

**INTRODUCTION TO ECONOMIC GROWTH
– REGULARITIES AND ISSUES**

Carl-Johan Dalgaard
Department of Economics
University of Copenhagen

WHY WORRY ABOUT GROWTH IN INCOME?

Economic growth is not “development”

Yet in some respects economic growth does seem to be a necessary (but not sufficient) condition for progress. Something pretty basic is life expectancy

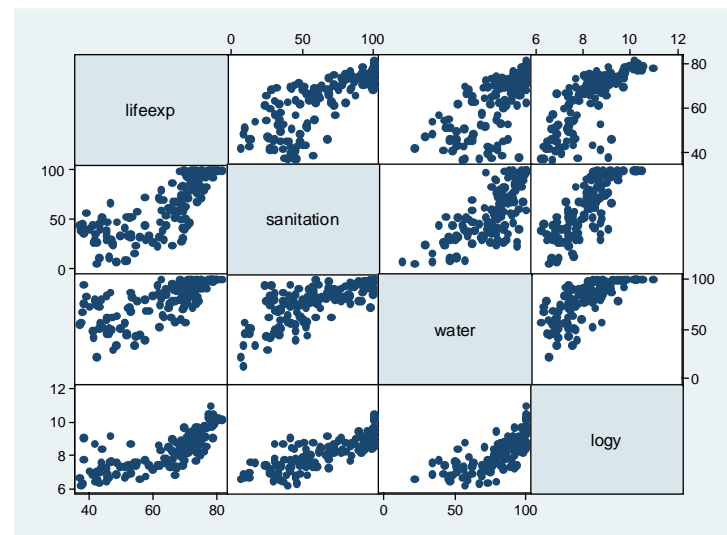
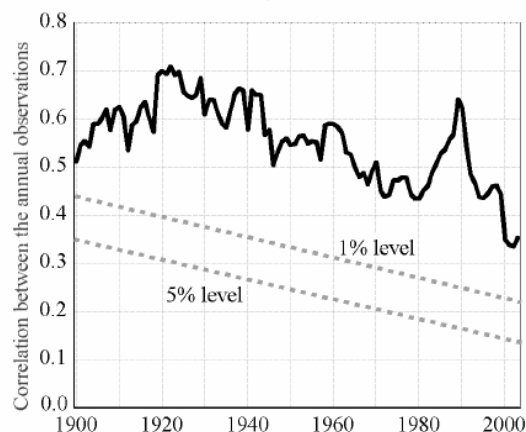


Figure 1: The figure shows the correlation between GDP per capita (logy) and life expectancy at birth (lifeexp), the fraction of population with access to “proper” sanitation (%) and with access to safe water supply (water). The year is 2002. Data source: World Development indicators 2005.

WHY WORRY ABOUT GROWTH IN INCOME?

Another indicator which is highly correlated with GDP per capita is political rights

Figure 1. The annual correlation between income and democracy, 1900-2003



Notes: There are only about 30 observation pairs in the first years compared to about 150 observation pairs in the last years of the 20th century. The increase in the number of observations is reflected in the declining slope of the curve of correlation points and the corresponding decline of the (interpolated) level of correlation that is necessary in order to pass conventional levels of statistical significance.

Figure 2:

Much evidence suggest that prosperity brings political rights. Controversy exist as to whether its “inevitable”, and as to whether political rights affect prosperity.

WHY WORRY ABOUT GROWTH IN INCOME?

Another pretty basic thing people care about (supposedly, at least) is consumption.

Think about the fundamental income identity from National Accounts

$$Y = C + I + G + EX - IM$$
$$\Updownarrow$$
$$\underbrace{Y + IM}_{\text{Supply of goods}} = C + I + G + EX$$

Hence, the ability of a society to consume is ultimately limited by the total output it produces (i.e., GDP). The availability of goods to be consumed by *each citizen*, i.e. “the standard of living”, is ultimately limited by GDP *per capita*.

WHY WORRY ABOUT GROWTH IN INCOME?

