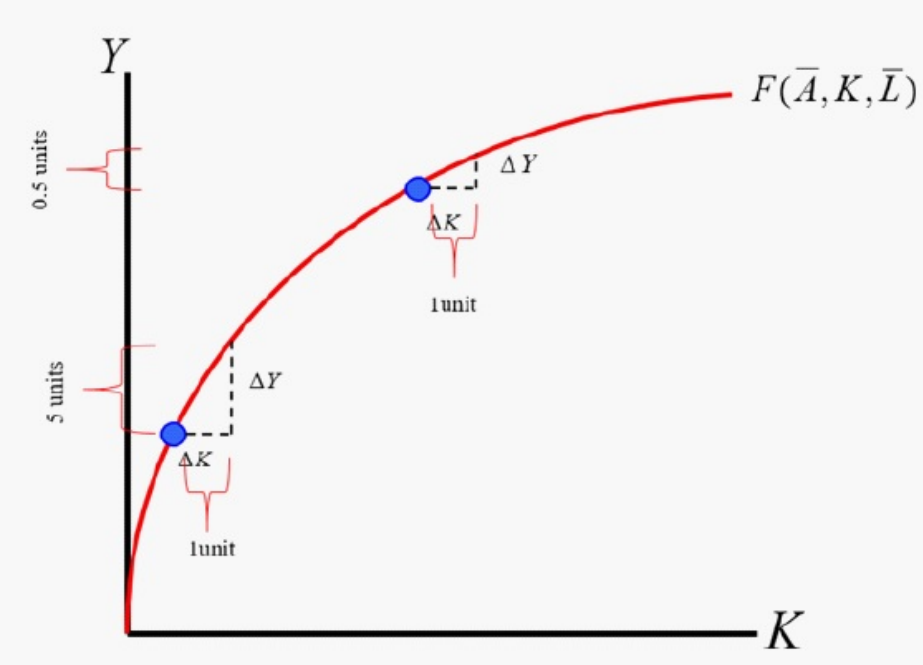
The Production Function - Assumption 2

$$Y_t = AK_t^a L_t^{1-a}, where\ a \in (0,1)$$

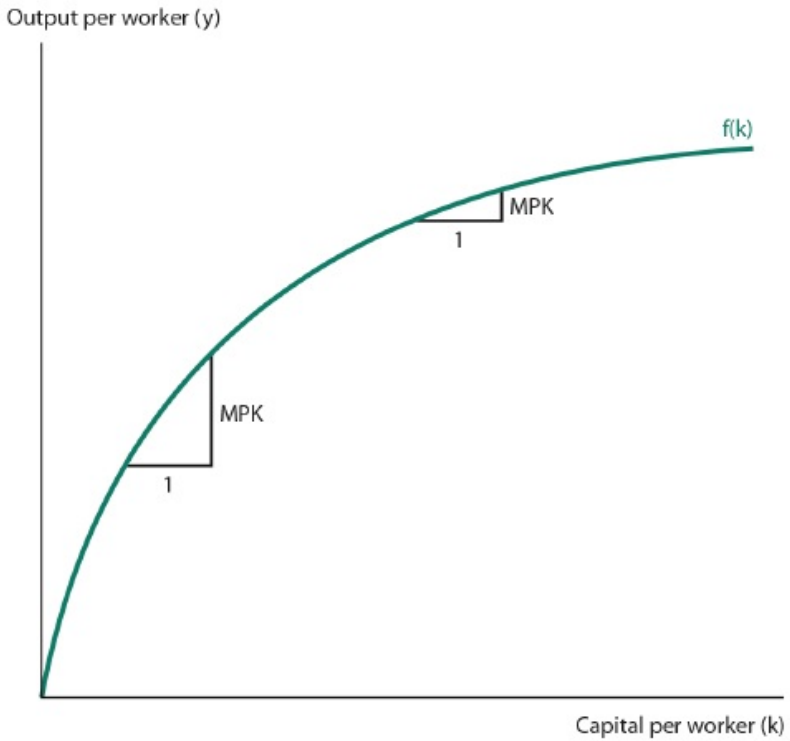
where $L_t > 0$ is labour/workers/hours and $K_t > 0$ is capital.

- Assumption 2.
  - a) K labour increases production, $MP_K \equiv \frac{\partial Y_t}{\partial K_t} = AaK_t^{a-1}L_t^{1-a} = Aa(\frac{K_t}{L_t})^{a-1} > 0$.
  - b) K capital increases production with decreasing rate, $\frac{\partial MP_K}{\partial K_t} < 0$. **(Diminishing Marginal Product of Capital)**

The Production Function - The MPk and K



The Production Function - The MPk and K/L



The Production Function - Assumption

- Assumption 3. **Constant returns to scale.**
  - a) Increasing both factors each by z increase output by z. $A(zK_t)^a(zL_t)^{1-a} = Az^aK_t^az^{1-a}L_t^{1-a} = AK_t^aL_t^{1-a}z^az^{1-a} = AK_t^aL_t^{1-a}z^{a+1-a} = AK_t^aL_t^{1-a}z = Y_tz$
  - b) Implication 1: Income per capita is a function of capital per worker: Can be written as $\frac{Y_t}{L_t} = \frac{AK_t^aL_t^{1-a}}{L_t} = \frac{AK_t^a}{L_tL_t^{-1+a}} = \frac{AK_t^a}{L_t^{1-1+a}} = \frac{AK_t^a}{L_t^a} = A\left(\frac{K_t}{L_t}\right)^a$

$$y_t = A(k_t)^a$$

    where $y_t \equiv A\left(\frac{K_t}{L_t}\right)^a$ is income per capita and $k_t \equiv \frac{K_t}{L_t}$ capital per worker
  - c) Implication 2: $MP_LL + MP_KK = Y$. Implies zero profits as MP_L shall equal wage rate and MP_K the return on capital.

Factor Payments and Shares

- Firms maximize profits: $P = Y - wL - rK$
- Wage per hour for worker should be in a competitive economy equal to the marginal product: $w = MP_L$
- The rental cost of capital in a competitive economy will equal the marginal product of capital, $r = MP_K$.
- The share of capital holders in the production (return * amount of capital / output):
$r * K = MP_K K = Aa(\frac{K_t}{L_t})^{a-1} K = aAK_t^a L_t^{1-a} = aY$

$$\frac{MP_K K}{Y} = a$$

thus a is the share of total output that goes to capital holders.

