The Open Economy I

(chapter 5)

macroeconomics

fifth edition

N. Gregory Mankiw

PowerPoint® Slides
by Ron Cronovich

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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

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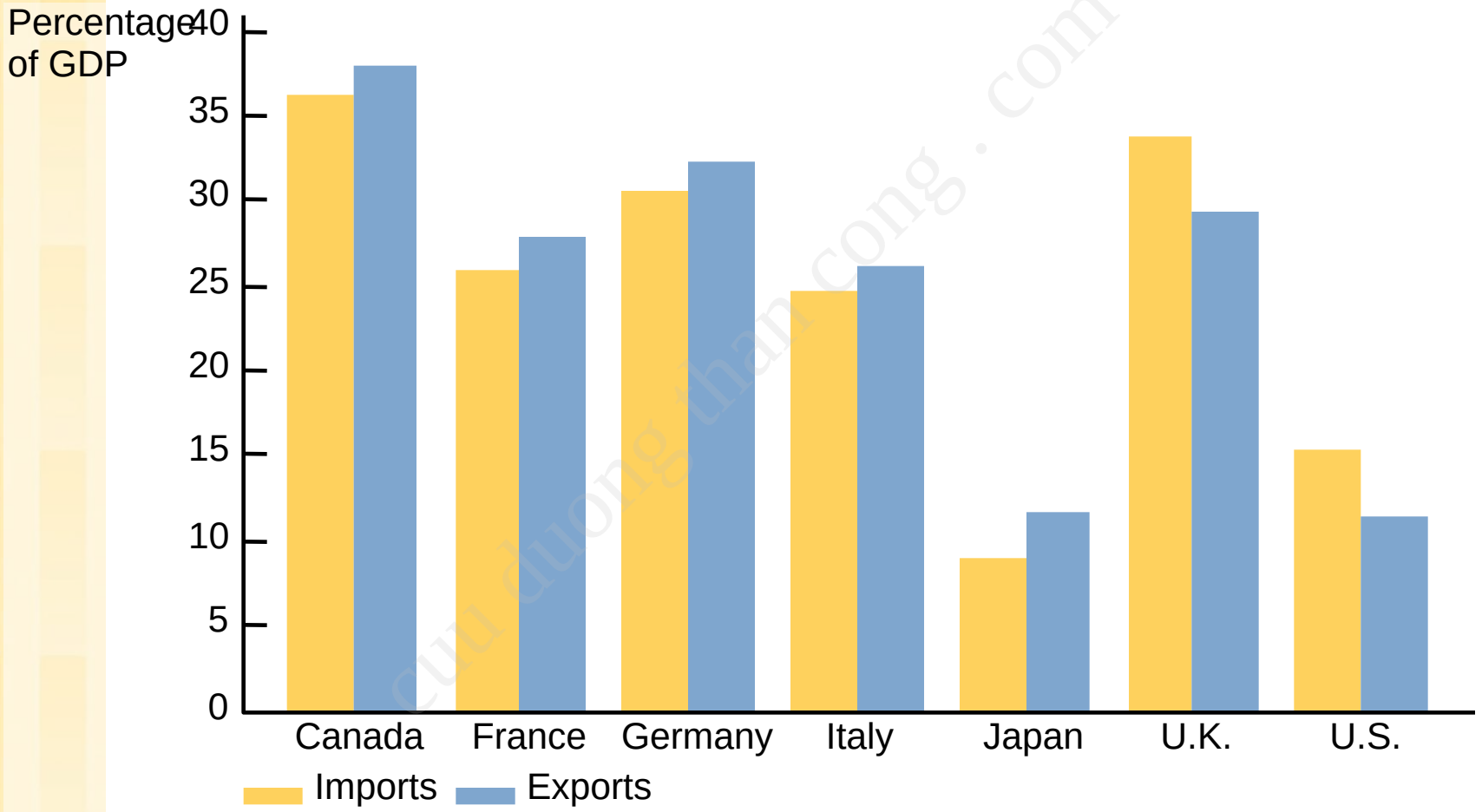
Imports and Exports as a percentage of output: 2000



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In an open economy,

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

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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

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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***

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GDP = expenditure on domestically produced g & s

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

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

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

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

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

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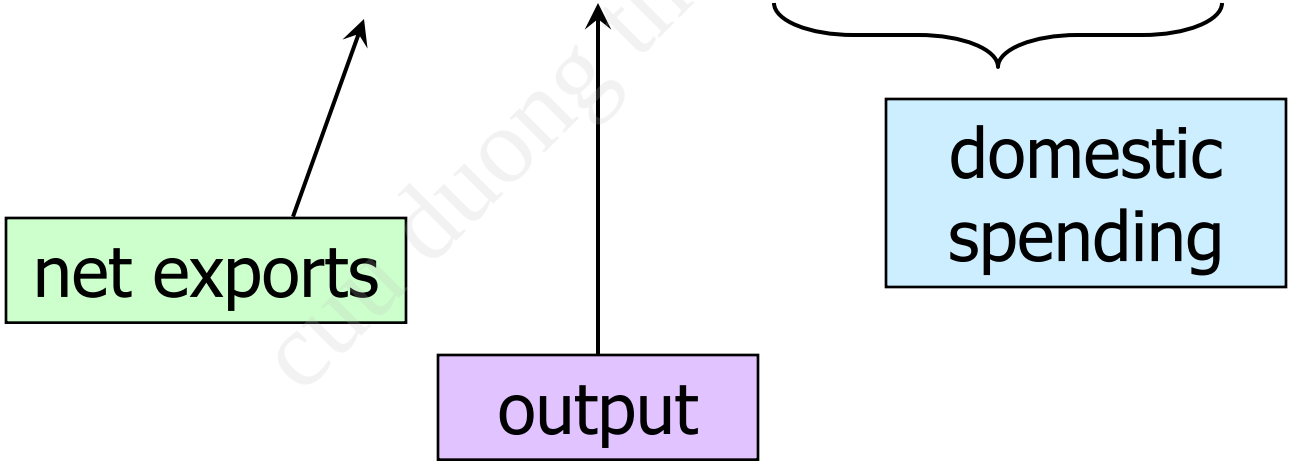
The national income identity in an open economy

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

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



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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

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Another important identity

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

implies

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

$$= S - I$$

trade balance = net capital outflows

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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: $Y = \overline{Y} = F(\overline{K}, \overline{L})$

consumption function: $C = C(Y - T)$

investment function: $I = I(r)$

exogenous policy variables: $G = \overline{G}, \quad T = \overline{T}$

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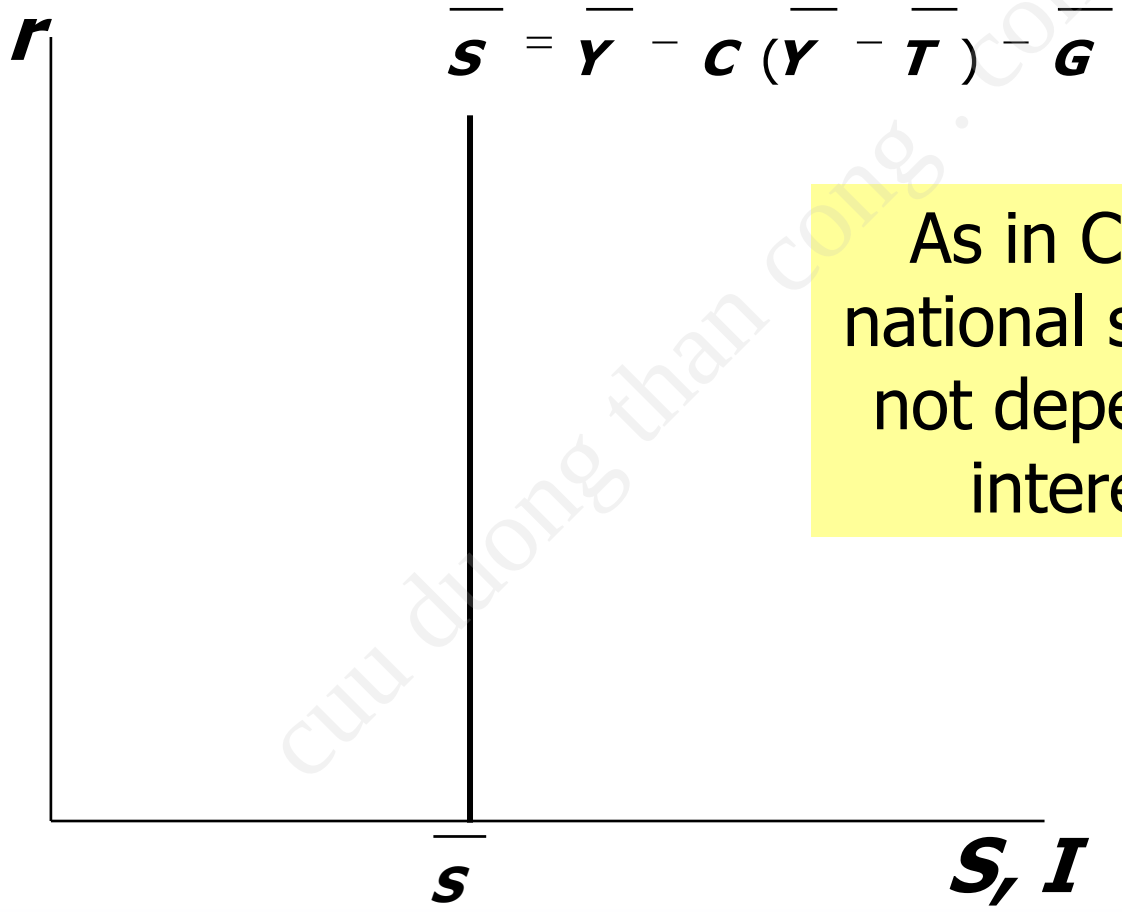
National Saving: The Supply of Loanable Funds



