

## Exercise 4

### Keynesian Cross and Fiscal Policy

1. Answer the following questions.

1.1 Suppose Govt Multiplier is 5 and  $\Delta G = 5$ . Find  $\Delta Y$ .

1.2 Suppose Tax Multiplier is -3 and  $\Delta Y = -9$ . Find  $\Delta T$ .

1.3 Suppose  $\Delta Y = 10$  and  $\Delta I = 2$ . Find Investment Multiplier.

• 1.1 Govt. Multiplier =  $\frac{\Delta Y}{\Delta G}$

$$5 = \frac{\Delta Y}{5}$$

$$25 = \Delta Y \#$$

• 1.2 Tax multiplier =  $\frac{\Delta Y}{\Delta T}$

$$-3 = \frac{-9}{\Delta T}$$

$$\Delta T = 3 \#$$

• 1.3 Investment multiplier =  $\frac{\Delta Y}{\Delta I}$

$$= \frac{10}{2}$$

$$= 5 \#$$

2. From  $Y = C + I + G$  where  $C = C_0 + C_1(Y - T)$ , find

2.1 Equilibrium Output  $Y^*$

2.2  $\Delta Y / \Delta I$

2.3  $\Delta Y / \Delta G$

2.4  $\Delta Y / \Delta T$

2.5 Balanced-Budget Multiplier (BBM)

2.6 Explain what the BBM is.

2.1  $AE = C + I + G$   
 $Y = AE$

$$Y = C_0 + C_1(Y - T) + I + G$$

$$Y = C_0 + C_1 Y - C_1 T + I + G$$

$$Y - C_1 Y = C_0 - C_1 T + I + G$$

$$Y(1 - C_1) = C_0 - C_1 T + I + G$$

$$Y^* = \frac{C_0 - C_1 T + I + G}{(1 - C_1)}$$

2.2  $AE = C + I + G$

$$= C_0 + C_1(Y - T) + I + G$$

$$= C_0 + C_1 Y - C_1 T + I + G$$

$$= C_1 Y + C_0 - C_1 T + I + G$$

Investment multiplier :  $\frac{\Delta Y^*}{\Delta I} = \frac{1}{1 - \text{slope of AE}}$   
 $= \frac{1}{1 - C_1}$

2.3)  $\frac{\Delta Y^*}{\Delta G} = \frac{1}{1 - \text{slope of AE}}$

$$= \frac{1}{1 - C_1}$$

2.4)  $\frac{\Delta Y^*}{\Delta T} = \frac{-MPC}{1 - \text{slope of AE}}$

$$= \frac{-C_1}{1 - C_1}$$

2.5)  $BBM = \frac{\Delta Y^*}{\Delta G} + \frac{\Delta Y^*}{\Delta T}$

$$= \frac{1 - C_1}{1 - C_1}$$

2.6) **BBM** is the sum of the two will tell how aggregate output will change when both  $G$  and  $T$  change by the same amount.

3. Assume a closed economy with government. The country has the following components of aggregate expenditure.

$$C = 300 + 0.75(Y_d)$$

$$I = 50$$

$$G = 50$$

$$T = 50 \text{ (lump-sum tax)}$$

- 3.1 Use the  $Y = AE$  (standard) approach to find the equilibrium output.
- 3.2 Draw the Keynesian Cross, and find the intercept on the vertical axis and the slope of the AE schedule.
- 3.3 Use the Leakage = Injection (or saving/investment) approach to find the equilibrium level of output.  
(Hint: the equilibrium condition is  $S + T = I + G$ , with  $Y_d = Y - T = C + S$ )
- 3.4 Draw the saving/investment curve to show the equilibrium.
- 3.5 Suppose that the government decides to build more roads, raising government spending by 50 units, but this project is to be financed by the increase in net taxes of 50 units. Use the  $Y = AE$  (standard) approach to find the new equilibrium output.
- 3.6 Use the Balanced-Budget Multiplier (BBM) derived from Question 2.5 to find the new equilibrium output.

