Financial Markets and Aggregate Demand

This lecture integrates two key financial variables into our discussion of spending balance.

A. Interest rate

B. Money supply

The Interest Rate's Effect on Spending

A. The investment function

1. Investment (I) depends negatively on the interest rate (R). [$R\uparrow \rightarrow I\downarrow$]

    a. A higher R increases borrowing costs, which discourages firms from investing.

    b. Even if I is self-financed, firms must forgo the R earned on financial securities to fund I.

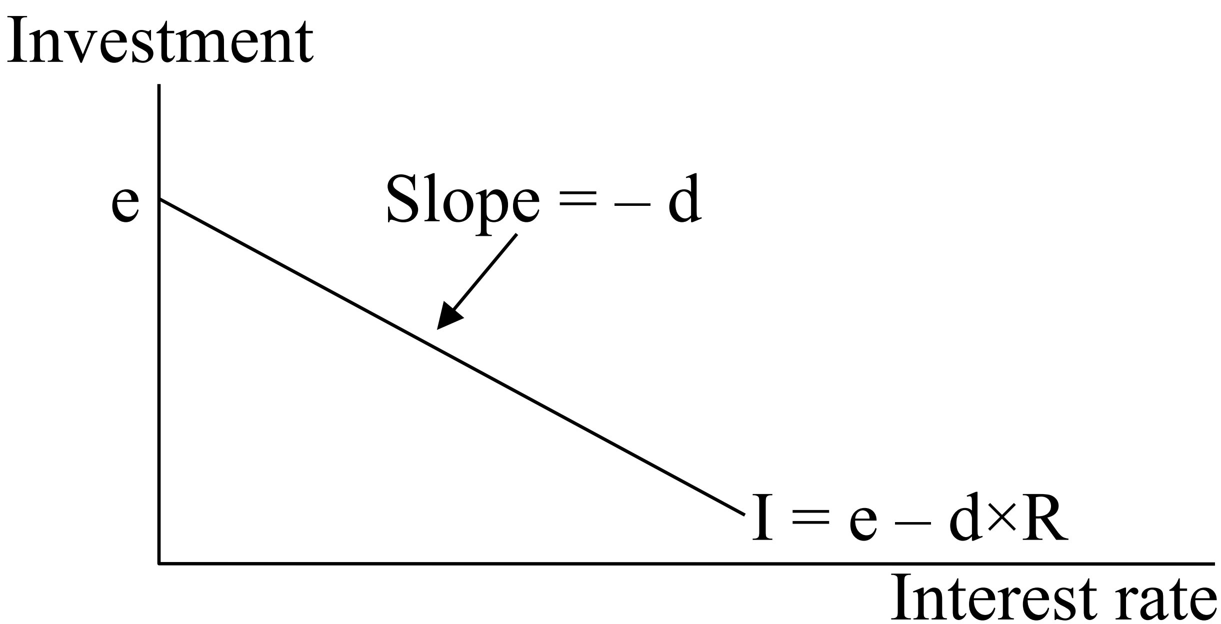
2. The algebraic description

$$I = e - d \times R.$$

a. $d > 0$ is the sensitivity of investment to the interest rate.

b. $e > 0$ is autonomous investment. (i.e., the level of investment if the interest rate is zero) This coefficient represents all the factors that affect investment EXCEPT the interest rate.

c. Graph of the investment function



3. Example

   Let $d = 2{,}000$ and $e = 1{,}000$

$$I = 1{,}000 - 2{,}000 \times R.$$

   If R is 5% then I equal to

$$I = 1{,}000 - 2{,}000 \times (0.05)$$

$$I = 900$$

4. The interest rate, R, used in the investment demand function is an average of many interest rates in the economy.

B. The net exports function, $(X - IM)$

1. Higher U.S. interest rates encourage foreigners to save in U.S. assets, which drives up the value of the dollar.

    a. This makes U.S. products more expensive overseas so exports (X) declines. $[R\uparrow \rightarrow X\downarrow]$

    b. This makes foreign products cheaper in the U.S. so imports (IM) rise. $[R\uparrow \rightarrow IM\uparrow]$

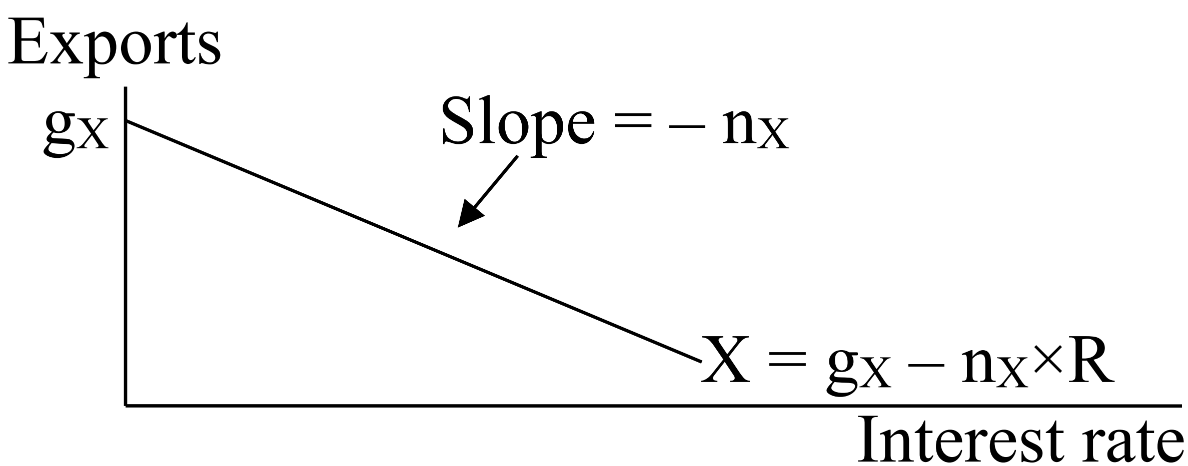
    c. $R\uparrow \rightarrow (X - IM)\downarrow$

2. The algebraic description

a. Exports

$$X = g_X - n_X \times R.$$

1. $n_X > 0$ is the sensitivity of exports to the interest rate.
2. $g_X > 0$ is autonomous exports. (i.e., the level of exports if the interest rate is zero) This coefficient represents all the factors that affect exports EXCEPT the interest rate.
3. Graph of the exports function

