

CHAPTER 12

THE OPEN ECONOMY IN THE SHORT RUN: THE MUNDELL-FLEMING MODEL AND THE EXCHANGE RATE REGIME

Objectives:

- To develop a small open-economy version of the IS-LM model [the **Mundell-Fleming model**];
- To use that model to show that the short-run behaviour of a small open economy in response to domestic policies or external demand shocks **depends on the exchange rate regime** adopted (i.e. fixed or floating);
- To understand the pros and cons of flexible versus fixed exchange rates.

I. The Mundell-Fleming model with FLOATING (flexible) exchange rate.

1. The structure of the model.

(a) The output market:

- As in the short-run model of the closed economy, we assume that the supply of output [Y] is perfectly elastic at a constant price level [\bar{P}] and that firms adjust output to meet demand:

$$Y = E$$

- Aggregate (planned) expenditure is the sum of consumption, investment, government spending **and net exports**:

$$E = C(Y - \bar{T}) + I(r) + \bar{G} + NX$$

- We assume that net exports (NX) are a **decreasing function of the real exchange rate (ϵ)**:

$$NX = NX(\epsilon) \quad \text{where: } \uparrow \epsilon \rightarrow \downarrow NX \text{ and } \downarrow \epsilon \rightarrow \uparrow NX$$

- Recall: an increase in the real exchange rate is an **increase in the relative price of domestic goods** which reduces export demand and increases import spending, causing NX to fall.

□ For simplicity, we assume that the **real and nominal exchange rates are identical:**

➤ Recall the formula for the real exchange rate:

$$\varepsilon = eP/P^*$$

➤ In the Mundell-Fleming model, both the domestic price level [P] and foreign price level [P^*] are assumed constant: $P = \bar{P}$, and $P^* = \bar{P}^*$

➤ For simplicity, we shall assume that the two price levels are equal ($\bar{P} = \bar{P}^*$) and thus the nominal and real exchange rates are identical: $\varepsilon = e$.

- Summary: The output market will be in equilibrium when:

$$Y = C(Y - \bar{T}) + I(r) + \bar{G} + NX(e)$$


$$\varepsilon = e.$$

(b) **The financial markets:**

- As in the closed economy model, the domestic interest rate (r) is determined at the level required to equate the (domestic) demand for money to the (domestic) supply of money:

$$\bar{M}/\bar{P} = L(r, Y)$$

- But now we assume a **small open economy** (Canada) in a world of **perfect international mobility of capital**, where **equilibrium in the foreign exchange (FX) market**, or equality between the demand and supply of C\$ ($D_{C\$} = S_{C\$}$) requires that the domestic interest rate (r) equal the [exogenous] world interest rate (r^*):

$$r = r^*$$

- What if $r \neq r^*$? Suppose that $r > r^*$, then foreigners will want to hold only Canadian securities and there will be an **excess demand for Canadian dollars** on the foreign exchange market ($D_{C\$} > S_{C\$}$) as foreigners rush to buy C\$ in order to purchase Canadian securities. As a result of this excess demand for C\$ on the FX market, the exchange rate, or US\$ price of one C\$, **will rise** ($\uparrow e$).

- The rise in the exchange rate will **lower net exports** and, hence, equilibrium output. As output falls, the domestic demand for money $L(r, Y)$ will **fall**, thus **reducing the domestic interest rate** until it equals the given world interest rate and foreign exchange market equilibrium is restored.

- Summary: equilibrium in the financial markets – the money market and the foreign exchange market - requires that the (domestic) demand for money and (domestic) supply of money be equal at the (exogenous) world interest rate:

$$\bar{M}/\bar{P} = L(r^*, Y)$$

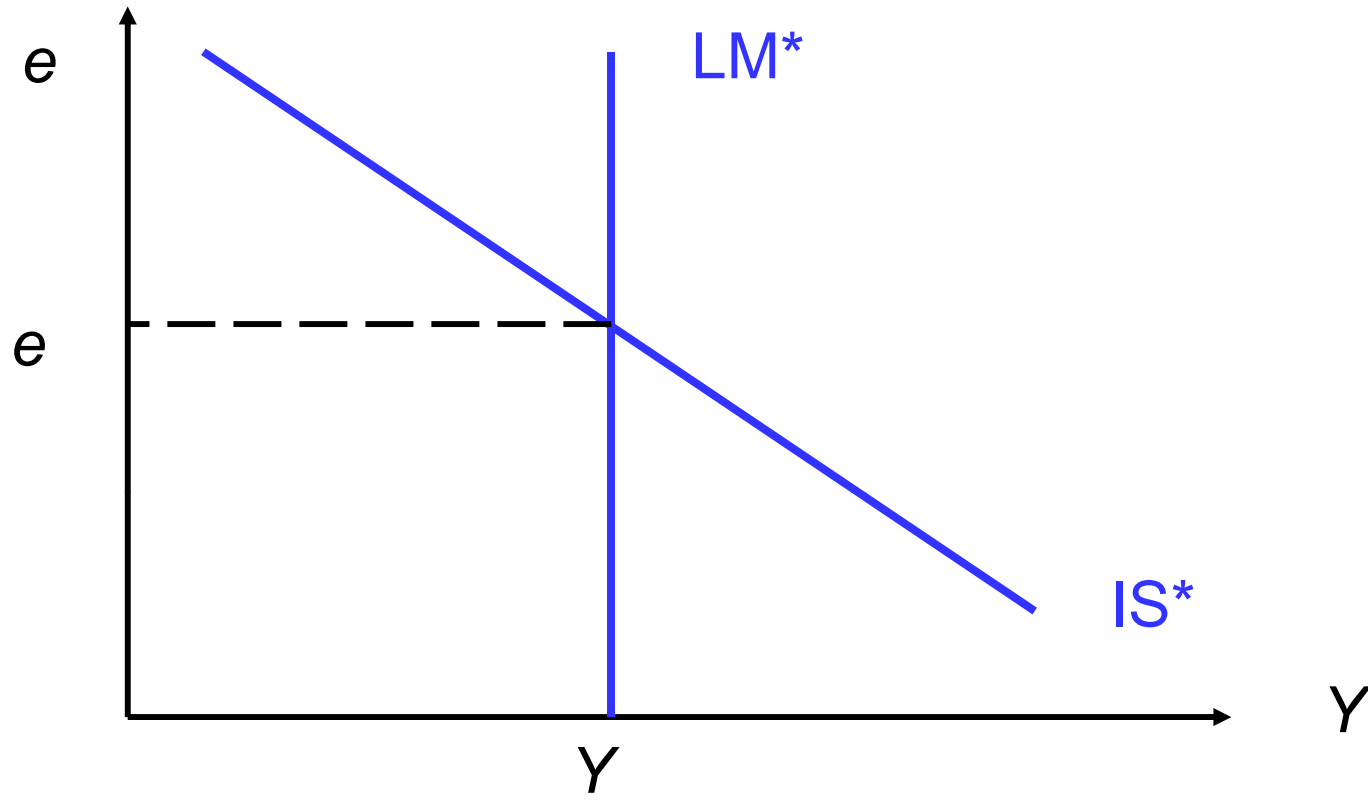
(c) **The complete model and the IS* and LM* curves.**

- The model has 2 equations in two “unknowns” or **endogenous** variables [Y, and e] :

$$\begin{aligned} [1] \quad Y &= C(Y - \bar{T}) + I(r^*) + \bar{G} + NX(e) && \rightarrow \text{IS* curve} \\ [2] \quad \bar{M}/\bar{P} &= L(r^*, Y) && \rightarrow \text{LM* curve} \end{aligned}$$

- The model can be depicted graphically in a diagram in which Y is on the horizontal axis and **the exchange rate [e]**, rather than the interest rate, is on the vertical axis.
- General equilibrium occurs when there is simultaneous equilibrium in the **goods** market, **money** market and **foreign exchange** market at the point of intersection of the IS* and LM* curves.