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

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Assumptions re: 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

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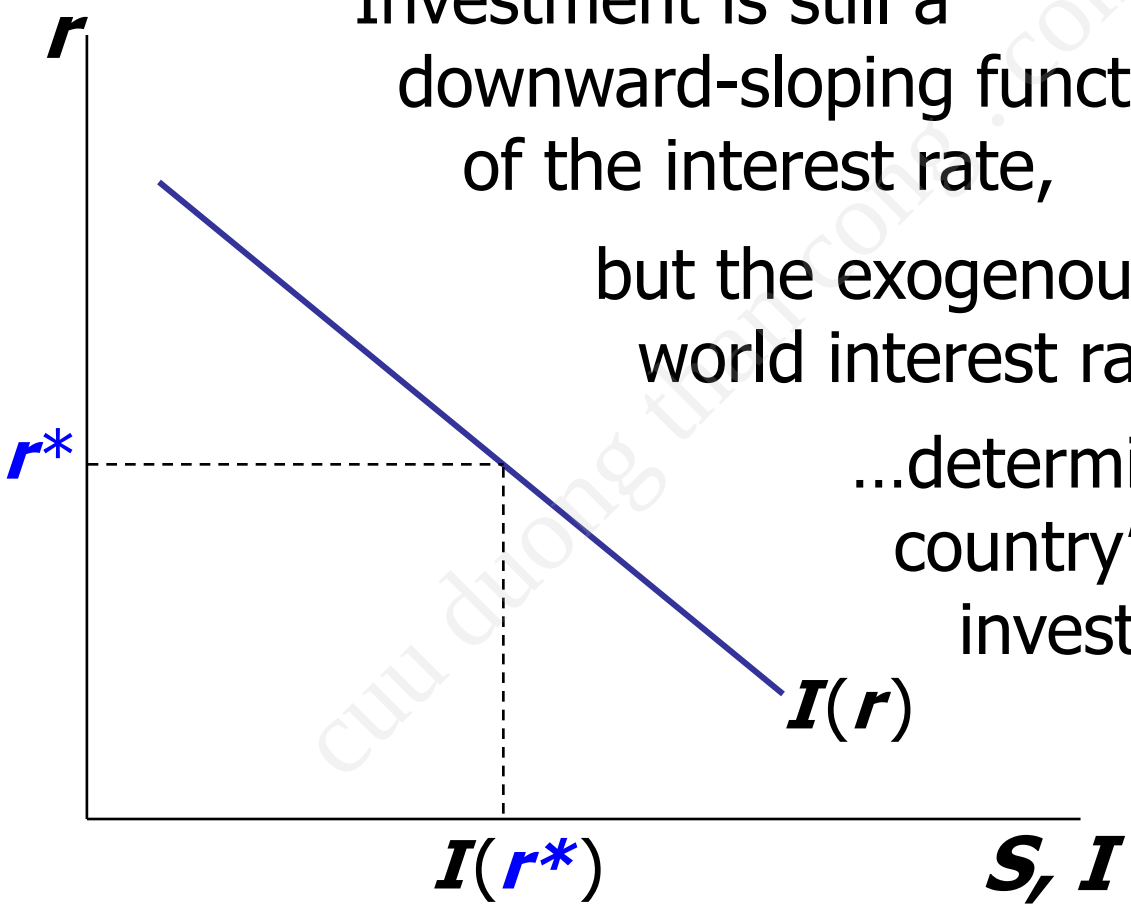
Investment: The Demand for Loanable Funds



Investment is still a downward-sloping function of the interest rate,

but the exogenous world interest rate…

…determines the country's level of investment.

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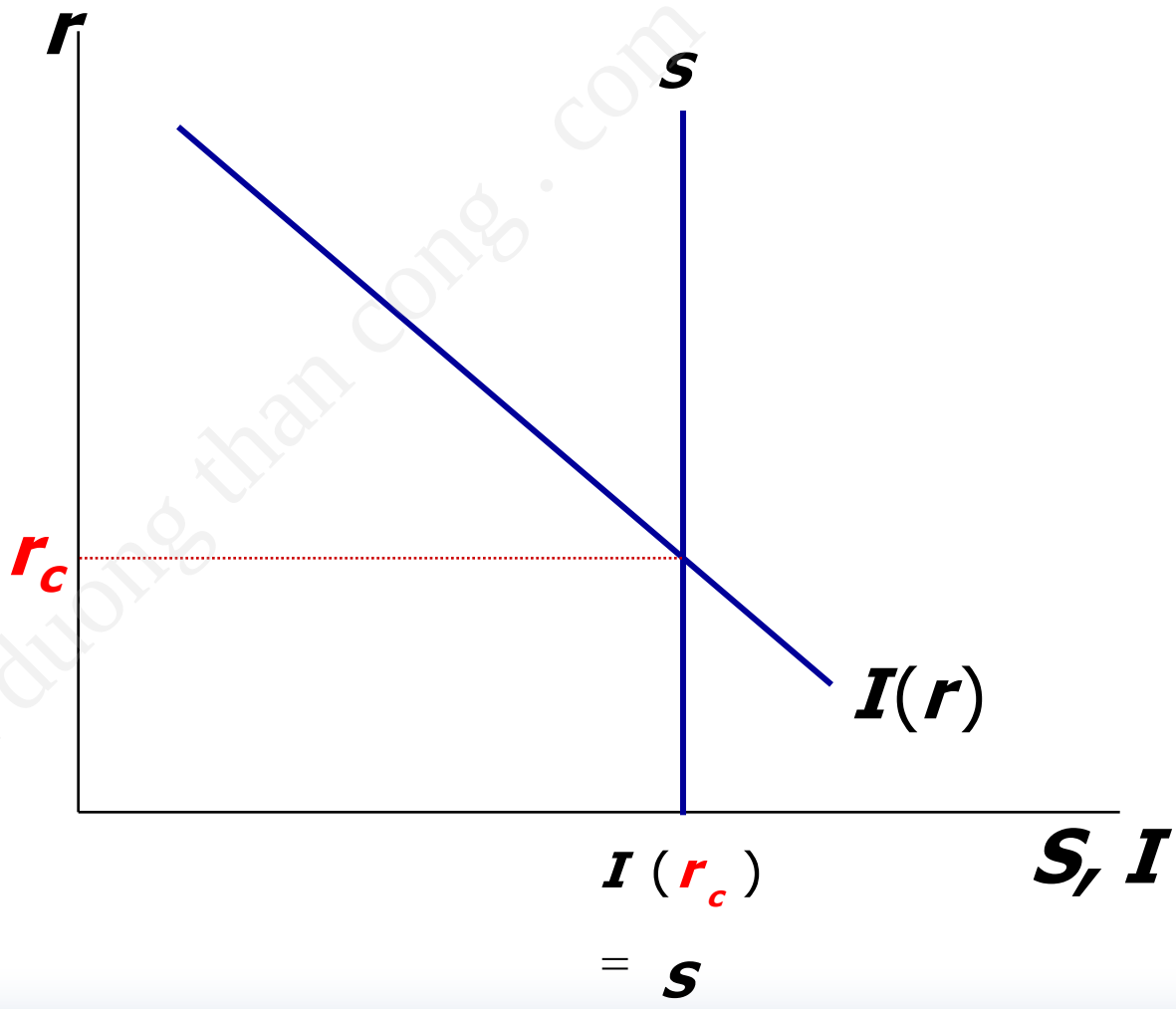
If the economy were closed…

