

Chapter 5: The Open Economy*

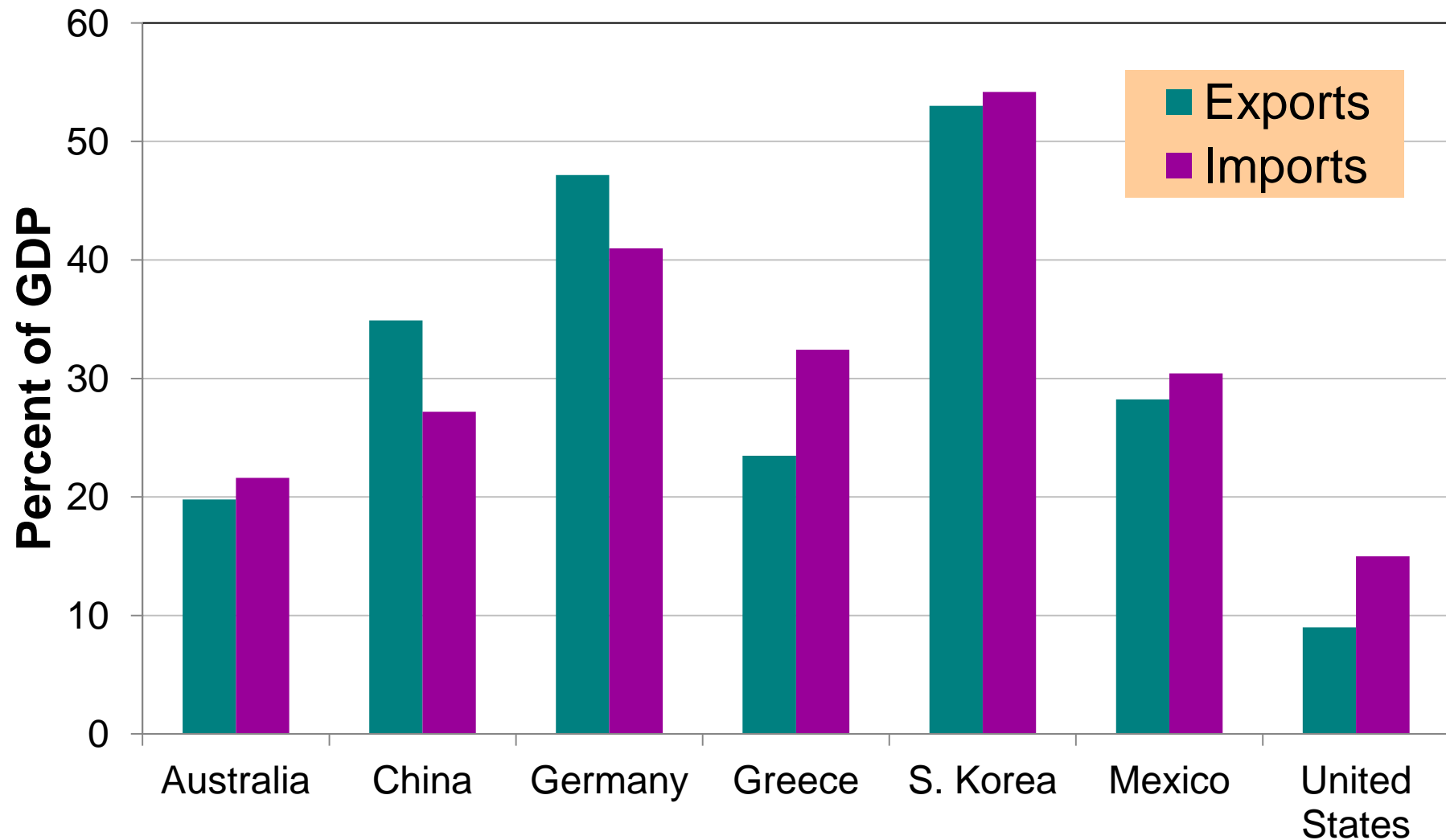
MACROECONOMICS

Seventh Edition

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*Slides based on Ron Cronovich's slides, adjusted for course in Macroeconomics at the Wang Yanan Institute for Studies in Economics at Xiamen University.

Imports and exports (% of GDP), 2007



Learning Objectives

This chapter introduces you to understanding:

- the international flows of capital and goods ←
- saving and investment in a small open economy
- Exchange rates
- the U.S. As a large open economy

5.1) The International Flows of C & G

In an international economy

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

5.1) The International Flows of C & G

→ Preliminaries

$$C = C^d + C^f$$

$$I = I^d + I^f$$

$$G = G^d + G^f$$

superscripts:

d = spending on domestic goods

f = spending on foreign goods

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”)
= $EX - IM$

5.1) The International Flows of C & G

→ GDP=Expenditure on Dom. Produced G & S

$$Y = C^d + I^d + G^d + EX$$

$$= (C - C^f) + (I - I^f) + (G - G^f) + EX$$

$$= C + I + G + EX - (C^f + I^f + G^f)$$

$$= C + I + G + EX - IM$$

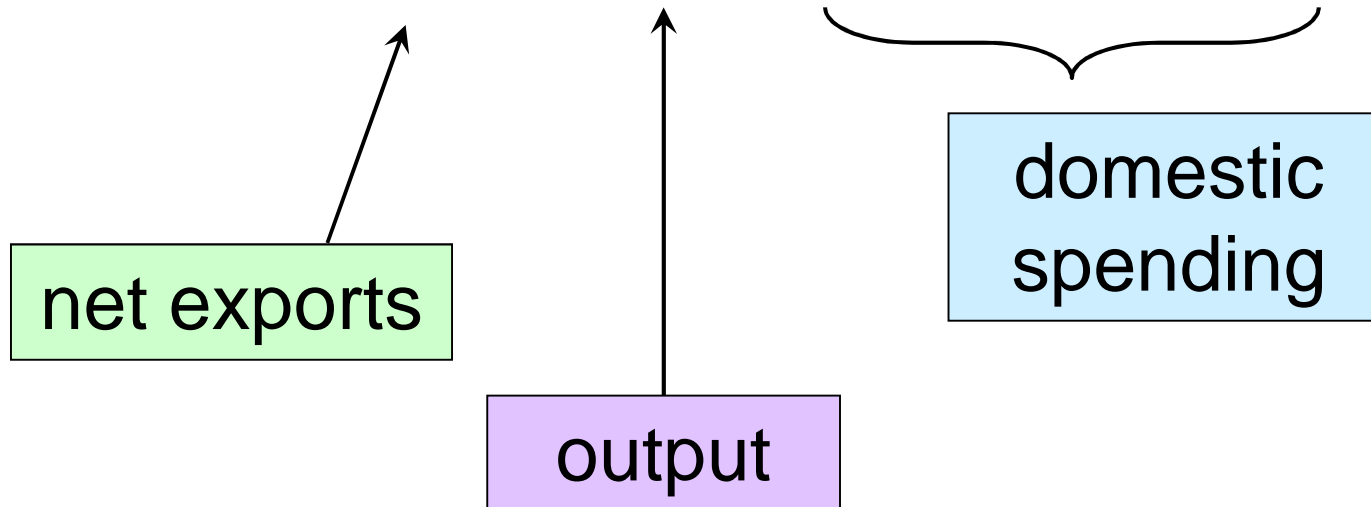
$$= C + I + G + NX$$

5.1) The International Flows of C & G

→ The Open Economy National Income Identity

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

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



5.1) The International Flows of C & 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 = $-NX$

5.1) The International Flows of C & G

→ 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

5.1) The International Flows of C & G

→ The Link Between Trade and Capital Flows

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

implies

$$\begin{aligned} NX &= (Y - C - G) - I \\ &= [\bar{Y} - C(\bar{Y} - \bar{T}) - \bar{G}] - I(r^*) \\ &= \bar{S} - I(r^*) \end{aligned}$$

Trade balance = Net capital outflow

Thus,
a country with a trade deficit ($NX < 0$)
is a net borrower ($S < I$).

5.1) The International Flows of C & G

→ The World's Largest Debtor Nation

- Every year since 1980s: huge trade deficits and net capital inflows, *i.e.* net borrowing from abroad
- As of 12/31/2009:
 - U.S. residents owned \$18.4 trillion worth of foreign assets
 - Foreigners owned \$21.1 trillion worth of U.S. assets
 - U.S. net indebtedness to rest of the world: \$2.7 trillion--higher than any other country, hence U.S. is the “**world's largest debtor nation**”

Learning Objectives

This chapter introduces you to understanding:

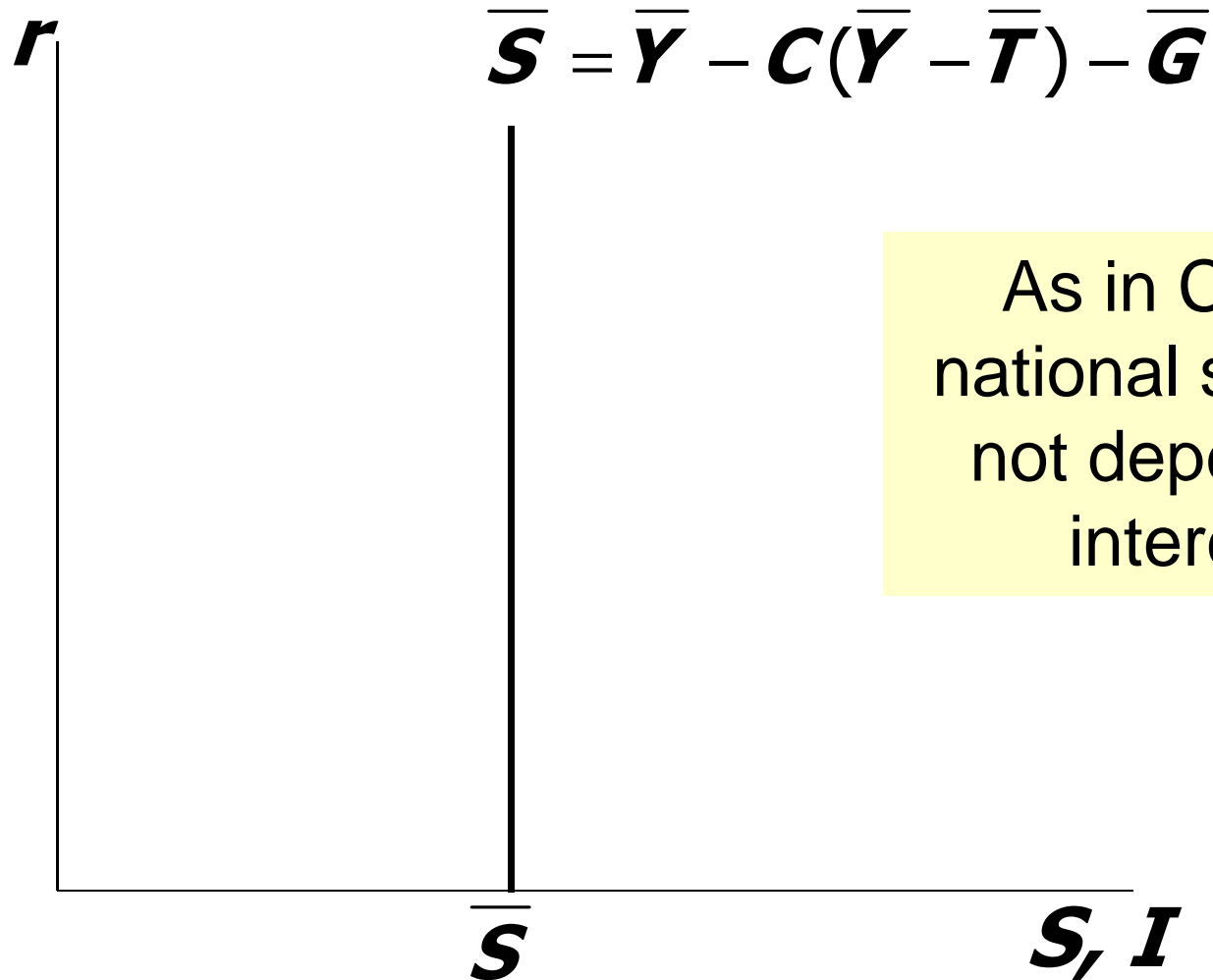
- the international flows of capital and goods ✓
- saving and investment in a small open economy ←
- Exchange rates
- the U.S. as a large open economy

