6 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
US Imports and Exports as % of GDP
Imports and Exports as % of GDP in 2004

Percentage of GDP

Canada
France
Germany
Italy
Japan
U.K.
U.S.

Imports
Exports
Net Exports

In an open economy, spending by residents does not equal output:

\[ C = C^d + C^f \]
\[ I = I^d + I^f \]
\[ G = G^d + G^f \]

superscripts: \( d \) spending on domestic goods, \( f \) spending on foreign goods

\( C^d + I^d + G^d \) is called **absorption**.

\[ EX = \text{exports} = \text{foreign spending on domestic goods} \]
\[ IM = \text{imports} = C^f + I^f + G^f = \text{spending on foreign goods} \]
\[ NX = \text{net exports or the “trade balance”} = EX - IM \]
Net Exports

\[ Y = C^d + I^d + G^d + EX \]
\[ = (C - C^f) + (I - I^f) + (G - G^f) + EX \]
\[ = C + I + G + EX - (C^f - I^f - G^f) \]
\[ = C + I + G + EX - IM \]
\[ = C + I + G + NX \]

\[ \Leftrightarrow \quad NX = Y - (C + I + G) \]

- **Trade Surplus**, \( NX > 0 \): output > spending, and exports > imports
- **Trade Deficit**, \( NX < 0 \): output < spending, and exports < imports
US Net Exports/GDP ratio

Shaded areas indicate US recessions - 2015 research.stlouisfed.org
BoP: Current Account

In an open economy, saving must not equal investment:

\[ NX = Y - (C + I + G) \]

\[ NX + NFP = (Y + NFP - C - G) - I \]

\[ NX + NFP = (GNP - C - G) - I = S - I \]

= net outflow of loanable funds
= net purchases of foreign assets
= current account, CA

- When \( CA > 0 \), country is a net lender
- When \( CA < 0 \), country is a net borrower
US Current Account
### Current Account

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net exports of goods and services ((\text{NX}))</td>
<td>−560.0</td>
</tr>
<tr>
<td>Exports of goods and services</td>
<td>2105.1</td>
</tr>
<tr>
<td>Goods</td>
<td>1497.4</td>
</tr>
<tr>
<td>Services</td>
<td>607.7</td>
</tr>
<tr>
<td>Imports of goods and services</td>
<td>−2665.0</td>
</tr>
<tr>
<td>Goods</td>
<td>−2235.7</td>
</tr>
<tr>
<td>Services</td>
<td>−429.3</td>
</tr>
<tr>
<td><strong>Net income from abroad ((\text{NFP}))</strong></td>
<td>221.1</td>
</tr>
<tr>
<td>Income receipts from abroad</td>
<td>738.7</td>
</tr>
<tr>
<td>Income payments to residents of other countries</td>
<td>−517.7</td>
</tr>
<tr>
<td><strong>Net unilateral transfers</strong></td>
<td>−134.6</td>
</tr>
<tr>
<td><strong>Current Account Balance ((\text{CA}))</strong></td>
<td>−473.4</td>
</tr>
</tbody>
</table>

### Capital and Financial Account

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capital Account</strong></td>
<td></td>
</tr>
<tr>
<td>Net capital account transactions</td>
<td>−1.2</td>
</tr>
<tr>
<td><strong>Financial Account</strong></td>
<td></td>
</tr>
<tr>
<td>Net financial flows</td>
<td>387.3</td>
</tr>
<tr>
<td>Increase in U.S.-owned assets abroad (financial outflow)</td>
<td>−396.4</td>
</tr>
<tr>
<td>U.S. official reserve assets</td>
<td>−15.9</td>
</tr>
<tr>
<td>Other U.S.-owned assets abroad</td>
<td>−380.5</td>
</tr>
<tr>
<td>Increase in foreign-owned assets in U.S. (financial inflow)</td>
<td>783.7</td>
</tr>
<tr>
<td>Foreign official assets</td>
<td>164.8</td>
</tr>
<tr>
<td>Other foreign-owned assets</td>
<td>618.9</td>
</tr>
<tr>
<td><strong>Financial derivatives</strong></td>
<td>6.8</td>
</tr>
<tr>
<td><strong>Capital and Financial Account Balance (KFA)</strong></td>
<td>392.9</td>
</tr>
<tr>
<td><strong>Statistical Discrepancy</strong></td>
<td>80.5</td>
</tr>
</tbody>
</table>

