

The Mundell-Fleming Model

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- The MF model is an extension of the IS-LM model to the open economy.
- The base-line MF model
 - A small open economy (takes foreign income and interest rate as given)
 - Fixed price (horizontal AS curve with fixed P and variable Y)
 - Static exchange rate expectations
 - The Marshall-Lerner condition holds.
 - Perfect capital mobility

1. References

- a. Robert A. Mundell (1963), "Capital mobility and stabilization policy under fixed and flexible exchange rates," *Canadian J of Economics and Political Science* 29, 475-85.
- b. Marcus J. Fleming (1962), "Domestic financial policies under fixed and under floating exchange rates," *IMF Staff Papers* 9 , 369-79.

2. A Keynesian model

- Nominal goods prices are rigid.
- Output is determined by aggregate demand.
- The supply side of the economy is irrelevant.

3. Ad hoc model

4. Static, not dynamic

5. Model of a “semi-small” open economy

- Too small to affect the world interest rate or the world price level
- Large enough to have the price-setting power for its own exports

6. Three markets

- The goods market: the IS curve

$$y = \delta(s + p^* - p) + \gamma y - \sigma(i - \pi^e) + g, \quad 0 < \gamma < 1$$

$$y = \delta s + \gamma y - \sigma i + g$$

- The money market: the LM curve

$$m - p = \phi y - \lambda i$$

$$m = \phi y - \lambda i$$

- The financial market: interest rate parity

$$i = i^* + \frac{s^e - s}{s}$$

$$i = i^*$$

Covered Interest Parity (CIP)

Covered interest arbitrage leads to CIP:

$$1 + i^{\$} = (F/S)(1+i^{\pounds}).$$

Using approximation,

$$i^{\$} = i^{\pounds} + (F-S)/S$$

or
$$i^{\$} - i^{\pounds} = (F-S)/S$$

The RHS is the forward premium on £.

Uncovered Interest Parity

Uncovered interest parity holds if

$$i^{\$} - i^{\pounds} = (S^e - S)/S.$$

- S^e is the expected future exchange rate.
- $i^{\pounds} + (S^e - S)/S$ is the expected return from uncovered investment in foreign assets.
- The $(S^e - S)/S$ is called the expected rate of depreciation of the domestic currency.

