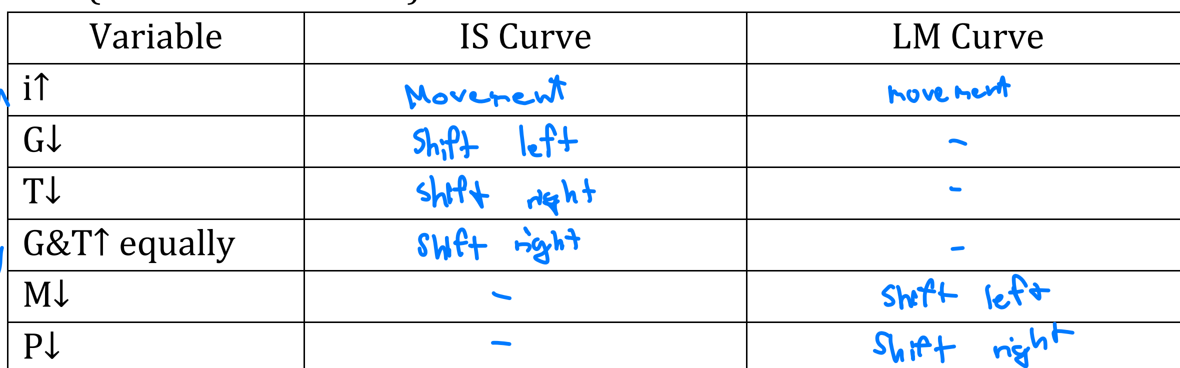
Exercise 6

IS-LM Model

1. The IS-LM Model is a <u>general equilibrium model</u>, which means that……a common price that clears 2 or more market……
   There are……2……markets, which are……commodity market & money market……
   The price that clears these markets is……interest rate……
   The IS curve represents a……negative……relationship between ……output……and……interest rate……This is because……higher interest rate discourages investors from investing and decrease output……
   The LM curve represents a……positive……relationship between ……output……and……interest rate……This is because……higher level of income makes people have more demand of money, so it drives up interest rate……
   Each point on the IS curve is an equilibrium in the……commodity……market.
   Therefore, we have the equilibrium condition: ……Y = AE……
   Each point on the LM curve is an equilibrium in the……money……market.
   Therefore, we have the equilibrium condition: ……Md = Ms……

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

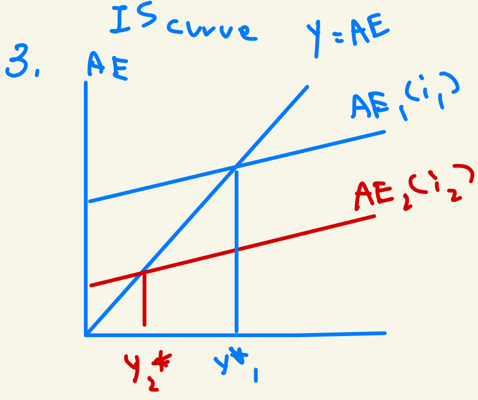


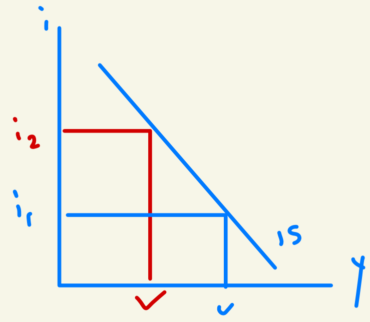
Variable	IS Curve	LM Curve
i↑	Movement	movement
G↓	Shift left	–
T↓	shift right	–
G&T↑ equally	shift right	–
M↓	–	shift left
P↓	–	shift right

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.

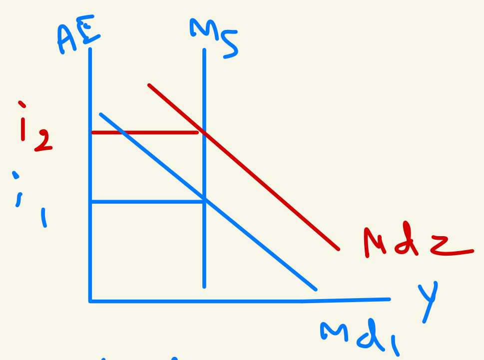
3. IS curve

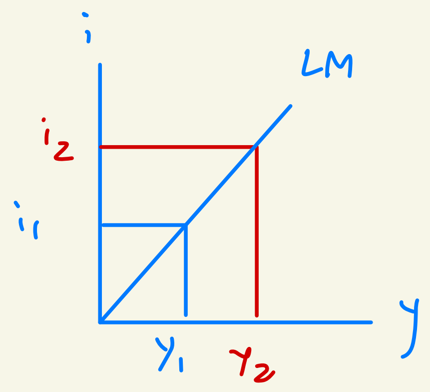




when interest rate is high, it discourages investors, so it reduce investment. It means that the aggregate expenditure fall [$AE_1(i_1) \to AE_2(i_2)$] and has low output (movement along the IS curve, $i_1 \to i_2$, $Y_1 \to Y_2$)
On the other hand, if interest rate is low, it courages investors and it make high output

LM curve





when the demand of money is high, it means people hold a lot of cash. It can cause inflationary. So, interest rate will increase to reduce inflationary gap. It's a positive relationship between output (income) and interest rate for LM curve; therefore, when income is high, either In the contary, if the demand of money is low, the output / income will low

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?

