ECON 202 Intermediate Macroeconomics: Stylized Facts About Long Run Economic Growth Lec 13-14

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Motivation

"I do not see how one can look at figures like these without seeing them as representing possibilities. Is there some action a government could take that would lead the Indian economy to grow like Indonesia's or Egypt's? If so, what exactly? If not, what is it about the "nature of India" that makes it so? The consequences for human welfare involved in questions like these are simply staggering: Once one starts to think about them, it is hard to think about anything else" (Lucas 1988).

Motivation

i. Differences across countries:
   1. Out of 6.4 billion people, 0.8 do not have access to enough food, 1 to safe drinking water, and 2.4 to sanitation.
   2. Life expectancy in rich countries is 77 years, 67 years in middle income countries, and 53 in poor countries.

ii. Differences across time:
   1. Japanese boy born in 1880 had a life expectancy of 35 years, today 81 years.
   2. An American worked 61 hours per week in 1870, today 34.

Kaldor Facts

i. Note that this lecture corresponds to chapter 4 form your main textbook.

ii. In a 1957 article Nicholas Kaldor listed a set of stylized facts characterizing the then relatively recent economic growth across countries Kaldor (1957).

iii. "Stylized" means that these facts are roughly true over sufficiently large periods of time. They do not exactly hold, especially over short time frequencies.

iv. These stylized facts help us define the qualitative and quantitative properties in the data which our models must match in order to be considered plausible.

Kaldor Facts

i. Kaldor Fact 1: Output per worker grows at a sustained, roughly constant, rate over long periods of time.

ii. Kaldor Fact 2: Capital per worker grows at a sustained, approximately constant, rate over long periods of time.

iii. Kaldor Fact 3: The capital to output ratio is roughly constant over long periods of time.

iv. Kaldor Fact 4: Labor share of income is roughly constant over long periods of time.

v. Kaldor Fact 5: The rate of return on capital is relatively constant.

vi. Kaldor Fact 6: Real wages grow at a sustained, approximately constant, rate.

Growth in Real GDP Per Worker

i. The graph on next slide plots a linear time trend, which is depicted with the dotted straight line, showing that GDP per worker grows at a sustained and reasonably constant rate.

ii. The average growth rate over this period is about 1.7 percent annually.

iii. How does a 1.7 percent annual growth rate translate into absolute differences in income over time?

iv. 70 *rule* $\Longrightarrow$ $\frac{70}{1.7} \approx 41$ years is the time it takes for GDP to roughly double.

Growth in Real GDP Per Worker

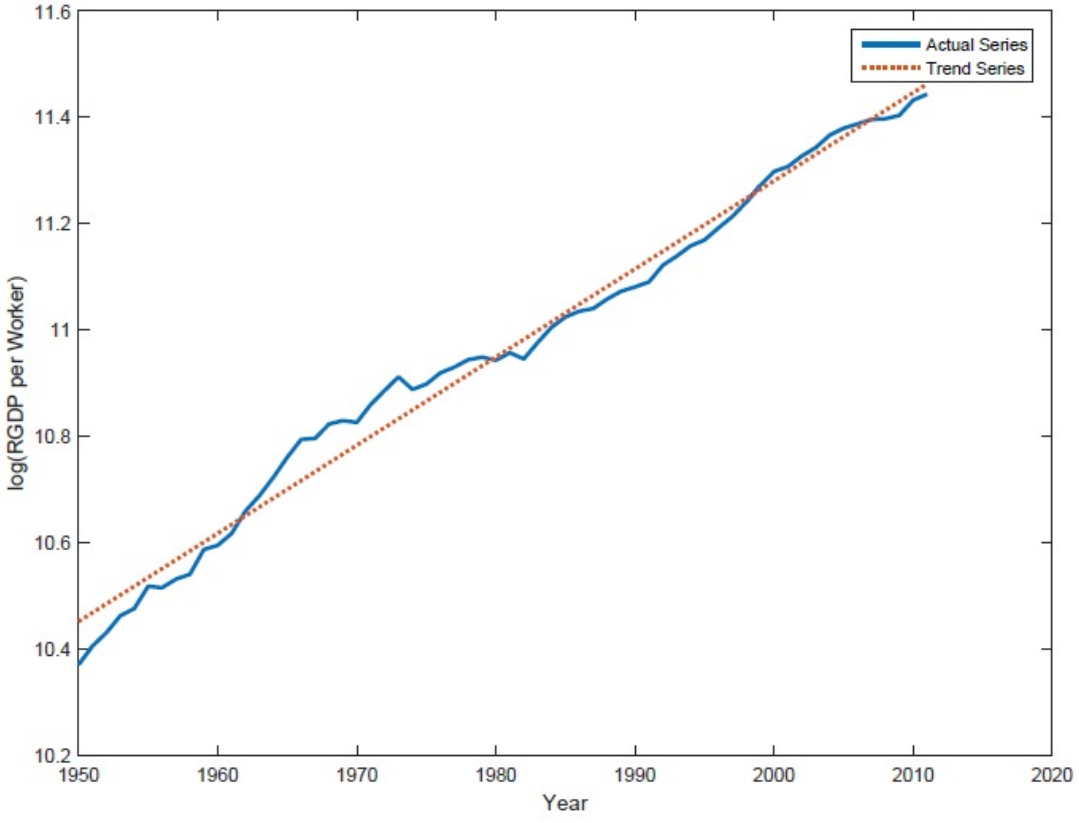
i. $2Y_0 = (1+g)^t Y_0 \implies \ln(2) = t\ln(1+g)$. For $g \approx 0$, $\ln(1+g) \approx g \implies t = \frac{\ln(2)}{\ln(1+g)} \approx \frac{\ln(2)}{g} \approx \frac{0.7}{g} \approx t$, where t is number of years it takes for figure to double.

ii. Small differences in average growth rates can amount to large differences in standards of living over long periods of time.

iii. If real GDP per capita were to grow at 1.7%, GDP will double 2.5 times over next century but if growth rate is 2.7% per year, real GDP per capita would double approximately 4 times over the next century.