7. Endogenous variables and exogenous variables

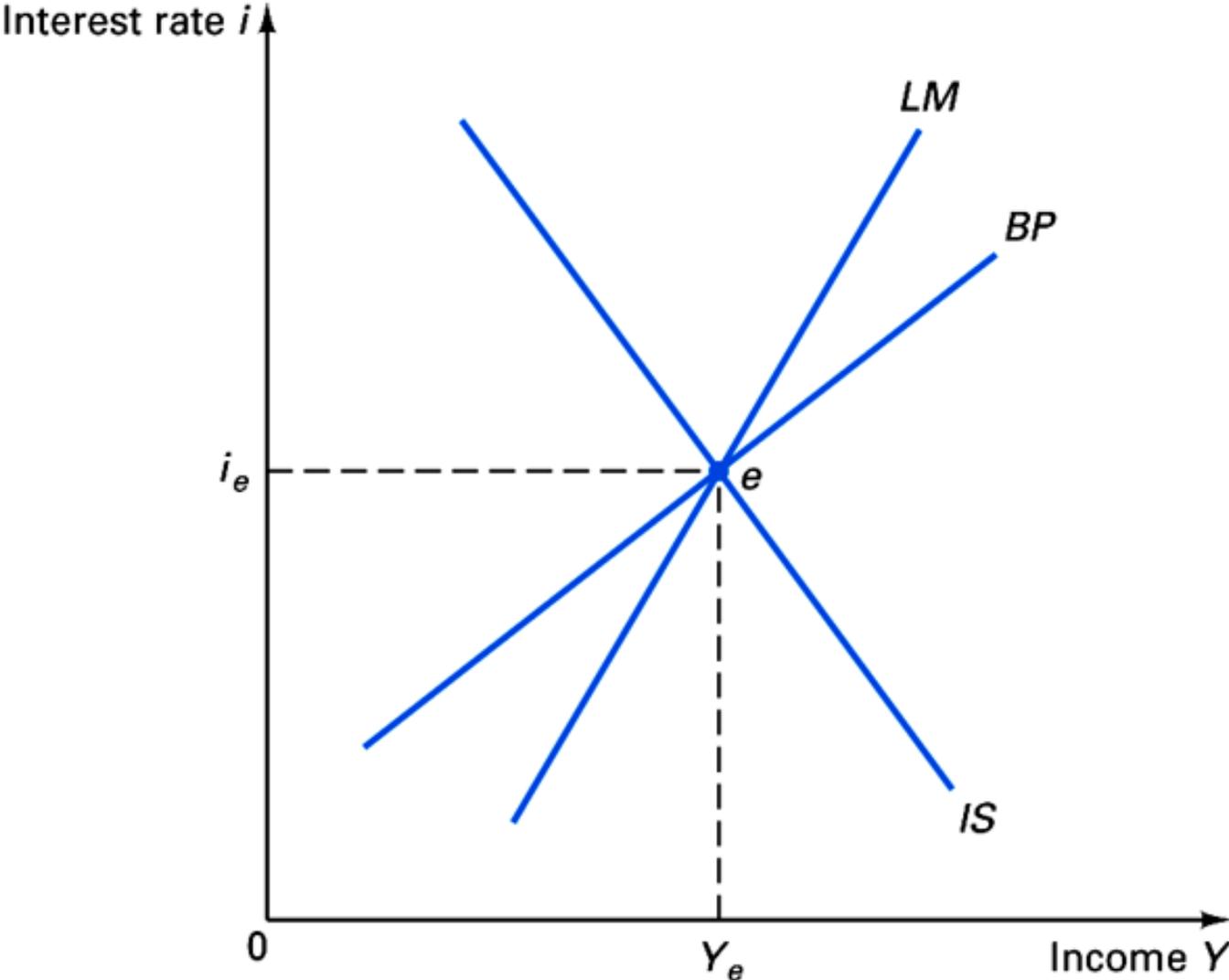
a. Under a floating exchange rate

- Endogenous variables: y, i, s
- Exogenous variables: m, g, i^*, π^*

b. Under a fixed exchange rate

- Endogenous variables: _____
- Exogenous variables: _____

Figure Equilibrium in the goods market (IS), money market (LM), and balance of payments (BP)



The IS Curve

- Equilibrium in the Goods Market:
$$Y = C+I+G+(X-IM)$$
- The IS curve shows the combinations of (Y, i) that provide equilibrium in the goods market.
- On the IS curve, Y and i are negatively related.
- There is an excess demand for goods to the left of the IS curve and an excess supply of goods to the right .

Shifts in the IS curve

- *If aggregate demand increases for reasons other than an increase in income or a decrease in the interest rate, the IS curve shifts to the right.*

Examples: In each of the following cases, the IS curve shifts to the right.

- Expansionary fiscal policy
 - An increase in G
 - A decrease in T
- C or I increases due to optimism about the future
- An increase in the current account due to
 - Foreign boom
 - Devaluation of the domestic currency*

The Money Market

- Money supply (M)
 - **Money supply** (M) = currency in circulation + demand deposits
 - **Monetary base** (MB) = currency in circulation + bank reserves
 - $M = \text{the money multiplier} \times MB$
 - Assume the money multiplier = 1
- Money demand (L)
 - arises due to transactions, precautionary or assets reasons.
 - It depends positively on real income and negatively on the interest rate.

The LM Curve

- The LM curve shows the combinations of (Y, i) that satisfy the money market equilibrium condition.
- On the LM curve, Y and i are positively related with a given supply of money (M).
- There is an excess demand for money to the right of the LM schedule and an excess supply of money to the left.
- Shifts in the LM curve:
 - An increase in money supply or a decrease in money demand shifts the LM curve to the right.

Short-run equilibrium

- The short-run equilibrium of the economy is obtained at the intersection of the IS and LM curves or when both the goods and the money markets are cleared.
- At other points, either the goods market or the money market or both are in disequilibrium.