**Memoranda:**

- Balance on goods and services (trade balance)   = −560.0
- Balance on goods, services, and income          = −338.9
- Official settlements balance =
  - Balance of payments =
  - Increase in U.S. official reserve assets minus increase in foreign official assets = 15.9 − 164.8 = −148.9

*Note: Numbers may not add to totals shown owing to rounding.*

BoP: Capital and Financial Account

The **capital and financial account** records trades in existing assets, either real (for example, houses) or financial (for example, stocks and bonds).

The **capital account** records the net flow of *unilateral* transfers of assets into the country.

- When home country sells assets to a foreign country, that is a capital inflow for the home country and a credit (+) item in the capital and financial account → increase in foreign owned assets in the US, financial inflow
- When assets are purchased from a foreign country, there is a capital outflow from the home country and a debit (-) item in the capital and financial account → increase in US owned assets in the abroad, financial outflow
The official settlements balance or balance of payments, is part of the capital and financial account.

Transactions in official reserve assets are conducted by central banks of countries.

Official reserve assets are assets (foreign government securities, bank deposits, and SDRs of the IMF, gold) used in making international payments.

Central banks buy (or sell) official reserve assets with (or to obtain) their own currencies.

The balance of payments equals the net increase in a country’s official reserve assets.
BoP: CA and KFA

The relationship between the current account and the capital and financial account:

Current account balance + capital and financial account balance = 0

\[ CA + KFA = 0 \]

This is just accounting: every transaction involves offsetting effects (see next table).

(Measurement problems, recorded as a statistical discrepancy, prevent \( CA + KFA = 0 \) from holding exactly)
Case I: United States Imports $75 Sweater from Britain; Britain Imports $75 Computer Game from United States

Current Account
- Exports + $75
- Imports - $75
Current account balance, CA 0

Capital and Financial Account
- No transaction
- Capital and financial account balance, KFA 0
- Sum of current and capital and financial account balances, CA + KFA 0

Case II: United States Imports $75 Sweater from Britain; Britain Buys $75 Bond from United States

Current Account
- Imports - $75
Current account balance, CA - $75

Capital and Financial Account
- Financial inflow + $75
- Capital and financial account balance, KFA + $75
- Sum of current and capital and financial account balances, CA + KFA 0

Case III: United States Imports $75 Sweater from Britain; Federal Reserve Sells $75 of British Pounds to British Bank

Current Account
- Imports - $75
Current account balance, CA - $75

Capital and Financial Account
- Financial inflow (reduction in U.S. official reserve assets) + $75
- Capital and financial account balance, KFA + $75
- Sum of current and capital and financial account balances, CA + KFA 0
Net Foreign Assets

Net foreign assets (NFA) are a country’s foreign assets minus its foreign liabilities.

The net increase in foreign assets equals a country’s current account surplus.

- NFA may change in value (example: change in stock prices)
- NFA may change through acquisition of new assets or liabilities, e.g.
  - **Foreign direct investment**: a foreign firm buys or builds capital goods
    Causes an increase in capital and financial account balance
  - **Portfolio investment**: foreigners acquire U.S. securities;
    also increases capital and financial account balance
Net international ownership of assets relative to US GDP
BoP: Summary

Equivalent measures of a country’s international trade and lending:

Current account surplus
  = capital and financial account deficit
  = net acquisition of foreign assets
  = net foreign lending
  ≈ positive trade balance (if NFP are small enough)
The US Current Account Deficit

From WWI to 1980s, the US was a net lender to the rest of the world.