Kaldor Fact 1: Output per Worker

Figure 4.1: Real GDP per Worker in the US 1950-2011



Growth in Capital Per Worker

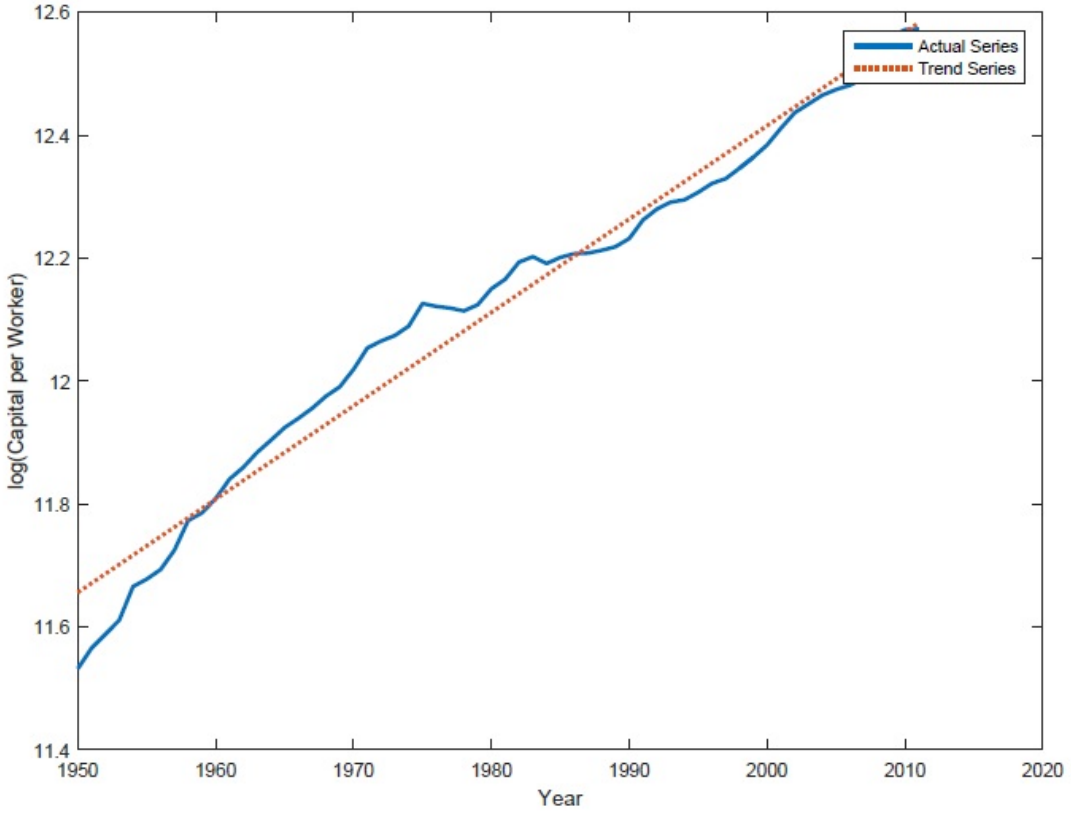
i. Figure 4.2 shows the time series of the log of capital per worker over the period 1950-2011 along with a linear time trend.

ii. The graph on next slide shows capital per worker in the US has grown at roughly constant growth rate, which is around 1.5% per year.

iii. The fact that capital and output grow at similar rates leads to the third of Kaldor's facts.

Kaldor Fact 2: Capital per Worker

Figure 4.2: Capital per worker in the US 1950-2011.