Balance of Payments (BP)

- BP = the sum of the current account balance (CA) and private capital flows (KA)
- $BP = CA + KA$
- $CA = X - IM = X_0 - (M_0 + mY) = (X_0 - M_0) - mY$
- $KA = KA_0 + k(i-i^*); \quad k > 0$
 - X_0 , M_0 , and KA_0 are autonomous components.
 - $(X_0 - M_0)$ depends positively on the exchange rate (The Marshall-Lerner condition is satisfied.)
 - m is the marginal propensity to import
 - Capital inflows increase if the domestic interest rate rises relative to the foreign interest rate.
 - k measures the **degree of capital mobility**. The greater is capital mobility, the higher is k .

The BP Curve

- The BP curve shows the combinations of (Y, i) that satisfy the condition: $BP \equiv CA + KA = 0$.
 - On the BP curve, Y and i are positively related.
 - To the right (left) of the BP curve, BP is in _____.
- The higher is capital mobility, the greater is k and the flatter is the BP curve.
 - The slope of the BP = m/k
 - With perfect capital mobility (and perfect asset substitutability), k is infinitely large and the BP curve becomes horizontal at i^* .

- The **SLOPE** of the BP curve
 - Horizontal: Perfect capital mobility
 - Vertical: No capital mobility
 - Positive and steeper than LM: Low capital mobility
 - Positive and flatter than LM: High capital mobility

 - We deal with the case of PCM in most cases. However, other cases can be useful as well.

- The BP curve shifts to the right if CA rises (for reasons other than changes in y or i)
 - Foreign income increases and our exports to them rise.
 - The domestic currency depreciates.
- Note: In both cases, the IS curve shifts to the right.
- In the case of PCM (the “flat” BP), the new BP will be identical to the old one after a horizontal shift. (to be discussed shortly)

BP and Money Supply

- The Simplified Balance Sheet of the Central Bank

<u>Assets</u>	<u>Liabilities</u>
Gov't securities (GS)	Currency in circulation
Foreign reserves (FR)	Bank reserves

- Monetary base (MB) consists of currency in circulation and bank reserves.
- GS is a main component of domestic reserves. It consists of securities issued by the government. (May use “domestic credit” for the same purpose.)
- (Assume that foreign central banks do not buy or sell domestic assets. Then,)
- $BP = \Delta FR =$ increase in domestic central bank's holding of foreign reserves (FR)

Intervention

- If BP is in surplus, foreign reserves and MB increase.
(The central bank buys FX with dollars.)
- If BP is in deficit, foreign reserves and MB decrease.
(The central bank sells FX for dollars.)
 - Foreign reserves may change for reasons other than intervention.

Sterilization

- The changes in monetary base due to FX market intervention can be sterilized by open market operations.
- In the case of a BP deficit, foreign reserves and MB decrease if there is no sterilization. The central bank can purchase government bonds from banks or the public to restore MB to the original level. In this case, a reduction in FR is offset by an increase in GS.
- Similarly, a BP surplus can be sterilized by the central bank's open market sale of government bonds.
- Note that sterilization, especially that of BP deficits, is feasible only for a while until foreign reserves last.

Perfect Capital Mobility (PCM)

- Perfect capital mobility is a polar case in which capital movement in search for arbitrage profits is fast and efficient so that there are no unexploited profits from interest arbitrage.
- It means that covered interest parity holds continuously. (to be discussed later)
- In this extreme case, k is infinitely large and the BP curve becomes flat at $i = i^*$. (Note: the slope of the BP = m/k .)
- *A small deviation of i from i^* will result in huge capital inflow if $i > i^*$ or outflow if $i < i^*$. Under a fixed exchange rate, money supply changes accordingly. (Sterilization will not be possible.)*

Summary

- The balance sheet of the central bank

$$GS + FR = MB$$

- Open market operation

$$\Delta MB = \Delta GS$$

- Intervention (non-sterilized)

