

# Development Economics - Assignment #1

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## Question 1

It means that social and institutional innovations and reform are also strongly correlated with economic growth as technological and scientific innovations do. This is why social science is as important as natural science. For instance, after the reform and opening-up, China grew at a high speed.

A more complete financial market can allocate funds more effectively; a more clean and efficient government can reduce corruption, provide better public services, organize human resources and fixed asset investment; the development of education and medical care promotes the accumulation of human capital and technological progress; and the protection of property rights promotes investment. We can see that this statement is intuitively correct.

To eliminate the interference of other factors and only look at the impact of social and institutional improvements on economic growth, we need to control variables. Considering the Solow neoclassical growth model:

$$Y(t) = K(t)^a (A(t)L(t))^{1-a}$$

In 1978, 18 households in Xiaogang, Anhui tried to clarify the property rights of each family and retain part of the harvest for the first time, then the farmers' output increased significantly in the following year compared with other neighboring ones, those with similar conditions but will still organize production according to the government, and confirm the property rights according to the village or people's commune.

This institutional reform has stimulated farmers' enthusiasm to use land capital to product. In just one year, the labor force  $L$  in the village has not increased significantly, and the level of science and technology  $A$  has not been significantly improved, but the efficiency of capital  $K$  utilization has been improved, and the output has been improved.

## Question 2

GNI calculated at purchasing power parity shows more equality.

We employ GNI per capita to compare the income level among countries, since most people earn income and consume goods in the same country, the standard of living depends not only on the amount of income currency they can earn, but also on the local price level. In developing countries, people have lower income, therefore, people can consume nontraded goods and service at lower price comparing to developed countries. Using exchange rates will ignore the different purchasing power of each currency but exaggerate the gap in real living standards among countries.

In detail, we do not use the official exchange rate to convert GNI, but use the amount of local currency that can be purchased for the same goods and services that can be purchased with one dollar in the U.S. as a reference for calculating GNI.

## Question 3

a. Given production function and the condition in the initial year, we have:

$$Y_0 = \min\{0.2K_0, 0.1L_0\} = \min\{8, 8\} = 8$$

In the next year, we have:

$$K_1 = (1 - \delta)Y_0 + sY_0 = 1.2Y_0 = 48$$

$$L_1 = (1 + n)L_0 = 1.04L_0 = 83.2$$

$$Y_1 = \min\{0.2K_1, 0.1L_1\} = \min\{9.6, 8.32\} = 8.32$$

b. At the beginning, capital per labor is  $K_0/L_0 = 0.5$ , one year later, it is  $K_1/L_1 = 0.577$ . Since  $k$  is still increasing, the economy does not reach a steady state.

c. The capital-output rate in the initial year is  $K_0/Y_0 = 40/8 = 5$ , in the next year it is  $K_1/Y_1 = 48/8.32 = 5.77$ . It shows the units of capital required to produce a unit of output over a given period of time.

d. Considering the Harrod-Domar growth model,

$$\Delta Y/Y = s^G/c - \delta$$

Given  $\delta = 0$ ,  $c = 5$ , to let the growth rate  $\Delta Y/Y$  reach 0.08,  $s^G$  must be 0.4.

Also, given  $s^G = 0.2$ , to reach the same growth rate,  $c$  must be 2.5.

In order to raise the growth rate, the saving rate need to rise because the state need to save part of its output to do investment and grow the economy. The more people save, the more capital can be used to invest and increase the growth rate.

Also, the capital-output ratio need to fall, because a small  $c$  means the nation can produce one unit of output in less capital, so the nation is more productive. In economic terms, decrease in  $c$  or increase in  $1/c$  means higher productivity.

## Question 4

a. I used matlab for interpolation since we only know 5 point in Lorenz curve.