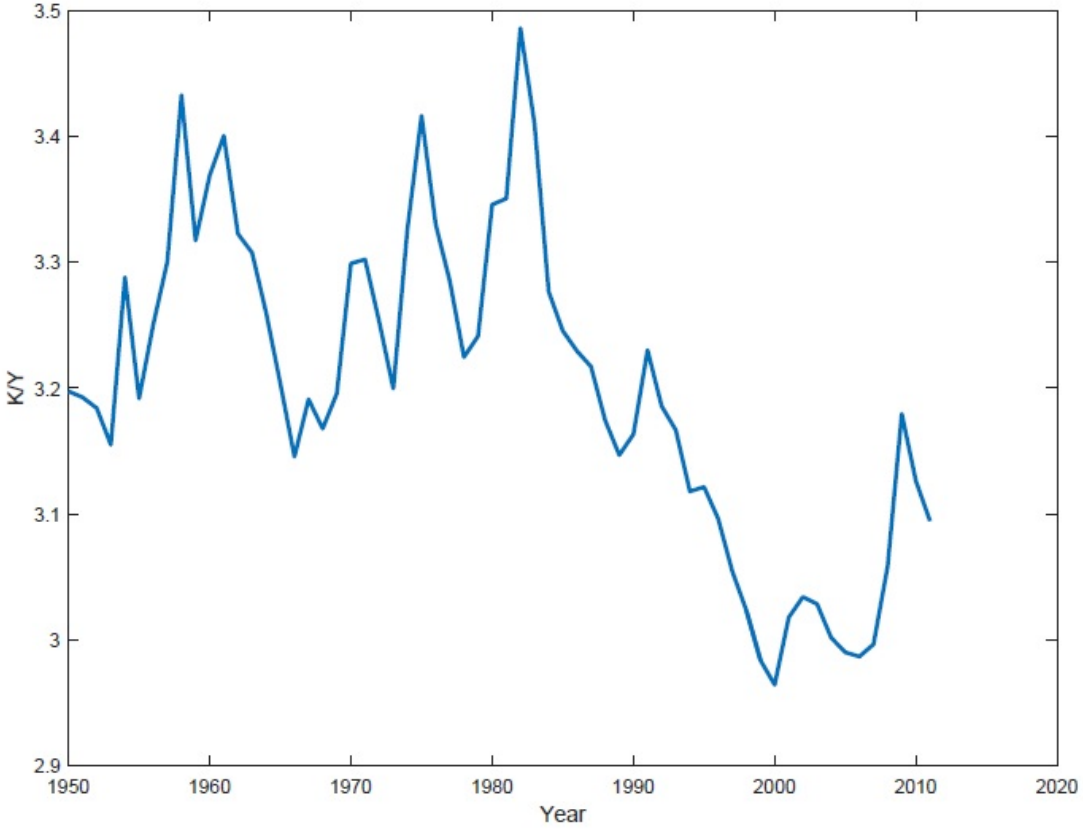
Growth in Capital to Output Ratio

i. If capital and output grew at identical rates from 1950 onwards, the capital to output ratio would be a constant. However, year to year, the exact growth rates differ and on average, capital grew a little slower than did output.

ii. The capital to output ratio fluctuated around a roughly constant mean from 1950 to 1990, but then declined substantially during the 1990s. The capital output ratio picked up during the 2000's.

Kaldor Fact 3: Capital to Output Ratio

Figure 4.3: Capital to Output Ratio in the U.S. 1950–2011



Growth in Capital to Output Ratio

i. Assume all income can be cleanly grouped into either capital or labor income.

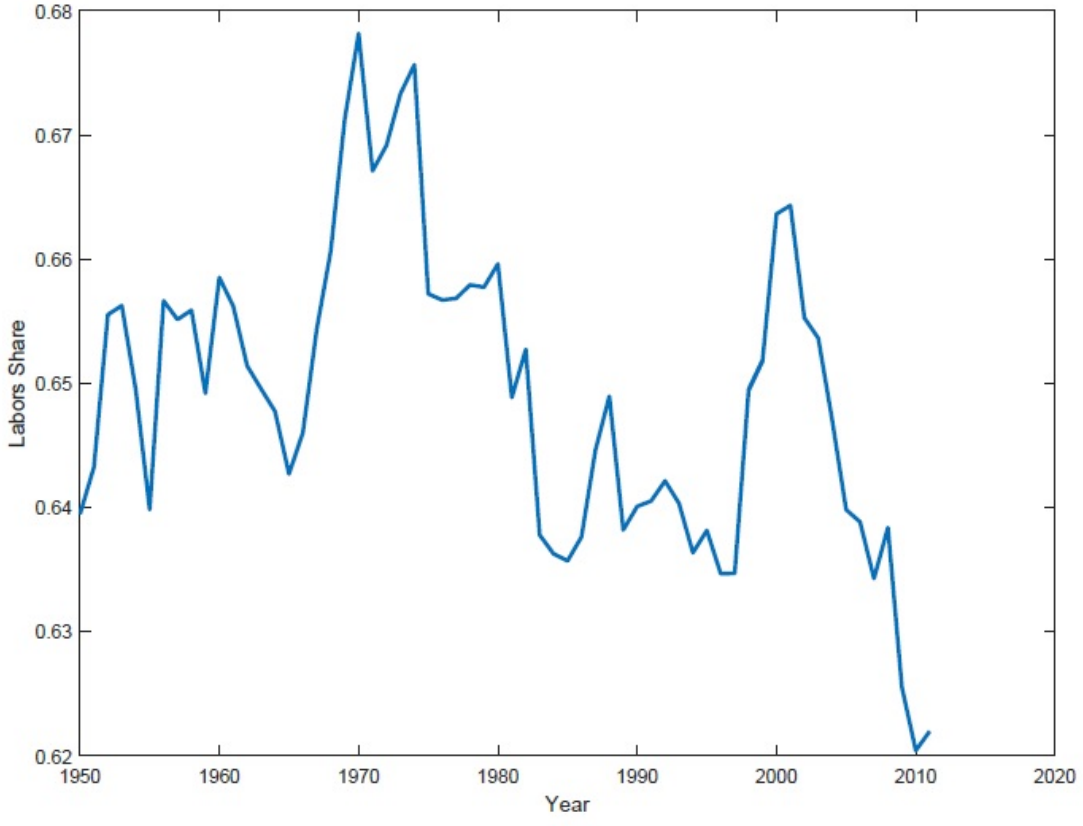
ii. $LABSH_t = \frac{w_t N_t}{Y_t}$ is labor share of income.

iii. $CAPSH_t = 1 - LABSH_t$

iv. The next graph shows that labor share of income in the US has been roughly constant around 0.65, even though in recent times the labor share of income has somewhat decreased.

Kaldor Fact 4: Labor Share of Income

Figure 4.4: Labor Share in the US 1950-2011.



