Exercise 6

IS-LM Model

1. The IS-LM Model is a general equilibrium model, which means that common price exist to clear 2 or more markets.
   There are 2 markets, which are G&S mkt and money mkt
   The price that clears these markets is the interest rate
   The IS curve represents a negative relationship between i and y. This is because $I = I(i)$ and $\frac{dI}{di} < 0$, that higher interest rate discourage investors to invest
   The LM curve represents a positive relationship between i and income. This is because when consumer have high income result in demand to increase as they have more money to purchase G&S, as a result when money ↑ interest rate will increase
   Each point on the IS curve is an equilibrium in the commodity market.
   Therefore, we have the equilibrium condition: Y = A.E
   Each point on the LM curve is an equilibrium in the money market.
   Therefore, we have the equilibrium condition: Y = A.E

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

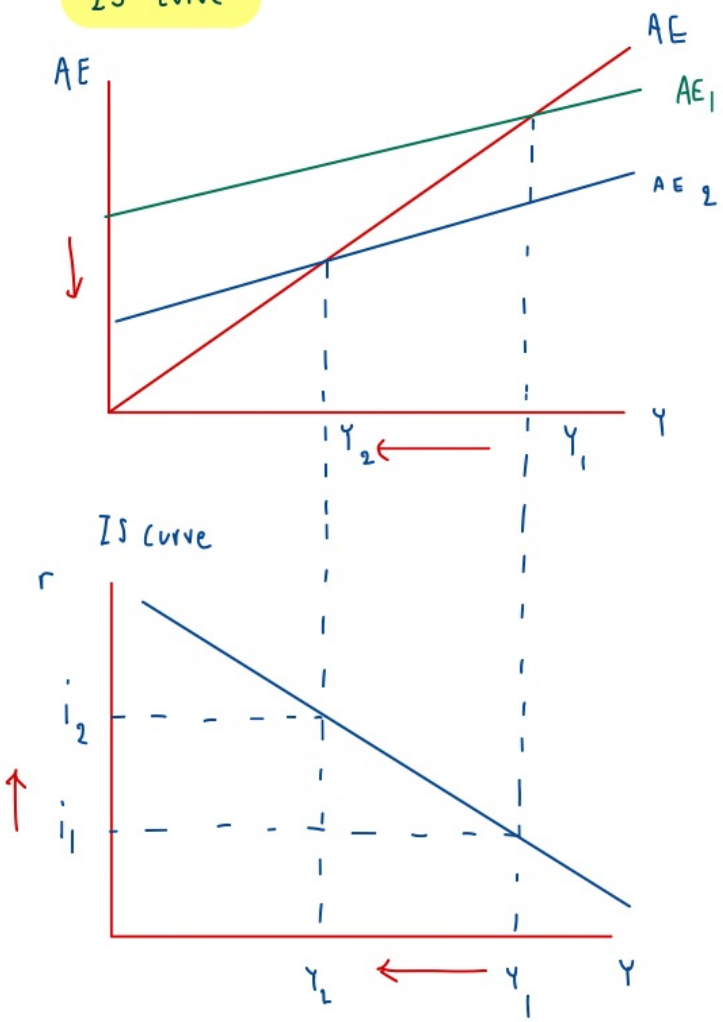
Variable	IS Curve	LM Curve
i↑	movement along the curve	movement along the curve
G↓	shift left	no change in LM
T↓	shift right	no change in LM
G&T↑ equally	shift right	no change in LM
M↓	no change on IS	shift left
P↓	no change on IS	shift right

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:
   $C = C_0 + C_1(Y - T)$ $I = I_0 - I_1 \cdot i$ $G = G_0$ $T = T_0$
   $L(i, Y) = L_Y \cdot Y - L_i \cdot i$ $M = M_0$ $P = P_0$
   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.