Fig. 12-3



□ **Def:** *The IS* curve joins all combinations of Y and e for which the goods market is in equilibrium [$Y = E$] for given values of G, T , and r^* .*

□ The IS* curve slopes **downwards** because:

$\uparrow e \rightarrow \uparrow \varepsilon \rightarrow \downarrow NX \rightarrow \downarrow E \rightarrow \downarrow Y$ to keep $Y = E$

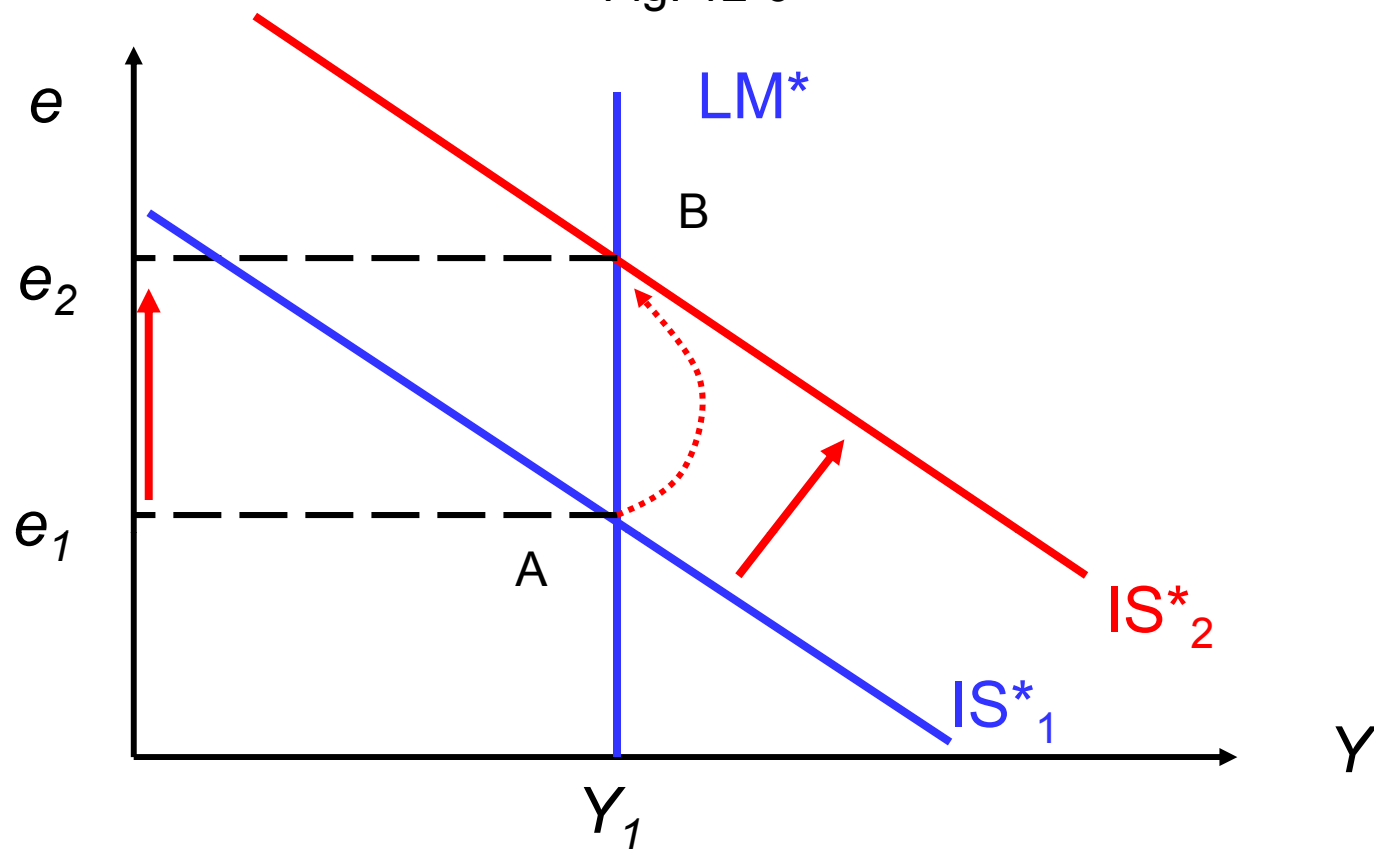
□ **Def:** *The LM* curve joins all combinations of Y and e for which there is money market equilibrium [$\bar{M}/\bar{P} = L(r^*, Y)$] for given values of \bar{M}/\bar{P} and r^* .*

□ The LM* curve is **vertical** because changes in the exchange rate [e] have **no** direct impact on either the demand or supply of money.

2. Fiscal policy in the small open economy with FLOATING exchange rate.

- Assume the economy is initially in equilibrium at point A where IS^*_1 intersects LM^* . $Y = Y_1$, and $e = e_1$.
- Then govt. adopts expansionary fiscal policy [$\uparrow G$].
- The IS^* curve shifts up/to right to IS^*_2 .
- The new equilibrium is at point B where:
 $Y = Y_1$ unchanged]; $e = e_2 > e_1$.