Return on Capital

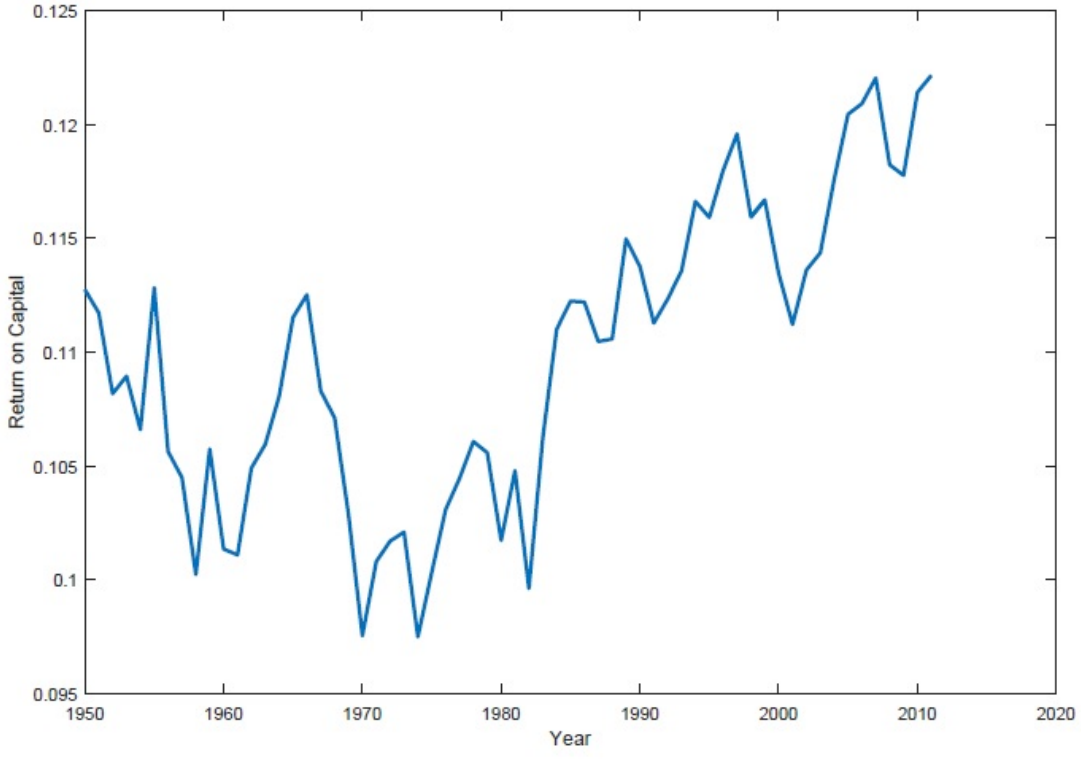
i. The return to capital is simply the value the owner gets from renting capital. If a producer owns his or her own capital this rent is implicit due to opportunity costs.

ii. We will use R_t to denote the rental rate on capital and let K_t be the total stock of capital.

iii. It is clear that $R_t = \frac{(1-LABSH_t)Y_t}{K_t}$, given that $CAPSH_t = \frac{R_t K_t}{Y_t}$.

iv. The rate of return on capital varies between 0.095 and 0.125 with an upwards trend since the mid 1980's. Therefore, the upward trend in capital's share since 2000 can be attributed more to the rise in the real return of capital rather than an increase in the capital to output ratio.

Kaldor Fact 5: Return on Capital



Growth in Real Wages

i. $LABSH_t = \frac{w_t N_t}{Y_t}$.

ii. $\frac{Y_t}{N_t}$ grows at constant rate from Kaldor fact 1, which means that $\frac{N_t}{Y_t}$ must fall at same rate. Thus, w_t must grow at roughly the same rate as output per worker does to ensure that $LABSH_t$ is constant.

iii. Annual wage growth averaged approximately 1.8 percent over the entire time period. This is close to the same rate at which output per worker and capital per worker rose.

Kaldor Fact 6: Growth in Real Wages

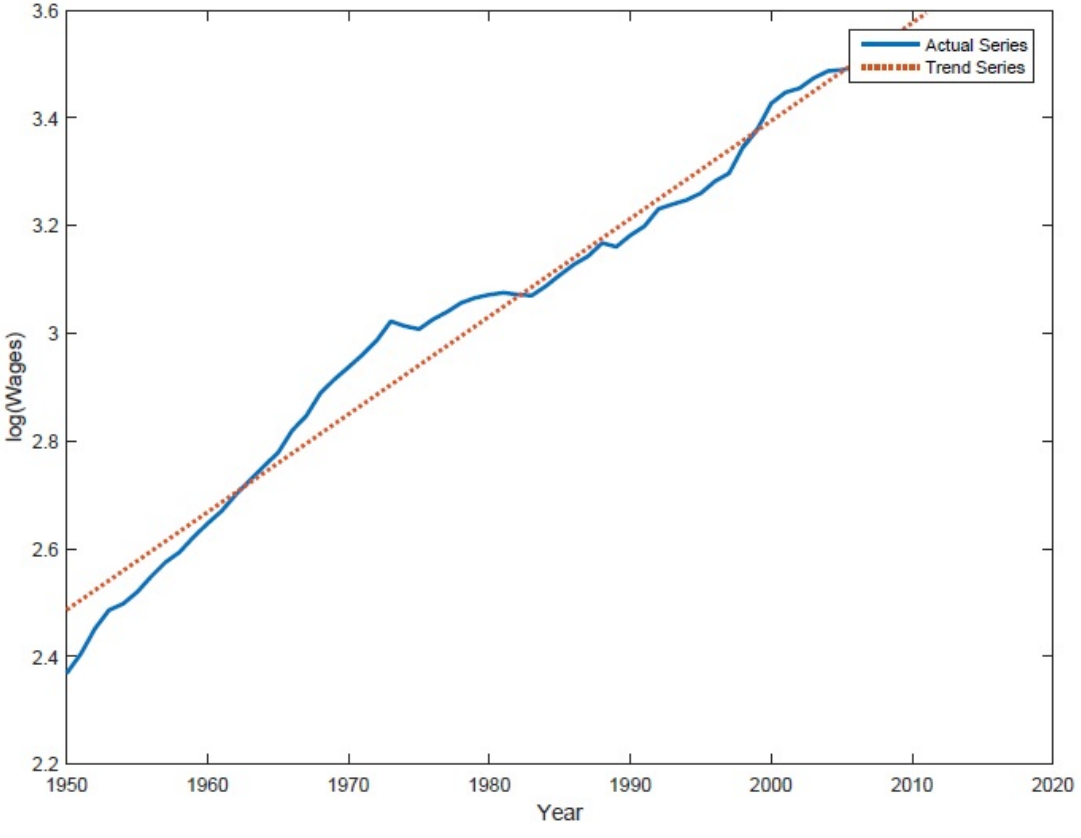


Figure 4.6: Wages in the US 1950-2011.

