

Exercise 4

Keynesian Cross and Fiscal Policy

1. Answer the following questions.

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

$$\begin{aligned}\text{Govt Multiplier} &= \frac{\Delta Y^*}{\Delta AE} = \frac{\Delta Y^*}{\Delta G} \\ 5 &= \frac{\Delta Y^*}{5} \\ \Delta Y^* &= 25 \# \end{aligned}$$

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

$$\begin{aligned}\text{Tax Multiplier} &= \frac{-MPC}{1 - \text{slope of AE}} = \frac{\Delta Y^*}{\Delta T} \\ -3 &= \frac{-9}{\Delta T} \\ \Delta T &= 3 \# \end{aligned}$$

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

$$\begin{aligned}\text{Investment multiplier} &= \frac{\Delta Y^*}{\Delta AE} = \frac{\Delta Y^*}{\Delta I} \\ &= \frac{10}{2} \\ &= 5 \# \end{aligned}$$

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

2.1 Equilibrium Output Y^*

$$Y = AE \rightarrow \text{equilibrium}$$

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

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

$$Y = C_0 + C_1Y - C_1T + I + G$$

$$Y - C_1Y = C_0 - C_1T + I + G$$

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

$$Y^* = \frac{C_0 - C_1T + I + G}{1 - C_1} \#$$

2.2 $\Delta Y / \Delta I$

$$AE = C + I + G$$

2.3 $\Delta Y / \Delta G$

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

$$AE = C_0 + C_1Y - C_1T + I + G$$

2.4 $\Delta Y / \Delta T$

$$AE = (C_0 + C_1T + I + G) + C_1Y$$

↳ slope of AE, MPC

$$\frac{\Delta Y}{\Delta I} = \frac{1}{1 - \text{slope of AE}} = \frac{1}{1 - C_1} \#$$

$$\frac{\Delta Y}{\Delta G} = \frac{1}{1 - \text{slope of AE}} = \frac{1}{1 - C_1} \#$$

$$\frac{\Delta Y}{\Delta T} = \frac{-\text{MPC}}{1 - \text{slope of AE}} = \frac{-C_1}{1 - C_1} \#$$

2.5 Balanced-Budget Multiplier (BBM)

$$\text{BBM} = \frac{\Delta Y}{\Delta G} + \frac{\Delta Y}{\Delta T} = \frac{1}{1 - C_1} + \frac{-C_1}{1 - C_1} = \frac{1 - C_1}{1 - C_1}$$

2.6 Explain what the BBM is.

Balance Budget Multiplier is a change in aggregate output when both G and T increase by 1 unit

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

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

$$I = 50$$

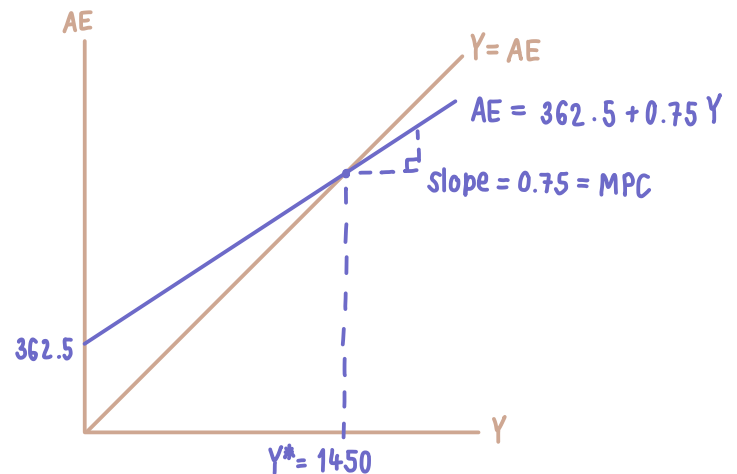
$$G = 50$$

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

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.

