Growth and development 2019-2020 40 hs. + 4hs. Collective tutorials

Part 1

1. Introduction: facts in search of explanation and growth paradigms
2. The neoclassical model
3. Cross-country convergence
4. Introduction to endogenous growth: the AK model
5. Human capital in the Solow and AK models
6. Growth accounting
7. Endogenous growth through variety-producing innovations
8. Endogenous growth through Schumpeterian creative destruction
9. Finance
10. Innovations and cross-country convergence/divergence

Mid-term examination (part 1): Thursday 7 November 2019, h. 12

Part 2

11. Competition, growth and innovation promoting institutions
12. Distance to frontier and policy
13. Poverty Traps
14. Stages of growth and structural change
15. Directed technological change and wage inequality
16. International trade and growth
17. Demand-led growth: Harrod model
18. Cumulative causation and export-led growth
19. Demand-led growth and automation
20. Growth and inequality: data and perspectives

2nd Partial examination (part 2)

Main Reference:
- P. Aghion, P. Howitt (2009), *The Economics of Growth*, MIT Press.
- additional material for download at my homepage

Final exam: written

Web page: http://docenti.unisi.it/maurocaminati/

Or reach my homepage from : www.deps.unisi.it

Lecture 1

Facts in search of explanation

Modern economic growth in historical perspective: *a 'recent' fact*

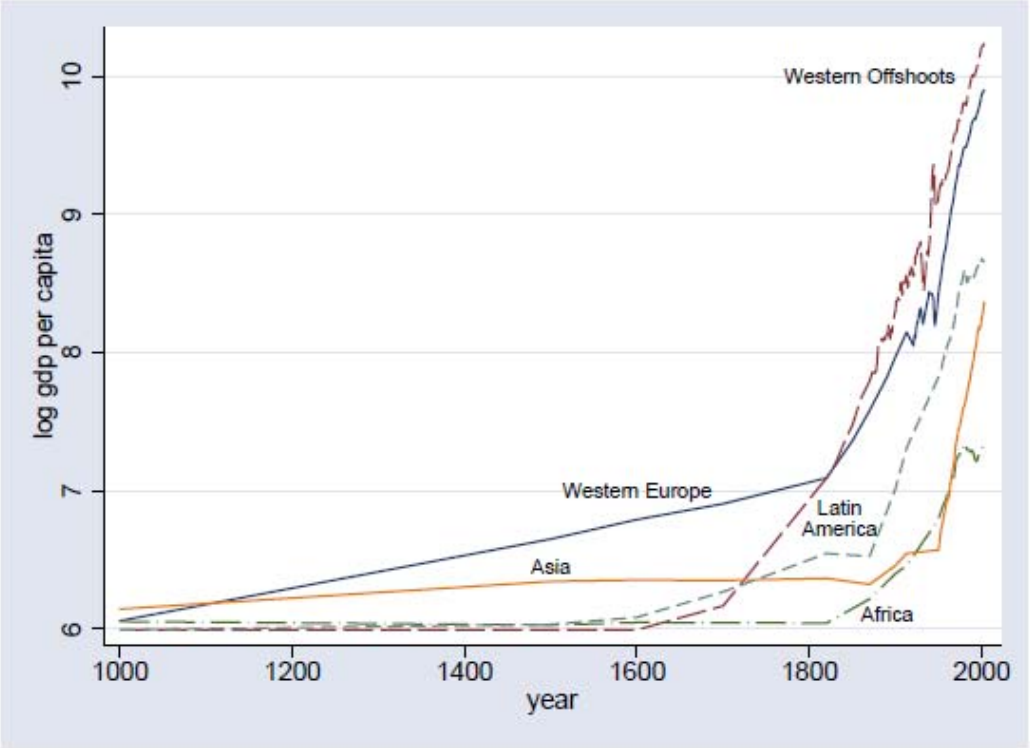


FIGURE 1.11. The evolution of average GDP per capita in Western Offshoots, Western Europe, Latin America, Asia and Africa, 1000-2000.

Western Offshoots: USA, Canada, Australia, New Zeeland

post-industrial-revolution era: early starters, and post-1950 East Asia miracle

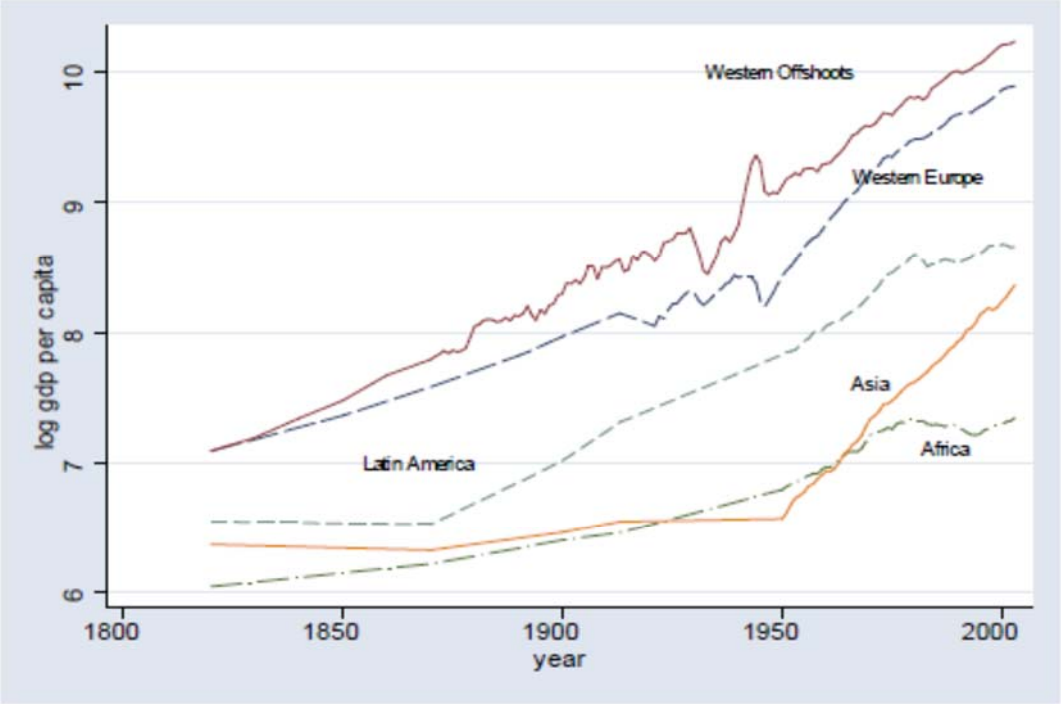


Figure: Evolution of GDP per capita 1820-2000.

