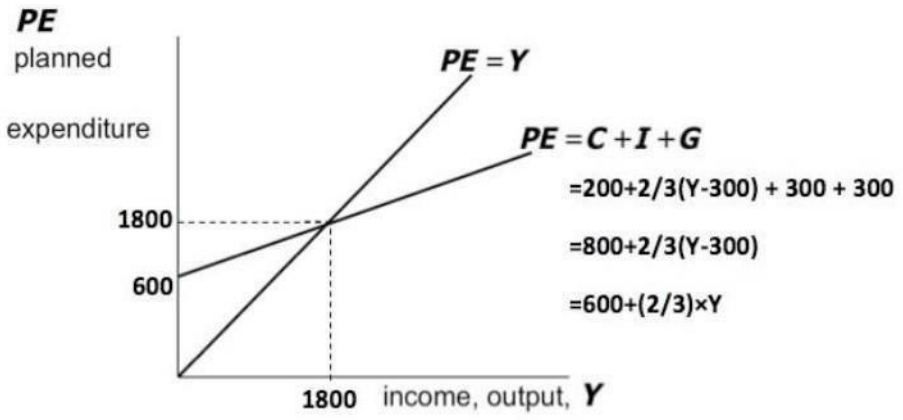
Department of Economics **Boğaziçi University**

EC 205 Macroeconomics I
Fall 2023

Problem Session 6 Suggested Solutions

1. Basics of the Keynesian Cross

a. Graphically illustrate the planned expenditure using the Keynesian Cross we studied in class.



b. If Y is 1500, planned expenditure PE= C+I+G=200+(2/3)(1500-300)+300+300=1600. Since actual output is 1,600 > 1,500, there is inventory de-accumulation of 1,600 - 1,500 = 100 units.
Higher planned expenditure motivates suppliers to produce more, and equilibrium output must be greater.

c. *C = 200 + 2/3(Y - T)*
I = 300 (which is independent of the real interest rate)
G = T = 300
PE = C + I + G >>> PE = A + MPC(Y – T) + I + G
PE = 200 + 2/3(Y – 300) + 300 + 300
In equilibrium, it must be that PE = Y. Using this condition, Y = C + I + G implies
Y = 200 + 2/3(Y - 300) + 300 + 300, rearranging yields
Y = 800 + 2/3(Y - 300) or Y = 600 + 2Y/3, which then implies **Y**
= 600 × 3 = 1,800

d. C = 200 + 2/3(Y - 300) = 200 + 2/3(1,800 - 300) = 1,200.
Private Saving = (Y – T) - C =1,800 – 300 - 1,200 = 300.
Public Saving = T – G = 300 – 300 = 0
National Saving = Y – C – G =1,800 - 1,200 – 300 = 300 (or sum of private and public saving)
Note that I = S condition is also verified as in Chapter 3, long run theory model.

e. The government spending multiplier is 1 / (1 - MPC) = 1 / (1/3) = 3. This implies that if G decreases by 100 units (from 300 to 200), output/income decreases by 100×3=300 units, hence equilibrium output must be equal to 1,800 – 300 =1,500 units. (MPC = 2/3)

If we want to see this result has to hold, we could invoke the definition of equilibrium PE = Y, which now implies Y= 200 + 2/3(Y - 300) + 300 + 200 or rearranging Y= 500 + 2Y/3, which also yields Y = 1,500

f. The tax multiplier is –MPC / (1 - MPC) = (–2/3) / (1/3) = -2. This implies that if T decreases by 100 units (from 300 to 200), output/income increases by 100×2=200 units, hence equilibrium output must be equal to 1,800+200=2,000 units.
To convince yourself, use the equilibrium definition, PE = Y, to see that using the new value of T = 200 yields Y = 2,000

2. IS/LM Numerical Example

a. Equilibrium condition is Y = PE = C + I + G or Y = PE = A + MPC(Y – T) + I + G implies
Y = 450 + 0.5(Y - 200) + 250 - 1000r + 200
By rearranging yields,
0.5Y = 800 - 1000r or Y = 1600 - 2000r will be the IS curve.

b. Money market equilibrium requires money supply to be equal to money demand, i.e. $(M/P)^d = (M/P)^s$ which numerically implies
1,300 = Y - 4000r or rearranging *Y = 1,300 + 4000r* is the LM curve.

c. In equilibrium, it must be that IS = LM, and numerically this implies:
1600 - 2000r = 1,300 + 4000r 300
= 6000r, by rearranging yields **r =**
0.05 = 5%

d. Plugging r = 0.05 = 5% into IS equation Y = 1600 - 2000r implies Y =1600 - 2000r = 1500. Note that we could also use the LM equation, which would give the following: Y = 1,300 + 4000r = 1300 + 200 = 1500, as the IS curve.

e. (MPC = 0.5) Note that the equilibrium effect of increase in government expenditure does not equal to 150×1/(1-MPC) = 300, LM curve slopes upward. To find the new equilibrium, first we derive the new IS curve: Y = 450 + 0.5(Y - 200) + 250 - 1000r + 350.