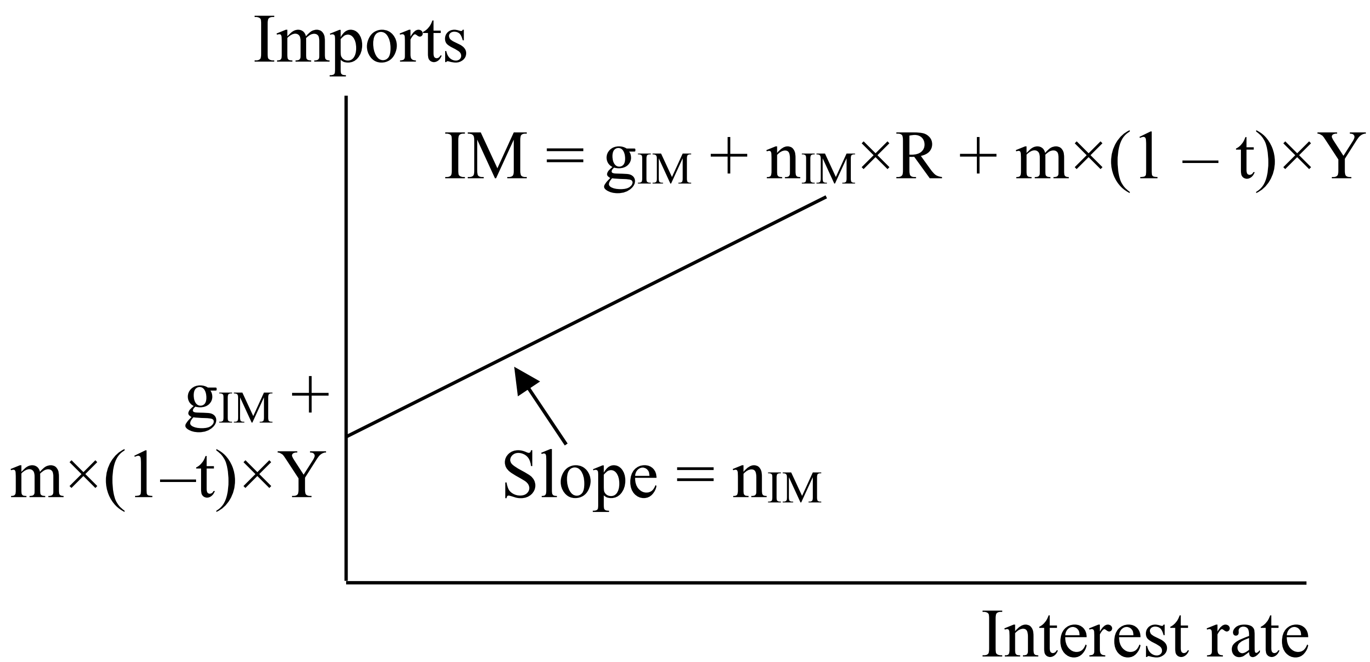


b. Imports

$$IM = g_{IM} + n_{IM} \times R + m \times (1 - t) \times Y.$$

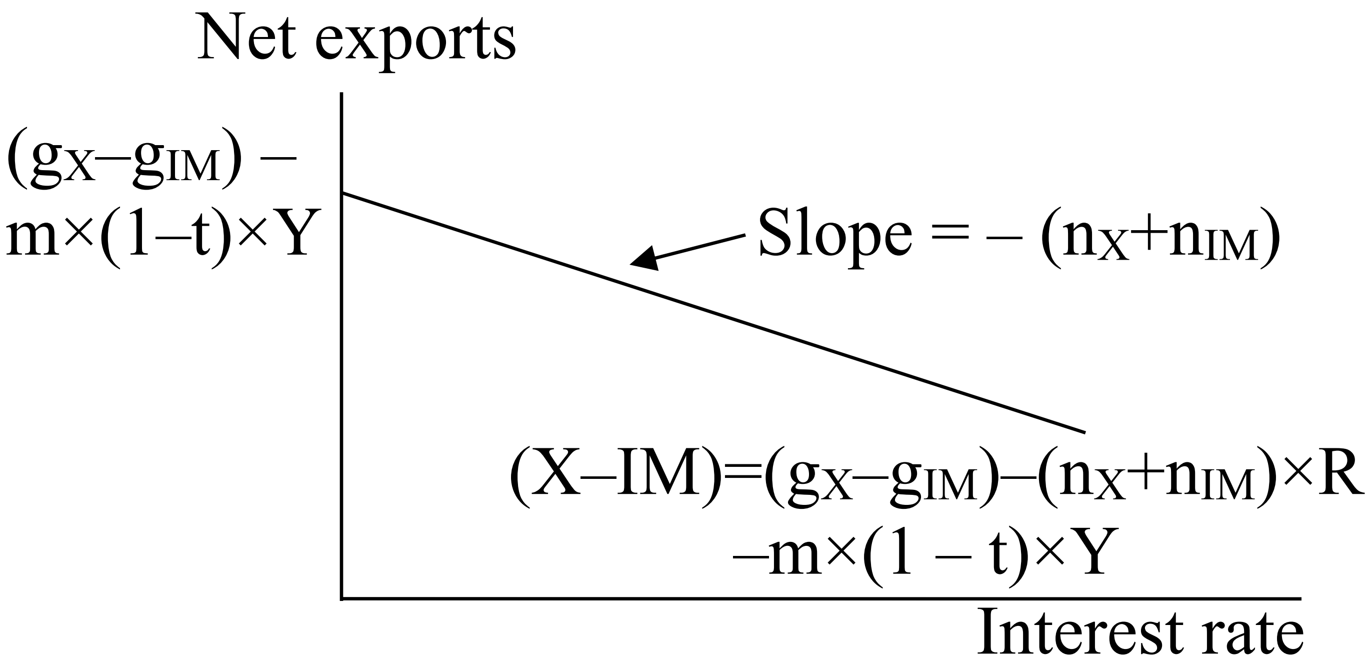
1. $n_{IM} > 0$ is the sensitivity of imports to the interest rate.
2. m is the marginal propensity to import.
3. $g_{IM} > 0$ is autonomous imports. (i.e., the level of imports if the interest rate and disposable income are zero) This coefficient represents all the factors that affect imports EXCEPT the interest rate and disposable income.

4. Graph of the imports function



c. Net Exports

$$(X - IM) = (g_X - g_{IM}) - (n_X + n_{IM}) \times R - m \times (1 - t) \times Y.$$



3. Example

Let $g_X = 1{,}000$, $g_{IM} = 475$, $n_X = 250$, $n_{IM} = 250$, $m = 0.125$, and $t = 0.20$.

$$(X - IM) = 525 - 500 \times R - 0.125 \times 0.8 \times Y$$

$$(X - IM) = 525 - 500 \times R - 0.1 \times Y$$

If $R = 0.05$ and $Y = 1{,}000$

$$(X - IM) = 525 - 500 \times 0.05 - 0.1 \times 1000$$

$$(X - IM) = 525 - 25 - 100$$

$$(X - IM) = 400$$

The IS and LM curves

A. Equations and assumptions

1. Assumptions

a. Y, C, I, (X – IM), and R are endogenous variables.

b. M^S and G are exogenous variables.

c. P is predetermined.

2. Five equations

a. Income identity

$$Y = C + I + G + (X - IM) \tag{1}$$

b. Consumption function

$$C = a + b\times(1 - t)\times Y \tag{2}$$

c. Investment function

$$I = e - d\times R \tag{3}$$

d. Net exports function

$$(X-IM) = (g_X - g_{IM}) - (n_X + n_{IM})\times R - m\times(1-t)\times Y \tag{4}$$

e. Money demand/ money supply equation

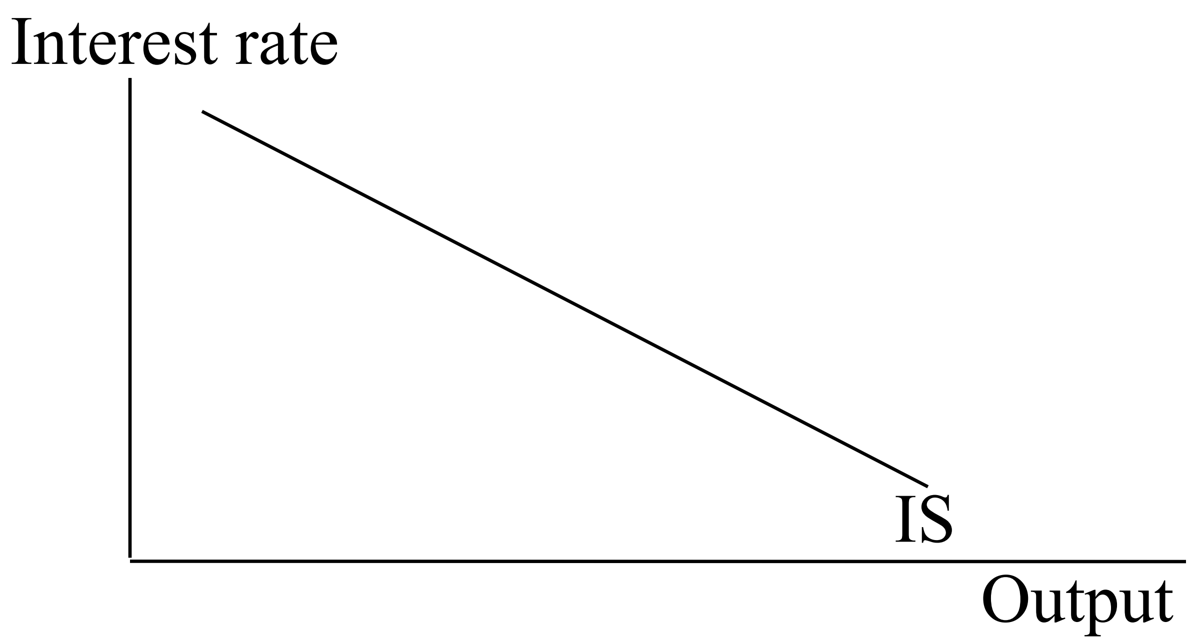
$$M^S = (k\times Y - h\times R)\times P \tag{5}$$

