Exercise 6

IS-LM Model

1. The IS-LM Model is a <u>general equilibrium model</u>, which means that...there exists common price that clears 2 or more markets.
   There are...2...markets, which are...commodity [G&S] market and the money market
   The price that clears these markets is...interest rate.....
   The IS curve represents a...negative....relationship between
   .....i.....and.....Y.....This is because...higher interest rate discourages investors from investing and thus decreases in AE. As a results, when AE decreases, Y also decreases.
   The LM curve represents a...positive.....relationship between
   .....i.....and.....Y.....This is because...the equilibrium condition, $M_s = M_d$. $\frac{M}{P}$ is constant. So, when i increase, M_d will fall [$M_s > M_d$]. To maintain $M_s = M_d$, an increase in Y causes an increase in M_d.
   Each point on the IS curve is an equilibrium in the...goods.....market.
   Therefore, we have the equilibrium condition: ...$Y = C(Y-T) + I(i) + G$
   Each point on the LM curve is an equilibrium in the...money...market.
   Therefore, we have the equilibrium condition: ...$\frac{M}{P} = L(Y, i)$.....

   $\therefore i\uparrow \rightarrow M_d\downarrow \Rightarrow M_s > M_d$
   $Y\uparrow \rightarrow M_d\uparrow \Rightarrow M_s = M_d$

2. Cetaris Paribus (other things equal), how will each variable affect each curve – shift (to which direction?) or movement?

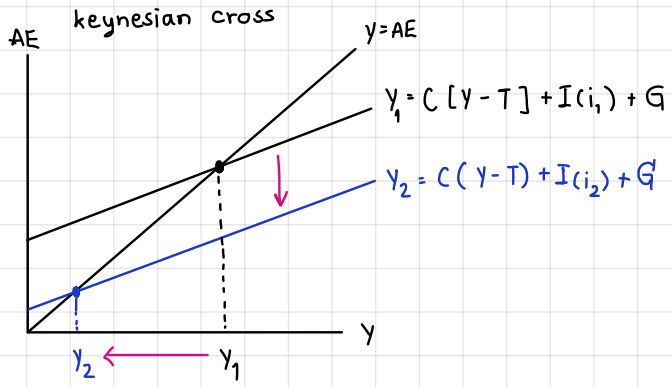
Variable	IS Curve	LM Curve
i↑	movement	movement
G↓	shift left	—
T↓	shift right	—
G&T↑ equally	shift right	—
M↓	movement	shift left
P↓	movement	shift right

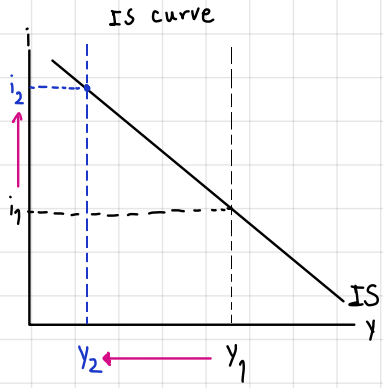
3. <u>Explain, together with diagrams,</u> how we can derive the IS curve from Keynesian Cross, and how we can derive the LM curve from the money market.

4. Assume a closed economy with the government. The economy has the following parameters:
   $C = C_0 + C_1(Y - T)$ $I = I_0 - I_1 \cdot i$ $G = G_0$ $T = T_0$
   $L(i, Y) = L_Y \cdot Y - L_i \cdot i$ $M = M_0$ $P = P_0$
   <u>Answer the following questions.</u>
   4.1 What are I_1, L_Y, and L_i?
   4.2 Why are I_1 and L_i negative?
   4.3 Derive the IS equation that shows how i and Y are related.

3. <u>Explain, together with diagrams,</u> how we can derive the IS curve from Keynesian Cross, and how we can derive the LM curve from the money market.

