Prof. Gustavo Indart
Department of Economics
University of Toronto

ECO209Y
MACROECONOMIC THEORY

Solution to Problem Set 8

(Odd numbers only)

1. a) First we find the IS curve. The AE curve is:

$$AE = C + I + G + X - Q$$

$$= \overline{C} + c\,(Y - t\,Y + \overline{TR}) + \overline{I} - b\,i + \overline{G} + \overline{X} + x\,(eP^f / \overline{P}) - \overline{Q} - m\,Y + s\,(eP^f / \overline{P})$$

$$= \overline{C} + \overline{I} + \overline{G} + \overline{X} - \overline{Q} + [c\,(1 - t) + f - m]\,Y - b\,i + (x + s)\,(eP^f / \overline{P})$$

$$= \overline{AE} + [c\,(1 - t) + f - m]\,Y - b\,i + (x + s)\,(eP^f / \overline{P})$$

where $\overline{AE} = \overline{C} + c\,\overline{TR} + \overline{I} + \overline{G} + \overline{X} - \overline{Q}$.

In equilibrium Y = AE:

$$Y = \overline{AE} + [c\,(1 - t) + f - m]\,Y - b\,i + (x + s)\,(eP^f / \overline{P})$$

$$0 = \overline{AE} - [1 - c\,(1 - t) - f + m]\,Y - b\,i + (x + s)\,(eP^f / \overline{P}).$$

And solving for i, we obtain the equation for the IS curve:

$$i = \frac{\overline{AE} + (x + s)\,(eP^f / P)}{b} - \frac{1 - c\,(1 - t) - f + m}{b}\,Y.$$

Then we find the equation for the LM curve. From the money market, we set L = M/P:

$$K\,Y - h\,i = \overline{M} / \overline{P}$$

And solving for i, we obtain the equation for the LM curve:

$$i = (k / h)\,Y - (1 / h)\,(\overline{M} / \overline{P}).$$

To obtain equilibrium income (Y*) we equate the IS and LM curves:

$$\frac{\overline{AE} + (x + s)\,(eP^f / \overline{P})}{b} - \frac{1 - c\,(1 - t) - f + m}{b}\,Y = \frac{k}{h}\,Y - \frac{1}{h} \cdot \frac{\overline{M}}{\overline{P}}$$

$$\overline{AE} + (x + s)\,(eP^f / P) + (b / h)\,(M/P) = [1 - c\,(1 - t) - f + m + (bk / h)]\,Y$$

And solving for Y:

$$Y^* = \frac{\overline{AE} + (x + s)\,(eP^f / P) + (b / h)\,(\overline{M} / \overline{P})}{1 - c\,(1 - t) - f + m + (bk / h)}.$$

And the equilibrium interest rate (i*) is found by substituting Y* into the LM curve (or the IS curve):

$$i^* = (k / h)\,Y^* - (1 / h)\,(\overline{M} / \overline{P}).$$

b) To find ΔY* / Δe, we change e in the equilibrium income equation to obtain:

$$\frac{\Delta Y^*}{\Delta e} = \frac{(x + s)\,(P^f / \overline{P})}{1 - c\,(1 - t) - f + m + (bk / h)} > 0.$$

To find Δi*/Δe, we change e in the equilibrium interest rate equation to obtain:

$$\frac{\Delta i^*}{\Delta e} = \frac{k}{h} \cdot \frac{\Delta Y^*}{\Delta e} > 0.$$

c) The balance of payments is:

$$BP = X - Q + CF$$

$$= \overline{X} + x\,(eP^f / \overline{P}) - \overline{Q} - m\,Y^* + s\,(ePf / \overline{P}) + \overline{CF} + g\,i^*$$

$$= \overline{X} - \overline{Q} + \overline{CF} - m\,Y^* + g\,i^* + (x + s)\,(eP^f / \overline{P})$$

Note that this equation has the equilibrium values of Y and i in it. To obtain ΔBP / Δe, we must recognize that both Y and i change.

$$\frac{\Delta BP}{\Delta e} = -m\frac{\Delta Y^*}{\Delta e} + g\frac{\Delta i^*}{\Delta e} + (x + s)\,(P^f / \overline{P})$$

$$= -m\frac{\Delta Y^*}{\Delta e} + g\frac{k}{h} \cdot \frac{\Delta Y^*}{\Delta e} + (x + s)\,(P^f / \overline{P})$$

$$= [(gk / h) - m]\frac{\Delta Y^*}{\Delta e} + (x + s)\,(P^f / \overline{P})$$

$$= [(gk / h) - m]\frac{(x + s)\,(P^f / \overline{P})}{1 - c(1 - t) - f + m + (bk / h)} + (x + s)\,(P^f / \overline{P})$$

$$= \left[\frac{(gk / h) - m}{1 - c(1 - t) - f + m + (bk / h)} + 1\right](x + s)\,(P^f / \overline{P})$$

$$= \frac{[(gk / h) - m] + [1 - c\,(1 - t) - f + m + (bk / h)]}{1 - c\,(1 - t) - f + m + (bk / h)}\,(x + s)\,(P^f / \overline{P})$$

$$= \frac{1 - c\,(1 - t) - f + (b + g)\,(k / h)}{1 - c(1 - t) - f + m + (bk / h)}\,(x + s)\,(P^f / \overline{P}) > 0.$$