$$\begin{aligned} AE &= C + I + G \\ AE &= 300 + 0.75(Y - T) + 50 + 50 \\ AE &= 400 + 0.75(Y - 50) \\ AE &= 400 + 0.75Y - 37.5 \\ AE &= 362.5 + 0.75Y \\ \downarrow \text{find } Y^* ; Y &= AE \\ Y &= 362.5 + 0.75Y \\ 0.25Y &= 362.5 \\ Y &= 1450 \# \end{aligned}$$

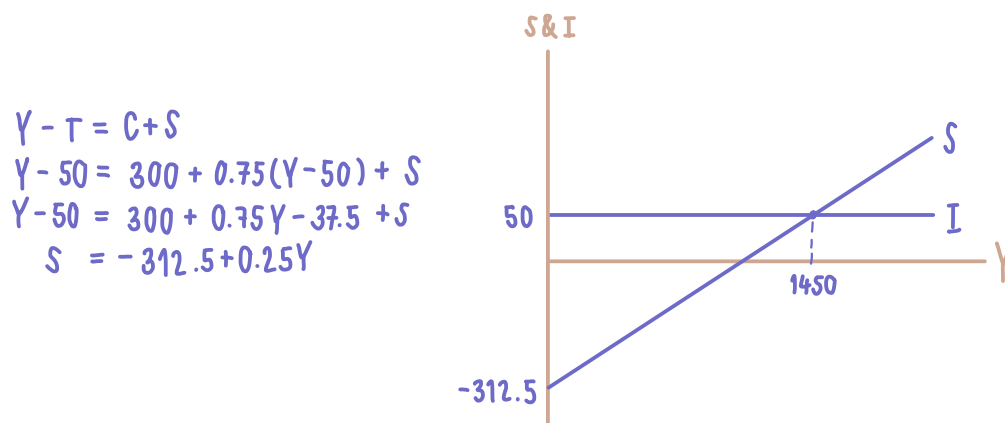


3.3 Use the Leakage = Injection (or saving/investment) approach to find the equilibrium level of output.

(Hint: the equilibrium condition is $S + T = I + G$, with $Y_d = Y - T = C + S$)

$$\begin{aligned} Y - C &= S + T \\ Y - C &= I + G \\ Y - C &= 50 + 50 \\ Y - C &= 100 \\ Y - (300 - 0.75(Y_d)) &= 100 \\ Y - (300 + 0.75(Y - 50)) &= 100 \\ Y - (300 + 0.75Y - 37.5) &= 100 \\ 0.25Y &= 362.5 \\ Y &= 1450 \# \end{aligned}$$

3.4 Draw the saving/investment curve to show the equilibrium.



$$\begin{aligned} Y - T &= C + S \\ Y - 50 &= 300 + 0.75(Y - 50) + S \\ Y - 50 &= 300 + 0.75Y - 37.5 + S \\ S &= -312.5 + 0.25Y \end{aligned}$$

- 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.

$$\begin{aligned}
 G &= 100 & \Delta G &= 50 \\
 T &= 100 & \Delta T &= 50 \\
 AE &= C + I + G \\
 AE &= 300 + 0.75(Y - T) + 50 + 100 \\
 AE &= 450 + 0.75(Y - 100) \\
 AE &= 450 + 0.75Y - 75 \\
 AE &= 375 + 0.75Y \\
 \downarrow \text{find } Y^* ; Y &= AE \\
 Y &= 375 + 0.75Y \\
 0.25Y &= 375 \\
 Y &= 1500 \#
 \end{aligned}$$

- 3.6 Use the Balanced-Budget Multiplier (BBM) derived from Question 2.5 to find the new equilibrium output.

$$\text{BBM} = \frac{\Delta Y}{\Delta G} + \frac{\Delta Y}{\Delta T} = \frac{1}{1 - C_1} + \frac{-C_1}{1 - C_1} = \frac{1 - C_1}{1 - C_1} = 1$$

when both G and T increase by 1 unit, output also increase by 1 unit
 so in this case government increase their spending by 50 & increase tax by 50, then the output will increase by 50

$$\begin{aligned}
 \therefore \text{new equilibrium output} &= \text{old } Y^* + \Delta Y^* \\
 &= 1450 + 50 \\
 &= 1500 \#
 \end{aligned}$$