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



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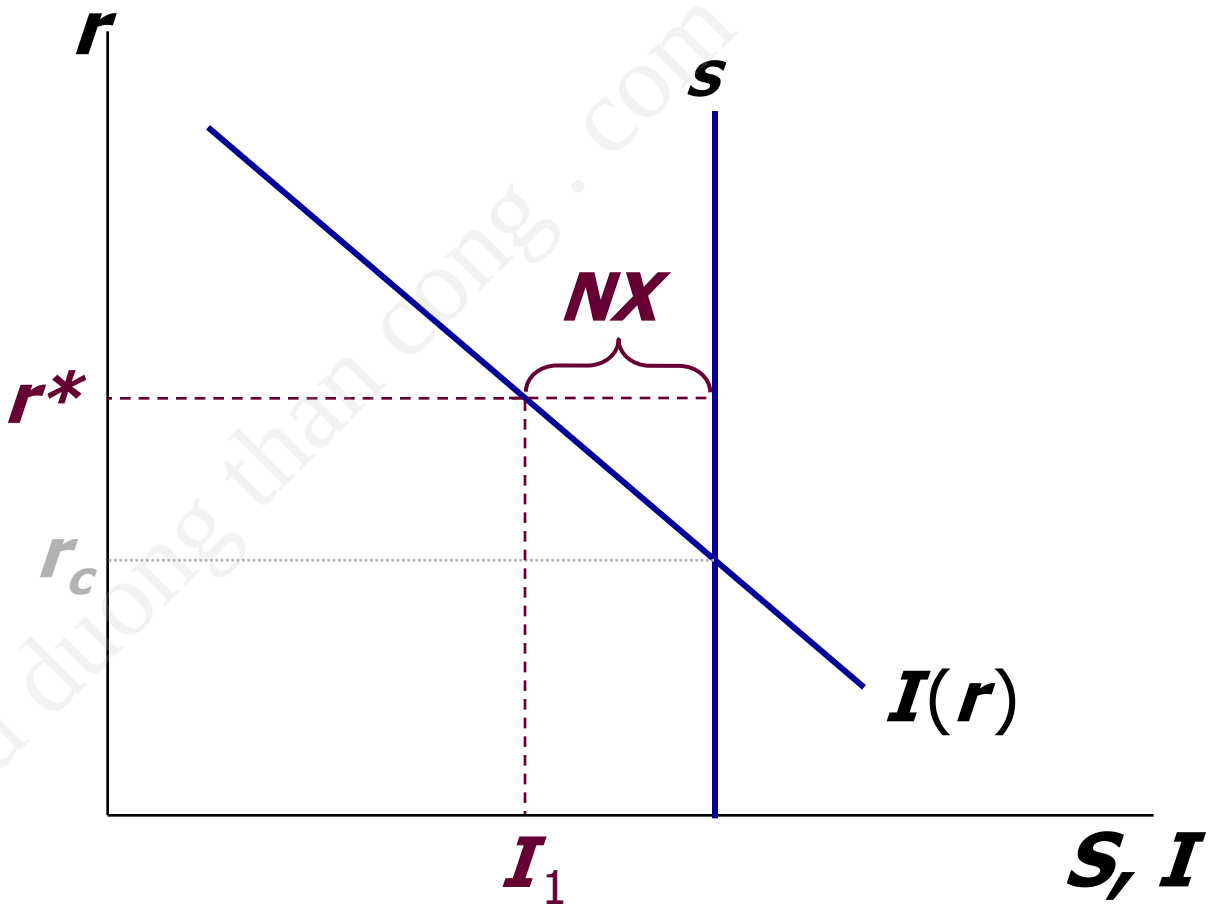
But in a small open economy…

the exogenous world interest rate determines investment…

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



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Three experiments

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

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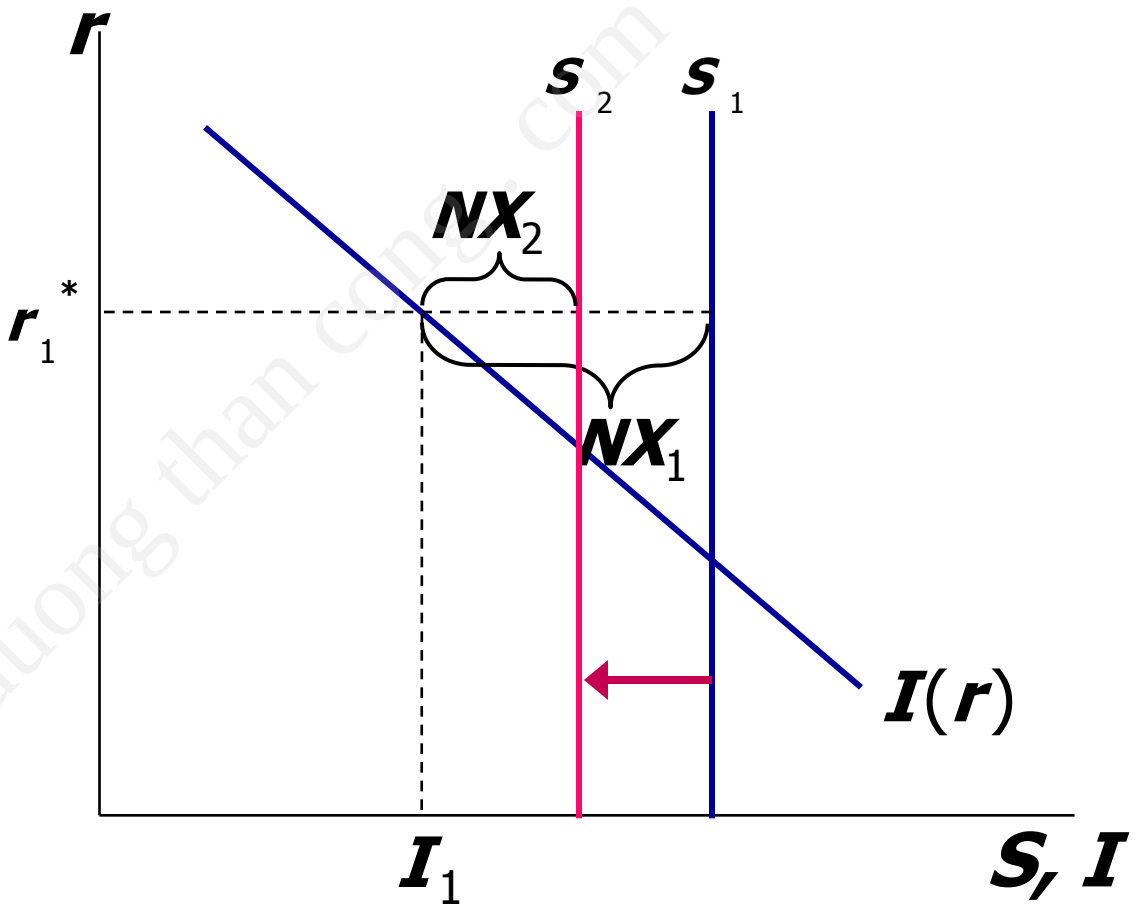
1. Fiscal policy at home

An increase in G or decrease in T reduces saving.