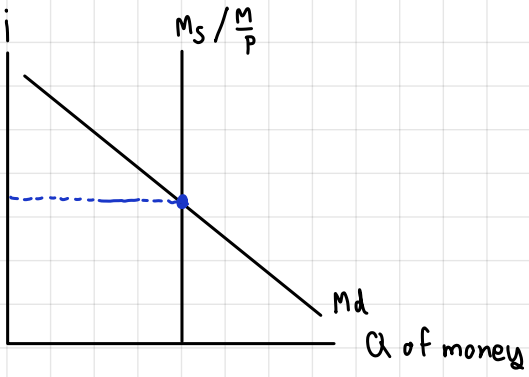
- The IS curve is derived from closed economy Keynesian cross, $Y = C + I + G$, but in the IS curve, investment depends on interest rate so that $Y = C[Y-T] + I(i) + G$





$i\uparrow \rightarrow I\downarrow \rightarrow AE\downarrow \rightarrow Y\downarrow$

- To derive the LM curve, it starts from the equilibrium condition in the money market: $M_S = M_d$ or $\frac{M}{P} = L(Y, i)$



4. Assume a closed economy with the government. The economy has the following parameters:

$C = C_0 + C_1(Y - T)$ $I = I_0 - I_1 \cdot i$ $G = G_0$ $T = T_0$

$L(i, Y) = L_Y \cdot Y - L_i \cdot i$ $M = M_0$ $P = P_0$

Answer the following questions.

4.1 What are I_1, L_Y, and L_i?

I_1 = sensitivity of investment to change in interest rate

L_Y = sensitivity of M_d to change in income

L_i = sensitivity of M_d to change in interest rate

4.2 Why are I_1 and L_i negative?

Because I_1 is the sensitivity of Investment to change in interest rate, and L_i is the sensitivity of M_d to change in interest rate. Both I_1 and L_i depend on interest rate. When interest rate rise, people will not want to invest and hold cash which means Investment and Money demand have negative relation ship with interest rate. So, these make I_1 and L_i are negative.

4.3 Derive the IS equation that shows how i and Y are related.

parameters:

$C = C_0 + C_1(Y - T)$ $\quad I = I_0 - I_1 \cdot i$ $\quad G = G_0$ $\quad T = T_0$

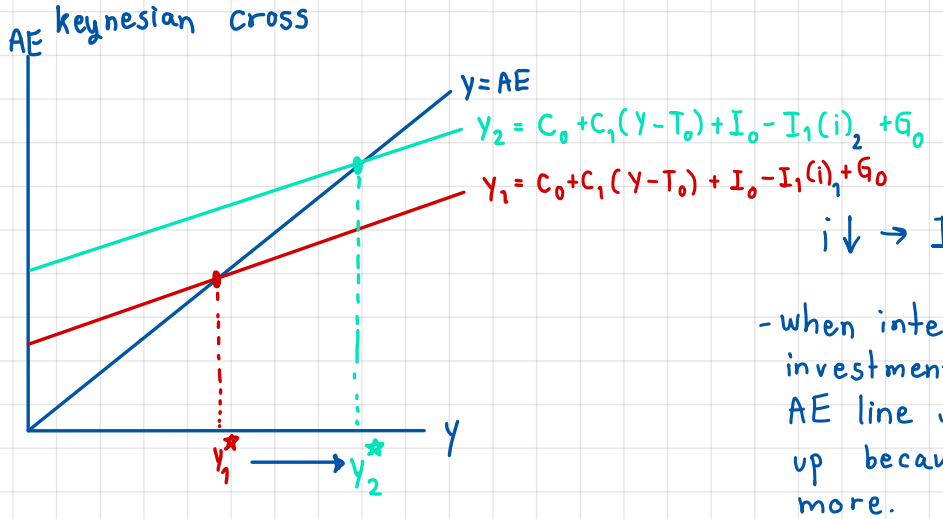
$L(i, Y) = L_Y \cdot Y - L_i \cdot i$ $\quad M = M_0$ $\quad P = P_0$

$$AE = C_0 + C_1(Y - T_0) + I_0 - I_1(i) + G_0$$

$$Y = AE$$

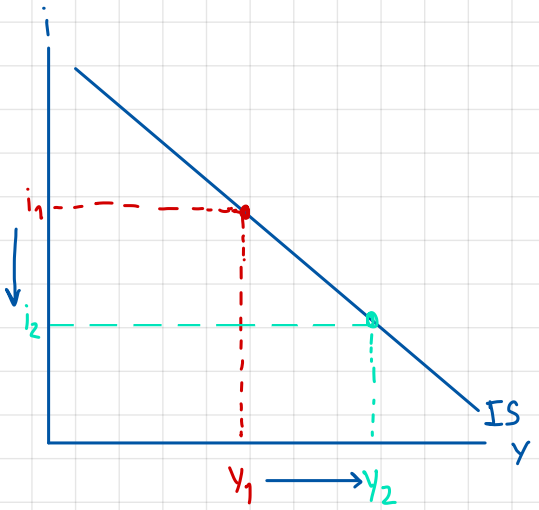
$$\text{So, } Y = C_0 + C_1(Y - T_0) + I_0 - I_1(i) + G_0$$

