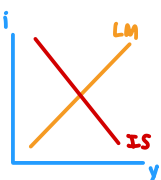


Exercise 6

IS-LM Model

- The IS-LM Model is a general equilibrium model, which means that... *exists a common price that clears two or more markets*... There are... *2*... markets, which are... *1) goods & services mkt 2) money mkt*... The price that clears these markets is... *the interest rate*... The IS curve represents a *negative*... relationship between *interest (i)* and *outcome (Y)*. This is because *higher interest rates... discourage investors from investing* $I = I(i)$ and $\frac{dI}{di} < 0$... The LM curve represents a *positive*... relationship between *interest (i)* and *outcome (Y)*. This is because... *at higher level of Y... people have more Md to buy g&s. Higher Md drives up interest rate*... Each point on the IS curve is an equilibrium in the *goods 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: $Md = Ms$...

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



Variable	IS Curve	LM Curve
$i \uparrow$	<i>movement along the curve</i>	<i>movement along the curve</i>
$G \downarrow$	<i>shift left</i>	-
$T \downarrow$	<i>shift right</i>	-
$G \& T \uparrow$ equally	<i>shift right</i>	-
$M \downarrow$	-	<i>shift left</i>
$P \downarrow$	-	<i>shift right</i>

- Explain, together with diagrams, how we can derive the IS curve from Keynesian Cross, and how we can derive the LM curve from the money market.
- Assume a closed economy with the government. The economy has the following parameters:

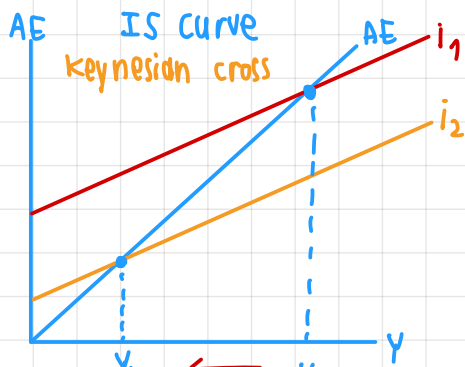
$$C = C_0 + C_1(Y - T) \quad I = I_0 - I_1 \cdot i \quad G = G_0 \quad T = T_0$$

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

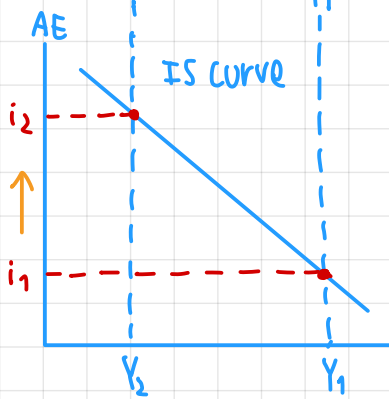
Answer the following questions.

- What are I_1 , L_Y , and L_i ?
- Why are I_1 and L_i negative?
- Derive the IS equation that shows how i and Y are related.

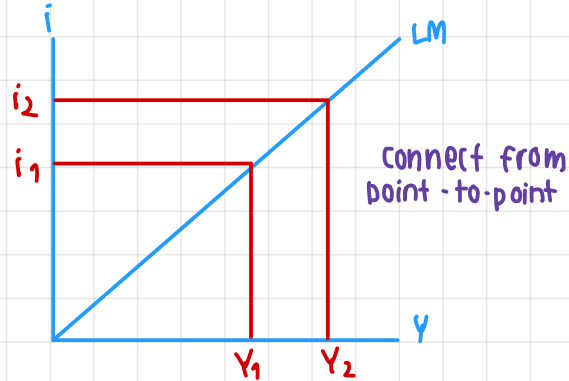
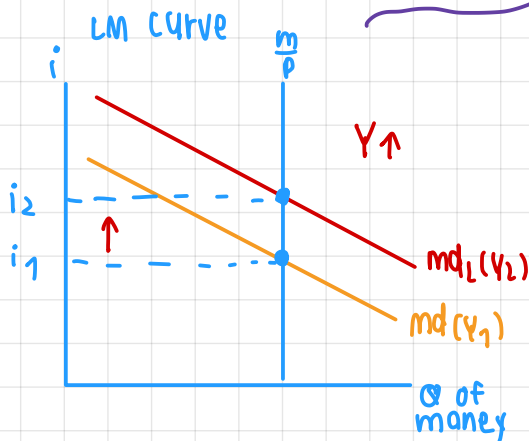
3. Explain, together with diagrams, how we can derive the IS curve from Keynesian Cross, and how we can derive the LM curve from the money market.



