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Exercise 6

IS-LM Model

1. The IS-LM Model is a general equilibrium model, which means that...there is a common price that clear the 2 or more markets.....
   There are...2.....markets, which are....at the equilibrium.....
   The price that clears these markets is.....interest rate (i).....
   The IS curve represents a...negative.....relationship between interest rate (i) and output (Y). This is because...higher interest discourage investor from investing so the output decreases. [i↑, I↓, Y↓]
   The LM curve represents a....positive.....relationship between interest rate (i) and output (Y). This is because...incase to make the money market at equilibrium Md = Ms, which Ms is constant so as Y↑ → I↑ also. [i↑, Y↑]
   Each point on the IS curve is an equilibrium in the...G&S.....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.....

   as the income increase (Y↑), ppl want to hold more money (Md↑), so i↑ to make eqrb.

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↓ (nominal money supply)	–	shift left
P↓ (price level)	* doesn't affect by price level *	shift right

G↓, T↓, G&T↑ equally: doesn't affect the money market

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.

high change to be Final

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.)

4.4 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.)

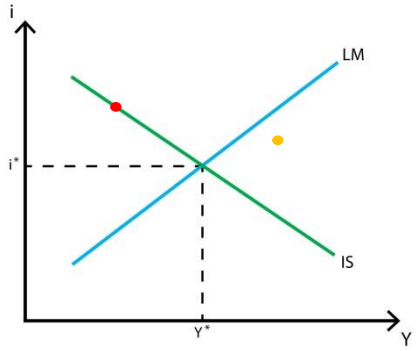
4.6 Find the slope of the LM curve.
(Hint: The coefficient before Y is the slope of LM.)

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.

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.

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?

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

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).

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

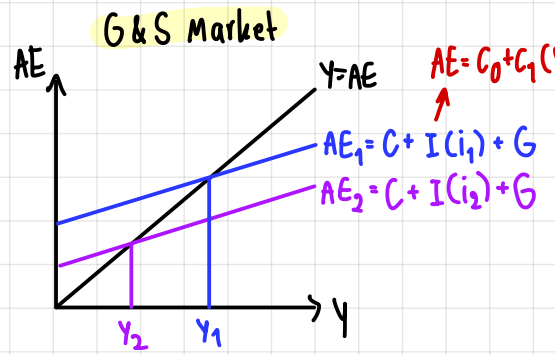
    $C = 100 + 0.5(Yd)$ $I = 80 - 100(i)$ $G = 40$ $T = 40$

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

    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.

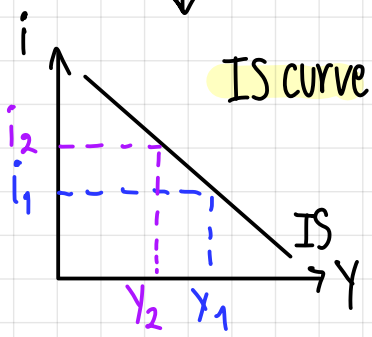
3. Explain, together with diagrams, how we can derive the IS curve from Keynesian Cross, and how we can derive the LM curve from the money market.

G&S market

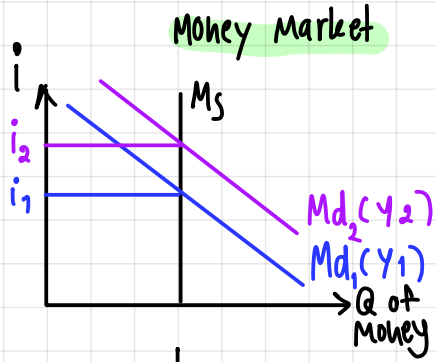


$AE = C_0 + C_1(Y-T) + I_0 + I(i_1) + G$

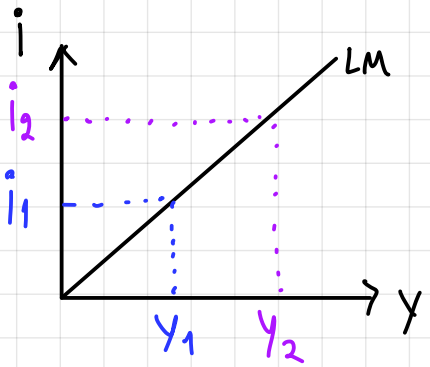
In this case $i_2 > i_1$, when interest rate (i) increase, The investment (I) decrease. Therefore, it also affects the AE to decreases → output (Y) decreases.



