PART 5 The Open Economy

This chapter:

- Balance of Payments Accounting
- Savings and Investment in the Open Economy
- Determination of the Trade Balance and the Exchange Rate
- Mundell Fleming model
- Exchange Rate Regimes
Mundell Fleming

**Mundell-Fleming model** is IS-LM for the small open economy

First, focus on the short run, i.e. $P$ is fixed.

Second, focus on the long run, i.e. $P$ adjusts.

Macroeconomic policies and the choice of exchange rate regimes
**IS Curve**

Key assumption: Small open economy with perfect capital mobility.

\[ r = r^w \]

Goods market equilibrium: in a **closed economy** we had:

\[ Y = C^a(r) + MPC \times (Y - \bar{T}) + I(r) + \bar{G} \]
IS Curve

Key assumption: Small open economy with perfect capital mobility.

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Goods market equilibrium: in a closed economy we had:

\[ Y = C^a(r) + MPC \times (Y - \bar{T}) + I(r) + \bar{G} \]

Now, in an open economy:

\[ Y = C^a(r^w) + MPC \times (Y - \bar{T}) + I(r^w) + \bar{G} + NX(e) \]

where \( e \) is the nominal exchange rate (euros per dollar).

In \((Y,e)\)-space, the open economy IS-curve is downward sloping.

Note, since in the short run \( P \) is fixed, \( \epsilon \) and \( e \) will move in tandem, so we can write \( NX(e) \).
The Slope of the IS-Curve

\[ Y = \frac{1}{1 - MPC} \left( C^a(r^w) - MPC \times \bar{T} + I(r^w) + \bar{G} + NX(\bar{e}) \right) \]
The Slope of the IS-Curve

\[ Y = \frac{1}{1-MPC} \left( C^a(r^w) - MPC \times T + I(r^w) + G + NX(e) \right) \]

Taking the total differential of this expression:

\[ dY = -\frac{C^a}{1-MPC} dr^w - \frac{MPC}{1-MPC} dT - \frac{l_r}{1-MPC} dr^w + \frac{1}{1-MPC} dG - \frac{NX_e}{1-MPC} de \]

Notation: \( C^a_r = -\frac{\partial C^a}{\partial r} > 0 \), \( l_r = -\frac{\partial l}{\partial r} > 0 \), \( NX_e = -\frac{\partial NX}{\partial e} > 0 \)
The Slope of the IS-Curve

\[ Y = \frac{1}{1 - MPC} \left( C^a(r^-w) - MPC \times \bar{T} + I(r^-w) + \bar{G} + NX(e) \right) \]

Taking the total differential of this expression:

\[ dY = -\frac{C^a}{1 - MPC} dr^w - \frac{MPC}{1 - MPC} dT - \frac{l_r}{1 - MPC} dr^w + \frac{1}{1 - MPC} dG - \frac{NX_e}{1 - MPC} de \]

Notation:  \( C^a_r = -\frac{\partial C^a}{\partial r} > 0, \ l_r = -\frac{\partial I}{\partial r} > 0, \ NX_e = -\frac{\partial NX}{\partial e} > 0 \)

We can use this to obtain the slope of the IS-curve in \((Y,e)\)-space by setting all infinitesimals to zero except \(de\) and \(dY\):

\[ \frac{\partial e}{\partial Y}|_{IS} = -\frac{1 - MPC}{NX_e} < 0 \]
Shifts in the IS-Curve

$$dY = -\frac{C^a_r}{1 - \text{MPC}} dr^w - \frac{\text{MPC}}{1 - \text{MPC}} dT - \frac{l_r}{1 - \text{MPC}} dr^w + \frac{1}{1 - \text{MPC}} dG - \frac{NX_e}{1 - \text{MPC}} de$$

Any factor that shifts the closed-economy IS curve (such as $T$ and $G$) shifts the open-economy IS curve in the same way.

An increase in $r^w$ shifts the IS curve to the left.

Factors that increase net exports shift the IS curve to the right, e.g. increase in world demand for export goods.
The LM-Curve

Equating the supply and demand for real money balances in the open economy, i.e.

\[ m \equiv \frac{M}{P} = L(Y, r^w + \pi^e) \]

The exchange rate \( e \) does not enter the LM equation.

