Chapter 10: Goods Market and IS / LM Model [1]

1 Goods Market

Generally, the market for goods and services produced in an economy; in equilibrium if demand equals output. Alternative names: aggregate expenditures (AE) model, Keynesian cross. Purpose: the goods market is used to derive the IS curve in the IS / LM model.

1.1 Definitions and assumptions

1. Consumption function: $C = C(Y_D) = \bar{C} + MPC(Y - T)$
2. Investment function: $I = I(r)$
3. Fiscal policy: $G = \bar{G}$, $T = \bar{T}$ (exogenous)
4. International sector: $NX = X = M = 0$ (closed economy)
5. Aggregate expenditure: $AE = C + I + G = \bar{C} + MPC(Y - T) + I(r) + \bar{G}$ (demand)
6. Output: represented by the 45° line, responds to demand with a lag (it doesn't adjust right away)

1.2 "Dynamics"

In the goods market, output adjusts to changes in aggregate expenditure through inventories. Let's say that firms want to keep their inventories constant. If firms observe higher inventories, they will decrease output; if inventories decline, firms will scale up output. This relationship can be summarized as follows: output and inventories move in opposite directions. There is no explicit dimension of time here.

$$AE > Y \Rightarrow \Delta inventories < 0 \Rightarrow \Delta Y > 0$$

$$AE = Y \Rightarrow \Delta inventories = 0 \Rightarrow \Delta Y = 0$$

$$AE < Y \Rightarrow \Delta inventories > 0 \Rightarrow \Delta Y < 0$$

1.3 Equilibrium

Equilibrium in the goods market: in equilibrium, $AE(Y) = Y$ and $\Delta inventories = 0$.
General case:

$$AE(Y) = C(Y) + I(r, Y) + G = Y \tag{1}$$

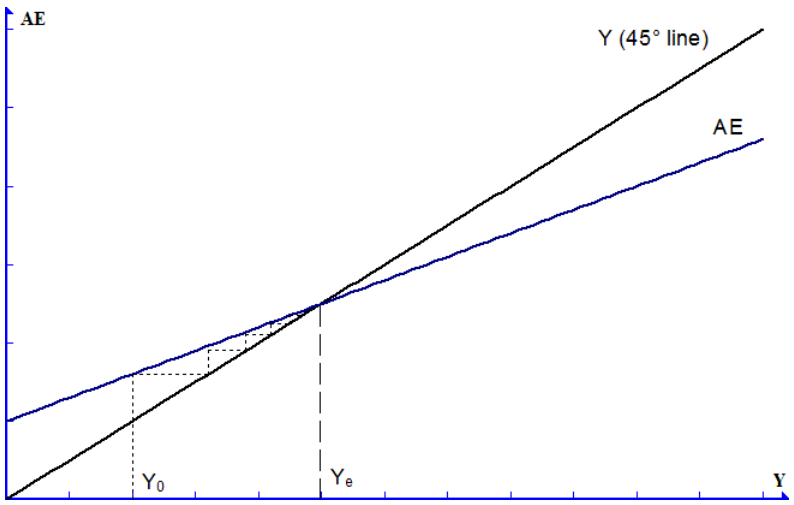
Case with our assumptions:

$$AE = \bar{C} + MPC(Y - T) + I(r) + \bar{G} = Y \tag{2}$$

$$Y_e = \frac{1}{1 - MPC}[\bar{C} - MPC(T) + I(r) + \bar{G}] \tag{3}$$

[1] Econ 302, Week 12, 11/20/2009; UW-Madison. TAs Lihan Liu and Scott Swisher.

Plot aggregate expenditure versus output and think about how we reach equilibrium. This is similar to the Solow model; in place of a steady-state in capital, we have a steady-state in output or inventories.



Starting at any initial $Y_0 \neq Y_e$, we converge to equilibrium output level Y_e over time. At Y_e, we have a steady-state in the sense that $Y_e = AE(Y_e)$.