The IS curve represents the 'negative relationship' of i and Y since i↑ → I↓ → AE↓ → Y↓



In this case income (Y) increase from $Y_1 \rightarrow Y_2$, When income increase, Money demand (Md) also increases (transaction demand etc.) people want to hold more cash. Therefore, people sell the bonds to get money. Bank issuers will increase i to make the money market in equilibrium.



The LM Curve represents the 'positive relationship' between i and Y

→ Y↑ Md↑ } Md = Ms
i↑ Md↓ }

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 is the sensitivity of Investment to change in interest rate (slope of investment func.)
- L_Y is the sensitivity of Money demand (L or Md) to change in income (Y)
- L_i is the sensitivity of Money demand (L or Md) to change in interest rate (i)

4.2 Why are I_1 and L_i negative?

- Due to investment function → $I = I_0 - I_1(i)$, when interest rate increases, it will decrease the investment [i↑ → I↓]
- Due to Money demand function → $L(i,Y) = L_Y(Y) - L_i(i)$, when interest rate increases, Money demand will decrease. [i↑ → Md↓] want to hold less cash.

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

$$Y = AE$$
$$Y = C + I + G$$
$$Y = C_0 + C_1(Y - T_0) + I_0 - I_1(i) + G_0$$
$$I_1(i) = C_0 + C_1Y - C_1T_0 + I_0 + G_0 - Y$$
$$i = \frac{C_0 + C_1Y - C_1T_0 + I_0 + G_0 - Y}{I_1} \quad \#$$

4.4 Find the slope of the IS curve.

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

$$i = \frac{C_0 + C_1Y - C_1T_0 + I_0 + G_0 - Y}{I_1}$$
$$i = \frac{Y(C_1 - 1) + C_0 - C_1T_0 + I_0 + G_0}{I_1}$$
$$i = \frac{-(C_1 - 1)Y + C_0 - C_1T_0 + I_0 + G_0}{I_1}$$
$$i = \frac{-(1 - C_1)Y}{I_1} + \frac{C_0 - C_1T_0 + I_0 + G_0}{I_1}$$
$$i = -\left(\frac{1}{m} \times \frac{1}{I_1}\right)Y + \frac{C_0 - C_1T_0 + I_0 + G_0}{I_1}$$

∴ Slope of IS equation is $-\left(\frac{1}{m} \times \frac{1}{I_1}\right)$ #

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.)

$$M_d = M_s$$
$$L(Y,i) = \frac{M}{P}$$
$$L_y \cdot Y - L_i \cdot i = \frac{M}{P}$$
$$L_i \cdot i = L_y \cdot Y - \frac{M}{P}$$
$$i = \frac{L_y \cdot Y}{L_i} - \frac{1}{L_i}\left(\frac{M}{P}\right)$$

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

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

$\therefore$ slope of 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 → $-\left(\frac{1}{M} \times \frac{1}{I_1}\right)$

= Slope of IS depends on M and I_1
- Large multiplier → flat IS curve
- Large I_1 → flat IS curve

slope of LM curve → $\frac{L_y}{L_i}$

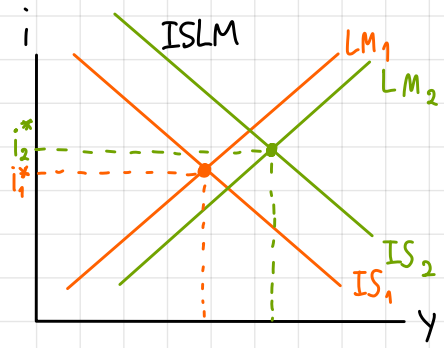
= slope of LM depends on L_y and L_i
- Large L_y or small L_i → steep LM curve
- Small L_y or large L_i → flat LM curve.

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 is public sector spending (G) reduces private sector spending (I)

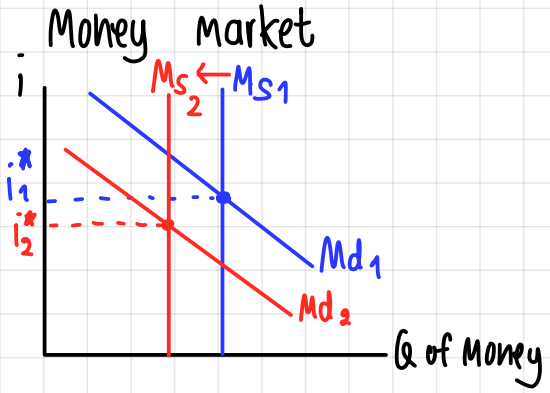
Expansionary fiscal policy
→ Increasing gov. spending affect aggregate expenditure (AE) to increase, so output (Y) will also increase. When income increases, people want to hold more cash which mean money demand increases. This causes bank issuers to raise interest rate to equate the money market. But at the same time, it reduces G & S market because high interest rate discourage investor from investing. This causes the AE and Y to increase.

