Long run growth 1: facts and possibilities

Revised: October 4, 2012

Latest version available at http://www.fperri.net/TEACHING/20205.htm

In the next few classes we will try to understand long run economic growth. Our focus will be both on long run variation of GDP (per capita) across time and across countries.

International Comparisons and PPP exchange rate

How do we compare per capita GDP in two different countries, since it is expressed in two different currencies? One possibility is to use the market exchange rate. Sometimes though this method can be misleading, especially if GDP is meant to capture standards of living. For example in 2009 GDP per capita in China was around Y25500, while in US was around $46400. If we use the market exchange rate (6.8 Yuan, or Renmimbi per 1 dollar) to compare the two levels we find that GDP per capita in China is about 25500/6.8=$3700, i.e. GDP per capita in US is about 12 times GDP per capita in China. In reality 6.8 Yuan in China have more purchasing power that 1 dollar in the US so that figure overstates the differences between standards of living US and China. A better way of comparing the two figures is obtained by using the PPP exchange rate is the exchange rate that equalize the purchasing power of the two currencies in each of the two countries. To compute the PPP exchange rate one needs to measure the cost of the typical basket of goods and services consumed in US (P_{US}) and in China (P_{China}) and then find the exchange rate that equalize these costs across countries. So the Dollar Yuan PPP exchange rate (denoted as e_{PPP}) is given by

$$e_{PPP} = \frac{P_{US}}{P_{China}}$$

In 2009 the PPP exchange rate is around 3.6 Yuan per dollar (Reflecting the fact that 3.6 Yuan in China get you the same amount of goods and services that you get in US with 1 dollar). If one uses this exchange rate then GDP per capita in China is around 25500/3.6=7000 i.e. US is about 7 times as rich as China. Figure 1 plots the GDP per capita of China relative to the US using the market rate and the PPP rate.
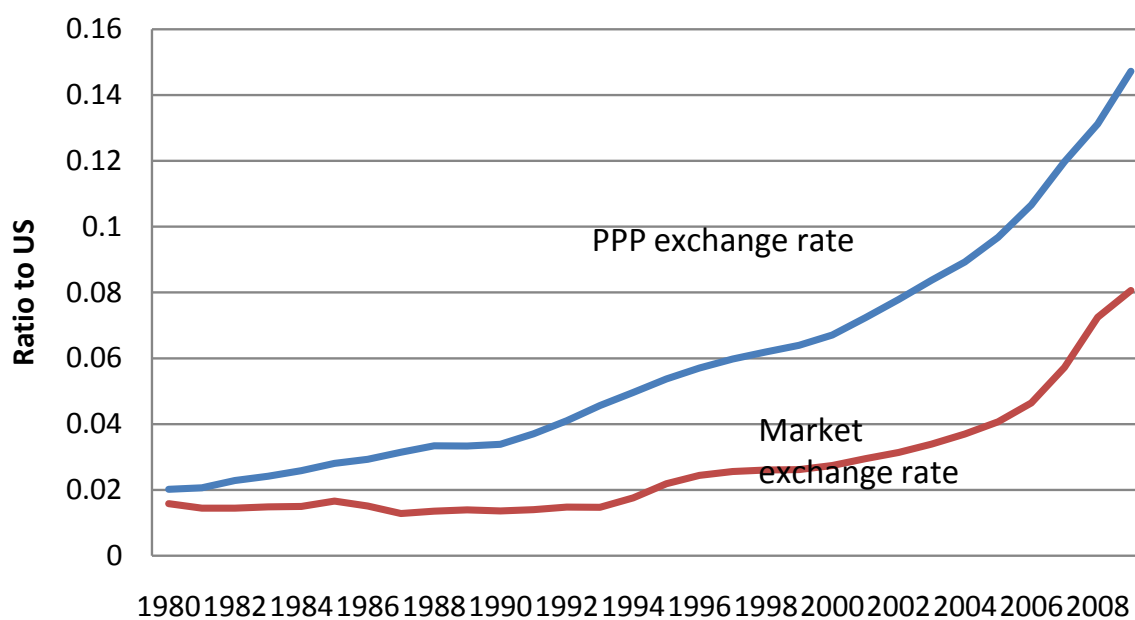
Figure 1: GDP PER CAPITA: CHINA RELATIVE TO US

Note that only the two series are remarkably different both in terms of level and of growth rates. When making international comparisons of GDP is more appropriate to use a PPP exchange rate and from now on all our international data will be based on PPP exchange rates.

