Solutions to Homework # 5

Question 1.

i. Nominal exchange rate – the price of one unit of foreign currency in terms of domestic currency; or equivalently, the rate at which one unit if foreign currency can be exchanged for the domestic currency.

ii. Real exchange rate – is the cost of a basket of goods in the foreign country (denominated in domestic currency units) relative to the cost in the domestic economy.

iii. Purchasing power parity – if there are no transportation costs and tariffs (or any other non-tariff trade barriers), the cost of the same basket of goods, denominated in the same currency, should be equal across countries.

iv. Uncovered interest rate parity refers to the idea that on average the difference between foreign and domestic interest rates should be equal to the proportional change in the exchange rate. In other words, if the domestic currency is expected to appreciate, foreign interest rates have to be higher than domestic interest rates by an amount equal to the expected change in the exchange rate in order to compensate any investor for the value they will lose by holding a foreign asset that is depreciating in value.

v. Devaluation – a reduction in the value of a country’s currency against another currency when exchange rate is fixed.

vi. Soft peg – There’s no long-term commitment to a particular value of the exchange rate, but the exchange rate can be fixed related to another currency for long periods of time with periodic revaluation and devaluations.

vii. Exchange rate appreciation – the number of domestic currency units per foreign currency increases (therefore, the domestic currency loses value relative to the foreign currency).

2.

i. Europe is the domestic economy (need to look at how the nominal exchange rate is specified. In this question, it is euros per dollar, hence Europe is the domestic economy).

<table>
<thead>
<tr>
<th>Years</th>
<th>US price</th>
<th>European price</th>
<th>Nominal exch. Rate (euros per dollar)</th>
<th>Real exch. Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>100</td>
<td>100</td>
<td>0.85</td>
<td>0.85</td>
</tr>
<tr>
<td>2001</td>
<td>105</td>
<td>95</td>
<td>0.7</td>
<td>0.77</td>
</tr>
<tr>
<td>2002</td>
<td>110</td>
<td>103</td>
<td>0.9</td>
<td>0.96</td>
</tr>
</tbody>
</table>
iii. In 2001, dollar depreciates against euro because ($e$ has decreased).

iv. A European tourist in the US would have been better-off in the year 2001 compared to other years since the real exchange rate was the highest in that year. In other words, a Euro would have exchanged for more American goods in 2002.

v. If PPP were to hold, then the real exchange rate would be one, which is not true here. Some factors that may cause deviations from the purchasing power parity:

1. non-tradable inputs of production used to produce tradable goods (e.g., the price of labor (wages) or the rental rate of land may vary substantially across countries, which change the cost at which goods are produced.)
2. trade barriers such as tariffs, export subsidies, and quotas may affect the price at which the same good is sold in different countries.

Q4.

(i) Find the steady state level of capital stock and steady state level of GDP in this case.

\[ K_{t+1} = (1 - \delta)K_t + I_t \]
\[ \Rightarrow K_{t+1} = (1 - \delta)K_t + sY_t \]
\[ \Rightarrow K_{t+1} = (1 - \delta)K_t + s(K_t)^{\frac{\nu}{2}}(Q_t)^{\frac{\nu}{2}} \]
\[ \Rightarrow K_{t+1} = (1 - \delta)K_t + s(K_t)^{\frac{\nu}{2}}(K_t)^{\frac{\nu}{2}} \]
\[ \Rightarrow K_{t+1} = (1 - \delta)K_t + sK_t = (1 - \delta + s)K_t \]
\[ = (1 - 0.08 + 0.2)K_t \]
\[ \Rightarrow K_{t+1} = 1.12K_t \]

In per capita terms,

\[ \frac{K_{t+1}}{N_t} = 1.12 \frac{K_t}{N_t} \]
\[ \Rightarrow \frac{K_{t+1}}{N_{t+1}} = 1.12 \frac{K_t}{N_t} \] (since $N_{t+1} = N_t$)
\[ k_{t+1} = 1.12k_t \]

At the steady state, $k_{t+1} = k_t = k_{ss}$. So, $k_{ss} = 1.12k_{ss}$ implies that zero is the only steady state capital stock per capita in this economy. Therefore, the steady state level of output per capita is also zero.
Consider two economies, A and B, with the same initial capital stock, same production function and same knowledge function in the scope of endogenous growth model. Suppose that $\delta^A = \delta^B = \delta = 0.08$ and $s^A = s^B = 0.4$. What is the prediction of the endogenous growth theory in terms of the growth paths of the two countries? Provide graphs, which support your explanation.

Solution: economy A grows at a higher rate than economy B. To show this graphically, we need to draw a graph of output per person tomorrow ($y_{t+1}$) versus output per person today ($y_t$). Because of our technology and the assumption that population size is 1, the production function—in per capita terms—reduces to $y_t = k_t$. Hence, we can alternatively draw a graph of $K_{t+1}$ versus $K_t$. This is easier as we derived the relationship between capital tomorrow and capital today above: $k_{t+1} = k_t (1 - \delta + s)$. This is a linear line that passes through the origin with slope $(1 - \delta + s)$. Plugging in the numbers given for economy A and economy B, we see that the slope is bigger for country A, which implies that A is growing at a higher rate. Hence, we conclude that country B will never catch up with country A in terms of its wealth.

\[ k_{t+1} = 1.32k_t \]
\[ k_{t+1} = 1.42k_t \]
\[ k_{t+1} = k_t \]