Fig. 12-6



□ Explanation:

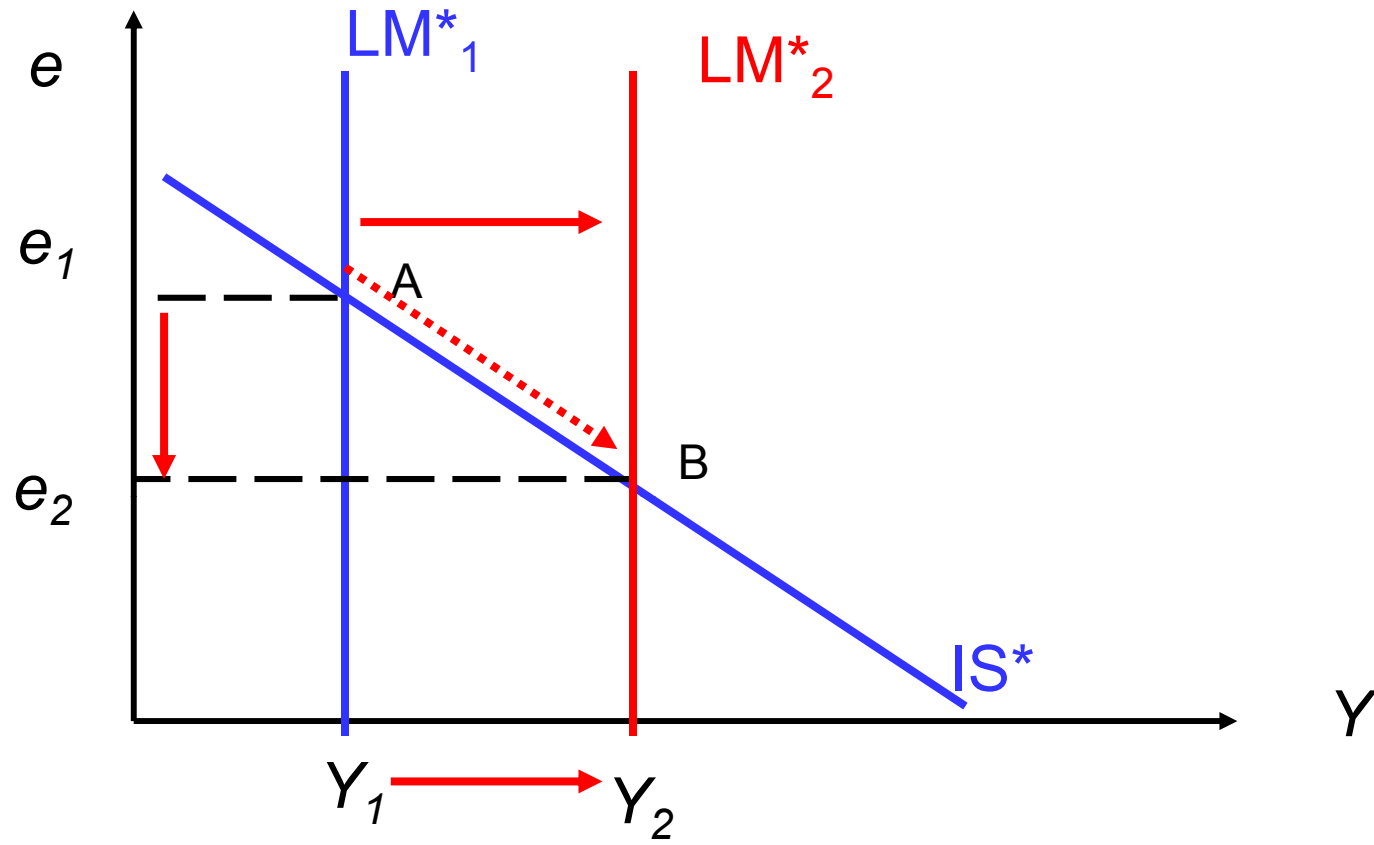
$\uparrow G \rightarrow \uparrow Y$
 $\rightarrow \uparrow r$
 $\rightarrow r > r^*$
 $\rightarrow D_{C\$} > S_{C\$}$
 $\rightarrow e \uparrow$
 $\rightarrow NX(e) \downarrow$
 $\rightarrow \downarrow Y$ until $Y = Y_1$
 $\rightarrow \downarrow r$ until $r = r^*$

□ **Conclusion: Under floating exchange rates, fiscal policy is ineffective.**

3. Monetary policy in the small open economy with **FLOATING** exchange rate.

- Assume the economy is initially in equilibrium at point A where IS^* intersects LM^*_1 . $Y = Y_1$, and $e = e_1$.
- Then govt. adopts expansionary monetary policy [$\uparrow \bar{M}$].
- The LM^* curve shifts right to LM^*_2 .
- The new equilibrium is at point B where:
$$Y = Y_2 > Y_1; \quad e = e_2 < e_1.$$

Fig. 12-7



□ Explanation:

$\uparrow \bar{M} \rightarrow \downarrow r$

$\rightarrow r < r^*$

$\rightarrow S_{C\$} > D_{C\$}$

$\rightarrow e \downarrow$

$\rightarrow NX(e) \uparrow$

$\rightarrow \uparrow Y$ until $Y = Y_2$

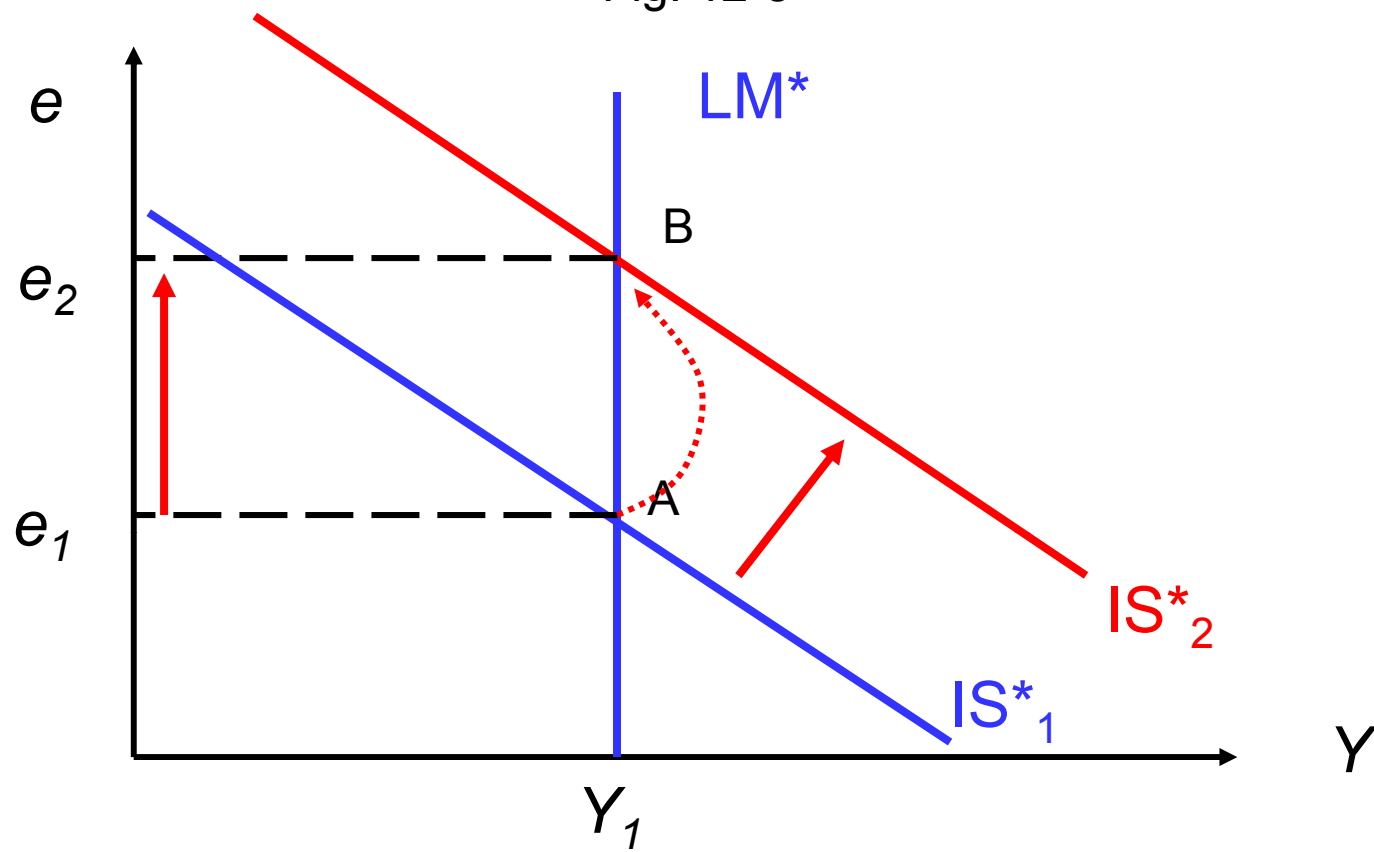
$\rightarrow \uparrow r$ until $r = r^*$