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^*

$$Y = AE \rightarrow \text{equilibrium}$$

$$Y = AE = C + I + G + X - M$$

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

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

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

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

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

4.2	$\frac{\Delta Y}{\Delta I}$	$AE = C + I + G$
4.3	$\frac{\Delta Y}{\Delta G}$	$AE = C_0 + C_1(Y - T) + I + G + X - (M_0 + M_1Y)$
4.4	$\frac{\Delta Y}{\Delta T}$	$AE = C_0 + C_1Y - C_1T + I + G + X - M_0 - M_1Y$
		$AE = C_0 - C_1T + I + G + X - M_0 + (C_1Y - M_1Y)$
		$AE = C_0 - C_1T + I + G + X - M_0 + (C_1 - M_1)Y$ ↳ slope of AE

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

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

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

4.5 Balanced-Budget Multiplier (BBM)

$$BBM = \frac{\Delta Y}{\Delta G} + \frac{\Delta Y}{\Delta T} = \frac{1}{1 - C_1 + M_1} + \frac{-C_1}{1 - C_1 + M_1} = \frac{1 - C_1}{1 - C_1 + M_1} \#$$

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

$$C = 200 + 0.7(Y_d)$$

$$I = 75$$

$$G = 75$$

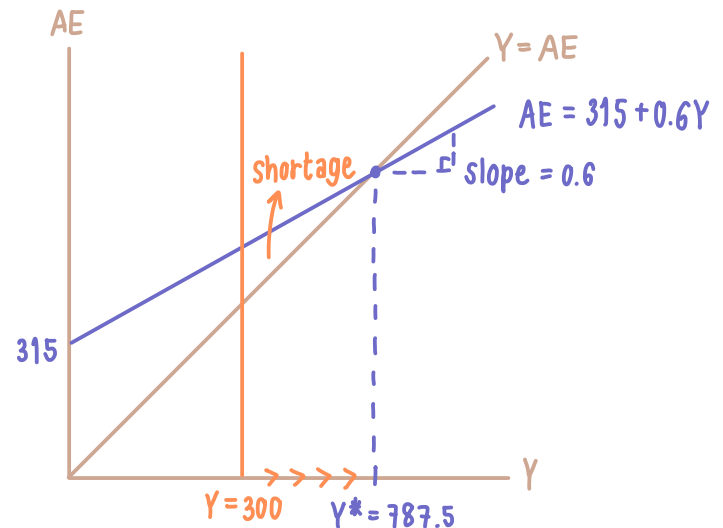
$$T = 50$$

$$X = 50$$

$$M = 50 + 0.1Y$$

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.

$$\begin{aligned} AE &= C + I + G + X - M \\ AE &= 200 + 0.7(Y - T) + 75 + 75 + 50 - (50 + 0.1Y) \\ AE &= 400 + 0.7(Y - 50) - 50 - 0.1Y \\ AE &= 350 + 0.7Y - 35 - 0.1Y \\ AE &= 315 + 0.6Y \\ \downarrow \text{ find } Y^* ; Y &= AE \\ Y &= 315 + 0.6Y \\ 0.4Y &= 315 \\ Y^* &= 787.5 \end{aligned}$$



When $Y = 300$ The level of production is below the equilibrium. $Y < C+I$ There is a shortage. The inventory decline, encouraging an increase in production to move toward equilibrium @ $Y = 787.5$

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.