The Big Mac index

A special example of PPP exchange rate is given by the exchange rate that equalizes the costs of Big-Macs. If for example the price of a Big-Mac is \$2 in US and 4 Euros in Europe the exchange rate that equalizes the cost of the two is 2 Euros per dollars. For more details check the link to the economist site Big Mac index and see below the Big Mac index in July 2010. Obviously PPP exchange rates we use to make cross country comparisons take into account not only Big-Macs but also the prices of the entire set of goods that are included in the CPI basket.

The Big Mac index

	Big Mac prices*		Implied PPP† of the dollar	Actual dollar exchange rate July 21st	Under(-)/over(+) valuation against the dollar, %
	in local currency	in dollars			
United States‡	\$ 3.73	3.73			
Argentina	Peso 14.0	3.56	3.75	3.93	-5
Australia	A\$ 4.35	3.84	1.17	1.13	3
Brazil	Real 8.71	4.91	2.33	1.77	31
Britain	£ 2.29	3.48	1.63 §	1.52§	-7
Canada	C\$ 4.17	4.00	1.12	1.04	7
Chile	Peso 1,750	3.34	469	524	-10
China	Yuan 13.2	1.95	3.54	6.78	-48
Colombia	Peso 8,200	4.39	2,196	1,868	18
Costa Rica	Colones 2,000	3.83	536	522	3
Czech Republic	Koruna 67.6	3.43	18.1	19.7	-8
Denmark	DK 28.5	4.90	7.63	5.81	31
Egypt	Pound 13.0	2.28	3.48	5.70	-39
Estonia	Kroon 32.0	2.62	8.57	12.2	-30
Euro area**	€ 3.38	4.33	1.10††	1.28††	16
Hong Kong	HK\$ 14.8	1.90	3.96	7.77	-49
Hungary	Forint 740	3.33	198	222	-11
Indonesia	Rupiah 22,780	2.51	6,102	9,063	-33
Israel	Shekel 14.9	3.86	3.99	3.86	3
Japan	¥ 320	3.67	85.7	87.2	-2
Latvia	Lats 1.55	2.80	0.42	0.55	-25
Lithuania	Litas 7.30	2.71	1.96	2.69	-27
Malaysia	Ringgit 7.05	2.19	1.89	3.21	-41
Mexico	Peso 32.0	2.50	8.57	12.8	-33
New Zealand	NZ\$ 5.00	3.59	1.34	1.39	-4
Norway	Kroner 45.0	7.20	12.1	6.25	93
Pakistan	Rupee 210	2.46	56.3	85.5	-34
Peru	Sol 10.0	3.54	2.68	2.83	-5
Philippines	Peso 102	2.19	27.3	46.5	-41
Poland	Zloty 8.30	2.60	2.22	3.20	-30
Russia	Rouble 71.0	2.33	19.0	30.4	-38
Saudi Arabia	Riyal 10.0	2.67	2.68	3.75	-29
Singapore	S\$ 4.23	3.08	1.13	1.37	-18
South Africa	Rand 18.5	2.45	4.94	7.54	-34
South Korea	Won 3,400	2.82	911	1,204	-24
Sri Lanka	Rupee 210	1.86	56.3	113	-50
Sweden	SKr 48.4	6.56	13.0	7.37	76
Switzerland	SFr 6.50	6.19	1.74	1.05	66
Taiwan	NT\$ 75.0	2.34	20.1	32.1	-37
Thailand	Baht 70.0	2.17	18.8	32.3	-42
Turkey	Lira 5.95	3.89	1.59	1.53	4
UAE	Dirhams 11.0	2.99	2.95	3.67	-20
Ukraine	Hryvnia 14.5	1.84	3.88	7.90	-51