- Sterilized intervention

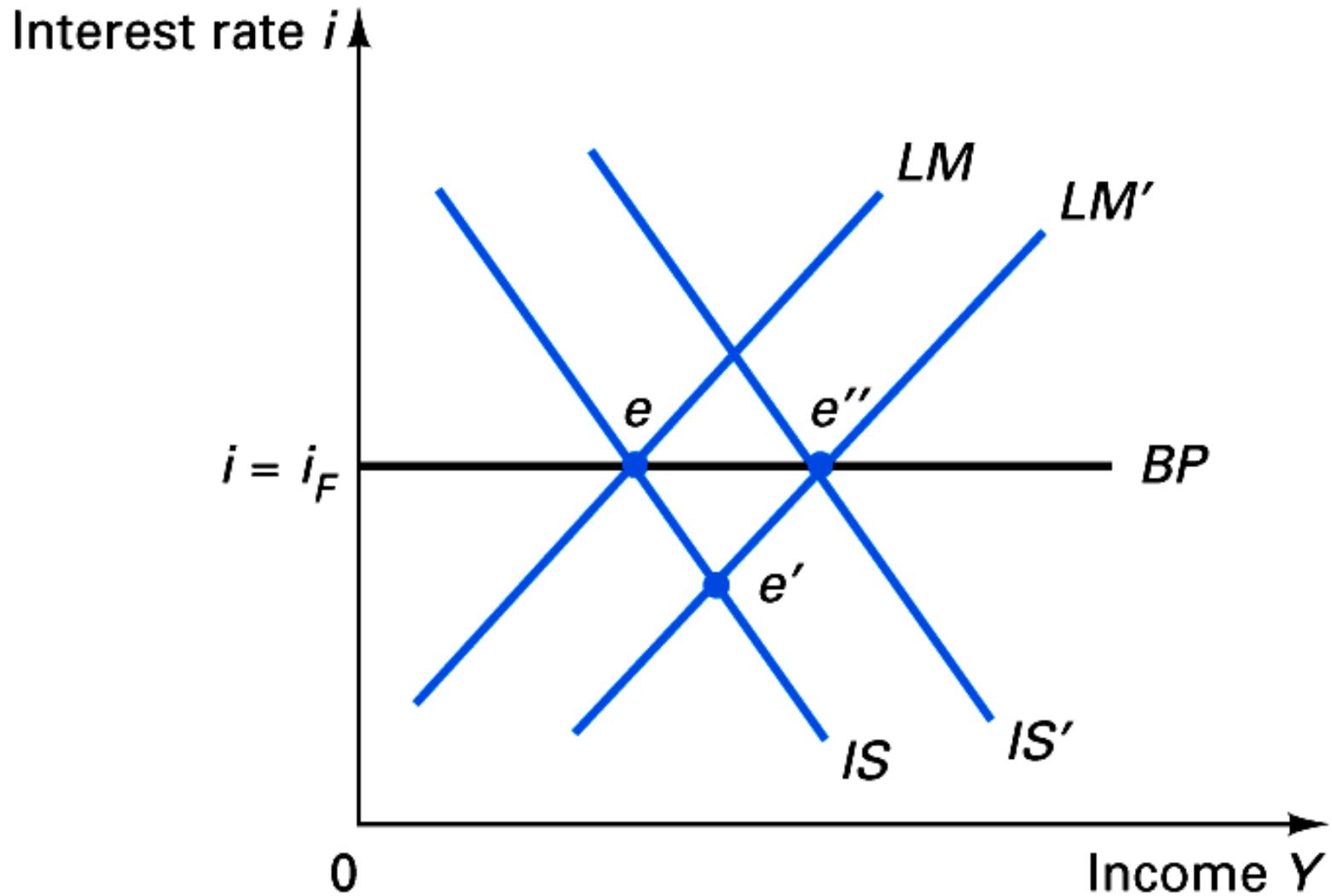
Order of discussion

- Fiscal policy
 - Float / PCM
 - Fixed / PCM
 - Float / NCM
 - Fixed / NCM
 - The cases of Low and High CM are left as homework exercise.
- Monetary policy
 - Do the same order

Monetary Policy under a Floating Exchange Rate

- An open market purchase of government bonds by the central bank increases both GS and MB. (a rightward shift in the LM)
- Income increases while the interest rate falls. Capital flows out (KA deficit). No intervention under pure floating
 - *The domestic currency depreciates.*
 - *(X-IM) increases. The IS shifts to the right.*
- The change in the exchange rate works in the same direction as the money supply change does. Thus, MP is more effective in an open economy than in a closed economy.
- What happens to CA and KA in the new equilibrium? *