Summary of Kaldor Facts

i. The Kaldor facts can be summarized as follows. Wages, output per worker, and capital per worker grow at approximately the same sustained rate and the return on capital is approximately constant. All the other facts are corollaries to these.

ii. A perhaps surprising implication of these facts is that economic growth seems to benefit labor (real wages rise over time) and not capital (the return on capital is roughly constant).

Facts about Cross Country Economic Growth

i. We will now have a cursory and panoramic view of a range of interesting stylized facts about economic growth across countries.

ii. There is huge variation in incomes and incomes per capita across countries.

iii. The world distribution of income has changed over time.

iv. There are growth miracles and growth disasters.

v. There is a strong, positive correlation between income per capita and human capital as well as other human welfare measures.

GDP Comparisons and PPP

i. When comparing living standards across countries, we use estimates of GDP per capita in a common set of prices known as purchasing power parity (PPP) prices.

ii. Prices are typically higher in richer countries such as Sweden than in Indonesia, meaning that once a common set of prices is applied, the difference between GDP per capita, measured at PPP is smaller than if the comparison were made at current exchange rates.

iii. At current exchange rates, GDP per capita in Indonesia is only 6% of the level of Sweden; at PPP where the comparison uses international prices, GDP per capita in Indonesia is 21% of the level of Sweden.

GDP Per Capita Across Countries

i. The data in table on next slide shows PPP adjusted GDP per capita in dollars for selected countries in upper, middle and lower income countries for 2011.

ii. The data shows the huge variation of income per capita across economies. For example, US GDP per capita is 25% higher than that of Germany and almost 37 times larger than that of Mali!

GDP Per Capita Across Countries in 2011

Table 4.1: GDP Per Capita for Selected Countries

		GDP per Person
High income countries		
	Canada	$35,180
	Germany	$34,383
	Japan	$30,232
	Singapore	$59,149
	United Kingdom	$32,116
	United States	$42,426
Middle income countries		
	China	$8,640
	Dominican Republic	$8,694
	Mexico	$12,648
	South Africa	$10,831
	Thailand	$9,567
	Uruguay	$13,388
Low income countries		
	Cambodia	$2,607
	Chad	$2,350
	India	$3,719
	Kenya	$1636
	Mali	$1,157
	Nepal	$1,281

Notes: This data comes from the Penn World Tables, version 8.1. The real GDP is in terms of chain-weighted PPPs.

The Hockey Stick of Economic Growth Over the Very Long Run

i. The graph on next slide is known as hockey stick of economic growth over the very long run.

ii. We understand that for most of recent human history, incomes per capita were roughly constant and most of the action has been in the last 2/2.5 centuries or so.

iii. When sustained growth occurred, it began at different times in different countries, leading to vast differences in living standards around the world.