Recall: $M^D = M^S$

B. The IS curve

1. The IS curve shows all the combinations of R and Y that satisfy equations (1) – (4).

   a. The IS curve is downward sloping because a higher R reduces I and (X – IM) which pushes down Y through the multiplier process.



   b. Increases (decreases) in G, a, e, and g_X, and decreases (increases) in g_{IM} shift the IS curve rightward (leftward).

2. Algebraic derivation of the IS curve

   a. Substitute equations (2) – (4) into equation (1) and solve for R:

$$Y = a+b\times(1-t)\times Y+e-d\times R+G+(g_X-g_{IM})-(n_X+n_{IM})\times R-m\times(1-t)\times Y,$$

$$Y = (a+e+G+g_X-g_{IM})+(b-m)\times(1-t)\times Y-(d+n_X+n_{IM})\times R,$$

$$R = [(a+e+G+g_X-g_{IM}) - (1-(b-m)\times(1-t))\times Y]/[d+n_X+n_{IM}].$$

   b. The slope of the IS curve is

$$-[1-(b-m)\times(1-t)]/[d+n_X+n_{IM}].$$

   c. Large values for b, d, n_X, and n_{IM} and small values for m and t contribute to a fairly flat IS curve (small changes in R have large effects on Y).

3. Suppose that R rises from R_A to R_B.

   a. The intercept of the spending line in the income-spending graph shifts down by

$$\Delta IX = [I_B – I_A] + [(X–IM)_B – (X–IM)_A] = – [d+n_X+n_{IM}]\times(R_B–R_A).$$

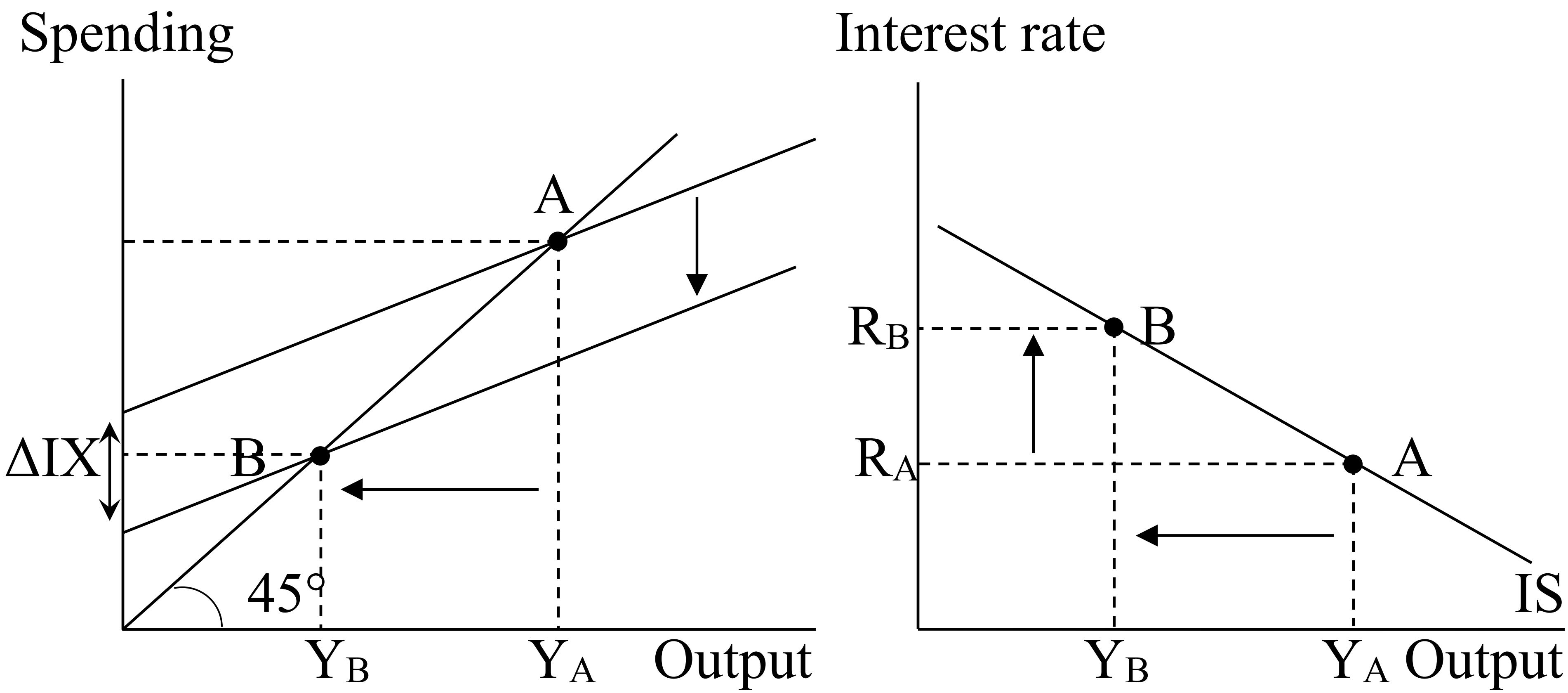
   b. Y declines from Y_A to Y_B by

$$(Y_B–Y_A) = [1/(1–(b–m)\times(1–t))]\times\Delta IX.$$

$$(Y_B–Y_A) = – [1/(1–(b–m)\times(1–t))]\times[d+n_X+n_{IM}]\times(R_B–R_A).$$

   c. A rise in R pushes down I and (X – IM), which leads to fall in Y. That decline in Y is represented by a downward shift in the spending line and an upward movement along the IS curve. [R↑ → I↓ & (X – IM)↓ → Y↓]

d. Graphical example of an increase in R from R_A to R_B.