5.2) Saving and Investment in a SOE

- Develop model of the flows of international capital and goods using a small open economy framework (SOE).
- Use some elements familiar from chapter 3, however in an open-economy context:
 - production function $Y = \bar{Y} = F(\bar{K}, \bar{L})$
 - consumption function $C = C(Y - T)$
 - investment function $I = I(r)$
 - exogenous policy variables $G = \bar{G}, T = \bar{T}$

5.2) Saving and Investment in a SOE

→ National Saving: Supply of Loanable Funds



As in Chapter 3,
national saving does
not depend on the
interest rate

5.2) Saving and Investment in a SOE

→ Assumptions on Capital Flows

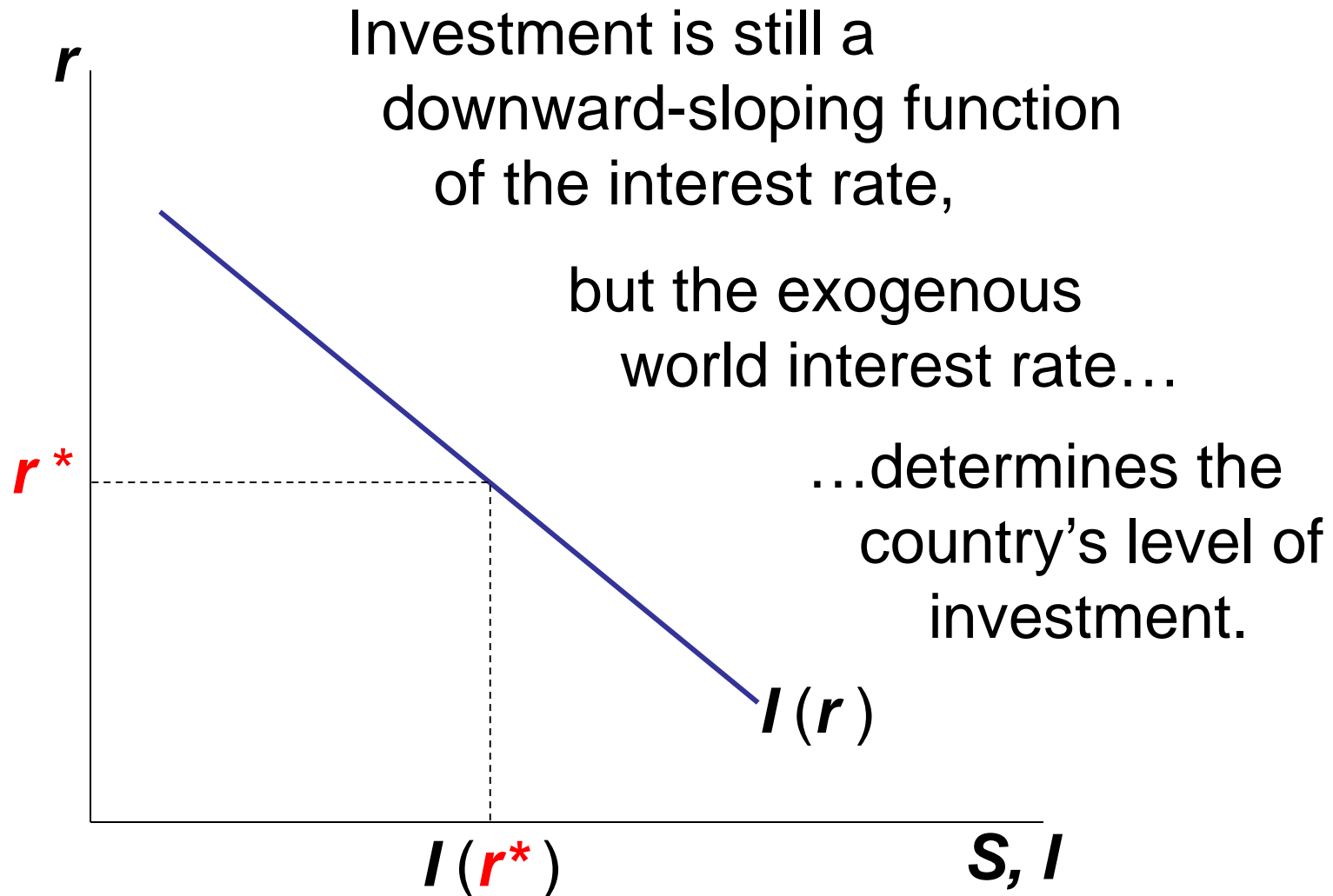
- a. Domestic & foreign bonds are perfect substitutes (same risk, maturity, *etc.*)
- b. **Perfect capital mobility:**
no restrictions on international trade in assets
- c. Economy is **small:**
cannot affect the world interest rate, denoted r^*

a & b imply $r = r^*$

c implies r^* is exogenous

5.2) Saving and Investment in a SOE

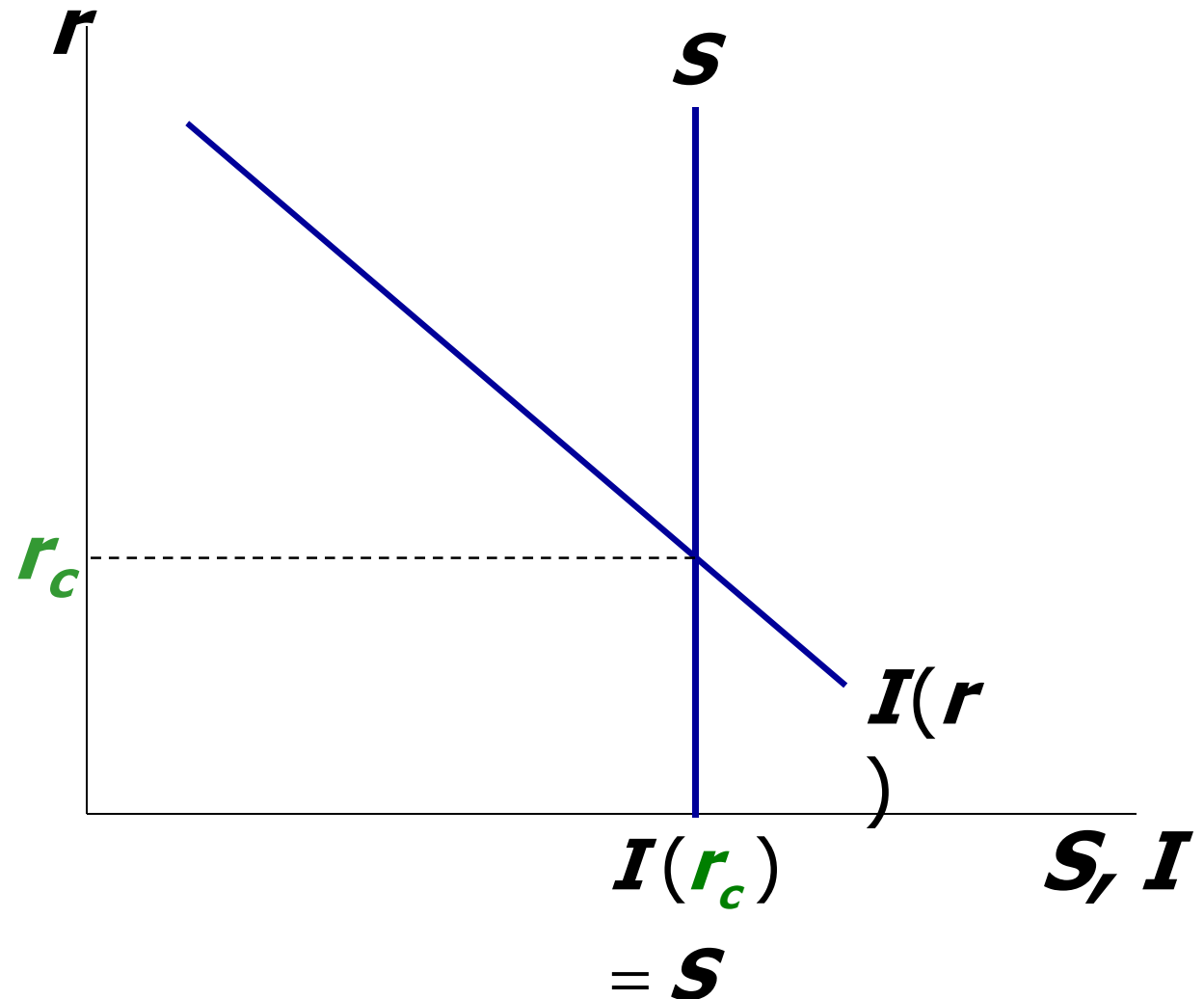
→ Investment: Demand for Loanable Funds



5.2) Saving and Investment in a SOE

→ If the Economy Were Closed...

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

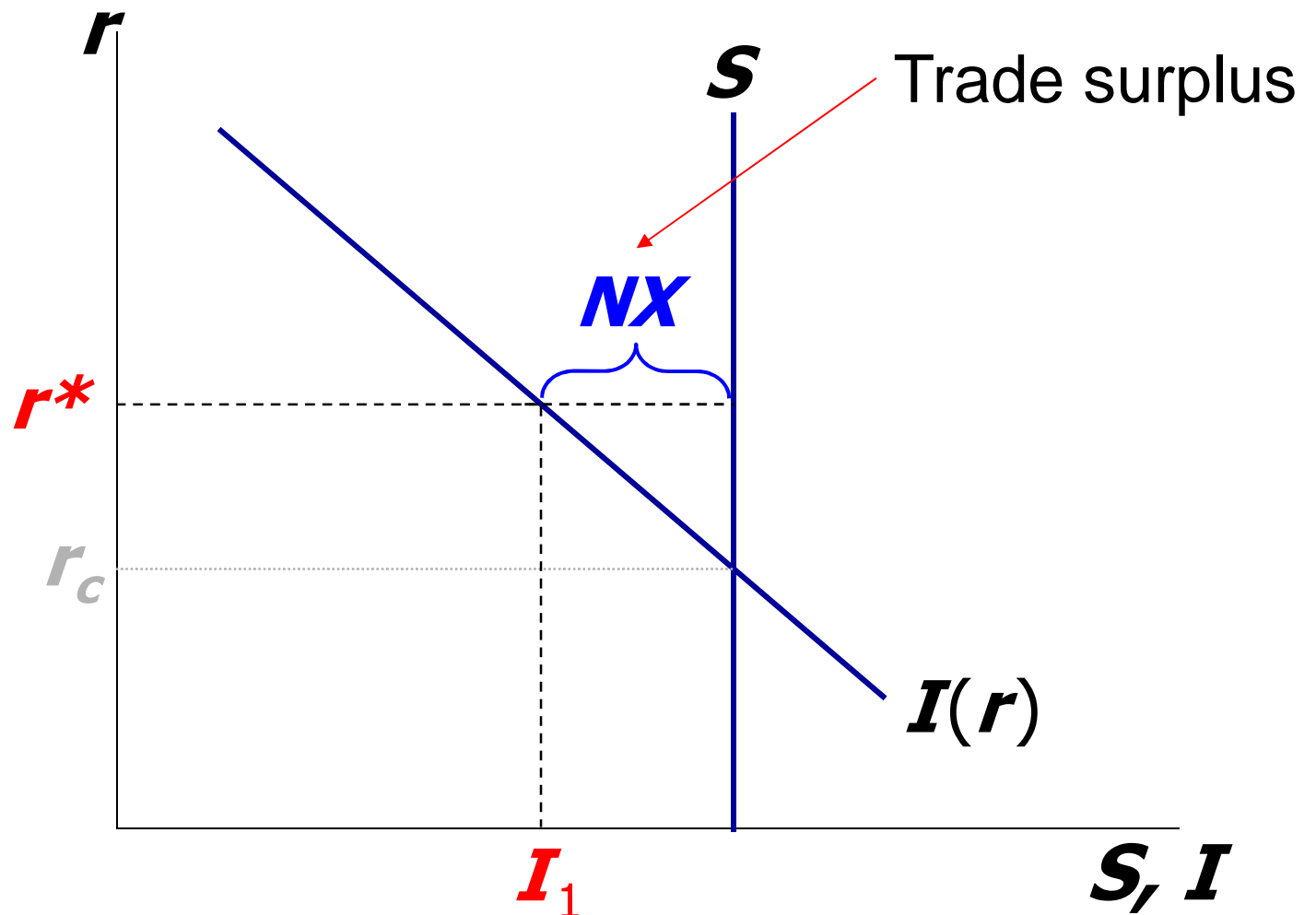


5.2) Saving and Investment in a SOE

→ 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



5.2) Saving and Investment in a SOE

→ Three Analyses...

