Student ID.....

EE212 Principles of Macroeconomics, 2/2016 (Sec. 046401)

Problem Sets 3 :

Chapter 6. ISLM Model

Please submit at the BE office, 5th floor department of Economics building.

Deadline of submission : April 7, 2016, before 15.00 hrs.

Late submission will not be accepted. Please do all questions on your own paper sheets. Attach your paper sheets with the question sheet and then submit on or before the due date.

1. Within the IS-LM curve model, show how income and the interest rate are affected by each of the following changes.

   (a) An increase in government spending

   (b) An autonomous decline in investment spending

   (c) An increase in taxes

   (d) An Increase in the money supply.

   ANSWER. * note that when a question contains many parts (i.e., (a), (b), ..) , when you do each part, please specify the part we are working with. Please follow this way in the exam.

   (a) **ANSWER. An increase in government spending.**

   - [*Define initial equilibrium*] Equilibrium in product market is at point E1 , where $Y = Y_1$ and $r = r_1$. (Figure 1). Equilibrium in money market is at point E1 where $Y = Y_1$ and $r = r_1$ (Figure 2). Equilibrium in economy is at point E1 in IS – LM model (Figure 3) where equilibrium is at $Y = Y_1$ and $r = r_1$.

Figure 1: (1a) DAE

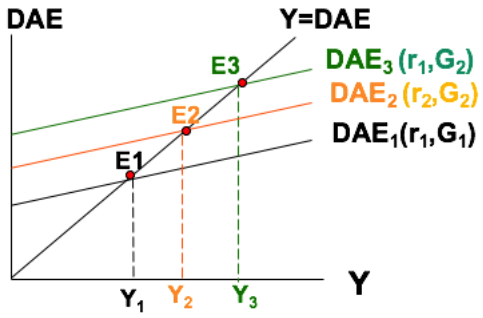


Figure 2: (1a) Money Market

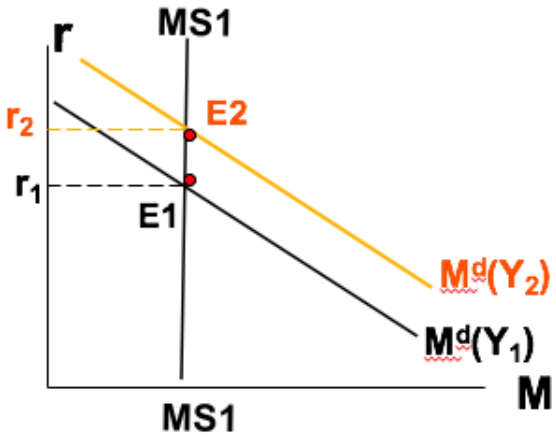
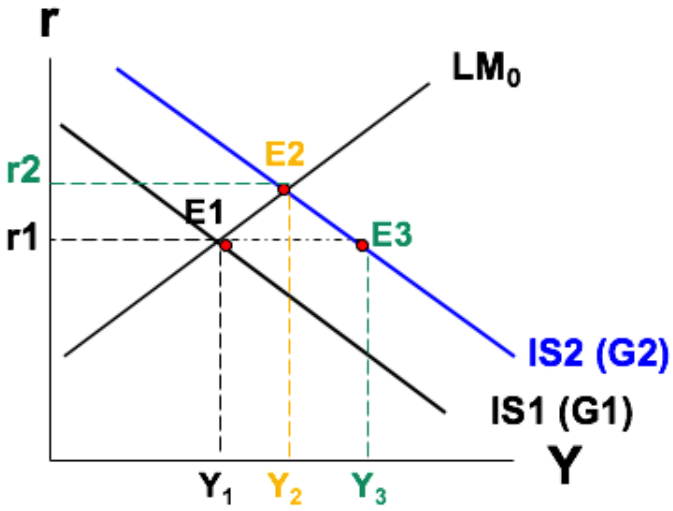


Figure 3: (1a) ISLM



- See Figure 1.
  - Expansionary Fiscal policy: As government spending increases, DAE increases for all levels of output.
  - DAE shifts upward. Output increases for all levels of interest rate. IS curve shift to the right.
- See Figure 3.
  - IS curve shifts to the right from IS1(G1) to IS2(G2).
  - Equilibrium output increases from Y1 to Y2 and equilibrium interest rate increases from r1 to r2.
- There are two effects associated with an increaase in government spending.
  (1) Given that interest rate remain the same at r1, due to an increase in government spending (from G1 to G2), DAE shifts from DAE1(r1,G1) to DAE3 (r1, G2). Output (Y) increases from Y1 to Y3.

