

Topic 14:
The Open Economy I
 (chapter 5)

macroeconomics
 fifth edition

N. Gregory Mankiw

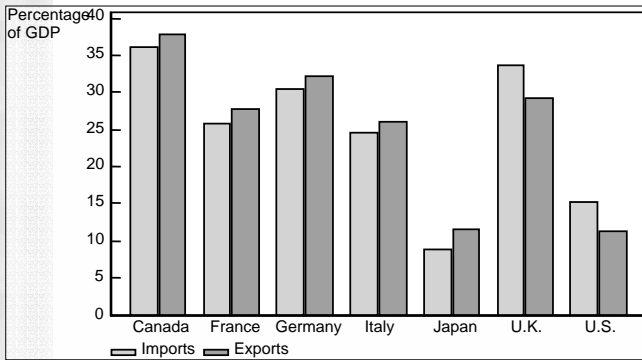
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Chapter objectives

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

Imports and Exports as a percentage of output: 2000



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

superscripts:
 d = spending on domestic goods
 f = spending on foreign goods

Preliminaries, cont.

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

- If $NX > 0$,
 country has a **trade surplus**
 equal to NX
- If $NX < 0$,
 country has a **trade deficit**
 equal to $-NX$

GDP = expenditure on domestically produced g & s

$$\begin{aligned}
 Y &= C^d + I^d + G^d + EX \\
 &= (C - C^f) + (I - I^f) + (G - G^f) + EX \\
 &= C + I + G + EX - (C^f + I^f + G^f) \\
 &= C + I + G + EX - IM \\
 &= C + I + G + NX
 \end{aligned}$$

The national income identity in an open economy

$$Y = C + I + G + NX$$

or, $NX = Y - (C + I + G)$

International capital flows

Net capital outflows

- = $S - I$
- = 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

Another important identity

$$NX = Y - (C + I + G)$$

implies

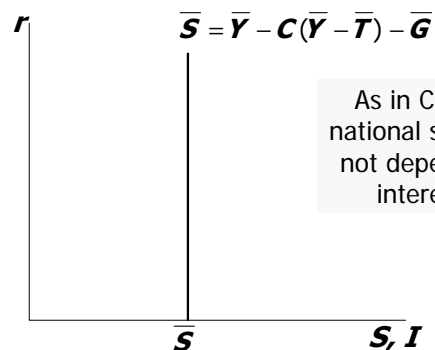
$$\begin{aligned}
 NX &= (Y - C - G) - I \\
 &= S - I
 \end{aligned}$$

trade balance = net capital outflows

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: $G = \bar{G}$, $T = \bar{T}$

National Saving: The Supply of Loanable Funds

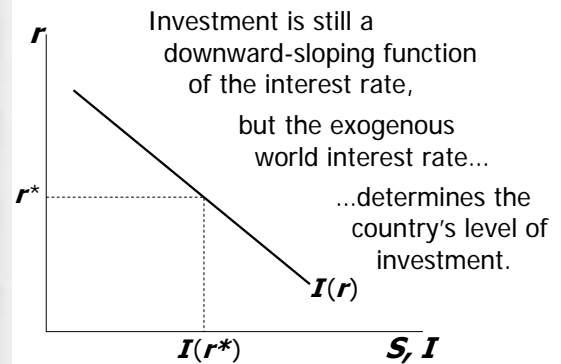


Assumptions re: capital flows

- domestic & foreign bonds are perfect substitutes (same risk, maturity, etc.)
- perfect capital mobility:**
no restrictions on international trade in assets
- economy is **small:**
cannot affect the world interest rate, denoted r^*

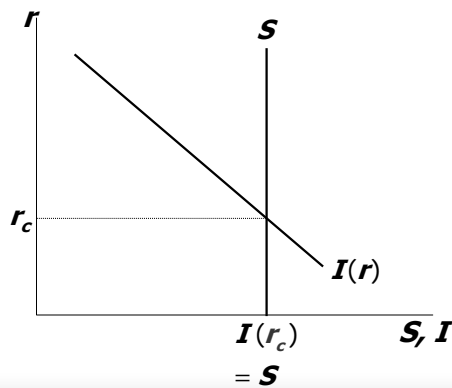
a & b imply $r = r^*$
c implies r^* is exogenous

Investment: The Demand for Loanable Funds



If the economy were closed...