1.4 Fiscal policy multipliers

Recall that, in equilibrium, $Y = \frac{1}{1-MPC}[\bar{C} - MPC(T) + I(r) + \bar{G}]$. This is derived from the equilibrium condition in the goods market. Let's say that we're interested in the response of output to fiscal policy shocks, i.e. government spending and taxes. The long-run response of output to a change in government spending is called the government expenditure multiplier; the long-run response of output to a change in the level of taxes is called the tax multiplier. Use partial derivatives to obtain the Keynesian multipliers in the aggregate expenditures model.

1.4.1 Government expenditure multiplier

$$M_G \equiv \frac{\partial Y}{\partial G} = \frac{1}{1 - MPC} \tag{4}$$

1.4.2 Tax multiplier

$$M_T \equiv \frac{\partial Y}{\partial T} = -\frac{MPC}{1 - MPC} \tag{5}$$

Since $MPC < 1$, $|M_G| > |M_T|$; the aggregate expenditures model predicts that an increase in government expenditure is more effective than a reduction in the level of taxes in terms of encouraging economic activity (increasing output). This assumes that the magnitudes of ΔG and ΔT are equal ($\Delta G = -\Delta T$).

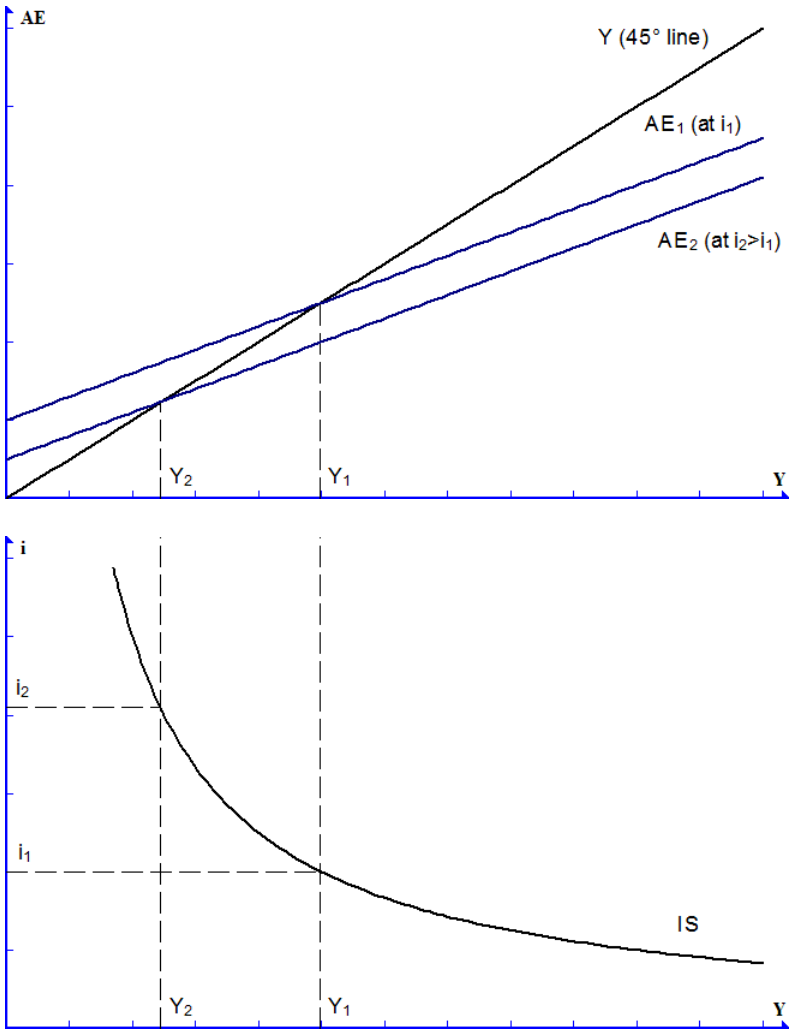
2 IS / LM Model

The IS / LM model is a short-run model of economic fluctuations based on equilibrium in two key markets. It is comprised of the IS and LM curves graphed in i versus Y space, as opposed to the P versus Y space of the AS / AD model. What two markets must be in equilibrium?