Constant Labour and Technology

- Lets assume for the moment the Labour is constant over time.
- Also, assume that there is no technological progress over time.
- All the action in the economy comes from capital accumulation

Consumption, Saving and Investment

- Production (Y) is either consumed (C) or saved (S). (We are going to analyze the determinants of this decision later on).

$$Y = C + I$$

- Saving rate, γ, is the fraction of income that is saved. So $\frac{S}{Y} = \gamma$ or

$$S = \gamma Y$$

- What it is saved, γY, becomes investment, $\gamma Y = I$.

$$I = S = \gamma Y$$

- Investment is used to buy/build new capital stock
- As we told before Capital wears out.

Capital Accumulation

- Capital Evolves over time as follows:

$$K_{t+1} = I + K_t - \delta K_t$$

- The capital stock next period, K_{t+1}, is equal to
  - 1) The new that have been purchased through investment, I
  - 2) plus what remained from the previous year i.e what we had from the previous year K_t minus the part that died, δK_t

Capital Accumulation

- Using $I = \gamma Y$ we get

$$K_{t+1} = \gamma Y + K_t - \delta K_t \tag{2}$$

and under constant labour over time ($L_{t+1} = L_t$) the capital stock per worker is given by

$$k_{t+1} = \gamma A k_t^a + k_t - \delta k_t \tag{3}$$

- The change of the capital stock over time, $\Delta k = k_{t+1} - k_t$ using (3) is given by:

$$\Delta k = \gamma A k_t^a - \delta k_t \tag{4}$$

Analysis of the growth of capital stock

$$k_{t+1} = \gamma A k_t^a + k_t - \delta k_t \Rightarrow \Delta k = \gamma A k_t^a - \delta k_t$$

- Consider the following example: Suppose that in the year 2010, the quantity of capital per worker in a certain country was equal to $k_0 = 100$, $A = 1$, the quantity of output per worker $y_t = 50$. The fraction of output saved/invested was 20%, and the depreciation rate was 5%.

Step 1. As $y_t = 50$ then investment is I=$50 * 20\% = 10$
Step 2. The number of machines that will not survice are $\delta k_0 = 100 * 5\% = 5$.

Analysis of the growth of capital stock

$$k_{t+1} = \gamma A k_t^a + k_t - \delta k_t \Rightarrow \Delta k = \gamma A k_t^a - \delta k_t$$

Step 3. In the next period we will have $k_1 = 100 + 10 - 5 = 105$.
Step 4. The change in the capital stock will then be
$k_1 - k_0 = 105 - 100 = 5$.
Result: If **investment** (10) is **higher than depreciation** (5) then **capital stock will increase**, otherwise will decrease.

Analysis of the growth of capital stock

$$\Delta k = \gamma A k_t^a - \delta k_t$$

- $\Delta k > 0$ if $\gamma A k_t^a > \delta k_t$ and $\Delta k < 0$ if $\gamma A k_t^a < \delta k_t$.
- $\Delta k = 0$ if $\gamma A k_t^a = \delta k_t \Rightarrow A\gamma \frac{k_t^a}{k_t} = \delta \Rightarrow k_t^{a-1} = \frac{\delta}{A\gamma} \Rightarrow$

$$k_t^* = \left(\frac{\delta}{A\gamma}\right)^{\frac{1}{a-1}}$$

where k_t^* is what we call the **steady-state** of the capital per worker.

- In other words, Δk depends on the level of k. If, $k < k^*$ then $\Delta k > 0$ and when $k > k^*$ then $\Delta k < 0$.

Why a steady-state exists?

- Assume that the economy starts at a k lower than the steady-state, thus $\Delta k > 0$
- As capital increases, output increases ($\gamma A k_t^a$) but at a diminishing rate due to diminishing returns. So investment increases by a diminishing rate.
- While, the capital depreciates with the same constant rate δk_t.
- Inevitably, at some point the rate of increase in output and, in turn, investment will be the same with the depreciation.
- Thus, from one hand capital will increase by the rate of investment but will decrease by the rate of depreciation. In other words, if the rates are the same, the capital will remain the same for every period. Thus, $\Delta k = 0$.

The Steady State of the Solow Model

1. Convergence to the steady-state (Stable)
2. Poor countries exhibit higher growth in output per capita

Determinants of the Long-run Position of the Economy

- Following the previous analysis, the steady-state denotes the long-run position of the economy. Once there, we stay there.

$$k_t^* = \left(\frac{\delta}{A\gamma}\right)^{\frac{1}{a-1}}$$

- What determines the long-run position
  - γ. The higher the savings/investment rate the higher the steady-state capital per worker, k_t^* and, in turn, the higher the output per worker $y^* = A(k^*)^a$.
  - A. Better technology, higher k_t^* and $y^* = A(k^*)^a$
  - δ. The higher the rate of depreciation, the lower k_t^* and $y^* = A(k^*)^a$.
- **Those are some testable predictions of the Solow-Model.**

The Process of Growth

$$\begin{aligned} K_0 &\rightarrow Y_0 \rightarrow \gamma Y_0 \rightarrow I \rightarrow \\ K_0 + I - \delta K_o &\rightarrow K_1 \rightarrow Y_1 \ldots \end{aligned}$$

Numerical Example 1. Differences in Ko

- Assume two countries that have the same rate of investment but different levels of income. *Country 1*, $K_0 = 40$ and Country 2, $K_0 = 20$.
- $Y = K^{0.3}L^{0.7}$, where $L = 20$, $\gamma = 0.3$ and $\delta = 0.02$.
- $K_1 = K_0 + I_0 - \delta K_0$ and $I = \gamma Y$
- Question 1. Which country has higher income per capita today?
- Question 2. Which economy will be richer in the long-run.
- Question 3. Will capital per worker and income per worker be increasing or decreasing?
- Question 4. Which county is going to growth faster until the long-run position?
- Question 5. What will the growth rate of output be in the long-run.