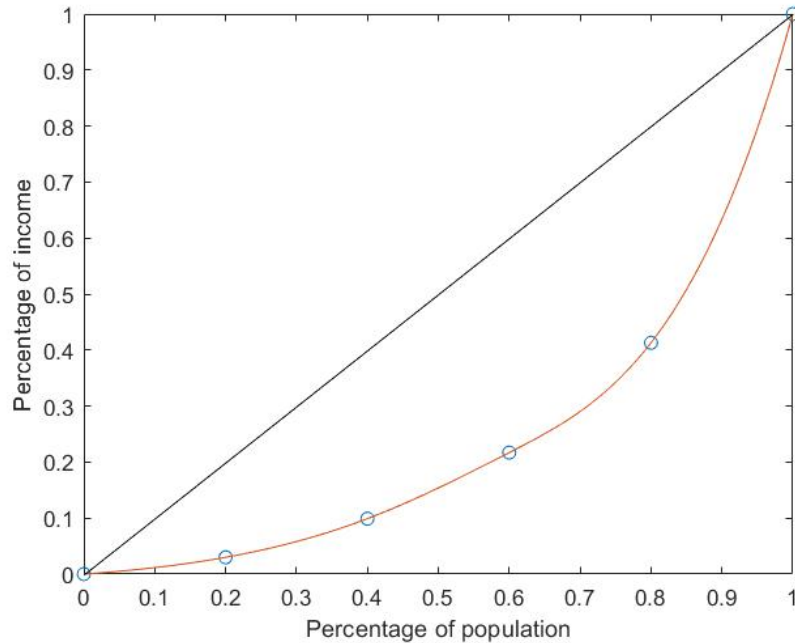


Figure 1: Lorenz curve and Gini coefficient

b. Graphically, Gini coefficient is the ratio of the area between the straight line and the Lorenz curve to the area of the triangle formed by the straight line and the coordinate axis.

c. The bottom 20% can obtain  $3.4 * 0.03 = 0.102$  trillion dollar, and the bottom 40% can get  $3.4 * (0.03 + 0.069) = 0.3366$  trillion dollar.

d.

In headcount index, we must find how many people is under the poverty line. The bottom 20% has  $102,000/41.8 = 2,440.19$  as GNI per capita, the second quintile has  $234,600/41.8 = 5,612.44$  as GNI per capita. According to the assumption of average income, we can say the bottom 20% is under the poverty line,  $H/N = 0.2$ .

In total poverty gap, we have  $TPG = 23400058000$

$$TPG = \sum_{i=1}^H (Y_p - Y_i) = 41,800,000 * (3,000 - 2,440.19) = 23400058000$$

In average poverty gap,  $APG = TPG/N = 111.962$

In average income shortfall,  $AIS = TPG/H = 559.81$

In normalized poverty gap,  $NPG = APG/Y_p = 0.037$

In normalized income shortfall,  $NIS = AIS/Y_p = 0.187$

In the Foster-Greer-Thorbecke indice,

$$P_0 = \frac{1}{N} \sum_{i=1}^H \left( \frac{Y_p - Y_i}{Y_p} \right)^0 = H/N = 0.2$$

$$P_1 = \frac{1}{N} \sum_{i=1}^H \left( \frac{Y_p - Y_i}{Y_p} \right)^1 = (H/N) * (NIS) = 0.037$$

$$P_2 = \frac{1}{N} \sum_{i=1}^H \left( \frac{Y_p - Y_i}{Y_p} \right)^2 = (H/N)[NIS^2 + (1 - NIS)^2(CV_p)^2] = 0.00696$$

e. Now the bottom 20% has 4% of national income, the top 20% has 57.7% of national income. Show it in the graphic, we can see the Lorenz curve moves a little bit to line of equality, therefore the Gini coefficient has decreased, the inequality has reduced.