4.2 Why are I_1 and L_i negative?

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

(Hint: Start with the equilibrium condition Y = AE. Then, substitute relevant variables into the expression. Lastly, rearrange i to the LHS and everything else on the RHS.)

4.1

I_1: sensitivity of investment to change in interest rate

L_Y: senstitivity of money demand to change in Income

L_i: sensitivity of money demand to change in interest rate

4.2

I_1 is negative because when i↑, it will discourage investment

L_i is negative because when i↑, PPL will demand less money

4.3 $Y = AE$

$Y = C + I + G$

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

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

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

4.4 Find the slope of the IS curve.

(Hint: The coefficient before Y is the slope of IS.)

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.)

4.6 Find the slope of the LM curve.

(Hint: The coefficient before Y is the slope of LM.)

4.4 Multiplier $= \dfrac{1}{1-MPC}$

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

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

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

$$i = \frac{(C_1 - 1)Y + C_0 - C_1 T_0 + I_0 + G_0}{I_1}$$

$$= \frac{-(1-C_1)Y + C_0 - C_1 T_0 + G_0}{I_1}$$

$$= \frac{-(1-C_1)Y}{I_1} + \frac{C_0 - C_1 T_0 + I_0 + G}{I_1}$$

$$= -\left(\frac{1}{M} \times \frac{1}{I_1}\right)Y + \frac{C_0 - C_1 T_0 + I_0 + G_0}{I_1}$$

$\therefore$ Slope of IS equation is $-\left(\frac{1}{M} \times \frac{1}{I_1}\right)$

4.5 $Md = Ms$

$$L(Y, i) = \frac{M}{P}$$

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

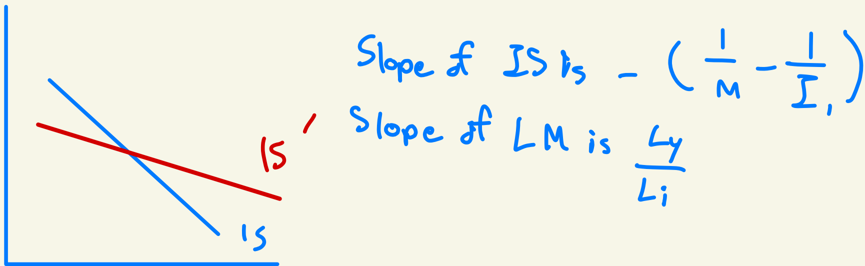
$$L_i\, i = L_Y Y - \frac{M}{P}$$

$$i = \frac{L_Y}{L_i} Y - \frac{1}{L_i}\left(\frac{M}{P}\right)$$

4.6

Slope of LM curve is $\dfrac{L_Y}{L_i}$

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 depends on M and I_1. For first factor (M), If the multiplier is high, IS curve will flat. If I_1 is high, Slope will be flat as well

Slope of LM depends on L_y and L_i. If L_y is high, LM curve will steep, but if L_i is high, LM curve will flat

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.

IS equation: $Y = C + I + G$

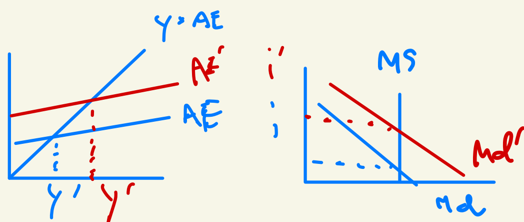
LM equation: $M/P = L(i, Y)$

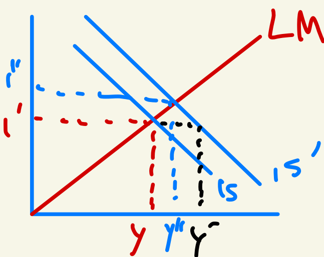
Expansionary fiscal policy → $G\uparrow$ (IS shift)

GM: $G\uparrow \rightarrow AE\uparrow \rightarrow Y\uparrow$

MM: $Y\uparrow \rightarrow Md\uparrow \rightarrow i\uparrow$

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





crowding-out effect is a problem of fiscal policy when goverment increases its spending or reduce tax

From the graph, firstly the government increases its spending ($G\uparrow$), it causes AE rises which output will rise as well. Hence, this represented by shifting rightward of IS curve (IS → IS') at Y'. Then in money market, as output increase, it leads to shift money demand to the right, so it also pushed up the interest level at i''. increasing in interest rate it will discourage the investor from investing, hence the AE falls which output will drop from Y' to Y''. Represent the crowding-out effect

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.

