

Economic growth

(Burda & Wyplosz , *Macroeconomics. A European text*, third edition.
Oxford University Press, 2001: Part VI –ch.18)

Economic growth

- Increase in the value of goods and services produced by the economy in the long run
- Conventionally measured as the percent increase in real GDP and/or in **real GDP per capita** (GDP/population), which is the most used indicator of the standard of living of a country.
- Growth in GDP per capita has some drawbacks in measuring a country development:
 - it does not provide any information on the *distribution of income* in a country;
 - it does not consider relevant factors in the social well being of a country, which are usually not traded and priced (environmental conditions, education, health, leisure,..)
- In recent years other indicators of national income and standard of living have been developed in order to give a more complete picture of a country well being, such as the *Index of Sustainable Economic Welfare*

Growth rates and income levels

- Small differences in **growth rates** determine very high differences in **per capita income levels** over time (due to compound rates):

If the growth rate x is: $x = 1\%$: $y(t+1) = 1,4 * y(t)$

where: t measures “one generation”

If the growth rate x is: $x = 3\%$: $y(t+1) = 2,5 * y(t)$

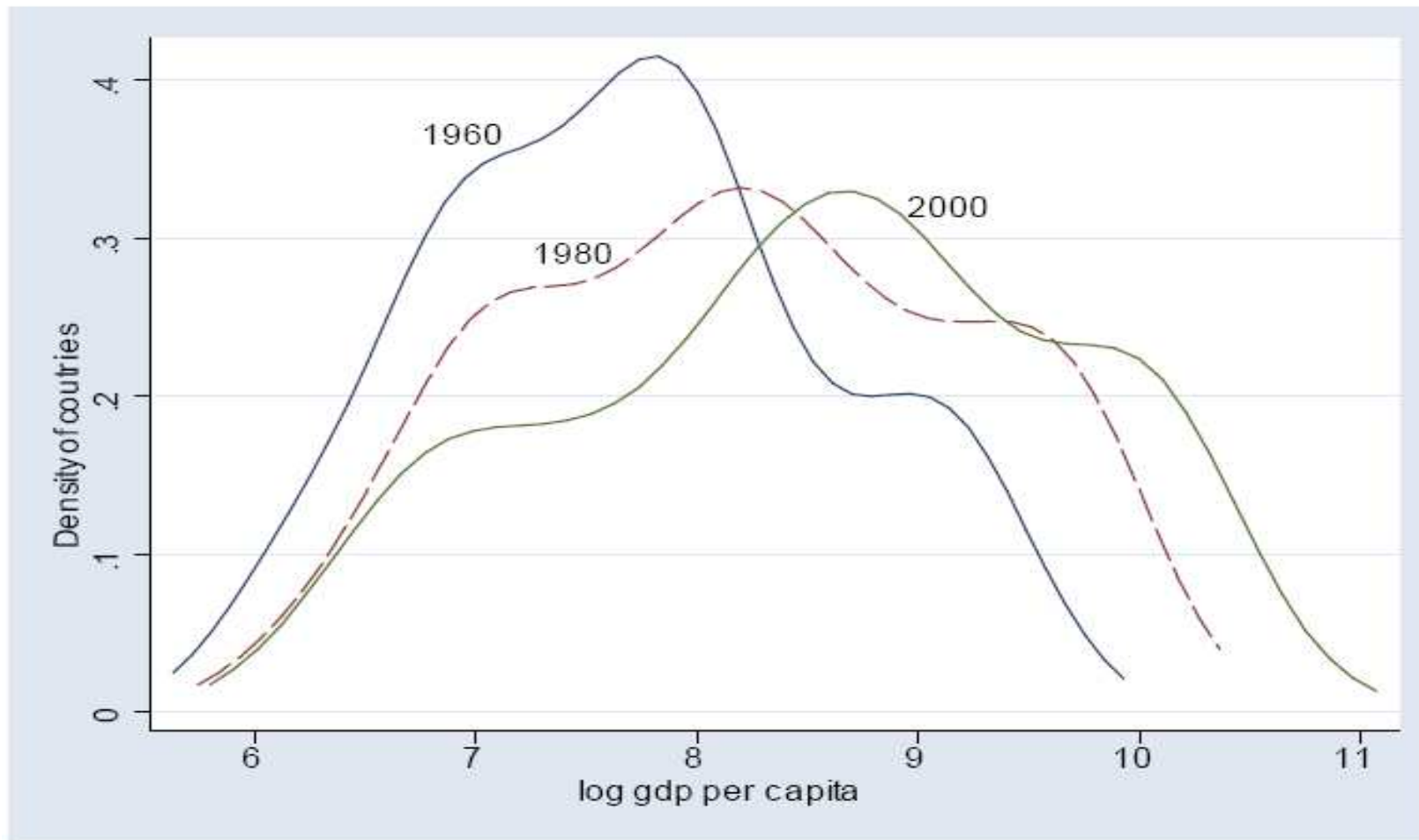
$x = 6\%$ in Italy in the 1960s and is currently *the growth rate in Asia*

- Growth is not usually a linear path and sometimes it may stop or slow down, as has happened in most developed countries since the mid 70s.
- Usually growth follows three phases: 1) decline in the share of the agricultural sector, 2) industrialisation, 3) terziarisation