$R\uparrow \rightarrow I\downarrow$ & $(X - IM)\downarrow \rightarrow Y\downarrow$

4. Suppose that G declines from G_A to G_B.

a. The intercept of the spending line in the income-spending graph shifts down by

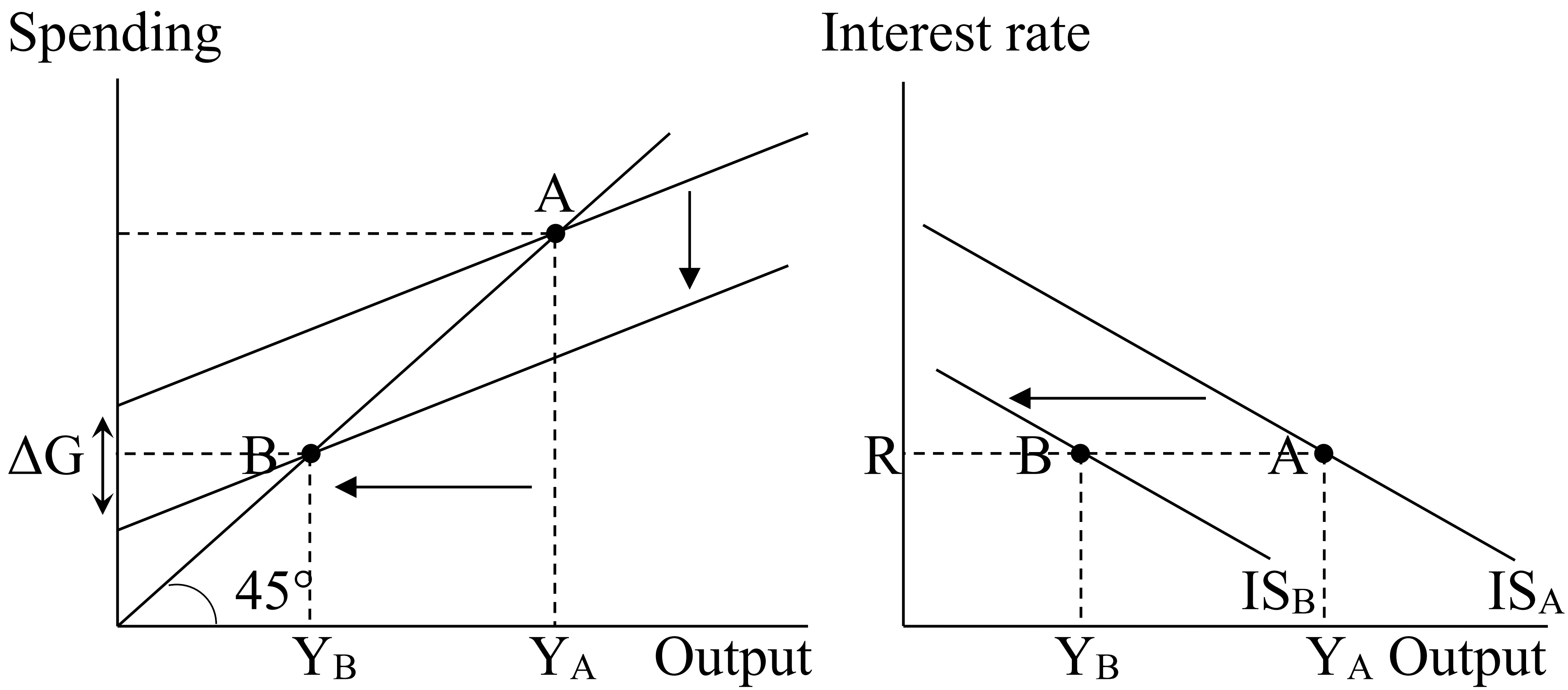
$$\Delta G = (G_B - G_A).$$

b. Y declines from Y_A to Y_B by

$$(Y_B - Y_A) = 1/[1-(b-m)\times(1-t)]\times\Delta G.$$

c. A decline in G pushes down Y which is represented by a downward shift in the spending line and a leftward shift in the IS curve from IS_A to IS_B. [$G\downarrow \rightarrow Y\downarrow$]

d. Graphical example of a decrease in G from G_A to G_B (the same results hold for a decrease in *a*, *e*, and g_X, or an increase in g_{IM}).

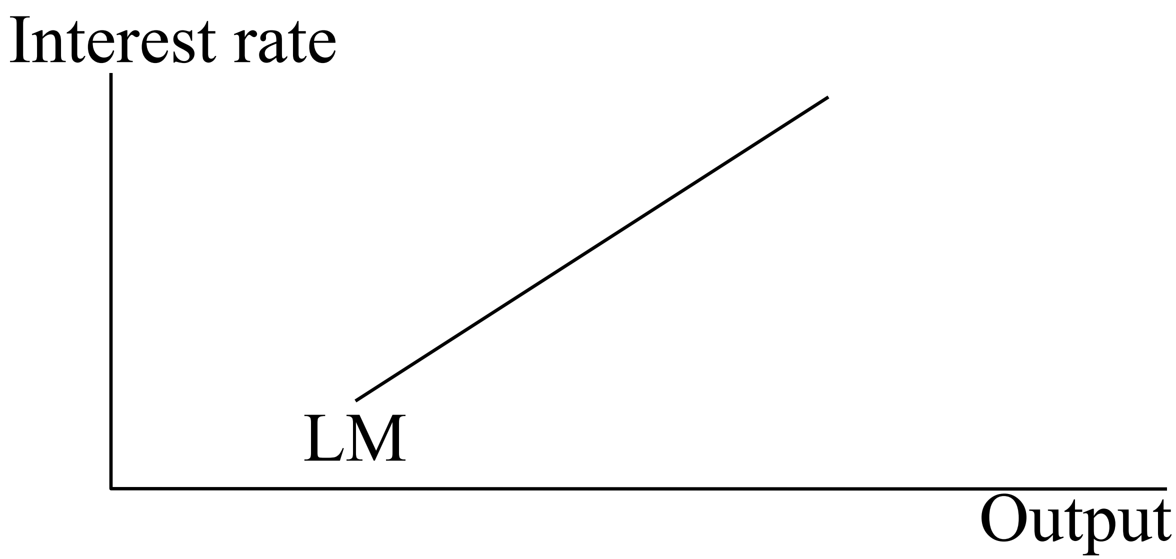


G↓ → Y↓

C. The LM curve

1. The LM curve shows all the combinations of R and Y that satisfy the money demand equation, (5) for a fixed M^S and a predetermined P.

   a. The LM curve is upward sloping because R must rise in response to an increase in Y to keep money demand (M^D) constant. [recall: $M^S/P = (k \times Y - h \times R)$; $M^D = M^S$]



   b. Increases (decreases) in M^S and decreases (increases) in P shift the LM curve rightward (leftward).

2. Algebraic derivation of the LM curve

   a. Solve the M^D equation (5) for R

$$R = (k/h)\times Y - (1/h)\times M^S/P.$$

   b. The slope of the LM curve is

$$(k/h).$$

   c. A large value for *h* and a small value for *k* result in a fairly flat LM curve.