$$i = \frac{Y - C_0 - C_1(Y - T_0) - I_0 - G_0}{-I_1}$$



$i \downarrow \rightarrow I \uparrow \rightarrow AE \uparrow \rightarrow Y \uparrow$

- when interest rate decreases, investment will increase. These make AE line shift up and then the output up because people can produce more.



4.4 Find the slope of the IS curve.

$$Y = C(Y - T) + \bar{I}(i) + G$$
$$Y = CY - CT + \bar{I}(i) + G$$
$$\bar{I}(i) = Y - CY + CT - G$$

4.5 Derive the LM equation that shows how i and Y are related.
(Hint: Start with the equilibrium condition Md = Ms. Then, substitute relevant variables into the expression. Lastly, rearrange i to the LHS and everything else on the RHS.)

$M_S = M_d$

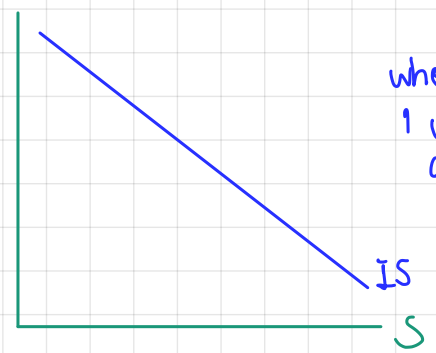
when $i \uparrow \rightarrow M_d \downarrow \longrightarrow Y \uparrow \rightarrow M_d \uparrow \rightarrow M_d = M_S$

4.6 Find the slope of the LM curve.

$$\frac{L_y}{L_i}$$

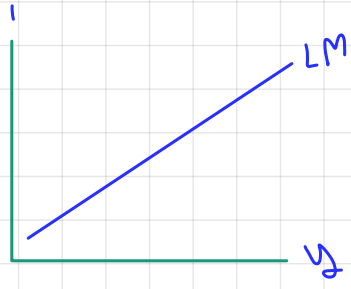
5. From Question 4.4, we can see that the slope of IS curve depends on two factors. Explain how each of these factors affects the slope of the IS curve. We also can see that the slope of LM curve depends on two factors. Explain how each of these factors affects the slope of the LM curve.

Slope of IS curve is $\frac{-1}{I_1 M}$ $\quad m = \frac{1}{c - c_1}$



when I_1 or m increase by 1 unit, The IS curve decreases by 1 unit.

Slope of LM curve is $\frac{L_y}{L_i}$



when L_i increases by 1 unit, L_y will increase by 1 unit.

6. What is the Crowding-Out Effect?
   Suppose that the government increases its spending, i.e. expansionary fiscal policy. Use the IS-LM diagram to explain how the economy moves to the new general equilibrium and the crowding-out effect.

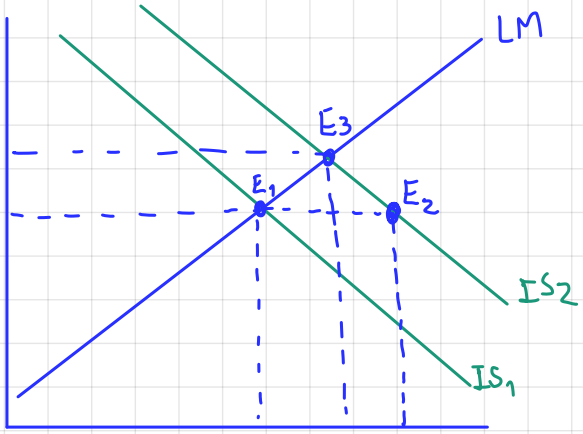
The crowding-out Effect is one of the weakness of fiscal policy, so that means the fiscal policy is not fully effective.
The crowding-out effect: public sector spending (G) reduces or eliminates private sector spending (I)

The crowding-out Effect is about the weakness of fiscal policy.
We use expansionary fiscal policy to boost the economy by increasing government spending or decreasing tax.