$\Delta Y = government\ multiplier \times \Delta G$. Point E1 and E3 in the ISLM graph (figure 3) and in DAE graph (Figure 1).
(2) As output increases, in the money market, money demand increases ⇒ interest rate increases ⇒ investment decreases ⇒ DAE decreases from DAE3(r1,G2) to DAE2(r2,G2). Output decreases from Y3 to Y2. Point E3 and point E2 in in the ISLM graph (figure 3) and in DAE graph (Figure 1). **Y3Y2 is crowding out effect**.

- In the money market, as output increases from Y1 to Y2, money demand increases from $M_1^d(Y_1)$ to $M_2^d(Y_2)$ and equilibrium interest rate increases from r1 to r2. (Figure 2)
- Overall, an increase in government spending causes an increase in equilibrium interest rate (from r1 to r2) and an increase in equilibrium output (from Y1 to Y2).
- Notice that government multiplier in ISLM model is **lower** than government multiplier in DAE model because of the crowding out effect.
- Note on the dynamics of adjustment.
  - As IS curve shifts to the right, E1 is not equilibrium for both goods market and money market anymore.
  - E1 is on LM curve but it is not located on the new IS curve (IS2(G2)).
  - E1 is located below the new IS curve (IS2(G2)). At E1, the good market is not in equilibrium: Y < DAE. Δactual inventory<Δdesired inventory. Inventory decreases. Producers produce more. **Output increases.** As output increases, money demand increases and **interest rate increases** [movement along LM curve from E1 to E2].. This explains the movement from E1 to E2.

(b) **An autonomous decline in investment spending.**

- [*Define initial equilibrium*] Equilibrium in product market is at point E1 , where $Y = Y_1$ and $r = r_1$. (Figure 4). Equilibrium in money market is at point E1 where $Y = Y_1$ and $r = r_1$ (Figure 5). Equilibrium in economy is at point E1 in IS – LM model (Figure 6) where equilibrium is at $Y = Y_1$ and $r = r_1$.

Figure 4: (1b) DAE

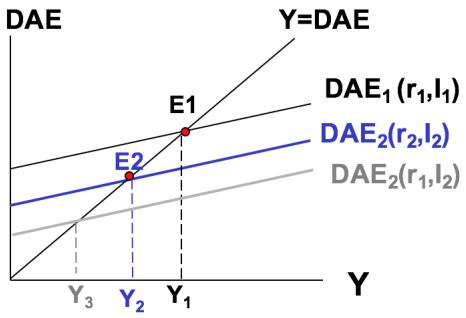


Figure 5: (1b) Money Market

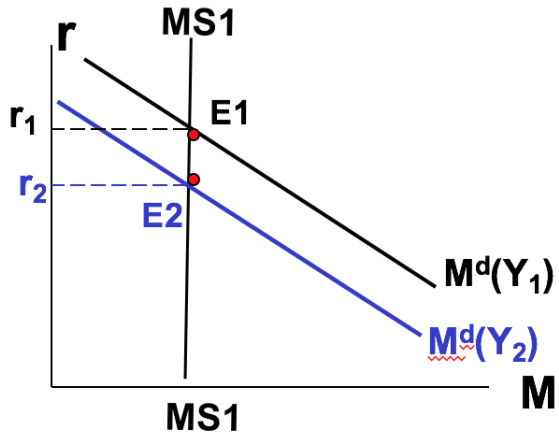
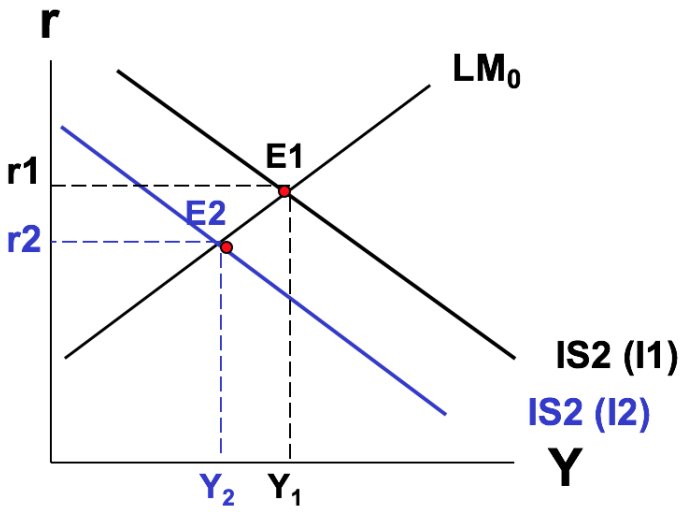


Figure 6: (1b) ISLM



- See Figure 4.
  - An autonomous decline in Investment: Investment declined for all levels of output and interest rate. DAE decreases for all levels of output (and interest rate).
  - DAE shifts downward. Output decreases for all levels of interest rate. IS curve shift to the left.
- See Figure 6.
  - IS curve shifts to the left from IS1(I1) to IS2(I2).
  - Equilibrium output decreases from Y1 to Y2 and equilibrium interest rate decreases from r1 to r2.
  - Explain the dynamics of adjustment.
    - As IS curve shifts to the left. E1 is not equilibrium for both goods market and money market anymore.