Since early 1980s U.S. has had large CA deficits and has been a net borrower each year since the early 1980s.

US has direct foreign investment (companies, land) in other countries about equal in size to other countries’ foreign direct investment in the United States.
Goods Market Equilibrium in Open Economies

Recall that in a closed economy: $S = I$: goods market equilibrium occurs at the real interest rate $r$ for which savings equal investment.

But in open economies $S \neq I$.

Two cases:

- **Small open economy**: an economy too small to affect the world real interest rate $r^w$ in the international capital market
- **Large open economy**: an economy large enough to affect the world real interest rate $r^w$
Small Open Economy

Assumptions:

1. Domestic & foreign bonds are perfect substitutes (same risk, maturity, etc.)
2. Perfect capital mobility: no restrictions on international trade in assets
3. Residents of the small open economy can borrow or lend at the expected world real interest rate

As before,
- Saving depends positively on $r$ (SE +, WE + > IE -)
- Investment depends negatively on $r$

In a small open economy, interest $r = r^w$ is now given and does not adjust to equate national saving with investment.
Current Account Surplus

The graph illustrates the relationship between foreign lending, saving, and investment. At point A, the world real interest rate is 6% and foreign lending equals $4 billion. The saving curve, S, intersects the investment curve, I, at point E, indicating the equilibrium. At point B, double the foreign lending ($8 billion) is desired. The x-axis represents desired national saving, $S^d$, and desired investment, $I^d$, in billions of dollars.
Current Account Deficit

![Graph showing the current account deficit with saving curve (S) and investment curve (I). The graph illustrates the relationship between the world real interest rate and the desired national saving and investment. At point E, the saving curve intersects the investment curve, indicating equilibrium. Point C represents the domestic saving level, and point D represents the domestic investment level. The area between C and D indicates foreign borrowing of $4 billion.](image)
Small Open Economy

The effects of economic shocks in a small open economy:

Anything that increases desired national saving ($Y$ rises, future $Y/\text{Wealth}$ falls, or $G$ falls) relative to desired investment (future $MP_K$ falls, capital taxes rise) at a given world interest rate increases net foreign lending.

Anything that reduces world saving relative to world desired investment increases $r^W$ and increases net foreign lending.
A Reduction in Savings

2. Current account surplus falls

1. Temporary adverse supply shock
Increase in Investment Demand

1. Expected future MPK increases

2. Current account surplus falls
The Current Account and Fiscal Policy

Expansionary fiscal policy at home:
- increase in $G$ or decrease in $T$ reduces national savings
- current account surplus falls

→ **Twin Deficits**: crucial is the response of private saving.

Expansionary fiscal policy in the rest of the world:
- increase in $r^w$ increases national savings
- current account surplus increases
Why does capital not flow to poor countries?

If the US is running a trade deficit, other countries must be running a trade surplus.

→ in 2005: Russia, Singapore, South Korea, China

These are relatively poor countries with low capital stocks.

\[ MP_K = \alpha A \left( \frac{K}{L} \right)^{\alpha-1} \]

Diminishing returns to K, so these countries must have much higher returns to capital than the US.

Why doesn’t capital flow to countries with low K, but vice versa?

- They have lower A: e.g. lower human capital, less efficient economic policies.
- Property rights are not enforced, corruption, political instability, government debt defaults
Large Open Economy

In a large open economy, shocks altering \( I \) and \( S \) affect the world real interest rate \( r^w \).