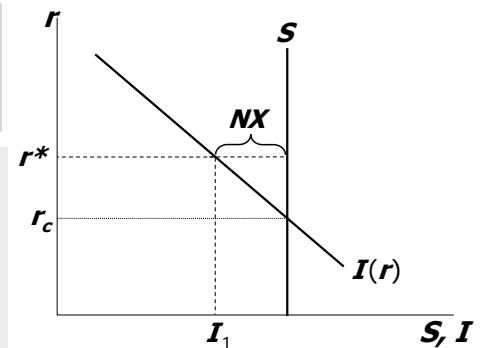
...the interest rate would adjust to equate investment and saving:



But in a small open economy...

the exogenous world interest rate determines investment...

...and the difference between saving and investment determines net capital outflows and net exports



Three experiments

- Fiscal policy at home
- Fiscal policy abroad
- An increase in investment demand

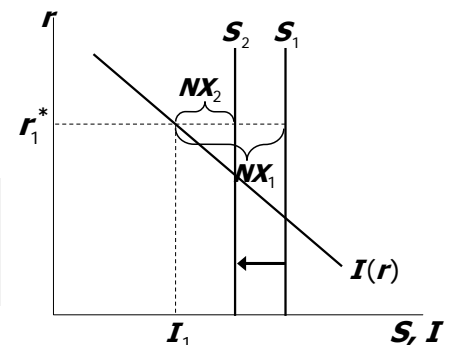
1. Fiscal policy at home

An increase in G or decrease in T reduces saving.

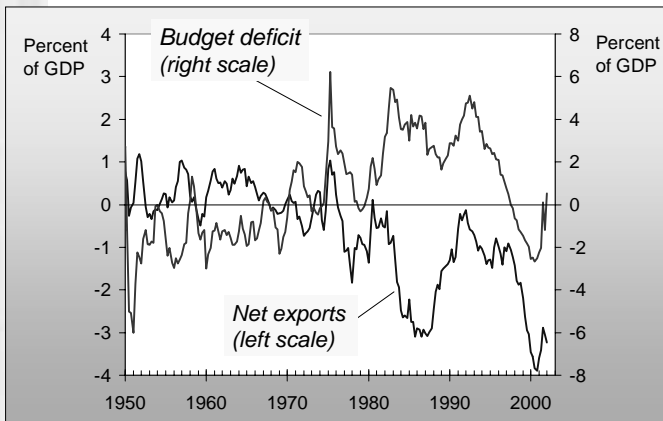
Results:

$$\Delta I = 0$$

$$\Delta NX = \Delta S < 0$$



NX and the Government Budget Deficit



CHAPTER 5 The Open Economy

slide 18

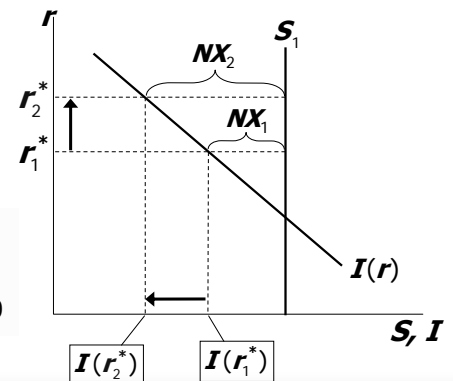
2. Fiscal policy abroad

Expansionary fiscal policy abroad raises the world interest rate.