- E1 is on LM curve but it is not located on the new IS curve (IS2(I2)).
- E1 is located above the new IS curve (IS2(I2)). At E1, the good market is not in equilibrium: Y > DAE. Δactual inventory>Δdesired inventory. Inventory increases. Producers produce less. **Output decreases.** As output decreases, money demand decreases and **interest rate decreases** [movement along LM curve from E1 to E2].

- In the money market, as output decreases from Y1 to Y2, money demand increases from $M_1^d(Y_1)$ to $M_2^d(Y_2)$ and equilibrium interest rate decreases from r1 to r2. (Figure 5)
- Overall,An autonomous decline in Investment causes a decrease in equilibrium interest rate (from r1 to r2) and a decrease in equilibrium output (from Y1 to Y2).

(c) An increase in Taxes.

- [*Define initial equilibrium*] Equilibrium in product market is at point E1 , where $Y = Y_1$ and $r = r_1$. (Figure 7). Equilibrium in money market is at point E1 where $Y = Y_1$ and $r = r_1$ (Figure 8). Equilibrium in economy is at point E1 in IS – LM model (Figure 9) where equilibrium is at $Y = Y_1$ and $r = r_1$.

Figure 7: (1c) DAE

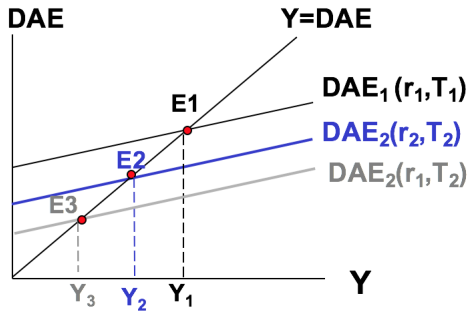


Figure 8: (1c) Money Market

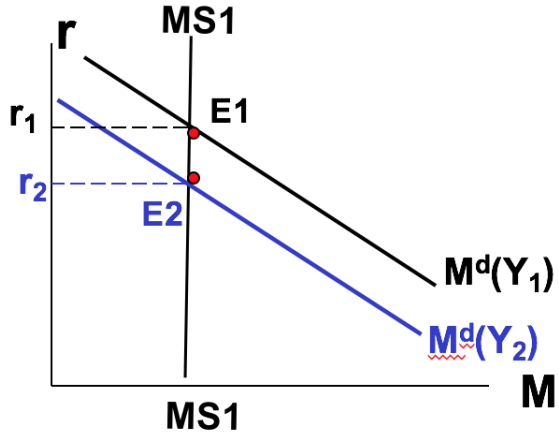
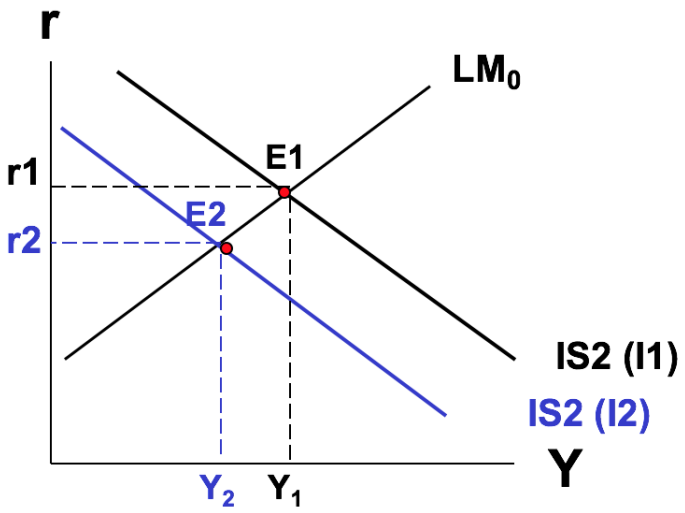


Figure 9: (1c) ISLM



decreases from Y3 to Y2. Point E3 and point E2 in in the ISLM graph (figure 3) and in DAE graph (Figure 1). **Y3Y2 is crowding out effect**.

