IN THIS CHAPTER, YOU WILL LEARN:

- Accounting identities for the open economy
- The small open economy model
  - what makes it “small”
  - how the trade balance and exchange rate are determined
  - how policies affect trade balance & exchange rate
In an open economy,

- spending need not equal output
- saving need not equal investment
Preliminaries

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

EX = exports =
foreign spending on domestic goods

IM = imports = \( C^f + I^f + G^f \)
= spending on foreign goods

NX = net exports (a.k.a. the “trade balance”)
= EX – IM

superscripts:
\( d \) = spending on domestic goods
\( f \) = spending on foreign goods
GDP = Expenditure on domestically produced g&s

\[ Y = C^d + I^d + G^d + EX \]

\[ = (C - C^f) + (I - I^f) + (G - G^f) + EX \]

\[ = C + I + G + EX - (C^f + I^f + G^f) \]

\[ = C + I + G + EX - IM \]

\[ = C + I + G + NX \]
The national income identity in an open economy

\[ Y = C + I + G + NX \]

or,

\[ NX = Y - (C + I + G) \]
Trade surpluses and deficits

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

- **Trade surplus:**
  output > spending and exports > imports
  Size of the trade surplus = \( NX \)

- **Trade deficit:**
  spending > output and imports > exports
  Size of the trade deficit = \(-NX\)
International capital flows

- **Net capital outflow**
  
  \[ S - I \]

  = net outflow of “loanable funds”

  = net purchases of foreign assets

  - the country’s purchases of foreign assets

  - minus foreign purchases of domestic assets

- When \( S > I \), country is a *net lender*

- When \( S < I \), country is a *net borrower*
The link between trade & cap. flows

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

implies

\[ \textit{NX} = (Y - C - G) - I \]

\[ = S - I \]

\textit{trade balance} = \textit{net capital outflow}

Thus,

a country with a trade deficit (\textit{NX} < 0)

is a net borrower (\textit{S} < \textit{I}).
Saving, investment, and the trade balance 1960–2014
U.S.: the world’s largest debtor nation

- Every year since the 1980s: huge trade deficits and net capital inflows, i.e., net borrowing from abroad

- As of 12/31/2014:
  - U.S. residents owned $24.7 trillion worth of foreign assets
  - Foreigners owned $31.6 trillion worth of U.S. assets
  - U.S. net indebtedness to rest of the world: $6.9 trillion—higher than any other country, hence U.S. is the “world’s largest debtor nation”
Saving and investment in a small open economy

- An open-economy version of the loanable funds model from Chapter 3.

- Includes many of the same elements:
  - production function \( Y = \bar{Y} = F(\bar{K}, \bar{L}) \)
  - consumption function \( C = C(Y - T) \)
  - investment function \( I = I(r) \)
  - exogenous policy variables \( G = \bar{G}, \quad T = \bar{T} \)
National saving:
The supply of loanable funds

\[ S = \bar{Y} - C(\bar{Y} - \bar{T}) - \bar{G} \]

As in Chapter 3, national saving does not depend on the interest rate.
Assumptions about capital flows

a. Domestic & foreign bonds are perfect substitutes (same risk, maturity, etc.)

b. Perfect capital mobility:
no restrictions on international trade in assets

c. Economy is small:
cannot affect the world interest rate, denoted $r^*$

a & b imply $r = r^*$
c implies $r^*$ is exogenous
Investment: The demand for loanable funds

Investment is still a downward-sloping function of the interest rate, but the exogenous world interest rate…

…determines the country’s level of investment.
If the economy were closed . . .

. . . the interest rate would adjust to equate investment and saving.
But in a small open economy...

the exogenous world interest rate determines investment...

...and the difference between saving and investment determines net capital outflow and net exports
The nominal exchange rate

\[ e = \text{nominal exchange rate, the relative price of domestic currency in terms of foreign currency (e.g., yen per dollar)} \]
A few exchange rates, as of 1/13/2015

<table>
<thead>
<tr>
<th>country</th>
<th>exchange rate</th>
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</thead>
<tbody>
<tr>
<td>Euro area</td>
<td>0.85 euro/$</td>
</tr>
<tr>
<td>Indonesia</td>
<td>12,576 rupiahs/$</td>
</tr>
<tr>
<td>Japan</td>
<td>118.0 yen/$</td>
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<tr>
<td>Mexico</td>
<td>14.6 pesos/$</td>
</tr>
<tr>
<td>Russia</td>
<td>65.85 rubles/$</td>
</tr>
<tr>
<td>South Africa</td>
<td>11.50 rand/$</td>
</tr>
<tr>
<td>U.K.</td>
<td>0.66 pounds/$</td>
</tr>
</tbody>
</table>
The real exchange rate

$$\epsilon = \text{real exchange rate, the relative price of domestic goods in terms of foreign goods (e.g. Japanese Big Macs per U.S. Big Mac)}$$
Understanding the units of $\varepsilon$

$$
\varepsilon = \frac{e \times P}{P^*} = \frac{(\text{Yen per $}) \times (\text{$ per unit U.S. goods})}{\text{Yen per unit Japanese goods}}$