Hence, economic growth is a pre-condition for higher levels of consumption.

It is most likely also a driving force behind increasing life expectancy (nutrition, sanitation and health investments)

Possibly also related to the extension of the franchise (albeit more controversial)

At the same time there is a darker side to the growth process.

WHY WORRY ABOUT GROWTH IN INCOME?

Pollution, for instance:¹

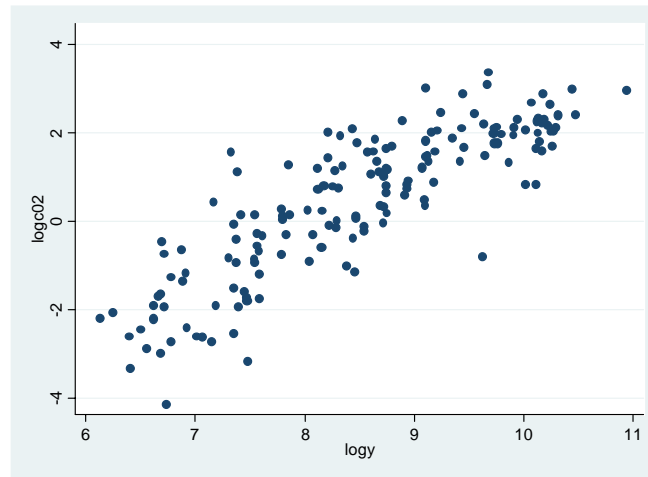


Figure 3: Log CO2 emissions per capita versus GDP per capita.

Some forms of technological change is a force for “good” (e.g., penicilin), and spurs growth. Other types of technology can spur growth (e.g., nuclear power), and yet be immensely destructive (e.g., nuclear power used as a weapon)

¹There is a caveat to this “result”: There is a literature on the “Environmental Kuznet’s curve”, which suggests pollution declines eventually, with income. The extent to which it holds true, and if so, where the “peak” level is reached is still in dispute.

FUNDAMENTAL FACT: PERSISTENT GDP PER CAPITA GROWTH IS A RECENT PHENOMENA

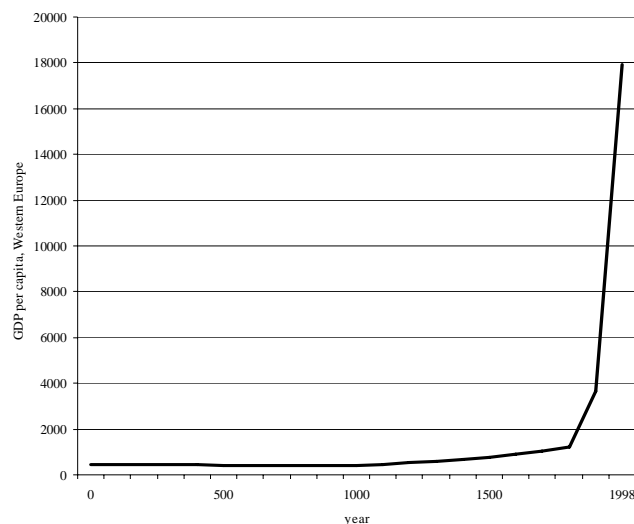


Figure 4: The Figure shows estimates of GDP per capita for Western Europe, Year 0-1998. Source: Maddison (2001): "The world economy - a millennial perspective".

If we think of time passed since the emergence of modern man as 1 hour then much evidence suggest that Western Europe has been growing for about 10 seconds. This course really only concerns the period **after** the “kink” aka “the industrial revolution”.

ISSUES AND REGULARITIES

1. The process of economic growth and the “Kaldorian Facts”
2. How to compare living standards across countries
3. Cross Country Evidence:
 - A. International growth difference
 - B. International income differences
 - C. Global inequality.