- See Figure 7.
  - An increase in Taxes, Contractionary Fiscal Policy : As Taxes increases from T1 to T2, DAE decreases for all levels of output (and interest rate).
  - DAE shifts downward. Output decreases for all levels of interest rate. IS curve shift to the left.
- See Figure 9.
  - IS curve shifts to the left from IS1(T1) to IS2(T2).
  - Equilibrium output decreases from Y1 to Y2 and equilibrium interest rate decreases from r1 to r2.
- There are two effects associated with an increase in Taxes.
  (1) Given that interest rate remain the same at r1, due to an increase in Tax (from T1 to T2), DAE shifts down from DAE1(r1,T1) to DAE3 (r1, T2). Output (Y) increases from Y1 to Y3. $\Delta Y = Taxmultiplier \times \Delta G$. Point E1 and E3 in the ISLM graph (figure 9) and in DAE graph (Figure 7).
  (2) As output increases, in the money market, money demand increases $\Rightarrow$ interest rate decreases $\Rightarrow$ investment increases $\Rightarrow$ DAE decreases from DAE3(r1,T2) to DAE2(r2,T2). Output increases from Y3 to Y2. Point E3 and point E2 in in the ISLM graph (figure 9) and in DAE graph (Figure 7). Note that this second effect is called crowding out effect, when we analyzed the effect of an expansionary fiscal policy.
- In the money market, as output decreases from Y1 to Y2, money demand increases from $M_1^d(Y_1)$ to $M_2^d(Y_2)$ and equilibrium interest rate decreases from r1 to r2. (Figure 8)
- Overall,An increase in Taxes causes a decrease in equilibrium interest rate (from r1 to r2) and a decrease in equilibrium output (from Y1 to Y2). In this case, when tax increases, output declines by less in ISLM model in comparison with DAE model.
- Notice that tax multiplier in ISLM model is **lower** than government multiplier in DAE model because of the second effect.
- Note on the dynamics of adjustment.
  - As IS curve shifts to the left. E1 is not equilibrium for both goods market and money market anymore.

- E1 is on LM curve but it is not located on the new IS curve (IS2(T2)).
- E1 is located above the new IS curve (IS2(T2)). At E1, the good market is not in equilibrium: Y > DAE. Δactual inventory>Δdesired inventory. Inventory increases. Producers produce less. **Output decreases.** As output decreases, money demand decreases and **interest rate decreases** [movement along LM curve from E1 to E2]. This explains the movement from E1 to E2.

(d) **An increase in Money Supply.**

- [*Define initial equilibrium*] Equilibrium in product market is at point E1 , where $Y = Y_1$ and $r = r_1$. (Figure 10). Equilibrium in money market is at point E1 where $Y = Y_1$ and $r = r_1$ (Figure 11). Equilibrium in economy is at point E1 in IS LM model (Figure 12) where equilibrium is at $Y = Y_1$ and $r = r_1$.

Figure 10: (1d) DAE

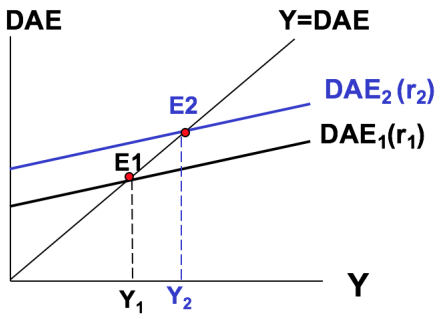


Figure 11: (1d) Money Market

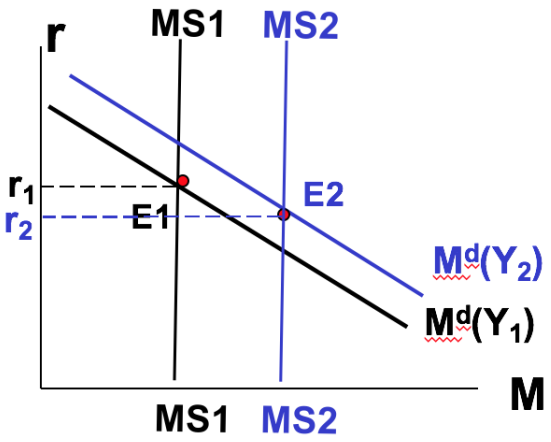
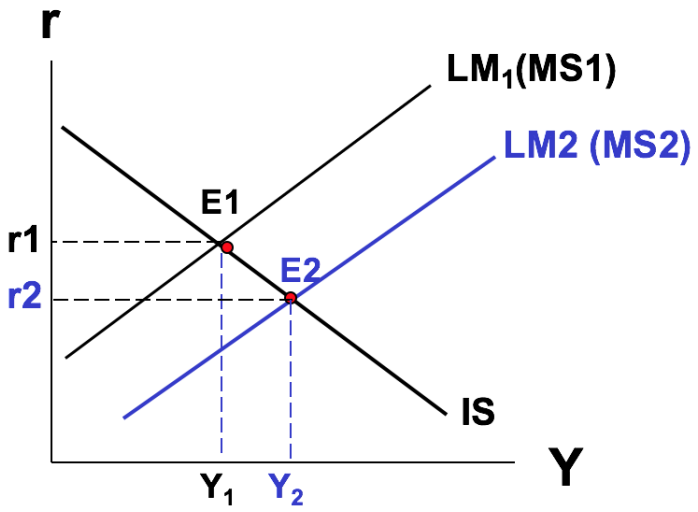