Numerical Example 1. Differences in Ko

- **For Country 1**:
- Step 1. The economy starts with $K_0 = 40$.
- Step 2. Plug K_0 into Y and obtain $Y_0 = 40^{0.3}20^{0.7} = 24.76$
- Step 3. Calculate savings/investment in Country 1: $S = I = \gamma Y_0 = 0.3 * 24.76 = 7.42$
- Step 4. Using the formula before calculate $K_1 = 46.58$.Then, repeate this process 5 times
- **For Country 2:** We just do the same process but for $K_0 = 20$.

Numerical Example 1. Differences in Ko

Time	K	L	Y	k=K/Y	y=Y/L	Growth rate
2000	40	20	24.6228883	2	1.23114441	-
2001	46.5868665	20	25.7750815	2.32934332	1.28875407	0.04679359
2002	53.3876536	20	26.8505538	2.66938268	1.34252769	0.04172527
2003	60.3750667	20	27.8598186	3.01875333	1.39299093	0.03758823
2004	67.5255109	20	28.8112009	3.37627554	1.44056004	0.03414891
2005	74.8183609	20	29.7114231	3.74091805	1.48557116	0.03124556

Time	K	L	Y	k=K/Y	y=Y/L	Growth rate
2000	20	20	20	1	1	-
2001	25.6	20	21.5373857	1.28	1.07686929	0.07686929
2002	31.5492157	20	22.9307134	1.57746079	1.14653567	0.06469345
2003	37.7974454	20	24.2080458	1.88987227	1.21040229	0.05570399
2004	44.3039103	20	25.3894688	2.21519551	1.26947344	0.04880291
2005	51.0346727	20	26.489917	2.55173363	1.32449585	0.0433427

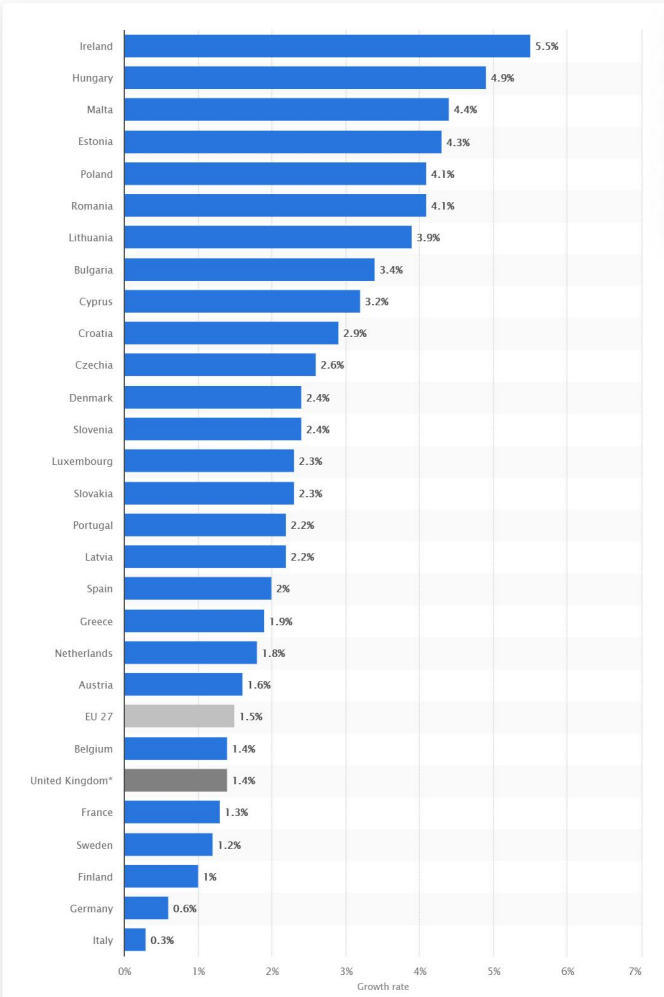
Numerical Example 1. Differences in Ko

- What the model predicts:
- Question 1. Which country has higher income per capita today? *Country 1 because for higher capital per worker.*
- Question 2. Which economy will be richer in the long-run? *None. They will arrive at the same steady-state.*
- Question 3. Will capital per worker and income per worker be increasing or decreasing? *Increasing because we are below the ss.*
- Question 4. Which county is going to growth faster until the long-run position? *Country 2 grows faster because of diminishing returns to capital that affect mostly Country 1.*
- Question 5. What will the growth rate of output be in the long-run. *Zero growth as capital investment will be equal to depreciation in the long-run.*

What the model predicts

- *If two countries have the same rate of investment but different levels of income, the country with lower income will have higher growth.*
- This is generally true and is called the convergence hypothesis.
- But not always.

European Example



Numerical Example 2 - Differences in savings

- Assume two countries that have the same rate $K_0 = 40$ but different savings rate. *Country 1*, $\gamma = 0.3$ and Country 2, $\gamma = 0.2$.
- Question 1. Which country has higher income per capita today?
- Question 2. Which economy will be richer in the long-run.
- Question 3. Will capital per worker and income per worker be increasing or decreasing?
- Question 4. Which county is going to growth faster until the long-run position?
- Question 5. What will the growth rate of output be in the long-run.

Numerical Example 2 - Differences in savings

Higher savings, higher income per worker and growth in the short-run

The growth process: The effect of **savings** on growth in the **short run**

Numerical Example: $Y = K^{0.3}L^{0.7}$, d=0.02

$K_0 = 40$ with high savings s=0.3

Time	Capital	Labour	Production	Income per capita	Growth rate
2000	**40**	20	24.6228883	1.231144413	-
2001	46.58686648	20	25.7750815	**1.288754074**	**0.046793585**
2002	53.3876536	20	26.8505538	1.342527689	**0.041725272**
2003	60.37506666	20	27.8598186	1.392990929	**0.03758823**
2004	67.5255109	20	28.8112009	1.440560044	**0.034148905**
2005	74.81836094	20	29.7114231	1.485571155	**0.031245564**

$K_0 = 40$ with high savings s=0.2

Time	Capital	Labour	Production	Income per capita	Growth rate
2000	40	20	24.6228883	1.231144413	-
2001	44.12457765	20	25.3585937	**1.267929685**	**0.029878925**
2002	48.31380484	20	26.0580774	1.302903868	**0.027583693**
2003	52.55914422	20	26.7248627	1.336243135	**0.025588431**
2004	56.85293387	20	27.3619384	1.368096922	**0.023838317**
2005	61.18826288	20	27.9718657	1.398593284	**0.022291083**

Higher savings, higher income per person and higher growth in the short-run (2000-2005)!!!