3

IS Curve

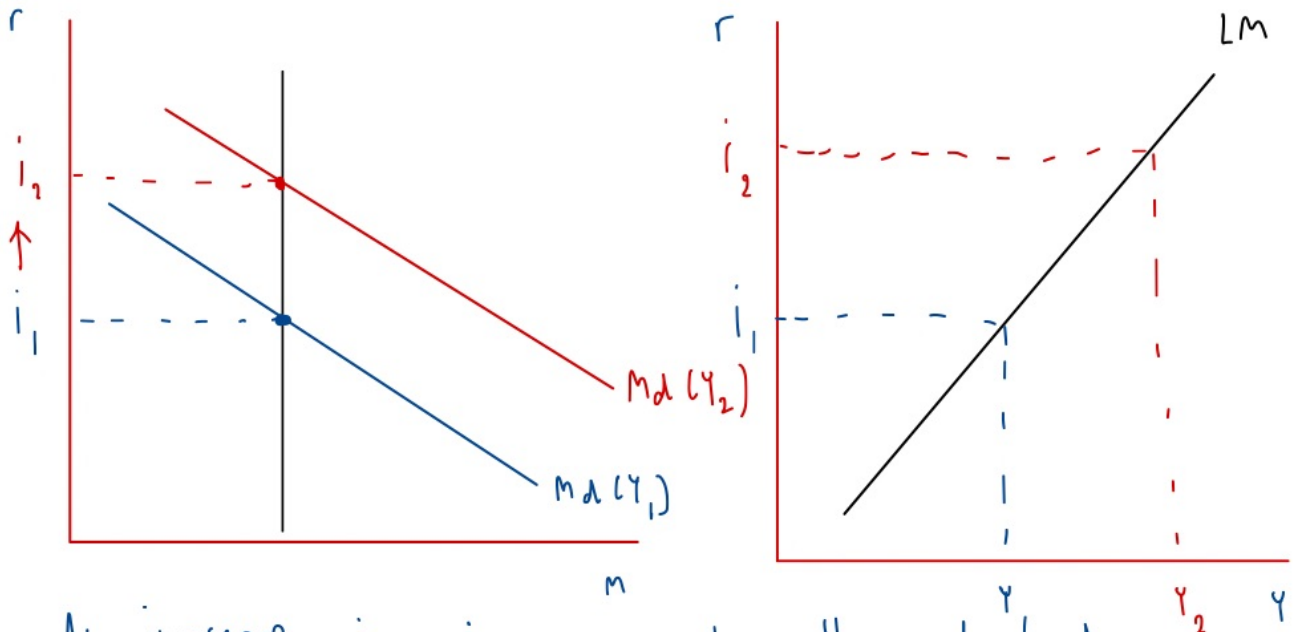


An increase in the interest rate, reduces in planned investment which shifts the PE function downward ($AE_1 \rightarrow AE_2$). The higher interest rate discourage investors that result in ↓AE.

The IS curve represents equilibrium in the G & S market.

The Is curve summarizing the relationship between the interest rate and Y. The higher the interest rate, the lower the level of Y.

LM curve



An increase in income raises the demand for money and thus raises the interest rate from i_1 to i_2. The LM curve summarizing this relationship between the interest rate and income: the higher level of income, the higher the interest rate.

4

4.1 I_1 : sensitivity of I to Δi

L_Y : sensitivity of M_d to in ΔY

L_i : sensitivity of M_d to in Δi

4.2 I_1 is negative because when there's higher i it discourage investors from investing.

$-I_1 = \frac{dI}{di}$ means that when $\uparrow i$ by 1 unit, investment will decrease by I_1 units.

L_i is negative because when we have higher i, people will not hold cash because people want to earn interest from bonds.

4.3 $AE = Y = C + I + G$

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

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

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

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

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

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

multiplier $= \frac{1}{1 - C_1}$ slope $= \frac{1}{mI_1}$

The slope of IS depends on

1. multiplier
2. I sensitivity to i

when m, I are large $\rightarrow$ IS is flat

4.5 $M_d = M_s$

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

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

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

4.6 $\left(\frac{L_y}{L_i}\right) y - \left(\frac{1}{L_i}\right)\left(\frac{M_0}{P_0}\right) = i$