1. Goods market (Keynesian cross); from the goods market, you can derive the IS curve.
2. Money market (monetary policy); from the money market, you can derive the LM curve.

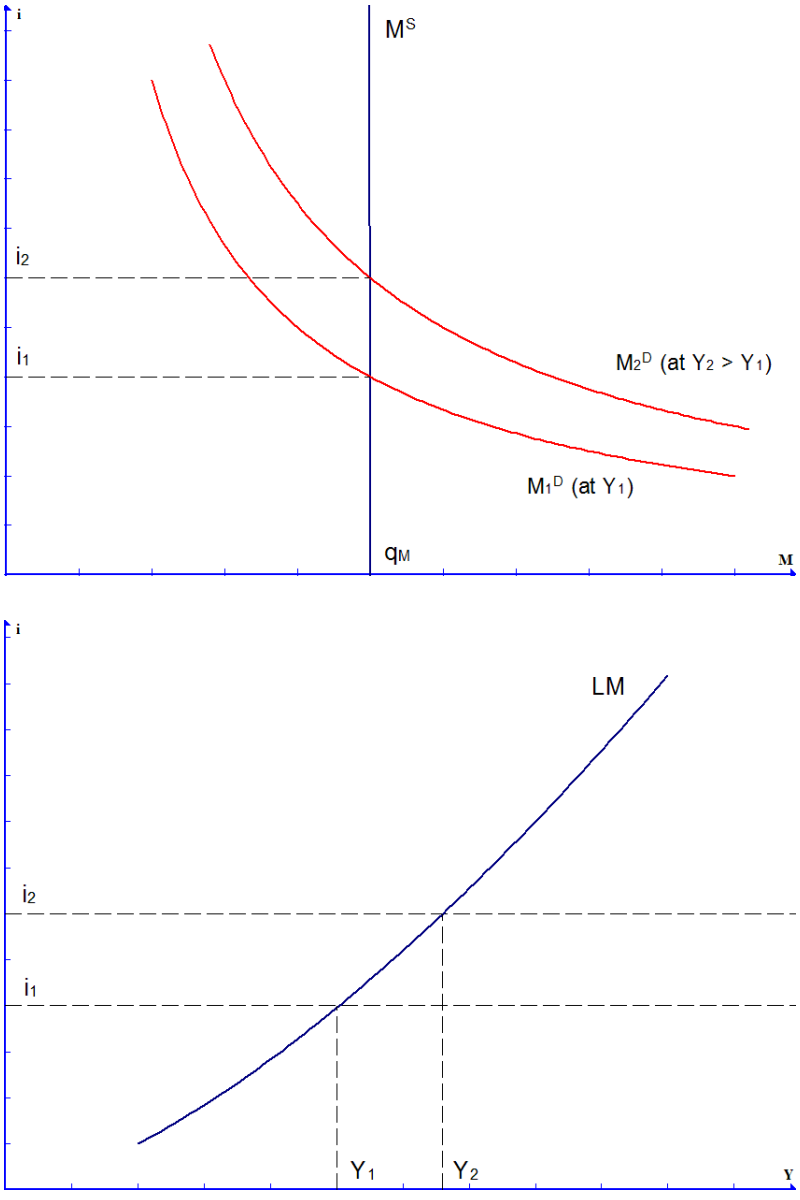
2.1 IS curve (goods market)

Let the nominal interest rate i vary in the goods market; this will proportionally change the real interest rate r as well, holding the price level constant. Trace out the IS curve based on the ordered pairs (i, Y) that constitute equilibrium in the goods market as r varies. In this graphical example, let's exogenously increase the nominal interest rate from i_1 to i_2; output decreases (Y_1 to Y_2 due to the decline in investment) and we can draw a downward-sloping IS curve in i vs. Y space.



