

Exercise 6

IS-LM Model

- The IS-LM Model is a general equilibrium model, which means that..... *a common price that clears 2 or more market*
 There are...*2*...markets, which are...*commodity and money market*
 The price that clears these markets is...*interest rate*
 The IS curve represents a...*inverse*...relationship between
 ...*output*...and...*IR*.....This is because...*high IR decrease the willingness to invest leads to smaller output being produced*
 The LM curve represents a...*positive*...relationship between
 ...*output*...and...*IR*.....This is because...*higher level of output means people have more income, higher demand for money leads to an ↑ in IR*
 Each point on the IS curve is an equilibrium in the...*comodity*...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: *$M_D = M_S$*

- 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</i>	<i>movement</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:

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

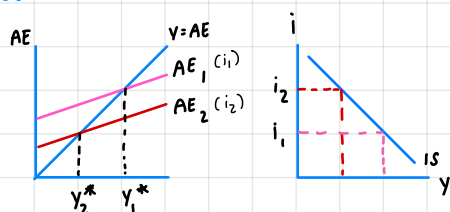
$$L(i, Y) = L_Y \cdot Y - L_i \cdot i \quad M = M_0 \quad P = P_0$$

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.

IS curved



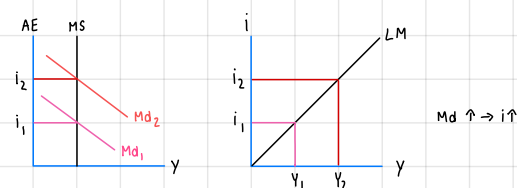
When IR increase it reduce the willingness of investor to invest.

Investment decrease leads to a fall in AE ($AE_1 \rightarrow AE_2$)

and shown in IS curve as i_1 has shifted to i_2 leads to smaller output

, vice versa.

LM curved



high demand of money means people are holding a lot of cash

This could create an inflation therefore, an IR will increase to reduce

inflationary gap. LM curve represent positive relationship between Y and IR

mean that increase in Y will result in an increase in IR.

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.

4.1)

I_1 : Sensitivity of investment to change in interest rate

L_Y : sensitivity of money demand to change in income

L_i : sensitivity of money demand to change in IR

4.2)

I_1 is negative because $IR \uparrow$ Investment $\downarrow$

L_i is negative because when $IR \uparrow$ 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.)

$$\begin{aligned}
 \text{multiplier} &= \frac{1}{1-MPC} \\
 m &= \frac{1}{1-C_1} \\
 1-C_1 &= \frac{1}{m} \\
 i &= \frac{C_0 + C_1 Y - C_1 T_0 + I_0 + G_0 - Y}{I_1} \\
 i &= \frac{(C_1 - 1)Y + C_0 - C_1 T_0 + I_0 + G_0}{I_1} \\
 &= \frac{-(1-C_1)Y + C_0 - C_1 T_0 + G_0}{I_1}
 \end{aligned}
 \quad
 \begin{aligned}
 &= \frac{-(1-C_1)Y}{I_1} + \frac{C_0 - C_1 T_0 + I_0 + G_0}{I_1} \\
 &= -\left(\frac{1}{m} \times \frac{1}{I_1}\right)Y + \frac{C_0 - C_1 T_0 + I_0 + G_0}{I_1} \\
 \therefore \text{ slope of IS equation is } &= -\left(\frac{1}{m} \times \frac{1}{I_1}\right)
 \end{aligned}$$

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.)

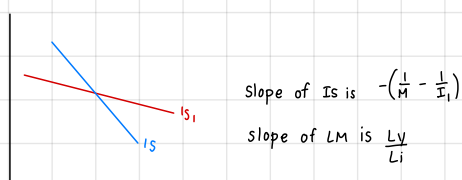
$$\begin{aligned}
 M_d &= M_s \\
 L(Y, i) &= \frac{M}{P} \\
 L_y \cdot Y - L_i \cdot i &= \frac{M}{P} \\
 L_i i &= L_y Y - \frac{M}{P} \\
 i &= \frac{L_y}{L_i} Y - \frac{1}{L_i} \left(\frac{M}{P} \right)
 \end{aligned}$$

4.6 Find the slope of the LM curve.

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

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

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.



