Ec 320: Solutions to Problem Set 1

October 6, 2009

1 Question 1

1.1 a

The current per capita income is

$$\$\frac{3,000}{2} = 1,500$$

1.2 b

GDP per capita in 5 years is:$(1+0.03)^5 \times 1500 = \$1738.9$

GDP per capita in 10 years is:$(1+0.03)^{10} \times 1500 = \$2015.87$

1.3 c

$x = \frac{70}{3} = 23.3$ (years)

1.4 d

$10 = \frac{70}{y}, \text{so} y = \frac{70}{10} = 7\%$

1.5 e

The GDP growth rate is 4% per annum: $g = g^* + n = 0.03 + 0.1 = 0.04$

GDP in 5 years is: $(1+0.04)^5 \times 3 = \$3.65(billion)$

GDP in 5 years is: $(1+0.04)^{10} \times 3 = \$4.44(billion)$

2

Since the current capital is \$6 billion and current GDP is \$ 3 billion, the capital-output ratio is

$$\theta = \frac{6}{3} = 2$$

By the Harrod-Domar formula, we can solve for the savings rate:

$$\frac{s}{\theta} = g + \delta \Rightarrow \frac{s}{2} = 0.04 + 0.1 = 0.14 \Rightarrow s = 2 \times 0.14 = 0.28$$

Or

$$\frac{s}{\theta} = g^* + n + \delta \Rightarrow \frac{s}{2} = 0.03 + 0.01 + 0.1 = 0.14 \Rightarrow s = 2 \times 0.14 = 0.28$$

If saving rate were halved, it would become:

$$\frac{0.28}{2} = 0.14$$

Then the growth rate per capita would be

$$\begin{aligned}\frac{0.14}{2} = g^* + n + \delta \Rightarrow 0.07 &= g^* + 0.01 + 0.1 \\ \Rightarrow g^* &= 0.07 - 0.11 = -0.04 = -4\%\end{aligned}$$

3

3.1 a

From question 2, we know the saving rate is 0.28

$$\begin{aligned}\text{From } 2000 \sim 3000\text{: } \theta &= 2(1+0.1) = 2.2 \\ \frac{0.28}{2.2} &= g^* + n + \delta = g^* + 0.11 \\ \Rightarrow g^* &= 1.727\% \\ \text{From } 3000 \sim 4000\text{: } \theta &= 2.2(1+0.1) = 2.42 \\ \frac{0.28}{2.42} &= g^* + n + \delta = g^* + 0.11 \\ \Rightarrow g^* &= 0.57\% \\ \text{From } 4000 \sim 000\text{: } \theta &= 2.42(1+0.1) = 2.662 \\ \frac{0.28}{2.662} &= g^* + n + \delta = g^* + 0.11 \\ \Rightarrow g^* &= -0.48\%\end{aligned}$$

3.2

In long run, $g^* = 0$. Growth rate of GDP per capita is positive when it is smaller than 4000 and negative when it is larger than 4000. This implies that the per capita income will stabilize, and the long run growth rate will be zero.

3.3

In long run, the GDP per capita is about 4000. When GDP per capita is below 4000, the growth rate is positive. But once it exceeds 4000, the growth rate becomes negative. Hence GDP per capita will be drawn back to 4000 whenever it exceeds this level. Therefore GDP per capita will tend to be stabilize at 4000 in the long run.