1. Fiscal policy at home
2. Fiscal policy abroad
3. An increase in investment demand

5.2) Saving and Investment in a SOE

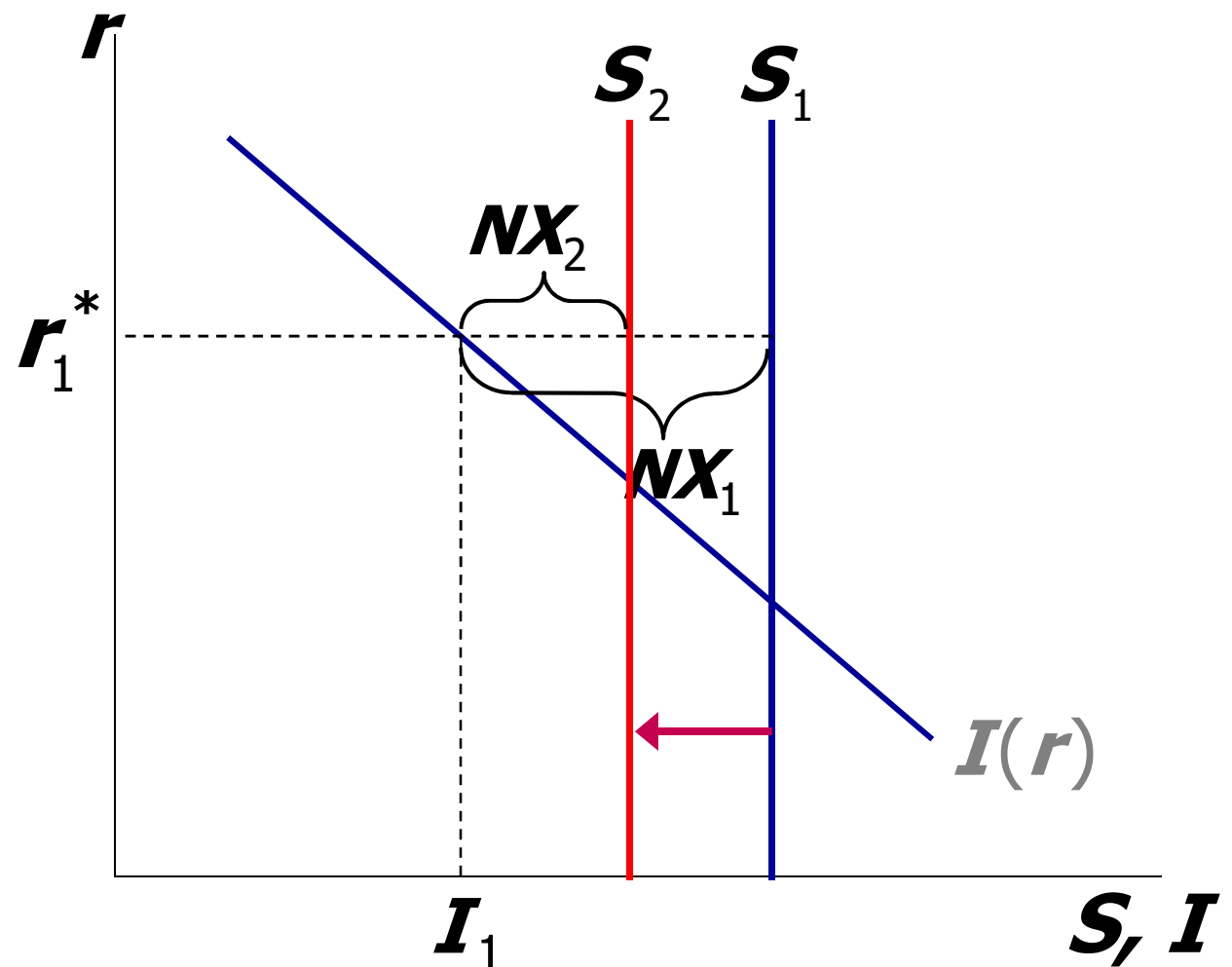
→ Fiscal Policy at Home

An increase in G
or decrease in T
reduces saving.

Results:

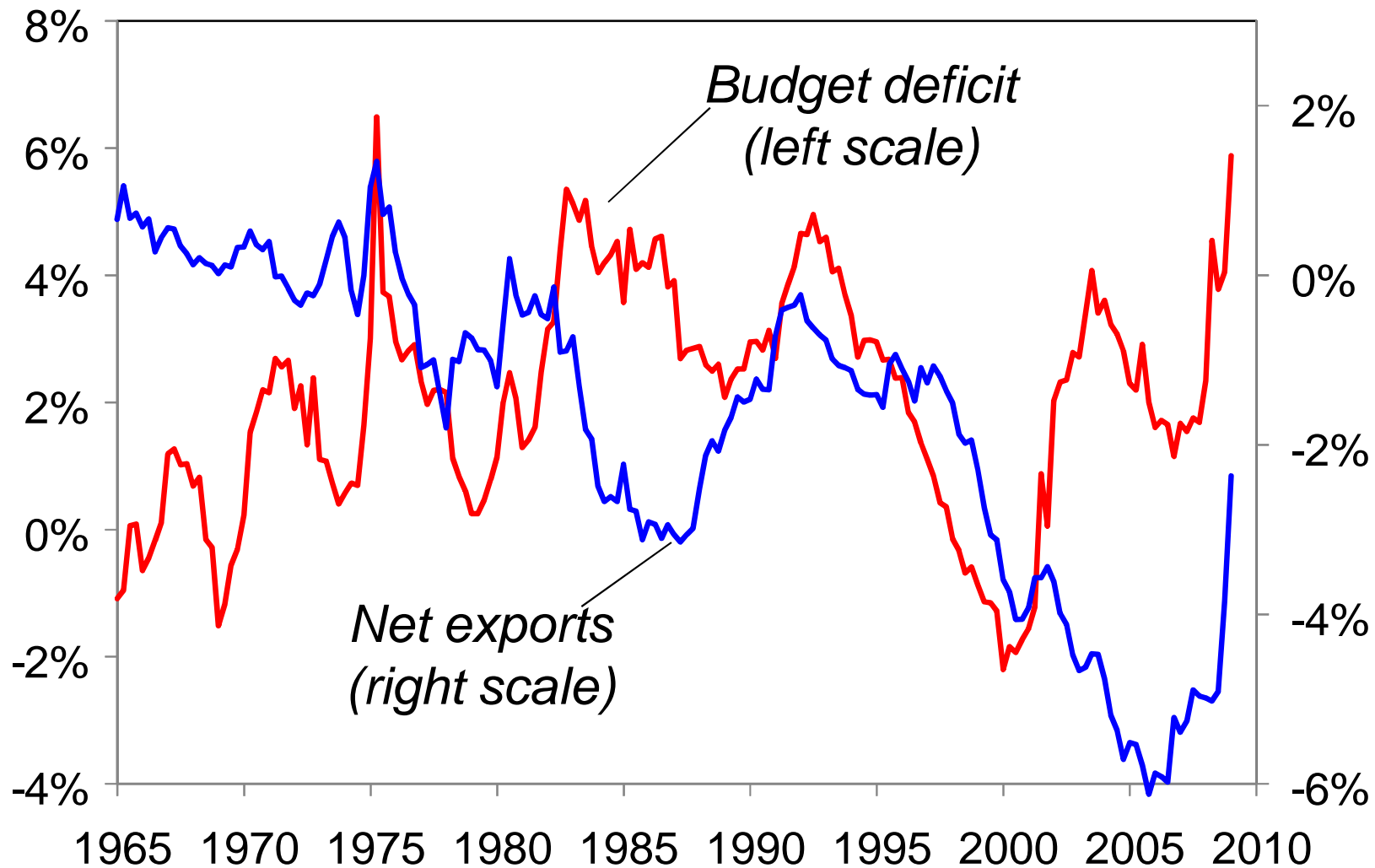
$$\Delta I = 0$$

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



5.2) Saving and Investment in a SOE

→ NX and the Federal Budget Deficit



5.2) Saving and Investment in a SOE

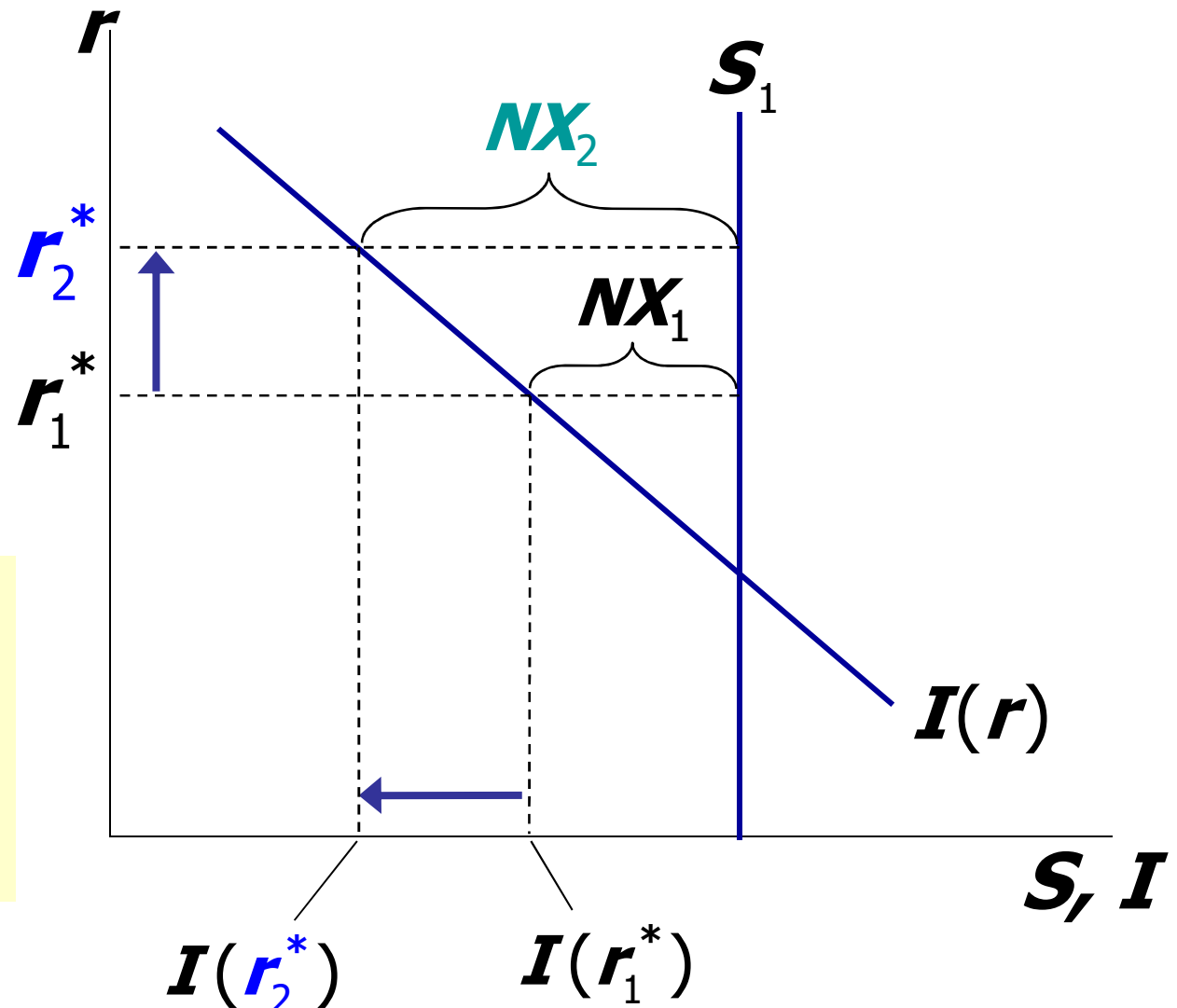
→ Fiscal Policy Abroad

Expansionary fiscal policy abroad raises the world interest rate.