      1. A large *h* implies that M^D is very elastic to changes in R.

      2. A small *k* implies that M^D is very inelastic to changes in Y.

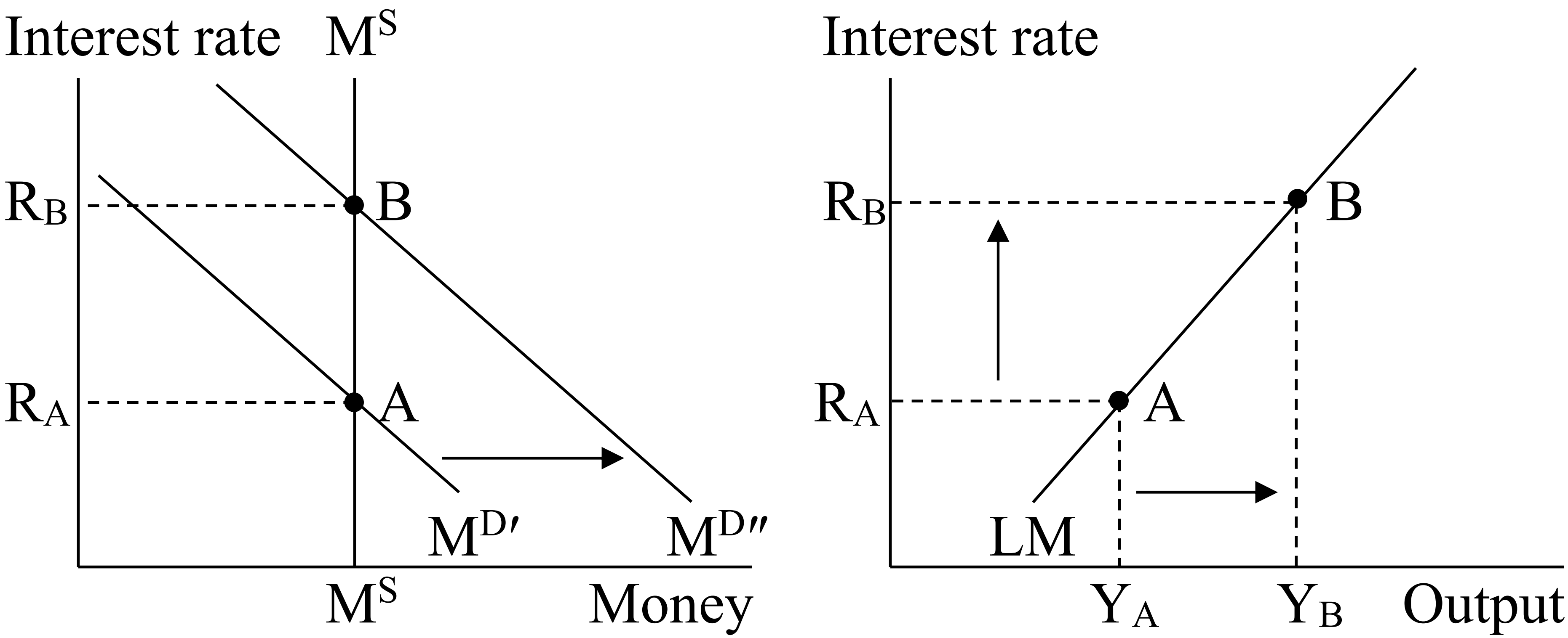
3. Suppose that Y rises from Y_A to Y_B.

   a. The money demand line shifts from $M^{D\prime}$ to $M^{D\prime\prime}$ such that

$$(R_B - R_A) = (k/h)\times(Y_B - Y_A)$$

   b. An increase in R caused by a rise in Y is represented by an upward movement along the LM curve. [$Y\uparrow \rightarrow M^D\uparrow \rightarrow R\uparrow$]

   c. Graphical example of an increase in Y from Y_A to Y_B.



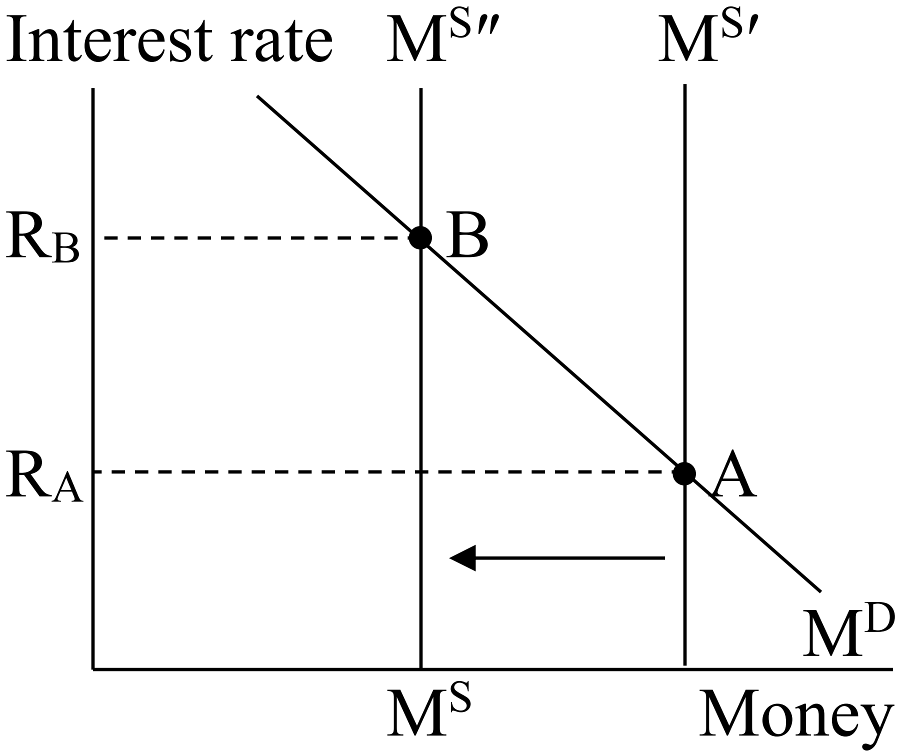
4. Suppose that M^S declines from $M^{S\prime}$ to $M^{S\prime\prime}$.

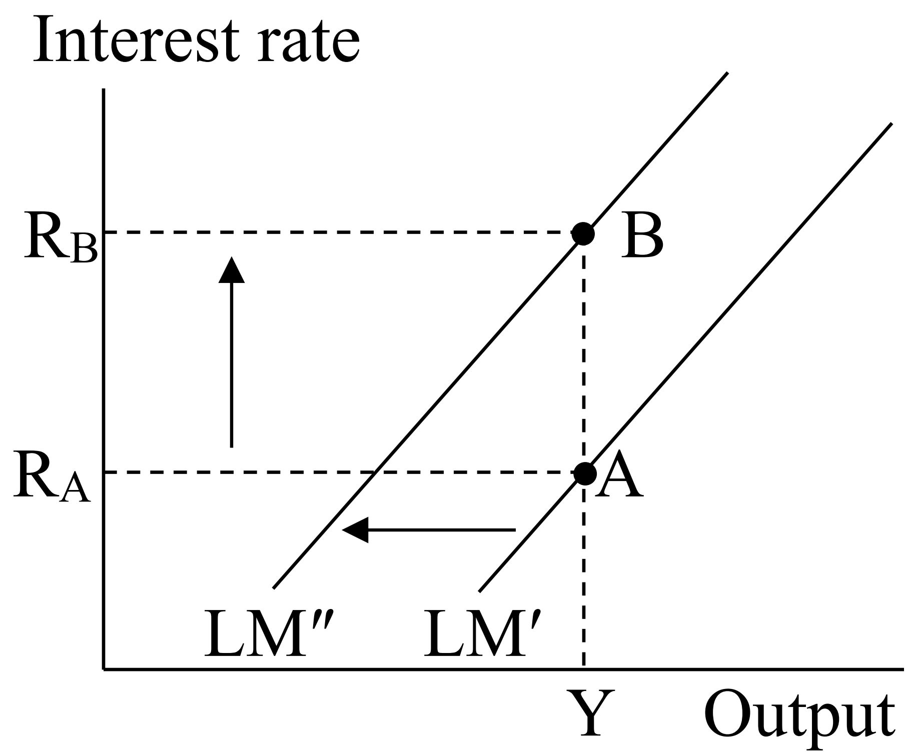
   a. The M^S curve shifts left and pushes up R from R' to R_A

   $$(R_B - R_A) = -(1/h)\times(M^{S\prime\prime} - M^{S\prime}).$$

   b. A rise in R caused by a fall in M^S shifts the LM curve from LM' to LM''. [$M^S\downarrow \rightarrow R\uparrow$]

   c. Graphical example of a decrease in M^S from $M^{S\prime}$ to $M^{S\prime\prime}$.