Step 1: In GM: G↑ or T↓ → AE↑ → Y↑ : GM is in eqbm E_2, but MM is not. so, MM will adjust.

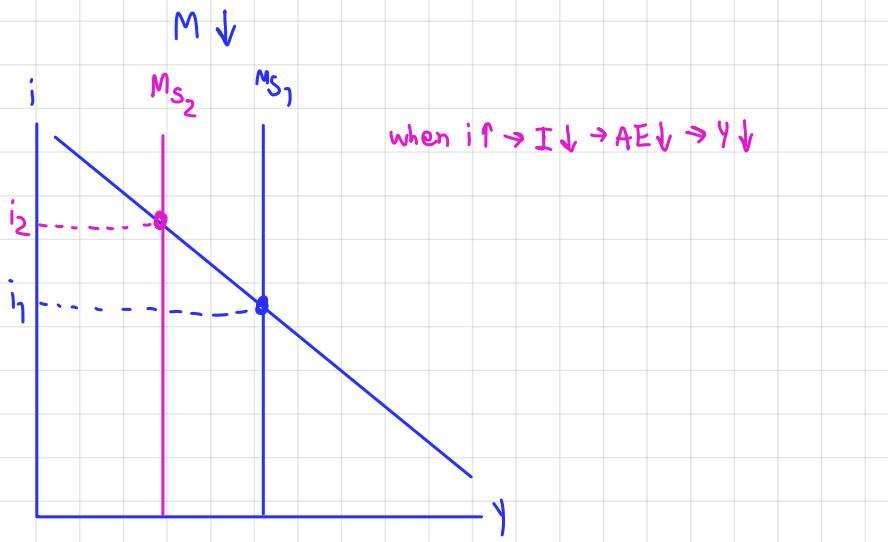
Step2: In MM: when Y↑ → M_d↑ → i↑ : MM is in E_3 but GM still at E_2.

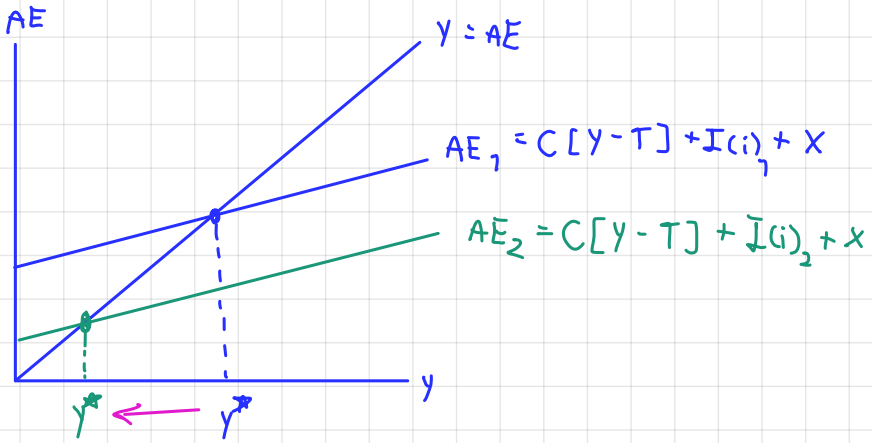
Step3: In GM: i↑ → I↓ → AE↓ → Y↓ : In this point, GM & MM are in new eqbm at E_3.

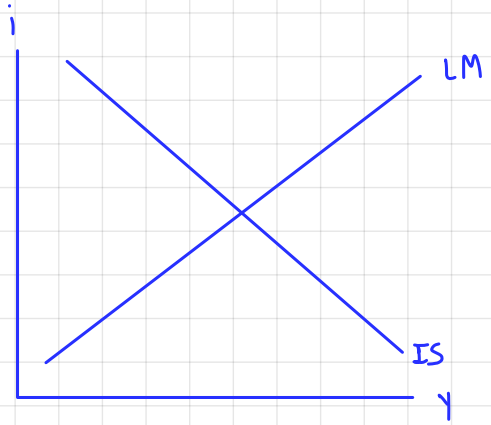


7. Suppose the central bank decreases its money supply, i.e. contractionary monetary policy. Use the IS-LM diagram to explain how the economy moves to the new general equilibrium.