Some disaggregation of post-industrial-revolution era

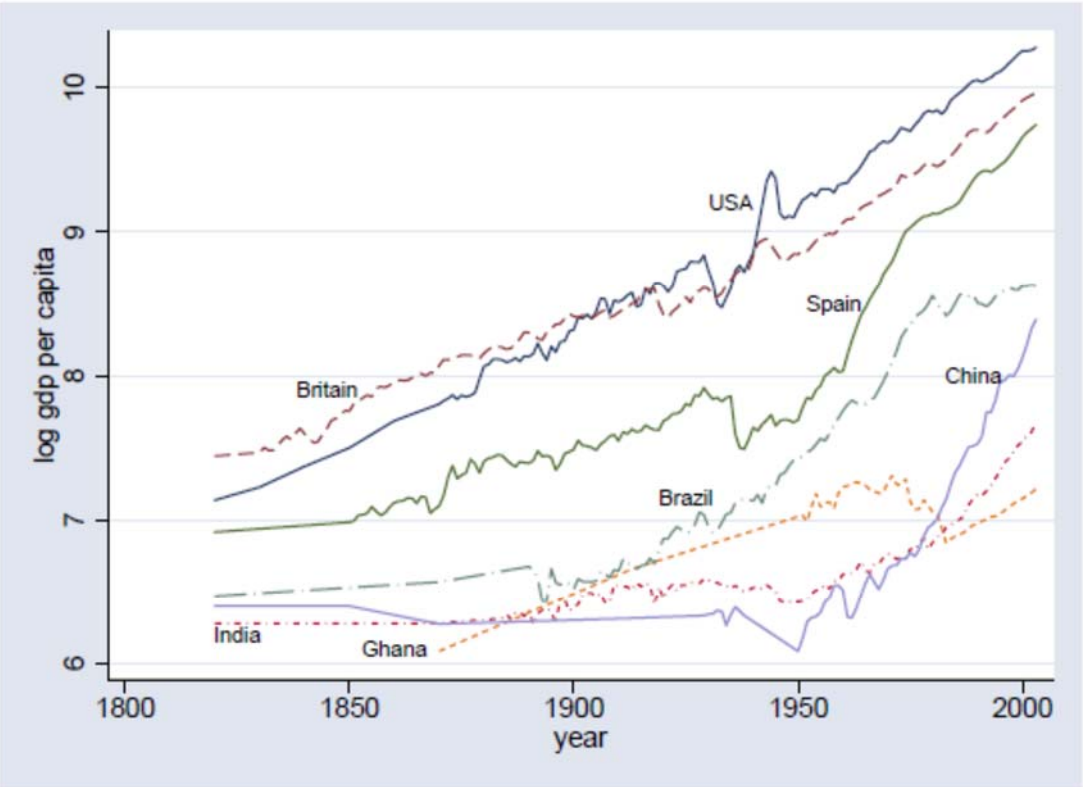


FIGURE 1.12. The evolution of income per capita in the United States, Britain, Spain, Brazil, China, India and Ghana, 1820-2000.

convergence in: per-capita GDP **growth rates,** per-capita GDP **levels**

- distinguish between: (a) convergence in per-capita GDP **growth rates**
  (b) convergence in per-capita GDP **levels**

- (b) implies (a), but (a) is a weaker notion than (b). For instance, convergence (equalization) of per-capita GDP **growth rates** is consistent with persistent differences in per-capita GDP **levels:**
Examples in the slide above are USA and UK; USA and Spain

- Use the term '*divergence*' for lack of convergence in growth rates

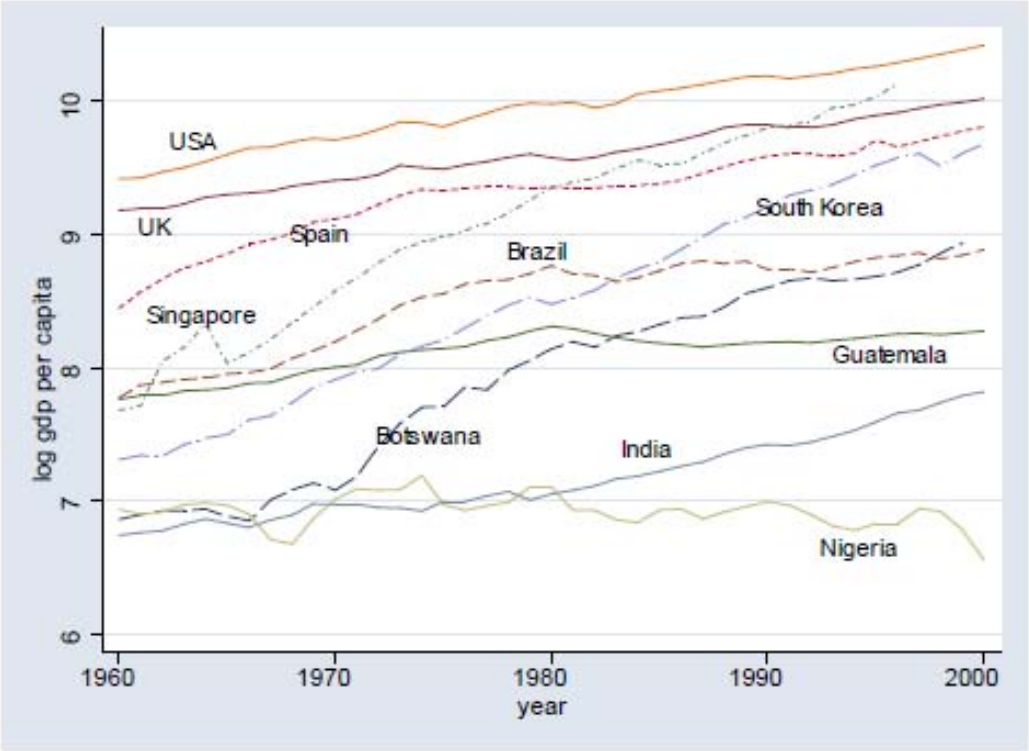


Figure: The evolution of income per capita 1960-2000.

Countries lagging behind in levels tend to grow faster than leading countries…

Countries lagging behind in levels often grow faster than leading countries…

Why?

a) *Neoclassical answer:* Higher marginal product of capital in backward countries caused by low K/L ratio
b) *Non-neoclassical answer*: Technology transfer from leading to backward countries (Gershenkron's "advantage of backwardness").

Also, there are relevant exceptions,

1. **divergence** (e.g. Nigeria)
2. convergence in growth rates may realize before convergence in per-capita GDP materializes, leading to **persistent per-capita GDP differences**
3. We observe also **leapfrogging** (Botswana and Guatemala; South Korea and Brazil)

A closer look at Sub-Sahara Africa

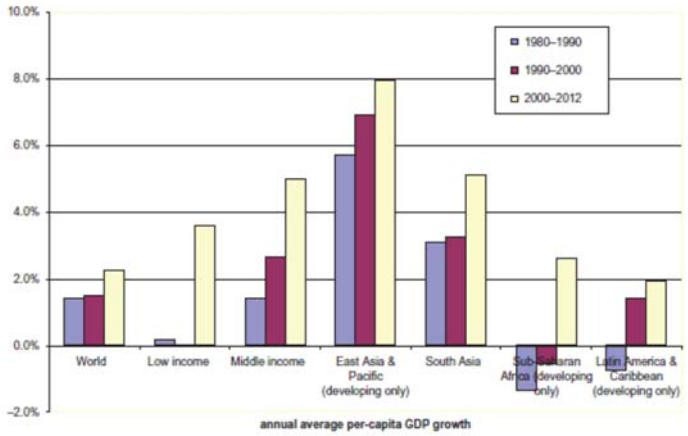


Figure 1: Growth performance of country groups since 1980.
Source: World Development Indicators, World Bank.

