14.02 Principles of Macroeconomics
Fall 2005
Quiz 3 Solutions

Short Questions (30/100 points)

Please state whether the following statements are TRUE or FALSE with a short explanation (3 or 4 lines). Each question counts 5/100 points.

2. An increase in taxes today always leads to a decrease in consumption today.

   False. If you consider expectations, then the effect can go the other way. For example, people may expect that the government will increase government spending in the future since the government has more revenues due to increased taxes. This would increase future output. Since current consumption should realistically also depend on people's expectations of their future income, consumption today may go up.

3. The fact that Japan has a current account surplus implies that part of Japanese saving is used to finance investment in other countries.

   True. The fact that Japan has a current account surplus (CA>0) implies that it must have a capital account deficit (KA<0) since CA+KA=0. Japan is thus lending to other countries. You can also see this from the saving/investment equation in an open economy: $I = S^{Priv} + S^{Pub} - NX$. *When NX is positive (= trade surplus), the country invests less than it saves and part of the saving is invested in other countries who have a trade deficit (= they invest more than they save).*

4. If imports are only a function of the real exchange rate (e.g. $IM = 100\varepsilon^2$), then the goods market multiplier is the same in an open economy as in a closed economy.

   True. In the standard open economy goods market model where imports depend on output (Y) and the exchange rate (ε), the multiplier is only smaller because some of the increase in Y is used to buy goods from abroad instead of locally produced goods (since IM depends on Y). If IM doesn't depend on Y, then this "leakage" doesn't exist and the multiplier is the same as in a closed economy.

5. Given that the Japanese nominal interest rate is close to 0% and that the nominal interest rate in the US is about 4%, American investors will never want to hold Japanese bonds.

   False. The return in dollars of Japanese bonds is given by $i^{JAPAN}+Expected\_Appreciation^{Yen}$. *Thus, even if* $i^{JAPAN}=0$, *the expected appreciation of the yen could be sufficiently big such that Americans are indifferent between holding Japanese bonds and other bonds or even prefer to hold Japanese bonds.*

6. Assume that the uncovered interest parity condition holds. Then, under a fixed exchange rate regime, investment unambiguously increases in the short-run as a consequence of a fiscal expansion. This statement is false under a flexible exchange rate regime.

   True. If UIP holds, under fixed exchange rates, the domestic interest rate does not increase after a fiscal expansion and output increases. Therefore, investment increases unambiguously. In contrast, under flexible exchange rates, both output and the interest rate increase in the short-run and, therefore, we cannot tell if investment increases or not.

7. Assume that the uncovered interest parity condition holds. Then, in a country that has a fixed exchange rate, the Central Bank just has to keep the domestic interest rate equal to the foreign interest rate.

   False. Investors might expect a devaluation and start demanding foreign currency. To keep the exchange rate level unchanged, the Central Bank has to satisfy the higher demand by selling foreign reserves and, if it runs out of them, it will not be able to defend the exchange rate any more.

Long Question I (35/100 points)
Open Economy IS-LM

Consider the following model of an open economy:

$C = 250 + 0.5(Y - T)$
$I = 100 + 0.2Y - 2000r$
$IM = 0.1Y\varepsilon + 30\varepsilon^2$
$X = 0.01Y^* - 70\varepsilon$
$T = 200$
$G = 200$
$Y^* = 15000$
$M^s = 800$
$M^d = PY - 4000i$
$i^* = 5\%$

where r is the real rate of interest, ε the real exchange rate, and the other variables have the usual meaning. Suppose that $P = P^* = 1$ and that there is no inflation $\pi^* = \pi = 0$.
Assume that the country has a **fixed** exchange rate regime.

1) Compute the equilibrium (Y, i, E, TB). (10 points)

From the uncovered interest parity and the fixed exchange rate regime assumption we get $i^* = i = 0.05$.
LM relation: $M^s = M^d$
Given $i = 0.05$*,*
$800 = Y - 4000i$
$Y = 800 + 4000 * 0.05$

$Y = 1000$

From the IS relation we get

$$Y = 250 + 0.5(Y - 200) + 100 + 0.2Y - 2000r + 200 + 0.01Y^* - 70\varepsilon - \frac{(0.1Y + 30\varepsilon)\varepsilon}{\varepsilon}$$

$100\varepsilon = 100$

$\varepsilon = 1$

Note that, given the assumptions, $E = \varepsilon$

$X = 80$

$\frac{IM}{\varepsilon} = 130$

$TB = X - \frac{IM}{\varepsilon} = -50$

2) Assume that government spending G increases by 100. What does the Central Bank have to do in order to maintain the fixed exchange rate? Compute. (10 points)

If the exchange rate parity is maintained, $\varepsilon = 1$ *and* $i^* = i = 0.05$.

$$Y = 250 + 0.5(Y - 200) + 100 + 0.2Y - 2000r + 300 + 0.01Y^* - 70\varepsilon - \frac{(0.1Y + 30\varepsilon)\varepsilon}{\varepsilon}$$