= \frac{\text{Yen per unit U.S. goods}}{\text{Yen per unit Japanese goods}}$

= \frac{\text{Units of Japanese goods}}{\text{per unit of U.S. goods}}$

CHAPTER 6 The Open Economy
ε in the real world & our model

- In the real world:
  We can think of ε as the relative price of a basket of domestic goods in terms of a basket of foreign goods.

- In our macro model:
  There’s just one good, “output.”
  So ε is the relative price of one country’s output in terms of the other country’s output.
How $\textit{NX}$ depends on $\varepsilon$

If $\varepsilon$ rises:

- U.S. goods become more expensive relative to foreign goods
- Exports fall, imports rise
- Net exports fall

- **Trade-weighted real exchange rate index**
- **Net exports (left scale)**

Index (March 1973 = 100)
The net exports function

- The net exports function reflects this inverse relationship between \( NX \) and \( \varepsilon \):

\[
NX = NX(\varepsilon)
\]
The $NX$ curve for the U.S.

When $\varepsilon$ is relatively low, U.S. goods are relatively inexpensive, so U.S. net exports will be high.
The \( NX \) curve for the U.S.

At high enough values of \( \varepsilon \), U.S. goods become so expensive that we export less than we import.
How $\varepsilon$ is determined

- The accounting identity says $NX = S - I$
- We saw earlier how $S - I$ is determined:
  - $S$ depends on domestic factors (output, fiscal policy variables, etc.)
  - $I$ is determined by the world interest rate $r^*$
- So, $\varepsilon$ must adjust to ensure

$$NX(\varepsilon) = \bar{S} - I(r^*)$$
How \( \varepsilon \) is determined

Neither \( S \) nor \( I \) depends on \( \varepsilon \), so the net capital outflow curve is vertical.

\( \varepsilon \) adjusts to equate \( NX \) with net capital outflow, \( S - I \).
Interpretation: supply and demand in the foreign exchange market

**Demand:**
Foreigners need dollars to buy U.S. net exports.

**Supply:**
Net capital outflow ($S - I$) is the supply of dollars to be invested abroad.
Four experiments:

1. Fiscal policy at home
2. Fiscal policy abroad
3. An increase in investment demand (exercise)
4. Trade policy to restrict imports
1. Fiscal policy at home

A fiscal expansion reduces national saving, net capital outflow, and the supply of dollars in the foreign exchange market...

...causing the real exchange rate to rise and $\text{NX}$ to fall.
NX and the federal budget deficit (% of GDP), 1965–2014

Budget deficit (left scale)

Net exports (right scale)
2. Fiscal policy abroad

An increase in $r^*$ reduces investment, increasing net capital outflow and the supply of dollars in the foreign exchange market...

...causing the real exchange rate to fall and $\text{NX}$ to rise.

\[
S_1 - I(r_1^*)
\]

\[
S_1 - I(r_2^*)
\]

\[
NX(\varepsilon)
\]
Determine the impact of an increase in investment demand on net exports, net capital outflow, and the real exchange rate.
An increase in investment reduces net capital outflow and the supply of dollars in the foreign exchange market...

...causing the real exchange rate to rise and $NX$ to fall.
4. Trade policy to restrict imports

At any given $\varepsilon$, an import quota reduces $IM$, increases $NX$, increases demand for dollars.