⇒ The IS curve is a 'locus of points' that means that each point is an Eqbm in Keynesian cross at each level of i/r . So, when we suppose $i \uparrow$ (from $i_1 \rightarrow i_2$) the higher i/r discourage investors that result in $AE \downarrow$. As a result, when $AE \downarrow$, Y also \downarrow ($Y_1 \rightarrow Y_2$), which proves that negative relationship between i and Y is depicted in the IS curve.



LM relation : $i \uparrow \rightarrow Y \uparrow$
 $Y \uparrow \rightarrow i \uparrow$
 $-Y \uparrow \rightarrow Md \uparrow$
 $i \uparrow \rightarrow Md \downarrow$



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

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

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

Answer the following questions.

4.1 What are I_1 , L_Y , and L_i ?

- ▷ I_1 : sensitivity of I to Δi
- L_Y : denotes the sensitivity of Md to changes in Y
- L_i : denotes the sensitivity of Md to changes in i

4.2 Why are I_1 and L_i negative?

- ▷ I_1 is negative because when there's higher i/r , people will not borrow money to invest, which $-I_1 = \frac{\Delta I}{\Delta i}$ means that when $i/r \uparrow$ by 1 unit, investment will decrease by I_1 units.
- ▷ L_i is negative because when we have higher i/r , people will not hold cash because people want to earn interest from bonds.

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

$$\begin{aligned}
 AE &= Y = C + I + G \\
 Y &= C_0 + C_1(Y - T) + I_0 - I_1 i + G_0 \\
 Y &= C_0 + C_1 Y - C_1 T + I_0 - I_1 i + G_0 \\
 I_1 i &= C_0 + C_1 Y - C_1 T + I_0 + G_0 - Y \\
 I_1 i &= C_1 Y + Y + C_0 - C_1 T + I_0 + G_0 \\
 I_1 i &= (C_1 - 1)Y + C_0 - C_1 T + I_0 + G_0 \\
 i &= \left(\frac{1}{I_1}\right) [(C_1 - 1)Y + C_0 - C_1 T + I_0 + G_0]
 \end{aligned}$$

4.4 Find the slope of the IS curve.

$$\begin{aligned}
 i = \text{slope} &\rightarrow \frac{C_1 - 1}{I_1} = \frac{-(1 - C_1)}{I_1} \\
 \text{multiplier} &= \frac{1}{1 - C_1} \quad \text{slope} = \frac{-1}{MI_1}
 \end{aligned}$$

★ Thus, slope of IS depends on
 1) multiplier
 2) I sensitivity to i
 - When M, I are large \rightarrow IS flat

4.5 Derive the LM equation that shows how i and Y are related.

$$\begin{aligned}
 M_d &= M_s \\
 L(Y, i) &= \frac{M}{P} \\
 L_Y \cdot Y - L_i \cdot i &= \frac{M_0}{P_0} \\
 L_Y Y - \frac{M_0}{P_0} &= L_i i \\
 \left(\frac{L_Y}{L_i}\right) Y - \left(\frac{1}{L_i}\right) \left(\frac{M_0}{P_0}\right) &= i
 \end{aligned}$$

4.6 Find the slope of the LM curve.

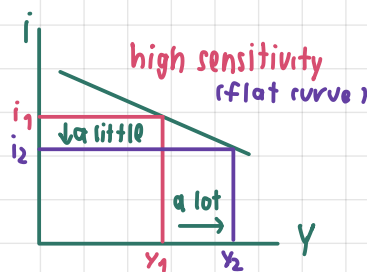
$$\text{slope} = \frac{L_Y}{L_i}$$

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.

$$\text{Slope of IS curve} = \frac{C_1 - 1}{I} \quad \text{or} \quad -\frac{(1 - C_1)}{I}$$

