## 14.02 Principles of Macroeconomics
## Problem Set 6
## Fall 2005
## ***Solutions***

Posted:      Wednesday, November 23, 2005
Due:         **FRIDAY**, December 2, 2005

## Exercise I.  True/False? Explain

1)  Assume that the Marshall-Lerner condition holds and $\frac{P}{P*}=1$ so that $\varepsilon = E$ (real and nominal exchange rates are the same). In the short run, in an open economy with flexible exchange rates and constant expectations about the future exchange rate ($\bar{E}^e$), an expansionary monetary policy has an ambiguous effect on the trade balance.

    *True. Net exports depend on domestic output, foreign output, and the exchange rate: $NX = NX(Y,Y^*,E)$. An expansionary monetary policy leads to an increase in output Y and a depreciation of E (from the interest parity condition). The first effect decreases next exports, while the second effect increases NX, given that the Marshall-Lerner condition holds. The overall effect is ambiguous.*

2)  In open economy, an increase in the foreign interest rate always shifts up the LM curve. Assume constant expectations on the exchange rate $\bar{E}^e$.

    *False. The only case when LM shifts up because of an increase of $i^*$ is under a fixed exchange rate regime with no capital controls, when the Central Bank decides to maintain the peg. In that case in order to keep the exchange rate parity, a monetary contraction is needed.*

3)  Adopting a fixed exchange rate regime implies necessarily that the Central Bank gives up the monetary policy as a policy tool.

    *False. If there is imperfect capital mobility, even under a fixed exchange rate regime, there is still room for monetary policy as a policy tool. Indeed, in this case the interest parity condition does not have to hold.*

4)  In the medium run, the choice of the exchange rate regime does not affect the equilibrium output level, but it does affect the equilibrium price level.

    *True. Assuming no inflation, in equilibrium we have a fixed medium run price level. As shown in the second long exercise, with a flexible exchange rate the medium run equilibrium price level is uniquely determined. With a fixed exchange rate the medium run equilibrium price level P depends on the peg $\bar{E}$.*

5) The AD curve in open economy is unambiguously flatter than in closed economy.

*False. In a closed economy the aggregate demand relation is $Y = Y\left(\dfrac{M}{P}, G, T\right)$.*

*The aggregate demand relation in an open economy becomes $Y = Y\left(\dfrac{EP}{P*}, G, T\right)$ under a*

*fixed exchange rate regime or $Y = Y\left(\dfrac{M}{P}, G, T, \dfrac{EP}{P*}\right)$ with flexible exchange rates. If the*

*Marshall Lerner condition is satisfied in all the cases the AD curve is downward sloping. Having a flatter open economy AD curve would mean that there is a bigger effect on Y, for given a change in P, compared to the closed economy case. It is not unambiguously true. The answer depends on the relative size of the elasticity of the open economy aggregate demand to the real exchange rate and of the elasticity of the closed economy aggregate demand to the money supply.*

6) A group of countries is an optimal currency area if two conditions are both satisfied: the countries experience similar shocks and there is high factor mobility between them.

*False. Verifying just one of the two conditions is sufficient to determine an optimal currency area.*

## Exercise II. Open economy IS-LM

Consider the following open economy:
$C = 215 + 0.3(Y - T)$
$I = 100 + 0.2Y - 750r$
$IM = 0.1Y\varepsilon + 100\varepsilon^2$
$X = 0.01Y* - 110\varepsilon$
$T = 50$
$G = 50$
$Y* = 10000$
$M^s = 500$
$M^d = PY - 2500i$
$i* = 4\%$
Suppose that $P = P* = 1$ and there is no inflation $\pi* = \pi = 0$.
Assume that the country has a **fixed** exchange rate regime.

1) Is the Marshall-Lerner satisfied in this economy?
*The Marshall-Lerner condition states $\dfrac{\partial NX}{\partial \varepsilon} < 0$.*

$$\frac{dNX}{d\varepsilon} = \frac{dX}{d\varepsilon} - \frac{d(IM/\varepsilon)}{d\varepsilon} = -110 - \left(0.1\frac{\partial Y}{\partial \varepsilon} + 100\right) = -210 + 35 = -175 < 0$$

2) Calculate the equilibrium ($Y, i, \varepsilon, TB$).