Still many SSA countries are less rich now than they were in 1960
Source: Rodrik 2016

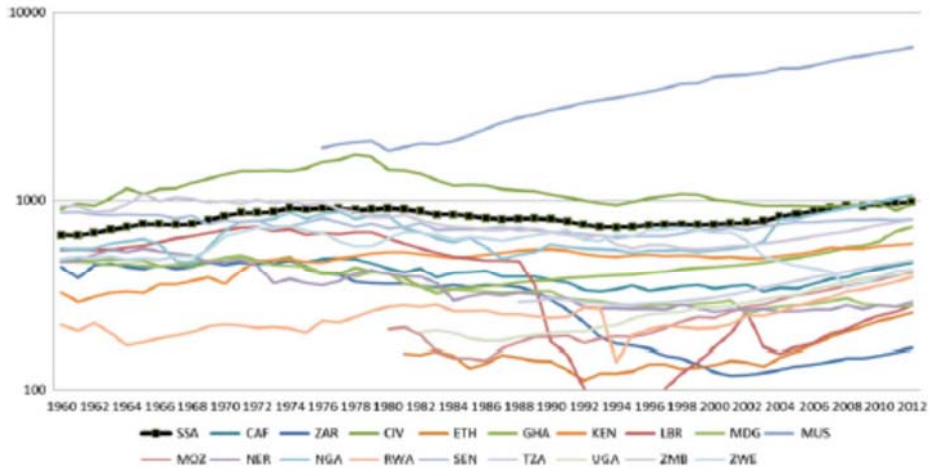


Figure 3: Economic performance in Sub-Saharan Africa, 1960–2012 (GDP per capita, constant 2005 $).
Source: World Development Indicators, World Bank.

Cross country distribution of *per-capita income* 1960-2000

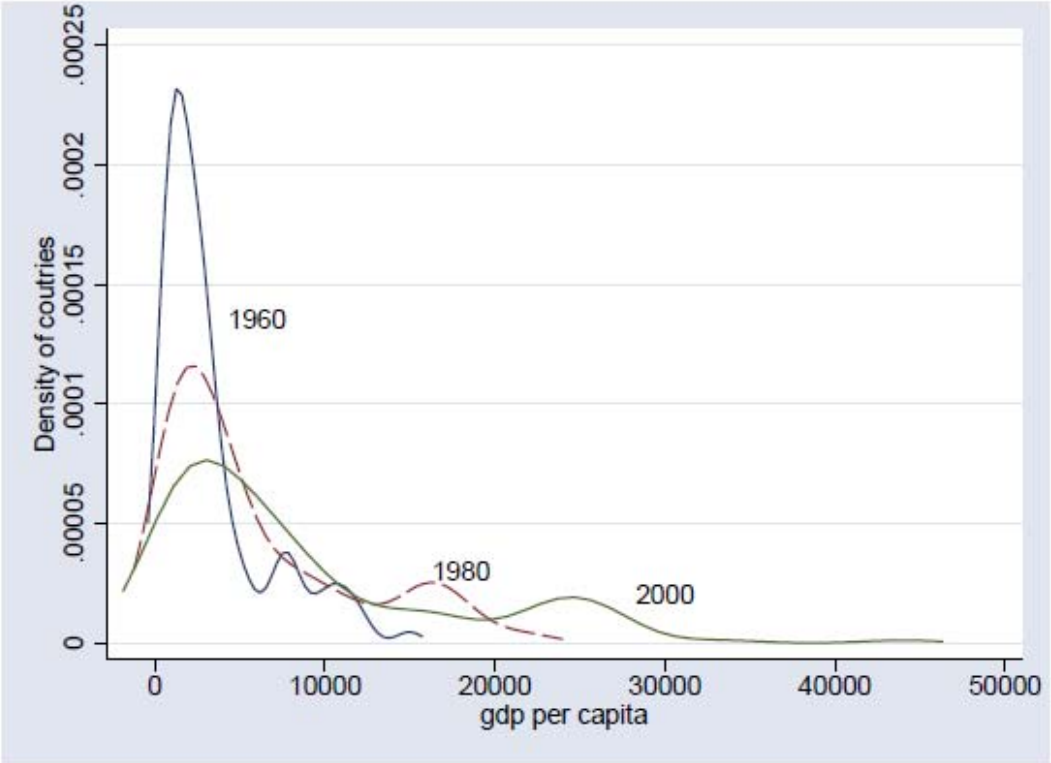


FIGURE 1.1. Estimates of the distribution of countries according to PPP-adjusted GDP per capita in 1960, 1980 and 2000.

1. more spread-out through time: rising cross country inequality?
2. mildly bimodal in 1980, 2000: evidence of *convergence clubs?*

Cross-country inequality is overstated by the observation that the per-capita GDP distribution is spreading out through time

- Part of the spreading out of the distribution in the Figure is because of the increase in average incomes.
- More natural to look at the log of income per capita when growth is approximately proportional:
  - when $x(t)$ grows at a proportional rate, $\log x(t)$ grows linearly,
  - if $x_1(t)$ and $x_2(t)$ both grow by 10%, $x_1(t) - x_2(t)$ will also grow, while $\log x_1(t) - \log x_2(t)$ will remain constant.

Example : suppose variables x_1 *and* x_2 grow at the exponential rate g

$$x_1(t) = ae^{gt} \qquad x_2(t) = be^{gt}$$

any initial difference $x_1(0) - x_2(0) = a - b$ *is amplified by* g

$$x_1(t) - x_2(t) = (a - b)e^{gt}$$ *grows through time*

take logs:

$\log x_1(t) = \log(ae^{gt}) = \log a + gt$ $\log x_2(t) = \log(ae^{gt}) = \log b + gt$

$\log x_1(t) - \log x_2(t) = \log a - \log b$ *constant through time*

taking logs of GDP per-capita we filter out any spreading out of the cross country per-capita GDP distribution caused by a common (world-wide) growth component

Cross-country distribution of log GDP per-capita: The **mean** increases (world growth)