Results:

$\Delta I = 0$

$\Delta NX = \Delta S < 0$

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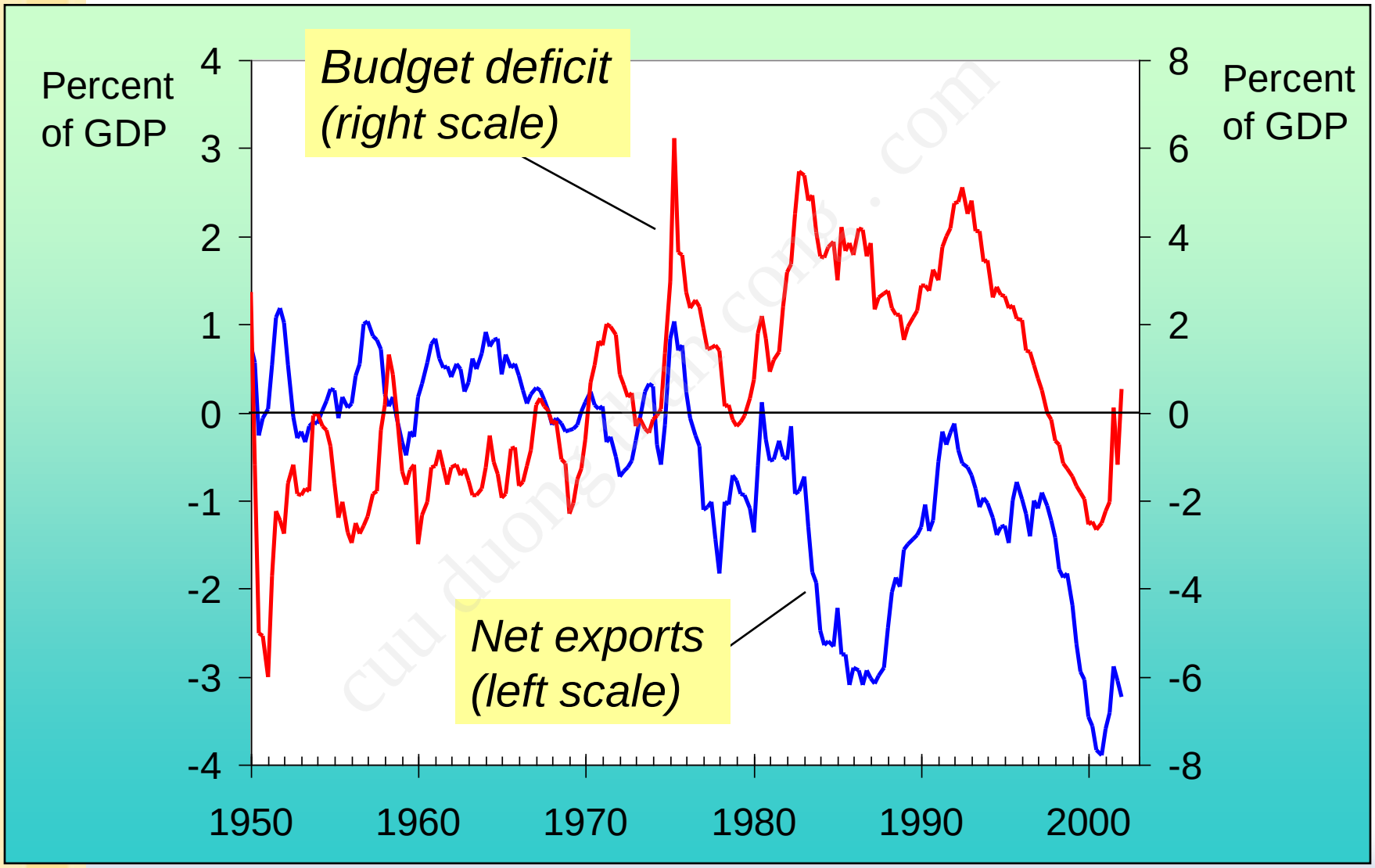
NX and the Government Budget Deficit



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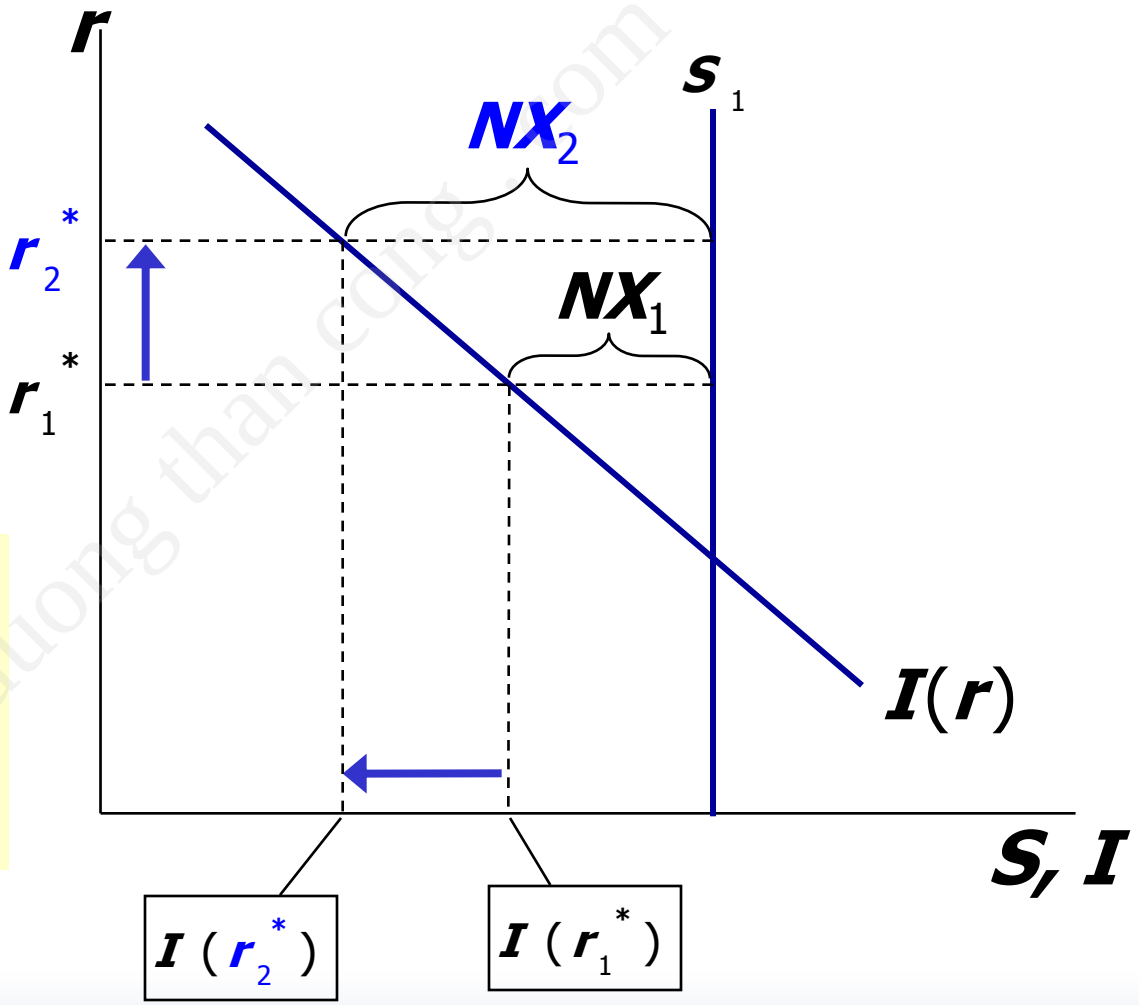
2. Fiscal policy abroad

Expansionary fiscal policy abroad raises the world interest rate.



Results:

$$\Delta I < 0$$

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

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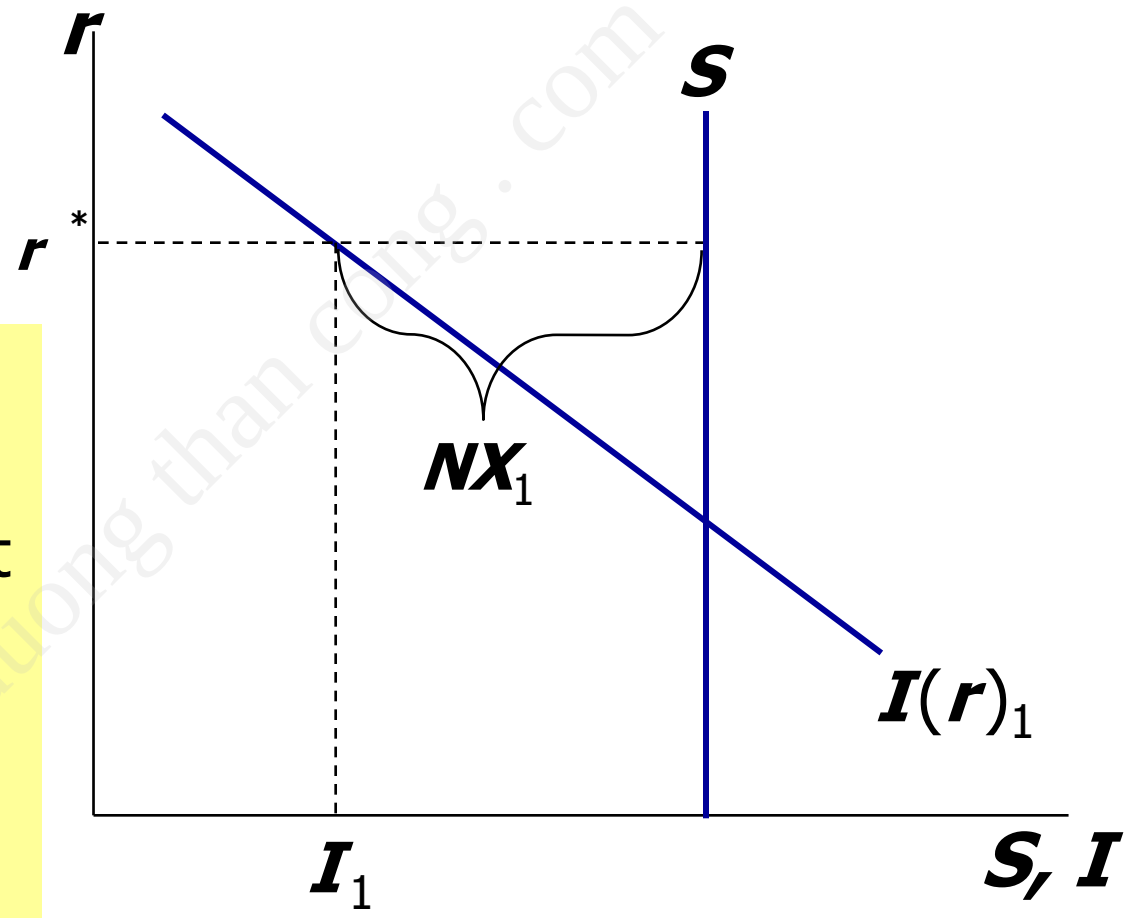
3. An increase in investment demand