□ **Conclusion: Under floating exchange rates, monetary policy is effective.**

4. The effects of an exogenous increase in net exports in the small open economy with FLOATING exchange rate.

- Assume the economy is initially in equilibrium at point A where IS^*_1 intersects LM^* . $Y = Y_1$, $e = e_1$, and $NX = NX_1$.
- Then there is a sudden exogenous increase in net exports ($\uparrow NX$) due perhaps to a boom in foreign markets or the imposition of a domestic trade restriction which limits imports
- The IS^* curve shifts up/to right to IS^*_2 .
- The new equilibrium is at point B where:
 $Y = Y_1$ [unchanged]; $e = e_2 > e_1$; $NX = NX_1$ [unchanged].

Fig. 12-8



□ Explanation:

$\uparrow NX \rightarrow \uparrow Y$
 $\rightarrow \uparrow r$
 $\rightarrow r > r^*$
 $\rightarrow D_{C\$} > S_{C\$}$
 $\rightarrow e \uparrow$
 $\rightarrow NX(e) \downarrow$
 $\rightarrow \downarrow Y \text{ until } Y = Y_1$
 $\rightarrow \downarrow r \text{ until } r = r^*$

□ **Conclusion: Under floating exchange rates, an exogenous change in the demand for net exports simply changes the exchange rate with no change in the equilibrium values of NX or Y .**

II. The Mundell-Fleming model with FIXED exchange rate.

1. How fixed exchange rates work.

□ Under a fixed exchange rate system:

- the govt. specifies a fixed value of e [\bar{e}];
- the Bank of Canada stands ready to buy or sell unlimited amounts of Canadian \$ in the For. Exch. Mkt., thus keeping $D_{C\$} = S_{C\$}$ at $e = \bar{e}$.

- Bank of Canada (**B of C**) purchases or sales of C\$ on the For. Exch. Mkt. **change M** :
 - B of C **buys** C\$ on For. Exch. mkt. → **Canadian money supply decreases ($M\downarrow$)**;
 - B of C **sells** C\$ on For. Exch. mkt → **Canadian money supply increases ($M\uparrow$)**.

- Thus under **fixed** exchange rates the nominal money supply [M] is an **endogenous variable** whose value adjusts to ensure that the domestic interest rate equals the world interest rate ($r = r^*$) and, hence, the equilibrium value of e [determined where IS^* intersects LM^*] equals \bar{e} .

2. The structure of the model.

- The complete model consists of 2 equations in two “unknowns” or **endogenous** variables [Y , and M] :

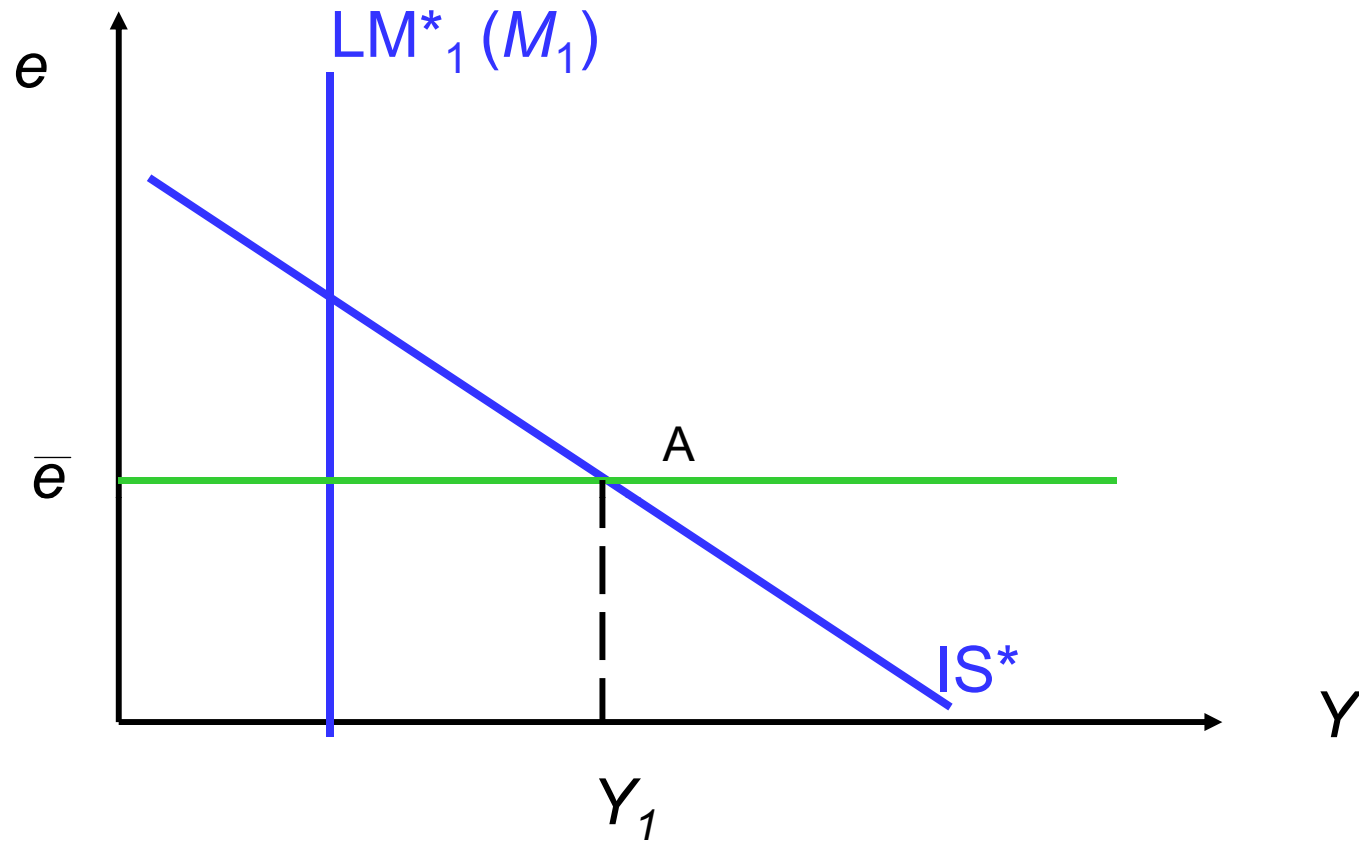
$$\begin{aligned} [1] \quad Y &= C(Y - \bar{T}) + I(r^*) + \bar{G} + NX(\bar{e}) && \rightarrow \text{IS}^* \text{ curve} \\ [2] \quad M/\bar{P} &= L(r^*, Y) && \rightarrow \text{LM}^* \text{ curve} \end{aligned}$$