slope $= \frac{L_y}{L_i}$

5 IS slope depend on

(1) Investment's sensitivity to change in interest rate

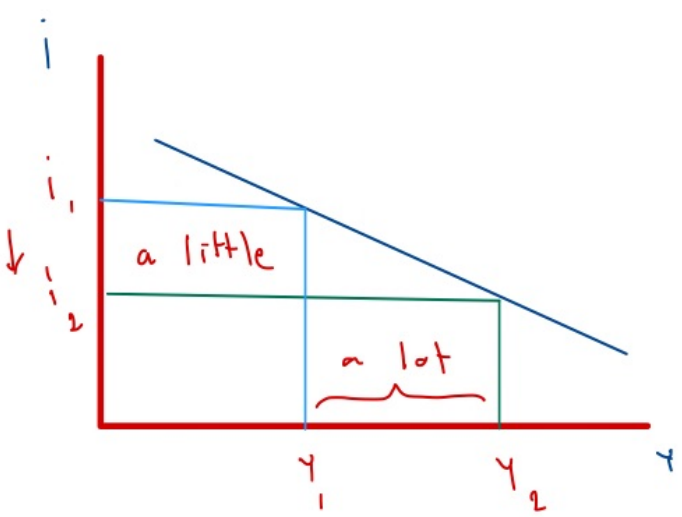
if there is a decrease in i, there will be a large increase in investment and hence increase in output.

∴ 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.

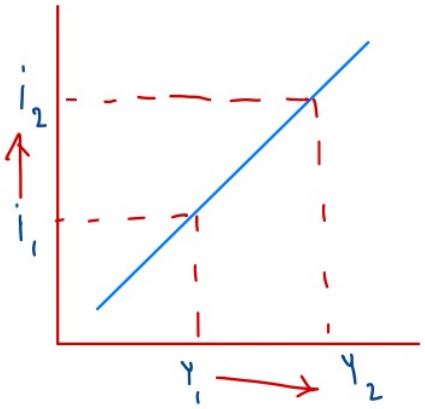
" $i \uparrow \rightarrow Z \downarrow \rightarrow Y \downarrow$ large amount "



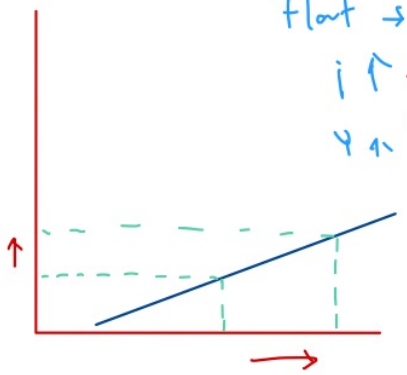
Slope LM : $\left(\frac{\Delta Y}{\Delta i}\right)$ since LM curve is upward slope

relation ↑i → Y↑

1. If i ↑ a lot and Y↑ a little: LM curve steep
2. If i↑ a little and Y↑ a lot: LM curve flat
   → Md sensitivity to change in interest rate



steep
↳ less incentive or insensitivity



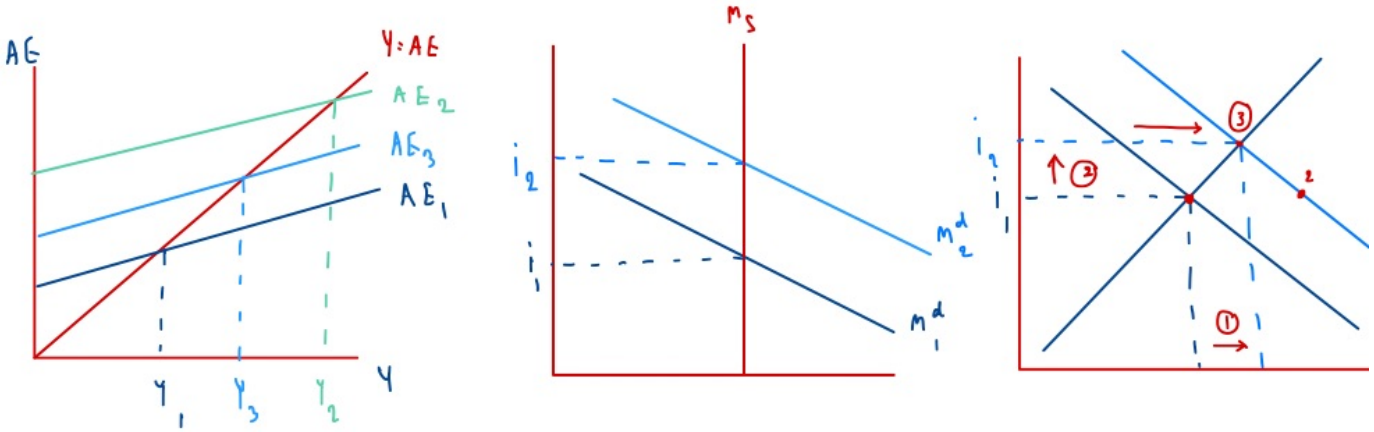
flat → higher sensitivity
i ↑ → Md ↓ > Md = Ms
Y ↑ → Md ↑
LM (flat)