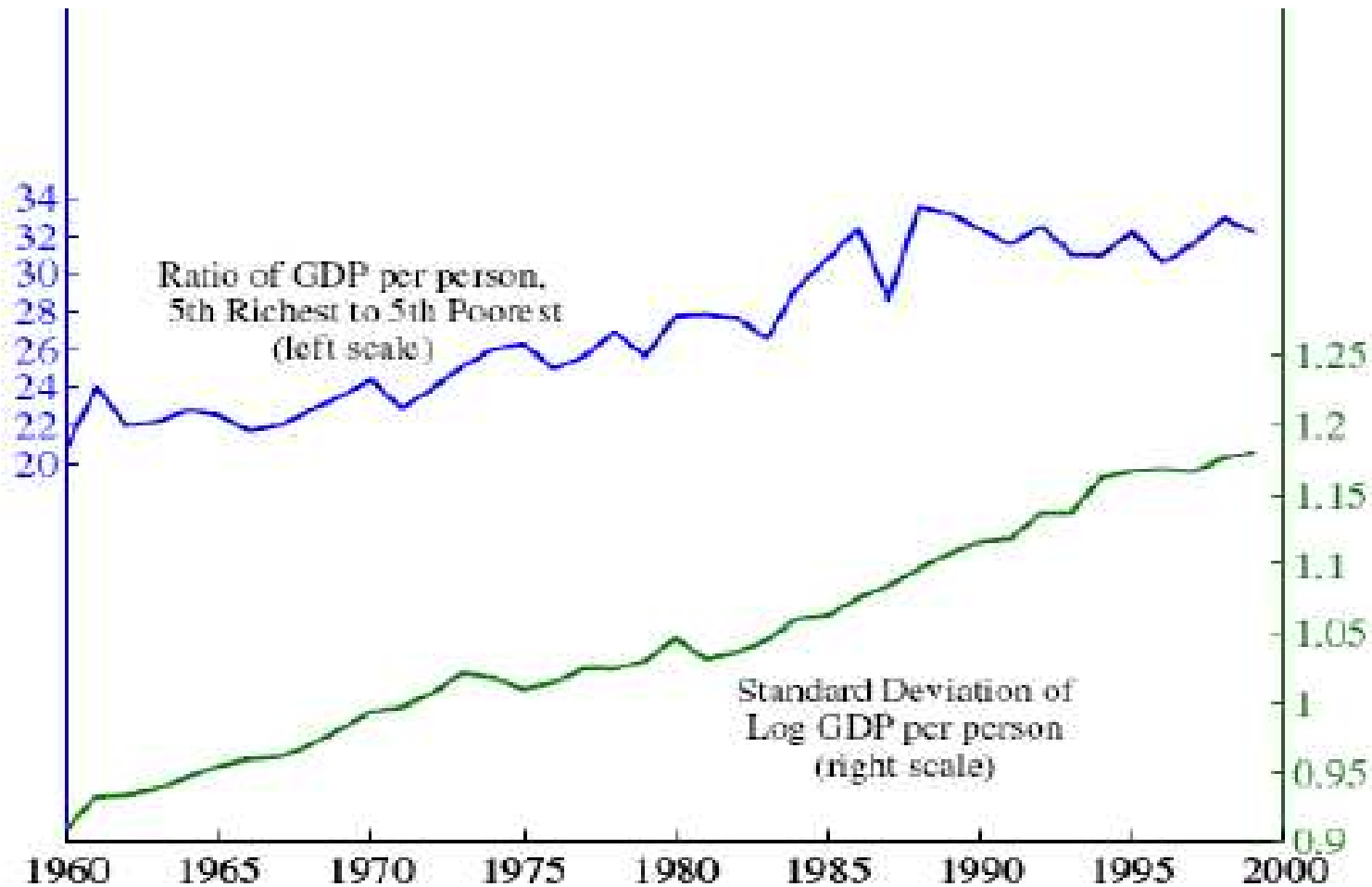
Some facts on growth/1

- The *levels* of GDP per capita across countries are very different:
GDP per capita at PPP (purchasing power parity). Year 2000, at 1995 prices:
 - USA US \$ 32,500
 - Mexico US \$ 9,000
 - China US \$ 4,000
 - India US \$ 2,500
 - Nigeria US \$ 1,000
 - Ethiopia US \$ 200
- There is a *convergence among developed countries*: the countries with lower per capita GDP have higher growth rates than countries with higher per capita GDP
- There seems to be a convergence of *some* poor countries (especially in the far East) toward rich ones. This happens for those countries which:
 - are more open to world trade
 - Are more stable politically and institutionally
 - Invest more in human capital