LM slope depends on L_y and L_i

L_y high = steep

L_i high = flat

IS slope depends on

m and I_1

if high m and high I_1 = flat 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.

$$\text{IS equation: } Y = C + I + G$$

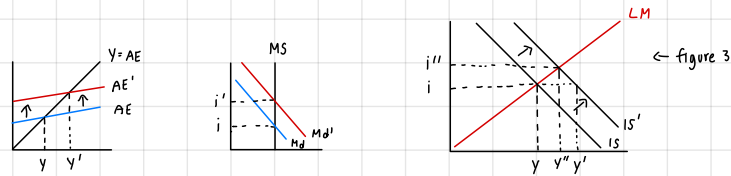
$$\text{LM equation: } \frac{M}{P} = L(i, Y)$$

Expansionary fiscal policy ($G \uparrow$)

$$\text{GM: } G \uparrow \dots AE \uparrow \dots Y \uparrow$$

$$\text{MM: } Y \uparrow \dots MD \uparrow \dots i \uparrow$$

$$\text{GM: } i \uparrow \dots I \downarrow \dots AE \downarrow \dots Y \downarrow$$



Crowding-out effect results from the use of

fiscal policy (government spend $\uparrow$ / tax rate $\downarrow$)

the gov. increase its spending which then increase the $AE(Y)$.

This is shown when IS shift to IS' (C Y to Y'). As output $\uparrow$ demand for money also $\uparrow$ (shift to the right). IR has also increased. This discourage investor from investing. AE then fall leads to a drop in Y

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.

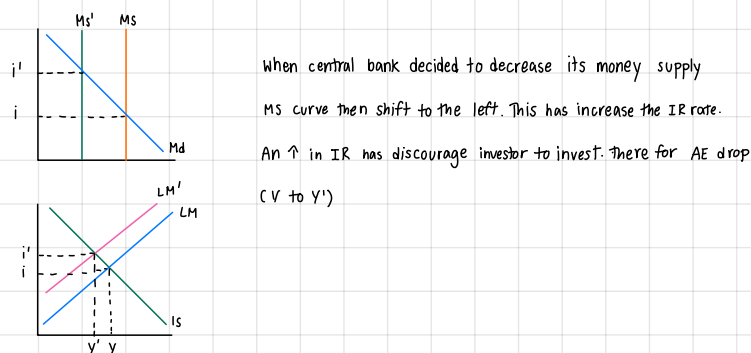
$$\text{IS equation: } Y = C + I + G$$

$$\text{LM equation: } \frac{M}{P} = L(i, Y)$$

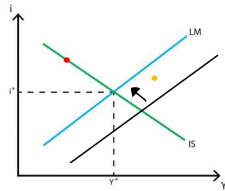
$$\text{MM: } M \downarrow \rightarrow \frac{M}{P} \downarrow \dots i \uparrow$$

$$\text{GM: } i \uparrow \dots I \downarrow \dots AE \downarrow \dots Y \downarrow$$

contractionary monetary policy - decrease money supply (LM shift to the left)



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) The goods market is in the equilibrium
 : Money market isn't in equilibrium
- 8.2) Central bank increase the IR to reduce MS (LM shift to the left)
 high IR discourage investor $\rightarrow$ AE and Y decrease
 However, IS curve is not in the equilibrium yet. So, the government will
 be using contractionary fiscal policy to also decrease AE and Y
 This will result in an 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) high MPC = high multiplier $\rightarrow$ flat IS
 : monetary policy

- 9.2) IS steep = fiscal policy

- 9.3) LM flat = fiscal policy

- 9.4) LM steep = monetary policy

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.

10.1) $Y = AE$

$$Y = C + I + G = C_0 + C_1 Y - C_2 T + I_0 - I_1(i) + G$$

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

$$100i = 200 + 0.5Y$$

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

10.2) $M_s = M_d$

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

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

$$200 = 0.5Y - 200i$$

$$200i = 0.5Y - 200$$

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

10.3) $IS = LM$

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

$$400 - Y = 0.5Y - 200$$

$$600 = 1.5Y$$

$$400 = Y$$