EXERCISE:

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

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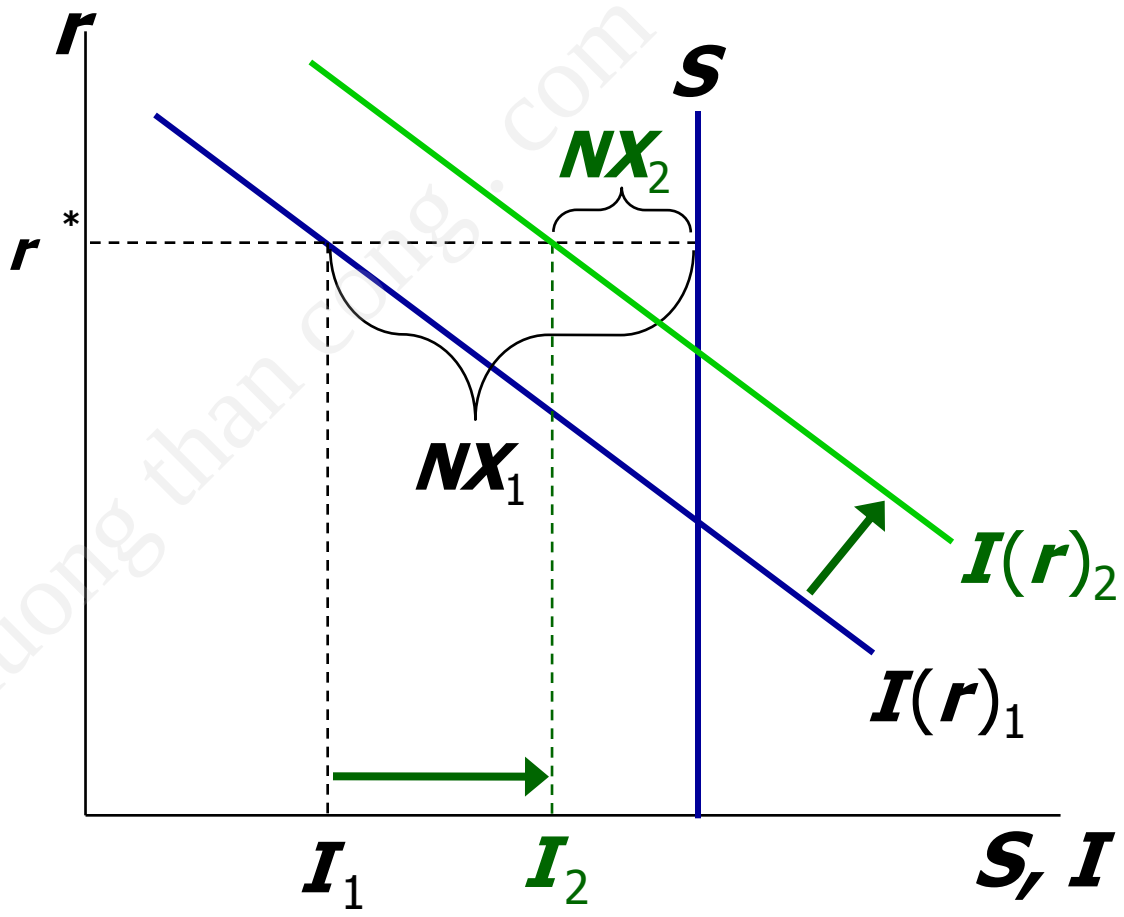
3. An increase in investment demand

ANSWERS:

$\Delta I > 0$,

$\Delta S = 0$,

net capital outflows and net exports fall by the amount ΔI



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The nominal exchange rate

e = nominal exchange rate,
the relative price of
domestic currency
in terms of foreign currency

(e.g. Yen per Dollar)

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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/$

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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

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Understanding the units of ε

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

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

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

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

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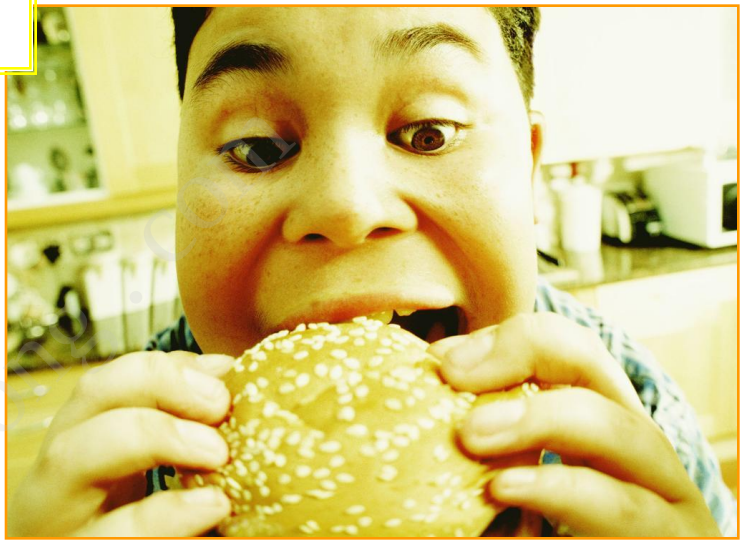
~ McZample ~

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

$$\varepsilon = \frac{e \times P}{P^*} = \frac{120 \times \$2.50}{200 \text{ Yen}} = 1.5$$



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

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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