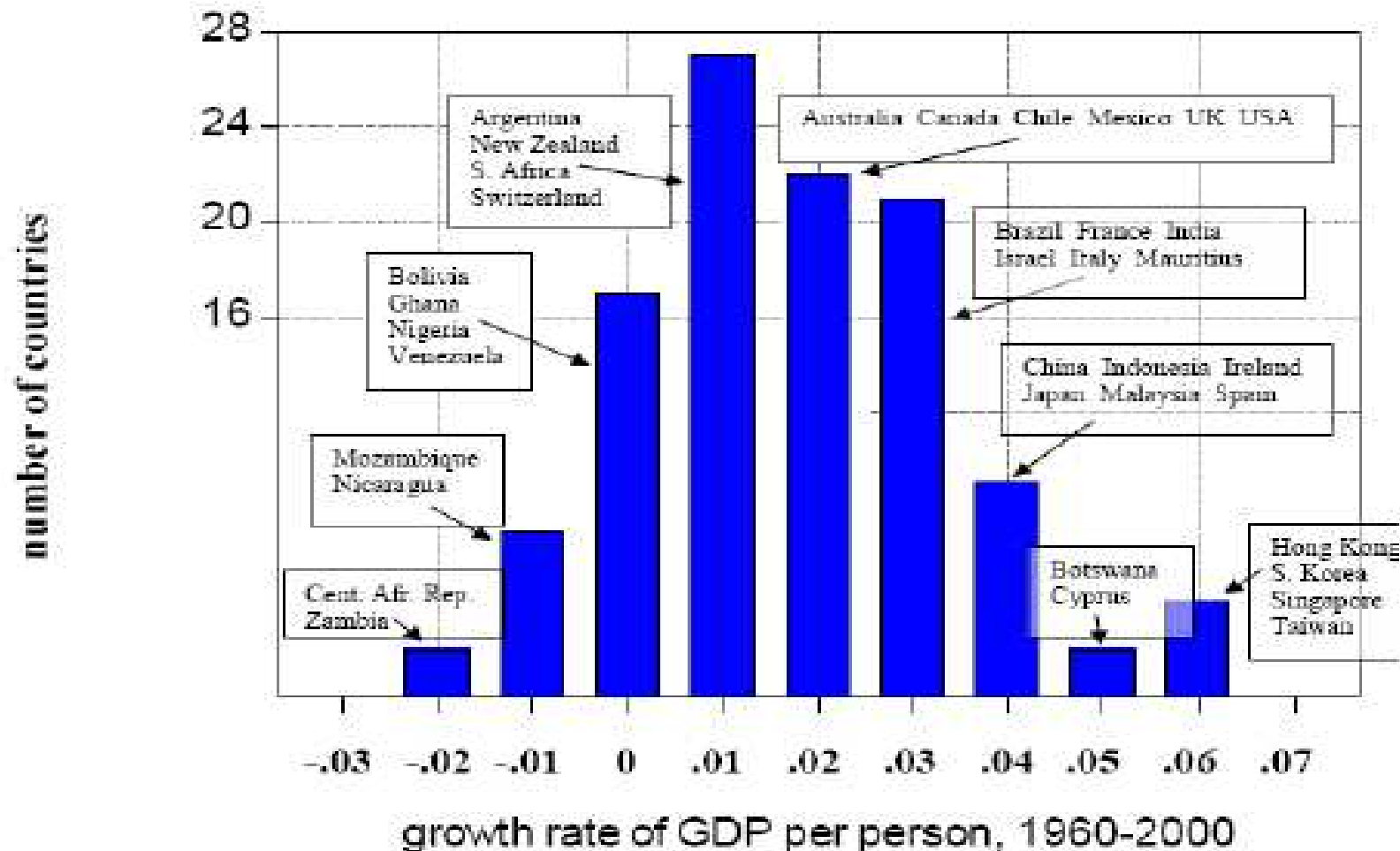
The distribution of GDP per capita in the world/1