Suppose there are only two large economies: Home and Foreign.

e.g. Home: US, Foreign: rest of the world

Again, we assume:

1. Domestic & foreign bonds are perfect substitutes (same risk, maturity, etc.)
2. Perfect capital mobility: no restrictions on international trade in assets

\( r^w \) adjusts such that \( CA^H + CA^F = 0 \).
(a) Home country

Desired national saving, $S^d$, and desired investment, $I^d$ (billions of dollars)

World real interest rate, $r^w$

Desired national saving, $S$ (billions of dollars)

Home saving curve, $S$

Points:
- $I = 150$, $S = 450$
- $I = 200$, $S = 400$
- $I = 200$, $S = 400$

Points:
- $I = 150$, $S = 450$
- $I = 200$, $S = 400$

(b) Foreign country

Desired national saving, $S_{For}$ (billions of dollars)

Foreign saving curve, $S_{For}$

Points:
- $S_{For} = 550$, $I_{For} = 650$
- $S_{For} = 500$, $I_{For} = 700$
- $S_{For} = 500$, $I_{For} = 700$

Points:
- $S_{For} = 550$, $I_{For} = 650$
- $S_{For} = 500$, $I_{For} = 700$
- $S_{For} = 500$, $I_{For} = 700$
Rest of the world affects $r^W$ and the US economy and vice versa.

Changes in the equilibrium $r^W$: Any factor that increases desired international lending of a country relative to desired international borrowing causes the world real interest rate to fall.

World’s economies are increasingly interdependent, more international trade and investment.
The US Current Account Deficit

Why is the US current account deficit getting worse?

- Lower foreign demand for US goods
- Better international investment opportunities, strong US financial markets.
- Higher oil prices
- Increased saving by developing countries
- Government dissaving (twin deficits)
Twin Deficits?
Exchange Rates

\( e = \text{nominal exchange rate} \), i.e. the relative price of domestic currency in terms of foreign currency

(e.g. euro per dollar)

- \( e \uparrow \): more euros for one dollar, \textit{nominal appreciation}
- \( e \downarrow \): less euros for one dollar, \textit{nominal depreciation}

\( \epsilon = \text{real exchange rate} \), i.e. the relative price of domestic goods in terms of foreign goods

(e.g. European Big Macs vs. US Big Macs)
Exchange Rates

\[ \epsilon = \frac{e \times P}{P^*} \]

where:
- \( e \) nominal exchange rate (euros per dollar)
- \( P \) dollar price
- \( P^* \) euro price

A Big Mac costs 2 euros in Paris, 3 dollars in NY, \( e = 0.5 \), then

\[ \epsilon = \frac{e \times P_{BM}}{P_{BM}^*} \frac{0.5 \times 3}{2} = \frac{3}{4} \]

You get \( 3/4 \) of a Big Mac in Paris for one Big Mac in NY.
Exchange Rates

In the real world: we usually think of $\epsilon$ as the relative price of a basket of domestic goods in terms of a basket of foreign goods.

In our models, there’s usually just one good, output $Y$. So $\epsilon$ is the relative price of one country’s output in terms of the other country’s output.

- $\epsilon \uparrow$ U.S. goods become more expensive relative to foreign goods: a *real appreciation* $\rightarrow NX \downarrow$
- $\epsilon \downarrow$ U.S. goods become more expensive relative to foreign goods: a *real depreciation* $\rightarrow NX \uparrow$. 
Real Exchange Rate

The real exchange rate (also called the terms of trade) represents the rate at which domestic goods and services can be traded for those produced abroad.

Changes in net exports affect overall economic activity and are a primary channel through which business cycles and macroeconomic policy changes are transmitted internationally.

The effect of a change in the real exchange rate may be weak in the short run and can even go the wrong way: the J-curve.

- $\epsilon \uparrow$ will reduce net exports in the long run, in the short run it may be difficult to quickly change imports and exports.
- As a result, a country will import and export the same amount of goods for a time, with lower relative prices on the foreign goods, thus increasing net exports.
Response to a Real Depreciation: J-curve
How are Exchange Rates Determined?

**Long run**: Law of One Price/Purchasing Power Parity

**Short run**: Foreign Exchange Market
Law of One Price

If there is free trade, the $\epsilon$ for a specific good would have to be 1, or else everyone would buy goods where they were cheaper.

Big Mac example: $\epsilon_{BM} = 3/4$

Buy Big Macs in NY and sell them in Paris.
You’d make an easy $2/0.5 - 3 = 1$ dollar profit per Big Mac.