$0.4Y = 500$

$Y = 1250$

From LM relation

$M^s = Y - 4000i$

$M^s = 1050$

$\Delta M^s = +250$

3) Assume that G=200 again. The government would like to balance trade (TB=0) while leaving the output level you found in part 1) unchanged. What should it do? Compute the right mix of fiscal policy and exchange rate policy. Assume that when the government announces a change in the value of the fixed exchange rate from $\overline{E}$ to $\overline{E}'$, both $\overline{E}_t$ and $\overline{E}^e_{t+1}$ change instantaneously to $\overline{E}'$. (10 points)

Trade Balance equal to zero: $NX = 0$

$Y = 250 + 0.5(Y - 200) + 100 + 0.2Y - 2000r + 200 + \Delta G$

$1000 = 250 + 0.5 * (1000 - 200) + 100 + 0.2 * 1000 - 2000 * 0.05 + 200 + \Delta G$

$\Delta G = -50$

$NX = 0$

$$0.01Y^* - 70\varepsilon - \frac{(0.1Y + 30\varepsilon)\varepsilon}{\varepsilon} = 0$$

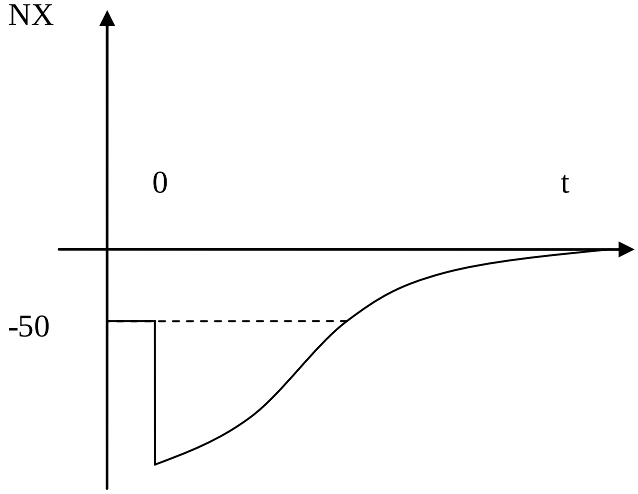
$$0.01 * 15000 - 70\varepsilon - \frac{(0.1 * 1000 + 30\varepsilon)\varepsilon}{\varepsilon} = 0$$

$100\varepsilon = 50$

$\varepsilon = 0.5$

The exchange rate is devaluated from 1 to 0.5.

4) Describe with a graph and **explain in words** the dynamics over time of net exports once the mixed policy you suggested in part 3) is implemented. Label the axes of the graph. (Hint: J-curve). (5 points)



The effect of the depreciation is reflected first in prices, and then quantities adjust. The drop in the real exchange rate leads to an initial deterioration of the trade balance. Given that the Marshall Lerner condition holds, the response of exports and imports becomes stronger over time than the adverse price effect. In the new equilibrium the improvement of the trade balance is such that net exports are zero.

Long Question II (35/100 points)
Open Economy AS/AD

Consider the following open economy at time t:

$C_t = 540 + 0.4(Y_t - T_t)$
$I_t = 200 + 0.2Y_t - 2500r_t$
$IM_t = 0.1Y_t\varepsilon_t + 20\varepsilon_t^2$
$X_t = 0.036Y_t * -80\varepsilon_t$
$T_t = 100$
$G_t = 100$
$Y* = 10000$
$M_t^s = 1300$
$M_t^d = P_tY_t - 5000i_t$

$W_t = P_t^e(z - 2u_t)$ where $z = 1$ is a parameter that represents the workers' bargaining power and u is the unemployment rate.
The following is the price setting relation
$P_t = (1+\mu)W_t$ where $\mu = 0.25$ is the markup.
The production function of the economy is constant: $Y_t = N_t$ for any t
The labor force is constant at $L = 2000$.
Assume that the country has a **flexible** exchange rate regime.

1) Derive the AS relation at t. (5 points)

The AS relation represents the equilibrium points in the labor market.

$$\begin{cases} P_t = (1+\mu)W_t \\ W_t = P_t^e(z - 2u_t) \end{cases}$$

$P_t = P_t^e(1+\mu)(z - 2u_t)$

Given that

$$u_t = \frac{U_t}{L} = \frac{L - N_t}{L} = 1 - \frac{Y_t}{2000}$$

$\mu = 0.25$ *and* $z = 1$ *we get*

$$P_t = P_t^e(1+0.25)\left(1 - 2\left(1 - \frac{Y}{2000}\right)\right)$$

$P_t = P_t^e(0.00125Y_t - 1.25)$.