3.1)

$$Y = AE$$

$$AE = C + I + G$$

$$= 300 + 0.75(Y - 50) + 50 + 50$$

$$= 300 + 0.75Y - 37.5 + 50 + 50$$

$$AE = 362.5 + 0.75Y$$

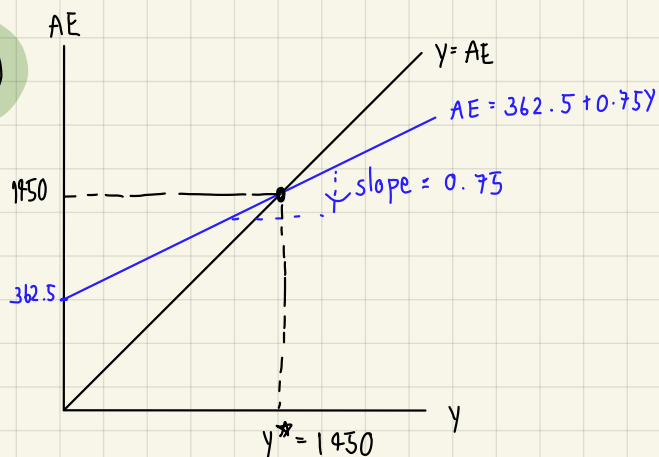
$$Y = 362.5 + 0.75Y$$

$$Y - 0.75Y = 362.5$$

$$0.25Y = 362.5$$

$$Y^* = 1450$$

3.2)



3.3)

$$S + T = I + G$$

$$Y - C = I + G = 50 + 50$$

$$Y - C = 100$$

$$Y - [300 + 0.75(Y - 50)] = 100$$

$$Y - (300 + 0.75Y - 37.5) = 100$$

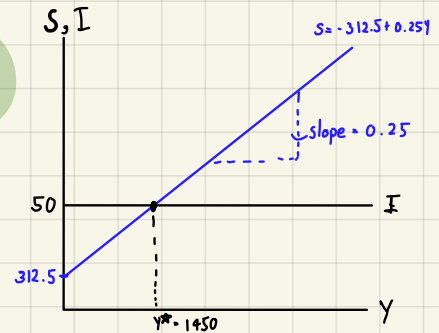
$$Y - 300 - 0.75Y + 37.5 = 100$$

$$Y - 262.5 - 0.75Y = 100$$

$$0.25Y = 362.5$$

$$Y^* = 1450$$

3.4)



$$S = Y - C - T$$

$$S = Y - 300 - 0.75(Y - 50) - 50$$

$$S = -312.5 + 0.25Y$$

$$3.5) \quad T = 100, \quad G = 100$$

$$Y = AE$$

$$AE = C + I + G$$

$$= 300 + 0.75(Y - 100) + 50 + 100$$

$$AE = 375 + 0.75Y$$

$$Y = 375 + 0.75Y$$

$$Y - 0.75Y = 375$$

$$Y_{\text{new}}^* = 1500$$

$$3.6) \quad \text{BBM} = \frac{\Delta Y^*}{\Delta G} + \frac{\Delta Y^*}{\Delta T} = \frac{1 - \text{MPC}}{1 - \text{slope of AE}}$$

$$\text{derived from q. 2.5} = \frac{1 - C_1}{1 - C_1} = 1^*$$

- When  $G$  &  $T$  increased by 1 unit,  $Y$  increased by 1 unit.

So, If the government raises government spending and net taxes by 50 units, the equilibrium output will increase 50 units

$$\text{The new equilibrium output} = 1450 + 50 = 1500$$

4. From  $Y = C + I + G + (X - M)$

where  $C = C_0 + C_1(Y - T)$  and  $M = M_0 + M_1(Y)$ , find

4.1 Equilibrium Output  $Y^*$

4.2  $\Delta Y / \Delta I$

4.3  $\Delta Y / \Delta G$

4.4  $\Delta Y / \Delta T$

4.5 Balanced-Budget Multiplier (BBM)

4.1)  $Y = AE$

$$Y = C_0 + C_1(Y - T) + I + G + [X - (M_0 + M_1Y)]$$

$$Y = C_0 + C_1Y - C_1T + I + G + X - M_0 - M_1Y$$

$$Y - C_1Y + M_1Y = C_0 - C_1T + I + G + X - M_0$$

$$Y(1 - C_1 + M_1) = C_0 - C_1T + I + G + X - M_0$$

$$Y^* = \frac{C_0 - C_1T + I + G + X - M_0}{1 - (C_1 + M_1)}$$

4.2)  $\frac{\Delta Y^*}{\Delta I} = \frac{1}{1 - \text{slope of AE}} = \frac{1}{1 - (C_1 + M_1)}$

4.3)  $\frac{\Delta Y^*}{\Delta G} = \frac{1}{1 - \text{slope of AE}} = \frac{1}{1 - (C_1 + M_1)}$