1. THE PROCESS OF GROWTH IN RICH PLACES

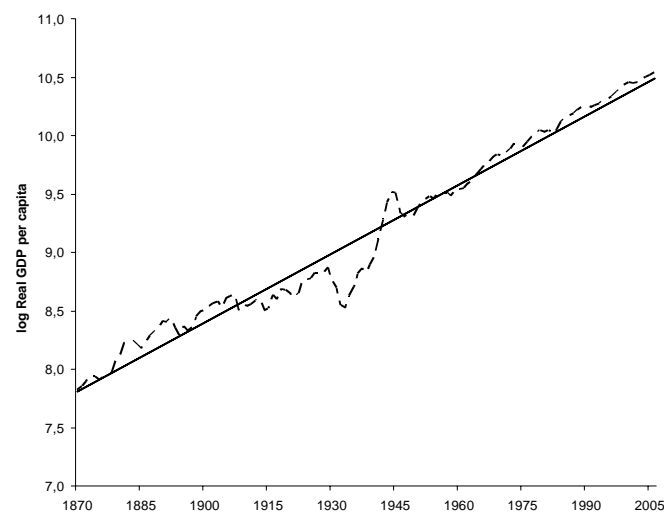


Figure 5: Log real GDP per capita in the US, 1870-2006. Data source: Johnston and Williamson (2007)

In some ways mysterious: Two world wars (total collapse of trade after no. 1; globalisation again after end of 2nd), structural change (agriculture-industry-services), mass education, origin of the Welfare State (DNK); female labor participation etc.

In spite of this: constant growth at about 2% per year.

1. THE PROCESS OF GROWTH IN RICH PLACES: STABLE GROWTH

Appreciating growth rates: What does 2% annual growth mean?

If GDP per capita grows at a constant exponential rate of g , and time is discrete ($t = 0, 1, 2..$), we have

$$y_t = (1 + g)^t y_0$$

and so

$$\frac{y_{1992}}{y_{1870}} = (1 + 0.019)^{122} \approx 10.$$

Note also: tiny growth differences packs a punch in the long-run

$$\frac{y_t^{1992, \text{Counterfactual}}}{y_t^{1992, \text{actual}}} = \left(\frac{1 + 0.018}{1 + 0.019} \right)^{122} = 0.88,$$

i.e., 12% lower standard of living from foregoing a mere 1/10th of a percentage point in average growth.

1. THE PROCESS OF GROWTH IN RICH PLACES

Nicolas Kaldor (1961) was among the first to point out that *growth in per capita GDP did not exhibit any tendency to decline over time* (i.e., “stable growth”).

But Kaldor also made other observations which he felt a sensible theory of growth *also* should be able to come to grips with:

The real rate of interest is fairly constant over long periods of time.

The share of wages in total output (aka “Labor’s share in national accounts”) is fairly constant over long periods of time.

– The last two “facts” *implies* a third ...

1. THE PROCESS OF GROWTH IN RICH PLACES

Recall (?) that we can calculate GDP by adding up all incomes received by economic agents contributing to production:²

$$Y = \text{Total wage income} + \text{total capital income} = wL + rK,$$

where w is the wage, L is employment, r is the return on capital (K) investments.

Now, Kaldor observed that

$$\frac{wL}{Y} = \text{constant}$$

But from the identity

$$1 = \frac{wL}{Y} + \frac{rK}{Y}$$

So *capital's share is also constant by construction*. As r is constant \Rightarrow K/Y is constant over time as well.

²National accounts “gymnastics”. You can calculate GDP in 3 ways: Expenditure approach (slide1, basically), the income approach (this one) and the product approach.

1. KALDOR'S FACTS

(1) No tendency for GDP per capita growth to decline, constant growth.

(2) Constant relative shares (wL/Y , rK/Y).

(3) Constant r .

From these three regularities, follows: Constant K/Y ratio, and so capital grows at the same rate as GDP. Also: wages grow at the same rate as Y/L (cf. constant wL/Y ratio). Nice illustrations of 1-3 are found in the textbook (p.50, 52-53)

Some people take these fact's a bit too literally. That is, nearly as "laws". Kaldor sure wouldn't have wanted us to; here is his opinion, which also explains why we bother with them...