Numerical Example 2 - Differences in savings

Higher savings, higher income per worker in the long-run but not in the short-run.

$K_0 = 40$ and high savings s=0.3

Time	Capital	Labour	Production	Income per capita	Growth rate
2000	40	20	36.62288827	1.231144413	-
2001	46.58686643	20	25.77508149	1.288754074	0.046793585
2002	53.3876536	20	26.85055377	1.342527689	0.041725272
2003	60.37506666	20	27.85081857	1.392540929	0.03758823
2004	67.5255109	20	28.81110089	1.440560044	0.034448005
2005	74.81886004	20	29.7114231	1.485571155	0.031245564
2006	82.23542066	20	30.56660448	1.528330224	0.028761721
2007	89.76051359	20	31.37954161	1.568977082	0.026615751
2008	97.37916581	20	32.15591055	1.607795528	0.024741244
2009	105.0783557	20	32.8084152	1.64403076	0.023000757
2010	112.8463131	20	33.60080915	1.680404057	0.021626604
2011	120.6723566	20	34.29283068	1.714641534	0.020319357
2012	128.5467587	20	34.94936875	1.747468438	0.019115053
2013	136.4606341	20	35.58141479	1.779070739	0.018084619
2014	144.4058459	20	36.19065384	1.809532692	0.017122395
2015	152.3749251	20	36.77858772	1.838929386	0.016245452
2016	160.3610029	20	37.34656181	1.86732809	0.015443054
2017	168.3577514	20	37.89578711	1.894789355	0.014706181
2018	176.3593325	20	38.4273584	1.92136792	0.014027187
2019	184.3603534	20	38.94226937	1.947113468	0.013399593
2020	192.3558271	20	39.44142534	1.972071267	0.012817845
2021	200.3411382	20	39.92565393	1.996282696	0.012277157
2022	208.3120116	20	40.39571419	2.019785709	0.011773389
2023	216.2644856	20	40.85230437	2.042615218	0.011302986
2024	224.1948872	20	41.29606856	2.064803428	0.010861648
2025	232.09981	20	41.72760249	2.086380124	0.010449758
2026	239.9760946	20	42.14745846	2.107372923	0.010065828
2027	247.8206102	20	42.55614978	2.127807489	0.009

$K_0 = 40$ and low savings s=0.2

Time	Capital	Labour	Production	Income per capita	Growth rate
2000	40	20	24.62288827	1.231144413	-
2001	44.12457765	20	25.3585957	1.267929665	0.029878925
2002	48.51580484	20	26.05807757	1.302903868	0.027585695
2003	52.55914422	20	26.72486209	1.336243135	0.025588431
2004	56.85293187	20	27.36193843	1.368096922	0.023836317
2005	61.15826188	20	27.97186568	1.398593284	0.022291065
2006	65.55687076	20	28.55685894	1.427842947	0.0209136
2007	69.95906513	20	29.11884845	1.455942423	0.019679668
2008	74.38365352	20	29.65952891	1.482976445	0.01856808
2009	78.82788623	20	30.1803979	1.509019895	0.017561607
2010	83.28740809	20	30.66278671	1.533139335	0.016646195
2011	87.75821727	20	31.16788513	1.558394257	0.015810116
2012	92.23662995	20	31.63676183	1.581838091	0.015043564
2013	96.71924871	20	32.05038094	1.604519047	0.014338355
2014	101.2020400	20	32.52061602	1.626480801	0.013687437
2015	105.6848053	20	32.95526153	1.647763076	0.013084361
2016	110.1621615	20	33.36804262	1.668402131	0.012525409
2017	114.6325168	20	33.76862339	1.68843117	0.012004923
2018	119.0936009	20	34.15761389	1.707880694	0.011519388
2019	123.5432517	20	34.53557612	1.726778806	0.011065241
2020	127.9795019	20	34.90302928	1.745151464	0.010638044
2021	132.4005177	20	35.26045417	1.763022709	0.010240512
2022	136.8045682	20	35.60829715	1.780414857	0.00986106
2023	141.1901655	20	35.94697848	1.797348574	0.009511163
2024	145.555757	20	36.27687087	1.813843543	0.00917732
2025	149.900015	20	36.59834956	1.829917477	0.008861322
2026	154.2216856	20	36.91174956	1.845587478	0.008563228
2027	158.5196018	20	37.21738788	1.860869394	0.008

Numerical Example 2 - Differences in savings

- What the model predicts:
- Question 1. Which county has higher income per capita today? *The both have the same income today because of the same capital per worker.*
- Question 2. Which county will be richer in the long-run? *The one that saves more will arrive in a higher steady-state.*
- Question 3. Will capital per worker and income per worker be increasing or decreasing? *Increasing because we are below the ss.*
- Question 4. Which county is going to growth faster until the long-run position? *Country 1 as it has higher savings rate.*
- Question 5. What will the growth rate of output be in the long-run. *Zero growth as capital investment will be equal to depreciation in the long-run because of diminishing returns.*

What the model predicts

- If two countries have the same level of income but different rates of investment, then the country with a higher rate of investment will have higher growth at least in the short run.
- A country that raises its level of investment will experience an increase in its rate of income growth.

What we learn about the initial questions

- Why some countries are poor?
  - Low capital per worker, low savings, low technology
- Why some poor countries seem to grow faster than advanced
  - At low capital stock, the marginal productivity of capital is high. Thus, increases in capital boost production more than in a country where the marginal productivity is low
- Why some poor countries stagnate?
  - Very low savings rate, high consumption. But why? This is not explained by the Solow model.

We still need to explain more.

- The Solow model predicts zero growth in the long-run. But this is not true. How this happens?
- What determines the savings rate?
- Only a part of income differences can be explained.

Technological Progress

- The only way an economic to grow over the long-run is only through continuing technological progress.
- This can be exogenous, $A_{t+1} = (1+g)A_t$
- Or endogenous, $A_{t+1} = (1+g(H,L,K,G,\tau))A_t$.