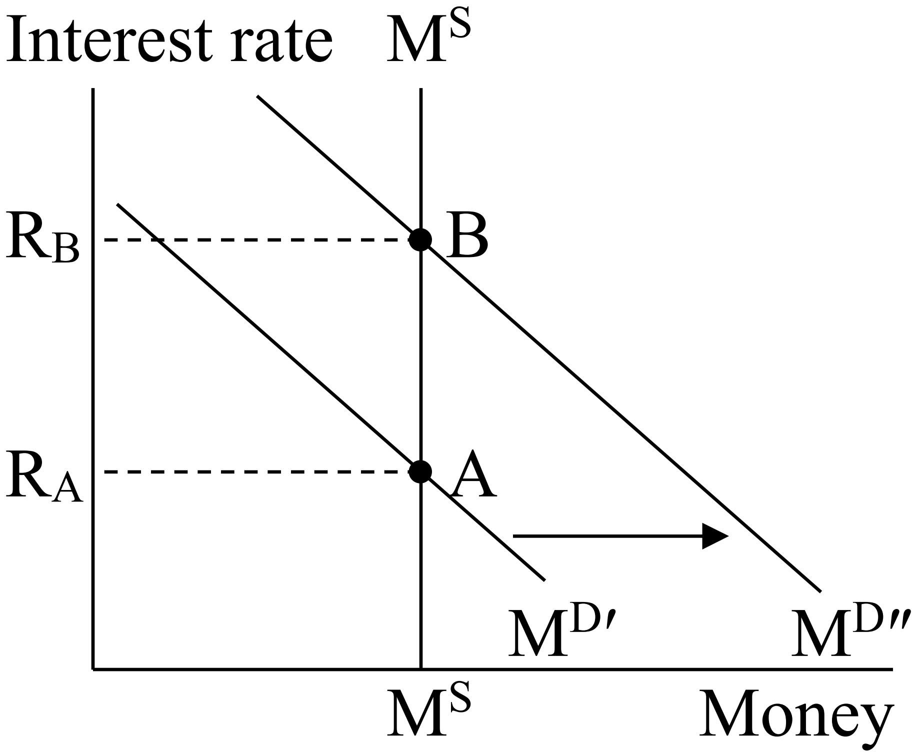
5. Suppose that P rises from P_A to P_B.

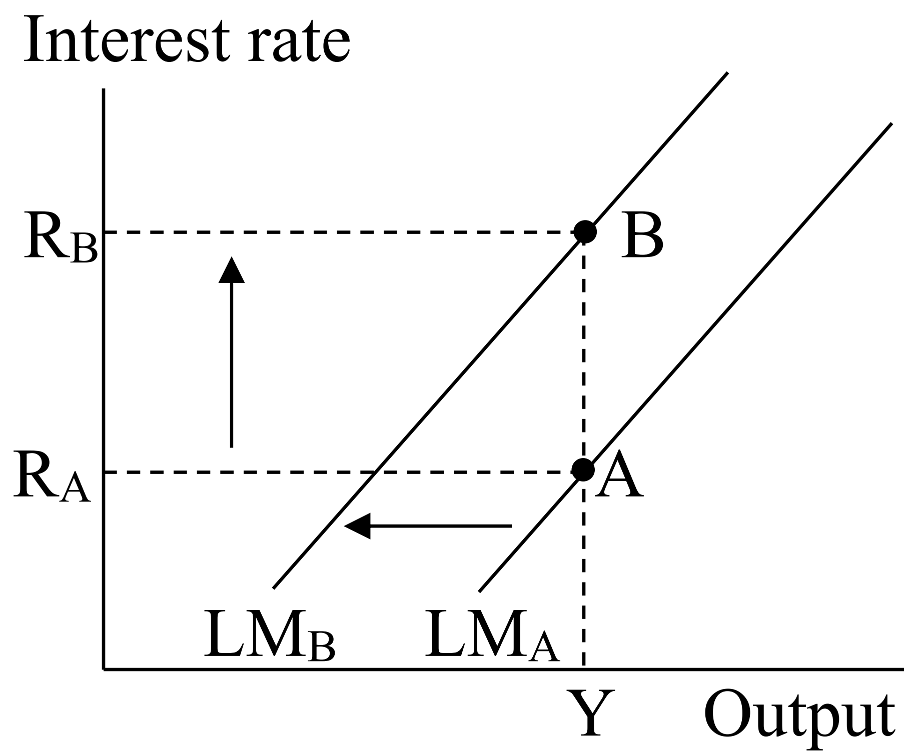
   a. The money demand line shifts from $M^{D\prime}$ to $M^{D\prime\prime}$ such that

   $$(R_B - R_A) = (1/h)\times(P_B - P_A)$$

   b. A rise in R caused by a jump in P shifts the LM curve from LM_A to LM_B. [$P\uparrow \rightarrow M^D\uparrow \rightarrow R\uparrow$]

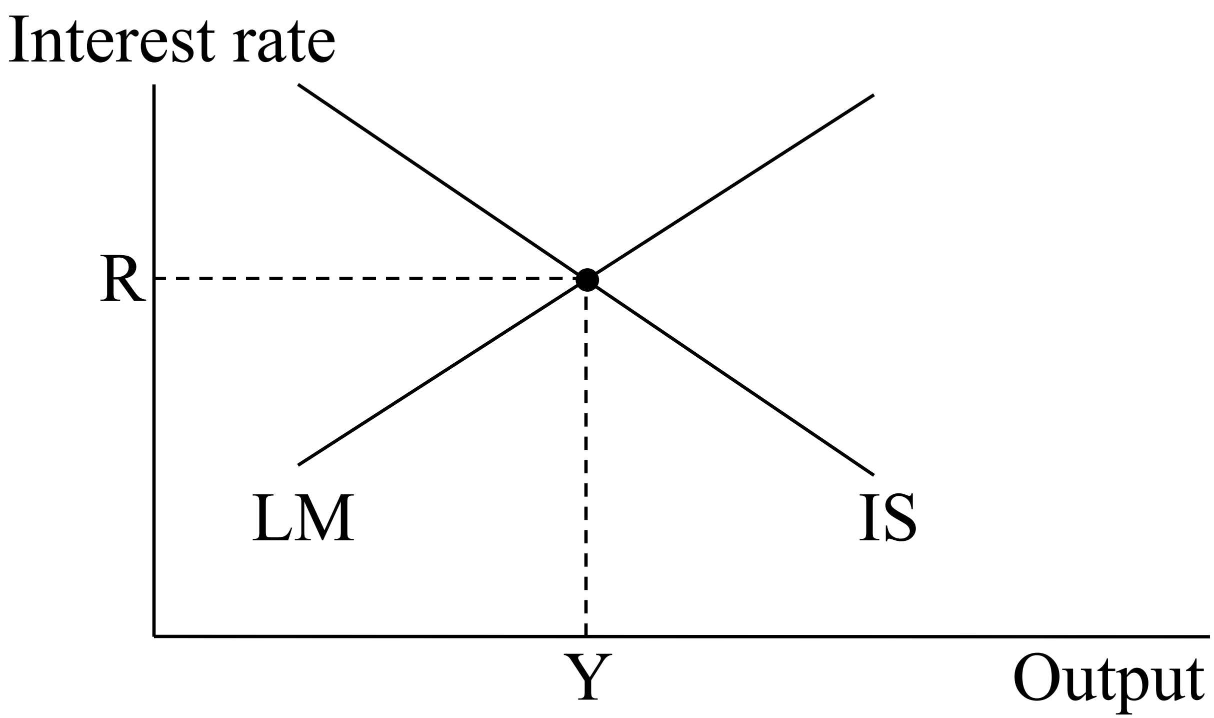
   c. Graphical example of an increase in P from P′ to P″.





D. Combining the IS and the LM curves

1. The intersection of the IS and LM curve shows the combination of R and Y that satisfy equations (1) – (5).



2. Algebraic derivation of the IS – LM curves

   a. The equation for the IS curve

$$R = [(a+e+G+g_X-g_{IM}) - (1-(b-m)\times(1-t))\times Y]/[d+n_X+n_{IM}].$$

   b. The equation for the LM curve

$$R = (k/h)\times Y - (1/h)\times M^S/P.$$

   c. To solve for equilibrium output (Y*), combine the IS and LM equations (This is also called the equation for the aggregate demand curve when a value for P is not given).