Trade policy doesn’t affect $S$ or $I$, so capital flows and the supply of dollars remain fixed.
4. Trade policy to restrict imports

Results:
\[ \Delta \varepsilon > 0 \]  
(demand increase)
\[ \Delta NX = 0 \]  
(supply fixed)
\[ \Delta IM < 0 \]  
(policy)
\[ \Delta EX < 0 \]  
(rise in \( \varepsilon \))
The determinants of the nominal exchange rate

- Start with the expression for the real exchange rate:

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

- Solve for the nominal exchange rate:

\[ e = \varepsilon \times \frac{P^*}{P} \]
The determinants of the nominal exchange rate

- So $e$ depends on the real exchange rate and the price levels at home and abroad . . .

and we know how each of them is determined:

$$ e = \varepsilon \times \frac{P^*}{P} $$

$$ \frac{M^*}{P^*} = L^*(r^* + \pi^*, Y^*) $$

$$ \frac{M}{P} = L(r^* + \pi, Y) $$

$$ NX(e) = \bar{S} - I(r^*) $$
The determinants of the nominal exchange rate

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

- Rewrite this equation in growth rates (see “arithmetic tricks for working with percentage changes,” Chapter 2):

\[ \frac{\Delta e}{e} = \frac{\Delta \varepsilon}{\varepsilon} + \frac{\Delta P^*}{P^*} - \frac{\Delta P}{P} = \frac{\Delta \varepsilon}{\varepsilon} + \pi^* - \pi \]

- For a given value of \( \varepsilon \), the growth rate of \( e \) equals the difference between foreign and domestic inflation rates.
Inflation differentials and nominal exchange rates for a cross section of countries

Mankiw, *Macroeconomics*, 10e, © 2019 Worth Publishers
Purchasing Power Parity (PPP)

Two definitions:

- A doctrine that states that goods must sell at the same (currency-adjusted) price in all countries.
- The nominal exchange rate adjusts to equalize the cost of a basket of goods across countries.

Reasoning:

- arbitrage, the law of one price
Purchasing Power Parity (PPP)

- **PPP:**
  \[ e \times P = P^* \]

- Solve for \( e \): \( e = P^*/P \)
- PPP implies that the nominal exchange rate between two countries equals the ratio of the countries’ price levels.
Purchasing Power Parity (PPP)

- If $e = P^*/P$,
  
  then $\varepsilon = e \times \frac{P}{P^*} = \frac{P^*}{P} \times \frac{P}{P^*} = 1$

  and the $NX$ curve is horizontal:

Under PPP, changes in $(S - I)$ have no impact on $\varepsilon$ or $e$. 

\[ \varepsilon = 1 \]

\[ S - I \]

\[ NX \]
Does PPP hold in the real world?

No, for two reasons:

1. International arbitrage not possible
   - nontraded goods
   - transportation costs

2. Different countries’ goods not perfect substitutes

Yet, PPP is a useful theory:

- It’s simple & intuitive.
- In the real world, nominal exchange rates tend toward their PPP values over the long run.
## CASE STUDY: The Reagan Deficits Revisited

<table>
<thead>
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<th></th>
<th>1970s</th>
<th>1980s</th>
<th>actual change</th>
<th>closed economy</th>
<th>small open economy</th>
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<tr>
<td>$G - T$</td>
<td>2.2</td>
<td>3.9</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>$S$</td>
<td>19.6</td>
<td>17.4</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
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<tr>
<td>$r$</td>
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<td>6.3</td>
<td>↑</td>
<td>↑</td>
<td>no change</td>
</tr>
<tr>
<td>$I$</td>
<td>19.9</td>
<td>19.4</td>
<td>↓</td>
<td>↓</td>
<td>no change</td>
</tr>
<tr>
<td>$NX$</td>
<td>-0.3</td>
<td>-2.0</td>
<td>↓</td>
<td>no change</td>
<td>↓</td>
</tr>
<tr>
<td>$\varepsilon$</td>
<td>115.1</td>
<td>129.4</td>
<td>↑</td>
<td>no change</td>
<td>↑</td>
</tr>
</tbody>
</table>

Data: Decade averages; all except $r$ and $\varepsilon$ are expressed as a percent of GDP; $\varepsilon$ is a trade-weighted index.
The U.S. as a large open economy

- So far, we’ve learned long-run models for two extreme cases:
  - closed economy (Chapter 3)
  - small open economy (Chapter 5)
- A large open economy—like the U.S.—falls between these two extremes.
- The results from large open economy analysis are a mixture of the results for the closed & small open economy cases.
- For example . . .
A fiscal expansion in three models

A fiscal expansion causes national saving to fall. The effects of this depend on openness & size.

<table>
<thead>
<tr>
<th></th>
<th>closed economy</th>
<th>large open economy</th>
<th>small open economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>( r )</td>
<td>rises</td>
<td>rises, but not as much as in closed economy</td>
<td>no change</td>
</tr>
<tr>
<td>( l )</td>
<td>falls</td>
<td>falls, but not as much as in closed economy</td>
<td>no change</td>
</tr>
<tr>
<td>( NX )</td>
<td>no change</td>
<td>falls, but not as much as in small open economy</td>
<td>falls</td>
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</table>