	GDP per capita	% of US	Population (Millions)
Rich Countries			
United States	47209.53	100%	304
Germany	37139.58	79%	82
Japan	33798.95	72%	128
Spain	32994.37	70%	46
Middle income countries			
Russia	20377	43%	142
Mexico	15313.72	32%	106
Turkey	14068.44	30%	74
Brazil	10366.74	22%	192
China	6194.661	13%	1325
Poor countries			
Indonesia	4000.538	8%	227
India	3031.64	6%	1140
Pakistan	2542.464	5%	166
Nigeria	2102.472	4%	151
Bangladesh	1337.307	3%	160
Tanzania	1302.719	3%	42
Ethiopia	868.52	2%	81

Figure 2: Levels of Development in 2008 (Source: World Bank)

Differences in per capita GDP levels

Very good sources of data for international comparisons in GDP per capita is the Penn World Tables which contains data that are comparable across countries for the period 1950-2007 and the World Bank World Development Indicators (Both are linked on the class webpage). Figure 2 uses data from these sources to document that the level of GDP per capita displays substantial variation across countries and that a large number of people live in extremely poor countries. This is also shown in figure 3 which shows that roughly 70% of the world population lives in countries that have a GDP level that is below 20% the level of US GDP. To get another measure of the magnitude of these differences observe figure 4. Note that the GDP of India today is about the level of US GDP in 1870. In some sense India is 130 years behind US and many African Countries are even further behind. This is particularly striking as many of the advanced technologies used in the US in 2000 are available to India while there were not available to the US 130 years ago.

One might argue that high GDP per capita does not *necessarily* mean high happiness. Although this is true figure 5 shows that, *on average*, countries with lower GDP tend to have lower level of personal satisfaction; in particular countries who have extremely low level of GDP per capita also tend to have very low level of happiness.
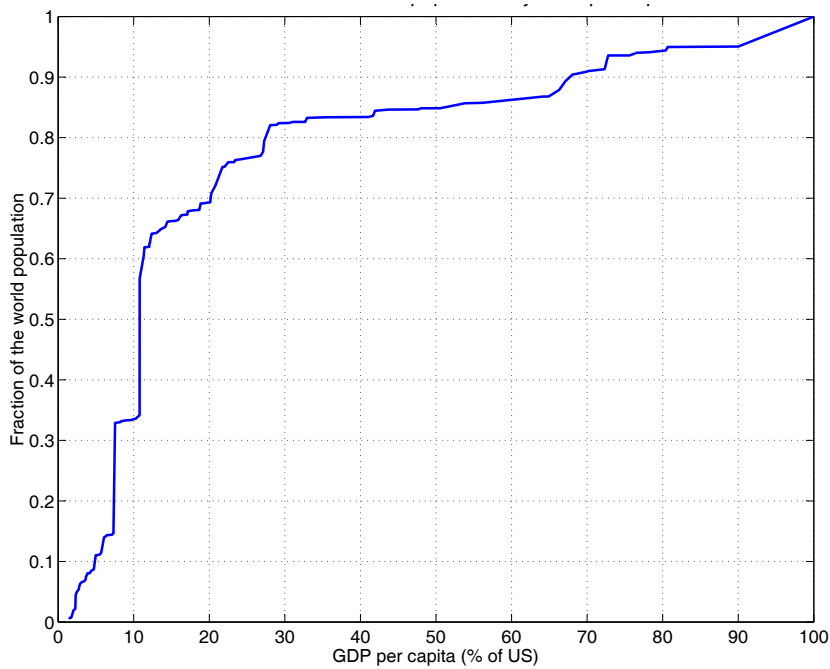
Figure 3: CUMULATIVE DISTRIBUTION OF WORLD POPULATION BY GDP PER CAPITA IN 2000 (SOURCE: PENN WORLD TABLES)
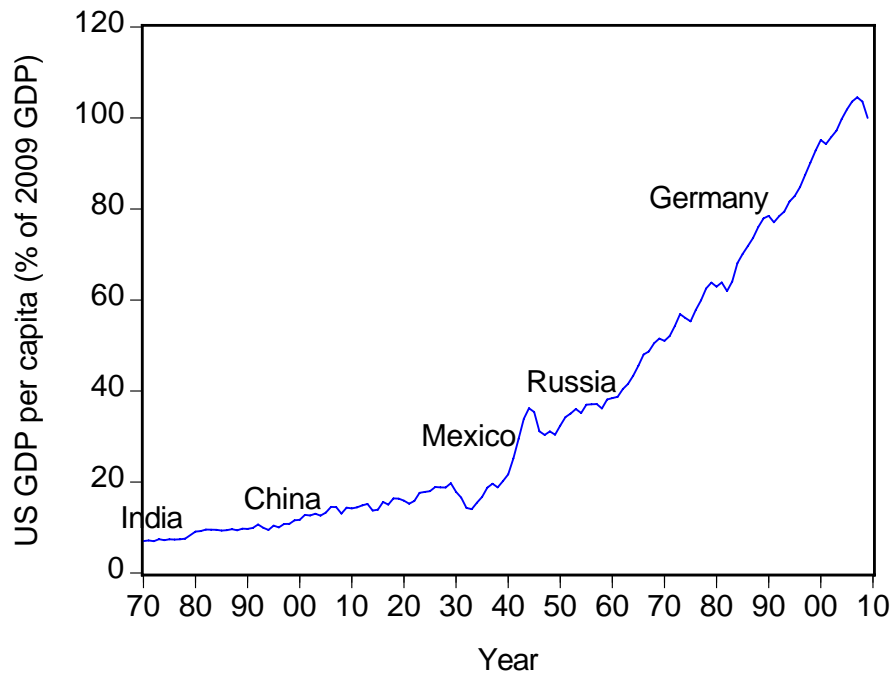