**Law of One Price**: The same good must have the same price in terms of the same currency (if there are no transportation costs)
Purchasing Power Parity

If there is free trade, the law of one price should hold for every good.

**Purchasing Power Parity (PPP)**

\[
\epsilon = e \times \frac{P}{P^*} = 1
\]

where \( P/P^* \) are now price *indices* for a basket of goods.

Purchasing power in dollars must be the same whether goods are purchased in the US or in the EU.
Empirical Evidence on PPP

We will assume PPP holds in the long run.

In the short run there are large deviations from PPP: Goods arbitrage takes time

But even in the long run there can be deviations from PPP:

1. Countries produce different goods
2. Some goods are not traded
3. Transportation costs
4. Legal barriers to trade
Exchange Rates in the Long run

When PPP holds, we can decompose changes in the real exchange rate into parts

\[
\frac{d\epsilon}{\epsilon} = \frac{de}{e} + \frac{dP}{P} - \frac{dP^*}{P^*} \\
0 = \frac{de}{e} + \pi - \pi^* \\
\frac{de}{e} = \pi^* - \pi
\]

In the long run, nominal exchange rates are determined by inflation differentials:

- A nominal appreciation \( \frac{de}{e} > 0 \) in the long run must be due to an inflation differential \( \pi^* - \pi > 0 \).
- A nominal depreciation \( \frac{de}{e} < 0 \) is must be due to an inflation differential \( \pi^* - \pi < 0 \).
Inflation Differentials and Nominal Exchange Rates
Nominal Exchange Rate Determination

The nominal exchange rate is determined in the foreign exchange market by supply and demand for the currency.

People buy and sell dollars to

- To be able to buy U.S. goods and services (U.S. exports)
- To be able to buy U.S. real and financial assets (U.S. financial inflows)

Supplying dollars means offering dollars in exchange for the foreign currency

Demanding dollars means wanting to buy dollars in exchange for the foreign currency
What Determines Exchange Rates in the Short Run?

- Think of the exchange rate as the price of domestic assets (bank deposits, bonds, equities denominated in domestic currency) in terms of foreign assets.
- The most important factor affecting the demand for domestic (dollar) assets and foreign (euro) assets is the relative expected return on these assets.
- If $R^D$ (return on dollar assets) > $R^F$ (return on euro assets), demand for dollar assets is high relative to demand for euro assets.
What Determines Exchange Rates in the Short Run?

- Suppose the dollar assets pays interest rate $i_d$ and there are no capital gains, i.e. expected return in dollars $i_d$.
- Suppose the euro assets pays interest rate $i_f$ and there are no capital gains, i.e. expected return in euros $i_f$.
- To compare returns, returns must be converted into the same currency:
  - Let $e_t$ be the exchange rate (euros per dollar)
  - Investing one euro in euro assets in $t$ gives $i_f$ euros in $t + 1$
  - Investing one euro in dollar assets in $t$ gives $1/e_t$ worth of dollar assets that pay $(1 + i_d)/e_t$ in dollars and $(1 + i_d)e_t(e_t+1)/e_t$ in euros
  - The expected euro return on dollar assets is $(1 + i_d)e_t(e_t+1)/e_t - 1$
What Determines Exchange Rates in the Short Run?

The relative return in terms of euros

\[
R_D^R = \left( (1 + i^d) \frac{e_{t+1}}{e_t} - 1 \right) - i^f
\]

\[
= \left( i^d \frac{e_{t+1}}{e_t} + \frac{e_{t+1}}{e_t} - 1 \right) - i^f
\]

\[
= \left( i^d \frac{e_{t+1}}{e_t} + \frac{e_{t+1} - e_t}{e_t} \right) - i^f
\]

\[
\approx i^d - i^f + \frac{e_{t+1} - e_t}{e_t}
\]

The expected return in terms of euros on dollar assets is higher relative to euro assets if

- The interest rate \( i^d > i^f \)
- The dollar is expected to appreciate versus the euro \( \rightarrow \frac{e_{t+1} - e_t}{e_t} \) is the expected percentage appreciation
What Determines Exchange Rates in the Short Run?