Since facts, as recorded by statisticians, are always subject to numerous snags and qualifications, and for that reason are incapable of being accurately summarized, the theorist, in my view, should be free to start off with a “stylized” view of the facts – i.e. concentrate on broad tendencies, ignoring individual detail and proceed on the “as if” method, i.e. construct a hypothesis that could account for these “stylized” facts, without necessarily committing himself on the historical accuracy, or sufficiency, of the facts or tendencies thus summarized.³

* This is how 1-3 became known as “**Kaldor’s Stylized Facts**”; Do **not** consider these regularities as “accurate”, but as tendencies; we would want *models* that motivate (are consistent with) these tendencies.

³Kaldor, N., 1961. Capital accumulation and economic growth. In Lutz and Hauge (eds.) “The Theory of Capital”, McMillan, London. p. 178.

1. GROWTH IN POOR PLACES: NON-Kaldorian

Currently poor countries rarely display the same sort of “persistency” in growth performance.

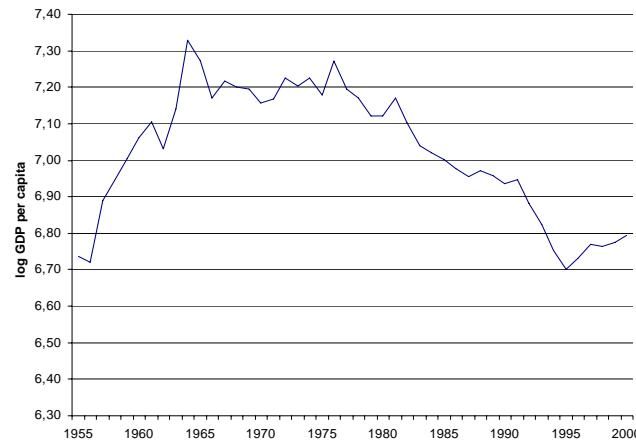


Figure 6: Growth of GDP per capita in Zambia 1955-2000 - No so Kaldorian. Data: Penn World Tables Mark 6.1.

Judged from time series evidence such as this (see also the textbook for other illustrations) it is safe to conclude that growth rates are *not* “relatively constant” over time, in poor places. We want to understand why Kaldor might be right in some places, and not in other places.

2. HOW TO COMPARE LIVING STANDARDS ACROSS COUNTRIES

Within a country: We can examine the evolution of GDP per capita in (constant) local currency units.

Across countries? Convert to common currency (US\$, say); GDP in Denmark in US\$ vs. GDP in China in US\$. Problem: Exchange rates are volatile.

Alternative conversion factor: “Purchasing Power Parity” exchange rate. Captures the value of a currency in terms of its ability to purchase similar goods

Example: *Official* D.kr./Yuan Exchange rate (January 31st 2007) was 0.74; 1 Yuan costs 0.74 D.kr.

2. HOW TO COMPARE LIVING STANDARDS ACROSS COUNTRIES

February 1st: Price of Big Mac in DNK: 27.75 D.kr. In China: 11 Yuan. The *PPP exchange rate* for Big Macs: 2.52.

In other words: You need to spend D.kr 2.52 kroner to be able to buy in Denmark the equivalent of 1 Yuan's worth of Big Mac's in China. In terms of purchasing power the Chinese are richer measured in PPP terms.

Repeat for many goods \rightarrow *PPP exchange rate* to convert GDP numbers into comparable units.

Makes a difference: *PPP* GDP per capita in Denmark in 2002: 27000 PPP\$ (common currency: 35000, p.3). *PPP* GDP per capita in China, in 2002, was 4000 (up from less than 1000 in common currency).

2. HOW TO COMPARE LIVING STANDARDS ACROSS COUNTRIES

A final data issue concerns whether to use GDP per capita, or, GDP *per worker*. (“workers” means “labor force”)

In 2002: PPP GDP per worker in China was 6761 US\$, and 48661 in Denmark.