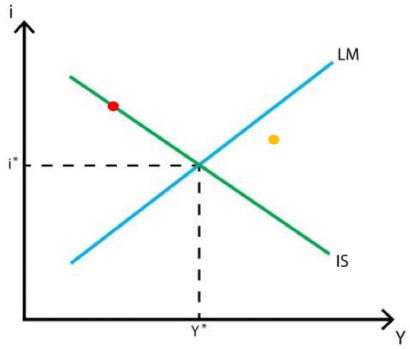
- Contractionary monetary policy : reducing in money supply and increasing interest rate. [$M_S \downarrow \rightarrow i \uparrow$]







8. Use the graph below to answer the following questions.



8.1 At the **Red** point, which market is in equilibrium, and which is not?

8.2 Explain how the goods and money markets at the **Orange** point will adjust towards the general equilibrium (Y*, i*).

1.) At the Red point, Goods and Services market is in equilibrium, and the money market is not in equilibrium.

2. At the orange point, the goods and money market are not in equilibrium, but we can use phase diagram to adjust both market to equilibrium.

9. The government is worried about the effectiveness of its policies. You are to advise which policy – fiscal or monetary – should be used in each of the following cases.
   9.1 Consumers have high MPC.
   9.2 Investment is NOT sensitive to changes in interest rate.
   9.3 Money demand is very sensitive to changes in interest rate.
   9.4 Money demand is very sensitive to changes in income (Y).

(1) Monetary policy is effective

(2) Fiscal policy is effective

(3) Monetary policy is effective

(4) Monetary policy is effective

10. Assume a closed economy with the government. The economy has the following parameters:

C = 100 + 0.5(Yd) I = 80 – 100(i) G = 40 T = 40

L(i, Y) = 0.5(Y) – 200(i) M = 400 P = 2

<u>Answer the following questions.</u>

10.1 Derive the IS equation.

10.2 Derive the LM equation.

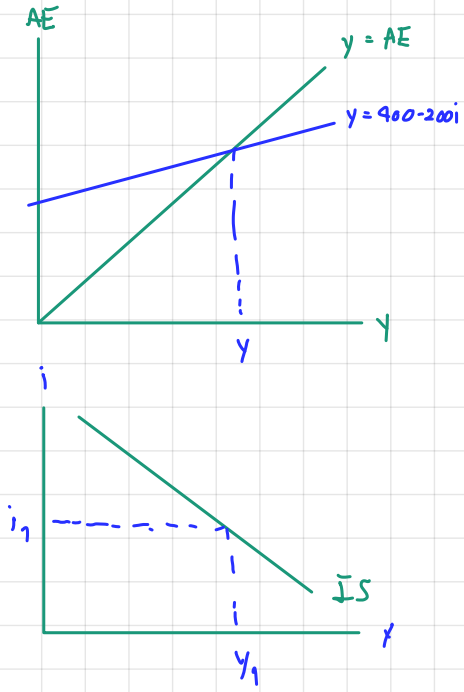
10.3 Find the general equilibrium output and interest rate.

① $AE = y$

$y = C_0 + C_1[y - T) + I_0 - I_1(i) + G$

$= 100 + 0.5(Y - 40) + 80 - 100(i) + 40$

$y = 400 - 200i$



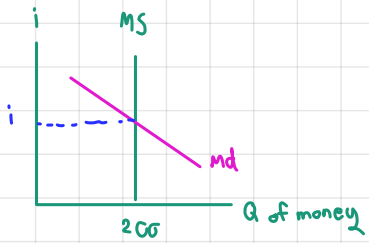
② $MS = Md$

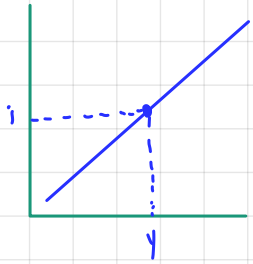
$\frac{M}{P} = L_y \cdot Y - L_i \cdot i$

$\frac{400}{2} = 0.5(Y) - 200(i)$

$400 = Y - 400i$

$Y = 400 + 400i$





(3) $IS = LM$

$200i = 400 + 400i$

$i = 0$