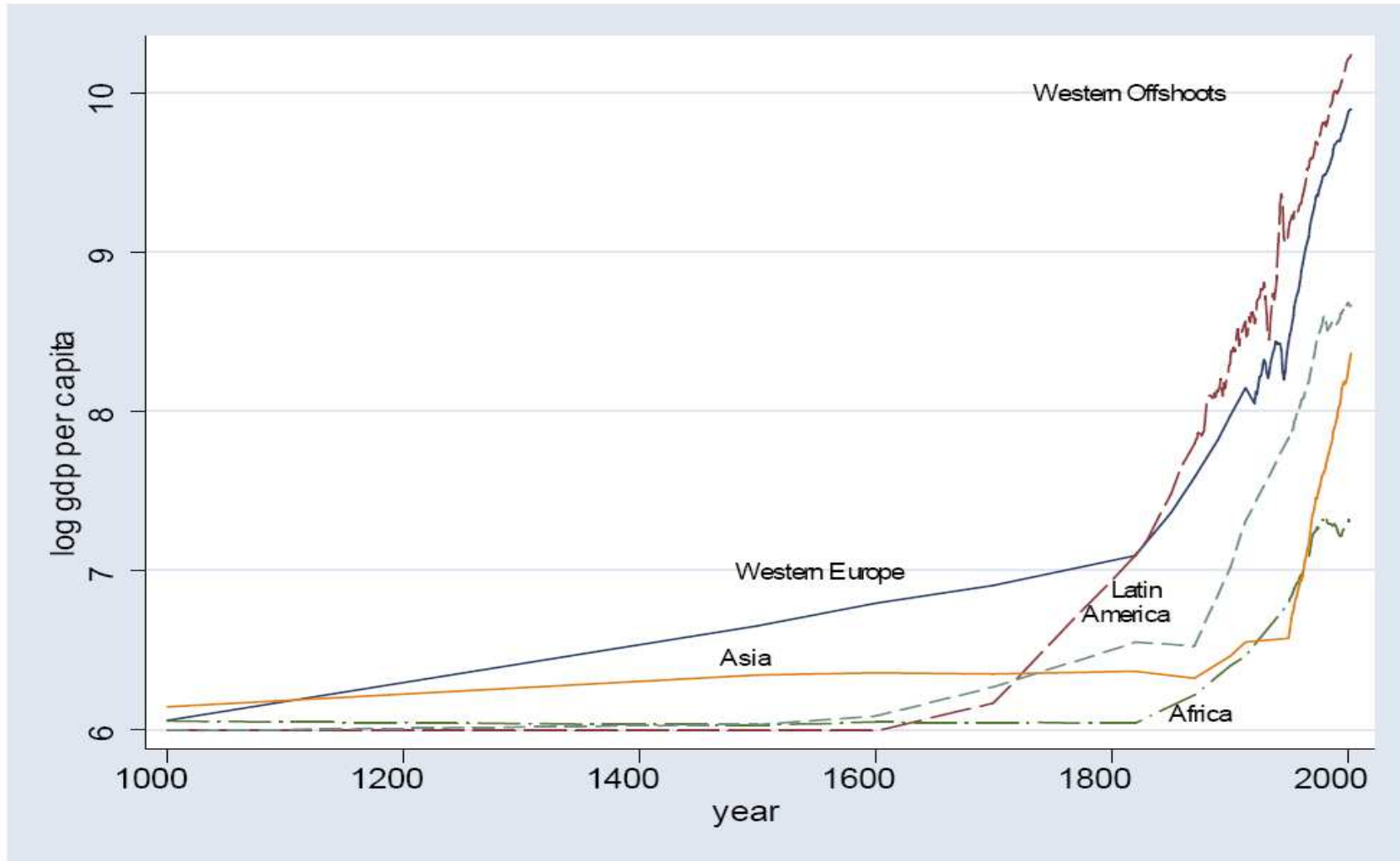
The dispersion has been increasing



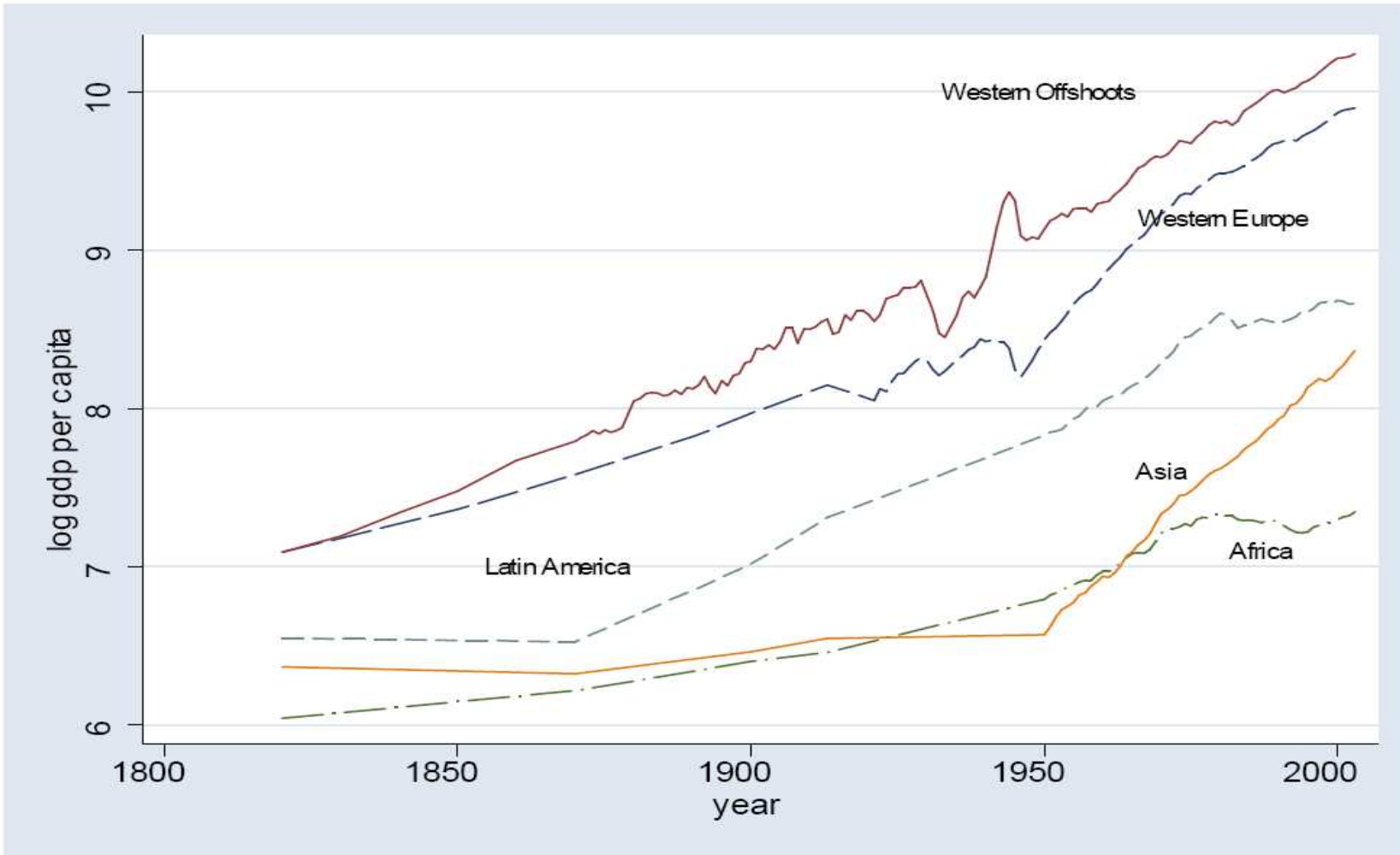
Rich countries, or countries which become rich are those which register the highest economic growth