Economic Growth over the Very Long Run

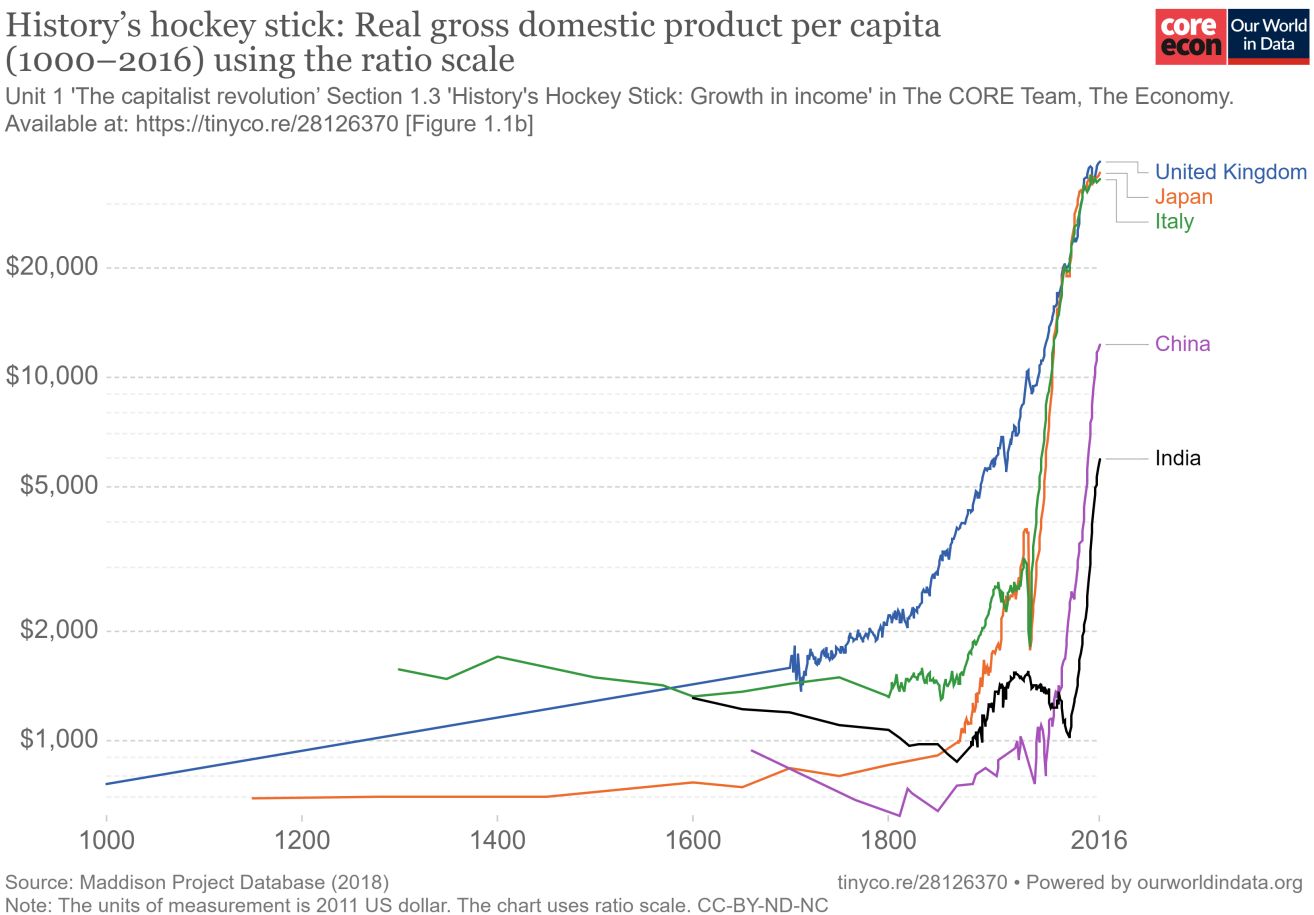


Figure: Source: CORE ECON

The Hockey Stick of Economic Growth Over the Very Long Run

i. *The Great Escape: Health, Wealth, and the Origins of Inequality* by Angus Deaton.

ii. *The Wealth of Nations* by Adam Smith.

iii. *The Maddison Project:* "Utta Bolt and Jan Juiten van Zanden. 2013. The First Update of the Maddison Project Re-Estimating Growth Before 1820. Maddison-Project Working Paper WP-4 (January)" is an example.

The Hockey Stick for China and India

i. **India:** According to Angus Deaton, when 300 years of British rule of India ended in 1947: "It is possible that the deprivation in childhood of Indians ... was as severe as that of any large group in history". In the closing years of British rule, a child born in India could expect to live for 27 years. Fifty years on, life expectancy at birth in India had risen to 65 years.

ii. **China:** It had once been richer than Britain, but by the middle of the twentieth century GDP per capita in China was one-fifteenth that of Britain.

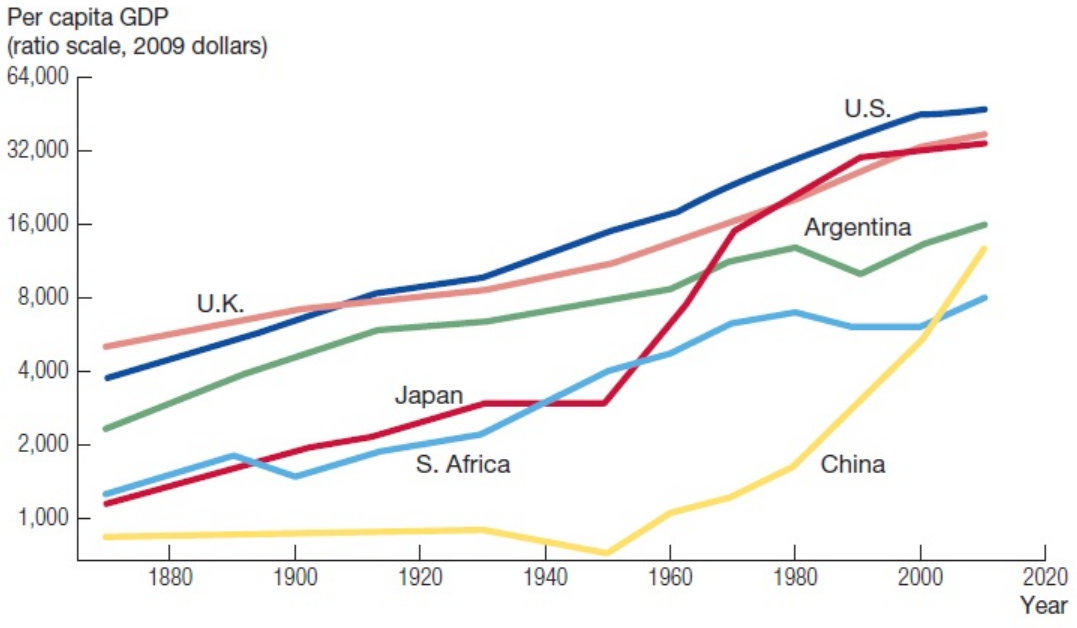
GDP Per Capita Since 1870

i. China took off after the mid twentieth century.
ii. Japan also accelerated quite a bit after the 1940's.
iii. The rest of the countries have had more or less steady economic growth since the 1870's.