You should note that, as expected, ΔBP/Δe is positive. This indicates that a devaluation results in an improvement in the Balance of Payments.

d) Now we want to increase (M/P). From the above equilibrium Y equation we obtain $\Delta Y^*/\Delta(M/P)$:

$$\frac{\Delta Y^*}{\Delta(M/P)} = \frac{(b/h)}{1 - c(1-t) - f + m + (bk/h)} = \frac{1}{(h/b)[1 - c(1-t) - f + m] + k}$$

And from the equilibrium rate of interest equation we obtain $\Delta i^*/\Delta(M/P)$:

$$\frac{\Delta i^*}{\Delta(M/P)} = \frac{k}{h} \cdot \frac{\Delta Y^*}{\Delta(M/P)} - \frac{1}{h}$$

$$= (-1/h)\left[1 - \frac{bk/h}{1 - c(1-t) - f + m + (bk/h)}\right]$$

$$= (-1/h)\frac{1 - c(1-t) - f + m}{1 - c(1-t) - f + m + (bk/h)}.$$

To determine the effect on BP again it is important to remember that both Y* and i* may change:

$$\frac{\Delta BP}{\Delta(M/P)} = -m\frac{\Delta Y^*}{\Delta(M/P)} + g\frac{\Delta i^*}{\Delta(M/P)}$$

$$= -m\frac{\Delta Y^*}{\Delta(M/P)} + g\left[\frac{k}{h} \cdot \frac{\Delta Y^*}{\Delta(M/P)} - \frac{1}{h}\right]$$

$$= [(gk/h) - m]\frac{\Delta Y^*}{\Delta(M/P)} - \frac{g}{h}$$

$$= \frac{[(gk/h) - m](b/h)}{1 - c(1-t) - f + m + (bk/h)} - \frac{g}{h}$$

$$= (-1/h)\frac{g[1 - c(1-t) - f + m + (bk/h)] - b[(gk/h) - m]}{1 - c(1-t) - f + m + (bk/h)}$$

$$= (-1/h)\frac{bm + g[1 - c(1-t) - f + m]}{1 - c(1-t) - f + m + (bk/h)} < 0.$$

Since $\Delta BP/\Delta(M/P) < 0$, an increase in real money supply causes the Balance of Payments to deteriorate. This occurs since as the real money supply rises, the interest rate falls causing a deterioration in the balance of the capital account (while the balance in the current account remains unchanged). Therefore, if we started at BP = 0, as the question states, there will be now a deficit in the overall Balance of Payments.

If the exchange rate were flexible, the deficit in the BP (and thus an excess demand for foreign currency in the exchange market) would cause the domestic currency to depreciate. If the government has a fixed exchange rate system in place, the central bank would sell foreign currency in the exchange market to eliminate the excess demand, and thus the money supply would fall to its original level.

If the government wanted to have an effective monetary policy while keeping a fixed exchange rate, it could introduce some regulations in the capital account in order to reduce the degree of capital mobility.

3. a) True. Exchange depreciation creates domestic employment at the expense of other countries (this is why it is called a beggar-thy-neighbor policy). It shifts demand from one country to another but does not change the level of world demand. When many countries experience a simultaneous economic downturn, exchange rate movements do not significantly increase world demand, even though they may affect the allocation of demand among countries. While an individual country may feel compelled to raise domestic output by attracting demand from other countries, a better way to increase demand in each country would be to coordinate fiscal and monetary policy.

   b) False. Expansionary fiscal policy will shift the IS-curve to the right, leading to an increase in the level of output demanded and a higher interest rate. This will cause an inflow of funds that will result in a currency appreciation. To maintain a fixed exchange rate, the central bank will have to respond by increasing the money supply, shifting the LM-curve to the right. Therefore, the level of output demanded will increase even further. The central bank will continue to increase money supply until the domestic interest rate is again in line with world interest rates. Since there will be no crowding out and the level of output will increase by the full multiplier effect, the statement is false.

   c) False. If foreign interest rates rise, a capital outflow will occur, leading to a downward pressure on the value of the currency. To maintain a fixed exchange rate, the central bank will be forced to buy domestic currency by selling its holdings of foreign currency. This reduction in money supply will lead to higher domestic interest rates and thus less output demanded. This will cause a recession and the level of domestic output will fall, not rise.

d) Expansionary monetary policy decreases the rate of interest and shifts the LM-curve to the right. Lower interest rates lead to capital outflows, thus putting a downward pressure on the value of the currency. Under a fixed exchange rate system, however, the central bank cannot allow the currency to depreciate and will have to trade foreign currencies for domestic currency, thereby reducing the supply of money. This will shift the LM-curve back to the left, and the foreign reserve holdings of the central bank will fall.