6

Crowding-Out effect will happened when government using fiscal policy

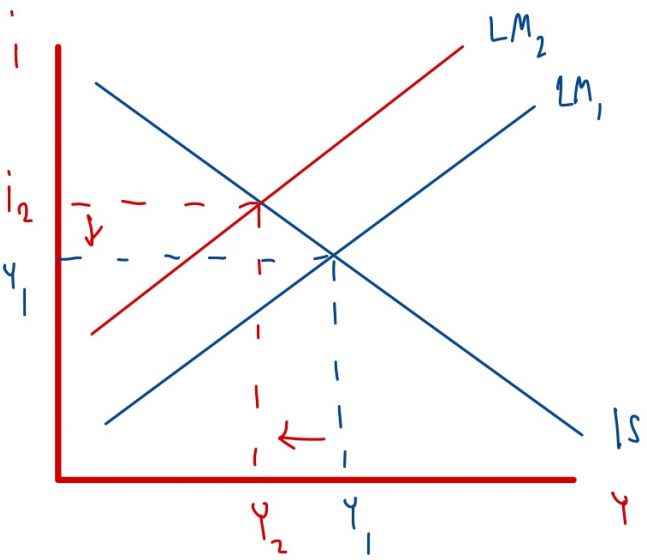
Crowding-out effect appeared when government ↑ spending lead to substantial rises in the interest rate, which discourages business from making investment.

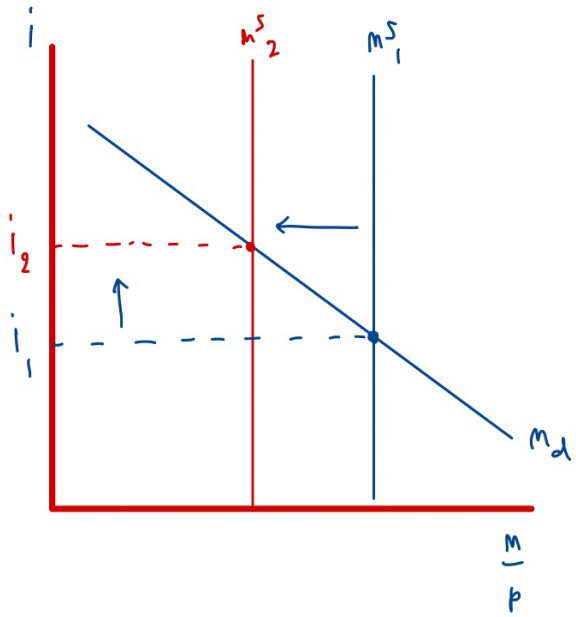
Assume: G ↑



from Y_2 to Y_3 is crowding-out effect b/c G push interest rate to rise up

7





1st: MM: M↓ → i↑

2nd: GM: i↑ → I↓ → AE↓ → Y↓

8

8.1 At red point, G&S is in the equilibrium but is not in money market.

8.2 We have to adjust both market below the LM curve
It's because excess in M_d, so interest rate in bond should increase above the IS curve.
It's because in G&S market Y>AE firm should produce less to reduce investment the orange point will shift to the left.

9 9.1 monetary policy

9.2 fiscal policy

9.3 fiscal policy

9.4 Monetary policy

10

10.1 $Y = AE = C + I + G$

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

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

$$0.5Y = 200 - 100i$$

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

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

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

$$0.5Y - 200i = 200$$

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

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

$$40000 - 100Y = 50Y - 20000$$

$$-150Y = -60000$$

$$Y^* = 400$$

$$i = 200 - 0.5(400)$$

$$= 200 - 200 = 0$$

(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.)

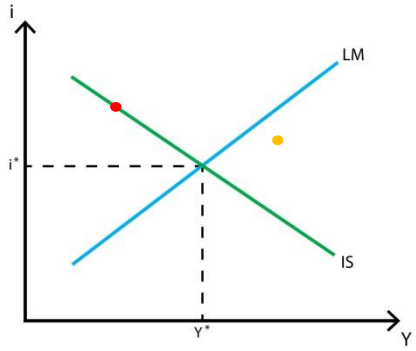
4.6 Find the slope of the LM curve.
(Hint: The coefficient before Y is the slope of LM.)

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.