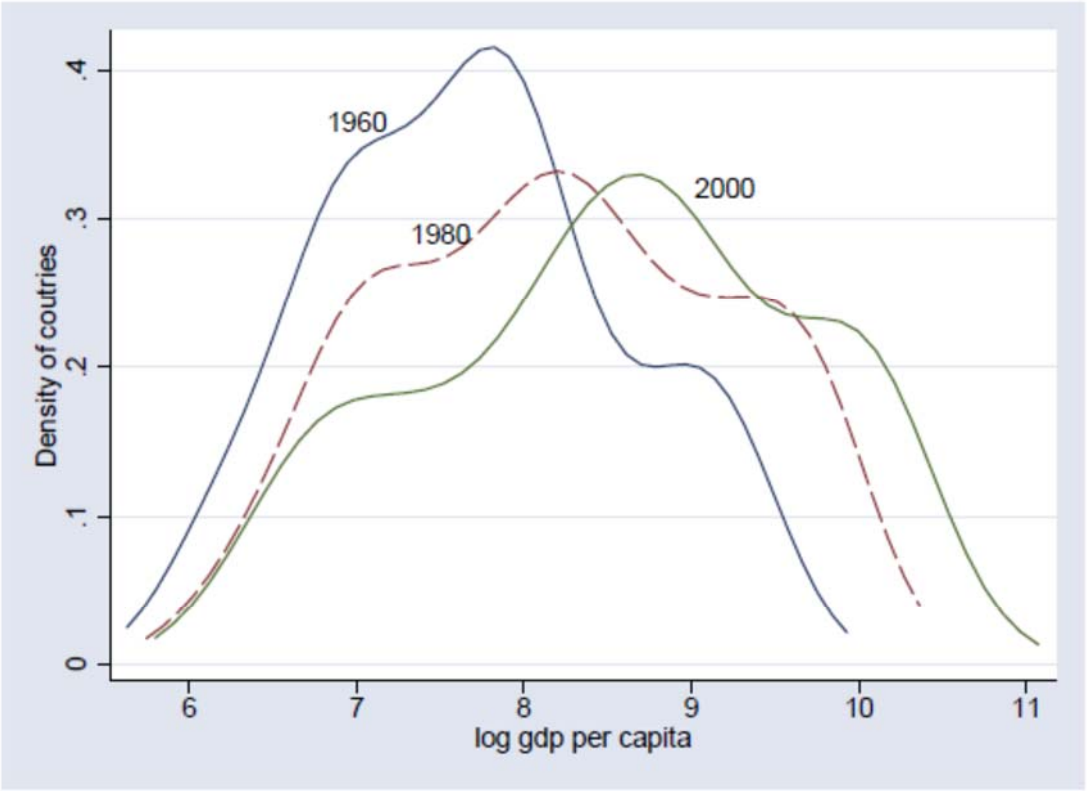


FIGURE 1.2. Estimates of the distribution of countries according to log GDP per capita (PPP-adjusted) in 1960, 1980 and 2000.

On average, world welfare is growing

Variance increases (distribution is more spread out): inequality grows

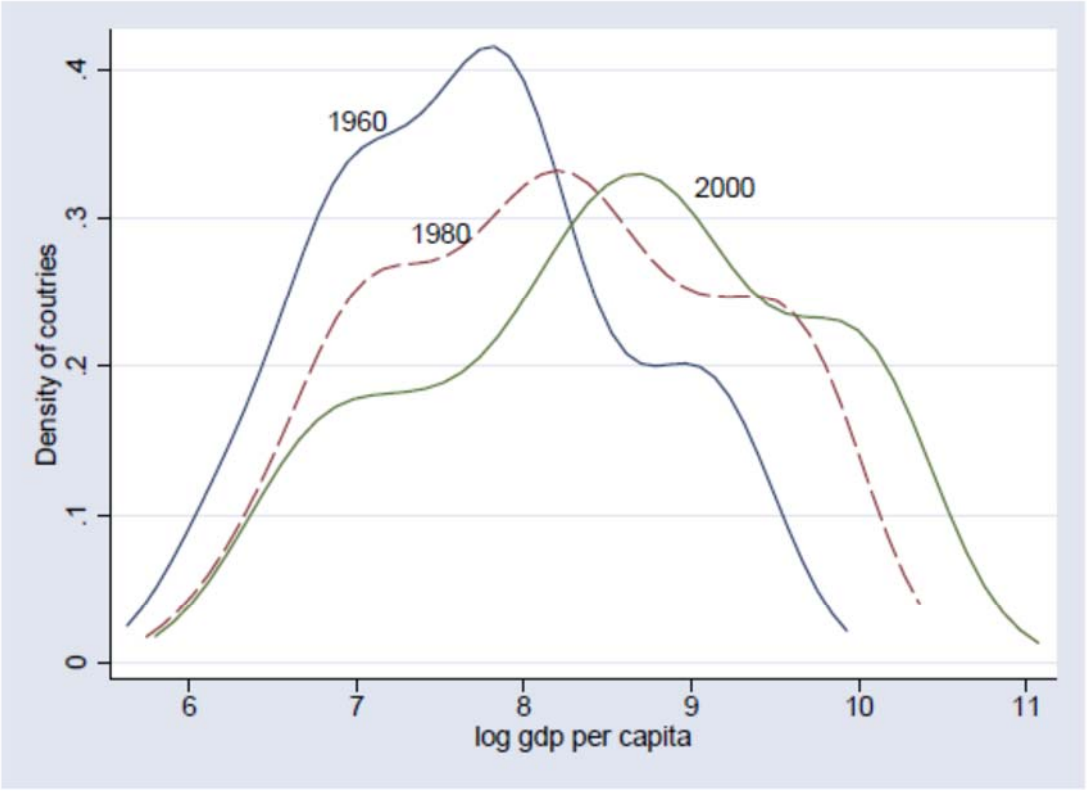


FIGURE 1.2. Estimates of the distribution of countries according to log GDP per capita (PPP-adjusted) in 1960, 1980 and 2000.

Asymmetry of distribution changes through time:

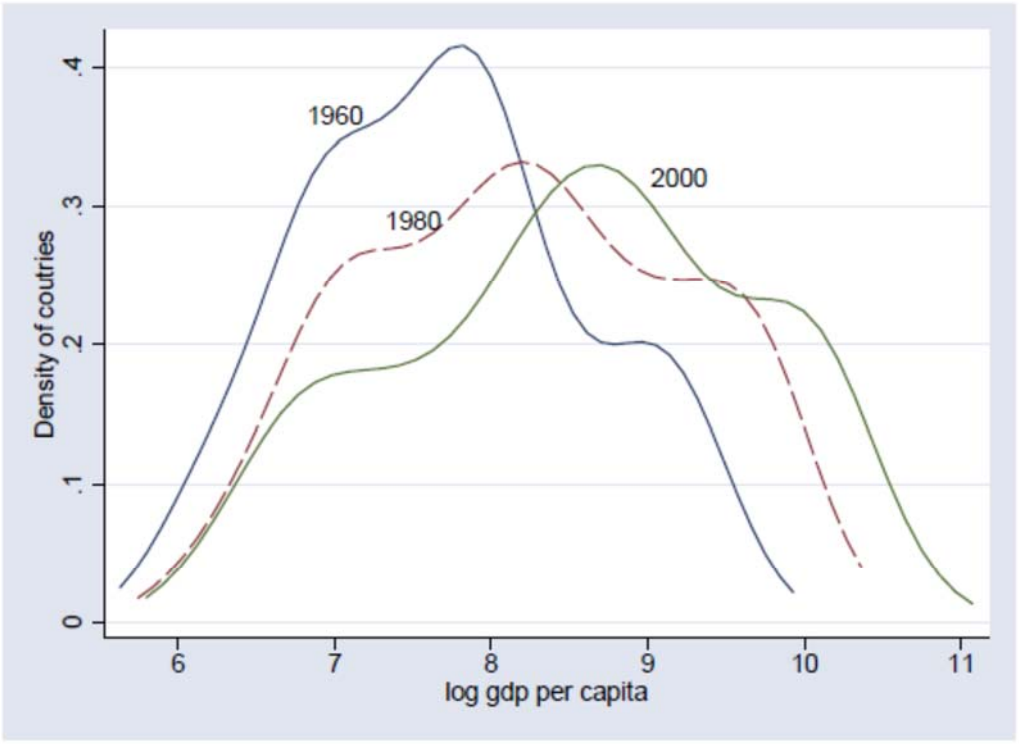


FIGURE 1.2. Estimates of the distribution of countries according to log GDP per capita (PPP-adjusted) in 1960, 1980 and 2000.