Figure 4: WHERE SOME COUNTRIES STAND RELATIVE TO THE US PAST

Measuring Satisfaction

A new study shows that people in wealthier countries are more likely to be satisfied with their lives. Earlier research had suggested that satisfaction did not necessarily increase once basic needs were met.

Percent who rate themselves an 8, 9 or 10 on a 10-point scale of satisfaction

KEY:

● Each dot represents one country

The line around the dot shows how satisfaction relates to income within that country:

Higher-income people are more satisfied

Higher-income and lower-income people are equally satisfied
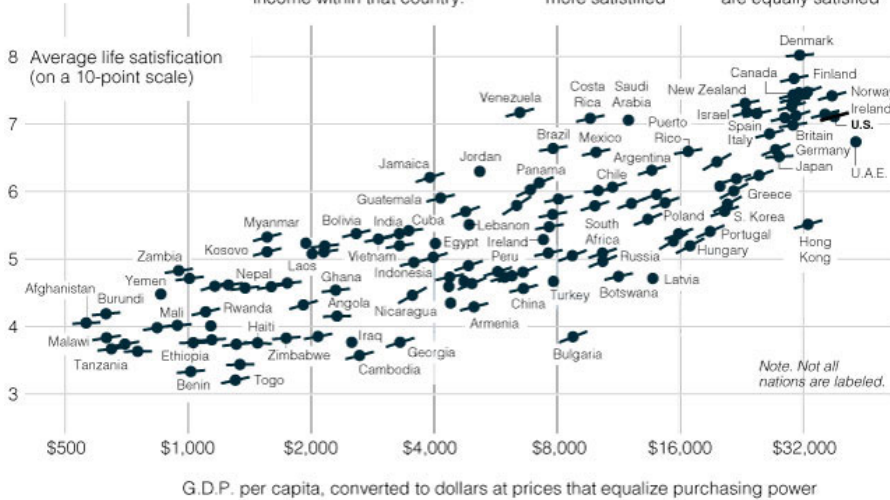
Source: Betsey Stevenson and Justin Wolfers, Wharton School at the University of Pennsylvania

THE NEW YORK TIMES

Figure 5: GDP AND HAPPINESS

The figure also shows that, for most countries, within a country household who have higher income are also happier. If you would like to know more about the relation between happiness and GDP you can check the freakonomics blog entry by economists Stevenson and Wolfers, who have studied happiness a lot.