*From the uncovered interest parity we get $i* = i = 0.04$.*

*LM relation: $M^s = M^d$*

*Given $i = 0.04$,*

$500 = Y - 2500i$

$Y = 500 + 2500 * 0.04$

$Y = 600$

*From the IS relation we get*

$$Y = 215 + 0.3(Y - 50) + 100 + 0.2Y - 750r + 50 + 0.01Y * -110\varepsilon - \frac{(0.1Y + 100\varepsilon)\varepsilon}{\varepsilon}$$

$210\varepsilon = 60$

$\varepsilon = \dfrac{2}{7}$

$X = 68.57$

$\dfrac{IM}{\varepsilon} = 88.57$

$TB = X - \dfrac{IM}{\varepsilon} = -20$

3) Assume that G increases by 55. What does the Central Bank have to do in order to keep the exchange rate fixed?

$$Y = 215 + 0.3(Y - 50) + 100 + 0.2Y - 750r + 105 + 0.01Y * -110\varepsilon - \frac{(0.1Y + 100\varepsilon)\varepsilon}{\varepsilon}$$

*If the exchange rate parity is maintained, $\varepsilon = \dfrac{2}{7}$.*

$0.6Y = 415$

$Y = 692$

*From LM relation*

$M^s = Y - 2500i$

$M^s = 592$

$\Delta M^s = +92$

4) How does the trade balance change after the expansionary fiscal policy? Comment.

$X = 68.57$

$\dfrac{IM}{\varepsilon} = 97.73$

$TB = X - \dfrac{IM}{\varepsilon} = -29.16$

*The budget deficit leads to a deterioration of the trade deficit.*

**Exercise III. Open-Economy AS-AD**

Consider the following open economy:
$C = 375 + 0.3(Y - T)$
$I = 210 + 0.2Y - 750r$
$IM = 0.1Y\varepsilon + 100\varepsilon^2$
$X = 0.01Y * -110\varepsilon$
$T = 50$
$G = 50$
$Y* = 10000$
$M^s = 500$
$M^d = PY - 2500i$
$W = P^e(z - 10u)$ where $z = 10.1$ is a parameter that represents the workers' bargaining power
and $u$ is the unemployment rate.
The following is the price setting relation $P = (1 + \mu)W$ where $\mu = 0.25$ is the markup.
The production function is: $Y = N$
The labor force is $L = 10000$.

1) Derive the AS relation in this open economy.

   *The AS relation represents the equilibrium points in the labor market.*
   $$\begin{cases} P = (1 + \mu)W \\ W = P^e(z - 10u) \end{cases}$$
   $$P = P^e(1 + \mu)(z - 10u)$$
   *Given that* $u = \dfrac{U}{L} = \dfrac{L - N}{L} = 1 - \dfrac{Y}{10000}$, $\mu = 0.25$, *and* $z = 10.1$ *we get*
   $$P = P^e(1 + 0.25)\left(10.1 - 10\left(1 - \frac{Y}{10000}\right)\right)$$
   $$P = P^e(0.00125Y + 0.125).$$
   *The AS curve has to pass through the point* $(P^e, Y)$ *such that* $Y = Y_n = 700$ : *the natural level of output.*

2) Derive the AD relation assuming that the economy has a **flexible** exchange rate. Express $Y$ as a function of $P_t$, $P^e_{t+1}$, and $\varepsilon_t$, using the approximation $r = i - \pi^e$.
   $$Y = 375 + 0.3(Y - 50) + 210 + 0.2Y - 750r + 50 + 0.01Y * -110\varepsilon - \frac{(0.1Y + 100\varepsilon)\varepsilon}{\varepsilon}$$
   $$0.6Y = 720 - 750r - 210\varepsilon$$
   $$M^s = PY - 2500i$$
   $$500 = PY - 2500i$$
   $$i = \frac{PY - 500}{2500}$$

$$r = i - \pi^e$$

$$r = i - \frac{P^e_{t+1} - P}{P} = i - \frac{P^e_{t+1}}{P} + 1$$

$$0.6Y = 720 - 0.3PY + 150 + 750\frac{P^e_{t+1}}{P} - 750 - 210\varepsilon$$

$$Y = 200 - 0.5PY + 1250\frac{P^e_{t+1}}{P} - 350\varepsilon$$

3) Calculate the medium run equilibrium $(Y, P, E)$. Assume that in the medium run trade is balanced, $P^* = 1$, and $P^e_{t+1} = P_{t+1} = P_t = P$.

$$Y = Y_n = 700$$

The trade is balanced when $\varepsilon = \frac{3}{21} = \frac{1}{7}$.