Figure 12: (1d) ISLM



- In the money market, as money supply increases from MS1 to MS2 (expansionary monetary policy), equilibrium interest rate decreases from for all levels of output. LM curve shifts to the right. (Figure 11)
- See Figure 12.
  - As LM curve shifts to the right, Equilibrium output increases from Y1 to Y2 and equilibrium interest rate decreases from r1 to r2.
  - Explain the dynamics of adjustment.
    - As LM curve shifts to the right. E1 is not equilibrium for both goods market and money market anymore.
    - E1 is on IS curve but it is not located on the new LM curve (LM2(MS2)).
    - E1 is located above the new LM curve (LM2(MS2)). At E1, money market is not inequilibrium. Interest rate is too high. There is excess money supply. People will buy bonds causing an increase in bond price and a decline in interest rate. As interest rate decreases, investment increases, moving along IS curve to the new equilibrium E2.
- In goods market, see Figure 10.
  - As interest rate decreases, Investment increases for all levels of output. DAE increases for all levels of output.
  - DAE shifts upward from DAE1 to DAE2. Output increases from Y1 to Y2.
- In the money market, as output increases from Y1 to Y2, money demand increases from $M_1^d(Y_1)$ to $M_2^d(Y_2)$ and equilibrium interest rate decreases from r1 to r2. (Figure 11)
- Overall, an increase in money supply causes a decrease in equilibrium interest rate (from r1 to r2) and a increase in equilibrium output (from Y1 to Y2).

2. Answer all parts of this question.

   (a) Consider an economy where the money demand is very sensitive to interest rate while investments are not very sensitive to the interest rate. Using diagrams to illustrate your answer. Discuss the effectiveness of fiscal and monetary policy in such a case using the IS-LM model.

   (b) According to monetarist view, money is not a close substitute of interest bearing assets only but it is a substitute of all possible assets. This implies that money demand is not very sensitive to the interest

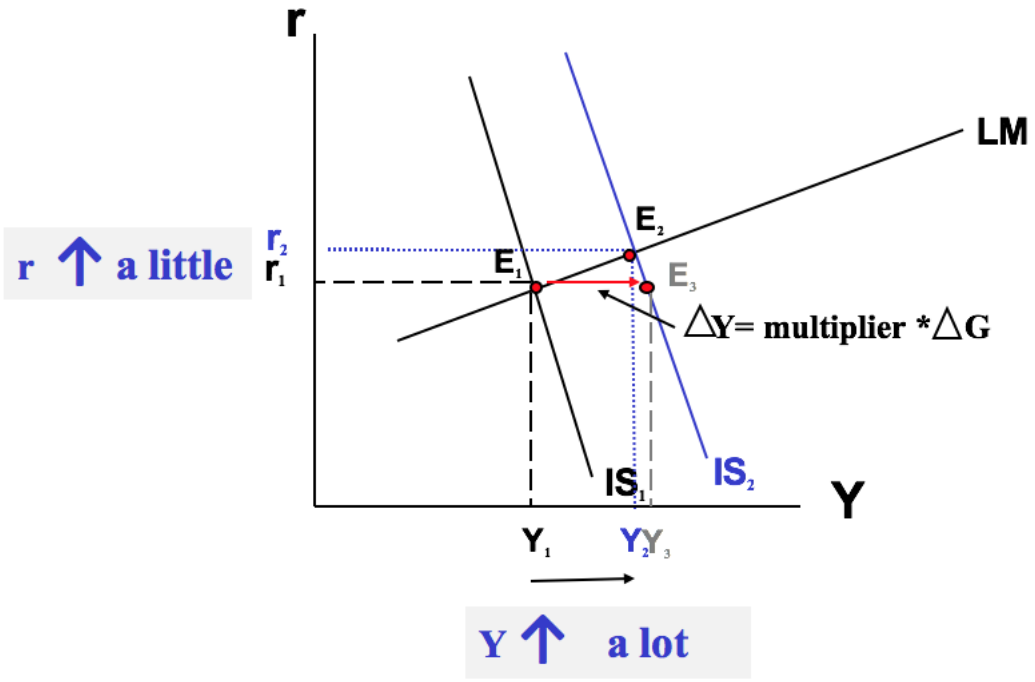
rate. Moreover investments are believed to be very sensitive to the interest rate. Using diagrams to illustrate your answer. Discuss the effectiveness of fiscal and monetary policy in such a case using the IS-LM model.

ANSWER.

(a) Money demand is very sensitive to interest rate while investments are not very sensitive to the interest rate.