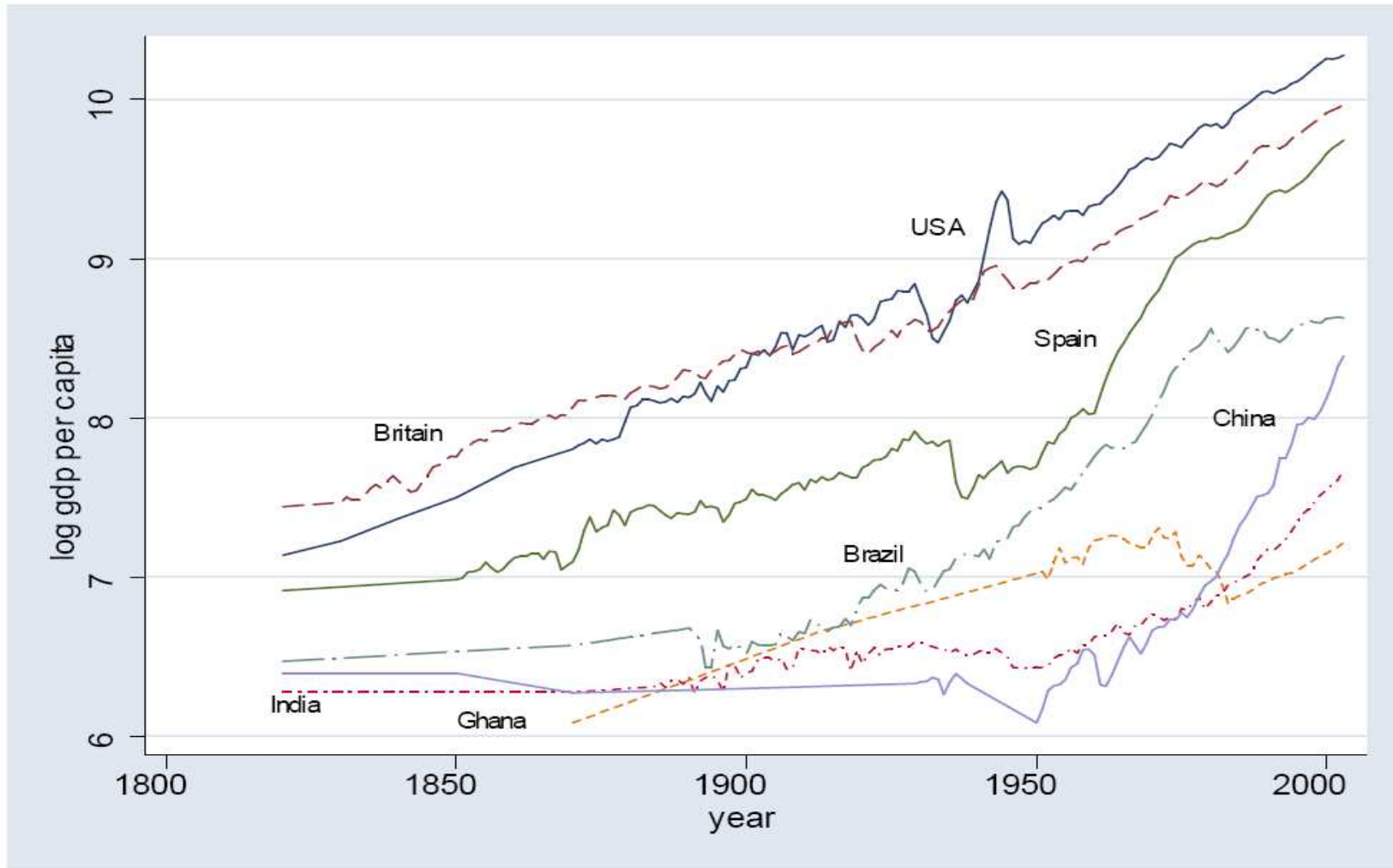
Economic growth only since the XVIII century



Economic growth since 1800



Economic growth in some countries



Questions on growth

- Why there are such large differences in GDP per capita across countries?
- Is there a convergence path among countries?
- Why some countries are not able to grow, while others suddenly start to grow very fast?
- We need a model explaining the factors and the mechanisms which support growth

The Solow model (1956)

- This model identifies three main sources of economic growth on the basis of an aggregate production function, with diminishing marginal returns to capital and to labour:

$$Y = F(K, N, A) \quad Y/N = Af(K/N)$$

1. Capital accumulation (K)
2. Population growth (N)
3. Technological progress (A)

- Both capital accumulation and population growth cannot support economic growth on their own because they are subject to diminishing marginal returns. They only explain the **level of real per capita GDP** in the long run and its growth during *transition periods* toward a steady state long run equilibrium, when growth in per capita income stops.
- **Capital accumulation** only affects the **level** of per capita GDP in the long run, not its growth rate. In the long run, countries with higher capital accumulation will have a higher level of per capita GDP. Capital accumulation depends on the saving rate.
- It is **technological progress** which is the engine of growth, because it increases the productivity of capital and labour. In its absence growth in per capita income, eventually approaches zero. In the long run, the **growth rate of per capita GDP only depends on the rate of technological progress** and GDP per capita growth rate is equal to the rate of technological progress.
- Technological progress is determined exogenously

The Solow model/2

- The Solow model explains the determinants of long run living standards (**levels of per capita GDP**), but not the determinants of long run growth.
- According to this model differences in long run living standards (measured by the levels in per capita GDP) depend on:
 - differences in capital accumulation, which depends on differences in saving rates
 - Differences in population growth rates (which reduce the capital/labour ratio)
 - Differences in technological progress
- In addition, according to this model, countries starting from a low per capita GDP should accumulate capital faster than rich countries and eventually catch up. If capital is free to move, capital would flow into poor countries where the rate of returns are higher : *convergence hypothesis* (capital-labour ratios will eventually equalise across countries, as will per capita GDPs)

Extensions of the Solow Model

- An expansion of the model also considers the accumulation of human capital (H) as a factor of production:

$$Y = F(K, N, H, A)$$

- As for physical capital, investment in human capital explains higher levels of GDP per capita in the long run, but not higher growth rates in the long run

The Solow model: empirical evidence

- Empirical cross country evidence shows that there is:
 - a positive relation between the saving rates and per capita income, which is consistent with the Solow model
 - A mildly negative relation between the population growth rate and per capita income, which is consistent with the Solow model
 - The convergence hypothesis appears to work only among wealthier countries and not between rich and poor countries. Why some poor countries are not able to escape from poverty, while others do? Other factors may be relevant such as human capital, institutions and public infrastructures.

