Macro Theory
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Answers to Problem Set #5

1. There are two ways one can proceed: attempt to solve directly for Yd or first solve for Y and then solve for Yd. I prefer the second since all other endogenous variables can be derived easily from the reduced form equation for Y.

Plug (4) into (3) and the result into both (1) and (2)

$Yd = Y - 50 - .1*Y = .9*Y - 50$ (3')

$C = 200 + .8*[.9*Y - 50] = 200 + .72*Y - 40 = 160 + .72*Y$ (1')

$Im = 25 + .2*[.9*Y - 50] = 25 + .18*Y - 10 = 15 + .18*Y$ (2')

Now plug (1') and (2') into (5) and set (5) = (6)

$Y = 160 + .72*Y + Ip + G + eX - 15 - .18*Y = 145 + .54*Y + Ip + G + eX$

Now solve for Y

$Y - .54*Y = .46*Y = 145 + Ip + G + eX$ which implies that

$Y = \frac{145 + Ip + G + eX}{.46}$; the reduced form for $Yd = .9*Y - 50 = \frac{145 + Ip + G + eX}{.511} - 50$

Given the values indicated in the problem $Y = 960/.46 = 2087$

from (4) $Yd = .9*Y - 50 = 1828.3$

b. From (1') $C = 160 + .72*2087 = 1662.6$ and (2') $Im = 15 + .18*2087 = 390.7$

Since $S = Y - C - T - Im = Yd - C - Im = 1828.3 - 1662.6 - 390.7 = -225.0$

c. The equilibrium level of taxes is the difference between Y and $Yd = 2087 - 1828.3 = 258.7$

The government deficit $G - T = 91.3$

d. Based on the reduced form statement for Y, a \$100 change in G yields a 100/.46 change in Y = 217. This can be checked by replacing G = 350 with G = 450.

e. Replace $t1 = .1$ in equation (4) with $t1 = .2$. As a result, $Yd = .8*Y - 50$; $C = 160 + .64*Y$; and $Im = 15 + .16*Y$.

After using equations (5) and (6), we find $Y = 960/.52 = 1846$

Thus, a .1 change in t1 yielded a 241 point change in the opposite direction in Y.

Taxes would be given by: $T = 50 + .2*1846 = 419.2$; Now the government would run a surplus of 69.2 (T - G).

2 a. To equations (1) - (3) we need to add

(4) $Yd = Y - T$

(5) $Ad = C + I + G + eX - Im$

(6) $Y = AD$

b. To find the reduced form, plug (4) into (1) and (3) and the results into (5), which is set equal to (6). Solve for Y.

(1) $C = 5000 + .9*Yd = 5000 + .9*Y - .9*[-1000 + .33Y] = 5900 + .6*Y$ (1')

(3) $Im = 500 + .15*Yd = 500 + .15*Y - .15*[-1000 + .33*Y] = 650 + .1*Y$ (2')

(5), (6) $Y = C + Ip + G + eX - Im = 5900 + .6*Y + Ip + G + eX - 650 - .1*Y$

$Y - .5*Y = .5*Y = 5250 + Ip + G + eX$; thus, $Y = \frac{5250 + Ip + G + eX}{.5}$

c. Im = 500 + .15*Yd = 650 + .1*Y = 1700 +.2*[Ip + G + eX]

d. A look at equation (5) suggests that the exogenous part of imports and governmental expenditures enter AD in the same way; thus, G would have to rise by 500 to match the rise in imports.

3a. I will provide the answer to part a. The answer to b. follows the result derived in class. Consider M endogenous and r exogenous. Interpretation: The Federal Reserve targets an interest rate and lets the stock of money adjust to whatever is needed to reach the desired level.

Strategy: Solve (1) - (6) for the IS curve.
First, plug (3) into (2) and then (2) into (1)
Yd = Y - .25*Y = .75*Y
C = a + .8*[.75*Y] = a + .6*Y (1')

Now plug (1') and (4) into (5) and set (5) = (6)
Y = AD = a +.6*Y + e - 10*r + G
which can solved for $Y = \frac{a + e - 10*r + G}{.4}$ (6')

Since r is exogenous, (6') serves as both the IS curve and the reduced form statement for Y.
Set (7) = (8) and solve for M in terms of r since r is exogenous.

M = (.25*Y - 5*r)*P Since Y is given by the IS curve in this case and since r and P are exogenous, this LM curve is the reduced form equation for M.

c. In part a, monetary policy consists of changes in r. For part a, a 1 percentage point change in r yields a 25 unit (10/.4) change in Y in the opposite direction. In part b, it consists of changes in M; *i.e.*, the multiplier for changes in real balances on income is 2/.9 = 2.22. Given P = 2, changes in M have an income multiplier of 1.11.

d. Fiscal policy can be analyzed through either changes in G or t. Given the model in part a, for G, the multiplier is [1/.4] = 2.5; thus, for each dollar change in G, Y changes by 2.5 dollars in the same direction. For part b, the multiplier is 1/.9 = 1.11.

e. The reduced form equation for Y, derived by plugging the LM curve value for r into the IS curve is

$$Y = \frac{a + e + G - 10*[-.2*M/P]}{1 - .6 + 10*(.25/5)} = (100 + 200 + 300+300)/.9$$

Thus, equilibrium Y = 1000

To reach natural Y (Y* = 1200), we must find the value of M that increases Y by 200.
The multiplier of money on output is given by -10*(-.2/P)/.9 = (2/P)/.9 = 1.11; thus, we would need to increase M by 200/1.11=180 to bring Y up to 1200.

f. As in e, we want to increase Y by 200, the governmental expenditures multiplier = 1/.9 = 1.11, the same as the money multiplier; thus, to reach Y*, governmental expenditures should be increased by 180.

4. To be able to derive the IS curve, we need to add the following equations:

(6) AD = C + I + G + eX - Im
(7) Yd = Y - T
(8) Y = AD
(9) Md = M with M exogenous

Now plug (1), (2), and (4) into (6).
Y = 700 + .90*Yd + 500 - 40*r + G + eX - 200 - .15*Yd
which can be collapsed into
(6') Y = 1000 + .75*Yd - 40*r + G + eX

Now plug (3) into (7) to yield: Yd = Y - .33*Y = .67*Y and the result into (6')
Y = 1000 + .75*(.67)*Y - 40*r + G + eX which can be solved for Y

IS: $Y = \frac{1000 - 40*r + G + eX}{.5}$ or Y = 2000 - 80*r + 2*G + 2*eX
with slope $\Delta r/\Delta Y = -1/80$.

b. Now use equation (5) along with the money market equilibrium condition (9) and solve for r to describe the LM curve.

Md = M and Md/P = .25*Y - 10*r

thus, r = -(1/10)*M/P + (.25/10) * Y gives the LM curve with slope $\Delta r/\Delta Y = .025$

c. Now plug the LM curve into r in the IS curve.

Y = 2000 - 80*[-(1/10)*M/P + (.25/10)* Y] + 2*G + 2*eX
Multiply out the terms in brackets and then solve for Y
Y = 2000 + 8*(M/P) - 2*Y + 2*G + 2*eX
and finally
Y* = 2000/3 + (8/3)*(M/P) + (2/3)*G + (2/3)*eX

d. The money multiplier is given by the second term on the right hand side.
For P = 2, $\Delta Y/\Delta M = 4/3$.

e. The fiscal policy multiplier is given by the coefficient of G in the reduced form equation:
$\Delta Y/\Delta G = 2/3$

f. Since the money multiplier is larger, monetary policy is more potent than fiscal policy.