Results:

$$\Delta I < 0$$

$$\Delta NX = -\Delta I > 0$$



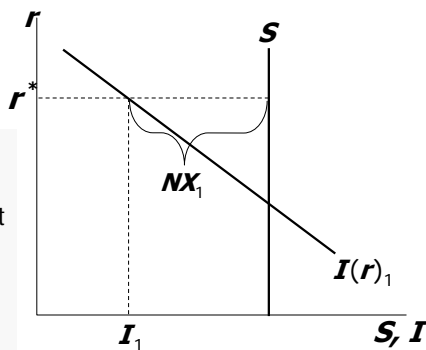
CHAPTER 5 The Open Economy

slide 19

3. An increase in investment demand

EXERCISE:

Use the model to determine the impact of an increase in investment demand on NX , S , I , and net capital outflow.



CHAPTER 5 The Open Economy

slide 20

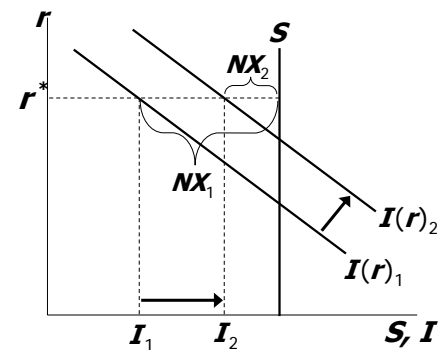
3. An increase in investment demand

ANSWERS:

$$\Delta I > 0,$$

$$\Delta S = 0,$$

net capital outflows and net exports fall by the amount ΔI



CHAPTER 5 The Open Economy

slide 21

The nominal exchange rate

e = nominal exchange rate, the relative price of domestic currency in terms of foreign currency (e.g. Yen per Dollar)

CHAPTER 5 The Open Economy

slide 22

Exchange rates as of June 6, 2002

country	exchange rate
Euro	1.06 Euro/\$
Japan	124.3 Yen/\$
Mexico	9.7 Pesos/\$
Russia	31.4 Rubles/\$
South Africa	9.8 Rand/\$
Turkey	1,444,063.1 Liras/\$
U.K.	0.68 Pounds/\$

CHAPTER 5 The Open Economy

slide 23

The real exchange rate

ϵ = real exchange rate, the relative price of domestic goods in terms of foreign goods (e.g. Japanese Big Macs per U.S. Big Mac)

the lowercase Greek letter epsilon

Understanding the units of ϵ

$$\begin{aligned} \epsilon &= \frac{e \times P}{P^*} \\ &= \frac{(\text{Yen per } \$) \times (\$ \text{ per unit U.S. goods})}{\text{Yen per unit Japanese goods}} \\ &= \frac{\text{Yen per unit U.S. goods}}{\text{Yen per unit Japanese goods}} \\ &= \frac{\text{Units of Japanese goods}}{\text{per unit of U.S. goods}} \end{aligned}$$

~ McZample ~

- one good: Big Mac
- price in Japan: $P^* = 200$ Yen
- price in USA: $P = \$2.50$
- nominal exchange rate $e = 120$ Yen/\$



$$\begin{aligned} \epsilon &= \frac{e \times P}{P^*} \\ &= \frac{120 \times \$2.50}{200 \text{ Yen}} = 1.5 \end{aligned}$$

To buy a U.S. Big Mac, someone from Japan would have to pay an amount that could buy 1.5 Japanese Big Macs.