Endogenous growth models (Romer, 1986; Lucas, 1988)/1

- Main limit of the Solow model: it does not explain the determinants of long run growth, because it does not explain why technological progress occurs (it is considered an exogenous factor).
- Endogenous growth models consider technological progress as determined by **knowledge**, which is a public good. Knowledge is determined by investment in human capital (education and training) and in research.
- At the basis is the hypothesis that **human capital is a key determinant of technological progress and economic growth.**
- At the macro-economic level, **investment in HC and research can generate positive growth externalities**, as a more educated and trained workforce and investment in research increases the probabilities of successful innovation and this generates faster productivity growth. Countries investing more in education and training tend to be better off in the long run and to have higher technological progress and growth rates

Endogenous growth models/2

- In this model: $A = a(H/N, K/N; R\&D, \dots)$, the increase in human and physical capital has a more persistent effect on long run growth (while the effect is only temporary in the Solow model) because knowledge and physical capital provide externalities which create *constant returns to production factors* (instead of diminishing returns as in the Solow model) and support endogenous growth.
- These models may explain the lack of convergence and the persistence of poverty in some countries, which depend on the lack of capital accumulation and of investment in human capital and knowledge.
- This model asks for public investment in R&D and education, because of their positive externalities (the market would invest too little without public support).

Human capital: policy implications/1

- If the endogenous model of growth is verified, there should be more public support to investment in human capital and in R&D
- European countries should invest more in education and training (currently EU investment in tertiary education is only 1,2% of GDP compared to 2,9% in the USA) and in research and development (currently the EU GDP allocated to R&D is 1,9% relative to 2,6% in the USA).
- A rationale for public intervention comes from **market failures, externalities and equity** considerations.

Policy implications/2

1. Market failures:

- **in capital markets** make it more difficult and costly to obtain funds for HC and research investments than for physical capital, because HC is illiquid and non transferable and research is uncertain in its results and often entails long gestation periods. In the case of education and training these difficulties may be higher for poor individuals (equity motivations) thus reducing their possibility to invest in education and training and reinforcing, rather than reducing, social and income inequalities.
- **incomplete information** may also be an obstacle to informed decisions and lead to suboptimal investment in HC and R&D. Again the risk is that the lack of adequate information is greater for individuals coming from poor households.

2. Externalities.

- **Human capital is a merit good:** the social benefits (monetary and non monetary) of HC are higher than the private ones, while the social costs are lower than private costs, due to scale economies. Thus there is the risk of underinvestment if investment is only left to individuals' decisions.
- At the macro-economic level, **investment in HC can generate positive growth externalities**, as a more educated and trained workforce increases the probabilities of successful innovation and this generates higher expenditure in R&D and faster productivity growth (*theories of endogenous growth*)

Policy implications/3

If social returns are higher than private ones and there are market failures, it is efficient to have public financing of investment in HC and in R&D.

How much investment should be supported with public funds?

- Compare the social costs and benefits of public investment in HC and in R&D, considering the trade off between equity and efficiency goals:
 - **Equity**: offer education and training opportunities especially to those with lower possibilities to access education and training in order to reduce social inequalities.
 - **Efficiency**: given the scarcity of resources it is more efficient to concentrate public resources on the most able and support market competition in the provision of education and training.

The choice depends on the distribution of ability and income among the population and on the social preferences in the trade off between equity and efficiency.

Note that equity reasons ask that only compulsory education be completely financed by public resources, while tertiary education should be paid by users to avoid the non users (usually low income families) paying for the education of users (usually coming from high income families).

In order to reduce inequalities in the access to tertiary education it is better to adopt scholarships and student loans for able students coming from low income households.

Why some countries are able to grow and others not?

Relevant variables explaining differences in growth rates:

- physical capital and capital accumulation
- knowledge and human capital
- Technological progress (innovation and imitation)
- stable economic and political environment (institutions)
- Openness to trade

The role of a stable economic and political environment and other factors

Stable environment reduce uncertainties and increase the incentive to invest in physical and human capital, especially when:

- Individual property rights for physical and human capital accumulation, usually property rights are associated with democratic regimes and peace periods.
- Peace
- Political stability
- Stable and favourable taxation systems
- Low inflation
- Openness to trade (which increases competition and knowledge dissemination)
- Health conditions
- Low public consumption (to avoid high taxation and displace investment)

Issues of causality: are these factors deriving from income growth or do they determine income growth?

