

(a) Find data on GDP for Cambodia (explicitly mention the source of the data, the website or publication). Find the average growth rate of the GDP per capita for the years 1990 to 2005. In how many years will Cambodia double its production? Quadruple? Now find the growth rates of the US and Germany. Assuming that the countries continue to grow at these rates, in what year will Cambodia overtake the US in terms of GDP per capita? And Germany? Comment on your calculations from the point of view of the neoclassical growth (Solow) model and convergence. Could the growth rates be sustained?

- GDP, GDP per capita for Cambodia, see attached Excel file. Source: Euromonitor International from International Monetary Fund (IMF), International Financial Statistics.
- The data for the Cambodian GDP was selected in PPP terms to account for the real local prices (the purchasing power).
- To compute the average growth rate, I have used the following formula:

$$g_t = \frac{y_{t+1} - y_t}{y_t}$$

Where g_t is the GDP growth rate and y_t is the GDP at year t .

-To calculate how many years it takes for the production to be doubled or quadrupled, I have taken 2005 as the base year. Thus:

$y_1 = y_{2005} = 20,144$ mil. \$, we assume $g_{2005} = \text{const.} = 17.04$

i) $y_n = 2y_{2005}$. We know that $y_n = y_{2005} \cdot (1+g)^{n-1}$,

$2y_{2005} = y_{2005} \cdot (1+g)^{n-1}$, $\log 2 = (n-1) \log(1+g)$, $n = (\log 2 + \log(1+g)) / \log(1+g) = (0.69 + 0.16) / 0.16 = 5.31$, thus, the production (expressed by the GDP) will double in approx. **5 years** at the const. growth rate of 17.04.

ii) using the same procedure, I obtain $n = (\log 4 + \log(1+g)) / \log(1+g) = 9.66$. Thus the production will quadruple in approx. **10 years**.

-From the excel data, I found the following growth rates for GDP (PPP)/cap. :

Year 2005	Cambodia	US	Germany
GDP (PPP)/cap.	$X_{KH,2005} = 1452.7$	$X_{US,2005} = 42,760.8$	$X_{DE,2005} = 30,434.40$
Growth rate	$g_{KH} = 15.18\%$	$g_{US} = 5.53\%$	$g_{DE} = 3.95\%$

-US/KH case: to calculate the year when GDP/ cap. of Cambodia will pass the US one, we need the exact year when they will be equal.

$$\text{Thus } X_{KH,n} = X_{KH,2005}(1+g_{KH})^{n-1} = X_{US,2005}(1+g_{US})^{n-1}$$

$$X_{KH,2005} * \left(\frac{1+g_{KH}}{1+g_{US}}\right)^{n-1} = X_{US,2005},$$

$$\left(\frac{1+g_{KH}}{1+g_{US}}\right)^{n-1} = X_{US,2005}/X_{KH,2005},$$

$n_{KH,US} = 1 + \frac{\log\left(\frac{X_{US,2005}}{X_{KH,2005}}\right)}{\log\left(\frac{1+g_{KH}}{1+g_{US}}\right)} = 39.65$. That means that after 40 years, the Cambodian GDP/cap will overtake the US one and this will happen in 2045.

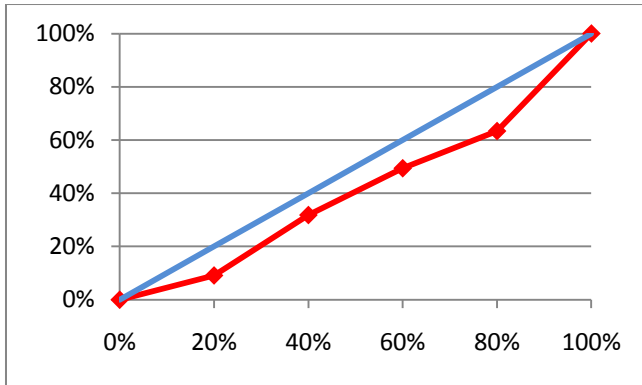
-DE/KH case: similarly I obtain the formula: $n_{KH,DE} = 1 + \frac{\log\left(\frac{X_{DE,2005}}{X_{KH,2005}}\right)}{\log\left(\frac{1+g_{KH}}{1+g_{DE}}\right)} = 30.65$. That means that after 31 years, the Cambodian GDP/cap will overtake the German one and this will happen in 2036.

According to the Solow Model, countries grow at different rates until they reach an equilibrium called a steady state. In our case, each of the 3 countries are growing with different rates, but the US and Germany have almost similar rates of growth because they are very similar (in terms of technology, etc). If we take the rates from 2005 and plot them in the future, we can see that Cambodia is catching up with the US and Germany. This is exactly what the Solow model predicts, the developing countries (in this case Cambodia), grows at a higher rate than the developed countries (Germany, US), until they reach convergence.