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How *NX* depends on ε

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

$\Rightarrow \downarrow EX, \uparrow IM$

$\Rightarrow \downarrow NX$

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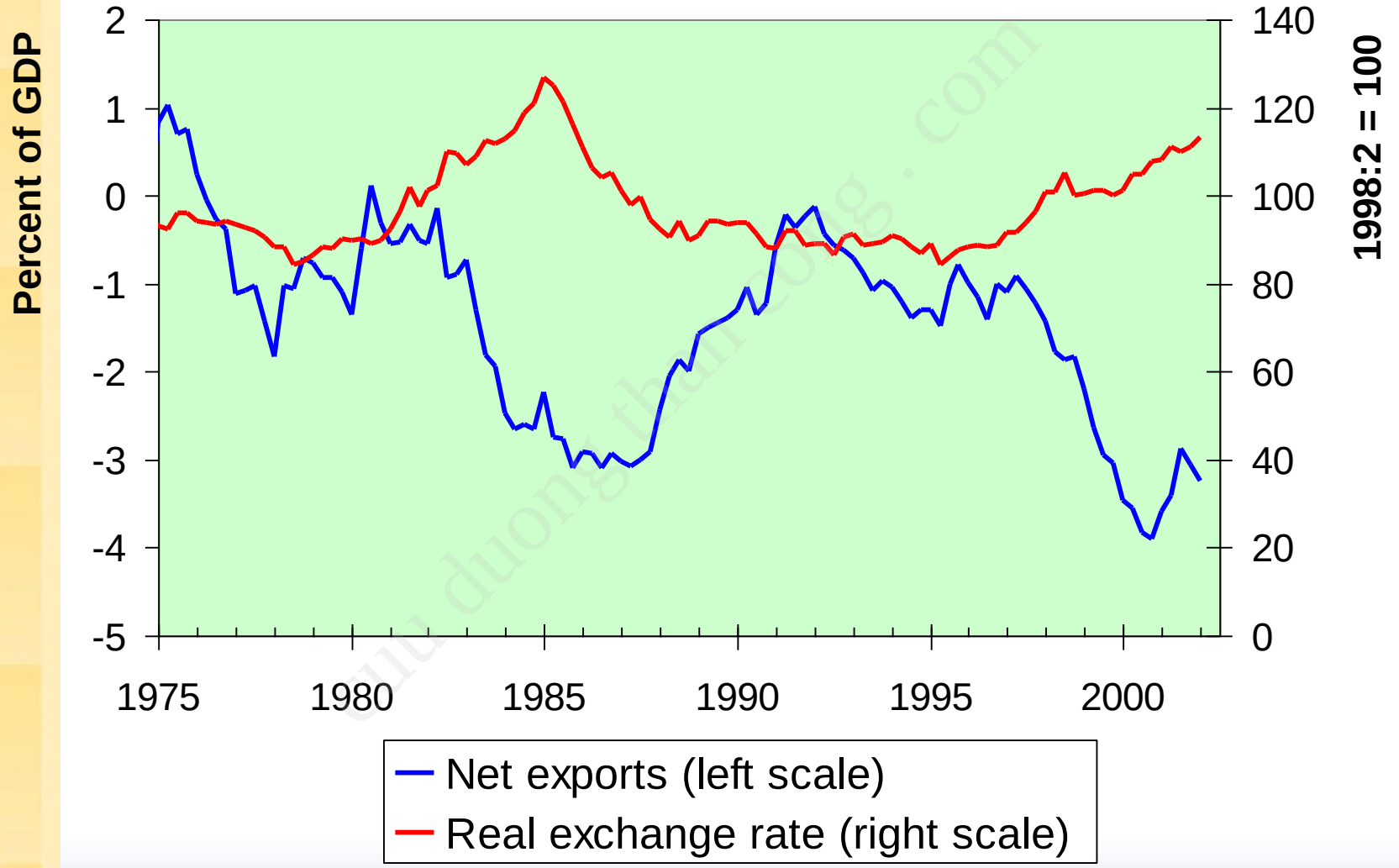
U.S. Net Exports and the Real Exchange Rate, 1975-2002



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The net exports function

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

$$NX = NX(\varepsilon)$$

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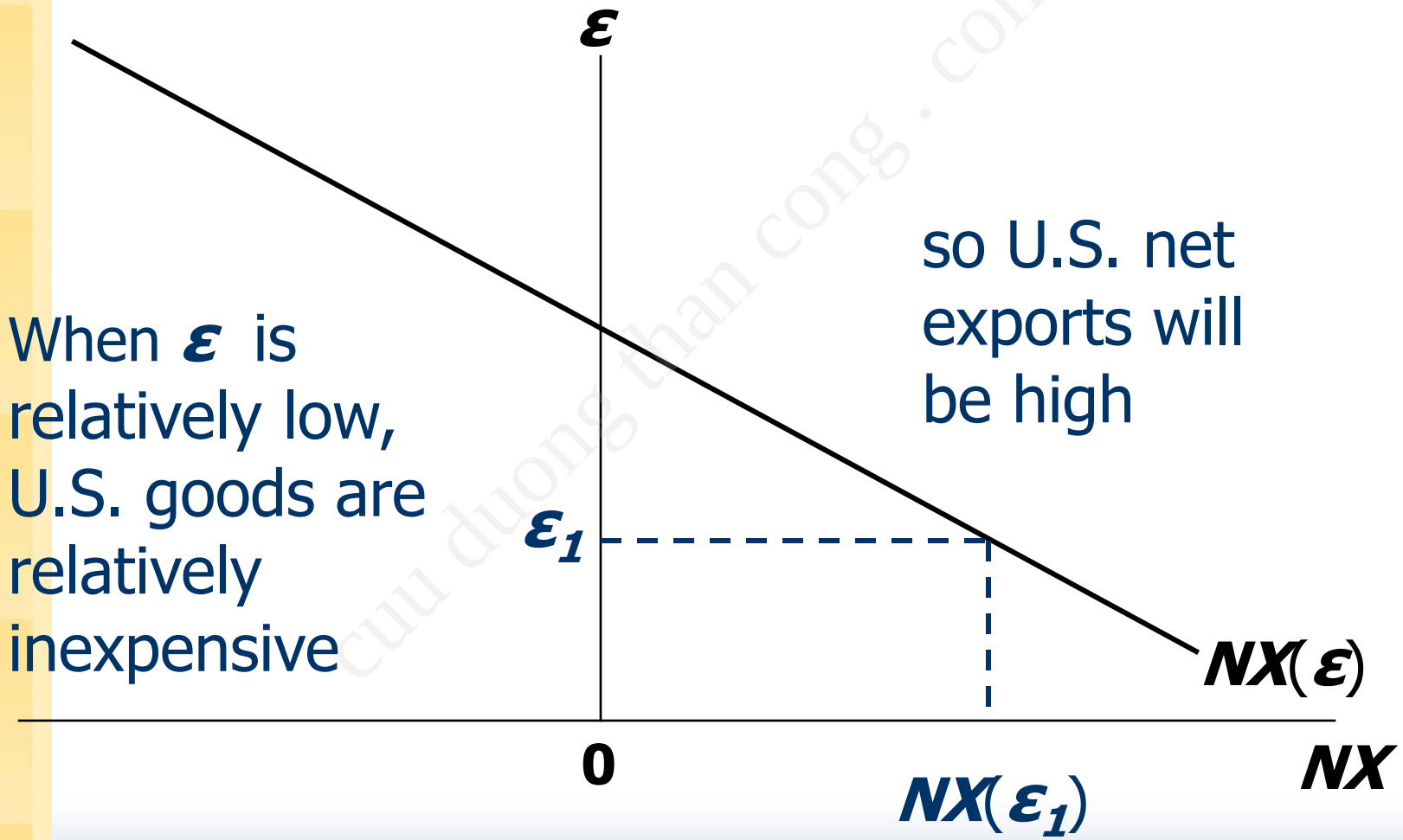
The *NX* curve for the U.S.



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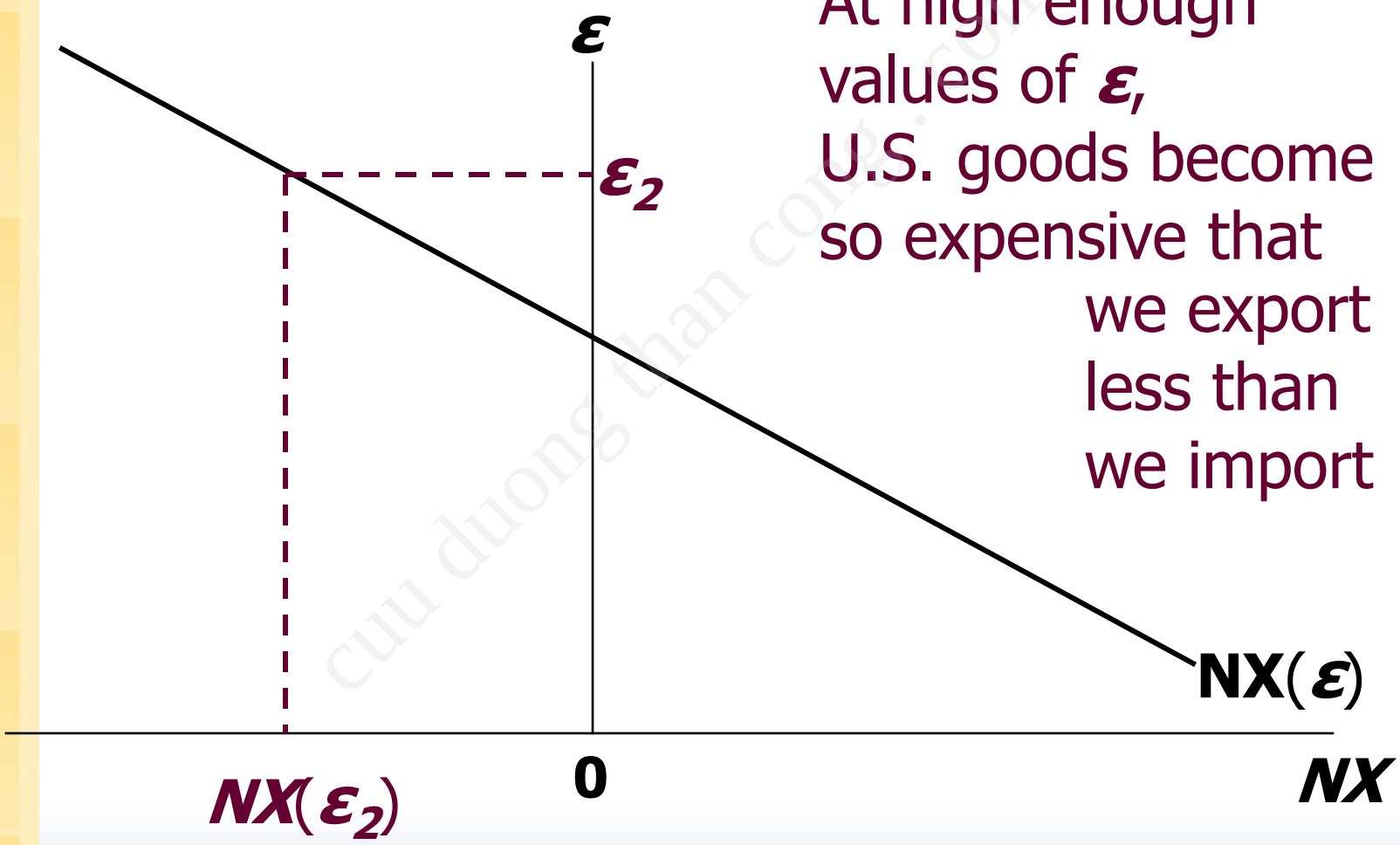
The *NX* curve for the U.S.