The LM curve is in \((Y,e)\)-space is vertical.
(a) The *LM* Curve

1. The money market equilibrium condition ...

2. ... and the world interest rate ...

(b) The *LM* Curve

3. ... determine the level of income.
Shifts in the LM-Curve

As before,

$$dm = L_y dY - L_r dr^w - L_r d\pi^e$$

Expansionary monetary policy shifts LM to the right

$$\frac{\partial Y}{\partial M}|_{LM} = \frac{1}{PL_y} > 0$$

Increases in expected inflation shifts LM to the right

$$\frac{\partial Y}{\partial \pi^e}|_{LM} = \frac{L_r}{L_y} > 0$$
The Mundell Fleming model

The **short-run equilibrium** (i.e. keeping $P$ fixed) in the Mundell Fleming model is the combination of $e$ and $Y$ that simultaneously satisfies the equilibrium conditions in the goods and money markets.
Exchange Rate Regimes

- In a system of **floating exchange rates**, $e$ is allowed to fluctuate in response to changing economic conditions.

- Under **fixed exchange rates**, the central bank trades domestic for foreign currency at a predetermined price.

The exchange rate regime is very important for determining the impact of changes in policy and other factors.
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Exchange rate regimes across the world:

- **Hard peg**: currency boards or no separate currency
- **Soft pegs**: conventional fixed pegs, crawling pegs, horizontal bands, crawling bands
- **Floating**
Figure 1. All Countries: Exchange Rate Regimes, 1991 and 1999

Source: IMF

Note: The number of countries is in parenthesis.
Figure 3. Developed and Emerging Markets Countries: Exchange Rate Regimes, 1991 and 1999

Source: IMF
Note: The number of countries is in parenthesis.

<table>
<thead>
<tr>
<th>Exchange Rate Regime</th>
<th>1991 (%)</th>
<th>1999 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Peg</td>
<td>5% (3)</td>
<td>25% (14)</td>
</tr>
<tr>
<td>Intermediate</td>
<td>65% (36)</td>
<td>27% (15)</td>
</tr>
<tr>
<td>Float</td>
<td>29% (16)</td>
<td>47% (26)</td>
</tr>
</tbody>
</table>

Source: IMF
Policy Analysis with Floating Exchange Rates

**Fiscal expansion** (\( G \uparrow \) or \( T \downarrow \))
- the IS curve shifts to the right
- \( e \uparrow \): exchange rate appreciation reduces net exports
- \( \Delta Y = 0 \): no effect on output

**Crowding out:**
- Closed economy: Fiscal policy crowds out investment by causing the interest rate to rise.
- Small open economy: Fiscal policy crowds out net exports by causing the exchange rate to appreciate
1. Expansionary fiscal policy shifts the IS* curve to the right, ...

2. ... which raises the exchange rate ...

3. ... and leaves income unchanged.
Policy Analysis with Floating Exchange Rates

**Monetary expansion** (\( M \uparrow \))

- the LM curve shifts to the right
- \( e \downarrow \): exchange rate depreciation increases net exports
- \( Y \uparrow \): output increases

**Transmission of monetary policy:**

- Closed economy: decrease in interest rate stimulates investment and consumption
- Small open economy: currency depreciation stimulates net exports by shifting demand from foreign to domestic products
1. A monetary expansion shifts the LM* curve to the right, ...

2. ... which lowers the exchange rate ...

3. ... and raises income.
Policy Analysis with Floating Exchange Rates

**Trade Policy** Consider a tariff or quota that reduces imports, and therefore increases $NX$:

- the IS curve shifts to the right
- $e \uparrow$: exchange rate appreciation reduces net exports
- $\Delta Y = 0$: no effect on output
Policy Analysis with Floating Exchange Rates

**Trade Policy** Consider a tariff or quota that reduces imports, and therefore increases $NX$

- the IS curve shifts to the right
- $e \uparrow$: exchange rate appreciation reduces net exports
- $\Delta Y = 0$: no effect on output

Because of crowding out (in), protectionist policies (free trade agreements) have no impact on output.
Import restrictions on specific products save jobs in the domestic industries that produce those products, but destroy jobs in export-producing sectors.

Import restrictions cannot reduce a trade deficit!!