- Equilibrium occurs when the IS* and LM* curves intersect at $e = \bar{e}$

3. The process of adjustment to IS*- LM* equilibrium under FIXED exchange rates.

- Suppose that the economy is at point A where the IS* curve is intersected by the horizontal $e = \bar{e}$ line. $Y = Y_1$.
- Initially, however, the money supply $(M/P)^s$ is **below** the level required to meet the demand for money at the world interest rate: $(M/P)^s < L(r^*, Y_1)$. In other words, the current LM* curve, denoted as LM^*_1 , lies to the **left** of the intersection of the IS* curve and the $e = \bar{e}$ line.

Fig. 12-10 (a)

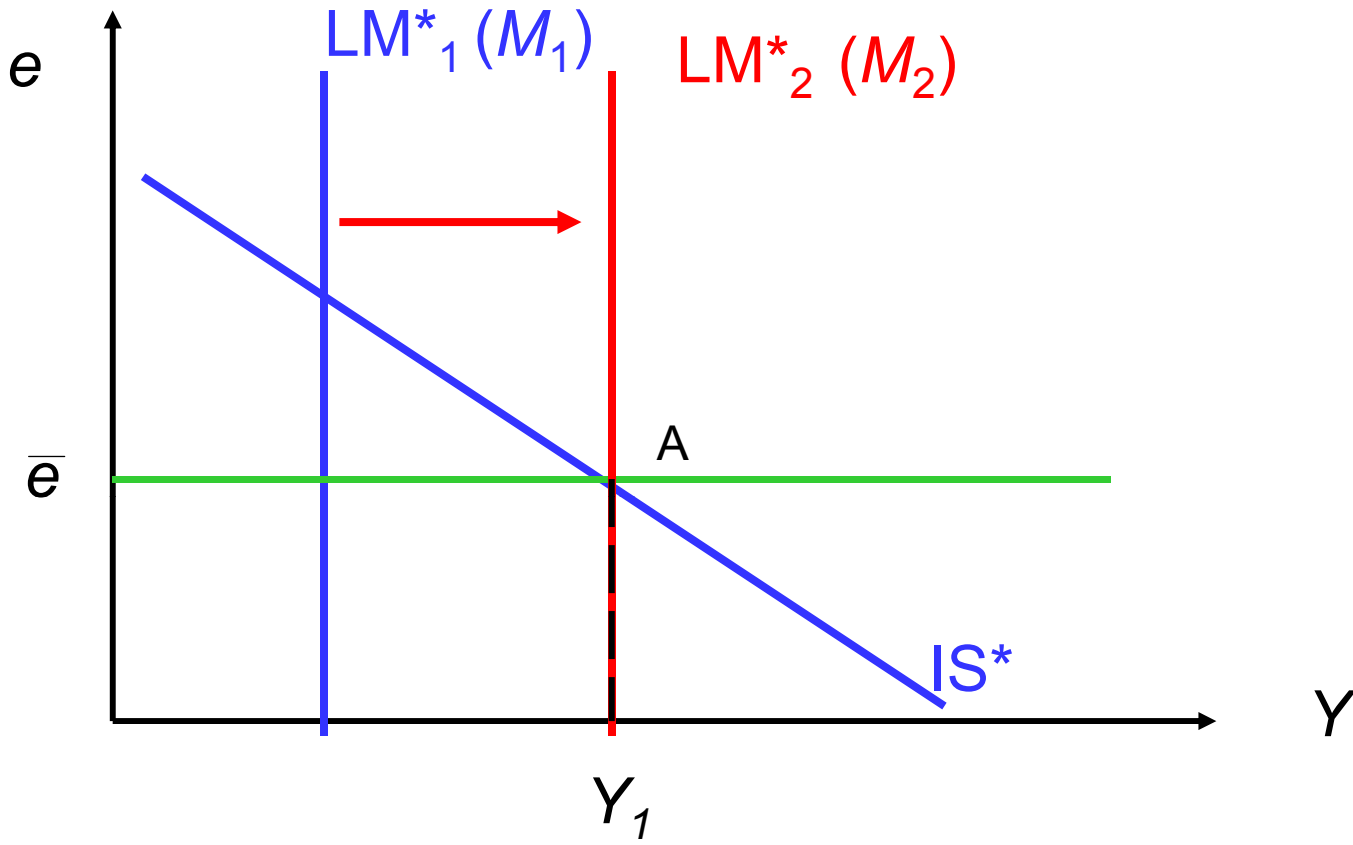


- **Excess demand for money** will cause the domestic interest rate to rise above the world level ($r > r^*$) producing an **excess demand for the domestic currency** on the foreign exchange market:
 $D_{C\$} > S_{C\$}$ at \bar{e} .
- To maintain the fixed exchange rate, the B of C must **sell C\$** on the foreign exchange market which then **increases the money supply ($\uparrow M$)**, **shifting the LM* curve to the right**.
- The process continues until $M = M_2$ where:

$$M_2 / \bar{P} = L(Y_1, r^*)$$

Equilibrium is reached when the LM* curve has shifted to LM*₂ which intersects IS* at $e = \bar{e}$.