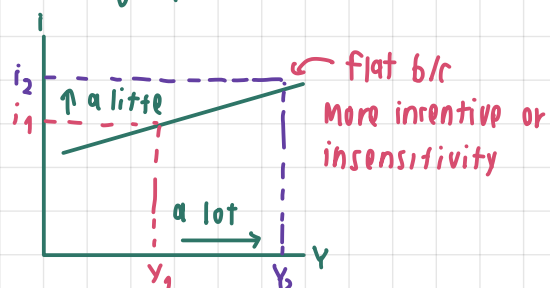
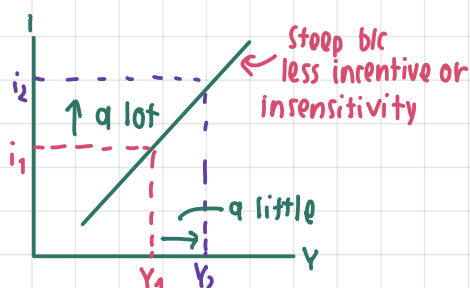
- IS
- 1) investment's sensitivity to change in interest rate
 : if there is a decrease in i , there will be a large increase in investment and hence increase in output. $\frac{\Delta I \uparrow \text{ a lot}}{\Delta i \uparrow \text{ a little}} \therefore$ IS flat due to high sensitivity.
 - 2) multiplier $\left[\frac{1}{1 - C_1}\right]$
 : if increase in investment \rightarrow it will causing a large increase in output.
 " $i \uparrow \rightarrow I \downarrow \rightarrow Y \downarrow$ large amount "



LM Slope LM : $\left(\frac{L_Y}{L_i}\right)$ since LM curve is upward slope relation

$$i \uparrow \rightarrow Y \uparrow$$

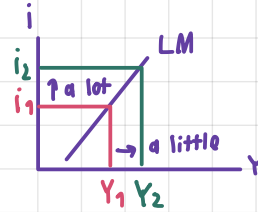
- 1) if $i \uparrow$ increase a lot and Y increase a little : LM curve will be steep
- 2) if $i \uparrow$ increase a little and Y increase a lot : LM curve will be flat
 \hookrightarrow M_d sensitivity to change in interest rate



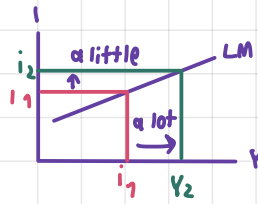
$$\begin{aligned}
 i \uparrow &\rightarrow M_d \downarrow > M_d = M_s \\
 Y \uparrow &\rightarrow M_d \uparrow
 \end{aligned}$$

LM relation : $i \uparrow \rightarrow M_d \downarrow$
 $Y \uparrow \rightarrow M_d \uparrow$ } $M_d = M_s$

1) L_y Large (M_d sensitive to ΔY)
 $i \uparrow$ a lot $\rightarrow M_d \downarrow$ a lot } $M_d = M_s$
 $Y \uparrow$ a little $\rightarrow M_d \uparrow$ a lot



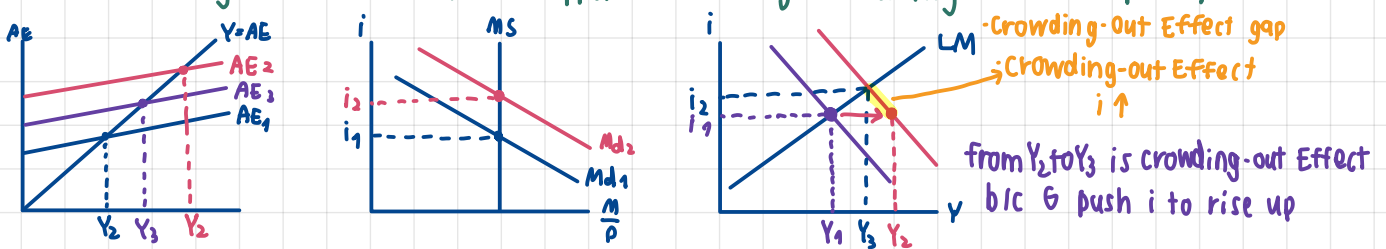
2) L_i Large (M_d sensitive to Δi)
 $i \uparrow \rightarrow M_d \downarrow$ a lot } $M_d = M_s$
 $Y \uparrow \rightarrow M_d \uparrow$ a lot