Another measure that correlates with GDP per capita is the so called Human Development Index, developed by the United Nations, which measures factors like life expectancy at birth and various measures of education. Figure shows how high level of GDP are usually highly correlated with high level of all the measures that constitute human development and more importantly low level of GDP per capita are associated with extremely low levels of very important factors such us life expectancy. Figure 7 shows that high levels of income per capita are also associated with so called gender empowerment, that is to better conditions for women in society. For more data and details on the Human development index check the UN website which also contains some interesting animations on the progress of all the countries of the world. The bottom line that emerges from these graphs is that although one cannot make causal inference in the data we observe huge changes in human development and happiness
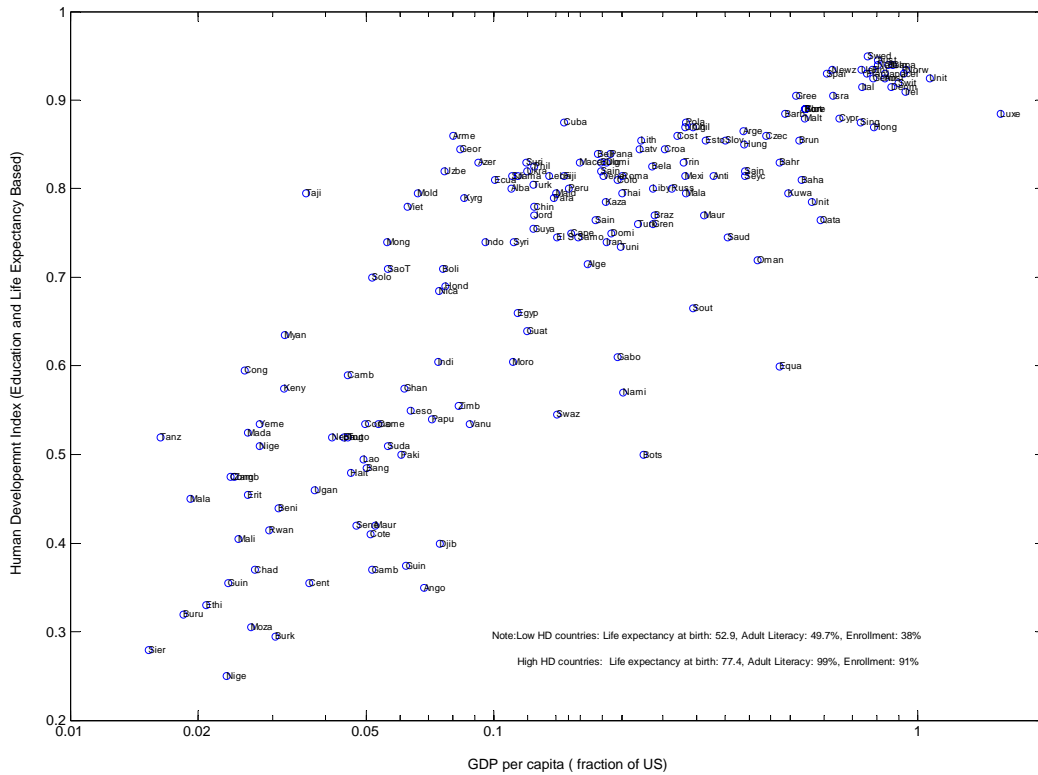
Figure 6: Human Development and GDP per capita

going from a low income country (less than 1/20 of US income) to being a middle income country.

Differences in Growth rates

Clearly levels and growth are related as a country that is growing fast will eventually reach a high level of income. Figure 8 highlights the fact that also growth rates can vary substantially across countries.