Results:

$$\Delta \mathbf{I} < 0$$

$$\Delta \mathbf{NX} = -\Delta \mathbf{I} > 0$$

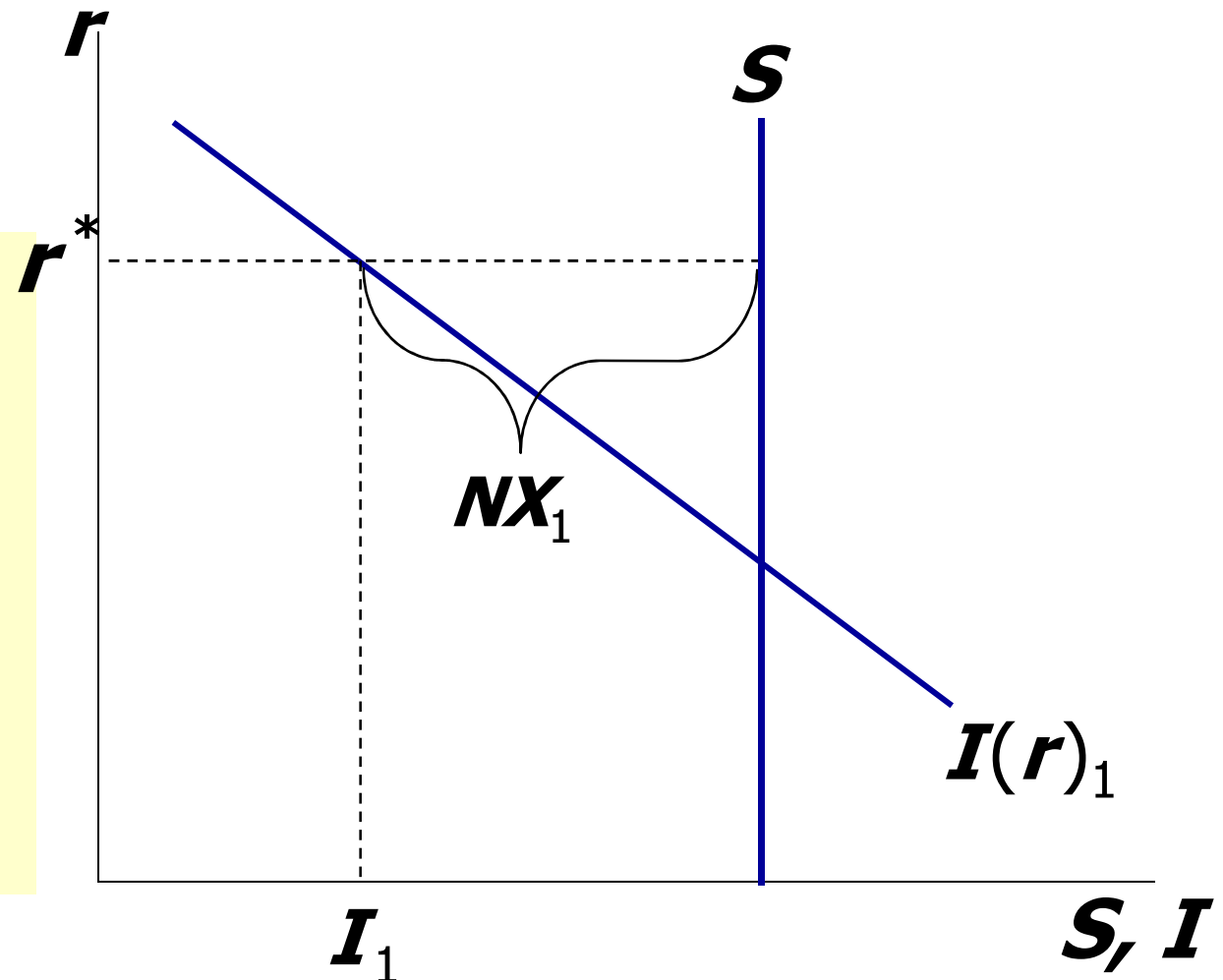


5.2) Saving and Investment in a SOE

→ 该你们了: 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.



Learning Objectives

This chapter introduces you to understanding:

- the international flows of capital and goods ✓
- saving and investment in a small open economy ✓
- Exchange rates ←
- the U.S. as a large open economy

5.3) Exchange Rates

→ Nominal Exchange Rate

e = Nominal exchange rate, the relative price of domestic currency in terms of foreign currency (e.g. Euro per Dollar, that is, how much Euro do I have to pay to obtain a Dollar)

e.g.:

$e=0.74 \text{ €/\$}$

5.3) Exchange Rates

→ A Few Exchange Rates, as of 30/09/11

<i>Country</i>	<i>Exchange rate</i>
Euro area	0.74 Euro/\$
China	6.40 RMB/\$
Indonesia	8800 Rupiahs/\$
Japan	76.56 Yen/\$
Mexico	13.74 Pesos/\$
Russia	31.98 Rubles/\$
South Africa	7.98 Rand/\$
U.K.	0.64 Pounds/\$

5.3) Exchange Rates

→ Real Exchange Rate

*the lowercase
Greek letter
epsilon*

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, that is, how many Japanese Big Macs do I have to pay to obtain one U.S. Big Mac)

5.3) Exchange Rates

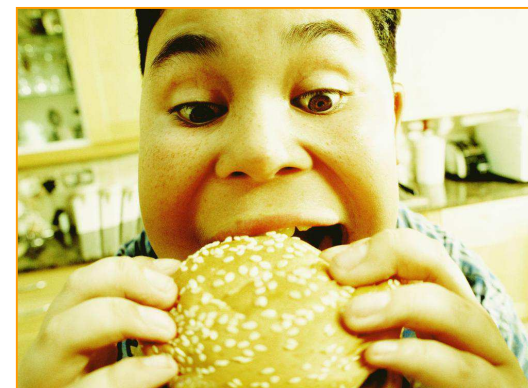
→ Understanding the Units of ε

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

5.3) Exchange Rates

→ 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.

5.3) Exchange Rates

→ ε in the Real World and 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

5.3) Exchange Rates

→ How NX depends on ε

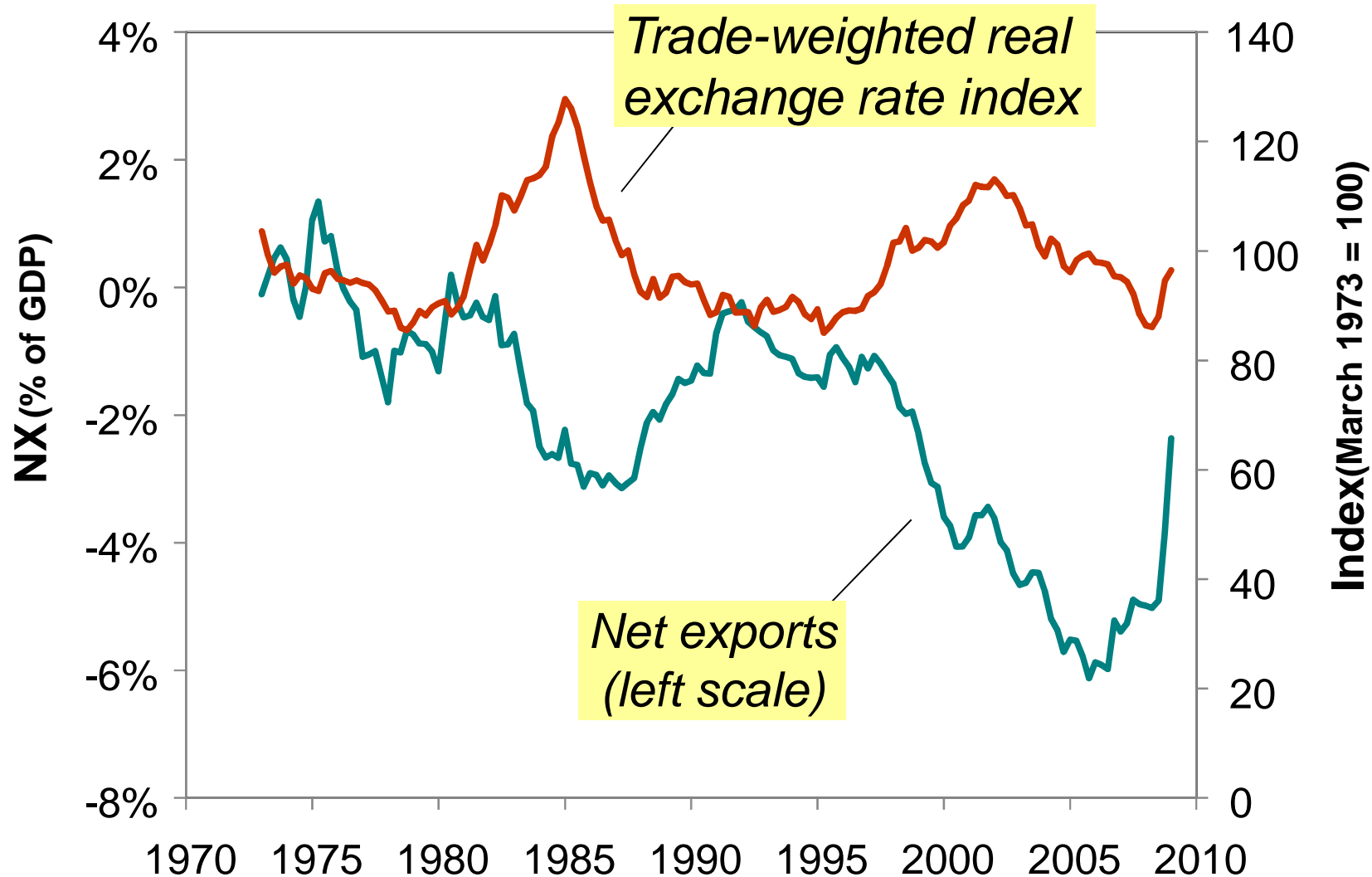
$\uparrow \varepsilon \Rightarrow$ U.S. goods become more expensive relative to foreign goods