Nevertheless, they reduce the volume of trade and less trade means fewer gains from trade.
Policy Analysis with Fixed Exchange Rates

- Under **fixed exchange rates**, the central bank stands ready to buy or sell the domestic currency for foreign currency at a predetermined rate.
- In the Mundell-Fleming model, the central bank shifts the LM curve as required to keep $e$ at its preannounced rate.
- This system fixes the nominal exchange rate.
- In the long run, when prices are flexible, the real exchange rate can move even if the nominal rate is fixed.
Policy Analysis with Fixed Exchange Rates

Fiscal expansion (\(G \uparrow\) or \(T \downarrow\))
- the IS curve shifts to the right
- the LM curve shifts to the right such that \(\Delta e = 0\)
- \(Y \uparrow\): output increases

In sharp contrast to the floating regime, fiscal policies are very effective under a fixed exchange rate regime.
1. With a fixed exchange rate ...

2. ... a fiscal expansion shifts the IS* curve to the right, ...

3. ... which induces a shift in the LM* curve ...

4. ... and raises income.
Policy Analysis with Fixed Exchange Rates

**Monetary expansion ( \( M \uparrow \))**

- the LM curve shifts to the right
- the LM curve shifts back to the left such that \( \Delta e = 0 \)
- \( \Delta Y = 0 \): no effect on output

In sharp contrast to the floating regime, monetary policies cannot be used to affect output under a fixed exchange rate regime.
Exchange rate, $e$

Fixed exchange rate

$LM^*$

$IS^*$

Income, output, $Y$
**Trade Policy** Consider a tariff or quota that reduces imports, and therefore increases $NX$

- the IS curve shifts to the right
- the LM curve shifts to the right such that $\Delta e = 0$
- $Y \uparrow$: output increases

In sharp contrast to the floating regime, import restrictions increase $Y$ and $NX$ under fixed exchange rates.
Summary of Results for the Short-Run

<table>
<thead>
<tr>
<th>Policy</th>
<th>Floating</th>
<th></th>
<th>Fixed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$Y$</td>
<td>$e$</td>
<td>$NX$</td>
<td>$Y$</td>
</tr>
<tr>
<td>Fiscal expansion</td>
<td>0</td>
<td>$\uparrow$</td>
<td>$\downarrow$</td>
<td>$\uparrow$</td>
</tr>
<tr>
<td>Monetary expansion</td>
<td>$\uparrow$</td>
<td>$\downarrow$</td>
<td>$\uparrow$</td>
<td>0</td>
</tr>
<tr>
<td>Import restriction</td>
<td>0</td>
<td>$\uparrow$</td>
<td>0</td>
<td>$\uparrow$</td>
</tr>
</tbody>
</table>

*Note:* This table shows the direction of impact of various economic policies on income $Y$, the exchange rate $e$, and the trade balance $NX$. A “$\uparrow$” indicates that the variable increases; a “$\downarrow$” indicates that it decreases; a “0” indicates no effect. Remember that the exchange rate is defined as the amount of foreign currency per unit of domestic currency (for example, 100 yen per dollar).
Fixed or Floating?

**Advantages of floating:**

- Allows monetary policy to be used to pursue other goals (stable growth, low inflation)
Fixed or Floating?

**Advantages of floating:**
- Allows monetary policy to be used to pursue other goals (stable growth, low inflation)

**Advantages of fixing:**
- disciplines monetary policy to prevent excessive money growth and hyperinflation
- avoids uncertainty and volatility, making international transactions easier

In practice, all central banks are concerned about the stability of exchange rates.
The Impossible Trinity

Free capital flows

Option 1 (United States)

Option 2 (Hong Kong)

Option 3 (China)

Independent monetary policy

Fixed exchange rate
Mundell-Fleming with $P$ adjusting

So far in Mundell-Fleming model, $P$ has been fixed.