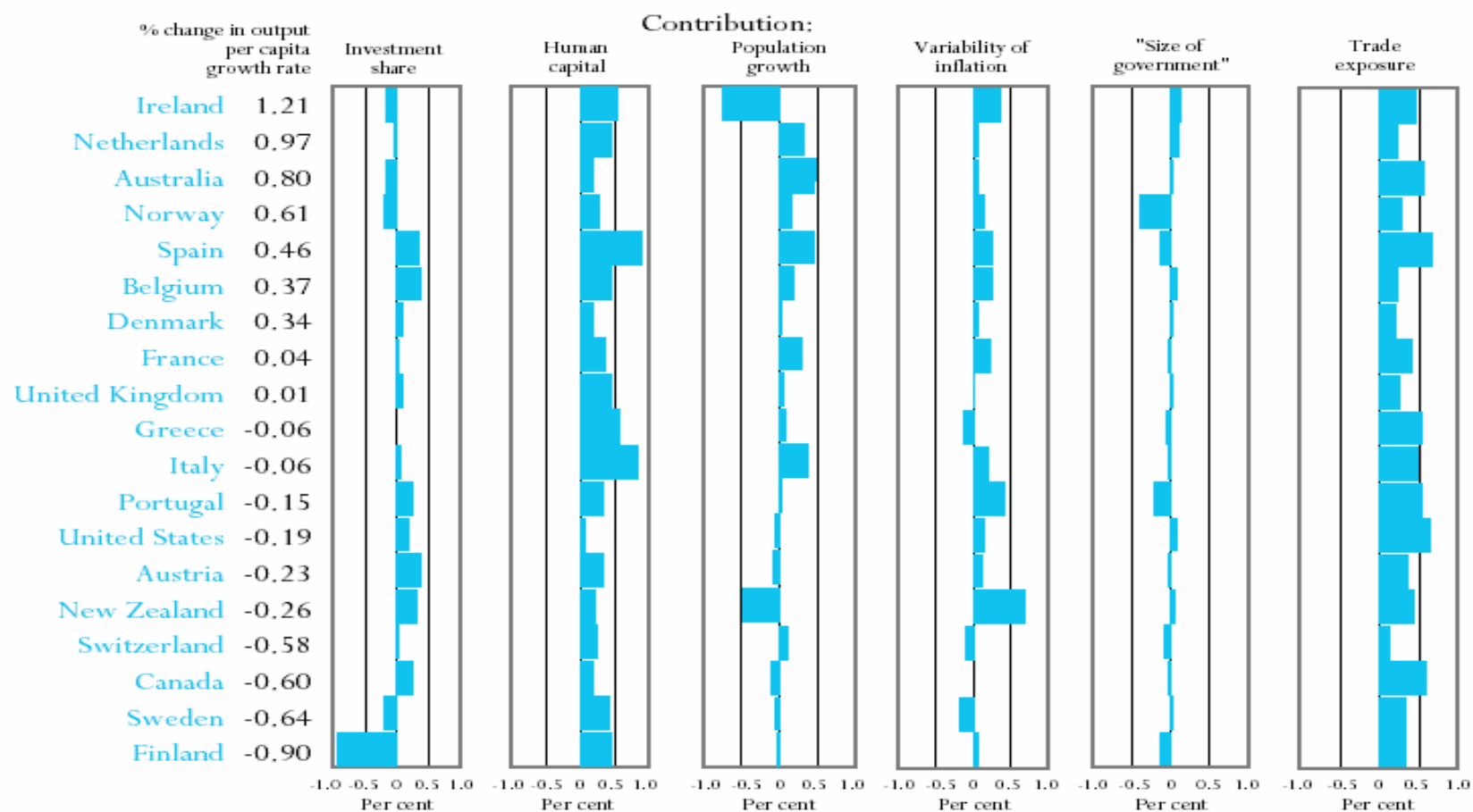
Issue of the role of democracy on growth: not clear evidence, especially in the early years of transition from low income conditions to high growth, which requires high saving rates and restructuring.

Empirical evidence

- Human capital investment is relevant in all countries . OECD estimations show that one additional year of labour force education increases the long run growth rate of per capita GDP about 4-9%. The role of education is particularly high for Greece, Ireland, Italy and Spain
- The openness to trade is also very relevant in all countries
- Physical capital increases per capita GDP by only 1,3-1,5 %.
- The variability of inflation rate appears to be relevant only in some countries, as public expenditure and population growth.

Chart A14.1.

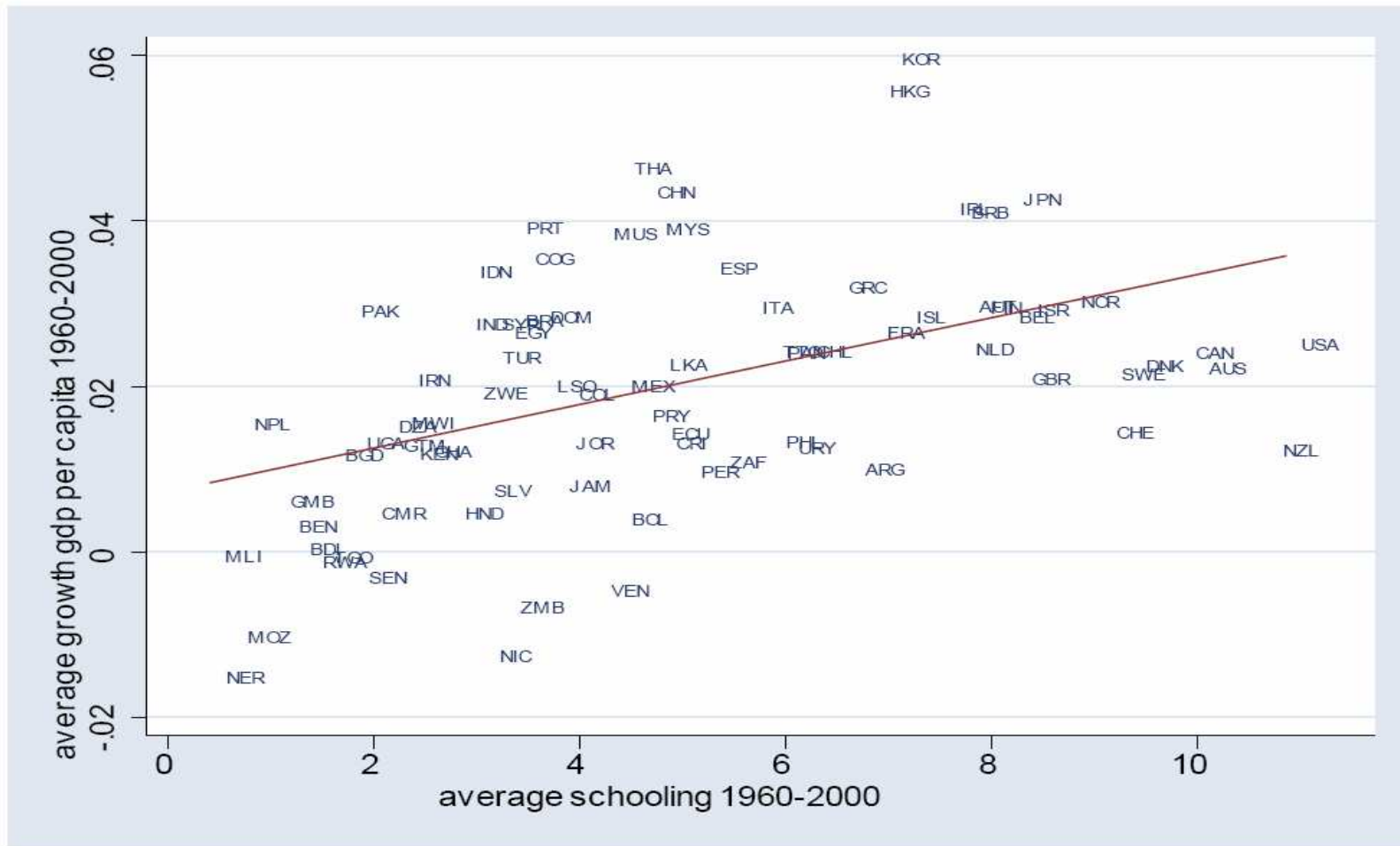
Decomposition of changes in annual average growth rates of GDP per capita
*Estimated effect of changes in explanatory variables to changes in output
 per capita growth rates over the period 1980s to 1990s*