By rearranging yields 0.5Y = 950 - 1000r or Y = 1900 - 2000r. LM curve has not changed, so it is still Y = 1,300 + 4000r.

Combining new IS&LM curves to equilibrium, we have 1900 - 2000r = 1,300 - 4000r, which then implies **r = 0.10 = 10%** Plugging r =10% into IS or LM equation yields Y = 1900 - 2000(0.10) = 1,700. So, output increased by **200** units.

f. We calculated in part e that the targeted real interest rate is 10% = 0.1. Fed wants to change the money supply to preserve this real interest rate after the increase in government expenditure, so we will be using the second IS curve, and we want to derive the new LM curve so that real interest rate stays at 5%, instead of going up to 10%.

Since targeted real interest rate is 5%, the output is implied by 5% real interest rate is Y = 1900 - 2000r = 1900 - 2000(0.05) = 1800. This is because a lower interest rate than 10% encourages greater planned investment, and this requires output to be greater than what we found in part e.

Now let us focus on the money market side. The new money supply (M/P) must adjust so that new money supply and money demand accommodates Y = 1800 & r=0.05. Then looking at the money demand equation, the new money demand with Y=1800 & r=0.05, $(M/P)_d$ = Y - 4000r implies M/P = 1800 - 4000(0.05) = 1600.

Since in equilibrium, money demand equals to money supply at these new values of Y=1800 & r=0.05, it must be that money supply (M/P) goes up from 1300 (as we found in part b) to 1600, so the Fed needs to raise the money supply by 300 units for the targeted interest rate.

This time note that output increases by 150×1/(1-MPC) = 300 (1800-1500) units suggested by the government purchase multiplier. This result is because Fed changes the money supply to preserve the real interest rate, which would have increased after higher government expenditure with non-shifted upward-sloping LM curve. By also shifting the money supply, thus LM curve, Fed stops the fall in investment because of higher real interest rate, and thus the government purchase multiplier kicks in with its full power.

g. We calculated Y = 1800 and r = 0.05, and we were given that G = 350 (i.e. 150 + 200) and T = 200.
Consumption then is C = 450 + 0.5(Y - T) =1250
Investment is I = 250 - 1000r = 200
Private saving: Y – T – C = 1800 – 200 -1250 = 350. Public
saving: T – G = 200 – 350 = -150
National saving: Y – C – G = 200 (note that it is equal to investment as before.)

3. IS/LM Numerical Example

Assume that an economy is characterized by the following equations:

C = 100 + (2/3)(Y - T) ,T = 600 , G = 500, I = 800 - (50/3)r

$M_s/P = M_d/P = 0.5Y - 50r$

a. The IS curve equals to *Y = C + I + G*.
Therefore, Y = 100 + (2/3)(Y – T) + 800 – (50/3)r + G.
Y = 900 + 2/3Y – 2/3T – (50/3)r + G
Y/3 = 900 – 2/3T – (50/3)r + G by rearranging
Y = 2,700 + 3G - 2T - 50r

b. $M_s / P = M_d / P = 0.5Y - 50r$
M/P = 0.5Y – 50r
50r = 0.5Y – (M/P). By rearranging **r**
= 0.01Y - 0.02(M/P)

c. P = 1 and M = 1,200, so M/P = 1200 r = 0.01Y - 0.02(1200)
Y = 2400 + 100r
Since C = 100 + (2/3)(Y - T) ,T = 600 , G = 500, I = 800 - (50/3)r and
Y = 2,700 + 3G - 2T - 50r
Y = 3000 – 50r
3000 – 50r = 2400 + 100r
150r = 600 **r =**
4, Y = 2800
C = 100 + 2/3(2800 – 600) = 1,566.67
I = 800 – (50/3)4 = 733.33

However, if P = 2 and M = 1,200, M/P = 600
r = 0.01Y - 0.02(600)
Y = 1200 + 100r
Since C = 100 + (2/3)(Y - T) ,T = 600 , G = 500, I = 800 - (50/3)r and
Y = 2,700 + 3G - 2T - 50r
Y = 3000 – 50r
3000 – 50r = 1200 + 100r
150r = 1800 **r =**
12, Y = 2400
C = 100 + 2/3(2400 – 600) = 1300
I = 800 – (50/3)12 = 600

d. LM Curve: r = 0.01Y - 0.02(M/P) and IS Curve: Y = 2,700 + 3G - 2T - 50r
So, r = 54 + (3/50)G – (1/25)T – 0.02Y
0.01Y – 0.02(M/P) = 54 + (3/50)G – (1/25)T – 0.02Y
0.03Y = 54 + (3/50)G – (1/25)T + 0.02(M/P) [multiply both sides with 100/3] **Y**
= 1800 + 2G – (4/3)T + 2/3 (M/P)