Asymmetry of distribution changes through time:

- **positively** (right) **skewed in 1960**: most countries have 'low' log GDP p.c.
- almost non skewed in 1980
- mildly **negatively** (left) **skewed in 2000**: a lower fraction of countries persists with 'low' log GDP per-capita

log GDP per-worker: *labor-productivity slow-down 1980 -1990*

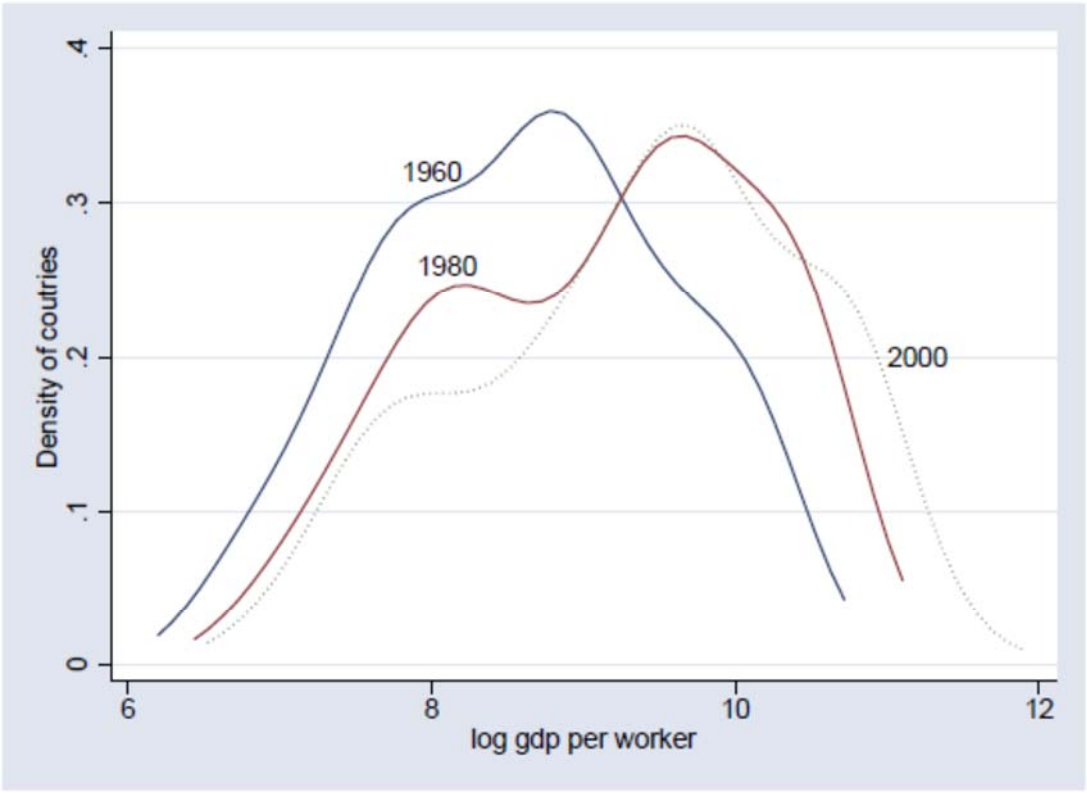


FIGURE 1.4. Estimates of the distribution of countries according to log GDP per worker (PPP-adjusted) in 1960, 1980 and 2000.

Population-weighted distribution of log GDP per-capita

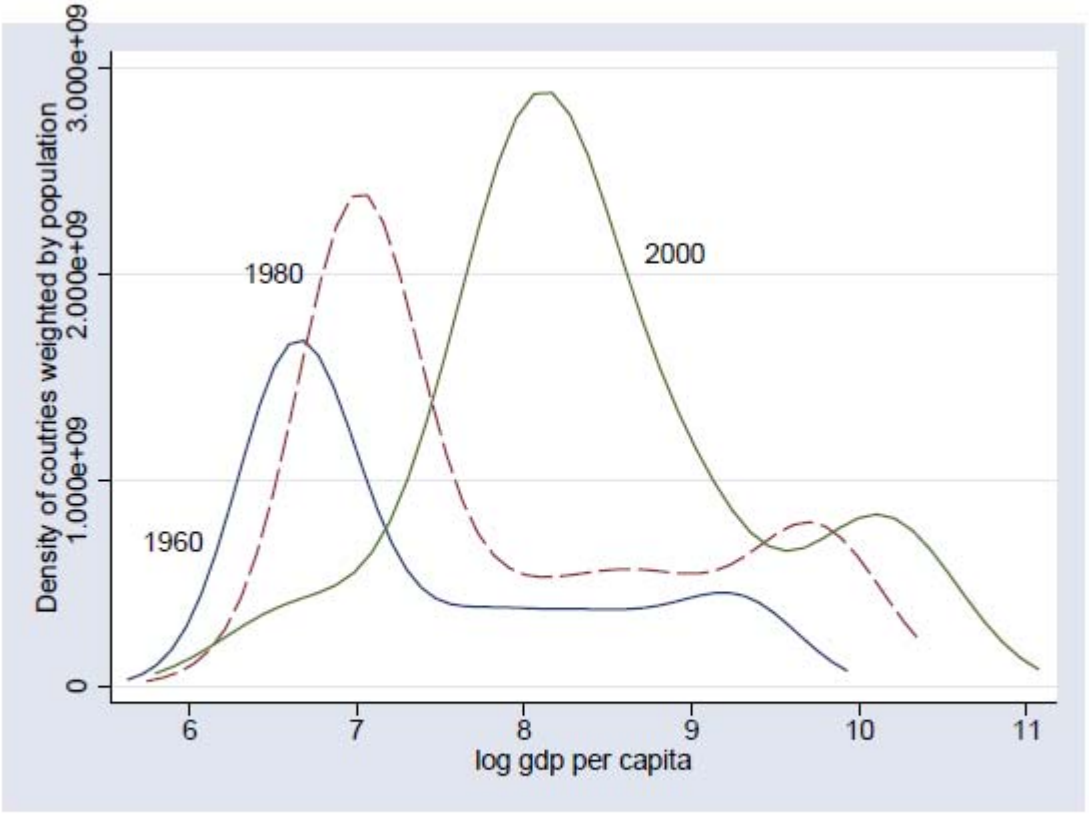


FIGURE 1.3. Estimates of the population-weighted distribution of countries according to log GDP per capita (PPP-adjusted) in 1960, 1980 and 2000.

If density of countries is weighted by population:

- larger changes in the mean of distribution 1980-2000
- tendency away from negative skewed distribution still present
- distribution mildly bimodal in 1980, 2000

Summing up:

- **world-wide growth** (increasing mean of log-GDP distribution)
- **rising cross-country inequality** (increasing variance of log-GDP distribution)
- evidence of **club-convergence** (population-weighted log-GDP distribution mildly bimodal)
- tendency away from positively skewed distribution: falling fraction of countries persisting with very low GDP per capita

Growth as a ‘long-run’ process

- The analysis of the growth process is focused on ‘long-run’ relations between economic variables
- Short-run, accidental fluctuations, are filtered out, to identify long-run tendencies: ‘the trend’
- The concept of **steady state** is a theoretical approximation of ‘the long run’

The steady state path

A steady state is a growth path, such that every variable grows at a constant rate <u>for ever</u>.