A simple rule of thumb to evaluate the impact of growth on GDP levels is given from the formula that tells us how many years it will take to a country that is growing at x% to double its income level

$$\text{Years to Double} \simeq \frac{70}{x}$$

(The rule is derived applying logs to the equation $2 = (1 + x)^{Years to Double}$ and noting that $log(1 + x) \simeq x$ and that $log(2) \simeq 0.7$). So for example if a country is growing
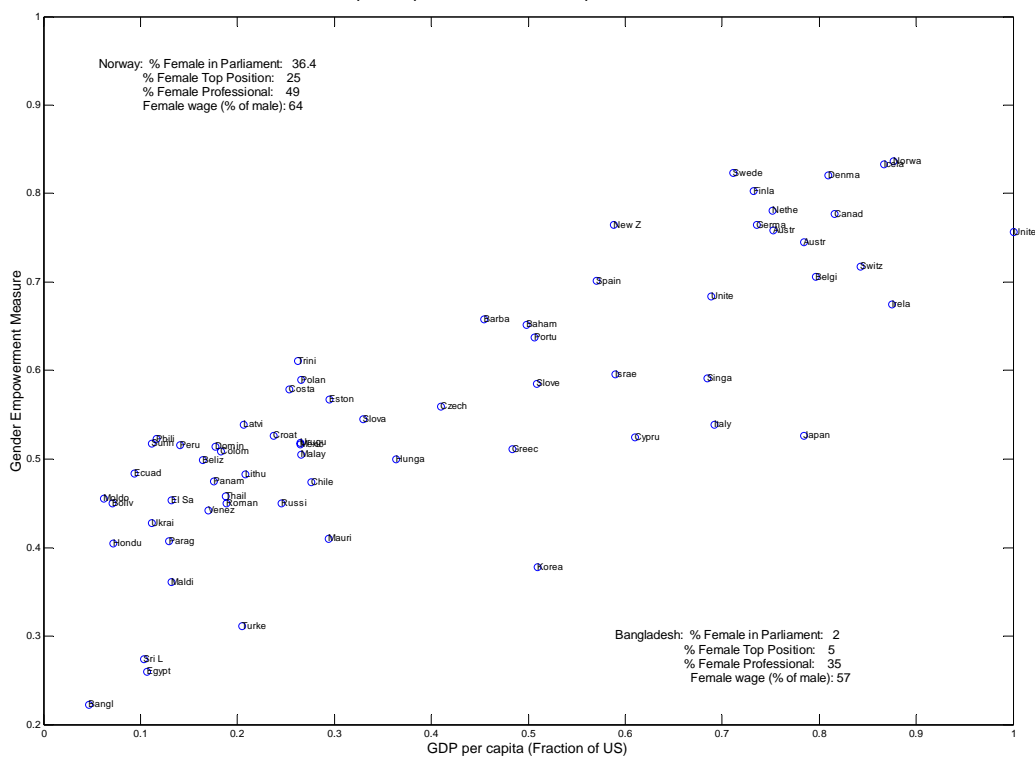
Figure 7: GENDER EMPOWERMENT AND GDP PER CAPITA

	Annual GDPC Growth (60-00)	Fraction of US in 1960	Fraction of US in 2000
Growth Miracles			
Singapore	6.5%	16.7	80.3
Korea	5.95%	11.6	41.9
Hong Kong	5.58%	23.6	78.3
Thailand	4.63%	9.52	18.8
China	4.34%	5.33	10.9
Japan	4.26%	38.2	72.8
Ireland	4.14%	41.1	76.3
Portugal	3.91%	26.9	48.0
Growth Disasters			
Venezuela	-0.47%	35.5	20.3
Chad	-0.64%	9.9	2.7
Zambia	-0.67%	18.6	2.36
Nigeria	-0.93%	7.6	2.32
Madagascar	-0.97%	11.9	2.46
Nicaragua	-1.26%	24.6	5.4
Niger	-1.52%	12.0	2.53