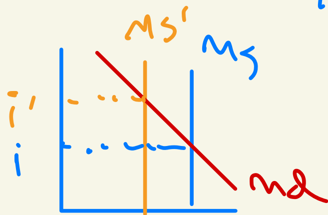
IS equation : $Y = C + I + G$

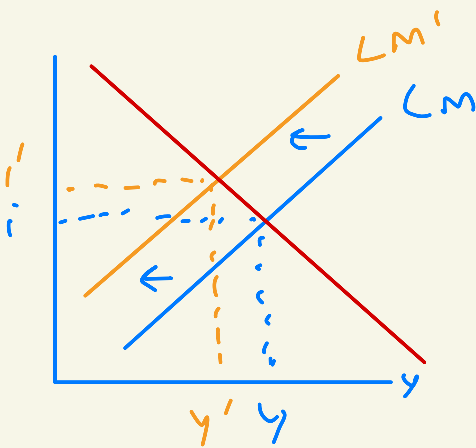
LM equation : $M/P = L(i, Y)$

MM : $M\downarrow \rightarrow M/P\downarrow \rightarrow i$

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

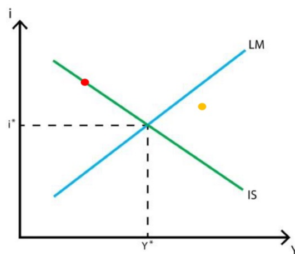
Contractionary monatary policy → $M\downarrow$ (LM shift)





from the graph, when central bank decreases it money supply (MS↓), then MS curve shift leftward (LM → LM'). Then, it causes higher level of interest rate at i', and also lower level of output at Y'. This is because the higher interest rate, the less investors investing. Hence, the AE will drop and decrease in output from Y to Y'

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



MM : MS↓ → i↑

GM : i↓ → I↑ + AE↑ → Y↑

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

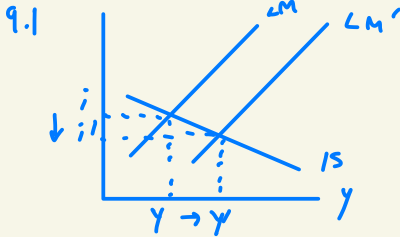
8.2 Explain how the goods and money markets at the **Orange** point will adjust towards the general equilibrium (Y*, i*).

8.1 The goods market is in equilibrium, and the money market is not in equillbrium.

8.2 Central bank want to decrease money supply, so the bond issuers will increase interest rate, make LM curve shift left with higher interest rate will discourage investment, hence lower AE and Y, create movement along IS curve. Now the IS curve is not adjust towards the general equilibrium yet. So, the govt. will use contractionary fiscal policy, increase tax, make AE and Y decrease. The IS curve will shift left toward general equilibrium

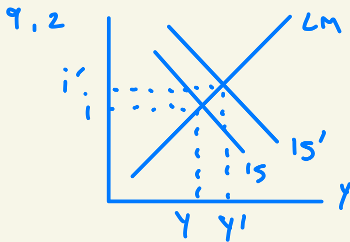
9. The government is worried about the effectiveness of its policies. You are to advise which policy – fiscal or monetary – should be used in each of the following cases.
   - 9.1 Consumers have high MPC.
   - 9.2 Investment is NOT sensitive to changes in interest rate.
   - 9.3 Money demand is very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

9.1



IS FLAT → monetary policy is more effective

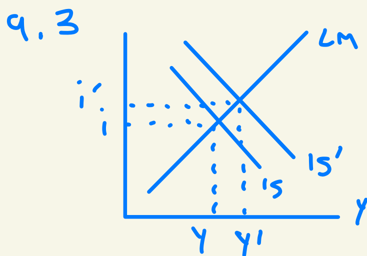
9.2



IS steep → fiscal policy is more effective

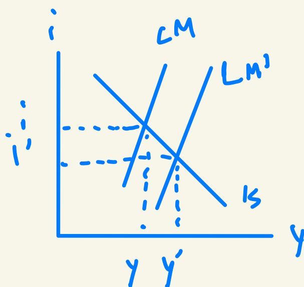
9.3

(LM is high)



LM FLAT → monetary policy is more effective

(Ly is high)



LM steep → Monetary policy is more 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

Answer the following questions.

10.1 Derive the IS equation.

10.2 Derive the LM equation.

10.3 Find the general equilibrium output and interest rate.

10.1 $Y = AE$

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

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

$100i = 200 + 0.5Y$

$i = \frac{200 + 0.5Y}{100}$

10.2 $M_s = M_d$

$M/P = L(Y, i)$

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

$200 = 0.5Y - 200i$

$200i = 0.5Y - 200$

$i = \frac{0.5Y - 200}{200}$

10.3 $\frac{200 + 0.5Y}{100} = \frac{0.5Y - 200}{200}$

$400 + Y = 0.5Y - 200$

$0.5Y = -600$

$Y^* = -300$

$i = \frac{200 + 0.5(-300)}{100}$

$= \frac{200 - 150}{100}$

$= \frac{50}{100}$

$i^* = 0.5$