- There are variables such as income, or the capital stock, that are in principle unbounded over an indefinitely long time interval
- Other variables are **by definition bounded**, like the share of employment in services, the average propensity to consume, the share of profits in income
- On a steady state path, the growth rate of a bounded variable must be zero! This variable is **constant** on a steady state path

Are steady states empirically relevant? Kaldor (1961) stylized facts and the long-run persistence of factors shares in income in the 20th century

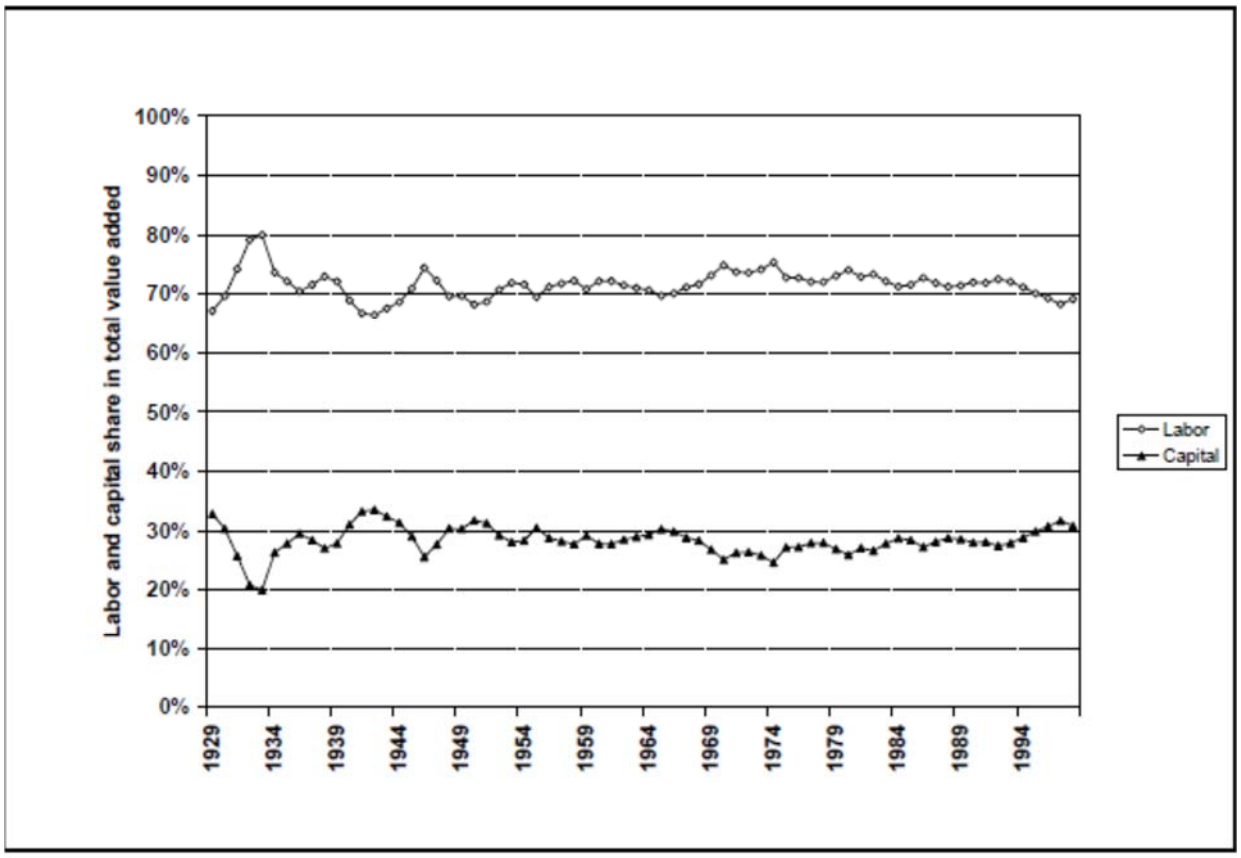
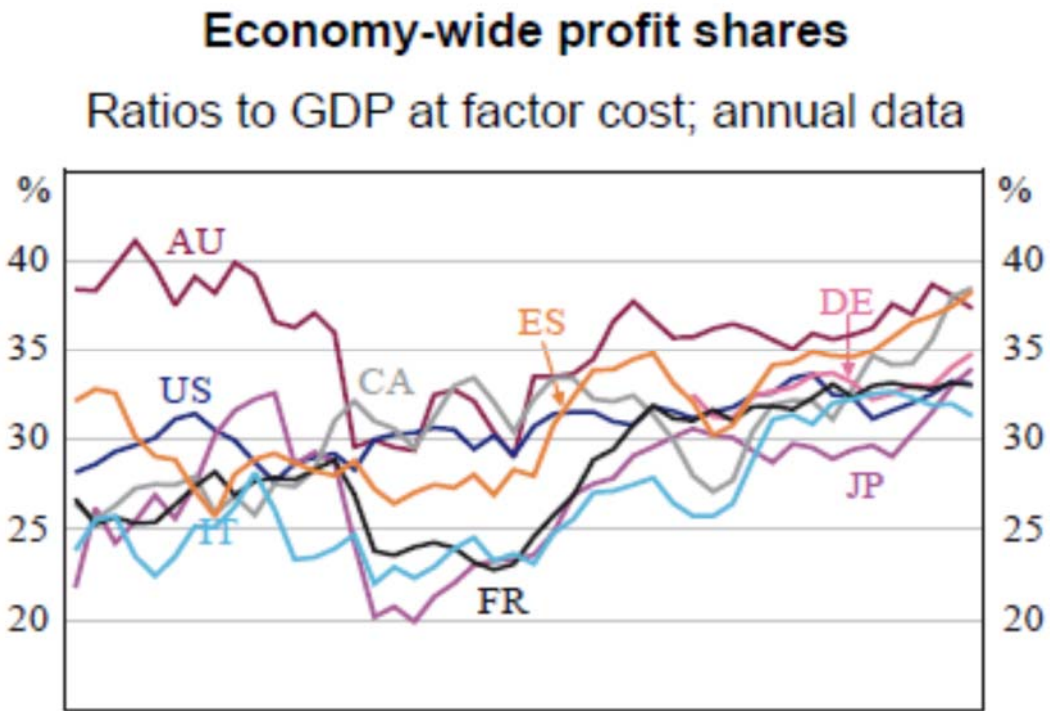


FIGURE 2.11. Capital and Labor Share in the U.S. GDP.