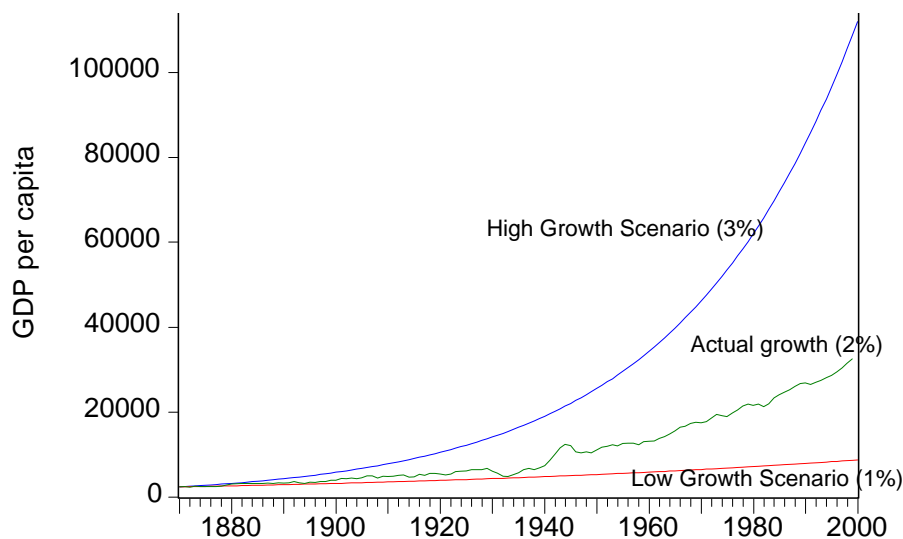Figure 8: GROWTH MIRACLES AND GROWTH DISASTERS

Figure 9: US UNDER DIFFERENT GROWTH SCENARIOS

at 2% it will take 35 years to double the income while growing at 1% it will take 70 years. Figure 9 show how small but persistent differences in growth rates can make a large differences in level. If US had grown just 1% less in the past 130 years now US would have the same level of income per capita as Mexico.

Also high growth is not only beneficial for a country a whole and a World Bank study, Growth is good for the poor, shows that in countries growing faster the poor people are growing at a faster rate than the average, improving their relative position, and that countries with high levels of GDP per capita are associated with even higher levels of GDP per capita of the people at the bottom quintile of the income distribution (See figure 10)

There are many possible explanations for the different level of income and for the different growth patterns across countries. These can be differences in luck, in natural endowments, in geography, in tastes, in culture and economic policies. Economists and policy makers are more interested in the last possible explanation because policies are, at least partly, endogenous and can be improved. An important feature of the data, that tells us that these differences cannot be explained solely by permanent factors (such as geography) is the variation of growth rates across time. Figure 11 shows that there is not a lot of correlation between growth in a decade and growth in the following decade and we see few countries going from doing very well to doing extremely poorly and viceversa.