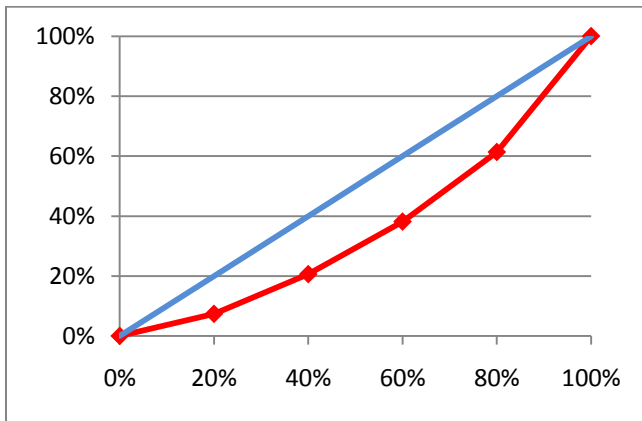
In the past decades, because of investments and a shift of the economy from the agricultural sector, lead to a high growth for the Cambodian GDP. But this economic miracle is fragile and the growth is not realistic for the next years because it is not sustainable. In the US case, German case, I think the small growth achieved until now can be projected for the future, but these rates might be smaller in the next years due to the global turmoil.

- (b) Find data on income distribution for Sweden, Taiwan and Slovakia. Draw the Lorenz curve for each of the countries. In an excel spreadsheet, calculate the values of Gini Index, Theil Index and Hoover Index. Comment on why the indices differ. Which index is better?

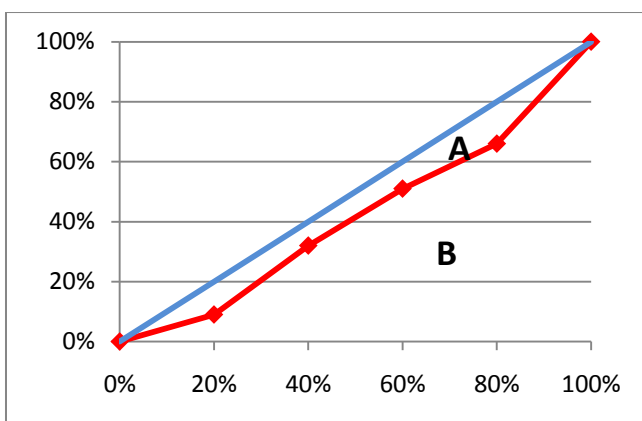
-Sweden income distribution (year 2000, source World Bank, World Development Indicators):



- Taiwan income distribution (year 1992, source Jong-Rong Chiou: A dominance evaluation of Taiwan's official income distribution statistics.):



-Slovakia income distribution (year 1996, source World Bank, World Development Indicators):



-To calculate the Gini coefficient we must know the areas from the triangle above. We know that the area of A+B is 0.5 . The area for B, based on the frequencies on the X and Y axis is:

$$B=0.5*(x_0+x_1)*0.2+\dots+0.5*(x_4+x_5).$$

$$\text{Gini} = 1 - B/0.5$$

The Gini values obtained are :

Sweden	Taiwan	Slovakia
0.20	0.29	0.17

-To compute the Theil index, the length of each quantile was named as follows: the income of each group is E_i where i is the total number of quantiles; the numbers of people of each group are named A_i .

The formula for the index is $\text{Theil} = \text{sum}(T)/2$,

$$\text{sum}(T) = T_1 + \dots + T_5,$$

$T_i = \ln(\text{average}(E_i) * D_i)$, $\text{average}(E_i) = E_i/A_i$ and $D_i = E_i/\text{sum}(E) - A_i/\text{sum}(A)$. Similar for all the 5 quintiles.

