

Exercise 6

IS-LM Model

1. The IS-LM Model is a general equilibrium model, which means that there exists a common price that clears two or more markets. There are 2 markets, which are 1.) G&S market 2.) 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 high $i \uparrow \rightarrow$ lower investment \rightarrow lower demand $\rightarrow Y \downarrow$. The LM curve represents a positive relationship between i and Y . This is because people have more income ($Y \uparrow$) \rightarrow people have more demand \rightarrow higher demand drives up $i \uparrow$. Each point on the IS curve is an equilibrium in the goods 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: $M_d = M_s$.

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

Variable	IS Curve	LM Curve
$i \uparrow$	movement along the curve	movement along the curve
$G \downarrow$	shift to the left	remains the same
$T \downarrow$	shift to the right	remains the same
$G \& T \uparrow$ equally	shift to the right	remains the same
$M \downarrow$	remains the same	shift up/shift to the left
$P \downarrow$	remains the same	shift down/shift to the right

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.
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 ?
- 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 $M_d = M_s$. 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.)

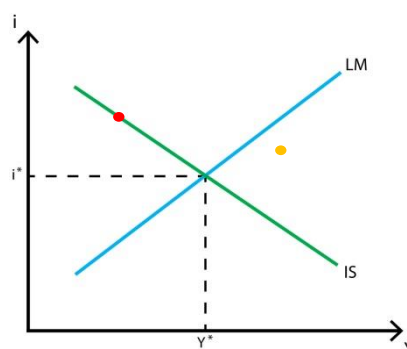
5. From Question 4.4, we can see that the slope of IS curve depends on two factors. Explain how each of these factors affects the slope of the IS curve. We also can see that the slope of LM curve depends on two factors. Explain how each of these factors affects the slope of the LM curve.

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:

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

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

Answer the following questions.

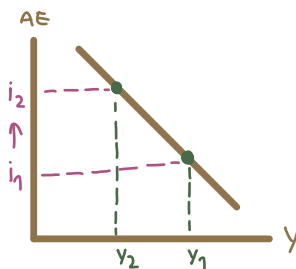
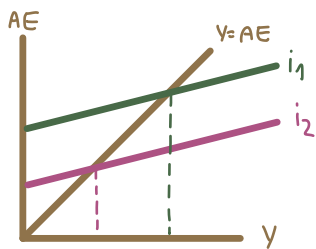
10.1 Derive the IS equation.

10.2 Derive the LM equation.

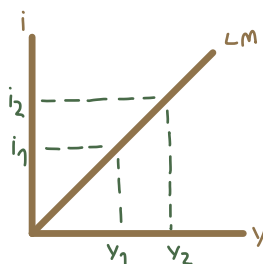
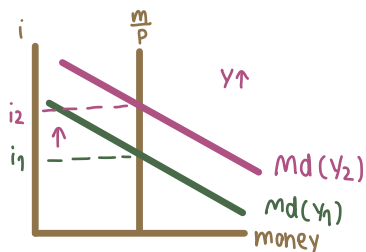
10.3 Find the general equilibrium output and interest rate.

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.

IS curve



LM curve



The IS curve is a locus of point that means each point is an Equilibrium 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 investor 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.

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 M_d to changes in Y .

L_i : denotes the sensitivity of M_d to changes in i .

4.2 Why are I_1 and L_i negative?

I_1 is negative \rightarrow higher $i/r \rightarrow$ people will not borrow money to invest, which $-I_1 = \frac{dI}{di}$

L_i is negative \rightarrow higher $i/r \rightarrow$ 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.

Derive the IS equation (i & Y)

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

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

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

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

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

$$I_1 i = (C_1 - 1) Y + C_0 - C_1 T + I_0 + G_0$$

$$i = \left(\frac{1}{I_1}\right) [(C_1 - 1) Y - C_0 - C_1 T + I_0 + G_0]$$

4.4 Find the slope of the IS curve.

slope of IS curve

$$i = \text{slope} \rightarrow \frac{C_1 - 1}{I_1} = \frac{-(1 - C_1)}{I_1}$$

$$\text{multiplier} = \frac{1}{1 - C_1} \quad \text{slope} = \frac{-1}{M I_1}$$

✳ 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.

Derive LM equation (i & Y)

$$M_d = M_s$$

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

$$L_y \cdot Y - L_i \cdot i = \frac{M_0}{P_0}$$

$$L_y \cdot Y - \frac{M_0}{P_0} = L_i \cdot i$$

$$\left(\frac{L_y}{L_i}\right)Y - \left(\frac{1}{L_i}\right)\left(\frac{M_0}{P_0}\right) = i$$

4.6 Find the slope of the LM curve.

slope of 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.