As Nobel prize laureate Robert E. Lucas put it*"I do not see how one can look at figures like these without seeing them as representing possibilities. Is there some action a government of India could take that would lead the Indian economy to grow*
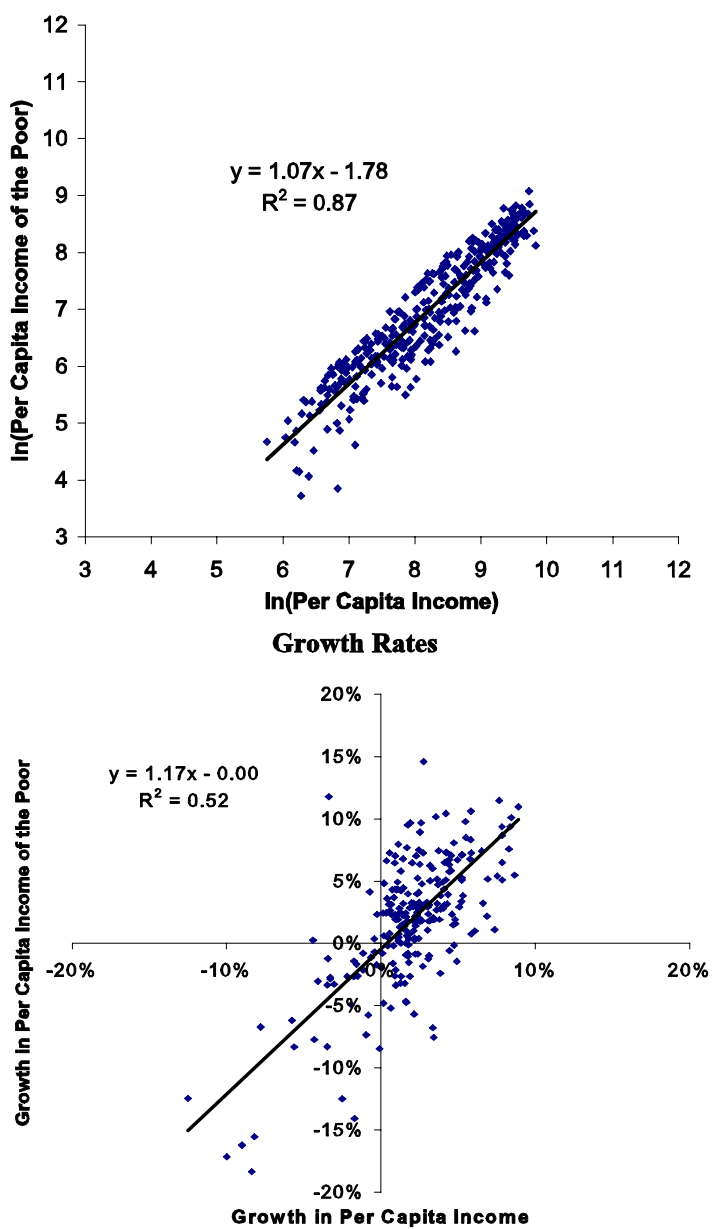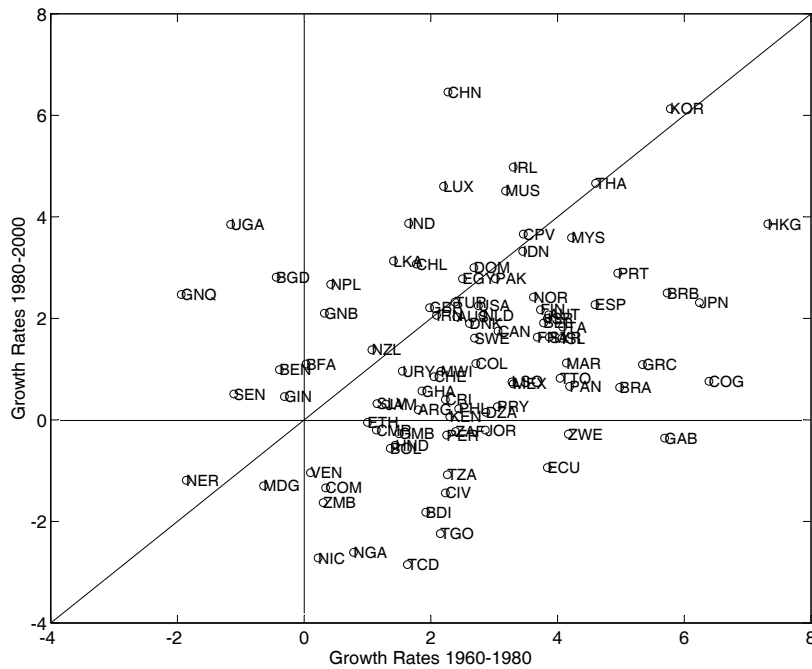
Figure 10: GROWTH AND THE POOR

Figure 11: VARIATION OF GROWTH RATES OVER TIME

like Indonesias 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."

Concepts you should know

1. PPP exchange rate

2. Large differences across countries and across time in per capita GDP level and growth

3. Countries with low GDP per capita are, on average, also countries with low happiness and low indicators of human development.