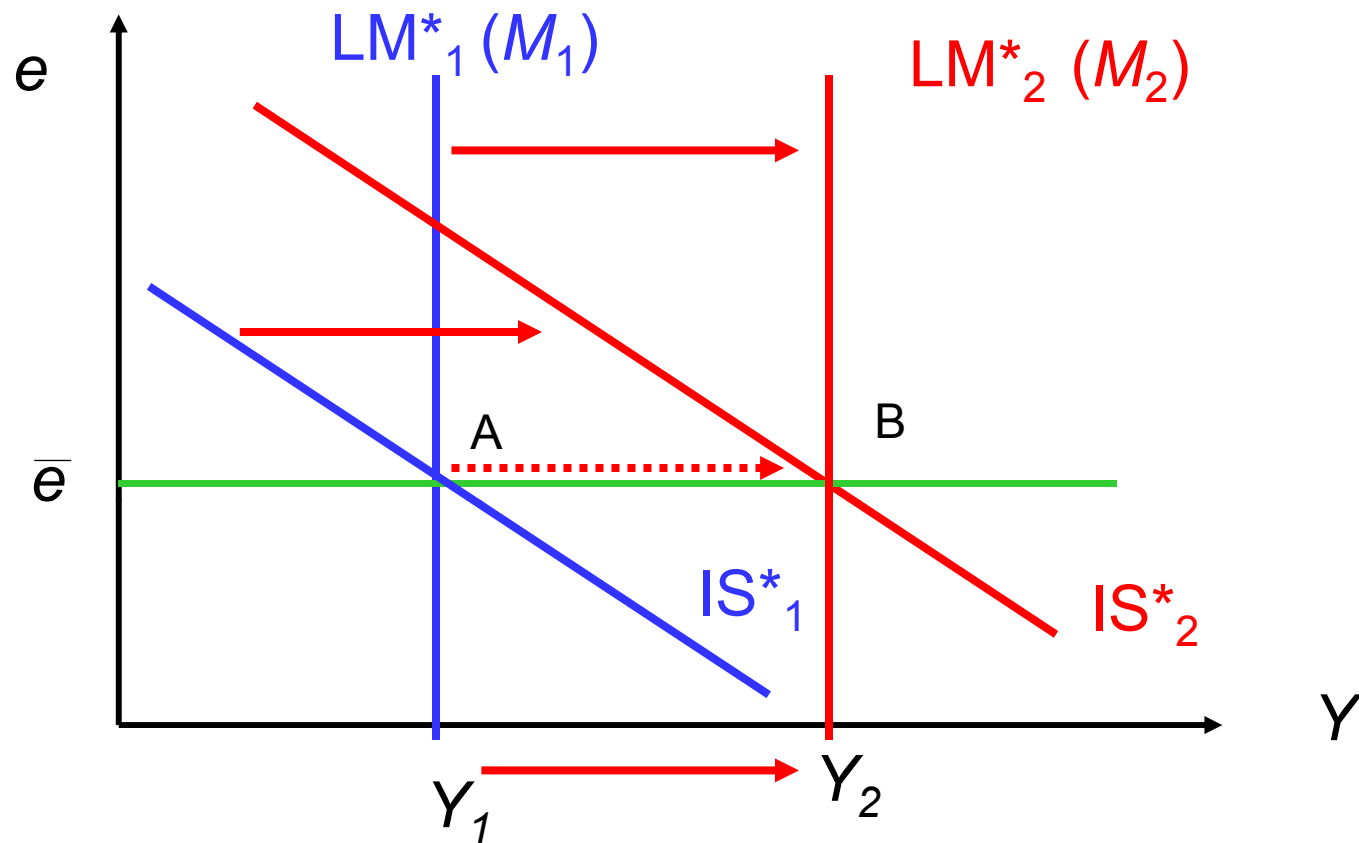
Fig. 12-10 (a)



4. Fiscal policy in the small open economy with FIXED exchange rate.

- Assume the economy is initially in equilibrium at point A where IS^*_1 intersects LM^*_1 . $Y = Y_1$, and $e = \bar{e}$.
- Then govt. adopts expansionary fiscal policy [$\uparrow G$].
- The IS^* curve shifts up/to right to IS^*_2 .
- The LM^* curve shifts right to LM^*_2 .
- The new equilibrium is at point B where:
 $Y = Y_2 > Y_1$; $e = \bar{e}$.

Fig. 12-11



□ Explanation:

$\uparrow G \rightarrow \uparrow Y$

$\rightarrow \uparrow r$

$\rightarrow r > r^*$

$\rightarrow D_{C\$} > S_{C\$}$ at \bar{e}

\rightarrow to prevent $e \uparrow$ B of C **sells C\$** on FX market

$\rightarrow \uparrow M$ and $(M/P) \uparrow$ (LM* shifts right)

$\rightarrow \downarrow r$ until $r = r^*$

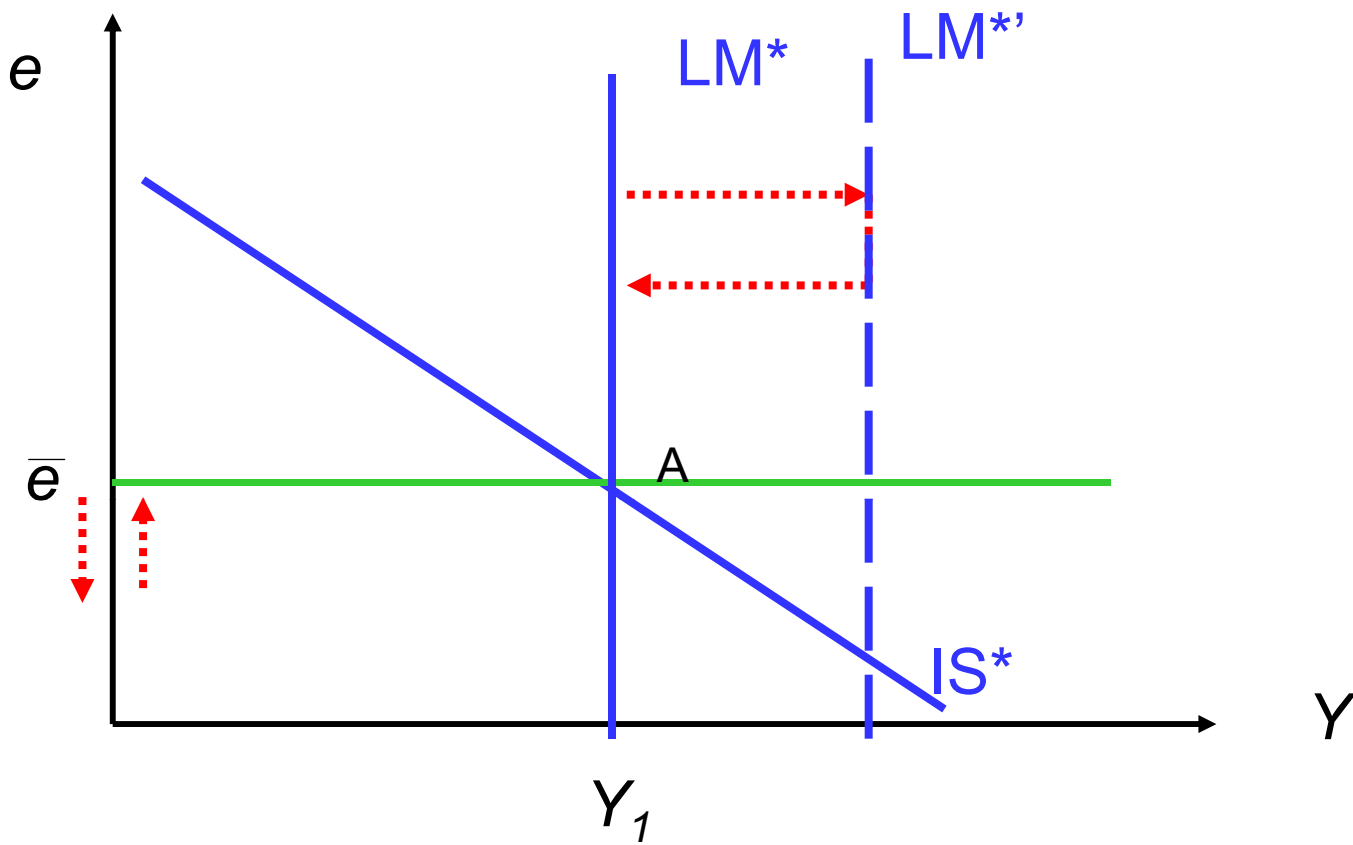
$\rightarrow D_{C\$} = S_{C\$}$ at \bar{e}