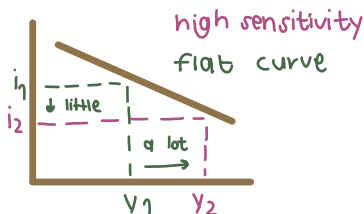
4.4) slope of IS : $\frac{c_1 - 1}{I_1}$ or $-\frac{c_1 - c_1'}{I_1}$

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 $\frac{dI \uparrow}{di \uparrow}$ a lot ∴ IS flat due to high sensitivity

2) multiplier $\left[\frac{1}{1 - c_1}\right]$

• if increase in investment → it will causing a large increase in output.
 " $i \uparrow \rightarrow I \downarrow \rightarrow Y \downarrow$ a lot "

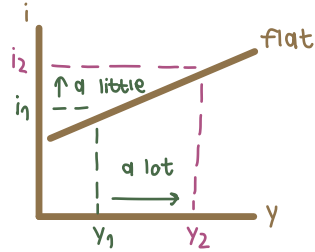
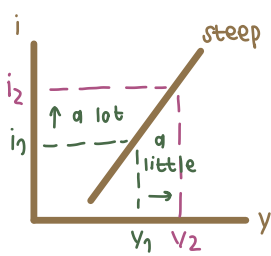


LM Slope of LM : $(\frac{L}{L_i})$ since LM curve is upward slope.

relation $i \uparrow \rightarrow Y \uparrow$

1) if $i \uparrow$ increase a lot and Y increase a little : LM steep

2) if $i \uparrow$ increase a little and Y increase a lot : LM flat



$i \uparrow \rightarrow md \downarrow$
 $Y \uparrow \rightarrow md \uparrow$ } $md = ms$

LM relation $i \uparrow \rightarrow md \downarrow$
 $Y \uparrow \rightarrow md \uparrow$ } $md = ms$

1) L_Y Large : $i \uparrow$ a lot $\rightarrow md \downarrow$ a lot
 $Y \uparrow$ a little $\rightarrow md \uparrow$ a lot } $md = ms$

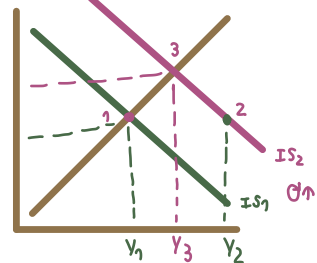
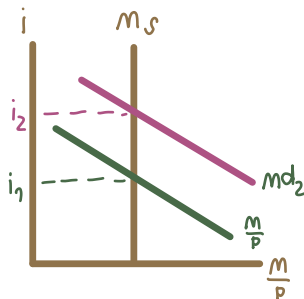
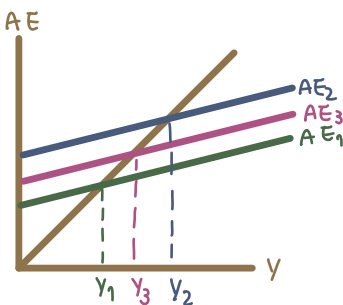
2) L_i Large : $i \uparrow \rightarrow md \downarrow$ a lot
 $Y \uparrow$ a lot $\rightarrow md \uparrow$ a lot } $md = ms$

6. What is the Crowding-Out Effect?

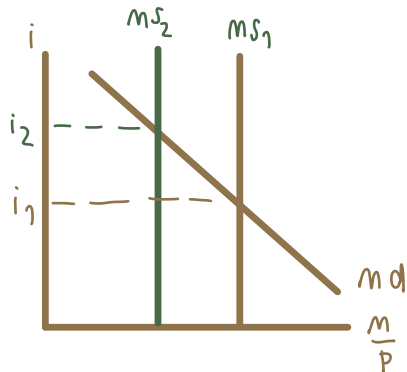
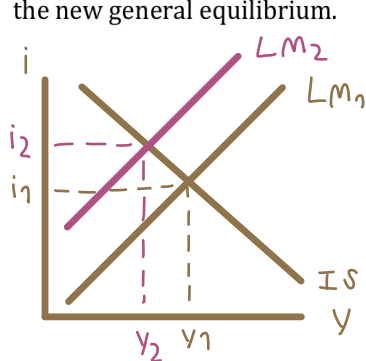
Suppose that the government increases its spending, i.e. expansionary fiscal policy. Use the IS-LM diagram to explain how the economy moves to the new general equilibrium and the crowding-out effect.

Crowding-out effect appeared when govt. spending \uparrow but lead private sectors to discourage from investment

Assume $G \uparrow$



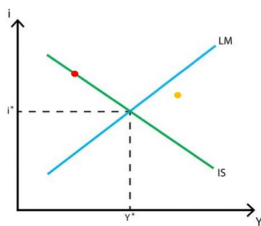
7. Suppose the central bank decreases its money supply, i.e. contractionary monetary policy. Use the IS-LM diagram to explain how the economy moves to the new general equilibrium.



1st: $M \downarrow \rightarrow i \uparrow$

2nd: $i \uparrow \rightarrow I \downarrow \rightarrow AE \downarrow \rightarrow Y \downarrow$

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, good and service market is in the eqbm but money market is not

8.2) We have to adjust both market below the LM curve

It's b/c excess in money demand, so interest in bond should increase above the IS curve.

It's b/c in good and service market $Y > AE$ firm should produce less to reduce investment the orange point will shift 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.

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) monetary policy

shift LM curve

control M

9.2) Fiscal policy

shift LM curve & IS steep

control θ & T

9.3) Fiscal policy

9.4) Monetary policy

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

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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.

$$10.1 \quad Y = C + I + G$$

$$Y = 100 + 0.5(Y - 10) + 80 - 100i + 40$$

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

$$0.5Y = 200 - 100i$$

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

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

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

$$0.5Y - 200i = 200$$

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

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

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

$$20,000 = 50Y$$

$$Y = 400$$

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