$$\frac{\Delta Y}{\Delta I} = \frac{1}{1 - \text{slope of AE}} = \frac{1}{1 - 0.6} = 2.5 \# \quad \text{when } I \text{ increase by 1 unit, } Y \text{ will increase by 2.5 unit}$$

$$\frac{\Delta Y}{\Delta G} = \frac{1}{1 - \text{slope of AE}} = \frac{1}{1 - 0.6} = 2.5 \# \quad \text{when } G \text{ increase by 1 unit, } Y \text{ will increase by 2.5 unit}$$

$$\frac{\Delta Y}{\Delta T} = \frac{-MPC}{1 - \text{slope of AE}} = \frac{-0.7}{1 - 0.6} = -1.75 \# \quad \text{when } T \text{ increase by 1 unit, } Y \text{ will decrease by 1.75 unit}$$

$$BBM = \frac{\Delta Y}{\Delta G} + \frac{\Delta Y}{\Delta T} = \frac{1}{1 - 0.6} + \left(\frac{-0.7}{1 - 0.6} \right) = 2.5 - 1.75 = 0.75 \#$$

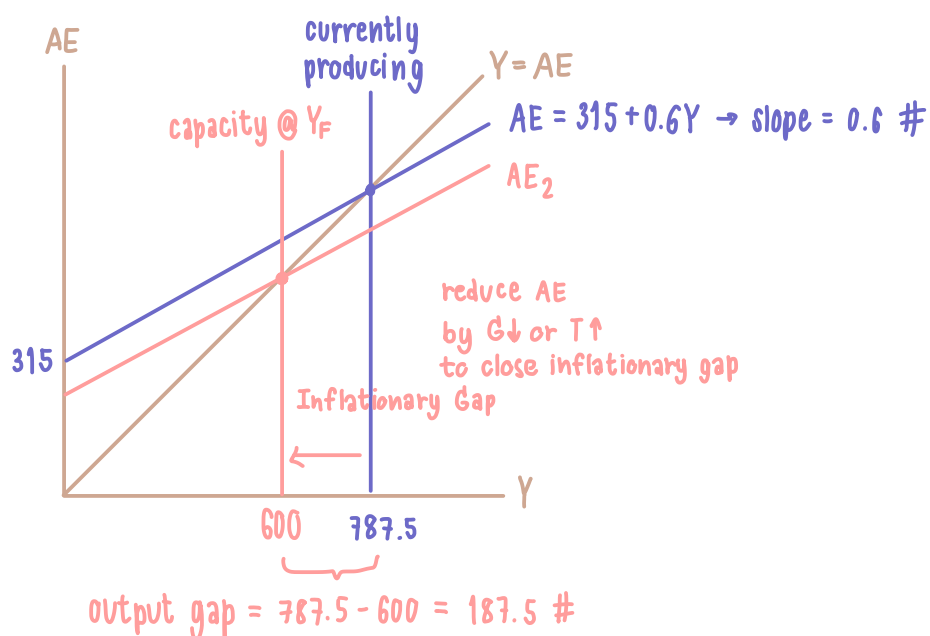
when both G & T increase by 1 unit, Y will increase by 0.75 unit

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.

$$\begin{matrix} Y_F = 600 \\ Y = 787.5 \end{matrix} \left. \vphantom{\begin{matrix} Y_F = 600 \\ Y = 787.5 \end{matrix}} \right\} Y > Y_F = \text{inflationary gap \#}$$

Unemployment rate is below the natural rate happen, when economy is growing too fast. Some factors of productions are over-employed. Policy solution to an inflationary gap is to shift the AE down, using policies like tax increase or government spending cuts



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?

$$\begin{aligned} \text{adjust only } G &\rightarrow \text{Government multiplier } \frac{\Delta Y^*}{\Delta G} = 2.5 \\ 2.5 &= \frac{-187.5}{\Delta G} \\ \Delta G &= 75 \# \end{aligned}$$

$$\begin{aligned} \text{adjust only } T &\rightarrow \text{Tax multiplier } \frac{\Delta Y^*}{\Delta T} = -1.75 \\ -1.75 &= \frac{-187.5}{\Delta T} \\ \Delta T &= 107.143 \# \end{aligned}$$

$$\begin{aligned} \text{adjust only } I &\rightarrow \text{Investment multiplier } \frac{\Delta Y^*}{\Delta I} = 2.5 \\ 2.5 &= \frac{-187.5}{\Delta I} \\ \Delta I &= -75 \# \end{aligned}$$