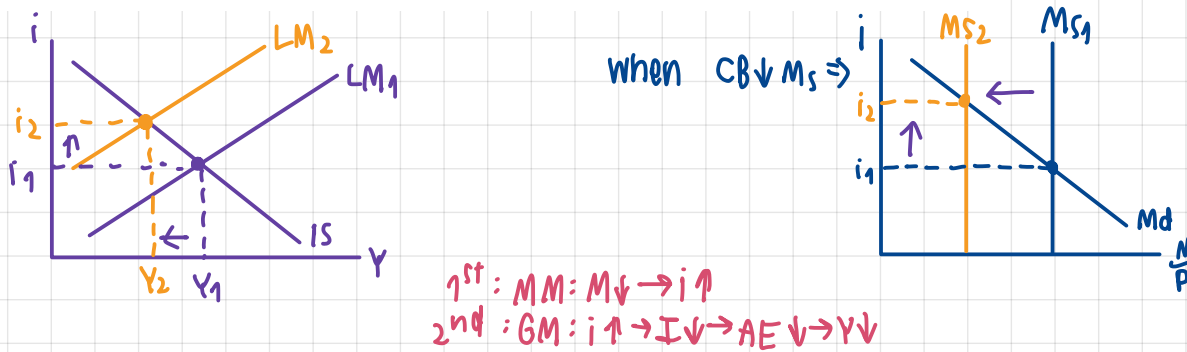
6. What is the Crowding-Out Effect?

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.

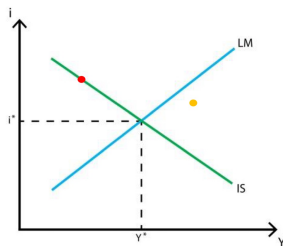
▷ Crowding-Out Effect appeared when govt spending \uparrow but lead private sectors to discourage from investment.
 ▷ Crowding-out Effect will happen when govt using fiscal policy.



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.



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?

▷ At red point goods and services market is in the eqbm money market is not.

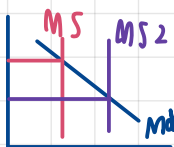
8.2 Explain how the goods and money markets at the **Orange** point will adjust towards the general equilibrium (Y^*, i^*).

▷ below the LM curve

: $I < I^s$ because excess in money demand, so interest in bond should ↑

▷ above the IS curve

: $I < I^s$ because in G&S market $Y > AE$ firm should produce less to reduce investment, the orange point will shift to the left.



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. **high Multiplier \Rightarrow is flat, shift steep curve**

9.1 Consumers have high MPC. **monetary policy**

9.2 Investment is NOT sensitive to changes in interest rate. **Fiscal policy**

9.3 Money demand is very sensitive to changes in interest rate. **Fiscal policy**

9.4 Money demand is very sensitive to changes in income (Y). **Monetary policy**

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

$$C = 100 + 0.5(Y_d) \quad Y-T \quad I = 80 - 100(i) \quad G = 40 \quad T = 40$$

$$L(i, Y) = 0.5(Y) - 200(i) \quad M = 400 \quad P = 2$$

Answer the following questions.

10.1 Derive the IS equation.

$$Y = C + I + G$$

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

$$Y = 100 + 0.5Y - 20 + 80 - 100i + 40$$

$$0.5Y = 200 - 100i$$

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

10.2 Derive the LM equation.

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

$$M_d = \frac{M_s}{P}$$

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

$$0.5Y - 200 = 200i$$

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

10.3 Find the general equilibrium output and interest rate.

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

$$40,000 - 100Y = 50Y - 20,000$$

$$20,000 = 50Y$$

$$Y^* = 400$$

$$i = \frac{200 - 0.5(400)}{100} = \frac{200 - 200}{100} = 0$$

$$i \text{ in IS} = i \text{ in LM}$$