4.4)  $\frac{\Delta Y^*}{\Delta T} = \frac{-MPC}{1 - \text{slope of AE}} = \frac{-C_1}{1 - (C_1 + M_1)}$

4.5)  $BBM = \frac{\Delta Y^*}{\Delta G} + \frac{\Delta Y^*}{\Delta T} = \frac{1 - C_1}{1 - (C_1 + M_1)}$

5. Assume an open economy with government. The country has the following components of aggregate expenditure.

$$C = 200 + 0.7(Y_d) \quad I = 75 \quad G = 75$$
$$T = 50 \quad X = 50 \quad M = 50 + 0.1Y$$

5.1 Use the  $Y = AE$  approach to find the equilibrium. Is  $Y = 300$  an equilibrium? If it is not, explain the adjustment process towards equilibrium.

5.2 Based on what you have derived in Question 4, calculate the investment, government spending, tax, and balanced-budget multipliers.

5.3 Interpret the value of each of the multipliers.

Suppose that the full-employment output ( $Y_F$ ) is 600;

5.4 What type of output gap is the economy currently experiencing?

5.5 Draw the Keynesian Cross. Identify its slope and intercept. Also, illustrate the output gap.

Now, government wants to correct the output gap by moving the economy to the full-employment level, and is considering different policies.

(Hint: use the multipliers from Question 5.2 to answer the following questions)

5.6 If the government wants to adjust **only its spending (G)**, how much G should be changed?

5.7 If the government wants to adjust **only its net taxes (T)**, how much T should be changed?

5.8 If the government wants to boost **only investment (I)**, how much I should be changed?

5.9 If the government wants to implement a balanced-budget policy, what should the government do with G and T?

5.1)  $Y = AE$

$$AE = C + I + G + (X - M)$$

$$= 200 + 0.7(Y_d - 50) + 75 + 75 + 50 - (50 + 0.1Y)$$

$$= 200 + 0.7Y - 35 + 75 + 75 + 50 - 50 - 0.1Y$$

$$AE = 315 + 0.6Y$$

•  $Y = AE$

$$Y = 315 + 0.6Y$$

$$0.4Y = 315$$

$$Y^* = 787.5$$

∴  $Y = 300$  is not an equilibrium,  $Y < Y^*$

• The adjustment towards equilibrium

- when we produce the aggregate output less than the equilibrium, we will have shortage. Firms will sell inventories that make unsold output declined. This is a signal that will encourage firms to increase their output and it will move automatically towards equilibrium.

## 5.2) Investment multiplier

$$\begin{aligned}\frac{\Delta Y^*}{\Delta I} &= \frac{1}{1 - \text{slope of AE}} = \frac{1}{1 - (C_1 - M_1)} \\ &= \frac{1}{1 - 0.6} = \frac{1}{0.4} = 2.5\end{aligned}$$

∴ When the investment increased by 1 unit, the aggregate output will increase 2.5 units.

## Government spending multiplier

$$\begin{aligned}\frac{\Delta Y^*}{\Delta G} &= \frac{1}{1 - \text{slope of AE}} = \frac{1}{1 - (C_1 + M_1)} \\ &= \frac{1}{1 - 0.6} = \frac{1}{0.4} = 2.5\end{aligned}$$

∴ When government spending increased by 1 unit, the aggregate output will increase 2.5 units.

## Tax multiplier

$$\begin{aligned}\frac{\Delta Y^*}{\Delta T} &= \frac{-MPC}{1 - \text{slope of AE}} = \frac{-C_1}{1 - (C_1 + M_1)} \\ &= \frac{-0.7}{1 - 0.6} = -1.75\end{aligned}$$

∴ When tax increased by 1 unit, the aggregate output will decrease 1.75 units.

## Balanced-budget multiplier

$$\begin{aligned}\text{BBM} &= \frac{\Delta Y^*}{\Delta G} + \frac{\Delta Y^*}{\Delta T} = \frac{1 - C_1}{1 - (C_1 + M_1)} \\ &= \frac{1 - 0.7}{1 - 0.6} = \frac{0.3}{0.4} = 0.75\end{aligned}$$

∴ When both government spending and tax are increased by 1 unit at the same time, the aggregate output will increase 0.75 units.

5.3)

**Investment multiplier** : when the investment increased by 1 unit, the aggregate output will increase 2.5 units.

**Government spending multiplier** : when government spending increased by 1 unit, the aggregate output will increase 2.5 units.