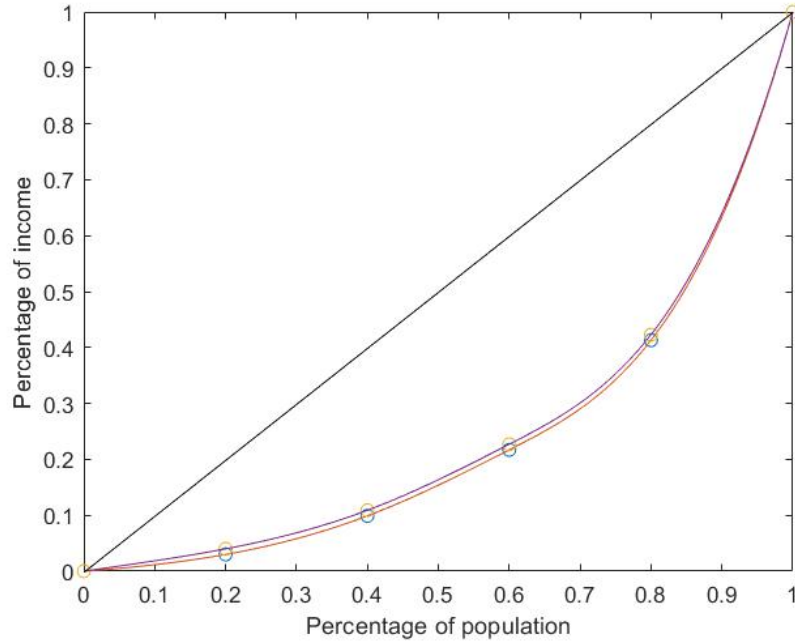


Figure 2: Comparison between two situation

f. If it happens, the GNI per capita for the bottom 20% will be 3,253.59 dollar, there will be no poverty since everyone is above the poverty line.

## Question 5

a. They will have children till the marginal revenue is below 0. Let C to be the number of children they decide to have,

$$MR_{Children} = totalbenefit_C - 100 * \sum_{i=1}^C i$$

Therefore, follow the assumption of rational people, they will have 3 children and the revenue of having additional one child is negative.

b. Let  $C_1$  and  $C_2$  to the the number of children Ron and Hermione, Harry and Ginny decide to have respectively. There is a noncooperated, simultaneous game about childbirth decision with complete information. The payoffs of two family are as followed. The Nash

equilibrium can be reached when two family cannot benefit from changing decision.

$$P_1 = totalbenefit_{C_1} - 50 * \sum_{i=1}^{C_1} i - 50 * \sum_{i=1}^{C_2} i$$

$$P_2 = totalbenefit_{C_2} - 50 * \sum_{i=1}^{C_2} i - 50 * \sum_{i=1}^{C_1} i$$

Draw the payoff matrix.

Number of Child	1	2	3	4	5	6	7	8	For Harry and Ginny
1	400,400	300,550	150,490	-50,340	-300,130	-600,-150	-950,-490	-1350,-890	
2	550,300	450,450	300,390	100,240	-150,30	-450,-250	-800,-590	-1200,-990	
3	490,150	390,300	240,240	40,90	-210,-120	-510,-400	-860,-740	-1260,-1140	
4	340,-50	240,100	90,40	-110,-110	-360,-320	-660,-600	-1010,-940	-1410,-1340	
5	130,-300	30,-150	-120,-210	-320,-360	-570,-570	-870,-850	-1220,-1190	-1620,-1590	
6	-150,-600	-250,-450	-400,-510	-600,-660	-850,-870	-1150,-1150	-1500,-1490	-1900,-1890	
7	-490,-950	-590,-800	-740,-860	-940,-1010	-1190,-1220	-1490,-1500	-1840,-1840	-2240,-2240	
8	-890,-1350	-990,-1200	-1140,-1260	-1340,-1410	-1590,-1620	-1890,-1900	-2240,-2240	-2640,-2640	
For Ron and Hermione									

Figure 3: The payoff matrix

From the payoff matrix, we can also get that NE is (3,3)

c. In joint family, due to increasing marginal cost of having child in single nuclear family, the behavior of other families to share the burden of raising children, creating a positive externality for this family. So, it encourages them to make more positive fertility decisions compared with a small family.

d. Countries with relatively youth population have a high youth dependency ratio, economically active adults need to support more children; In an aging society, the dependency burden is also heavy. The proportion of economically active adults in the population structure is negatively related to the dependency.

Review: Why I am wrong?

1. Additional cost = marginal cost, change in benefit = marginal benefit.

2. Rational people think at margin. For each decision to have additional one child, the benefit and cost of having previous child is forgone, it is sunk costs, we shall not consider it.

## Code

For question 4 problem a

```
x1=0:0.2:1;  
y1=[0 0.03 0.099 0.217 0.413 1];  
x2=0:0.01:1;  
y2=spline(x1,y1,x2);  
xlabel('Percentage of population')  
ylabel('Percentage of income')  
plot(x1,y1,'o',x2,y2)
```

For question 4 problem e

```
x1=0:0.2:1;  
y1=[0 0.03 0.099 0.217 0.413 1];  
x2=0:0.01:1;  
y2=spline(x1,y1,x2);  
xlabel('Percentage of population')  
ylabel('Percentage of income')  
y3=[0 0.04 0.109 0.227 0.423 1];  
y4=spline(x1,y3,x2);  
plot(x1,y1,'o',x2,y2)  
hold on  
plot(x1,y3,'o',x2,y4)
```