Chapter 5: open economy

- accounting identities for the open economy
- small open economy model
  - what makes it “small”
  - how the trade balance and exchange rate are determined and affected by policy
- In an open economy, spending ≟ output

GDP = expenditure on domestically produced g & s

Domestic economy: \( Y = C + I + G \)

Open economy: \( Y = C^D + I^D + G^D + EX \)

\[ IM = C^D + I^D + G^D \]

\[ EX - IM = NX = \text{net exports ("trade balance")} \]

\[ C = C^D + C^F \]

\[ I = I^D + I^F \]

\[ G = G^D + G^F \]

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

The income identity in an open economy and International capital flows

Goods markets

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

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

Financial markets

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

net outflow of goods = net purchases of foreign assets

S > I international lender, S < I international borrower
Saving and Investment in a Small Open Economy

- Open-economy version loanable funds model.

- Key elements:
  - Production function: \( Y = F(K, L) \)
  - Consumption function: \( C = C(Y - T) \)
  - Investment function: \( I = I(r) \)
  - Exogenous policy variables: \( G = \tilde{G}, \quad T = \tilde{T} \)

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 \( r^* \)

   \[ A \text{ and } B \rightarrow r = r^* \]

   \[ C \rightarrow r^* \text{ exogenous} \]

Investment and saving

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

\[ I = I(r) \]

\[ NX = S - I \]
Experiment 1: Fiscal policy at home

An increase in $G$ reduces saving.

Results:
\[ \Delta I = 0 \]
\[ \Delta NX = \Delta S < 0 \]

2. Fiscal policy abroad

Expansionary fiscal policy abroad raises the world interest rate.

Results:
\[ \Delta I < 0 \]
\[ \Delta NX = -\Delta I > 0 \]

The nominal exchange rate

\[ e = \text{nominal exchange rate, the relative price of one currency in terms of the other} \]

<table>
<thead>
<tr>
<th>Country</th>
<th>Exchange Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euro</td>
<td>1.41 $/Euro (0.70 Euro/$)</td>
</tr>
<tr>
<td>Japan</td>
<td>115 Yen/$</td>
</tr>
</tbody>
</table>

Beware of the conventions!

Euro: we normally quote dollar vs euro

Yen: we normally quote yen vs dollar
**The real exchange rate**

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

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

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

\[ e = \text{real exchange rate, relative price of domestic goods in terms of foreign goods} \]

---

### Example 1

- **One good**: Big Mac
- **Price in Japan**: \( P^* = 280 \) Yen
- **Price in USA**: \( P = \$3.22 \)
- **Nominal exchange rate**: \( e = 115 \) Yen/$

\[ e = \frac{115 \times 3.22}{280} = 1.32 \]

This example: \( e > 1 \)

Goods in US are “more expensive” than in Japan

Dollar is overvalued w.r.t. yen

---

### Example 2

- **One good**: iPod Nano 8gB
- **Price in Italy/Euro Area**: \( P^* = 200 \) euros
- **Price in USA**: \( P = 210 \) dollars
- **Nominal exchange rate**: \( e = 0.70 \) Euro/$

\[ e = \frac{0.70 \times 210}{200} = 0.73 \]

This example: \( e < 1 \)

Goods in US are “less expensive” than in the Euro area
How $NX$ depends on $\varepsilon$

$\uparrow \varepsilon \Rightarrow$ U.S. goods become more expensive relative to foreign goods
$\Rightarrow \downarrow EX, \uparrow IM$
$\Rightarrow \downarrow NX$

- The net exports function:

$$NX = NX(\varepsilon)$$

---

How $\varepsilon$ is determined

- $NX = S - I$
  - $S$ depends on domestic factors (output, fiscal policy variables, etc)
  - $I$ is determined by the world interest rate $r^*$
- $\varepsilon$ must adjust to ensure

$$NX(\varepsilon) = S - I(r^*)$$

---

How $\varepsilon$ is determined

- Diagram showing the relationship between $\varepsilon$, $S - I(r^*)$, and $NX(\varepsilon)$.
Exp 1. Fiscal policy at home

\[ \text{Fiscal policy at home} \]

\[ \epsilon \]

\[ \text{NX} \]

\[ (\epsilon) \]

\[ \text{SI r} \]

\[ \epsilon_1 \]

\[ \text{NX}_1 \]

\[ \text{NX}_2 \]

Exp. 2. Fiscal policy abroad

\[ \text{Fiscal policy abroad} \]

\[ \epsilon \]

\[ \text{NX} \]

\[ (\epsilon) \]

\[ \text{SI r} \]

\[ \epsilon_1 \]

\[ \text{NX}_1 \]

\[ \text{NX}_2 \]

From real to nominal variables:

Nominal Exchange Rate determination

- Real exchange rate: \( e = \frac{P}{P^*} \)
- Solve for nominal exchange rate:

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

\[ \frac{\Delta e}{e} = \frac{\Delta P}{P} = \frac{\Delta P^*}{P^*} = \frac{\Delta \epsilon}{\epsilon} \epsilon^* - \pi \]
Inflation and nominal exchange rates

<table>
<thead>
<tr>
<th>Percentage change in nominal exchange rate</th>
<th>Inflation differential</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>-1</td>
</tr>
<tr>
<td>9</td>
<td>-2</td>
</tr>
<tr>
<td>8</td>
<td>-3</td>
</tr>
<tr>
<td>7</td>
<td>-4</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>-1</td>
<td>8</td>
</tr>
<tr>
<td>-2</td>
<td>9</td>
</tr>
<tr>
<td>-3</td>
<td>10</td>
</tr>
<tr>
<td>-4</td>
<td>11</td>
</tr>
</tbody>
</table>

Inflation differential relative to U.S. dollar

Appreciation relative to U.S. dollar

Depreciation relative to U.S. dollar

France
Canada
Sweden
Australia
UK
Ireland
Spain
South Africa
Italy
New Zealand
Netherlands
Germany
Japan
Belgium
Switzerland

Purchasing Power Parity (PPP)

goods must sell at the same (currency adjusted) price in all countries.

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

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

If \( e = P^*/P \),

then

and the NX curve is horizontal:

Under PPP, changes in \( S - I \) have no impact on \( \varepsilon \) or \( e \).
Does PPP hold in the real world?

No, for two reasons:
1. International arbitrage not possible.
   - nontraded goods
   - transportation costs
2. Goods of different countries not perfect substitutes.

---

CASE STUDY
The Reagan Deficits revisited

<table>
<thead>
<tr>
<th></th>
<th>1970s</th>
<th>1980s</th>
<th>actual change</th>
<th>closed economy</th>
<th>small open economy</th>
</tr>
</thead>
<tbody>
<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>
</tr>
<tr>
<td>$r$</td>
<td>1.1</td>
<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>$\epsilon$</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 $\epsilon$ are expressed as a percent of GDP; $\epsilon$ is a trade-weighted index.

---

US: large open economy

A FISCAL EXPANSION causes national saving to fall. The effects of this depend on the degree of openness:

<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>$I$</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>
</tr>
</tbody>
</table>