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

Problem Sets 4

Chapter 6. ISLM Model

1. We normally draw the IS curve as downward sloping and the LM curve as upward sloping, as appropriate for our usual assumptions about behavior. How would either or both of these curves look different if the following unusual assumptions were made? Either describe or draw your answers, being sure in either case to make clear what you mean.

   (a) Investment does not depend on the interest rate. In other words, elasticity of investment demand with respect to interest rate is equal to zero.

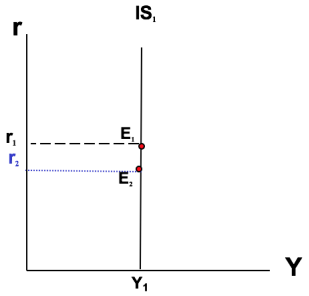
   (b) Investment demand is perfectly elastic with respect to interest rate.

   (c) Demand for money does not depend on interest rate. In other words, elasticity of money demand with respect to interest rate is equal to zero.

   (d) Demand for money is perfectly elastic with respect to interest rate. Note that this case is called "liquidity trap" in macroeconomics.

   ANSWER.

   (a) Investment does not depend on the interest rate. In other words, elasticity of investment demand with respect to interest rate is equal to zero.

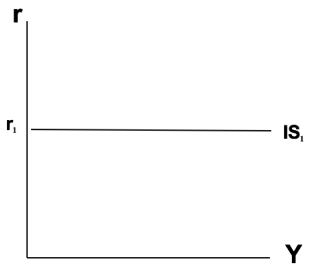


   - Investment does not depend on the interest rate.
   - $\varepsilon_r^I = 0$.
   - $r \uparrow \Rightarrow I$ would be constant as $\varepsilon_r^I = 0$, investment does not respond to interest rate change.
   - $r \uparrow \Rightarrow I$ constant $\Rightarrow DAE$ constant $\Rightarrow Y$ constant
   - Initially, interest rate is at r_1 and the goods market equilibrium is at Y_1. Suppose interest rate decreases from r_1 to r_2, investment remains the same and thus DAE remains the same. Equilibrium output in the goods market remains the same at Y_1.
   - IS shows the combination of r and Y that makes the equilibrium in the goods market.
   - As investment does not respond to interest rate change, **IS curve is vertical. ANSWER.**

   (b) Investment demand is perfectly elastic with respect to interest rate.

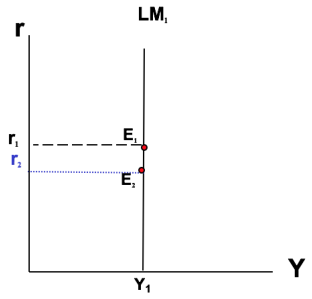
   - Investment is perfectly elastic with respect to interest rate.
   - $\varepsilon_r^I = \infty$.
   - $r \uparrow \Rightarrow I$ decrease enormously.

- $r \downarrow \Rightarrow I$ increase enormously.
- $r \uparrow \Rightarrow I$ decrease enormously $\Rightarrow DAE$ decrease enormously $\Rightarrow Y$ decrease enormously
- IS shows the combination of r and Y that makes the equilibrium in the goods market.
- As investment is perfectly elastic with respect to interest rate, **IS curve is horizontal. ANSWER.**



(c) Demand for money does not depend on interest rate. In other words, elasticity of money demand with respect to interest rate is equal to zero.

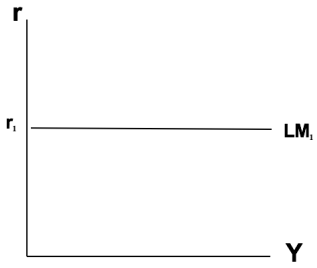
- Demand for money does not depend on interest rate.
- $\varepsilon_r^{Md} = 0$.
- $r \uparrow \Rightarrow$ Money demand does not decrease. Money Demand remains constant.
- $r \downarrow \Rightarrow$ Money demand does not increase. Money Demand remains constant.
- As Y increases, money demand will increase. Equilibrium in the money market implies that $\frac{MS}{P} = M^d = L(Y, r)$. With constant money supply, money demand increases. The market can not be in equilibrium.
- Since LM curve shows us combinations between interest rate and output which makes equilibrium in the money market. Output cannot be changed.
- Hence, when Demand for money does not depend on interest rate., **LM curve is vertical. ANSWER.**
- Note that when r changes, money demand remains the same. Suppose at (Y_1, r_1) money market is at equilibrium, implies that $\frac{MS}{P} = M^d = L(Y_1, r_1)$. When r decreases from r_1 to r_2, holding output constant, money demand remains the same, $\frac{MS}{P} = M^d = L(Y_1, r_2)$. Hence, LM curve is vertical.