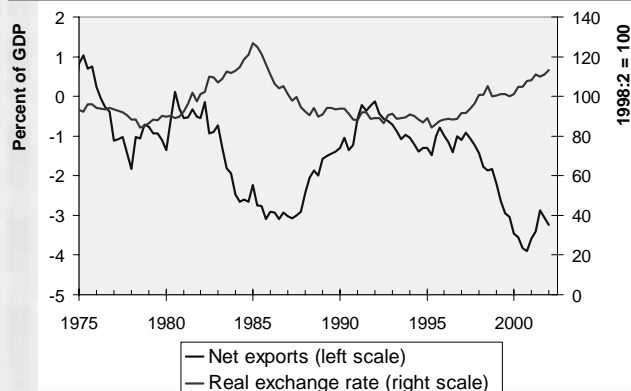
ϵ in the real world & our model

- 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 NX depends on ϵ

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

U.S. Net Exports and the Real Exchange Rate, 1975-2002

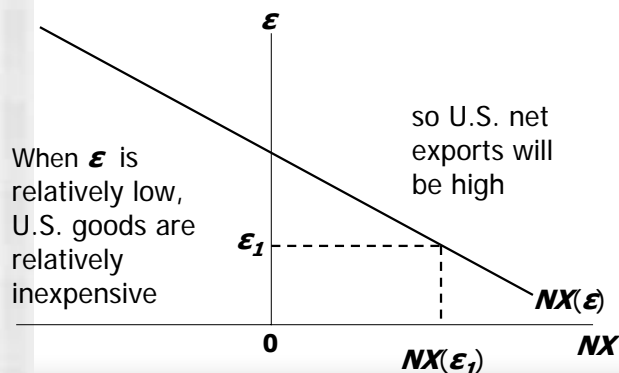


The net exports function

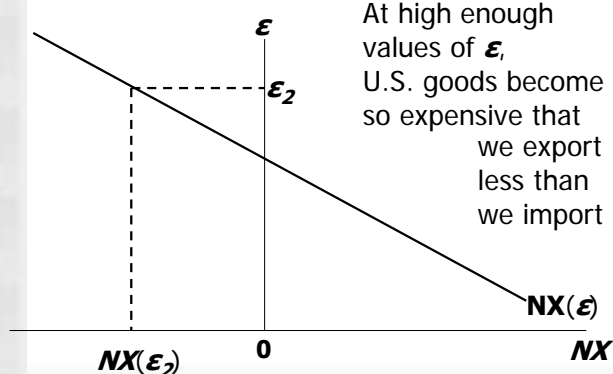
- The **net exports function** reflects this inverse relationship between NX and ϵ :

$$NX = NX(\epsilon)$$

The NX curve for the U.S.



The NX curve for the U.S.



How ϵ is determined

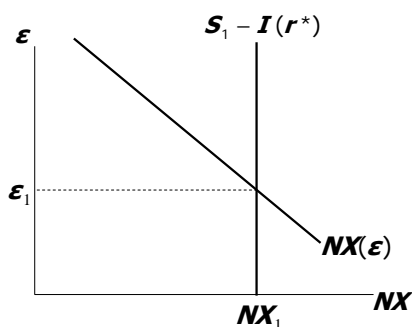
- The accounting identity says $NX = S - I$
- We saw earlier how $S - I$ is determined:
 - S depends on domestic factors (output, fiscal policy variables, etc)
 - I is determined by the world interest rate r^*
- So, ϵ must adjust to ensure

$$NX(\epsilon) = \bar{S} - I(r^*)$$

How ϵ is determined

Neither S nor I depend on ϵ , so the net capital outflow curve is vertical.

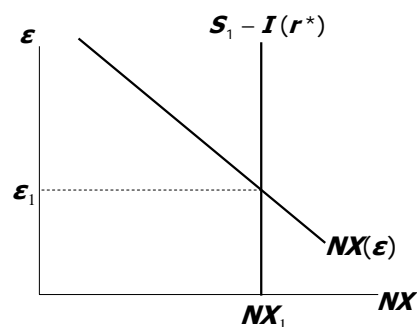
ϵ adjusts to equate NX with net capital outflow, $S - I$.



Interpretation: supply and demand in the foreign exchange market

demand:
Foreigners need dollars to buy U.S. net exports.

supply:
The net capital outflow ($S - I$) is the supply of dollars to be invested abroad.