Per Capita GDP in Selected Economies

FIGURE 3.6

Per Capita GDP since 1870



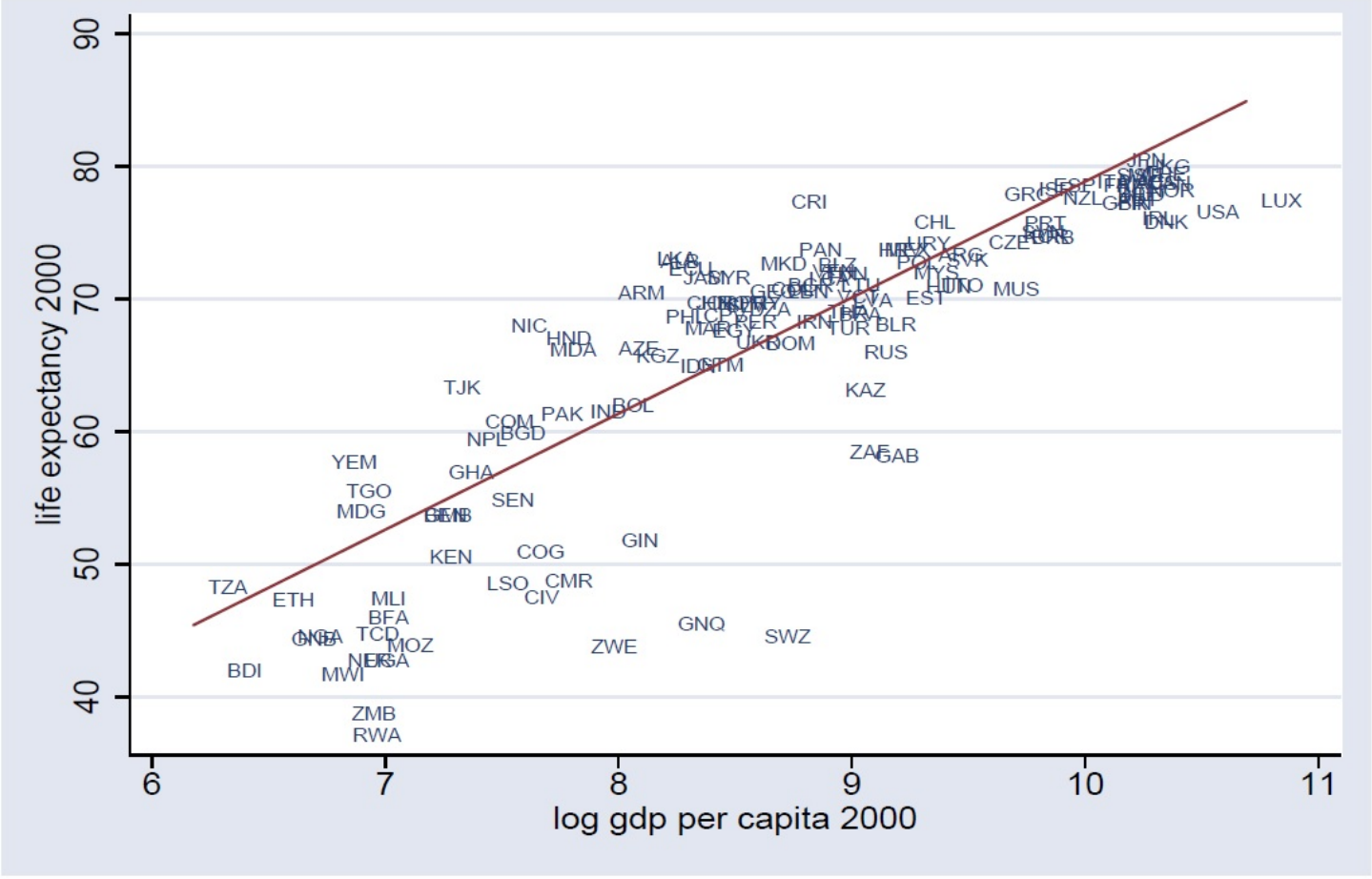
Source: The Maddison-Project, www.ggdc.net/maddison/. Observations are presented every decade after 1950 and less frequently before that as a way of smoothing the series.

GDP and Human Welfare

i. We discussed the limitations of GDP as a measure of human welfare in Lecture 5 but GDP is correlated with other direct measures of human welfare such as life expectancy and human capital.

ii. We also know that in many cases, crime rates have a negative effect on economic growth and crime rates tend to be lower during business cycle expansions.

GDP and Life Expectancy



Human Capital and Income Per Person

i. Human Capital can be measured by average years of education/schooling received by population after making quality adjustments to enable better cross-country comparisons.

ii. Human Capital Index is positively correlated with aggregate income per person across countries.

iii. This does not necessarily imply that causation runs from education to higher incomes. The reverse causation may also be relevant.

iv. However, education does impart basic numeracy and literacy as well as digital competence which increases labor market productivity.