Numerical Example 1. Differences in Rate of TP

- Assume two countries that have the same rate of investment, same capital depreciation, same initial capital, 40, and initial size of population, 20 , same initial technology $A_0 = 1$ and same population growth
- They different only in the rate of technological progress
- Country A has $g = 0$, Country B, $g = 0.06$.
- $Y = K^{0.3}(AL)^{0.7}$, where $\gamma = 0.3$ and $\delta = 0.02$.
- $K_1 = K_0 + I_0 - \delta K_0$ and $I = \gamma Y = 0.3$

Numerical Example. No TP

- **For Country 1 No technological Progress**:
- Step 1. The economy starts with, $A = 1$, $K_0 = 40$ and $L_0 = 20$.
- Step 2. Plug K_0 into Y and obtain $Y_0 = 40^{0.3}20^{0.7} = 24.76$
- Step 3. Calculate savings/investment in Country 1: $S = I = \gamma Y_0 = 0.3 * 24.76 = 7.42$
- Step 4. Using the formula before calculate $K_1 = 46.58$.Then, $K_1 = 46.58$ and $L_1 = L_0 + (0.02)L_0 = 20.4$ gives $Y_1 = 26.13$ and $\frac{Y_1}{L_1} = 1.281$. We repeate this process 30 times

Numerical Example. TP 0.06

- **For Country 2 Technological Progress** $g = 0.06$.:
- Step 1. The economy starts with $A_0 = 1$, $K_0 = 40$ and $L_0 = 20$.
- Step 2. Plug K_0 into Y and obtain $Y_0 = 40^{0.3}20^{0.7} = 24.76$
- Step 3. Calculate savings/investment in Country 1: $S = I = \gamma Y_0 = 0.3 * 24.76 = 7.42$
- Step 4. Using the formula before calculate $K_1 = 46.58$.Then, $K_1 = 46.58$ and $L_1 = L_0 + (0.02)L_0 = 20.4, A_1 = 1 * 1.06$ gives $Y_1 = 27.22$ and $\frac{Y_1}{L_1} = 1.231$ and growth=0.084. We repeate this process 30 times

Technological Progress zero

Time	K	L	A	Y	k=K/L	y=Y/L	Growth r
2000	40.00	20.00	1.00	24.62	2.00	1.231	-
2001	46.59	20.40	1.00	26.13	2.28	1.281	0.041
2002	53.50	20.81	1.00	27.62	2.57	1.327	0.036
2003	60.71	21.22	1.00	29.09	2.86	1.371	0.033
2004	68.23	21.65	1.00	30.55	3.15	1.411	0.029
2005	76.03	22.08	1.00	32.00	3.44	1.449	0.027
2006	84.10	22.52	1.00	33.44	3.73	1.485	0.025
2007	92.45	22.97	1.00	34.89	4.02	1.518	0.023
2008	101.07	23.43	1.00	36.33	4.31	1.550	0.021
2009	109.95	23.90	1.00	37.78	4.60	1.581	0.020
2010	119.08	24.38	1.00	39.24	4.88	1.609	0.018
2011	128.47	24.87	1.00	40.70	5.17	1.637	0.017
2012	138.11	25.36	1.00	42.17	5.45	1.663	0.016
2013	148.00	25.87	1.00	43.66	5.72	1.687	0.015
2014	158.14	26.39	1.00	45.16	5.99	1.711	0.014
2015	168.52	26.92	1.00	46.67	6.26	1.734	0.013
2016	179.15	27.46	1.00	48.20	6.53	1.755	0.012
2017	190.03	28.00	1.00	49.74	6.79	1.776	0.012
2018	201.15	28.56	1.00	51.30	7.04	1.796	0.011
2019	212.52	29.14	1.00	52.88	7.29	1.815	0.011
2020	224.13	29.72	1.00	54.48	7.54	1.833	0.010
2021	236.00	30.31	1.00	56.11	7.79	1.851	0.010
2022	248.11	30.92	1.00	57.75	8.02	1.868	0.009
2023	260.47	31.54	1.00	59.42	8.26	1.884	0.009
2024	273.09	32.17	1.00	61.11	8.49	1.900	0.008
2025	285.96	32.81	1.00	62.82	8.71	1.915	0.008
2026	299.09	33.47	1.00	64.56	8.94	1.929	0.008
2027	312.47	34.14	1.00	66.33	9.15	1.943	0.007
2028	326.12	34.82	1.00	68.12	9.37	1.956	0.007
2029	340.04	35.52	1.00	69.95	9.57	1.969	0.007
2030	354.22	36.23	1.00	71.80	9.78	1.982	0.006

Technological Progress positive

Time	K	L	A	Y	k=K/L	y=Y/L	Growth rate
2000	40.00	20.00	1.00	24.62	2.00	1.231	-
2001	46.59	20.40	1.06	27.22	2.28	1.334	0.084
2002	53.82	20.81	1.12	30.02	2.59	1.443	0.081
2003	61.75	21.22	1.19	33.05	2.91	1.557	0.079
2004	70.43	21.65	1.26	36.31	3.25	1.677	0.077
2005	79.92	22.08	1.34	39.83	3.62	1.804	0.075
2006	90.27	22.52	1.42	43.63	4.01	1.937	0.074
2007	101.55	22.97	1.50	47.74	4.42	2.078	0.073
2008	113.84	23.43	1.59	52.18	4.86	2.227	0.072
2009	127.22	23.90	1.69	56.98	5.32	2.384	0.071
2010	141.76	24.38	1.79	62.16	5.81	2.550	0.070
2011	157.58	24.87	1.90	67.77	6.34	2.725	0.069
2012	174.76	25.36	2.01	73.84	6.89	2.911	0.068
2013	193.41	25.87	2.13	80.39	7.48	3.107	0.067
2014	213.66	26.39	2.26	87.48	8.10	3.315	0.067
2015	235.63	26.92	2.40	95.15	8.75	3.535	0.066
2016	259.47	27.46	2.54	103.44	9.45	3.768	0.066
2017	285.31	28.00	2.69	112.41	10.19	4.014	0.065
2018	313.32	28.56	2.85	122.11	10.97	4.275	0.065
2019	343.69	29.14	3.03	132.59	11.80	4.551	0.065
2020	376.59	29.72	3.21	143.94	12.67	4.843	0.064
2021	412.24	30.31	3.40	156.20	13.60	5.153	0.064
2022	450.86	30.92	3.60	169.47	14.58	5.481	0.064
2023	492.68	31.54	3.82	183.81	15.62	5.828	0.063
2024	537.97	32.17	4.05	199.33	16.72	6.196	0.063
2025	587.01	32.81	4.29	216.11	17.89	6.586	0.063
2026	640.10	33.47	4.55	234.25	19.13	6.999	0.063
2027	697.58	34.14	4.82	253.88	20.43	7.437	0.063
2028	759.79	34.82	5.11	275.10	21.82	7.900	0.062
2029	827.12	35.52	5.42	298.05	23.29	8.392	0.062
2030	899.99	36.23	5.74	322.86	24.84	8.912	0.062