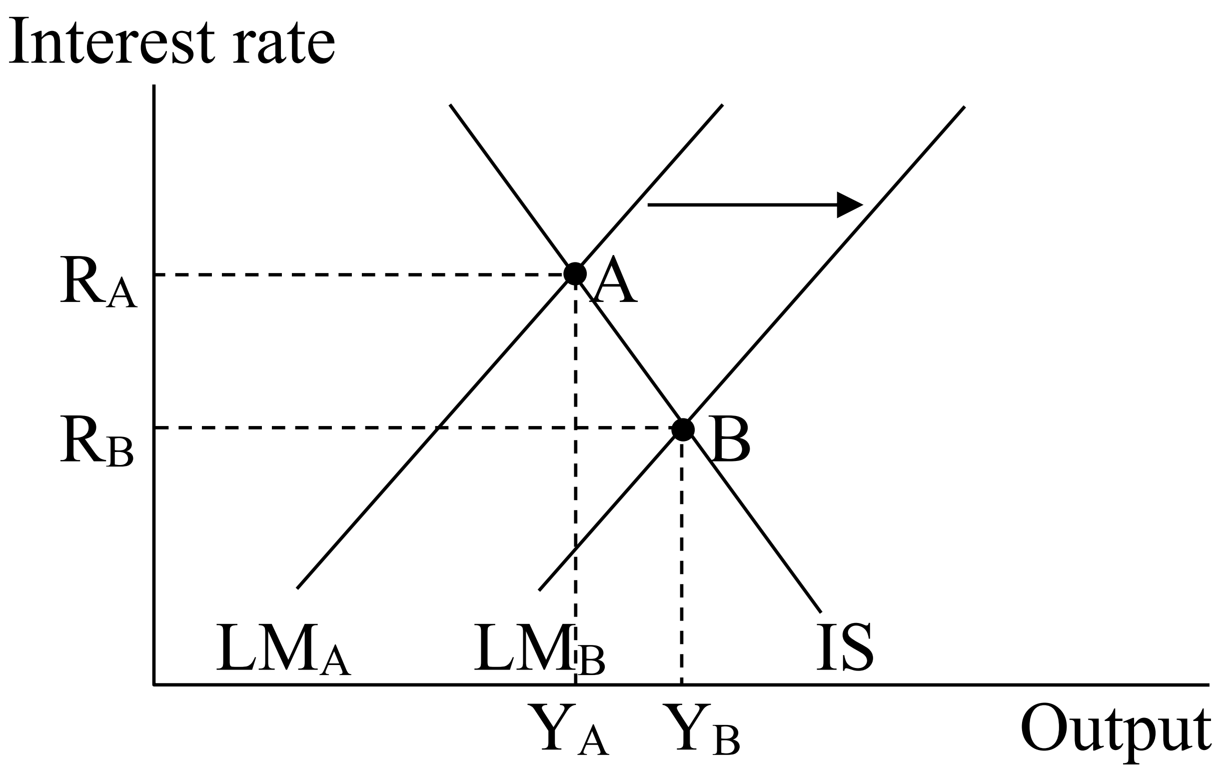
   d. To solve for the equilibrium interest rate (R*), substitute Y* into either the equation for the IS or LM curves.

   e. To solve for the equilibrium consumption, C*, investment, I*, and net exports, (X – IM)*, substitute Y* and R* into equations (2) – (4), respectively.

Policy Analysis with IS – LM

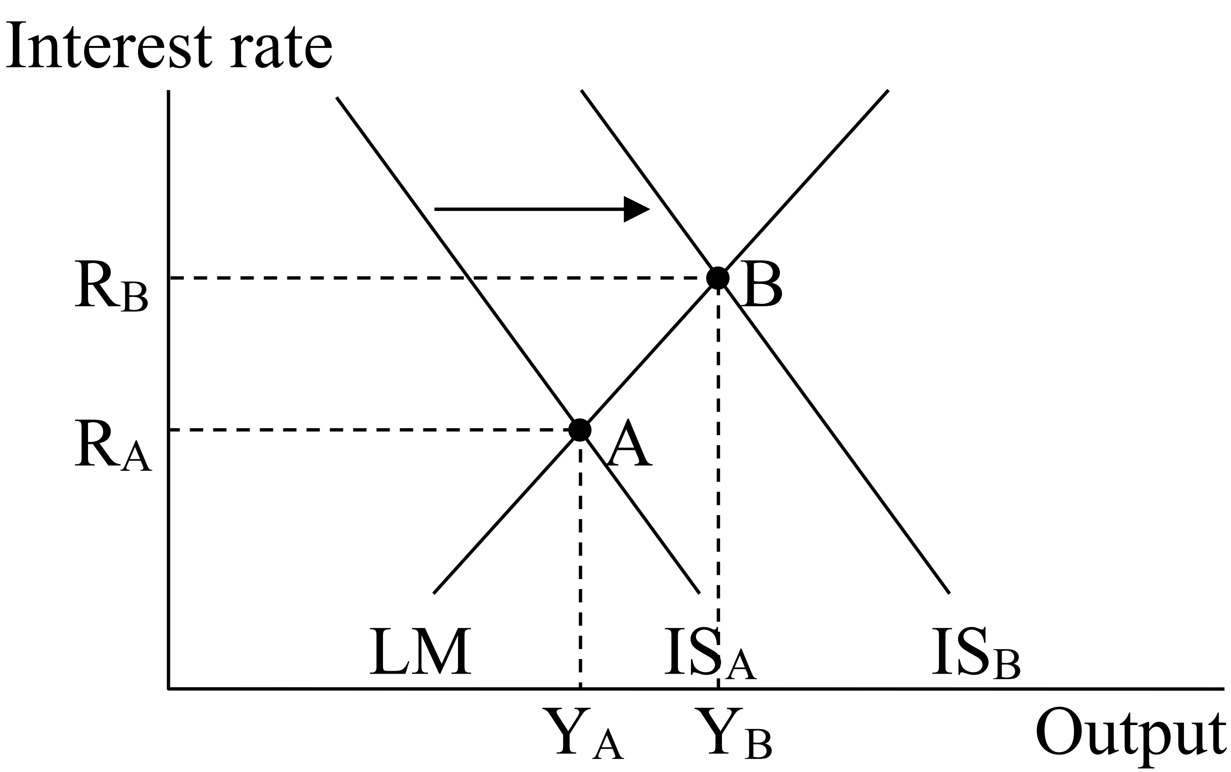
A. Monetary policy (suppose M^S increases)

1. $M^S\uparrow \rightarrow R\downarrow \rightarrow I\uparrow$ & $(X - IM)\uparrow \rightarrow Y\uparrow$
2. The increase in M^S and the resulting rise in Y (Y_A to Y_B) and decline in R (R_A to R_B) are shown by a rightward shift in the LM curve (LM_A to LM_B).



B. Fiscal policy (suppose G increases)

1. $G\uparrow \rightarrow Y\uparrow \rightarrow M^D\uparrow \rightarrow R\uparrow$
2. The increase in R leads to declines in I and (X – IM) which moderates the increase in Y. Thus, higher G <u>crowds out</u> I.
3. A rise in G and the resulting rise in Y (Y_A to Y_B) and R (R_A to R_B) are shown by the IS curve's (IS_A to IS_B) shift right.