The Theil values obtained are :

Sweden	Taiwan	Slovakia
0.11	0.14	0.09

-The Hoover index has a formula based on the same variables:

$$H = \frac{1}{2} * \sum_{i=1}^n \left| \frac{E_i}{\text{sum}(E)} - \frac{A_i}{\text{sum}(A)} \right|$$

-The Hoover values are:

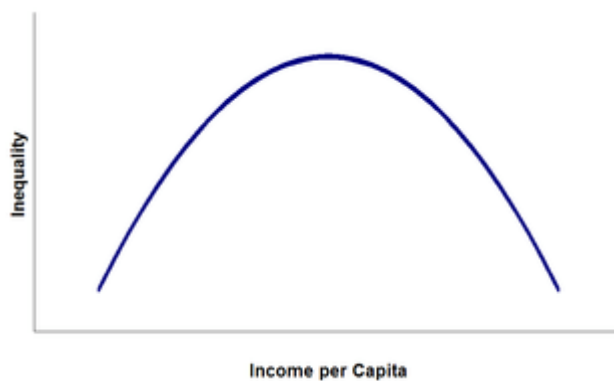
Sweden	Taiwan	Slovakia
0.19	0.22	0.17

-After computing all the 3 indexes, we observe that all the 9 values are very close. Between the indexes, there is not much difference, the deviations are not big. Basically all the indexes lead to the same results, the biggest income equality is in Slovakia, followed by Sweden and then Taiwan, in all the 3 indexes. We also notice that the Gini values are more pessimistic since they are closer to inequality than the Theil values which are more optimistic.

When it comes to choosing one of the indices, Gini is the most widely preferred because it is very simple to calculate (just computing an area on a graph). However,

the Theil index has much more power because it takes into account the differences between regions.

- (c) Explain Kuznets Hypothesis. Describe some theory that intends to explain it. Find a real life example that refutes the Kuznets hypothesis (A real life data, or some scientific article with an interpretation is a satisfactory answer. However, cases of Taiwan and the US cannot be used.



According to Simon Kuznets, the income inequality is low for the least developed countries with lower income, and starts to increase when the income of the country increases up to a point when it starts decreasing again.

The representation of the relationship between inequality and income is represented by the inverted U shaped Kuznets Curve.

According to Moran, T. P. (2005), the main explanation in the past for why inequality rises as a country starts to develop is tied to the population shift. During the process of development, large numbers of people start to commute from rural to urban areas, from agriculture field to industrial field, thus creating wage differences. Simon Kuznets states that during this growth that a country is going through, some sectors grow faster and some slower, creating discrepancies.

As more and more people and sectors are integrated on the industrialization path, Matins-Bekat, C. points out that the inequality reduces, supporting the Kuznets Curve. Furthermore, high income states invest more in education and welfare, thus more people have access to education and opportunities are available for each one. The government policy is stronger towards national cohesion and homogenization.

An example that refutes the Kuznets Curve is **Estonia**, supporting the writings of Fields (2001). During the 90's, up to the present, this country was on a path of development from a communist country to a capitalist economy. As we see from the table below, even though, the GDP had higher growth rates, the inequality decreased, as measure by the GINI index, contradicting the Kuznets Hypothesis.

Year	1993	1998	2000	2001	2002	2003	2004
GDP growth	-6%	5%	10%	8%	8%	7%	8%
GINI Index	40	38	37	37	37	36	36

(d) How do Guiso, Sapienza & Zingales (2003) explain the fact that 'trust towards others' is affected mostly by religious participation, not by religious upbringing?

Guiso, Sapienza & Zingales, have researched the factors influencing trust towards others by using data from the World Values Survey, conducted in many countries in the past. People responded to questions, and according to their answer, a correlation was found between religious participation / upbringing and trust in other people.

The authors explain that religious participation in Christian countries, mostly protestant, increase the trust in others while in the rest of religions, trust decreases. The reason why this happens is that active church goers are defined as good people, having positive attitudes thus trusting the others more. Those who go more often to church, as the authors explain, are socializing more, are present in a collective environment as opposed to the people with religious upbringing, mostly alone. The survey showed negative impacts on trust for Catholics, Muslims and Hindus.

Another distinction between the two situations is that when a person is raised religiously since childhood, this is involuntarily, some people might have low trust in others by nature. Being brought up in a certain way, doesn't mean that you are willing to behave in that way. Religious participants however, are going to church voluntarily.

(e) What was the vision of the Rev. Thomas Malthus' on economic growth and development?

Rev. Thomas Malthus, can be included in the pessimistic category when referring to his attitude towards future economical growth. His vision is mostly focused on demographics, especially population growth. According to Malthus, in regions with abundance of resources, there is a high increase of population, that later will lead to social distress. There is a discrepancy between the rate of population growth and the supporting resources. More people have more needs and with a constant pool of

resources, distress is created. The Malthusian growth model stated that investment in land produces diminishing marginal returns and the land is limited, thus, there are no good prospects for the future, for the mankind.

Based on the problems highlighted in "An essay on the principle of population", he proposes some solutions. Thomas Malthus proposes lowering birth rates and raising death rates. Moral abstinence was his solution for overpopulation. He also pointed out that development can be achieved by investing in agriculture, a domain he argued has infinite potential of development.