Technology Creation

- Creating new technologies requires investment.
- Nature of investment in technology varied across different places and times.
- In a modern economy, vast resources are devoted to (R&D), to create new products or processes.

Research and Development

1. A fairly recent phenomenon.
2. Before the mid-nineteenth century technological advance was primarily the product of "tinkerers"rather than formally trained scientists.
3. Even today, formal R&D of big corporations is often overshadowedby hackers working in their spare time out of a garage.
4. Most R&D conducted by private firms seeking to maximize profits.
5. Unique nature of technology led governments to play a role in research

Transfer of Technology

- Transfer of Technology is non-rival: one person's use of a piece of technology in no way prevents others from using it just as effectively.
- Non-rivalry of technology means we should focus on transfers between firms or countries.
- Easy transferability means that the incentives for creating technology are diminished.
- European integration has been proven to promote technology transfer.

Patents and Trade Secrets

- Transferability reduces incentive to create new technologies.
- Venice patent law of 1474
- Patenting an invention requires a detailed public description. Makes it easier to come up with a close substitute –and once the patent has expired others will be able to copy it exactly.
- Coca-Cola was never patented, and has remained secret for more than a century.

Deep routes. The Origins of Innovation and Trust

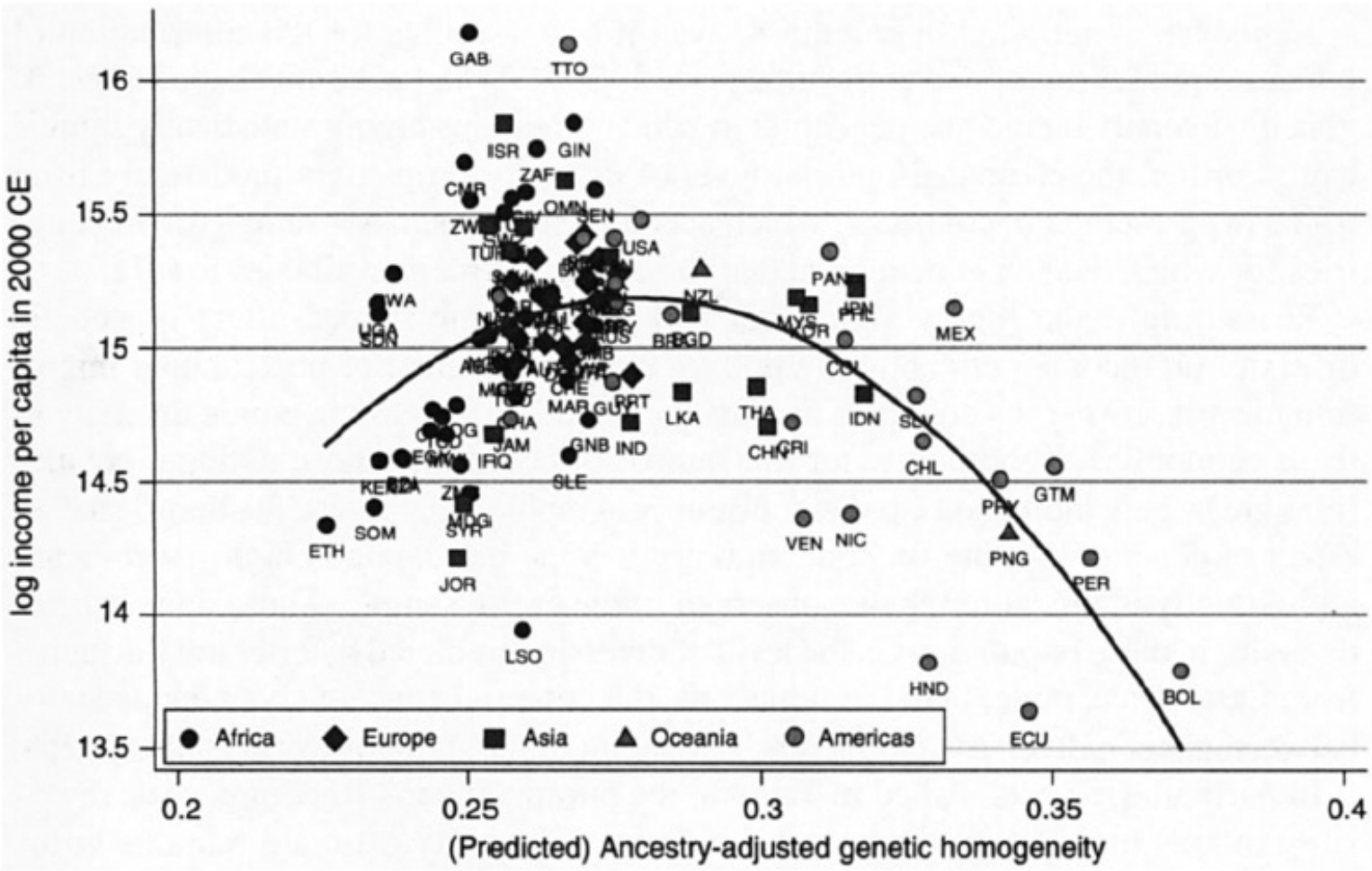
- The role of ancestry genetic diversity on economic development
- Reading: Ashraf and Galor, 2013, “The "Out of Africa" Hypothesis, Human Genetic Diversity, and Comparative Economic Development”, American Economic Review.
- 1. (Channels) Heterogeneity raises the likelihood of disarray and mistrust, reducing cooperation and disrupting the socioeconomic order.
- 2. (Channels) Aggregate productivity is enhanced by an increased capacity for technological advancement and innovation
- The closer the migratory distance from africa, the higher the genetic diversity. (Africa very diverse, Latin America very homogeneous)