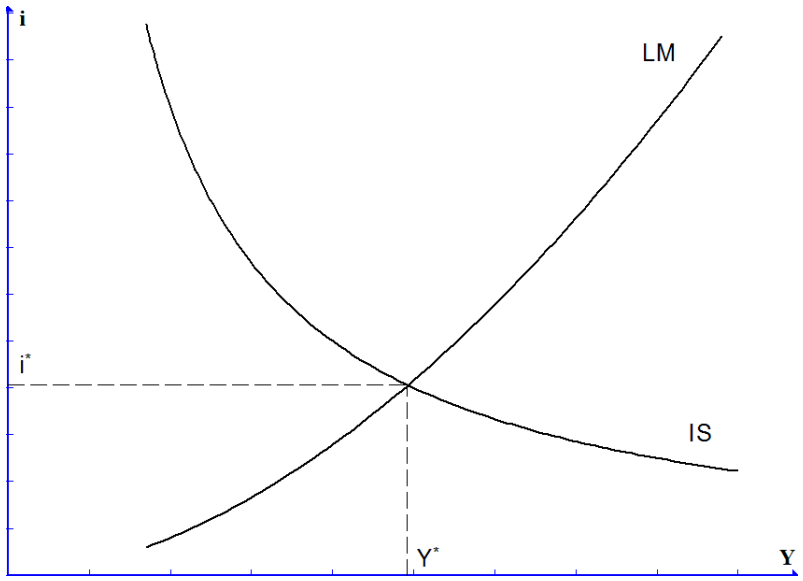
2.2 LM curve (money market)

Let income Y vary in the money market, and then trace out the LM curve based on the ordered pairs (i, Y) that constitute equilibrium in the money market as Y varies. In this graphical example, let's exogenously increase income from Y_1 to Y_2; the nominal interest rate increases (i_1 to i_2 due to the increase in money demand) and we can draw an upward-sloping LM curve in i vs. Y space.



2.3 Equilibrium in the IS / LM model (short-run)

Draw the IS and LM curves on a single graph in i vs. Y space, and determine their intersection point. At this point (i^*, Y^*), both markets clear.



Equilibrium in the IS / LM model: in equilibrium, the IS and LM curves intersect, which implies that both the goods and money markets clear.
IS curve (i as a function of Y):

$$i = IS(Y) \tag{6}$$

LM curve (i as a function of Y):

$$i = LM(Y) \tag{7}$$

IS / LM equilibrium:

$$i^* = IS(Y^*) = LM(Y^*) \tag{8}$$

2.4 IS / LM shocks

Shock	Shift in IS or LM curve	At $\bar{i}$, ...	At $\bar{Y}$, ...
$T \uparrow$	IS, left	$Y \downarrow$	
$G \uparrow$	IS, right	$Y \uparrow$	
$\bar{C} \uparrow$	IS, right	$Y \uparrow$	
$MPC \uparrow$	IS, right	$Y \uparrow$	
$M \uparrow$	LM, right		$i \downarrow$
$P \uparrow$	LM, left		$i \uparrow$

3 Exercise: IS / LM Model

Consider the IS / LM model.

Consumption function:

$$C = 200 + 0.25(Y - T) \tag{9}$$

Investment function:

$$I = 150 + 0.25Y - 1000i \tag{10}$$

Fiscal policy:

$$G = 250 \tag{11}$$

$$T = 200 \tag{12}$$

Real money demand:

$$(\frac{M}{P})^d = 2Y - 8000i \tag{13}$$

Real money supply:

$$\frac{M}{P} = 1600 \tag{14}$$

Given the information above, please answer the following questions:

a) Derive the IS curve.

b) Derive the LM curve.

c) Solve for Y^*.

d) Solve for i^*.

e) Solve for C^*, I^*.

f) Let $\frac{M}{P} = 1840$; repeat parts (a) through (e). Comment on the direction of movement for equilibrium variables relative to the initial case $\frac{M}{P} = 1600$.

g) Let $\frac{M}{P} = 1600$, $G = 400$; repeat parts (a) through (e). Comment on the direction of movement for equilibrium variables relative to the initial case $G = 250$.