Figure Monetary expansion with floating exchange rates and perfect capital mobility

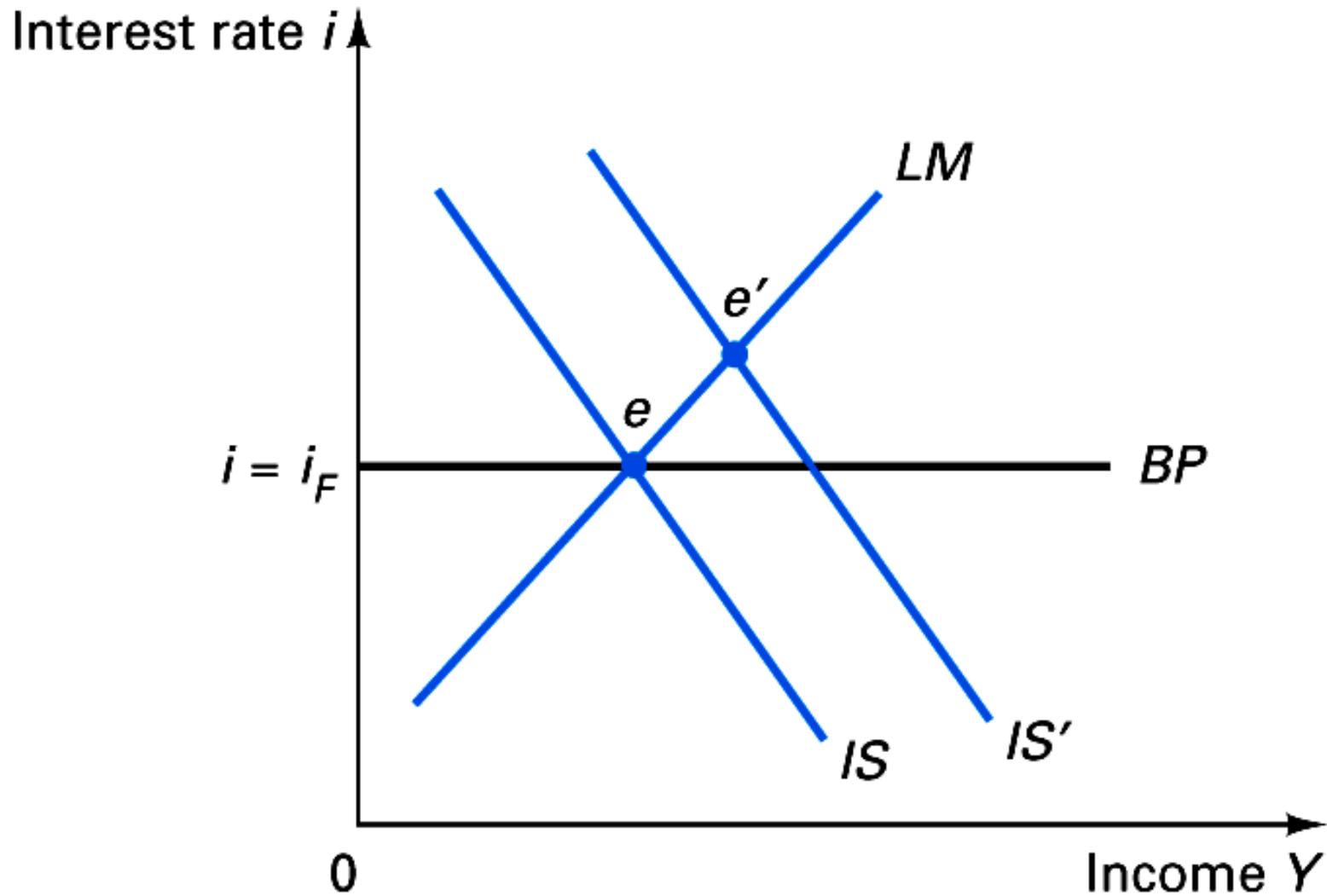


Fiscal Policy

under a Floating Exchange Rate

- An increase in government spending (G) shifts the IS schedule to the right.
- Both income and the interest rate increase.
- The current account declines while the capital account increases.
- If the capital mobility is high or perfect, the change in the capital account dominates.
 - *The domestic currency appreciates.*
 - *CA declines and the IS shifts to the left, offsetting the effect of the increase in G .*
- Under perfect capital mobility, fiscal policy becomes completely powerless in a small country.
- What happens to CA and KA in the new equilibrium?