At high enough values of ε, U.S. goods become so expensive that we export less than we import

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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

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

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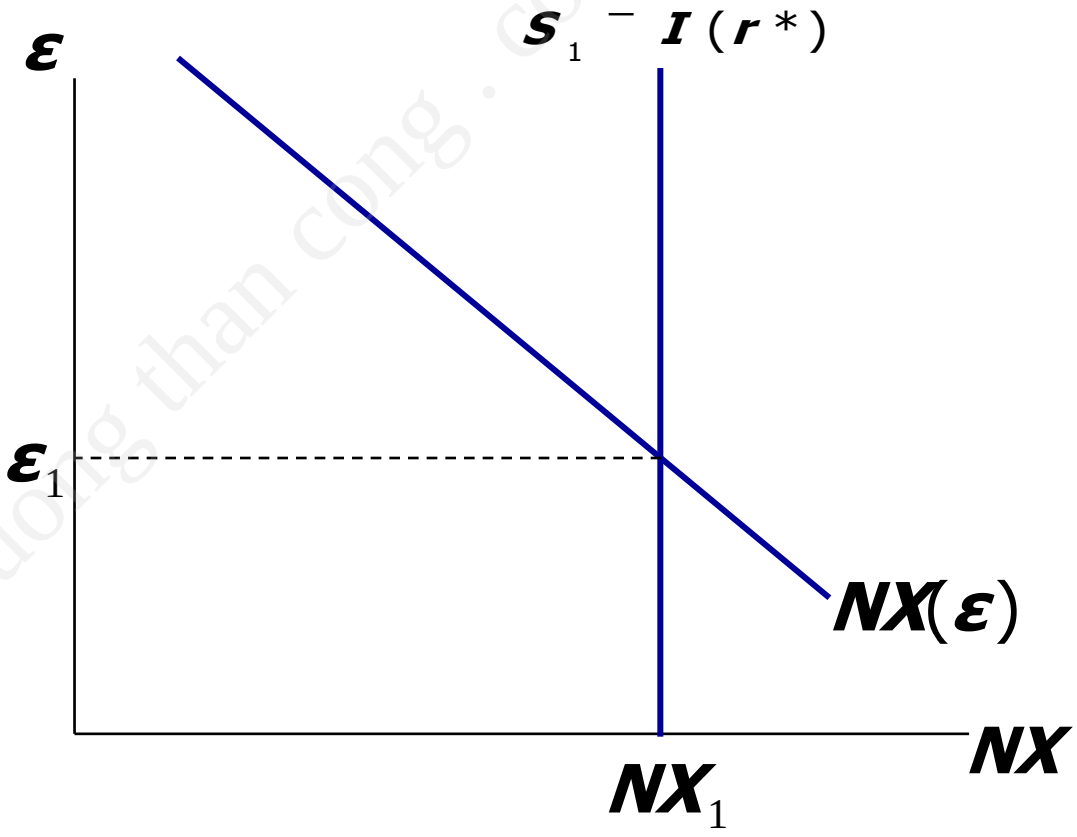
How ε is determined

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

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



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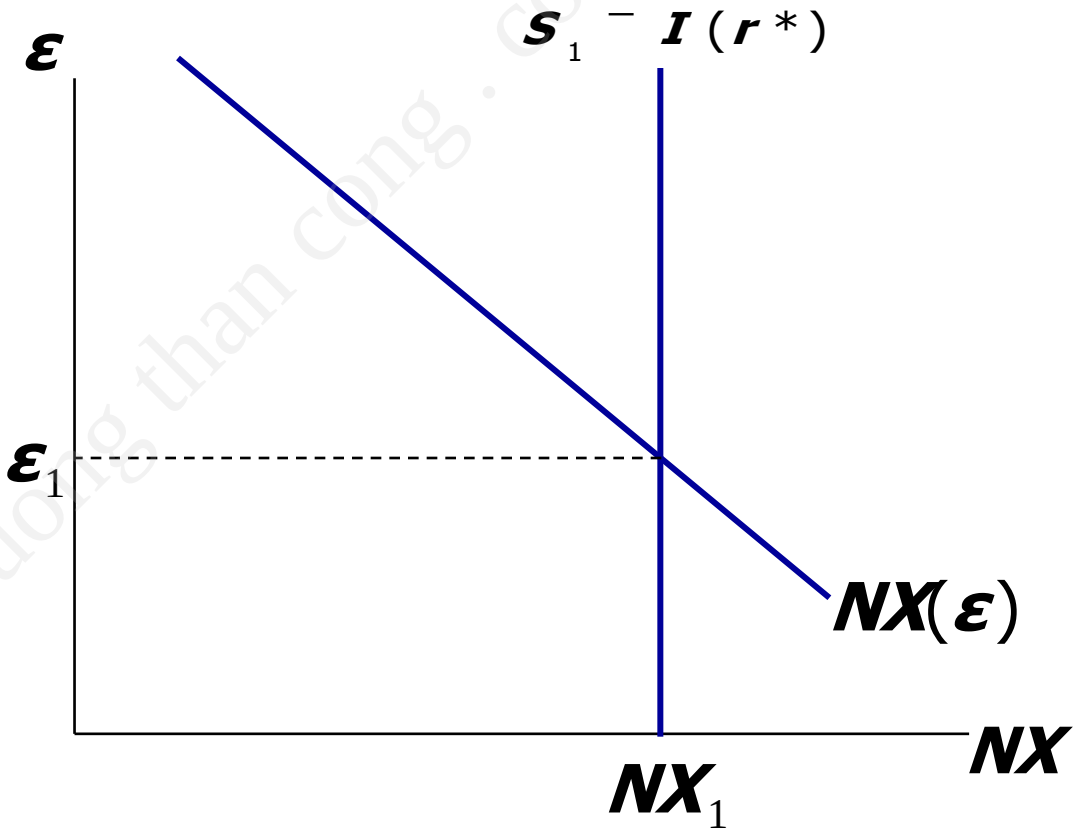
Interpretation: supply and demand in the foreign exchange market

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.