If $P$ can adjust, now we need to reformulate exports as a function of the real exchange rate:

$$Y = C^a(r^w) + MPC \times (Y - \bar{T}) + I(r^w) + \bar{G} + NX \left( \frac{eP}{P^*} \right) \quad \text{(IS)}$$

$$\frac{M}{P} = L(Y, r^w + \pi^e) \quad \text{(LM)}$$

In the small open economy AD curve is downward sloping in $P$
The Slope of the AD-Curve Analytically

Under floating exchange rates,

\[ dY = - \left( \frac{C^a_r + I_r}{1 - MPC} \right) dr^w - \frac{MPC}{1 - MPC} dT + \frac{1}{1 - MPC} dG - \frac{NX\epsilon}{1 - MPC} (de + dP - dP^*) \] (IS)

\[ dm = \frac{dM}{P} - m \frac{dP}{P} = L_Y dY - L_r dr^w - L_r d\pi^e \] (LM)

Notation: \( NX\epsilon = - \frac{\partial NX}{\partial \epsilon} > 0 \)
The Slope of the AD-Curve Analytically

Under floating exchange rates,

\[
dY = -\left[ \frac{C_r + I_r}{1 - MPC} \right] dr^w - \frac{MPC}{1 - MPC} dT
\]

\[
+ \frac{1}{1 - MPC} dG - \frac{NX_\epsilon}{1 - MPC} (de + dP - dP^*) \quad \text{(IS)}
\]

\[
dm = \frac{dM}{P} - m \frac{dP}{P} = L_y dY - L_r dr^w - L_r d\pi^e \quad \text{(LM)}
\]

Notation: \(NX_\epsilon = -\frac{\partial NX}{\partial \epsilon} > 0\)

We can find the slope of the AD-curve in \((Y,P)\)-space from the LM curve by setting all infinitesimals to zero except \(dY\) and \(dP\) and solve for \(dY/dP\):

\[
\frac{dY}{dP} \mid_{AD} = -\frac{m}{PL_y} < 0
\]

Aggregate demand is only determined by the LM curve.
The Slope of the AD-Curve Analytically

Under **fixed exchange rates**,

\[ dY = - \left( \frac{C^a_r + I_r}{1 - MPC} \right) dr^w - \frac{MPC}{1 - MPC} dT \]

\[ + \frac{1}{1 - MPC} dG - \frac{NX_\epsilon}{1 - MPC} (dP - dP^*) \]  \hspace{1cm} \text{(IS)}

\[ M = \text{whatever ensures that } de = 0 \]  \hspace{1cm} \text{(LM)}
The Slope of the AD-Curve Analytically

Under **fixed exchange rates**,

\[
dY = - \left[ \frac{C_a + I_r}{1 - MPC} \right] dr^w - \frac{MPC}{1 - MPC} dT \\
+ \frac{1}{1 - MPC} dG - \frac{NX_\epsilon}{1 - MPC} (dP - dP^*) \tag{IS}
\]

\[
M = \text{whatever ensures that } de=0 \tag{LM}
\]

We can find the slope of the AD-curve in (Y,P)-space from the IS-curve by setting all infinitesimals to zero except \(dY\) and \(dP\) and solve for \(dY/dP\):

\[
\left. \frac{dY}{dP} \right|_{AD} = - \frac{NX_\epsilon}{1 - MPC} < 0
\]

Aggregate demand is only determined by the IS curve.
AD-AS in the open economy

Note:

- Short run equilibrium: \( AD = SRAS \), but what shifts the AD curve depends on the exchange rate regime.
AD-AS in the open economy

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- Long run equilibrium $Y$ is determined by the LRAS curve only (as in a closed economy).
AD-AS in the open economy

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- Long run equilibrium \( Y \) is determined by the LRAS curve only (as in a closed economy).
- Long run equilibrium \( P \) is determined by the LM curve only (as in a closed economy) under floating \( e \).
AD-AS in the open economy

Note:

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AD-AS in the open economy

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- Long run equilibrium \( P \) is determined by the LM curve only (as in a closed economy) under floating \( e \).
- Long run equilibrium \( P \) is determined by the IS curve only under fixed \( e \).
- IS-LM determines the equilibrium real exchange rate.
AD-AS in the open economy

Note:

• Short run equilibrium: \( AD = SRAS \), but what shifts the AD curve depends on the exchange rate regime.
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• Long run equilibrium \( P \) is determined by the LM curve only (as in a closed economy) under floating \( e \).
• Long run equilibrium \( P \) is determined by the IS curve only under fixed \( e \).
• IS-LM determines the equilibrium real exchange rate.
• PPP can be obtained in the long run by changes in international trade patterns (exports) through shifts in the IS curve.