Figure Fiscal expansion with floating exchange rates and perfect capital mobility

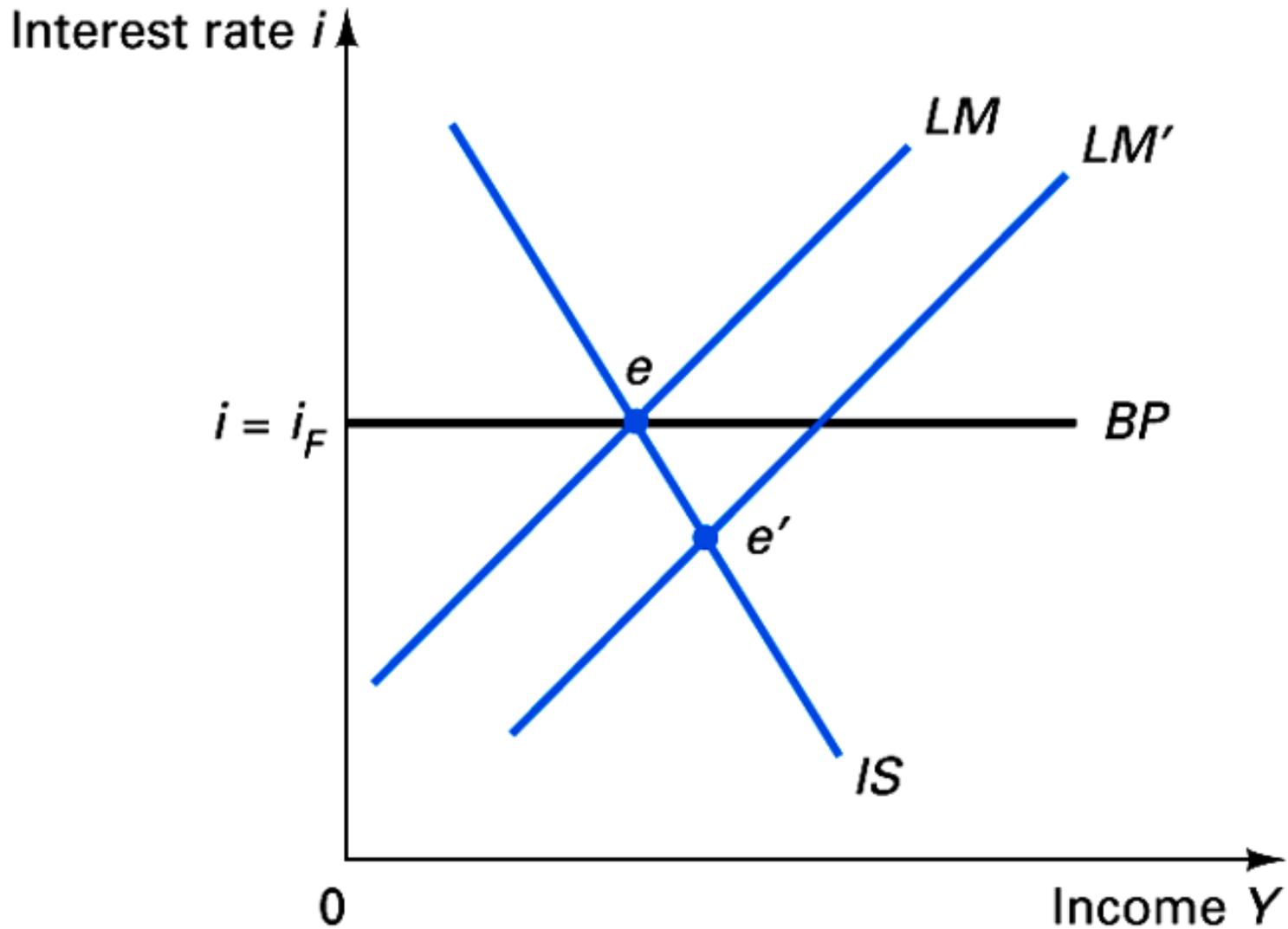


Monetary Policy under a **Fixed** Exchange Rate

- An open market purchase of government bonds by the central bank increases both GS and MB. (a rightward shift in the LM)
- Income increases while the interest rate falls. Imports increase and the current account declines.
- Capital flows out (KA deficit).
- The domestic currency tends to weaken.
- The central bank intervenes and buys domestic currency by selling foreign reserves. (BP turns to deficit.)
- Money supply decreases due to losses in foreign reserves.
- This shifts the LM back towards the initial situation.

- In a small economy under fixed exchange rates, monetary policy is relatively ineffective in influencing economic activity.
- Greater capital mobility further reduces the scope for independent management of monetary policy.