The Origins of Innovation and Trust

TABLE 9—COSTS AND BENEFITS OF DIVERSITY

	Degree of interpersonal trust			Scientific articles per capita per year 1981–2000		
	Full sample (1)	Full sample (2)	Common sample (3)	Full sample (4)	Full sample (5)	Common sample (6)
Predicted diversity (ancestry adjusted)	−1.880** (0.829)	−2.226** (0.862)	−1.920** (0.940)	2.484*** (0.566)	1.860*** (0.550)	3.023** (1.222)
log Neolithic transition timing (ancestry adjusted)	0.069 (0.062)	0.089 (0.063)	0.091 (0.060)	−0.085* (0.047)	−0.080* (0.046)	−0.189** (0.085)
log percentage of arable land	0.004 (0.019)	−0.002 (0.018)	−0.014 (0.019)	0.008 (0.016)	0.005 (0.015)	−0.005 (0.037)
log absolute latitude	−0.003 (0.027)	0.003 (0.028)	−0.008 (0.031)	0.046* (0.024)	0.055** (0.023)	0.079 (0.073)
Social infrastructure	0.200*** (0.069)	0.146* (0.079)	0.149* (0.081)	0.702*** (0.109)	0.547*** (0.125)	0.627*** (0.197)
Ethnic fractionalization	0.060 (0.065)	0.048 (0.064)	0.054 (0.067)	0.091 (0.094)	0.073 (0.093)	0.088 (0.155)
Percentage of population at risk of contracting malaria	−0.063 (0.090)	−0.033 (0.092)	−0.048 (0.100)	0.093* (0.054)	0.135*** (0.048)	0.026 (0.120)
Percentage of population living in tropical zones	−0.074 (0.053)	−0.040 (0.059)	−0.046 (0.062)	0.020 (0.057)	0.051 (0.055)	0.113 (0.181)
Mean distance to nearest waterway	0.094 (0.064)	0.098 (0.060)	0.077 (0.058)	0.104*** (0.038)	0.115*** (0.035)	0.159** (0.067)
Years of schooling		0.013 (0.010)	0.017* (0.010)		0.031*** (0.008)	0.021 (0.023)
Observations	58	58	56	93	93	56

Genetic Diversity and Economic Development



Government Policy

- Assume Population $L = 1$ and no population growth
- Assume that the production function is now given by:

$$Y_t = K_t^a (H_t)^{1-a} \tag{1}$$

where H_t denotes the level of human capital

Government Policy

- Production is used for consumption, investment and government spending:

$$Y_t = C_t + I_t + G_t \tag{2}$$

where G denotes government spending on education.

- Government Finances G by levying a tax on income:

$$G_t = \tau Y_t \tag{3}$$

- After paying taxes, a fraction γ of the disposable (after taxes) income $(1-\tau)Y$ goes to consumption and investment

$$I = \gamma(1-\tau)Y_t \text{ and } C = (1-\gamma)(1-\tau)Y_t$$

Government Policy

- Capital accumulation follows Solow.
- Capital tomorrow is determined by investment in new capital, $I = \gamma(1-\tau)Y$, plus what capital left from the previous period $(K_t - \delta K_t)$

$$K_{t+1} = \gamma(1-\tau)Y_t + K_t - \delta K_t \qquad (4)$$

Government Policy

- Human capital accumulation will be driven by the provision of public schooling from the government. Denoting public investment in education by G , we can write the dynamics of Human capital as:

$$H_{t+1} = G_t + H_t - \delta^H H_t \tag{5}$$

where δ^H $(0 < \delta^H < 1)$ is the depreciation rate of human capital.

Government Policy

- Substructing $\frac{Y_t}{Y_t}$ in both sides of (9) we get $\frac{Y_{t+1}}{Y_t} - \frac{Y_t}{Y_t} = A\gamma^a(1-\tau)^a\tau^{1-a} - \frac{Y_t}{Y_t}$:

$$g \equiv \frac{Y_{t+1} - Y_t}{Y_t} = A\gamma^a(1-\tau)^a\tau^{1-a} - 1$$

which is the growth rate of income per capita end depends on:

  - Productivity, A (positively)
  - Savings/Investment rate, γ (positively)
  - and the level of **tax rate (inverse U-shaped)**

What drives differences in savings rates?

- The motive for savings depends on
- a) Market: the return on savings (productivity of the capital stock)
- b) Culture: the subjective discount rate (rate of time preference)
- Aristotle said "Patience is bitter, but its fruit is sweet"
- This is confirmed by the empirical data.