$G\uparrow \rightarrow AE\uparrow \rightarrow Y\uparrow$
$Y\uparrow \rightarrow Md\uparrow \rightarrow i\uparrow$
$i\uparrow \rightarrow I\downarrow \rightarrow AE\downarrow \rightarrow Y\downarrow \Rightarrow$ Crowding out effect

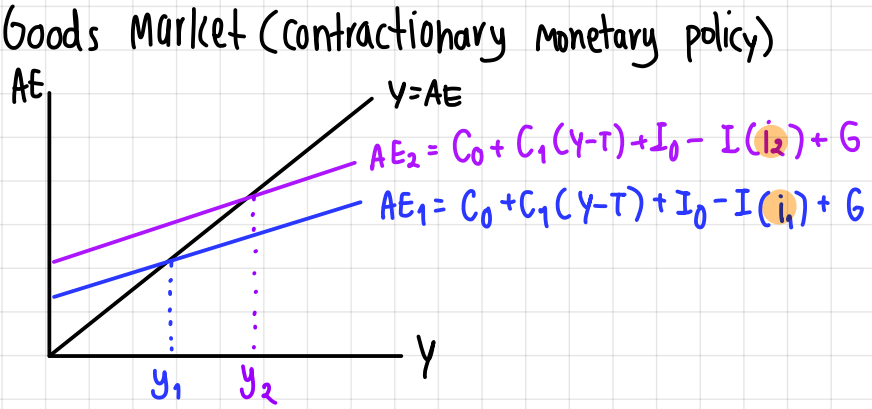


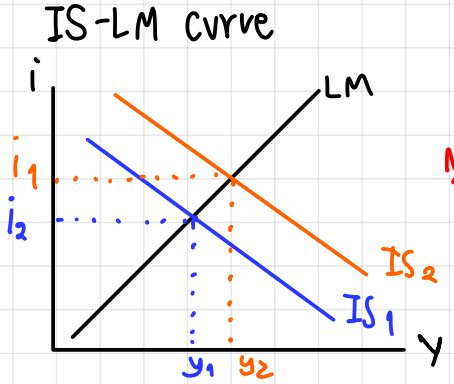
$M_S\downarrow$

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.



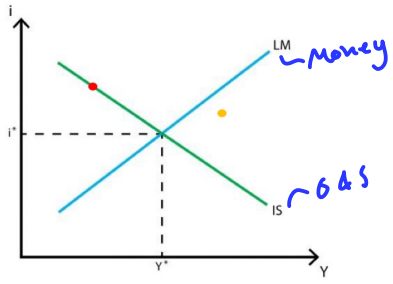
i↓





NOTE $i_2 < i_1$

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*).

8.1 At red point, The Goods Market is in equilibrium but the money market is not.

8.2 At the orange point

for IS curve (goods market)

= This is when you have surplus → inventories ↑ → signal firm to cut production

∴ Goods Market will reduce production and move to equilibrium.

for LM curve (Money Market)

= This is when $i > i^*$ so you have surplus of Money Supply, so people go buy bonds to get interest. So Bond issuers reduce the interest rate b/c they can't pay high i. and to adjust to equilibrium. [i moves downward]

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).

NOTE. Fiscal shift IS curve
Monetary shift LM curve
ONLY!!

9.1 high MPC → large multiplier → when I ↑, Y ↑ a lot so IS curve is flat
so, Monetary policy will be effective.

9.2 I is not sensitive to Δi means when i ↑, I ↓ little = small crowding out effect
↓
G ↑ → AE ↑ → Y ↑ → Md ↑ → i ↑ → Y ↓ a little
Fiscal policy should be used.

9.3 Md is sensitive to Δi means Li is large, so LM = flat
Fiscal policy should be used

9.4 Md is sensitive to ΔY means Ly is large, so LM = steep
Monetary policy should be used

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

C = 100 + 0.5(Yd) Y-T 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 $Y = C + I + G$

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

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

$0.5Y = 200 - 100i$

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

10.2 $L(i,Y) = \frac{M}{P}$

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

$0.5Y - 200 = 200i$

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

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

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

$20{,}000 = 50Y$

$Y^* = 400$

$i = 200 - 0.5(400)$

$= 200 - 200$

$= 0$ → i in IS curve = i in LM curve.