- Money demand is very sensitive to interest rate: ε_r^{Md} is high. $\frac{MS}{P} = M^d = L(Y, r)$. For a given increase in Y , money demand increases. Money market is not inequilibrium. Interest rate has to increase. Since money demand is very sensitive to interest rate, a little increase in interest rate will bring about a big decrease in Money demand. This means that it requires just a little increase in interest ratre (r) to make money market equilibrium again for a given increase in Y. Hence, Δr is small for a given ΔY (in the same direction). Therefore, **LM curve is flat** when Money demand is very sensitive to interest rate.
- Investments are not very sensitive to the interest rate: ε_r^I is low. When interest rate (r) increases a lot, investment decreases a little. Then, output (Y) decreases just a little. This means that $\left|\frac{\Delta r}{\Delta Y}\right|$ is high. **IS curve is, therefore, steep.**
- This is the Keynesian case, where the IS is quite steep (investments are not very sensitive to the interest rate) while the LM curve is quite flat (money demand is very sensitive to inteest rate.). In this particular case we have the following results: Fiscal policy is really powerful in affecting the equilibrium level of output; Monetary policy is not particularly effective.
- **I. Fiscal Policy is effective.**
  - Consider an Expansionary Fiscal policy: As government spending increases, DAE increases for all levels of output.
  - DAE shifts upward. Output increases for all levels of interest rate. IS curve shift to the right.
  - IS curve shifts to the right from IS1 to IS2.
  - Equilibrium output increases from Y1 to Y2 and equilibrium interest rate increases from r1 to r2.
  - There are two effects associated with an increaase in government spending.
    (1) Given that interest rate remain the same at r1, due to an increase in government spending. Output (Y) increases from Y1 to Y3. $\Delta Y = government\, multiplier \times \Delta G$. Point E1 and E3 in the ISLM graph (figure 13).
    (2) As output increases, in the money market, money demand increases $\Rightarrow$ interest rate increases $\Rightarrow$ investment decreases. Output decreases from Y3 to Y2. Point E3 and point E2 in in the ISLM graph (figure 13). **Y3Y2 is crowding out effect**.
    (2.1) LM curve is flat, Money demand is very sensitive to interest rate: As output increases, money demand increases. Money market is not inequilibrium. Interest rate has to increase. Since money demand is very sensitive to interest rate, a little increase in interest rate will bring about a big decrease in Money demand. This means that it requires just a little increase in interest ratre (r) to make money market equilibrium again for a given increase in Y. Hence, **interest rate increases just a little**.
    (2.2) IS curve is steep, Investments are not very sensitive to the interest rate: As interest rate increases, investment decreases a little. Then, **output (Y) decreases just a little**.
    - **From (2.1) and (2.2), this means that the crowding out effect is small. Therefore, Fiscal policy is effective.**