**Tax multiplier** : when tax increased by 1 unit, the aggregate output will decrease 1.75 units.

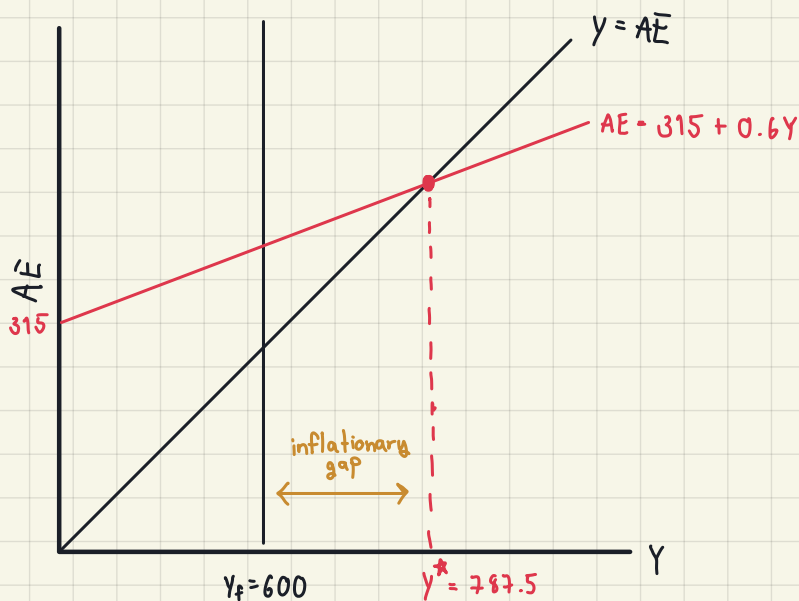
**Balanced-budget multiplier** : when both government spending and tax are increased by 1 unit at the same time, the aggregate output will increase 0.75 units.

5.4)

- the full-employment output is 600
- the equilibrium = 787.5

- In this time, we have inflationary gap,  $y_f < y^*$ , because we are producing too much and we want to close inflationary gap down. we can close this by using contractionary fiscal policy, increasing tax and reducing government spending.

5.5)



$$5.6) \frac{\Delta Y^*}{\Delta G} = 2.5$$

$$\frac{-187.5}{\Delta G} = 2.5$$

$$\therefore \Delta G = -75$$

$$5.8) \frac{\Delta Y^*}{\Delta I} = 2.5$$

$$\frac{-187.5}{\Delta I} = 2.5$$

$$\therefore \Delta I = -75$$

$$5.7) \frac{\Delta Y^*}{\Delta T} = -1.75$$

$$\frac{-187.5}{\Delta T} = -1.75$$

$$\therefore \Delta T = 107.14$$

$$5.9) \frac{\Delta Y^*}{\Delta G} + \frac{\Delta Y^*}{\Delta T} = 0.75$$

$$\frac{-187.5}{\Delta G, \Delta T} = 0.75$$

$$\Delta G, \Delta T = -250$$

$$\therefore \Delta G = -250, \Delta T = -250$$

7. Let  $S = -200 + 0.5Y$  and  $I = 50$ , be the saving function and investment.

7.1 Use the saving/investment approach to find the equilibrium output.

7.2 Find the equilibrium saving. (Hint: substitute  $Y^*$  into  $S$ )

Suppose people decide to save more, increasing autonomous saving by 100.

7.3 Use the saving/investment approach to find the new equilibrium output.

7.4 Find the new equilibrium saving. (Hint: substitute new  $Y^*$  into  $S$ )

7.5 Comment on your result.

7.1) Saving = investment

$$-200 + 0.5Y = 50$$

$$0.5Y = 250$$

$$Y^* = 500$$

7.2) the equilibrium saving

$$S = -200 + 0.5(500)$$

$$= -200 + 250$$

$$S^* = 50$$

7.3) increasing saving by 100

$$\bullet \text{ New saving} = -200 + 0.5Y + 100$$

$$= -100 + 0.5Y$$

\bullet New equilibrium output

$$S = I$$

$$-100 + 0.5Y = 50$$

$$0.5Y = 150$$

$$Y^* = 300$$

7.4) the new equilibrium saving.

$$S = -100 + 0.5(300)$$

$$S^* = 50$$

7.5) According to the paradox of thrift, when people save their money more which is leakage, the aggregate expenditure will decrease. Decreasing the aggregate output, people now have lower income and then saving they make become smaller.