P=2

$$E = \frac{3}{42} = \frac{1}{14}.$$

4) Now assume that the country has a **fixed** exchange rate regime with $E = \overline{E}$. Foreign countries have $i^* = 0.36$, $P^* = 1$, and $\pi^* = 0$. Derive the AD relation.

$$0.6Y = 720 - 750r - 210\varepsilon$$
$$Now \ E^e = \overline{E}$$
$$i = i^*$$
$$r = 0.36 - \pi^e_{t+1}$$
$$\varepsilon = \frac{\overline{E}P}{P^*} = \overline{E}P$$

$$0.6Y = 720 - 270 + 750\frac{P^e_{t+1}}{P} - 750 - 210\overline{E}P$$

$$Y = 1250\frac{P^e_{t+1}}{P} - 350\overline{E}P - 500$$

5) Assume again $P^e_{t+1} = P_{t+1} = P_t = P$ and calculate the medium run equilibrium $(Y, P, E)$. Can you pin down a unique value for $\overline{E}$? Compare with part 3). What is the value of the Trade Balance in the medium run?

$$Y = Y_n = 700$$
*From the AD relation, we have*
$$350\overline{E}P = 50$$

$$P = \frac{1}{7\overline{\overline{E}}}$$

*$P$ and $\overline{E}$ are jointly determined. Once $\overline{E}$ is fixed, $P$ is determined consequently. If $\overline{E}$ is fixed at a value higher than $\frac{1}{14}$, $P < 2$, and vice versa.*

*Trade is balanced in the medium run. $P\overline{E} = \varepsilon = \frac{1}{7}$, the real exchange rate corresponding to which the net exports are zero.*

*Note that the medium run real exchange rate is the same in both exchange rate regimes (flexible and fixed exchange rates).*

6) Assume that the economy is in a short run equilibrium with Y=500. Describe with words and graphs the dynamics to the medium run equilibrium under the two scenarios (flexible exchange rate and fixed exchange rate).

*In a flexible exchange rate regime both AS and AD curves shift because both $P_t^e$ and E change to their medium run values $P^e = P = 2$ and $E = \frac{1}{14}$.*
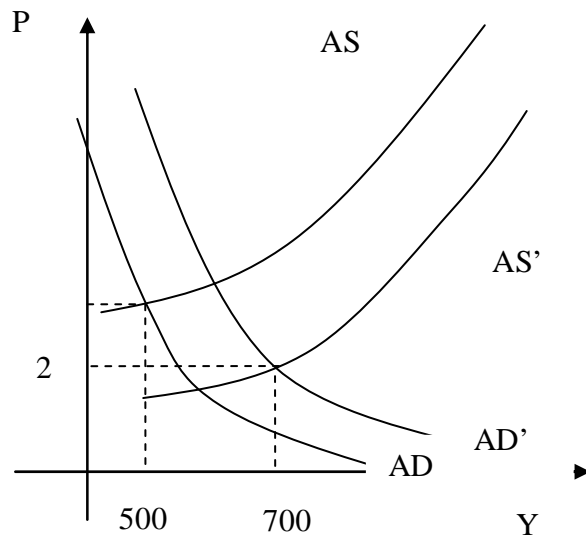


*In a fixed exchange rate regime there are two possible dynamics.*
*If the exchange rate peg is maintained, the AD curve does not shift. The AS curve moves downwards until $P^e = P = \frac{1}{7\overline{\overline{E}}}$.*
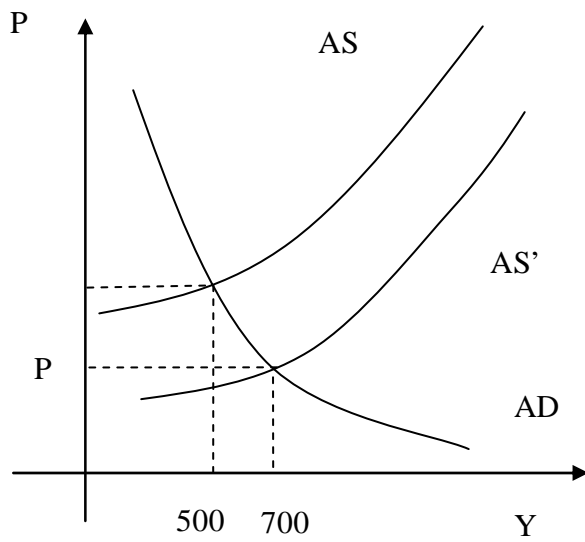
*If the exchange rate is devaluated from $\overline{E}$ to $\overline{E}'$, the AD curve moves to the right and the AS curve shifts downward until $P^e = P' = \dfrac{1}{7\overline{E}'}$.*