$\Rightarrow \downarrow EX, \uparrow IM$

$\Rightarrow \downarrow NX$

5.3) Exchange Rates

→ U.S. Net Exports and the Real Exchange Rate



5.3) Exchange Rates

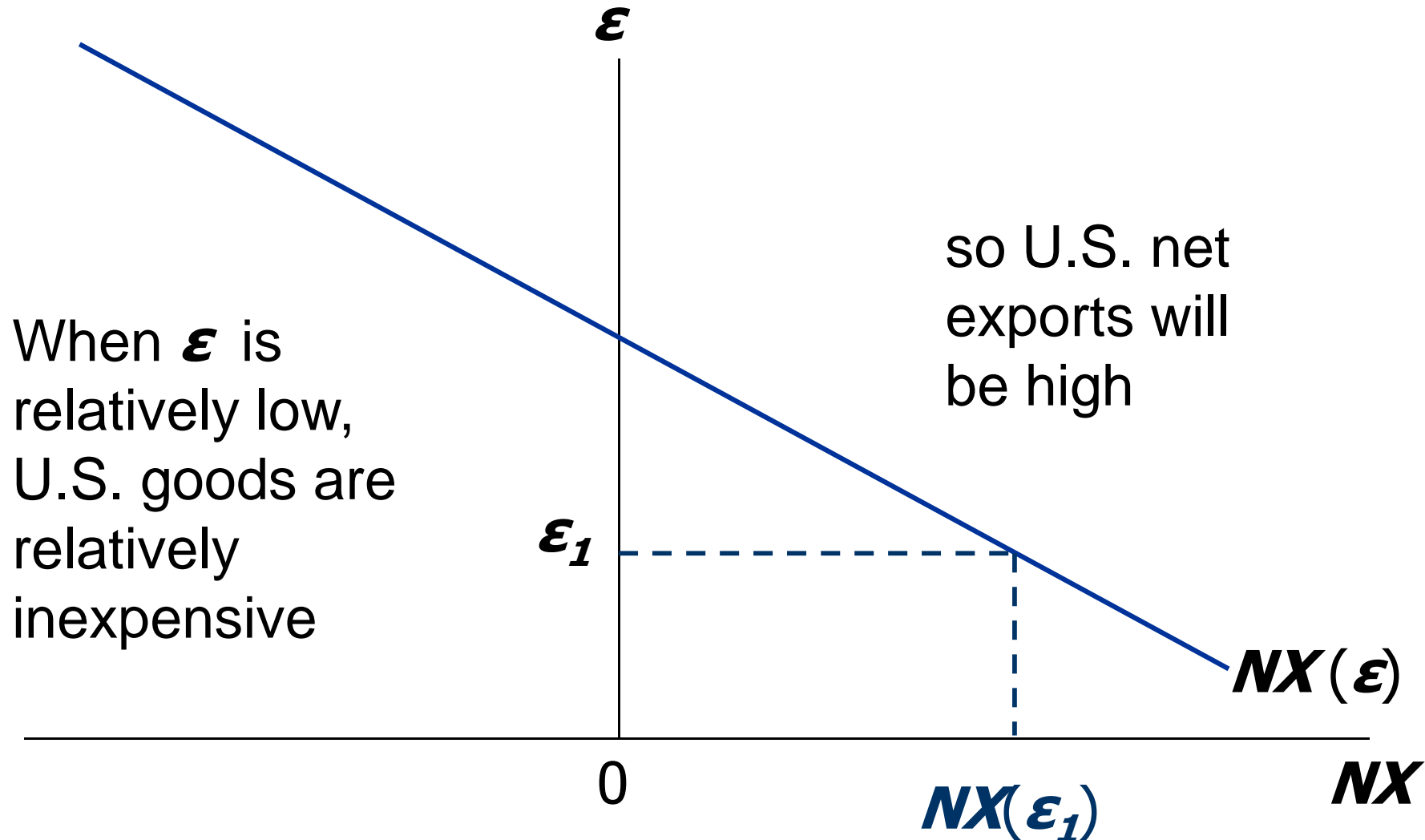
→ The Net Exports Function

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

$$NX = NX(\epsilon)$$

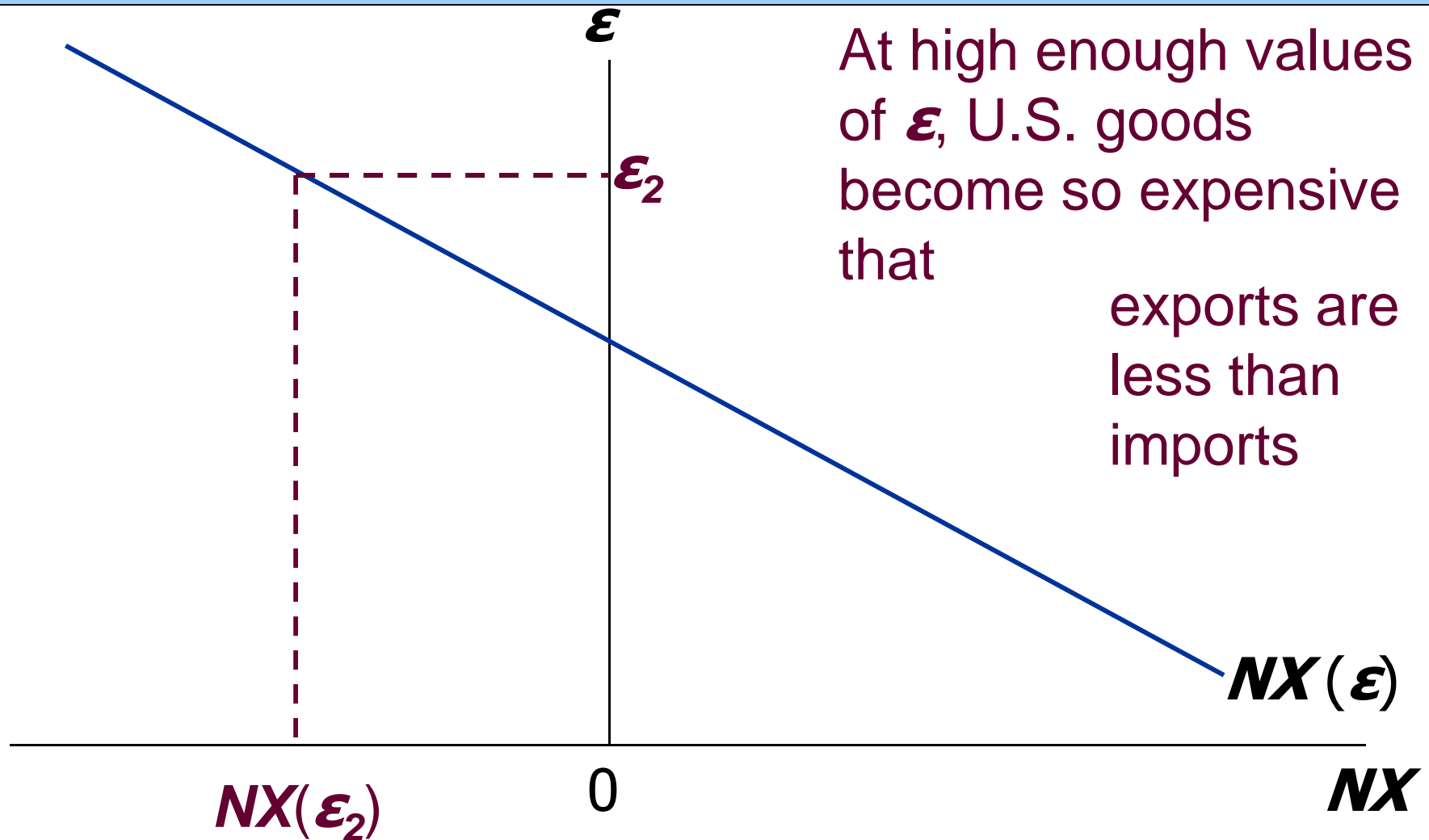
5.3) Exchange Rates

→ The NX Curve for the U.S.



5.3) Exchange Rates

→ The NX Curve for the U.S.



5.3) Exchange Rates

→ How ε is Determined in the Model

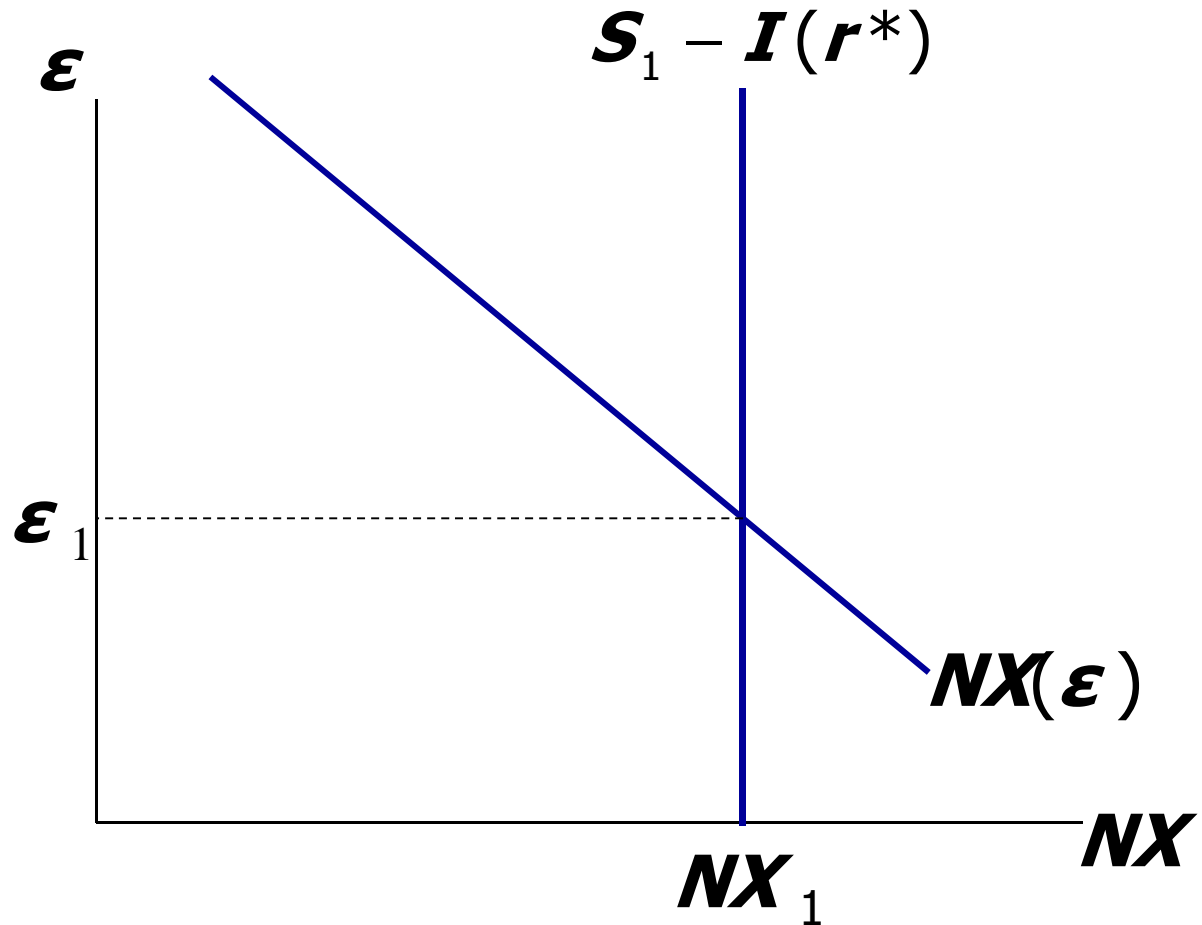
- The accounting **identity** says $\mathbf{NX} = \mathbf{S} - \mathbf{I}$
- We saw earlier how $\mathbf{S} - \mathbf{I}$ is determined:
 - \mathbf{S} depends on domestic factors (output, fiscal policy variables, *etc*)
 - \mathbf{I} is determined by the world interest rate r^*
 - r^* adjusts to equate global savings and investment
- So, ε must adjust to ensure
$$\mathbf{NX}(\varepsilon) = \overline{\mathbf{S}} - \mathbf{I}(r^*)$$

5.3) Exchange Rates

→ How ϵ is Determined in the Model (ctd.)