□ **Conclusion: Under fixed exchange rates, fiscal policy is effective.**

5. Monetary policy in the small open economy with FIXED exchange rate.

- ❑ Assume the economy is initially in equilibrium at point A where IS^* intersects LM^* . $Y = Y_1$, and $e = \bar{e}$.
- ❑ Then govt. adopts expansionary monetary policy [$\uparrow M$].
- ❑ The LM^* curve initially shifts right lowering equilibrium e below \bar{e} . But that results in B of C purchases of C\$ on the FX market which reduce M shifting LM^* back to the left to the original position.
- ❑ Equilibrium is restored at A where: $Y = Y_1$ [unchanged]; $e = \bar{e}$.

Fig. 12-12



□ Explanation:

$M \uparrow$ and $M/P \uparrow$ (LM* shifts right)

→ $\downarrow r$

→ $r < r^*$

→ $S_{C\$} > D_{C\$}$ at \bar{e}

→ to prevent $e \downarrow$ B of C **buys C\$** on FX market

→ $\downarrow M$ and $(M/P) \downarrow$ (LM* shifts left)

→ $\uparrow r$ until $r = r^*$

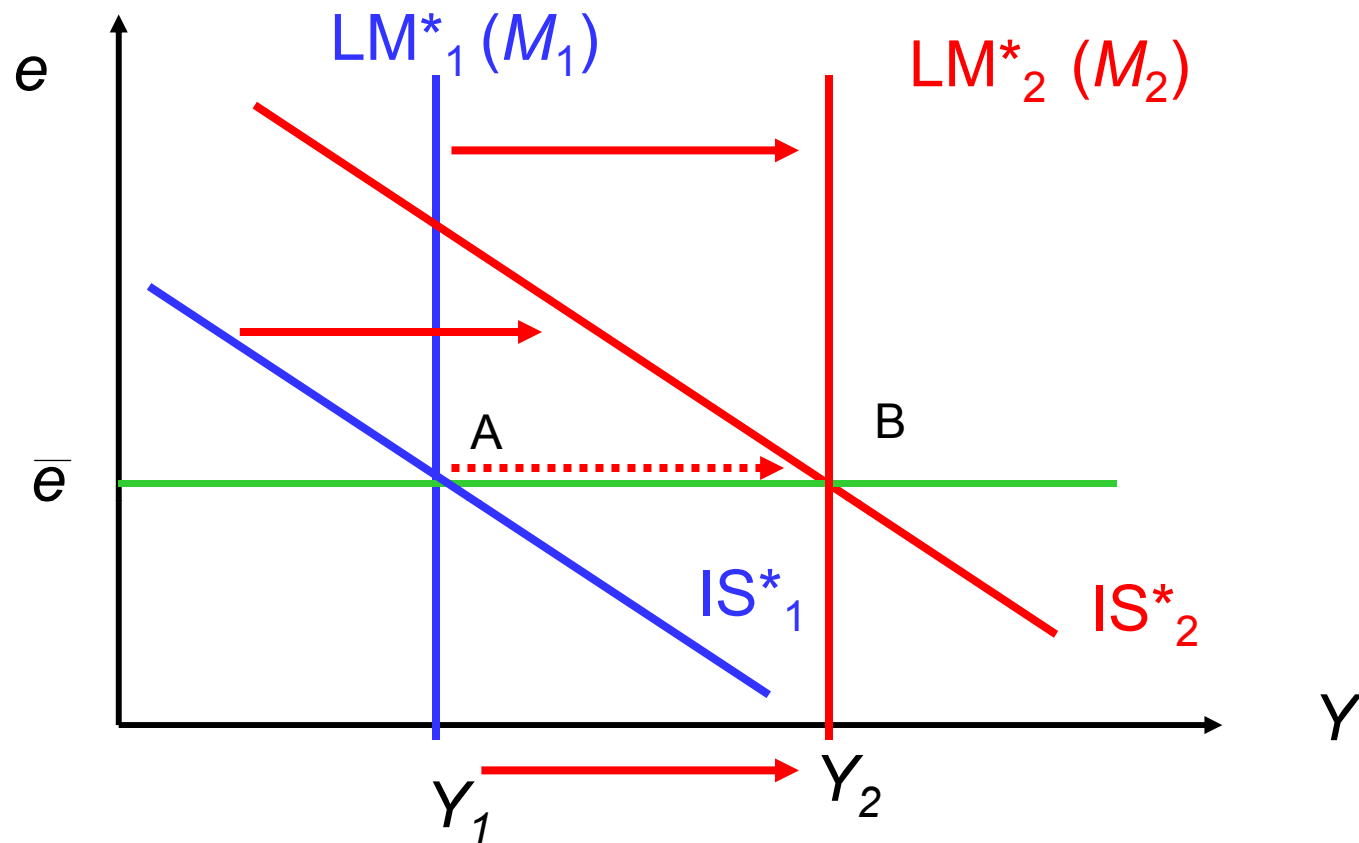
→ $D_{C\$} = S_{C\$}$ at \bar{e}

□ **Conclusion: Under fixed exchange rates, monetary policy is ineffective.**

6. The effects of an exogenous increase in net exports in a small open economy with FIXED exchange rate.

- Assume the economy is initially in equilibrium at point A where IS^*_1 intersects LM^*_1 . $Y = Y_1$, $NX = NX_1$ and $e = \bar{e}$.
- There is then a sudden exogenous increase in net exports [$\uparrow NX$] due perhaps to a boom in foreign markets or the imposition of domestic trade restrictions which limit imports
- The IS^* curve shifts up/to right to IS^*_2 .
- The LM^* curve shifts right to LM^*_2 .
- The new equilibrium is at point B where: $Y = Y_2 > Y_1$;
 $e = \bar{e}$; $NX = NX_2 > NX_1$.

Fig. 12-13



□ Explanation:

$\uparrow NX \rightarrow \uparrow Y$

$\rightarrow \uparrow r$

$\rightarrow r > r^*$

$\rightarrow D_{C\$} > S_{C\$}$ at \bar{e}

\rightarrow to prevent $e \uparrow$ B of C **sells C\$** on FX market

$\rightarrow \uparrow M$ and $(M/P) \uparrow$ (LM^* shifts right)

$\rightarrow \downarrow r$ until $r = r^*$

$\rightarrow D_{C\$} = S_{C\$}$ at \bar{e}

□ **Conclusion: Under fixed exchange rates an exogenous increase in net exports leads to an increase in equilibrium output and net exports.**

III. Exchange rate expectations, country risk, and currency crises under fixed exchange rates

1. Country risk and exchange rate risk

- The above analysis of the operation of a fixed exchange rate system implicitly assumed the absence of two factors:
 - **Country risk** - the perceived risk that borrowers in a particular country will **default** on payment of principal and/or interest on loans;
 - **Exchange rate risk** - the perceived risk that the current fixed exchange rate cannot be sustained and that a **devaluation** of the currency ($\downarrow \bar{e}$) will occur.