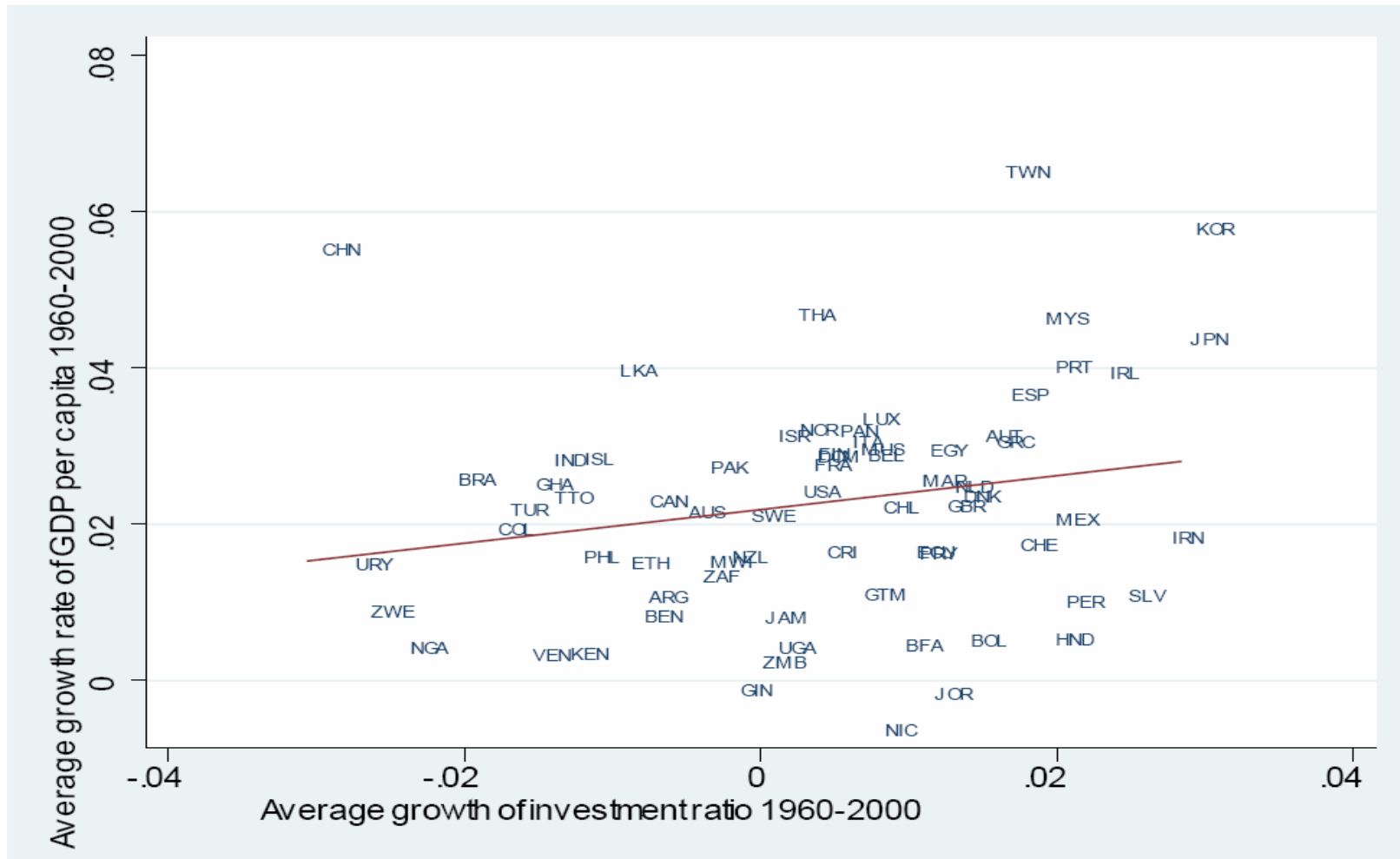
Countries are ranked in descending order of the percentage change in output per capita growth rate.

Source: OECD Economic Outlook, December 2000, Table A14.1.

The relation between schooling and growth



The relation between growth and investment



Growth and inequality in the distribution of income

The relation between growth and inequality in the distribution of income is bell shaped (Kuznets curve).

Income inequality increases as income increases up to a point, then the relation becomes negative.

High inequalities preserves incentives for entrepreneurs, but it also may reduce incentives for growth when it becomes too high (social unrest and insecurity, reduced investment in human capital,..).