- Investing one dollar in dollar assets in $t$ gives $i^d$ dollars in $t + 1$
- Investing one dollar in euro assets in $t$ gives $e_t$ worth of euro assets that pay $(1 + i^f)e_t$ in dollars and $(1 + i^f)\frac{e_t}{e_{t+1}}$ in dollars
- The expected dollar return on dollar assets is $i^d$
- The expected dollar return on euro assets is $(1 + i^f)\frac{e_t}{e_{t+1}} - 1$
- The relative return in terms of dollars:

$$
\text{Relative } R^D = i^d - \left((1 + i^f)\frac{e_t}{e_{t+1}} - 1\right)
$$

$$
\approx i^d - i^f + \frac{e_{t+1}^e - e_t}{e_t}
$$
Interest Parity Condition

If assets can be traded freely across borders, then arbitrage implies the **interest parity condition**

\[ i^d = i^f - \frac{e_{t+1}^e - e_t}{e_t} \]

- Capital mobility with similar risk and liquidity ⇒ the assets are perfect substitutes
- The domestic interest rate equals the foreign interest rate minus the expected appreciation of the domestic currency
- In equilibrium, expected returns are the same on both domestic and foreign assets
Demand and Supply for Domestic Assets

- **Demand for Domestic Assets**
  - Determined by relative expected return \( i^d - i^f + \frac{e_{t+1} - e_t}{e_t} \)
  - At lower current values of the dollar (everything else equal), the quantity demanded of dollar assets is higher
  → Demand curve is downward sloping in \( e_t \)

- **Supply for Domestic Assets**
  - The amount of bank deposits, bonds, and equities in the U.S.
  - Assume fixed with respect to the exchange rate \( e_t \)
  → Vertical supply curve

Keeping \( i^d, i^f, e_{t+1} \) fixed, \( e_t \) in equilibrium equates supply and demand.
Equilibrium in the Foreign Exchange Market

Equilibrium in the foreign exchange market occurs at point B, the intersection of the demand curve D and the supply curve S. The equilibrium exchange rate is $E^* = 1$ euro per dollar.
Explaining changes in exchange rates

- A rise in the domestic interest rate $i^d$ shifts demand curve to the right. $\rightarrow$ appreciation $e_t \uparrow$

- A rise in the foreign interest rate $i^f$ shifts demand curve to the left. $\rightarrow$ depreciation $e_t \downarrow$

- A rise in the future expected exchange rate $e_{t+1}^e$ shifts demand curve to the right. $\rightarrow$ appreciation $e_t \uparrow$
FIGURE 4
Response to an Increase in the Domestic Interest Rate, \( i^D \)
When the domestic interest rate \( i^D \) increases, the relative expected return on domestic (dollar) assets increases and the demand curve shifts to the right. The equilibrium exchange rate rises from \( E_1 \) to \( E_2 \).
FIGURE 5
Response to an Increase in the Foreign Interest Rate, $i^f$

When the foreign interest rate $i^f$ increases, the relative expected return on domestic (dollar) assets falls and the demand curve shifts to the left. The equilibrium exchange rate falls from $E_1$ to $E_2$. 

Exchange Rate, $E_t$
(euros/$)

Quantity of Dollar Assets

$S$

$E_1$

$E_2$

$D_1$

$D_2$
**FIGURE 6**  
**Response to an Increase in the Expected Future Exchange Rate, \( E_{t+1}^e \)**  
When the expected future exchange rate increases, the relative expected return on domestic (dollar) assets rises and the demand curve shifts to the right. The equilibrium exchange rate rises from \( E_1 \) to \( E_2 \).
Summary

In the long run, PPP holds and nominal exchange rates are determined by inflation differentials.

In the short run, nominal exchange rates are determined by nominal interest rate differentials and future nominal expected exchange rates.