- When there is country risk and/or exchange rate risk, then foreign exchange market equilibrium will occur only when the **domestic interest rate exceeds the world interest rate by a *risk premium* (θ):**

$$r = r^* + \theta, \quad \theta > 0$$

2. The fixed exchange rate IS*-LM* model with country risk and/or exchange rate risk.

□ The two equations of the model are:

$$[1] \quad Y = C(Y - \bar{T}) + I(r^* + \theta) + \bar{G} + NX(\bar{e})$$

$$[2] \quad M/\bar{P} = L(r^* + \theta, Y)$$

□ The equilibrium levels of Y and r are now determined, in part, by the **size of the risk premium (θ)**.

3. The effects of an increase in risk ($\uparrow \theta$)

- Consider a small open economy operating with fixed exchange rates. Assume that initially there is no perceived country risk or exchange rate risk: $\theta = 0$, and $r = r^*$.
- The economy is initially in equilibrium where:
$$Y = Y_1, \quad e = \bar{e}, \quad \text{and} \quad r = r_1 = r^*.$$
- Then internal political turmoil leads to fears that the country may default on its debts and may have to devalue its currency ($\downarrow \bar{e}$). **There is a significant increase in the risk premium ($\uparrow \theta$).**

- The consequences are as follows:
 - The **domestic interest rate is initially too low** to compensate for this significant increase in risk [$r_1 < r^* + \theta$] and foreigners sell domestic securities (and domestic currency) leading to a significant **excess supply of the domestic currency** at the fixed exchange rate [$D_{C\$} < S_{C\$}$ at \bar{e}].
 - To keep $e = \bar{e}$, the **govt. has to buy domestic currency** using its foreign exchange reserves which thus **lowers the domestic money supply** and **raises the domestic interest rate ($\uparrow r$)** until $r = r_2 = r^* + \theta$.

- Higher domestic interest rates **reduce investment spending ($\downarrow I$) and output ($\downarrow Y$) with output decreasing to $Y_2 < Y_1$.**

4. Increases in risk, speculative attacks, and currency crises

- In reality, the increase in country risk and/or exchange rate risk may be so great that the rise in domestic interest rates required to compensate for it cannot be sustained.
- As a consequence, to maintain the fixed exchange rate the country has to continuously sell its foreign exchange reserves to support the domestic currency until such reserves are exhausted and either devaluation ($\downarrow \bar{e}$) or abandonment of the fixed exchange rate regime in favour of a floating exchange rate become the only options.

- This was the experience of Mexico in 1994-5 and a number of East Asian countries (notably Thailand and Indonesia) in 1997-98.

5. International Financial Crisis: Mexico 1994-5

- ❑ In August 1994, a Mexican peso was worth 30 US cents. A year later it was worth only 16 US cents.
- ❑ In 1994 negative internal political developments in Mexico (a violent uprising in the Chiapas region and the assassination of a leading presidential candidate) scared investors and led to an increase in the country risk premium which increased the supply of Mexican pesos on the foreign exchange market and reduced the demand for the Mexican pesos leading to an **excess supply** of Mexican pesos at the current fixed exchange rate.

- A second factor contributing to an excess supply of pesos was the **overvaluation of the peso**: the inflation rate in Mexico was significantly higher than in the US and Mexican goods were more expensive than US goods (after taking the exchange rate into account).

- The third reason for excess supply of pesos is that investors sensed that the current fixed exchange rate was **not sustainable** (because Mexico's reserves of foreign currency were too small to maintain a fixed exchange rate) and the currency might be devalued. This led to an increase in the exchange rate risk premium.

- ❑ To avoid depreciation the Mexican central bank (Banco de Mexico) had to **intervene** on the foreign exchange market by increasing the demand for pesos by **buying pesos and selling its foreign exchange reserves**.

- ❑ After a large loss of reserves, on December 20 1994, the government gave up and **devalued** the peso by 15%.

- ❑ But devaluation made investors even more distrustful of Mexican policy makers. The risk premium rose again as did interest rates. The stock market plummeted and it appeared that the Mexican govt. might default on its debt.
- ❑ The US govt. and the International Monetary Fund (IMF) stepped in to provide loan guarantees to the Mexican govt. The Banco de Mexico switched to a **flexible exchange rate**.

IV. Should exchange rates be floating or fixed?

1. The history:

- ❑ until 1973- fixed exchange rates in OECD, except for Canada;
- ❑ after 1973- most industrialised countries adopted flexible rates; most emerging economies had fixed rates;
- ❑ since 1998 - emerging economies started switching to flexible rates;
- ❑ in 1999, 11 European countries formed a *monetary union* - the most extreme form of fixed exchange rates - and adopted a common currency, the **euro**. Monetary policy in the EMU (European Monetary Union) is the responsibility of the European Central Bank (ECB).

2. The advantages of floating rates:

- ❑ Flexible rates allow **independent control of monetary policy** to pursue goals of stable output and low inflation;
- ❑ Prevents **shocks to IS* curve** (i.e shifts in IS*) from affecting output and employment;
- ❑ Avoids the problem of choice of “too high” or “too low” an exchange rate - an **“overvaluation”** or **“undervaluation”** of the currency. [See case study on Chinese yuan below];
- ❑ **Avoids currency crises** which can occur when there is a widespread expectation of a future devaluation leading to a ***speculative attack*** on the currency.

3. The advantages of fixed exchange rates:

- ❑ **predictable exchange rates** reduce foreign trade risk and increase trade;
- ❑ **reduced foreign exchange rate risk** encourages international borrowing and lending;
- ❑ fixed exchange rates **impose discipline on monetary policy** and prevent excessive monetary expansion.

4. The Chinese currency controversy

- From 1995 to 2005 the Chinese currency – the yuan – was pegged to the US dollar at an exchange rate of 8.28 yuan per US\$.
- This fixed exchange rate policy was combined with restrictions on international capital flows which prevented Chinese citizens from converting their yuan into US\$ or euros to invest abroad.

- ❑ By the early 2000s it was evident that the yuan was significantly *undervalued*. There was an excess demand for yuan and to keep the yuan at its pegged value Chinese central bank had to supply yuan and buy US dollars, thus accumulating large dollar reserves.
- ❑ The pegged yuan became a political issue in the US, with calls from US politicians to let the yuan float and threats to impose tariffs on cheap Chinese imports.
- ❑ In 2005 China announced a move in the direction of a floating exchange rate – a “managed” float rather than a “pure” float. Since then the yuan has appreciated by about 17% against the US dollar but the value of the yuan is still a matter of controversy in some US political circles.