Figure 13: Fiscal Policy Effectiveness

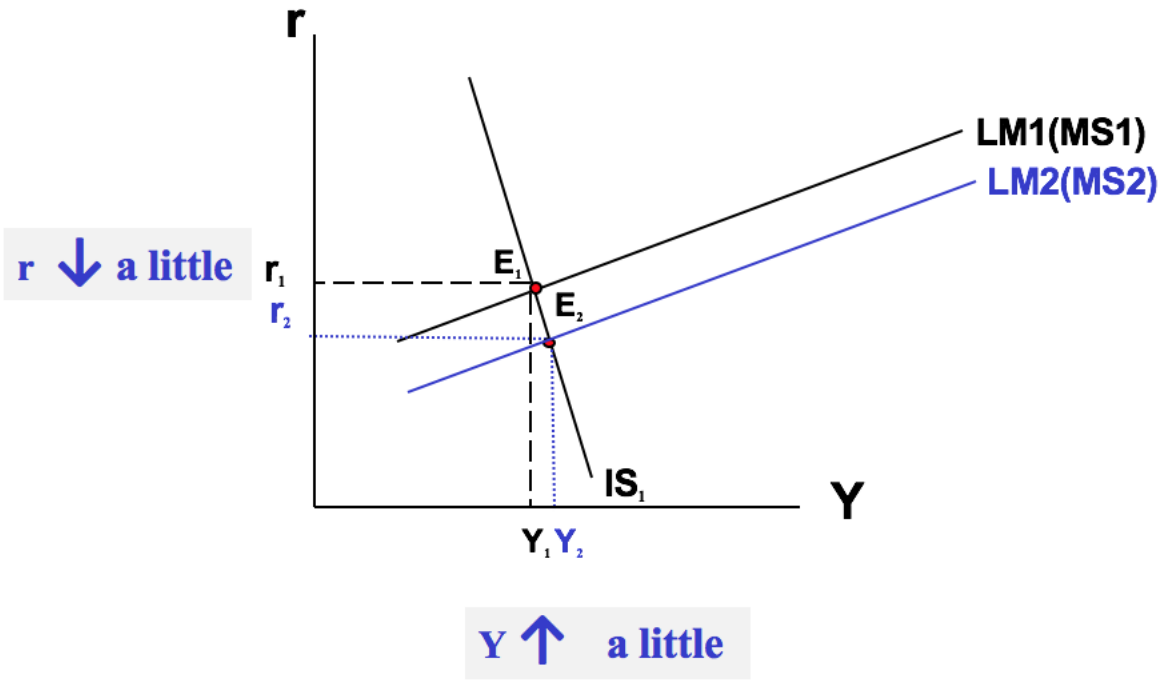


- **II. Monetary Policy is ineffective.**
  - Consider an Expansionary Monetary policy: As money supply increases from MS1 to MS2. Equilibrium interest rates declines for all levels of output (Y). LM curve shifts to the right.
  - LM curve shifts to the right from LM1(MS1) to LM2(MS2).
  - Equilibrium output increases from Y1 to Y2 and equilibrium interest rate decreases from r1 to r2.
  - Adjustment to equilibrium:
    - As LM curve shifts to the right. E1 is not equilibrium for both goods market and money market anymore.
    - E1 is on IS curve but it is not located on the new LM curve (LM2(MS2)).
    - E1 is located above the new LM curve (LM2(MS2)). At E1, money market is not inequilibrium. Interest rate is too high. There is excess money supply. People will buy bonds causing an increase in bond price and a decline in interest rate. As interest rate decreases, investment increases, moving along IS curve to the new equilibrium E2.

    (1) IS curve is steep, Investments are not very sensitive to the interest rate: As interest rate decreases, investment increases just a little. Then, **output (Y) increases just a little**.
    (2) LM curve is flat, Money demand is very sensitive to interest rate: Money supply increases, there is excess money supply at the original level of interest rate and output. Interest rate has to decline to make money market in equilibrium. Since money demand is very sensitive to interest rate, a little decrease in interest rate will bring about a big increase in Money demand. This means that it requires just a little decrease in interest rate to make money market in equilibrium. Hence, **interest rate decreases just a little**.

– **From (1) and (2), this means that interest rate decreases just only a little and investment increases just only a little. Therefore, output (Y) increases just a little. Monetary policy is, therefore, ineffective.**

Figure 14: Monetary Policy Ineffectiveness

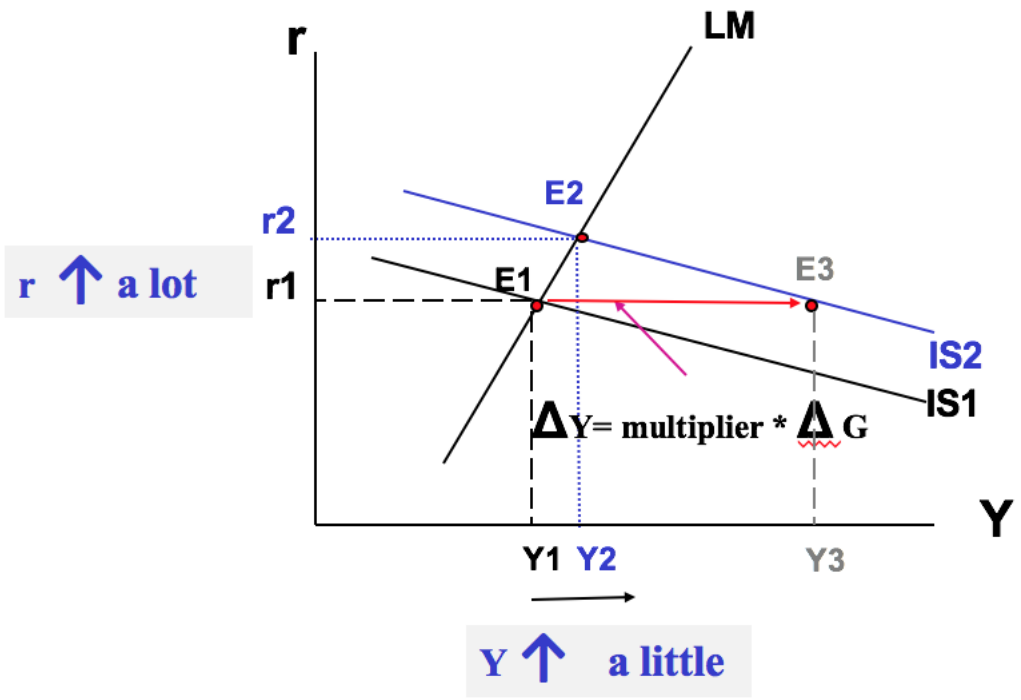


(b) **ANSWER**. According to monetarist view, money demand is not very sensitive to the interest rate and investments is very sensitive to the interest rate.