(d) Demand for money is perfectly elastic with respect to interest rate. Note that this case is called "liquidity trap" in macroeconomics.

- $\varepsilon_r^{Md} = \infty$.
- $r \uparrow \Rightarrow$ Money demand decrease enormously.
- $r \downarrow \Rightarrow$ Money demand increase enormously.

- As Y increases, money demand will increase. Equilibrium in the money market implies that $\frac{MS}{P} = M^d = L(Y, r)$. With constant money supply, money demand increases. Interest rate needs to be increased to reduce money demand to make the money market goes back to the equilibrium again. A very tiny small (approaches to zero) increase in the interest rate will be needed.
- Since LM curve shows us combinations between interest rate and output which makes equilibrium in the money market.
- Hence, when Demand for money is perfectly elastic with respect to interest rate, **LM curve is horizontal. ANSWER.**



2. Consider an economy in which the goods and money markets are described by the following equations:

- Aggregate consumption: $C = 400 + 0.2(Y - T)$
- Aggregate investment: $I = 80 + 0.5Y - 10r$.
- Government sector: $G = T = 100$.
- Money demand: $M^d = 100 + Y - 50r$.
- Real Money supply: $\dfrac{M^s}{P} = 100$.

Hint.

I. **Equilibrium in the good market** : $Y = DAE = C + I + G$.

$$\begin{aligned} Y &= DAE \\ &= 400 + 0.2(Y - 100) + 80 + 0.5Y - 10r + 100 \\ &= 400 + 0.2Y - 20 + 80 + 0.5Y - 10r + 100 \\ &= 560 + 0.7Y - 10r \end{aligned}$$

$$Y = \frac{1}{0.3}[560 - 10r] \tag{1}$$

Equation (1) is the IS equation. It shows us the combination between interest rate (r) and output (Y) that makes equilibrium in the good market. The minus sign of the coefficient in front of the variable r, shows us that the slope of IS is negative.

II. **Equilibrium in the money market** : $\dfrac{M^s}{P} = M^d$

$$\begin{aligned} \frac{M^s}{P} &= M^d \\ 100 &= 100 + Y - 50r \\ r &= \frac{1}{50}Y \end{aligned}$$

$$r = \frac{1}{50}Y \tag{2}$$

Equation (2) is the IS equation. It shows us the combination between interest rate (r) and output (Y) that makes equilibrium in the good market. The positive sign of the coefficient in front of variable Y, shows us that the slope of LM curve is positive.

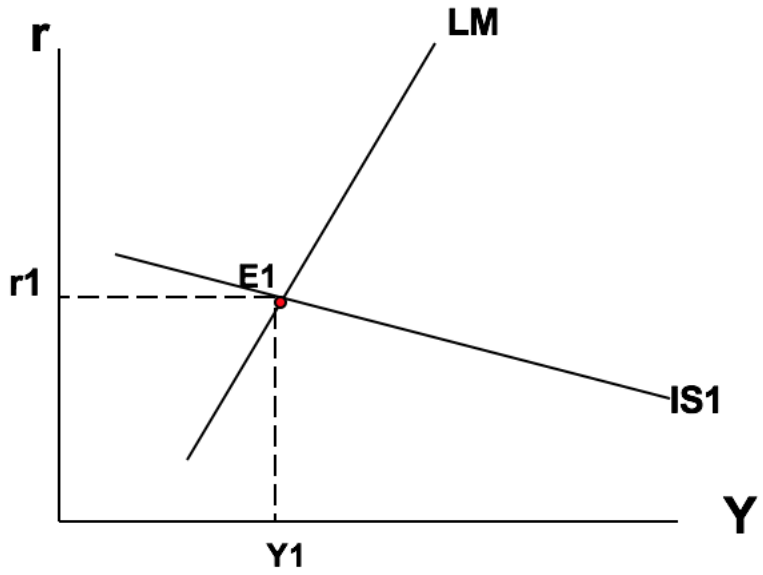
(a) Equilibrium for ISLM model holds when both equation (1) and equation (2) are satisfied. The combination between interest rate (r) and output (Y) that makes equilibrium in both the good market and the money market. Solve the system of two equations, equation (1) and equation (2). Calculate the equilibrium level of income and interest rate, and describe your solution with a graph.