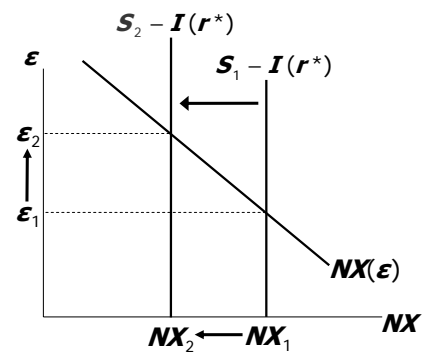
Four experiments

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

1. Fiscal policy at home

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

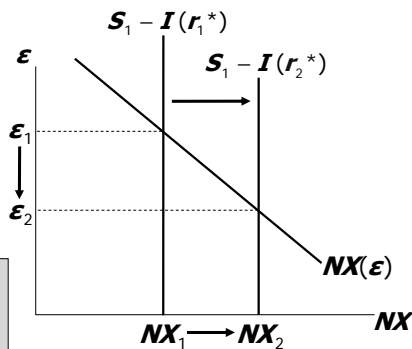
...causing the real exchange rate to rise and NX to fall.



2. Fiscal policy abroad

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

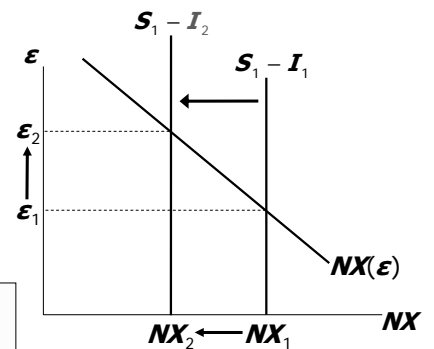
...causing the real exchange rate to fall and NX to rise.



3. An increase in investment demand

An increase in investment reduces net capital outflows and the supply of dollars in the foreign exchange market...

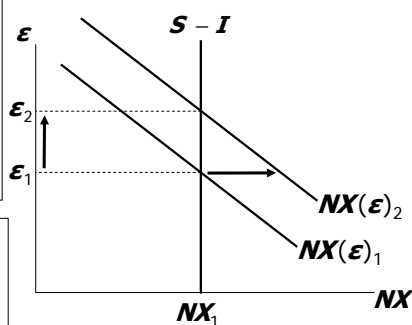
...causing the real exchange rate to rise and NX to fall.



4. Trade policy to restrict imports

At any given value of ϵ , an import quota $\Rightarrow \downarrow IM \Rightarrow \uparrow NX$
 \Rightarrow demand for dollars shifts right

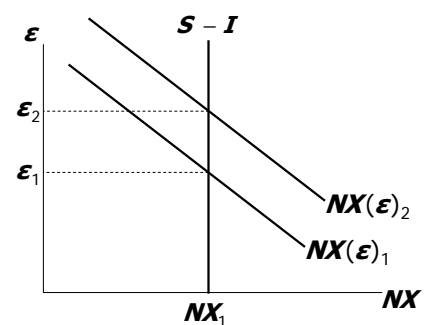
Trade policy doesn't affect S or I , so capital flows and the supply of dollars remains fixed.



4. Trade policy to restrict imports

Results:

- $\Delta \epsilon > 0$
(demand increase)
- $\Delta NX = 0$
(supply fixed)
- $\Delta IM < 0$
(policy)
- $\Delta EX < 0$
(rise in ϵ)



The Determinants of the Nominal Exchange Rate

- Start with the expression for the real exchange rate:

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

- Solve it 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:

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

$\frac{M^*}{P^*} = L^*(r^* + \pi^*, Y^*)$
 $\frac{M}{P} = L(r^* + \pi, Y)$
 $NX(\varepsilon) = \bar{S} - I(r^*)$

The Determinants of the Nominal Exchange Rate

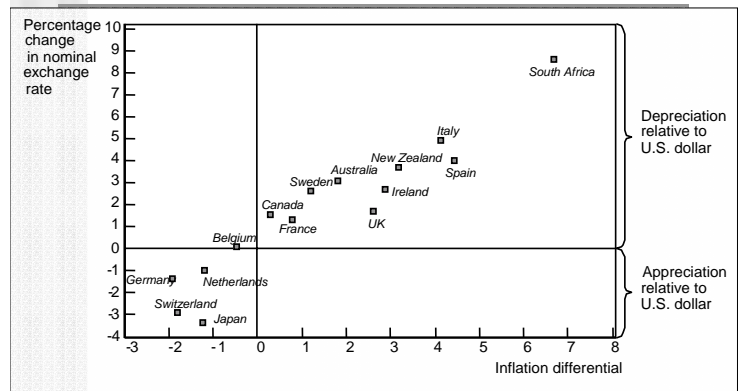
$$e = \varepsilon \times \frac{P^*}{P}$$