- Money demand is not very sensitive to interest rate: ε_r^{Md} is low. $\frac{MS}{P} = M^d = L(Y, r)$. For a given increase in Y , money demand increases. Money market is not inequilibrium. Interest rate has to increase. Since money demand is not very sensitive to interest rate, a big increase in interest rate will bring about a little decrease in Money demand. This means that it requires a big increase in interest ratre (r) to make money market equilibrium again for a given increase in Y. Hence, Δr is large for a given ΔY (in the same direction). This means that $\left|\frac{\Delta r}{\Delta Y}\right|$ is high. Therefore, **LM curve is steep** when Money demand is very sensitive to interest rate.
- Investments are very sensitive to the interest rate: ε_r^I is high. When interest rate (r) increases a little, investment decreases a lot. Then, output (Y) decreases a lot. This means that $\left|\frac{\Delta r}{\Delta Y}\right|$ is low. **IS curve is, therefore, flat.**
- This is the Monetarist case, where the IS is quite flat (investments are very sensitive to the interest rate) while the LM curve is quite steep (money demand is not very sensitive to inteest rate.). In this particular case we have the following results: Mopnetary policy is really powerful in affecting the equilibrium level of output; Fiscal policy is not particularly effective. This is why the belief is called "Monetarist". They believe in the power of monetary policy.

- **I. Fiscal Policy is uneffective.**
  - Consider an Expansionary Fiscal policy: As government spending increases, DAE increases for all levels of output.
  - DAE shifts upward. Output increases for all levels of interest rate. IS curve shift to the right.
  - IS curve shifts to the right from IS1 to IS2.
  - Equilibrium output increases from Y1 to Y2 and equilibrium interest rate increases from r1 to r2.
  - There are two effects associated with an increaase in government spending.
    (1) Given that interest rate remain the same at r1, due to an increase in government spending. Output (Y) increases from Y1 to Y3. $\Delta Y = government\ multiplier \times \Delta G$. Point E1 and E3 in the ISLM graph (figure 15).
    (2) As output increases, in the money market, money demand increases $\Rightarrow$ interest rate increases $\Rightarrow$ investment decreases. Output decreases from Y3 to Y2. Point E3 and point E2 in in the ISLM graph (figure 15). **Y3Y2 is crowding out effect**.
    (2.1) LM curve is steep, Money demand is not very sensitive to interest rate: As output increases, money demand increases. Money market is not inequilibrium. Interest rate has to increase. Since money demand is not very sensitive to interest rate, a big increase in interest rate will bring about a little decrease in Money demand. This means that it requires a big increase in interest ratre (r) to make money market equilibrium again for a given increase in Y. Hence, **interest rate increases a lot**.
    (2.2) IS curve is flat, Investments are very sensitive to the interest rate: As interest rate increases, investment decreases a lot. Then, **output (Y) decreases a lot**.
    * **From (2.1) and (2.2), this means that the crowding out effect is large. Therefore, Fiscal policy is ineffective.**

Figure 15: Fiscal Policy Ineffectiveness



- **II. Monetary Policy is effective.**
  - Consider an Expansionary Monetary policy: As money supply increases from MS1 to MS2. Equilibrium interest rates declines for all levels of output (Y). LM curve shifts to the right.
  - LM curve shifts to the right from LM1(MS1) to LM2(MS2).
  - Equilibrium output increases from Y1 to Y2 and equilibrium interest rate decreases from r1 to r2.
  - Adjustment to equilibrium:
    * As LM curve shifts to the right. E1 is not equilibrium for both goods market and money market anymore.
    * E1 is on IS curve but it is not located on the new LM curve (LM2(MS2)).
    * E1 is located above the new LM curve (LM2(MS2)). At E1, money market is not inequilibrium. Interest rate is too high. There is excess money supply. People will buy bonds causing an increase in bond price and a decline in interest rate. As interest rate decreases, investment increases, moving along IS curve to the new equilibrium E2.

    (1) IS curve is flat, Investments are not very sensitive to the interest rate: As interest rate decreases, investment increases a lot. Then, **output (Y) increases a lot.**
    (2) LM curve is steep, Money demand is not very sensitive to interest rate: Money supply increases, there is excess money supply at the original level of interest rate and output. Interest rate has to decline to make money market in equilibrium. Since money demand is not very sensitive to interest rate, a big decrease in interest rate will bring about a little increase in Money demand. This means that it requires a big decrease in interest rate to make money market in equilibrium. Hence, **interest rate decreases a lot.**
  - **From (1) and (2), this means that interest rate decreases a lot and investment increases a lot. Therefore, output (Y) increases a lot. Monetary policy is, therefore, effective.**

Figure 16: Monetary Policy Ineffectiveness