Distribution of Time Preference

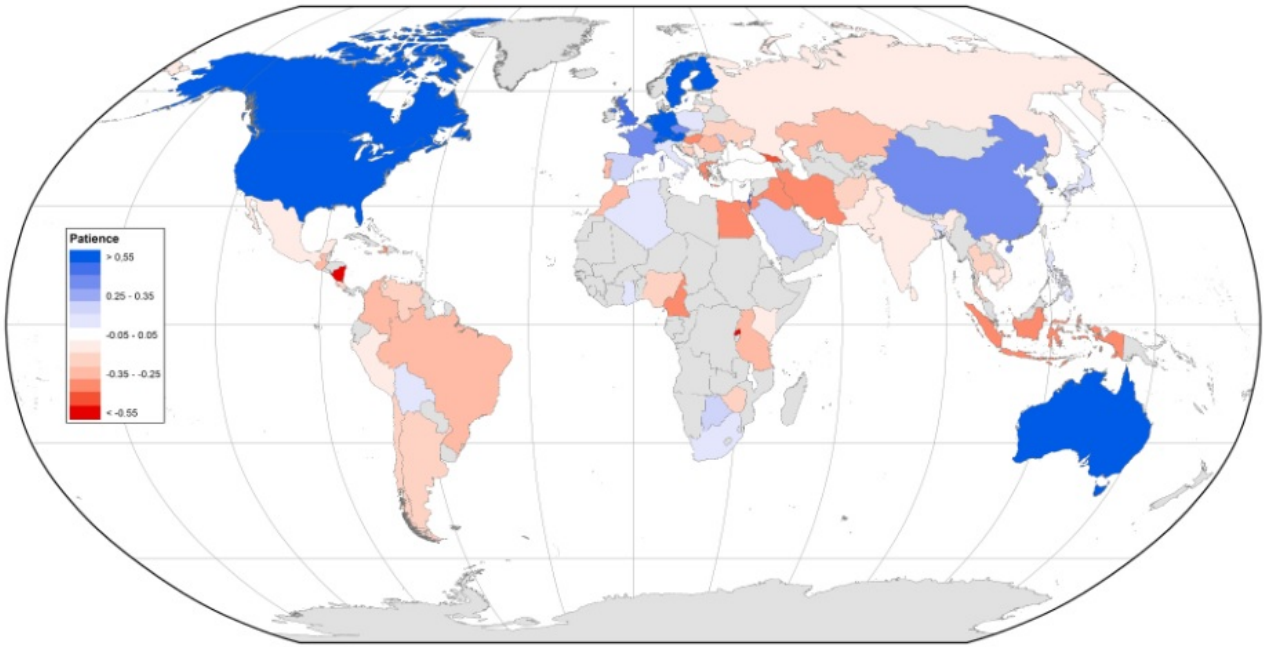
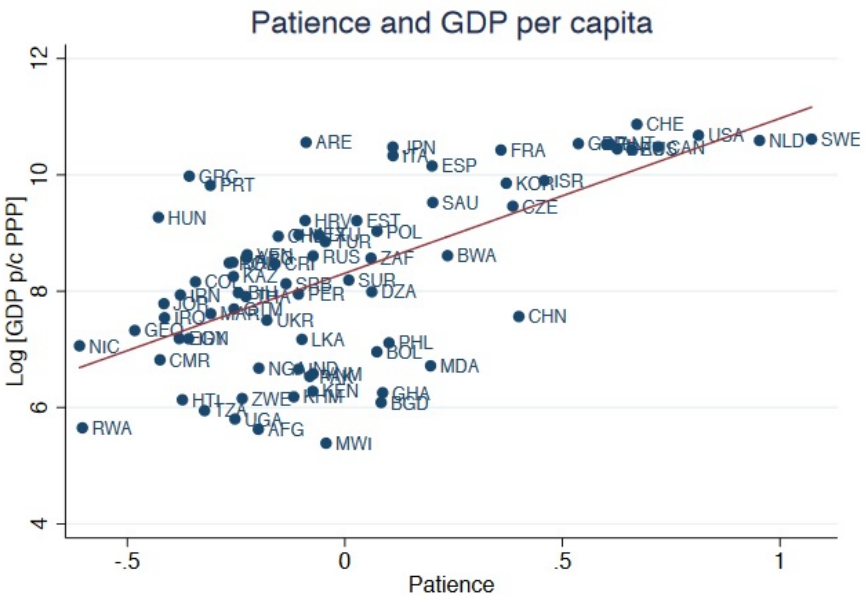


Figure 2: Distribution of Patience Across Countries

Time Preference and GDP per capita



Conclusions - Exogenous Growth

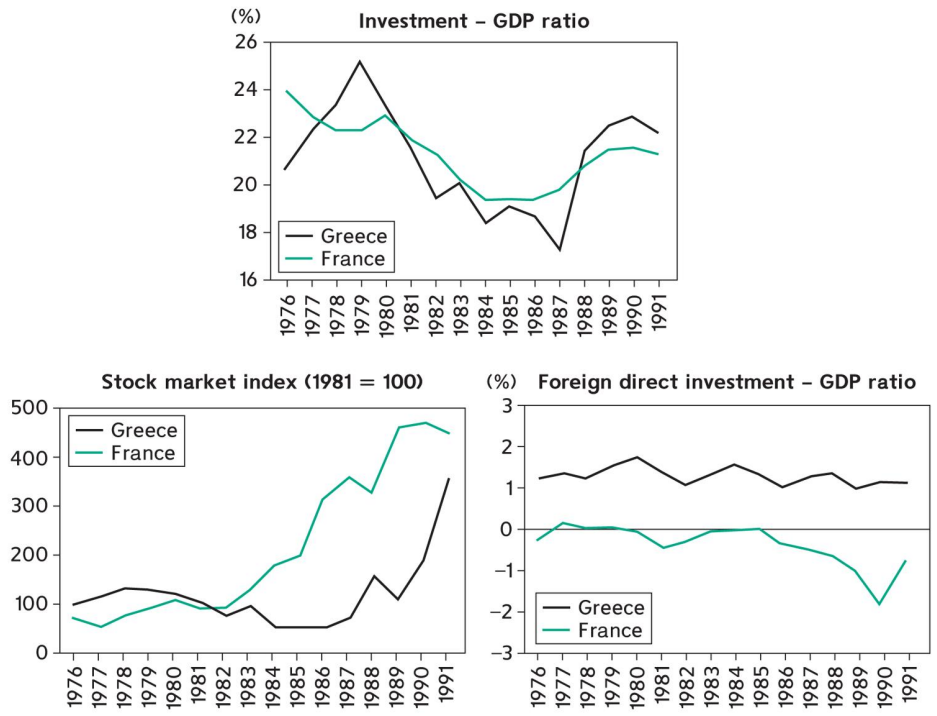
- Income per worker depends positively on capital per worker. More machines per worker, more production per worker, higher income per worker.
- The long-run level of capital per worker depends on savings, technology and depreciation.
- Savings/investment rates positively affect capital per worker in the short-run and in the long-run.
- Growth inevitably stops in the long-run if capital experiences diminishing returns in production.
- An one time increase in saving or technology has only a positive short-run effect on growth.

Conclusions - Endogenous Growth

- Technological progress is the key to explain persistent long-run growth
- But, where technological progress comes from? Answer, the decision of agents.
- That is, savings, years of education, taxation, spending on research and development, trust, cooperation.
- This in turn explains differences in income per capita around Europe.
- Answers European policys and growth pacts targeting those factors.

Conclusions - Example Greece

Figure 7.7 Integration-induced investment-led growth in Greece



Source: Based on data from Baldwin and Seghezza (1998).