- **Under perfect capital mobility, monetary policy becomes completely ineffective in a small country with a fixed exchange rate.**
- This is an example of Monetary Policy Trilemma in a small open economy.

Figure Monetary expansion with fixed exchange rates and perfect capital mobility



The case of no capital mobility

- The shape of the BP under no capital mobility:
- What happens when the economy is off the BP line?
- Redo the case of monetary expansion under a fixed exchange rate.

International Monetary Policy Trilemma

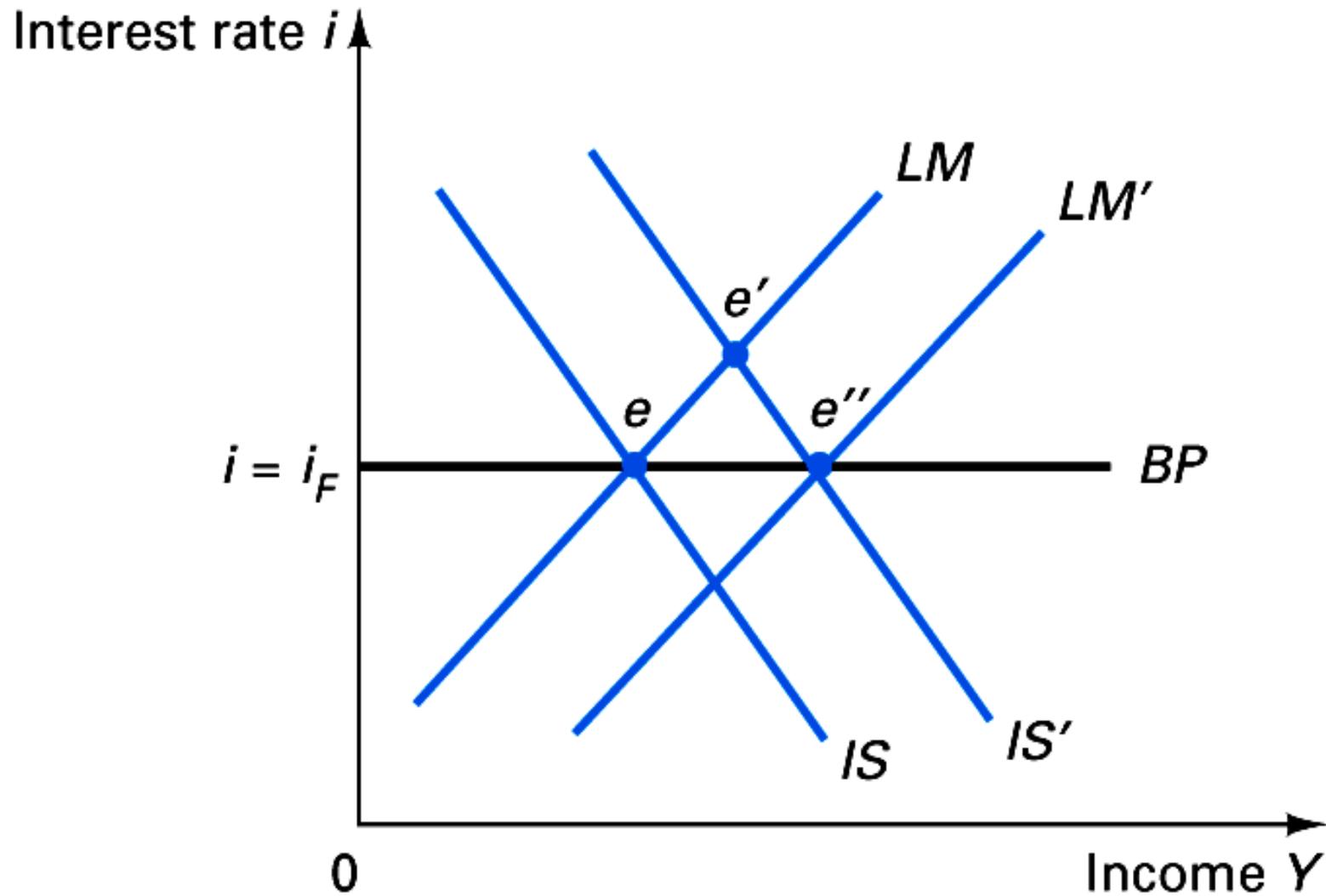
- The following three cannot coexist:
 - A fixed exchange rate
 - Perfect capital mobility
 - Independent monetary policy
- A typical government wants to retain independent monetary policy. The impossibility theorem implies that it will have to give up either one of the first two and choose
 - a flexible exchange rate (i.e., sacrificing fixed exchange rate) or
 - controls on international capital movements (i.e., giving up perfect capital mobility)