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

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



5.3) Exchange Rates

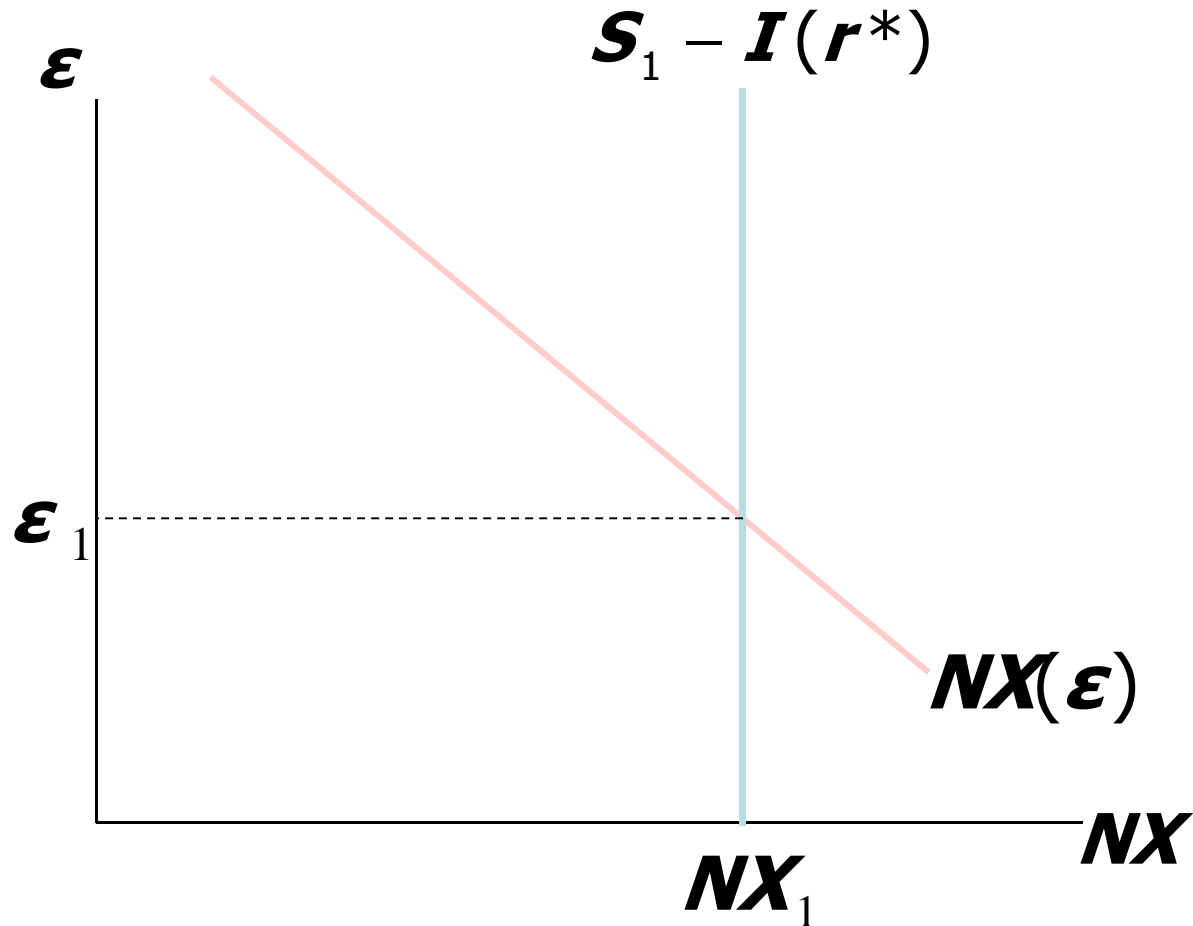
→ Supply and Demand in the FX Market

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.



5.3) Exchange Rates

→ Four Analyses...

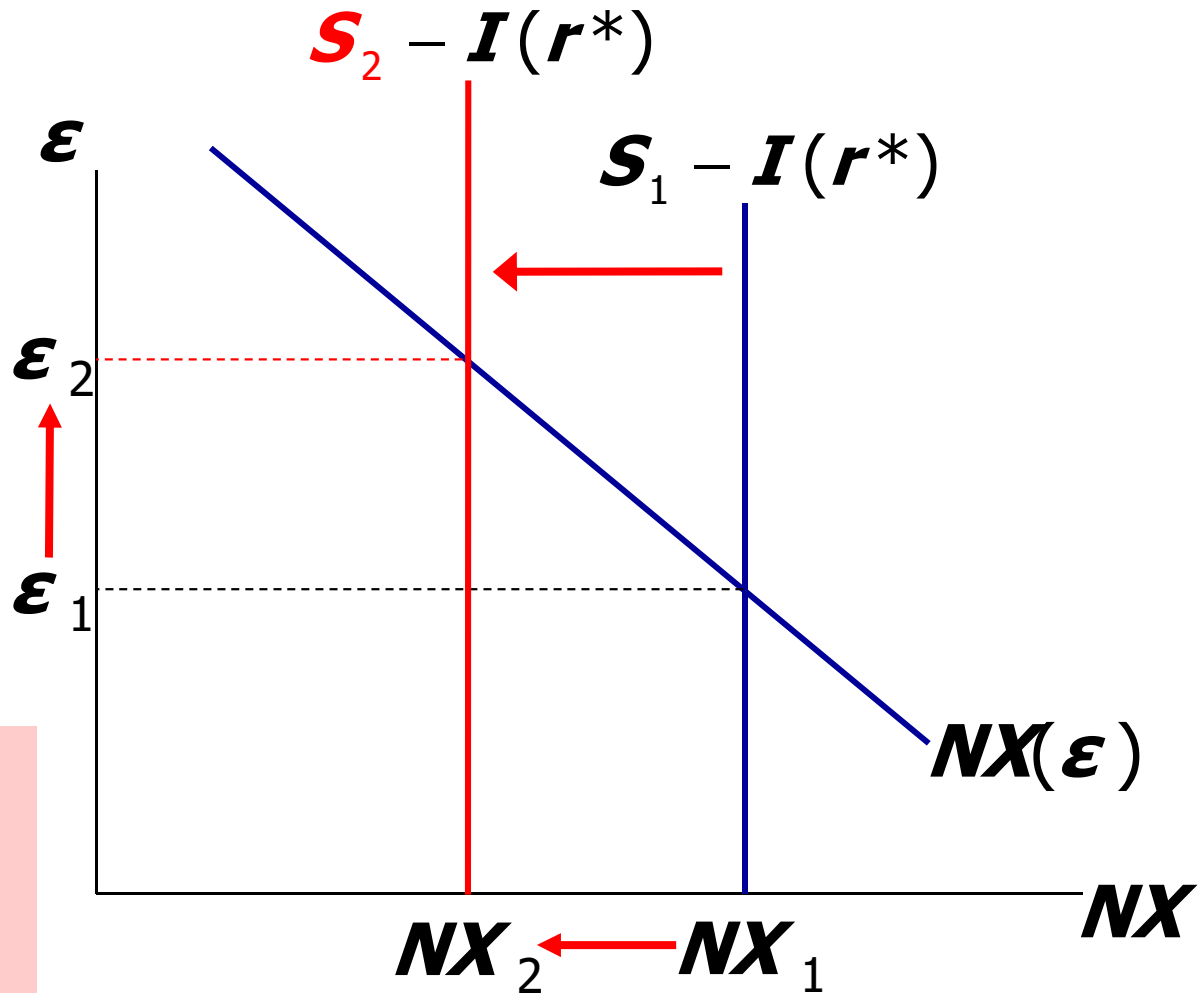
1. Fiscal policy at home
2. Fiscal policy abroad
3. An increase in investment demand
4. Trade policy to restrict imports

5.3) Exchange Rates

→ 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 NX to fall.

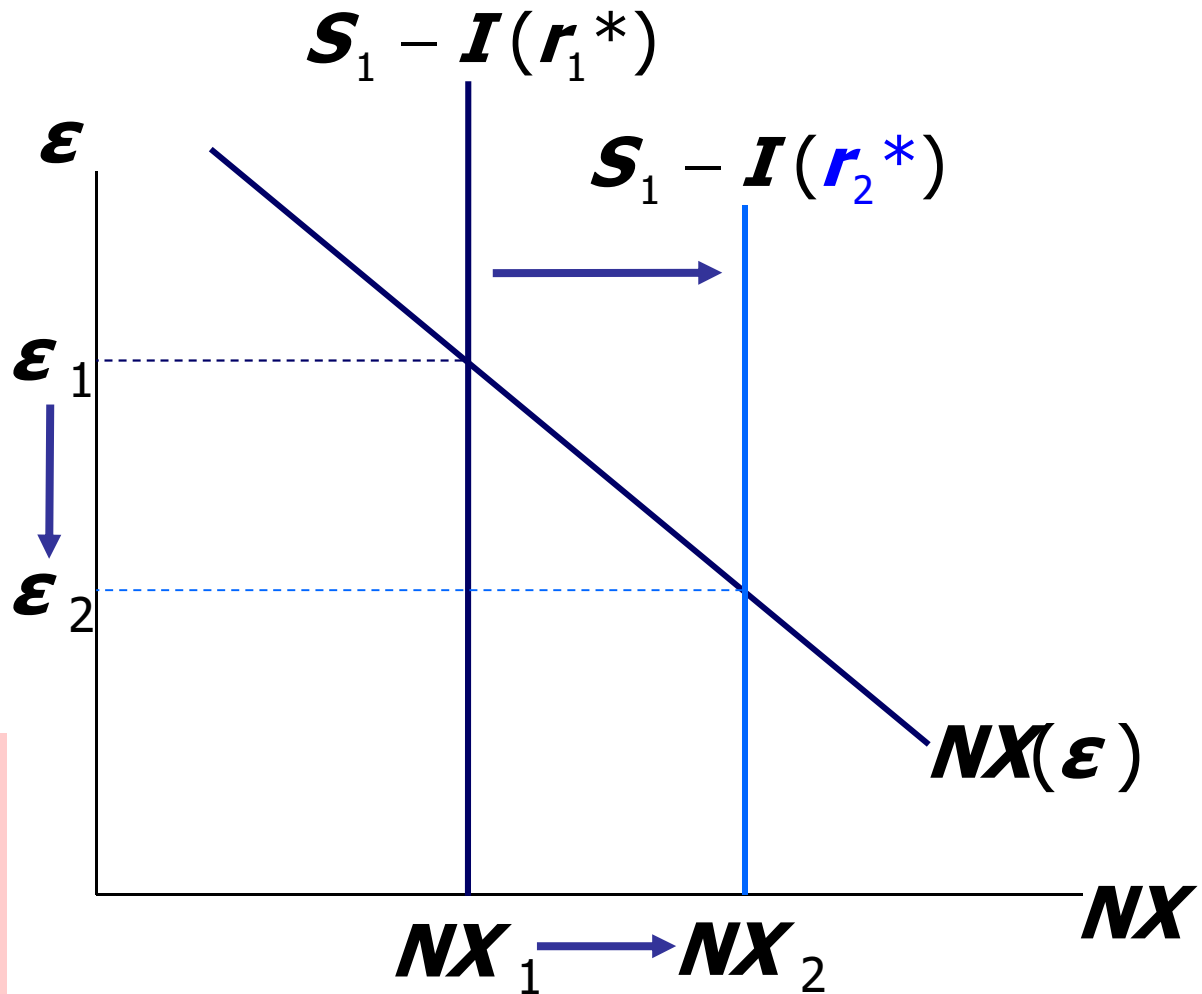


5.3) Exchange Rates

→ 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 NX to rise.