The AS curve has to pass through the point (P^e, Y) *such that* $Y = Y_n = 1800$ *: the natural level of output.*

2) Derive the AD relation at t. Express Y as a function of P_{t+1}^e, P_t, and ε_t. Assume P*=1 and use the approximation $i_t = r_t + \pi_{t+1}^e$ (10 points)

$$Y_t = 540 + 0.4(Y_t - 100) + 200 + 0.2Y_t - 2500r_t + 100 + 0.036Y^* - 80\varepsilon_t - \frac{(0.1Y + 20\varepsilon_t)\varepsilon_t}{\varepsilon_t}$$

$$0.5Y_t = 1160 - 2500r_t - 100\varepsilon_t$$

$$M_t^s = P_t Y_t - 5000i_t$$

$$1300 = P_t Y_t - 5000i_t$$

$$i_t = \frac{P_t Y_t - 1300}{5000}$$

$$r_t = i_t - \pi_{t+1}^e$$

$$r_t = i_t - \frac{P_{t+1}^e - P_t}{P_t} = i_t - \frac{P_{t+1}^e}{P_t} + 1 = \frac{P_t Y_t - 1300}{5000} - \frac{P_{t+1}^e}{P_t} + 1$$

$$0.5Y_t = 1160 - 2500r_t - 100\varepsilon_t$$

$$0.5Y_t = 1160 - \frac{P_t Y_t}{2} + 650 + 2500\frac{P_{t+1}^e}{P_t} - 2500 - 100\varepsilon_t$$

where

$$\varepsilon_t = \frac{E_t P_t}{P^*} = E_t P_t$$

$$Y_t = \frac{\left(5000\frac{P_{t+1}^e}{P_t} - 1380 - 200\varepsilon_t\right)}{1 + P_t}$$

3) Assume that in the medium run trade is balanced and that $g_m = 0.068$, so that the Aggregate Demand relation becomes $g_y = g_m - \pi$ (in the medium run there is a positive constant growth rate of the nominal money stock). Compute the medium run equilibrium values for output (Y), the nominal interest rate (i), inflation (π) and the real exchange rate (ε). If the economy has reached its medium run equilibrium at *t*, what is the value of the equilibrium price level at *t* (P_t)? What is the value of the equilibrium nominal exchange rate at *t* (E_t)? (10 points)

$$Y = Y_n = 1800$$

Given the assumptions of constant labor force and constant technology, the AS curve determines a medium run output equilibrium level. In medium run the growth rate of output is $g_y = 0$.

Trade is balanced

$$0.036Y^* - 80\varepsilon - \frac{(0.1Y + 20\varepsilon)\varepsilon}{\varepsilon} = 0$$

$$360 - 80\varepsilon - (0.1*1800 + 20\varepsilon) = 0$$

$\varepsilon = 1.8$

From the IS relation, given balanced trade, we have

$Y_n = 540 + 0.4(Y_n - 100) + 200 + 0.2Y_n - 2500r + 100$

$0.4Y_n = 800 - 2500r$

$r = 0.032 = 3.2\%$

From the assumption that $g_m = 0.068$*, given that* $g_y = 0$*, we get* $\pi = 0.068$ *in medium run.*

$i = 0.032 + 0.068 = 0.1$.

From the LM curve at t and given that the economy at t is in its medium run equilibrium

$1300 = P_t Y_n - 5000i$

$1300 = P_t 1800 - 5000 * 0.1$

$P_t = 1$

$E_t = \varepsilon = 1.8$

4) Assume that P* is equal to 1 and constant. Assume perfect capital mobility. What is the medium run foreign real interest rate r*? Compute and explain. (10 points)

From the interest parity condition

$$(1 + i_t) = (1 + i_t^*)\frac{E_t}{E_{t+1}^e}$$

Note that in the medium run we have $E_{t+1}^e = E_{t+1}$ *and* $P_{t+1}^e = P_{t+1}$.

Given the medium run real exchange rate $\varepsilon_t = \dfrac{E_t P_t}{P^*} = E_t P_t$ *is constant at the level at which trade is balanced, every change in* P_t *has to be compensated by a proportional change in* E_t.

$E_t P_t = E_{t+1} P_{t+1}$

$$\frac{E_t}{E_{t+1}} = \frac{P_{t+1}}{P_t} = 1 + \pi_{t+1}$$

$(1 + i_t) = (1 + i_t^*)(1 + \pi_{t+1})$

In equilibrium the time indexes are not necessary

$(1 + r)(1 + \pi) = (1 + r^*)(1 + \pi^*)(1 + \pi)$

$(1 + r) = (1 + r^*)$

$r^* = 0.032$.

Another equivalent way to solve the problem is noting that arbitrage conditions have to hold both in nominal and in real terms.

The uncovered interest parity is an arbitrage condition.

Restating the UIP in real terms, it becomes

$$(1 + r_t) = (1 + r_t^*)\frac{\varepsilon_t}{\varepsilon_{t+1}^e}$$

In equilibrium, $\varepsilon_{t+1}^e = \varepsilon_{t+1}$*. Given that the real exchange is constant in the medium run equilibrium,* $\varepsilon_t = \varepsilon_{t+1}$*. This implies* $(1 + r) = (1 + r^*)$.