- Substitute equation (2) in to equation (1) and solve for Y^*

$$
\begin{aligned}
Y^* &= \frac{1}{0.3}\left\{560 - 10\left(\frac{1}{50}Y^*\right)\right\} \\
&= \frac{560}{0.3} - \frac{10}{50 \times 0.3}Y^* \\
\left(1 + \frac{10}{15}\right)Y^* &= \frac{560}{0.3} \\
\frac{25}{15}Y^* &= \frac{560}{0.3} \\
Y^* &= \frac{560}{0.3} \times \frac{15}{25} \\
&= \frac{5600}{3} \times \frac{3}{5} \\
Y^* &= 1,120
\end{aligned}
$$

- Substitute Y^* into equation (2) for r^*.

$$
\begin{aligned}
r^* &= \frac{1}{50} \times 1,120 \\
r^* &= 22.4
\end{aligned}
$$



- Note that the graph is not drawn to scale.
- Along LM curve, equation (2) is satisfied. There is a positive relationship between r and Y.
- Along IS curve, equation (1) is satisfied. There is a negative relationship between r and Y.
- Only at point E1 both equations, equation (2) and equation (1) are satisfied. $r_1 = r^* = 22.4$ and $Y_1 = Y^* = 1120$.

(b) Suppose government spending increases to 200. Compute the fiscal policy multiplier (hint: this is the increase in Y divided by the increase in G).

- Suppose government spending increases to 200. Then, the new IS curve function becomes,

$$
\begin{aligned}
Y &= DAE \\
&= 400 + 0.2(Y - 100) + 80 + 0.5Y - 10r + \mathbf{200} \\
&= 400 + 0.2Y - 20 + 80 + 0.5Y - 10r + \mathbf{200} \\
&= \mathbf{660} + 0.7Y - 10r
\end{aligned}
$$

$$
Y = \frac{1}{0.3}[\mathbf{660} - 10r] \tag{3}
$$

- Solve for new Y_2^*,

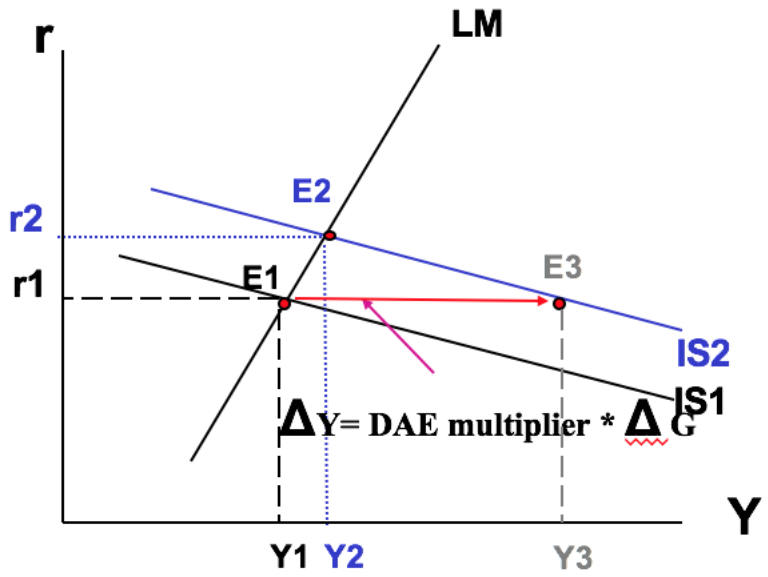
$$
\begin{aligned}
Y_2^* &= \frac{1}{0.3}\left\{660 - 10\left(\frac{1}{50}Y_2^*\right)\right\} \\
&= \frac{660}{0.3} - \frac{10}{50 \times 0.3}Y_2^*
\end{aligned}
$$

$$
\begin{aligned}
\left(1 + \frac{10}{15}\right)Y_2^* &= \frac{660}{0.3} \\
\frac{25}{15}Y_2^* &= \frac{660}{0.3} \\
Y_2^* &= \frac{660}{0.3} \times \frac{15}{25} \\
&= \frac{6600}{3} \times \frac{3}{5} \\
Y_2^* &= 1,320
\end{aligned}
$$

- Solve for new r_2^*,

$$
\begin{aligned}
r_2^* &= \frac{1}{50} \times 1,320 \\
r_2^* &= 26.4
\end{aligned}
$$

- the fiscal policy multiplier is equal to $\dfrac{\Delta Y^*}{\Delta G} = \dfrac{1320 - 1120}{200 - 100} = \dfrac{200}{100} = 2$.
- Note that in this case the government expenditure multiplier in DAE model is equal to $\dfrac{1}{1-b} = \dfrac{1}{0.2} = 5$.
- In this case, the government expenditure multiplier is reduced due to the crowding-out effect.



- Note that $Y_1 = 1120$, $r_1 = 22.4$
- $Y_2 = Y_2^* = 1320$, $r_2 = r_2^* = 26.4$.
- $Y_3 = Y_1 + (\Delta G \times 5) = 1120 + (100 \times 5) = 1120 + 500 = 1620$.