Living standards (GDP per capita) vs. Labor *productivity* (GDP per worker)

Some argue GDP per worker is a better measure of living standards than GDP per capita (Unofficial economy; see §2.1. in textbook). Over-estimation of living standards though - productivity lower in unofficial economy.

3A. CROSS COUNTRY EVIDENCE: GROWTH DIFFERENCES

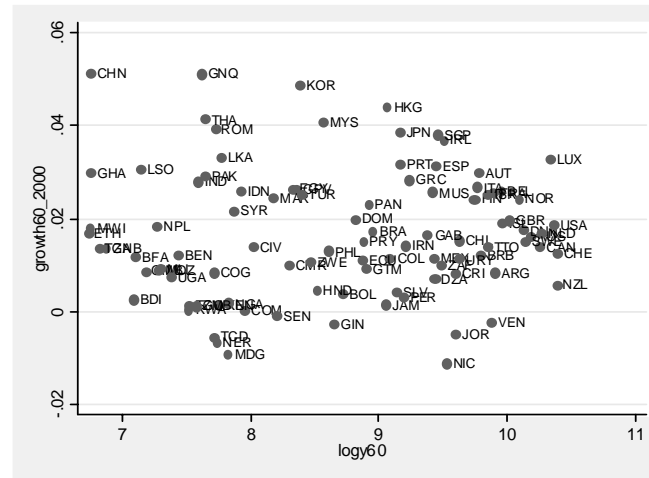


Figure 7: Growth in GDP per worker 1960-2000 vs. log GDP per worker 1960, 97 countries. Data source: Penn World Tables 6.2

Note: Some countries have been shrinking, on average, for 40 years!
Large growth differences: Up to 7 percent per year! (Remember what 0.001 percentage point difference could do?)

Note also: Initially poor are not “outgrowing” initially rich; similar to “Gibrat’s Law of Proportionate Effect” (firm’s).

3A. CROSS COUNTRY EVIDENCE: GROWTH DIFFERENCES

If we focus attention on countries that are “similar”, another picture emerges

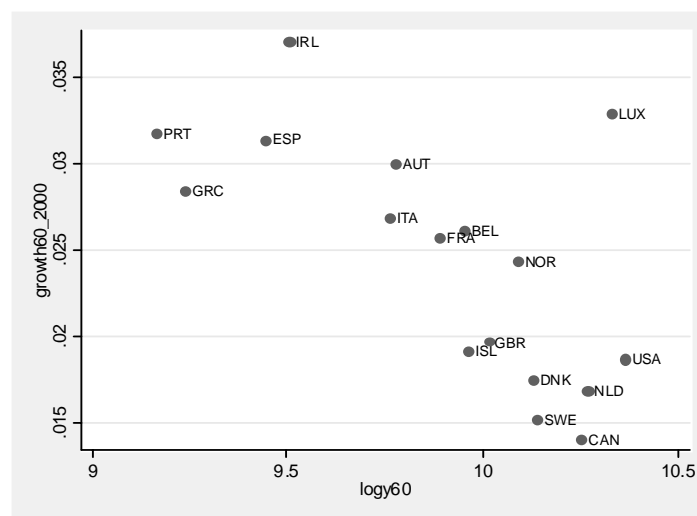


Figure 8: Growth in GDP per worker 1960-2000, 17 original OECD member countries. Data source: Penn World Tables 6.2 .

3A. CROSS COUNTRY EVIDENCE: GROWTH DIFFERENCES

Also true if we look at the poorest countries ...