- We can rewrite this equation in terms of growth rates (see "arithmetic tricks for working with percentage changes," Chap 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 ε , the growth rate of e equals the difference between foreign and domestic inflation rates.

Inflation and nominal exchange rates



Purchasing Power Parity (PPP)

- def1: a doctrine that states that goods must sell at the same (currency-adjusted) price in all countries.
- def2: 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)

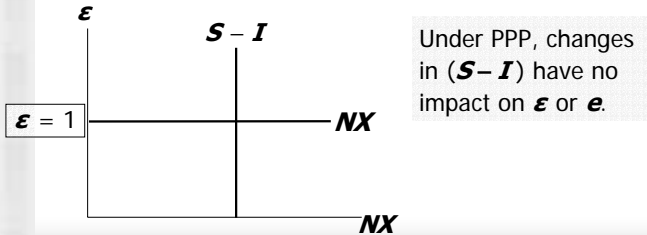
- PPP: $e \times P = P^*$
 - Cost of a basket of domestic goods, in foreign currency.
 - Cost of a basket of domestic goods, in domestic currency.
 - Cost of a basket of foreign goods, in foreign currency.

- 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 $\epsilon = e \times \frac{P}{P^*} = \frac{P^*}{P} \times \frac{P}{P^*} = 1$

and the NX curve is horizontal:



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.

Nonetheless, PPP is a useful theory:

- It's simple & intuitive
- In the real world, nominal exchange rates have a tendency toward their PPP values over the long run.

CASE STUDY

The Reagan Deficits revisited

	1970s	1980s	actual change	closed economy	small open economy
$G - T$	2.2	3.9	↑	↑	↑
S	19.6	17.4	↓	↓	↓
r	1.1	6.3	↑	↑	no change
I	19.9	19.4	↓	↓	no change
NX	-0.3	-2.0	↓	no change	↓
ϵ	115.1	129.4	↑	no change	↑

Data: decade averages; all except r and ϵ are expressed as a percent of GDP; ϵ 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.---is in between these two extremes.
- The analysis of policies or other exogenous changes in a large open economy is 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 the degree of openness:

	closed economy	large open economy	small open economy
r	rises	rises, but not as much as in closed economy	no change
I	falls	falls, but not as much as in closed economy	no change
NX	no change	falls, but not as much as in small open economy	falls

Chapter summary

1. Net exports--the difference between
 - exports and imports
 - a country's output (Y) and its spending ($C + I + G$)
2. Net capital outflow equals
 - purchases of foreign assets minus foreign purchases of the country's assets
 - the difference between saving and investment
3. National income accounts identities:
 - $Y = C + I + G + NX$
 - trade balance $NX = S - I$ net capital outflow

Chapter summary

4. Impact of policies on NX :
 - NX increases if policy causes S to rise or I to fall
 - NX does not change if policy affects neither S nor I . Example: trade policy
5. Exchange rates
 - nominal: the price of a country's currency in terms of another country's currency
 - real: the price of a country's goods in terms of another country's goods.
 - The real exchange rate equals the nominal rate times the ratio of prices of the two countries.

Chapter summary

6. How the real exchange rate is determined
 - NX depends negatively on the real exchange rate, other things equal
 - The real exchange rate adjusts to equate NX with net capital outflow
7. How the nominal exchange rate is determined
 - e equals the real exchange rate times the country's price level relative to the foreign price level.
 - For a given value of the real exchange rate, the percentage change in the nominal exchange rate equals the difference between the foreign & domestic inflation rates.