Fiscal Policy under a Fixed Exchange Rate

- An increase in government spending (G) shifts the IS schedule to the right.
- Both income and the interest rate increase.
- The current account declines while the capital account increases.
- If the capital mobility is high or perfect, the change in the capital account dominates and the domestic currency tends to appreciate.
- The central bank intervenes and buys foreign exchange. (BP turns to deficit.)
- Money supply increases due to the increase in foreign reserves.
- This shifts the LM curve to the right.

- Thus, in a small economy under fixed exchange rates, a fiscal expansion is accompanied by an increase in money supply. It makes fiscal policy becomes more effective in influencing economic activity.
- Under PCM, fiscal policy becomes a powerful tool of macroeconomic policy in a small country.

Figure Fiscal expansion with fixed exchange rates and perfect capital mobility



International transmission

- Consider a foreign monetary contraction.
- It will raise i^* and lower y^* .
- Under **a flexible exchange rate**, the higher i^* causes an incipient capital outflow and a DC depreciation. The IS shifts out and domestic output expands. (note)
- In this case, (foreign) monetary policy is **NEGATIVELY** transmitted.
- Consider the case of a **fixed exchange rate** and show that (foreign) monetary policy is **POSITIVELY** transmitted.

Solving the IS-LM-BP model under PCM

$$\text{IS: } Y = C(Y, i, T) + I(i) + G + CA(Y, e) \Rightarrow \text{IS}(Y, i, e: G, T)$$

$$\text{LM: } M/P = L(Y, i) \Rightarrow \text{LM}(Y, i: M)$$

$$\text{BP: } i = i^*$$

- In this model, there are **three endogenous variables: Y, i, and e** in 3 equations.
- Under a flexible ER, e is endogenously determined. The three equations can solve 3 endogenous variables.
- **The solution procedure:**
 - (i) Determine i from BP
 - (ii) Use LM to determine Y;
 - (iii) Use IS to find the equilibrium value of e.
- Graphically, this means that i is given by BP and Y is determined by BP and LM. Exchange rate changes allow the IS curve to move to the intersection point so that all three curves intersect at the same point.

- Under a fixed ER, e is held fixed by the government and no longer an endogenous variable.
- However, M (the money supply) become and endogenous variable under a fixed ER. When the central bank intervenes in the FX market, changes in the central bank holdings of foreign reserves affect the money supply.
- **The solution procedure**
 - (i) determine i from BP as above
 - (ii) use IS to determine equilibrium Y
 - (iii) use LM to find the equilibrium value of M .
- Graphically, this means that i is given by _____ and Y is determined by _____ with the given interest rate. Changes in M allow the _____ curve to move to the intersection point so that all three curves intersect at the same point.