The Aggregate Demand Curve

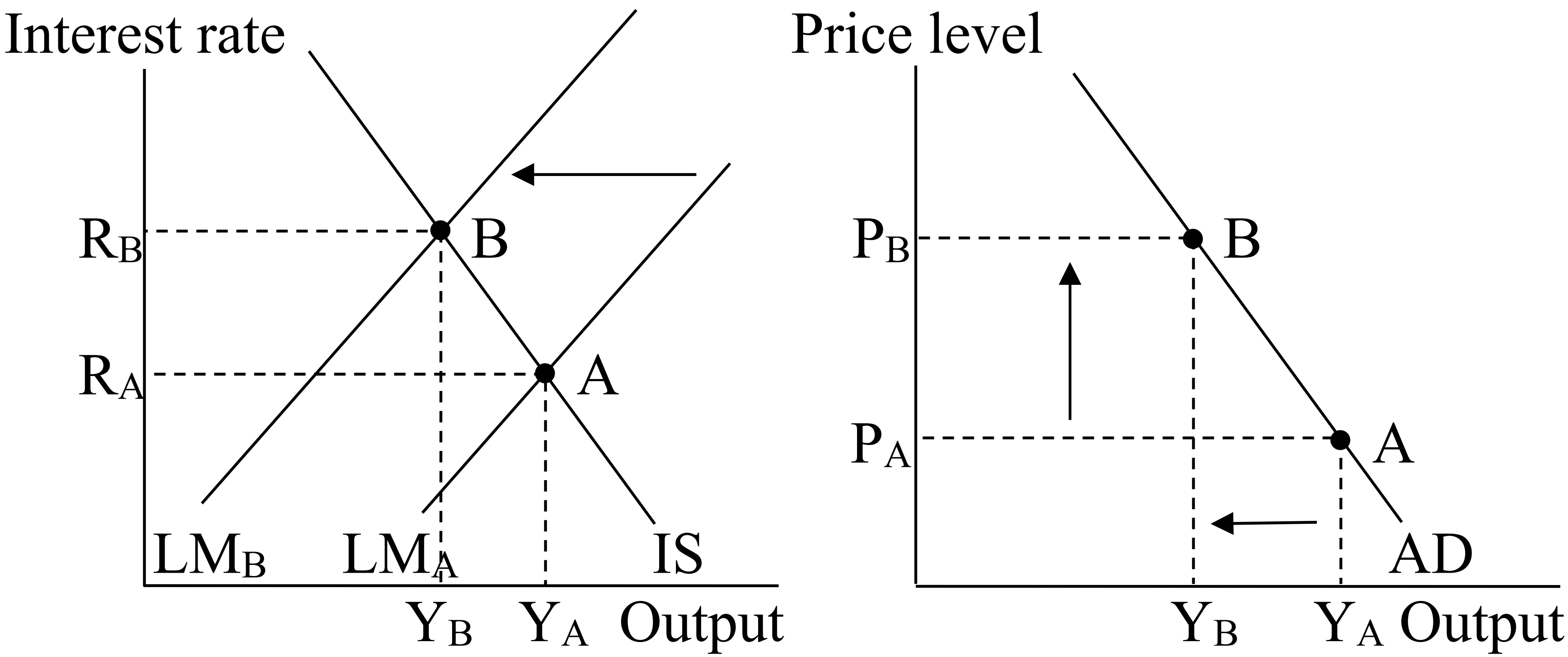
A. The aggregate demand curve is the relationship between quantity of output demanded and the price level, holding everything else constant.

B. Deriving the aggregate demand curve (the price level changes)

1. A rise in P (P_A to P_B) shifts the LM curve leftward (LM_A to LM_B), which causes Y to decrease (Y_A to Y_B) and R to increase (R_A to R_B).

2. Since the change in Y was caused by a change in P, this action is represented by a movement along the AD curve.

3. Graphical example of an increase in P

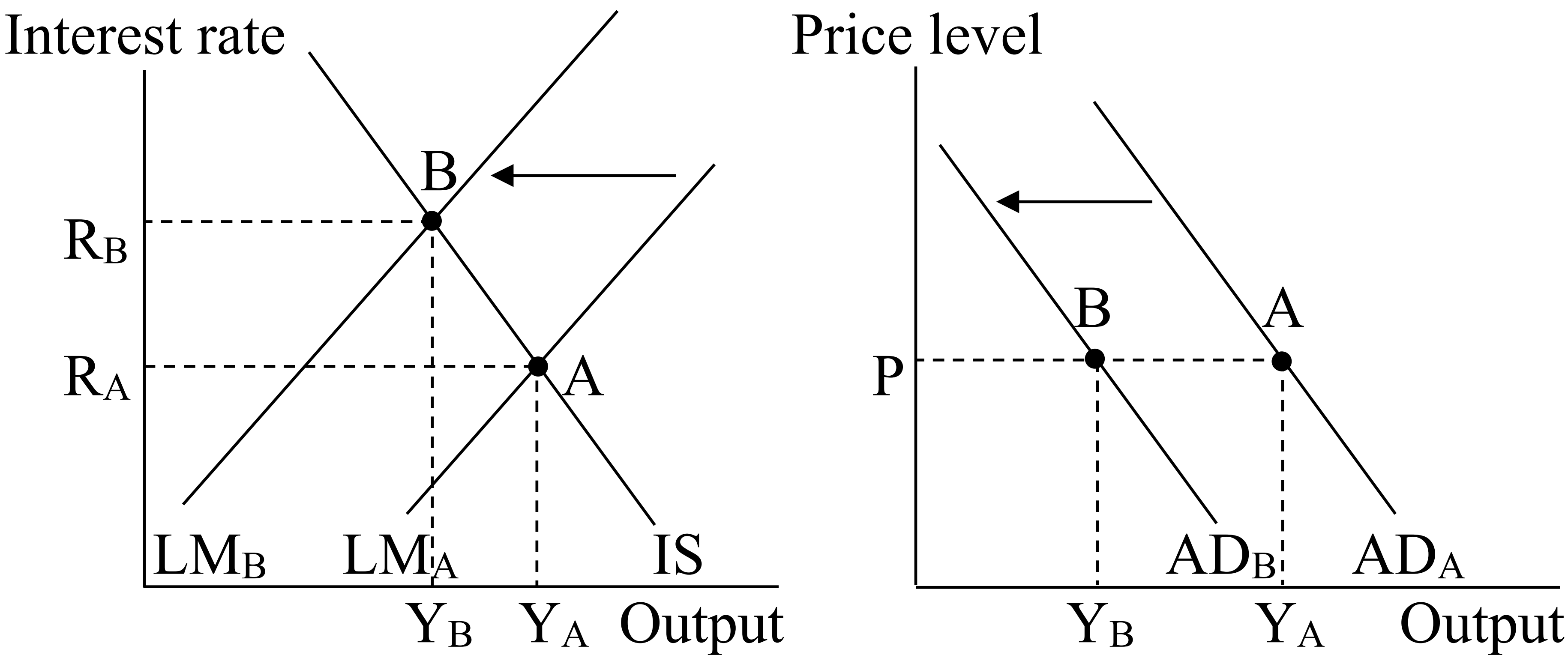


C. Shifting the aggregate demand curve by changing M^S

1. A fall in M^S shifts the LM curve leftward (LM_A to LM_B), which causes Y to fall (Y_A to Y_B) and R to rise (R_A to R_B).

2. Since the change in Y was NOT caused by a change in P, this action is represented by a leftward shift in the AD curve.

3. Graphical example of a decrease in M^S



D. Shifting the AD curve by raising a, e, G, and g_X or reducing g_{IM}

1. A rise in G shifts the IS curve rightward (IS_A to IS_B), which causes Y to increase (Y_A to Y_B) and R to increase (R_A to R_B).
2. Since the change in Y was NOT caused by a change in P, this action is represented by a rightward shift in the AD curve.
3. Graphical example of an increase in G