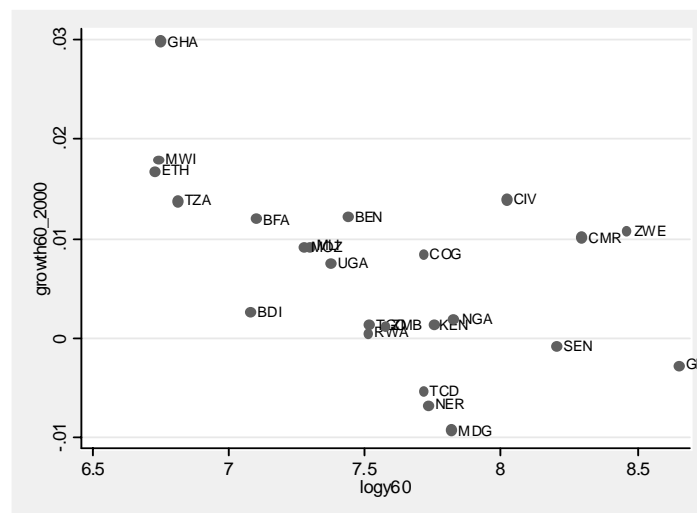


Figure 9: Growth in GDP per worker, 1960-2000: 24 tropical sub-saharan African countries. Data source: Penn World Tables 6.2

Our theories better explain *why*.

3B. CROSS COUNTRY EVIDENCE: INCOME DIFFERENCES

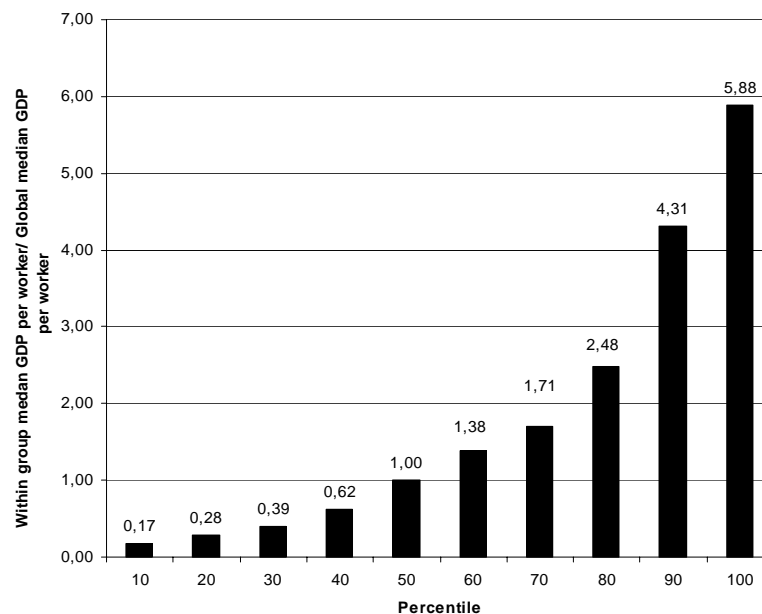


Figure 10: The numbers refer to the year 2000 and are PPP corrected. Source: World Development Indicators CD-rom 2004.

Moving from median in the top group to median of lowest group: Difference on a scale of 1:35. Our theories should motivate such differences quantitatively.

3C. CROSS COUNTRY EVIDENCE: INEQUALITY

A final issue is whether the *dispersion of levels* of GDP per capita, or worker, across countries, is falling or not. That is, is the “World distribution of Income” becoming more or less equal?

But how do we measure it?

Arguably, the simplest would be the variance of log GDP per worker (or capita; “i” is an index for country)

$$\sigma_y^A = \frac{1}{n} \sum_i^n (\ln y_i - \ln \bar{y})^2, \ln \bar{y} \equiv \frac{1}{n} \sum_i^n \log y_i$$

3C. CROSS COUNTRY EVIDENCE: INEQUALITY

This is the result:

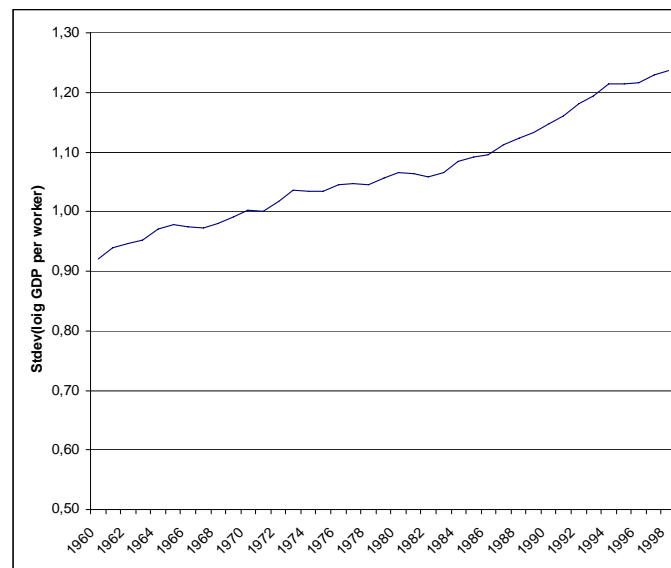


Figure 11: Evolution of Standard deviation of log GDP per worker, 1960-1998. Data: Penn World Tables 6.1.

That is, using this measure you tend to find increasing inequality.

3C. CROSS COUNTRY EVIDENCE: INEQUALITY

This “only” tells us that the dispersion of productivity is not declining *between nations*.

Indeed, a problem with this measure is that Denmark weights as much as China. Doesn't tell us much about inequality between individuals. So, alternatively, we could weight each country by its population share, λ_i :

$$\sigma_y^B = \sum_i^n \lambda_i \cdot (\ln y_i - \ln \bar{y})^2, \quad \ln \bar{y} \equiv \sum_i^n \lambda_i \ln y_i$$

This is the approach taken in the book (§ 2.2). Here you tend to find roughly constant (or weakly declining) inequality. Hence: Large and initially poor countries (e.g., China and India) have been growing rapidly.

3C. CROSS COUNTRY EVIDENCE: INEQUALITY

A potential problem with σ_y^B is that we are assuming every citizen in each country gets GDP per worker (or capita). They really don't; we are ignoring *within country inequality*. That is, we would like to make “i” individuals, rather than countries. This is what we find

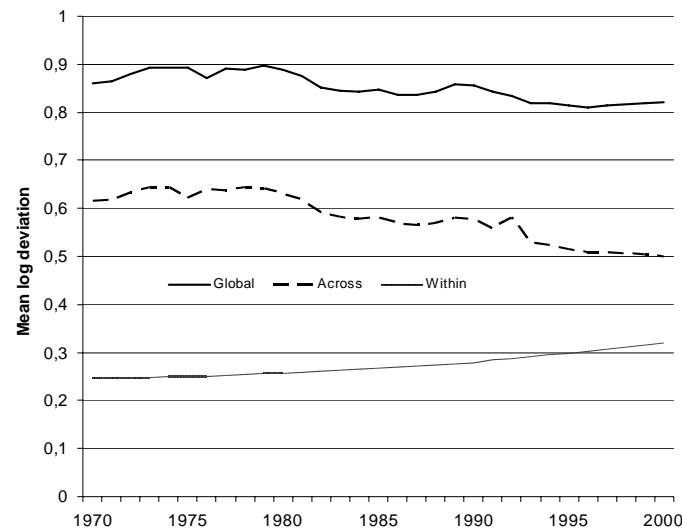


Figure 12: The Figure shows the evolution of inequality of the global size distribution of income, measured by the mean log deviation. Note: “Across” refers to inequality across nations; “Within” refers to inequality within nations. The two components sum to “Global”.

SUMMING UP

A. In rich places growth has been steady for a century or more. During this process, real rates of interest and factor shares have been relatively constant (Kaldor) \rightarrow We would like to understand the mechanics of this process, and why it may not hold always!

C. There are huge differences in GDP per worker across countries. How do we explain difference of 1:35 magnitude?

D. How do we explain sustained differences in growth rates?

E. Why do we see a negative association between initial GDP per worker levels, and subsequent growth, when we consider countries that ex ante are “similar”, while no such thing is discernable in general?