Blow-up of the post 1960 period: profit shares 1960 - 2005



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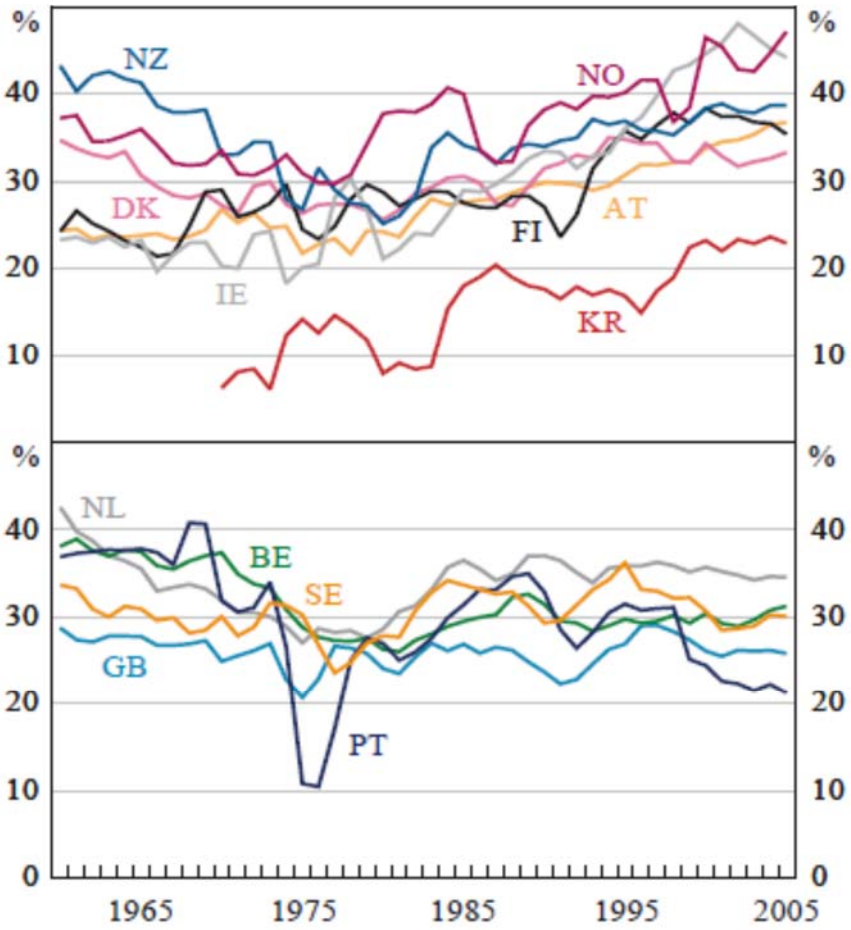
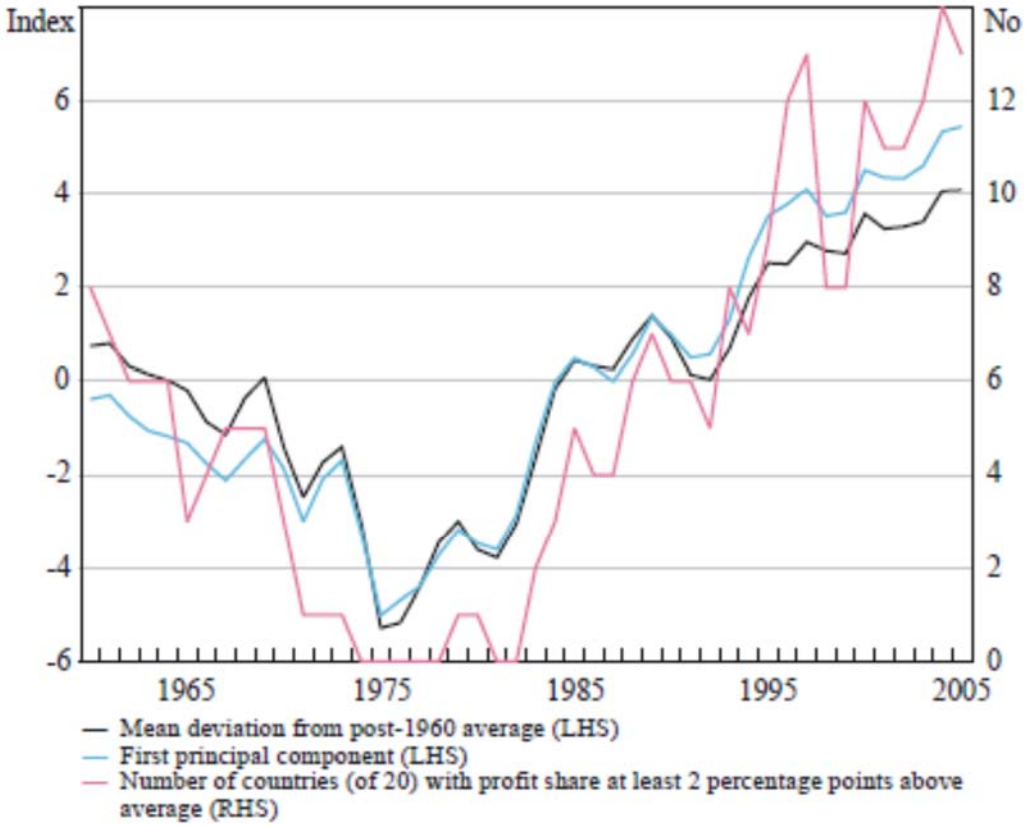


Source: European Commission; authors' calculations

Reproduced from Ellis, Smith (2010)

Economy-wide profit shares

Various measures of the common trend; annual data



Source: European Commission; authors' calculations

Reproduced from Ellis, Smith (2010)

Remark 1:

- The steady state is, at best, a theoretical approximation
- Writing growth models that admit steady-state solutions is a convenient, simplifying, way of theorizing. It is not a compelling requirement.
- Implications should be interpreted with great care

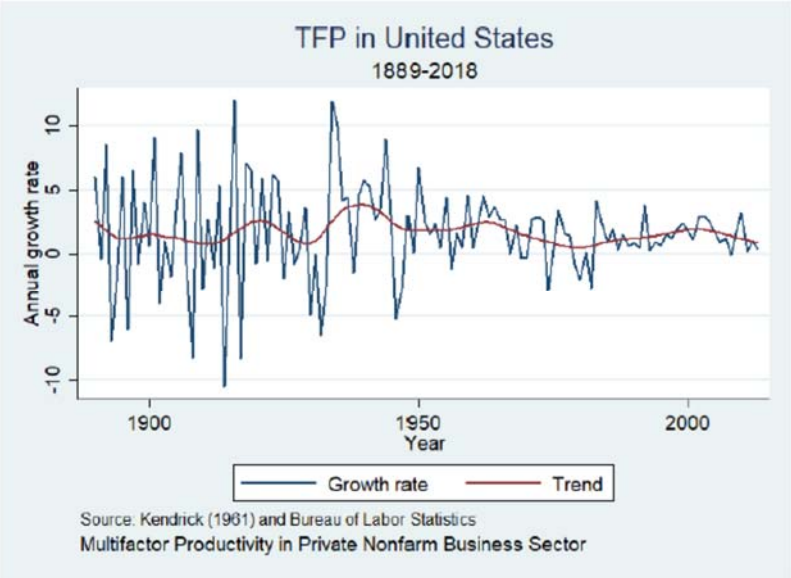
Remark 2:

What is the explanation of the rising profit share in many advanced countries after 1980? Candidate explanations are:

- Technological change + outsourcing
- Institutional change
- Growing financial intermediation

Technological progress: a secular view

Total-factor-productivity (TFP) growth in the USA: 1889-2018

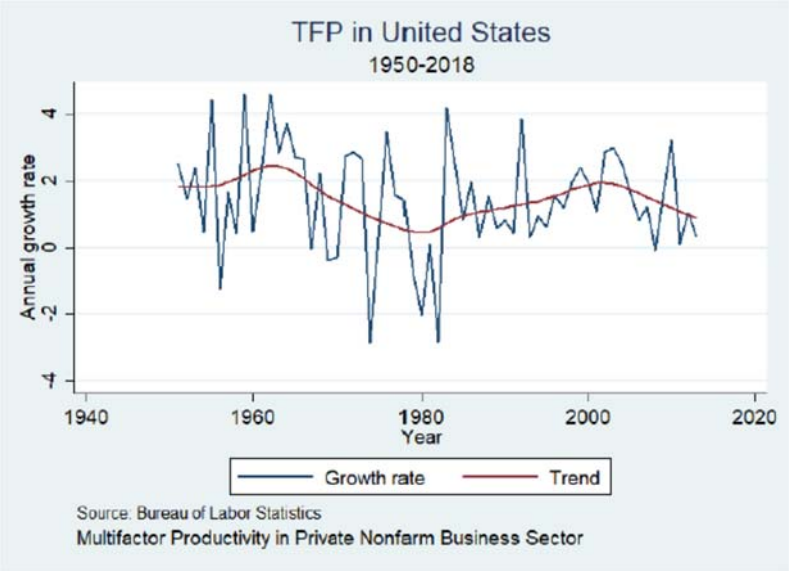


Secular slow-down of TFP growth in the USA

Table III. Statistics for multifactor productivity, 1889 – 2018

Average growth rates		
	Non-adjusted estimates	BLS adjusted estimates
1889 – 20	1.498	
1920 – 50	2.369	
1950 – 72	1.937	1.774
1972 – 96	0.976	0.637
1996 – 07	1.771	1.225
2007 – 18	0.985	0.531

TFP growth in the USA after 1950



Searching for the cause of the secular fall in TFP growth

the post-1970's fall in the wage share and in TFP growth are common to the USA and many other advanced countries. Is there a relation between them?

- **Some say "no": the slow-down in TFP growth is a supply side fact related to the nature of technological progress (cf. Gordon)**
- **Others, including myself, suggest a qualified "yes": a lower wage share, through the negative effect on demand, may affect growth and technological progress also in the long run.**

We shall try to interpret the facts above (and others not covered by these slides) by referring to three groups of theories:

- **Neoclassical theory: Solow model, Ramsey-Cass model, neoclassical model with human capital (Mankiw, Romer, Weil 1992)**
- **New growth theory: Lucas 1988, Aghion-Howitt 1992, Grossman-Helpman 1991**
- **Post Keynesian growth theory and Verdoorn-Kaldor law**

What theories to explain the stylized facts on growth?

- **Every theory contains a number of simplifying restrictions (e.g. restrictions necessary to the existence of a steady-state solution)**
- **Criteria to reject or validate a growth model**

How do We Assess Models?

(i) Karl Popper's approach of "conjectures and refutations"

The linear model of scientific progress

Theory ⇒testing ⇒ rejection of hypothesis ⇒ new better theory ….

Science objectively progresses over time

Methodological prescription:
Theoretical hypotheses rejected by empirical tests should be abandoned

(ii) Thomas Kun's "Structure of Scientific Revolutions"

(a) 'Normal science' = theory development along a **scientific paradigm**

(b) Paradigms are built around a set of a-priori theoretical postulates

(c) 'Revolutions' = paradigm change

(d) Different paradigms may not be commensurable

(e) Falsified predictions do not necessarily entail rejection of a paradigm

(f) Conversely, paradigm change is not equivalent to unambiguous 'scientific progress'

(g) development of science may not be linear

two influential paradigms in growth theory

1. Neoclassical growth (Solow, Ramsey-Cass) + endogenous growth
   Basic postulates:

- Optimizing behavior of agents
- Supply orientation: focus on full employment equilibrium
- Abstraction from unemployed factors justified by focus on long-run growth of GDP per-capita, largely determined by growth of GDP per employed worker

- Emphasis on material factor accumulation (Solow, Ramsey-Cass)
- Emphasis on knowledge accumulation (endogenous growth models)

2. ‘Keynesian’ growth theory (Harrod, *late* Kaldor, Kalecki, neo-Ricardians)

Basic postulates:

- Under-employment of labor and capital is a normal state of affairs producing an **inherent flexibility of the economic system**.
- **Growth is demand constrained** and demand induced. Demand is the prime engine of growth.
- The flexibility of the economic system is a source of a self-reinforcing processes of ‘**cumulative causation**’.

Both paradigms do not survive Popper's criteria:

1. Neoclassical exogenous growth theory is prima-facie falsified by:
   Evidence of divergence in GDP per capita across countries

2. Keynesian growth theory is prima facie unable to explain take-offs spurred by supply factors.

Research Paradigms survive because economists do not use Popper's criteria:

(iii) Conventionalist research methodology 1

- **Theories** are not 'true' or 'false' because they **are tools for predictions**, and like proper tools, should be used only when applicable. Different theories may be required for different problem situations.
- *Methodology widely applied in economics*

Research Paradigms survive because economists do not use Popper's criteria:

(iii) Conventionalist research methodology 2

- **' *As if* ' theorizing**.
  Example: Successful firms and agents in the real world behave *as if* they were efficiently solving optimization problems. Firms do not properly optimize, but only those most closely approaching an optimal solution survive, the others simply die out. (M. Friedman)

- Optimization is an "ex-post" outcome produced by economic selection.

If each of the previous methodological approaches contains a grain of truth, the contrast between scientific paradigms in growth theory is better understood in the light of Lakatos' approach:

(iv) Lakatos' Methodology of scientific research programs

A research programme (neoclassical, Keynesian or other…) is not a single hypothesis or theory… It **is an organic unit, which contains both rigid and flexible components**

- essential, structural components ‘**hard core**’
- non-essential components ‘**protective belt**’

Lakatos' Methodology of scientific research programs'

- 'hard core'
- 'protective belt'

supplementary hypotheses are added to the protective belt, with the aim of bringing a larger set of facts under the domain of the theory:

supplementary hypotheses are progressive if they yield testable propositions, which are empirically corroborated.

In recent decades an expansion of protective belts has taken place.

New growth theory adds new hypotheses to the neoclassical hard-core:

- **increasing returns, externalities, deviations from perfect competition** can explain technological progress, the possibility of market failures, inefficiency, poverty traps.
- **institutions** are a fundamental cause of growth; factor accumulation is only a proximate cause. Political and economic institutions co-evolve (Acemoglu).

- New growth theory has been used to explain many growth puzzles.

- Protective-belt expansion of Keynesian growth theory was also taking place, but it was less significant.

The course provides intermediate level knowledge of neoclassical and new growth theory, and contains a brief introduction to Keynesian growth theory.

Theories are discussed with reference to the stylized facts of growth