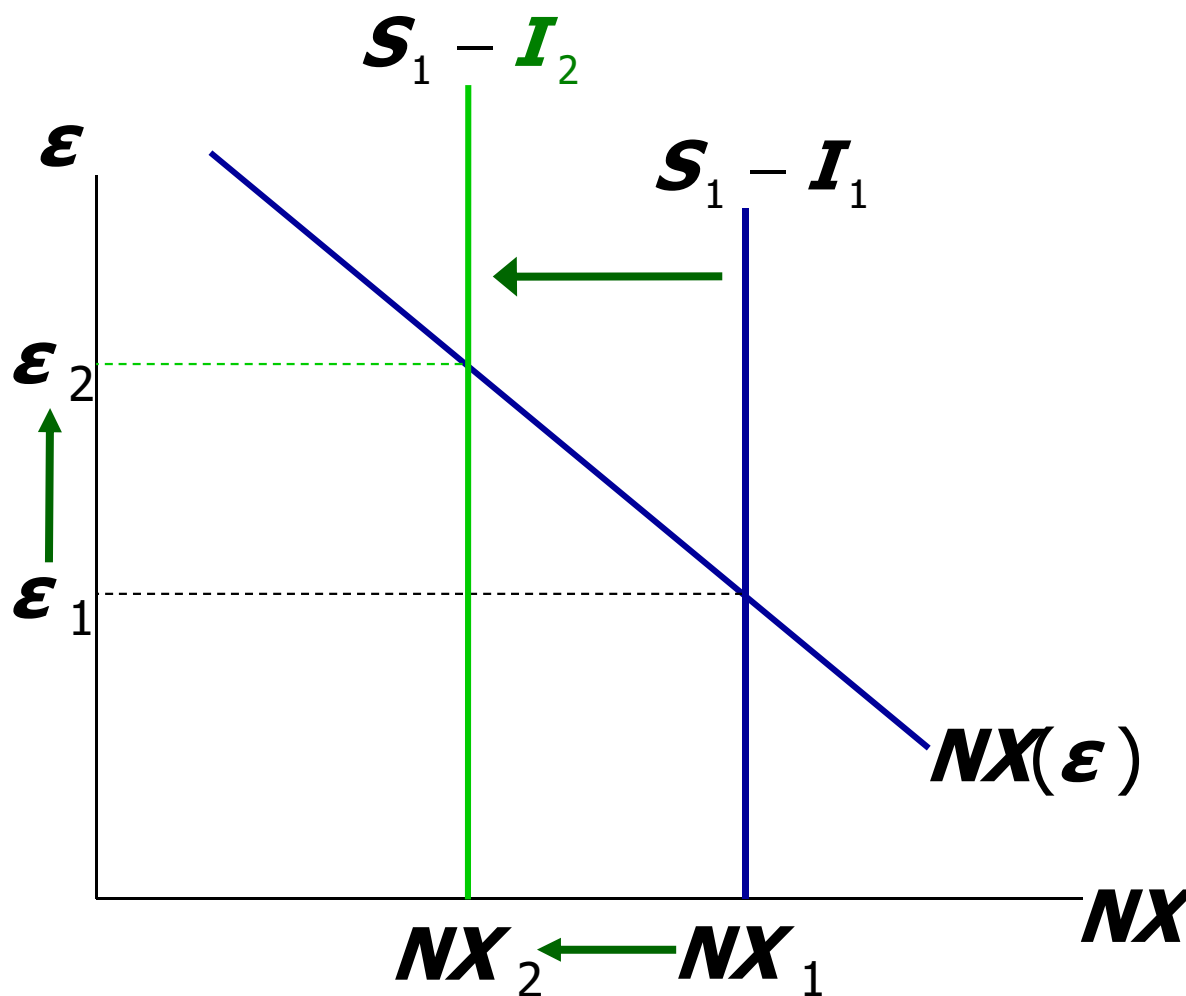


5.3) Exchange Rates

→ 3. Increase in Investment Demand

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.

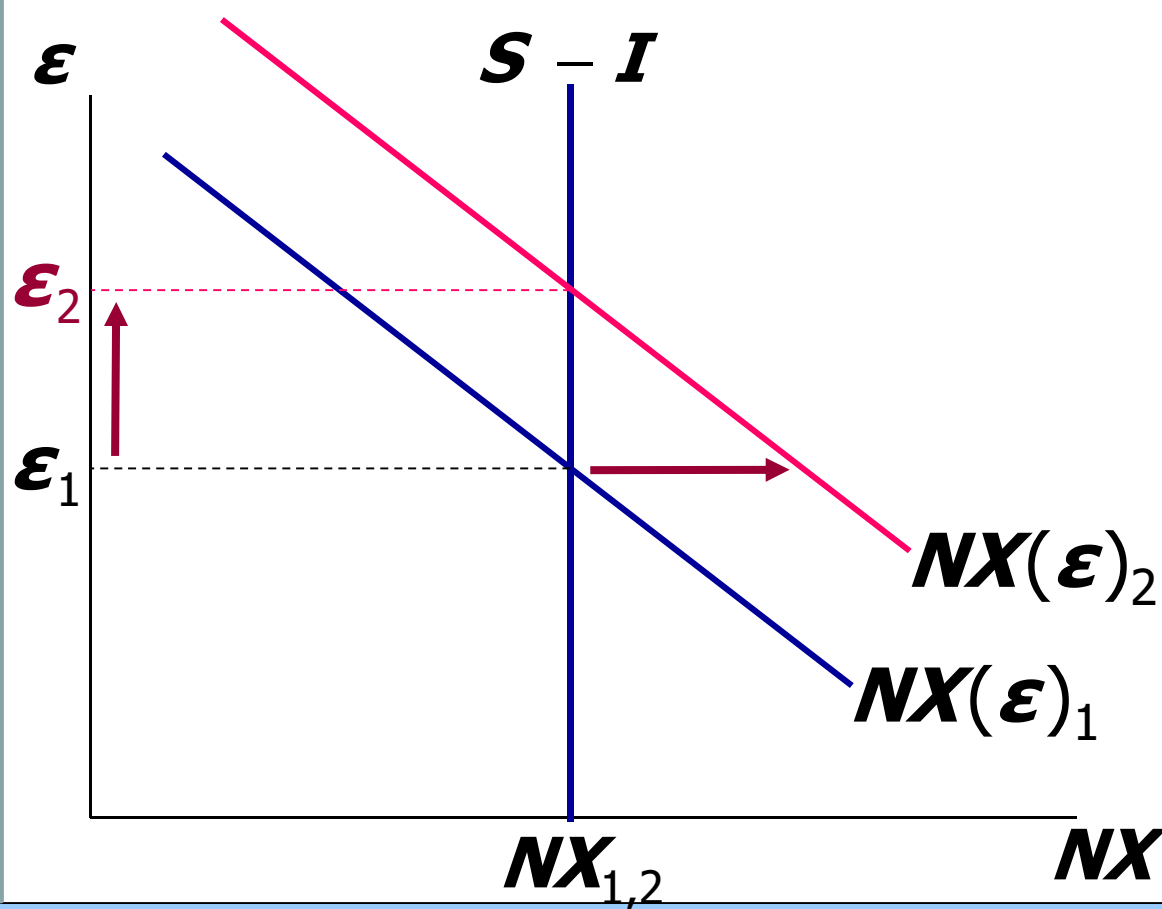


5.3) Exchange Rates

→ 4. Trade Policy to Restrict Imports

Trade policy doesn't affect S or I , so cap. flows and dollar supply remain fixed.

At any given value of ϵ , an import quota causes
⇒ $\downarrow IM$ ⇒ NX curve shifts right
⇒ This causes higher net capital demand from abroad to finance larger trade deficit
⇒ ϵ needs to adjust to equilibrate D and S
⇒ Since at higher ϵ exports \downarrow , NX remains unchanged



5.3) Exchange Rates

→ 4. Trade Policy to Restrict Imports

Results:

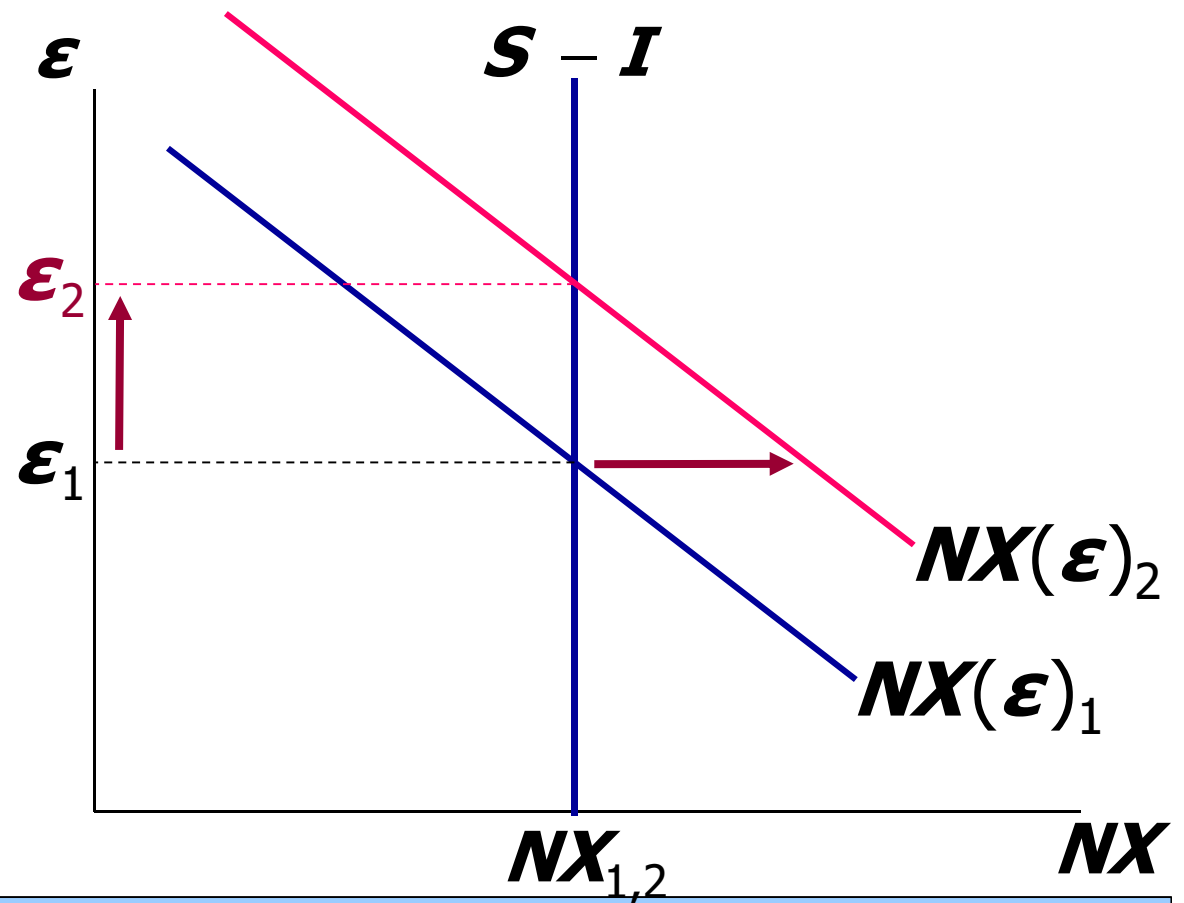
$$\Delta \boldsymbol{\varepsilon} > 0$$

(demand increase)

$$\Delta \boldsymbol{NX} = 0 \text{ (supply fixed)}$$

$$\Delta \boldsymbol{IM} < 0 \text{ (policy)}$$

$$\Delta \boldsymbol{EX} < 0 \text{ (rise in } \boldsymbol{\varepsilon} \text{)}$$



5.3) Exchange Rates

→ Determinants of the Nominal Exchange Rate

- Start with the expression for the real exchange rate:

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

- Solve for the nominal exchange rate:

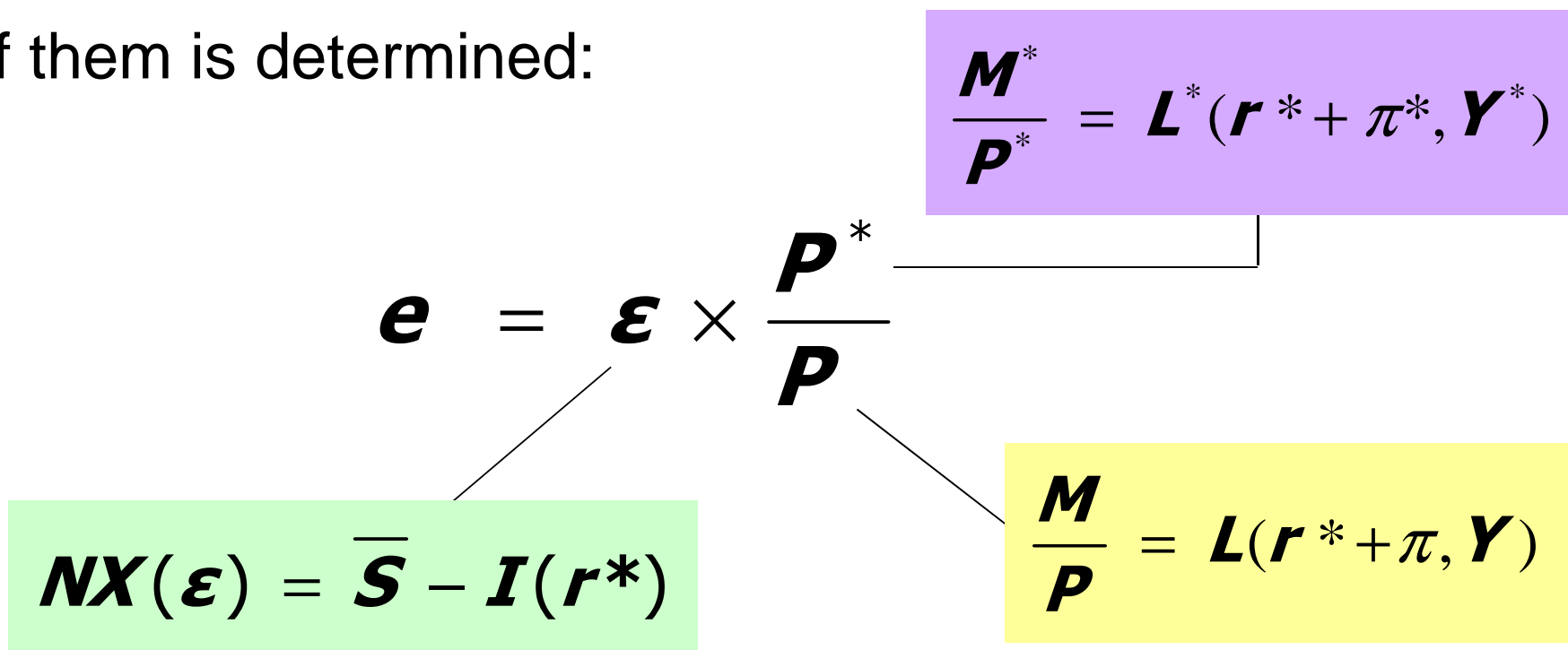
$$\boldsymbol{e} = \boldsymbol{\varepsilon} \times \frac{\boldsymbol{P}^*}{\boldsymbol{P}}$$

5.3) Exchange Rates

→ 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:

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


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

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

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

5.3) Exchange Rates

→ Determinants of the Nominal Exchange Rate

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

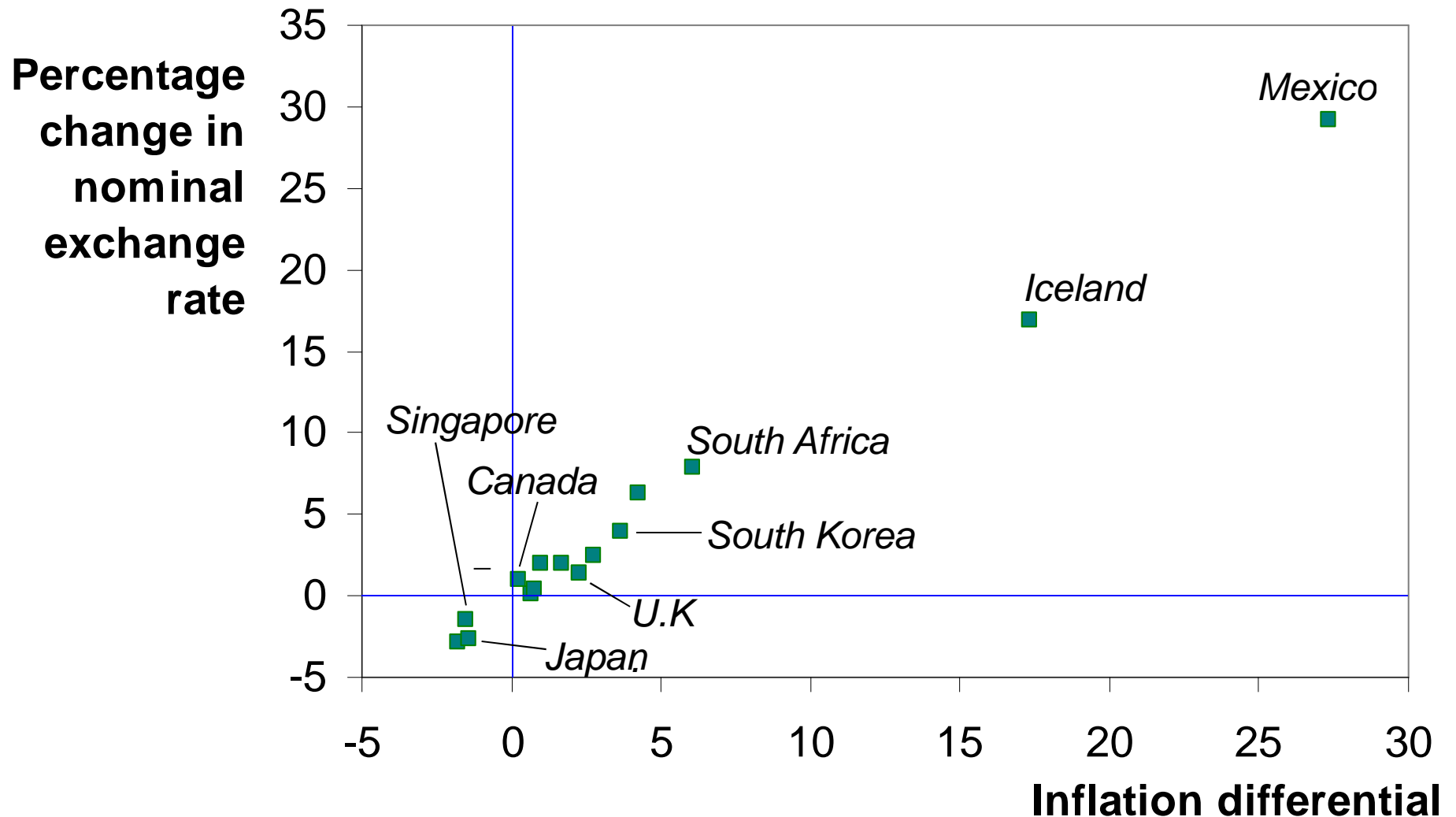
- Rewrite this equation in growth rates (see “*arithmetic tricks for working with percentage changes,*” Chap 2):

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

- For a given value of ε , the growth rate of e equals the difference between foreign and domestic inflation rates.

5.3) Exchange Rates

→ Inflation Differentials and Nom. Ex. Rates



5.3) Exchange Rates

→ Purchasing Power Parity

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

5.3) Exchange Rates

→ Purchasing Power Parity

- PPP:

$$e \times P = P^*$$

Cost of a basket of foreign goods, in foreign currency.

Cost of a basket of domestic goods, in foreign currency.

Cost of a basket of domestic goods, in domestic currency.

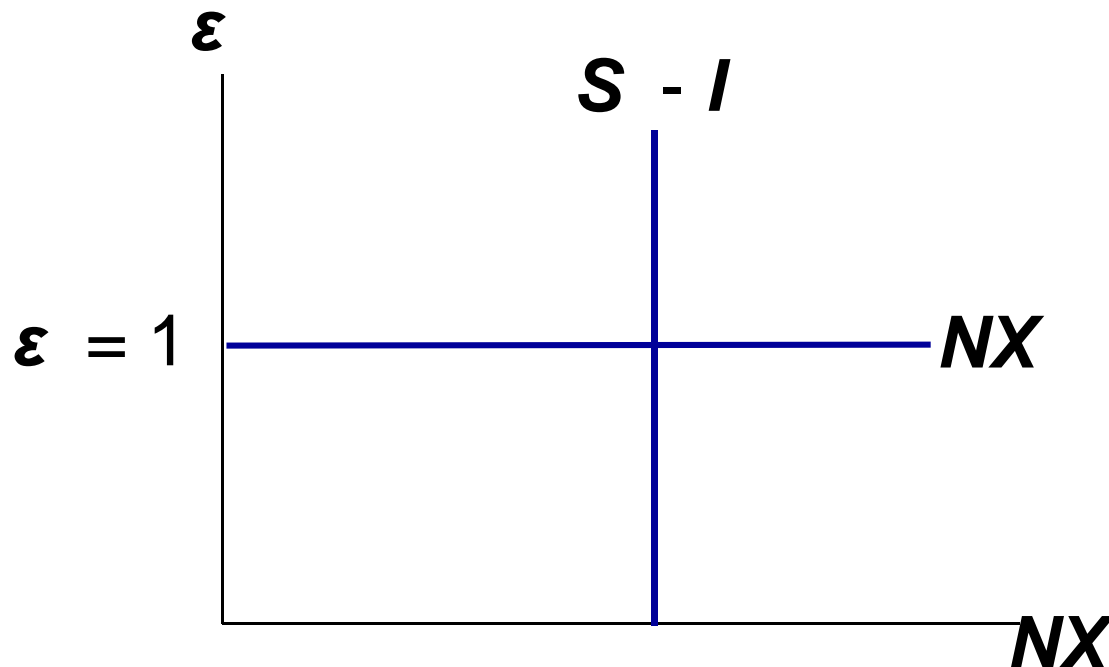
- Solve for e : $e = P^*/P$
- PPP implies that the nominal exchange rate between two countries equals the ratio of the countries' price levels.

5.3) Exchange Rates

→ Purchasing Power Parity

- 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:



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

5.3) Exchange Rates

→ Does PPP hold in the Real World?

- No, for two reasons:
 1. International arbitrage not possible.
 - Non-traded goods
 - transportation costs
 2. Different countries' goods not perfect substitutes.
- Nonetheless, 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.

Learning Objectives

This chapter introduces you to understanding:

- the international flows of capital and goods ✓
- saving and investment in a small open economy ✓
- Exchange rates ✓
- the U.S. as a large open economy ←

5.4) The U.S. as a LOE

→ Purchasing Power Parity

- So far, we've learned long-run models for two extreme cases:
 - closed economy (chap. 3)
 - small open economy (chap. 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...

5.4) The U.S. as a LOE

→ A Fiscal Expansion in Three Models

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

	<i>Closed economy</i>	<i>Large open economy</i>	<i>Small open economy</i>
<i>r</i>	rises	rises, but not as much as in closed economy	no change
<i>I</i>	falls	falls, but not as much as in closed economy	no change
<i>NX</i>	no change	falls, but not as much as in small open economy	falls

Chapter Summary

- Net exports--the difference between
 - exports and imports
 - a country's output (Y) and its spending ($C + I + G$)
- Net capital outflow equals
 - purchases of foreign assets minus foreign purchases of the country's assets
 - the difference between saving and investment

Chapter Summary (ctd.)

- National income accounts identities:
 - $Y = C + I + G + NX$
 - trade balance $NX = S - I$ net capital outflow
- 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

Chapter Summary (ctd.)

- 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 (ctd.)

- 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

Chapter Summary (ctd.)

- 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.