Relationship between Human Capital and Income per Person

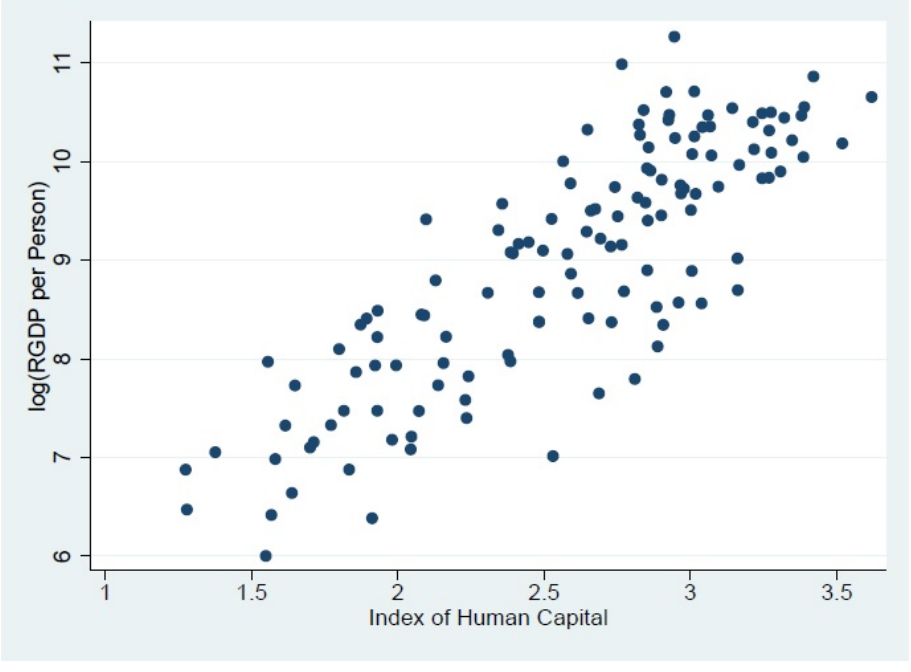


Figure 4.7: Relationship Between Human Capital and Income per Person

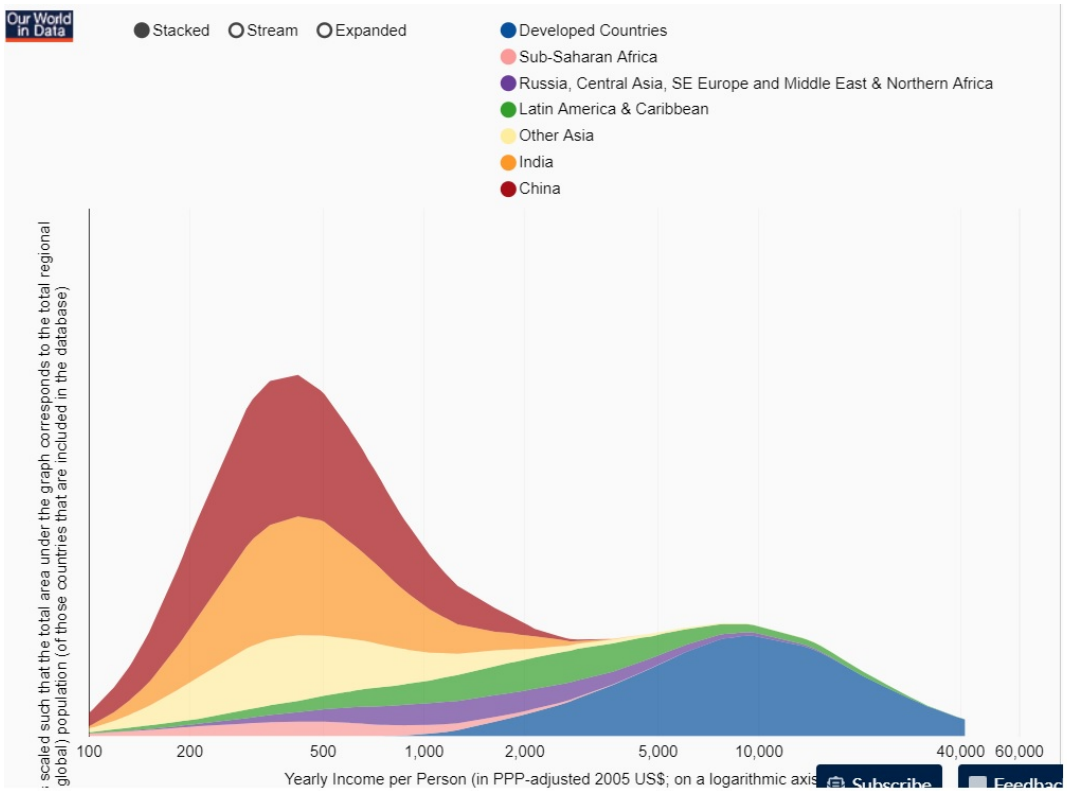
Distribution of World Income

i. Due to the growth of emerging economies such as China and India etc, the percentage of world population living in countries with GDP per capita in the extremely low ranges has fallen over time.

ii. Absolute poverty levels have fallen dramatically in recent decades.

iii. Income Inequality in many advanced economies such as the US has increased in the last 4 decades but world income inequality has reduced in recent decades.

Changing World Income Distribution Over Time: 1988-2011



Growth Miracles and Growth Disasters

i. Some counties in East Asia are the poster children of growth miracles and the success of capitalism in creating widespread material affluence.

ii. Meanwhile, many countries in continental Africa continue to be shackled by poverty and malnutrition. In fact, some African countries have experienced a growth disaster in the last 40 years.

iii. *The Bottom Billion* by Paul Collier (Oxford University).

Bostwana: Growth Miracle in Africa

i. Botswana is governed democratically, has a GDP per capita that makes it an upper middle-income country and regularly surpasses countries like Italy and Spain on corruption indices.

ii. It benefits from the country's huge diamond reserves on equal terms with the mining company De Beers. The returns from diamond sales have been invested in health, education, infrastructure etc while accumulating large foreign exchange reserves.

iii. However, there is basically no manufacturing sector, 18% unemployment rate and it is one of the most unequal countries in the world with a GINI of 0.53 (World Bank 2015). This is why some economists refer to this as a case of "growth without development".

Growth Miracles and Growth Disasters

Table 4.2: Growth Miracles and Growth Disasters

Growth Miracles				Growth Disasters			
	1970 Income	2011 Income	% change		1970 Income	2011 Income	% change
South Korea	$1918	$27,870	1353	Madagascar	$1,321	$937	-29
Taiwan	$4,484	$33,187	640	Niger	$1,304	$651	-50
China	$1,107	$8,851	700	Burundi	$712	$612	-14
Botswana	$721	$14,787	1951	Central African Republic	$1,148	$762	-34

Notes: This data comes from the Penn World Tables, version 8.1. The real GDP is in terms of chain-weighted PPPs.

Thank you