$$\text{BBM} = \frac{\Delta Y}{\Delta G} + \frac{\Delta Y}{\Delta T} = 0.75$$

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

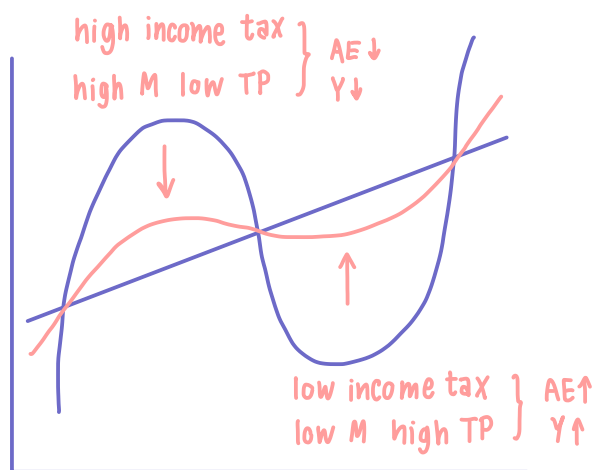
$$\begin{aligned} \Delta G \ \& \ \Delta T &= \frac{-187.5}{0.75} \\ &= -250 \# \end{aligned}$$

decrease both G & T by 250

6. Explain the role of Import as an automatic stabilizer. If the government wants to further stabilize the economy, is there anything that the government can do with its tax system? Explain.

Automatic stabilizers is components in the AE that automatically change with the state of the economy in such a way as to stabilize GDP.

The role of automatic stabilizer is to reduce fluctuation of output in business cycles



When economy is good, Y is high

↳ Government raise T and M to reduce people income (Y) which help to slow down the economy during the good times

When economy is bad, Y is low

↳ Government reduce T and M to increase people income (Y) which help to boost the economy during the bad times

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.

$$\begin{aligned} \text{Leakage} &= \text{Injection} \\ S &= I \\ -200 + 0.5Y &= 50 \\ 0.5Y &= 250 \\ Y^* &= 500 \# \end{aligned}$$

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

$$\begin{aligned} S &= -200 + 0.5(500) \\ S &= -200 + 250 \\ S^* &= 50 \# \end{aligned}$$

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

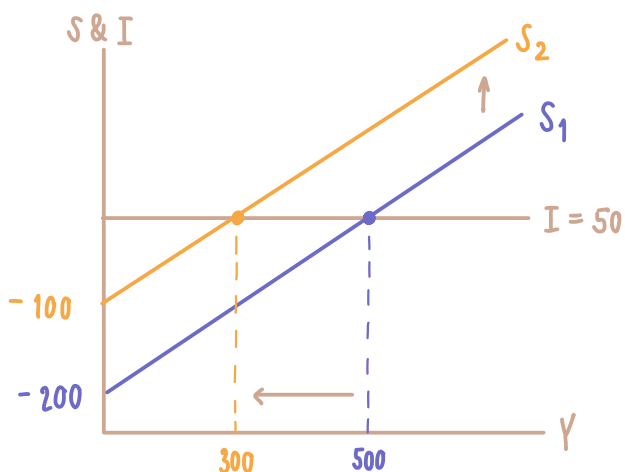
7.3 Use the saving/investment approach to find the new equilibrium output

$$\begin{aligned} S &= -200 + 100 + 0.5Y \\ S &= -100 + 0.5Y \\ &\downarrow \\ S &= I \\ -100 + 0.5Y &= 50 \\ 0.5Y &= 150 \\ Y^* &= 300 \# \end{aligned}$$

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

$$\begin{aligned} S &= -100 + 0.5(300) \\ S &= -100 + 150 \\ S^* &= 50 \end{aligned}$$

7.5 Comment on your result.



Paradox of thrift

people save more by 100 (from $S_1 \rightarrow S_2$)
 \downarrow
 people spend less
 \downarrow
 less G & S produced in economy
 \downarrow
 income in the economy fall
 \downarrow
 people can save less

Output decrease by 200
(from 300 \rightarrow 500)