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Four experiments

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

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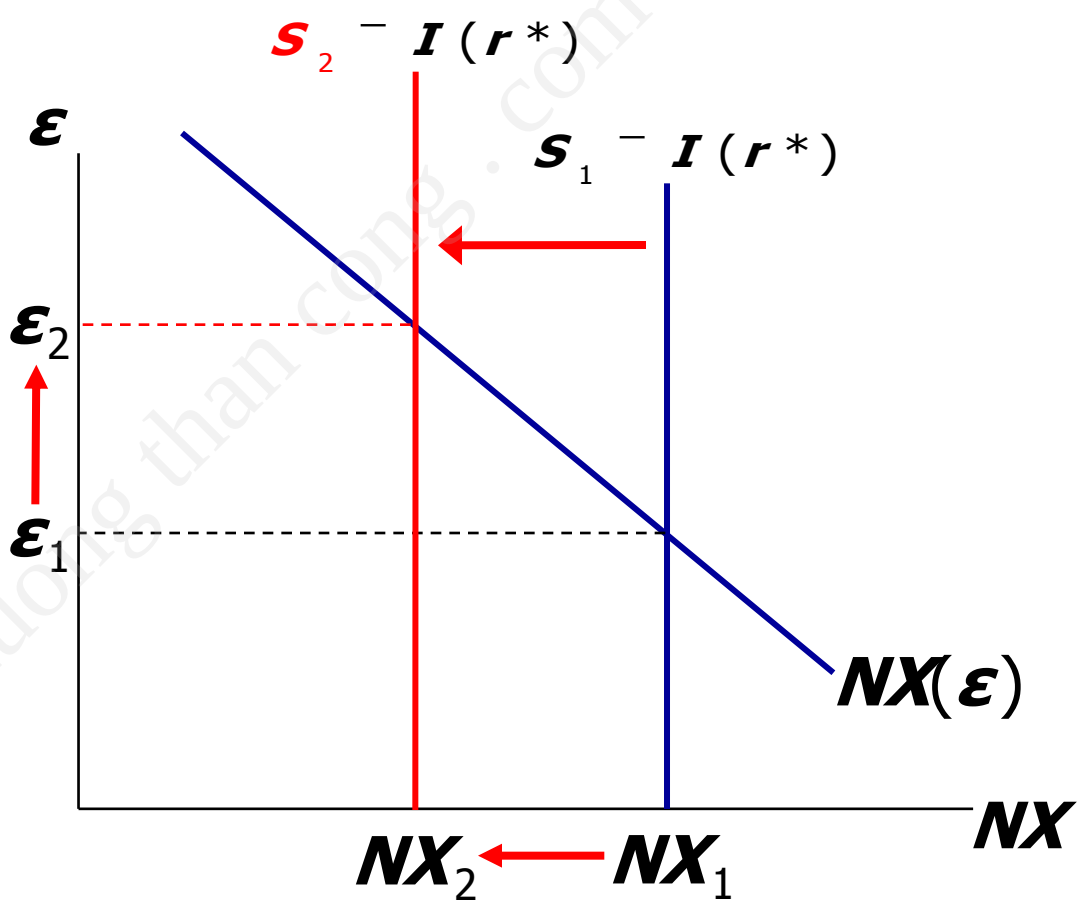
1. Fiscal policy at home

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.

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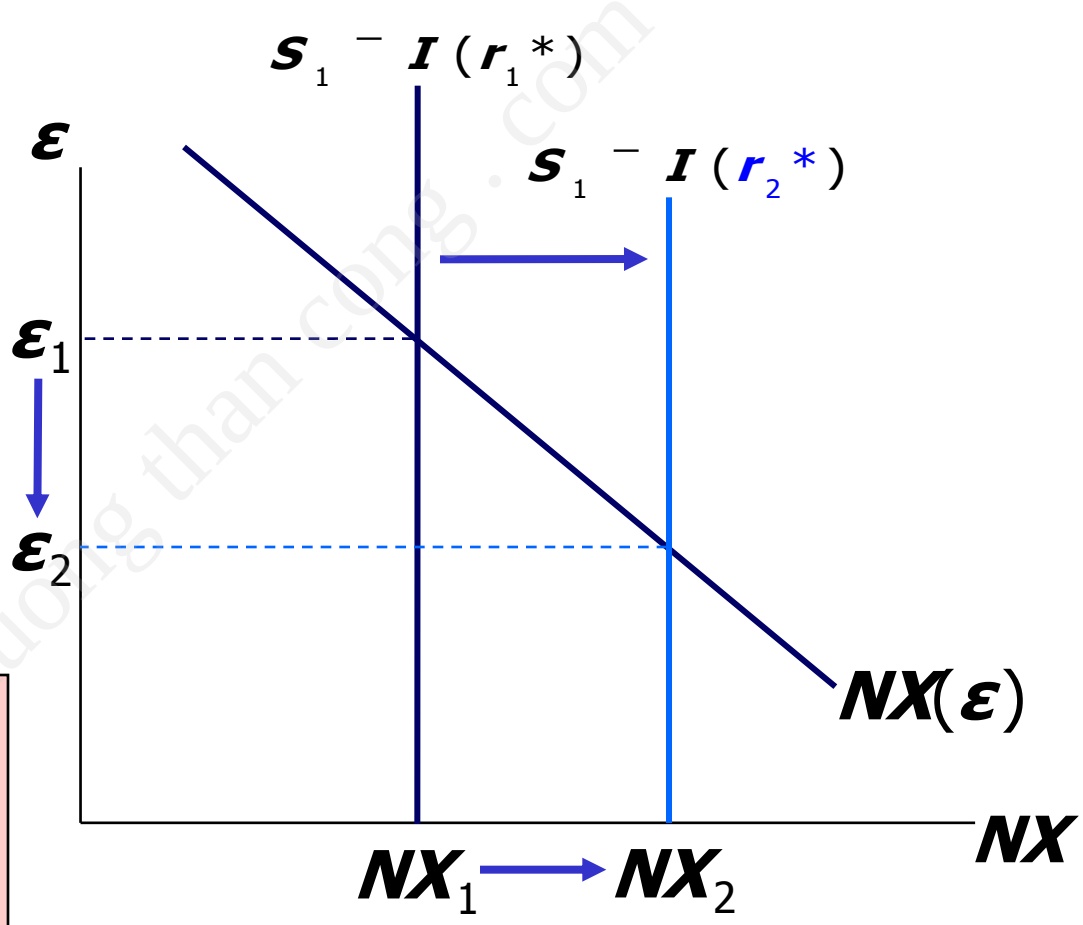
2. Fiscal policy abroad

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.

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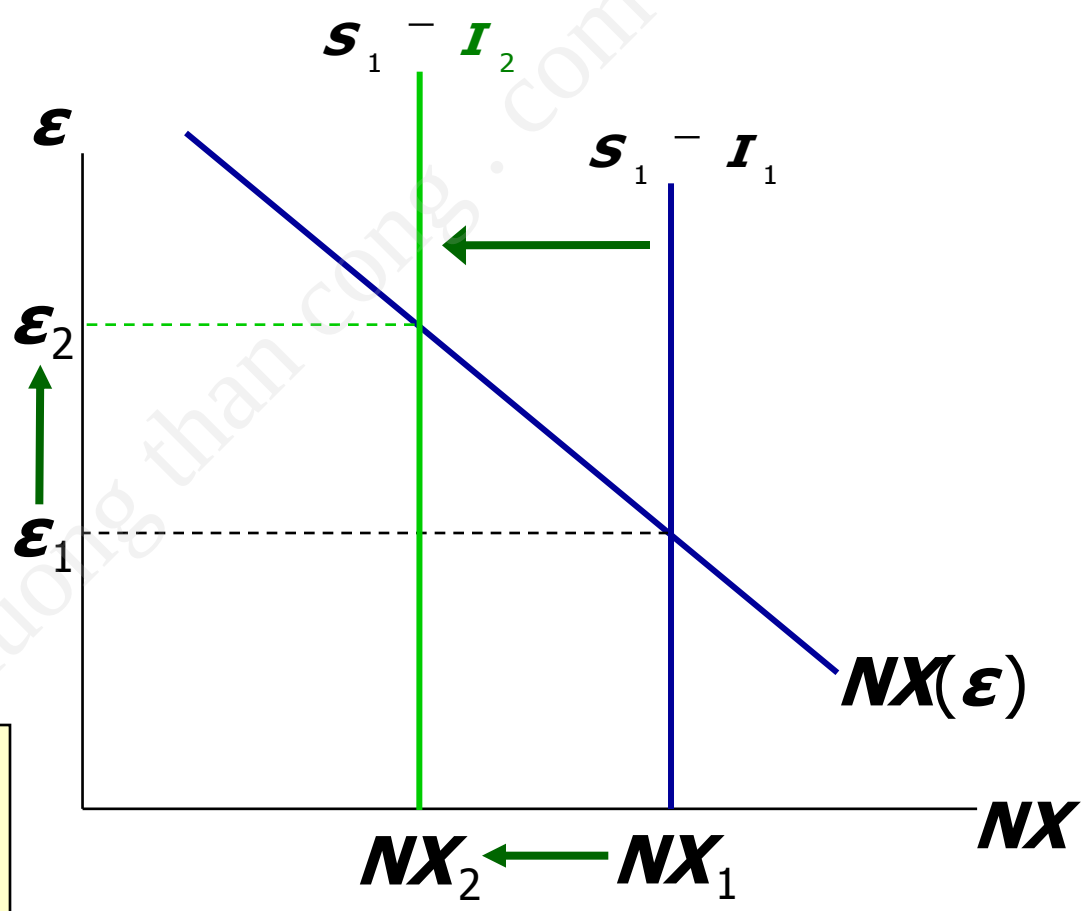
3. An increase in investment demand

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.

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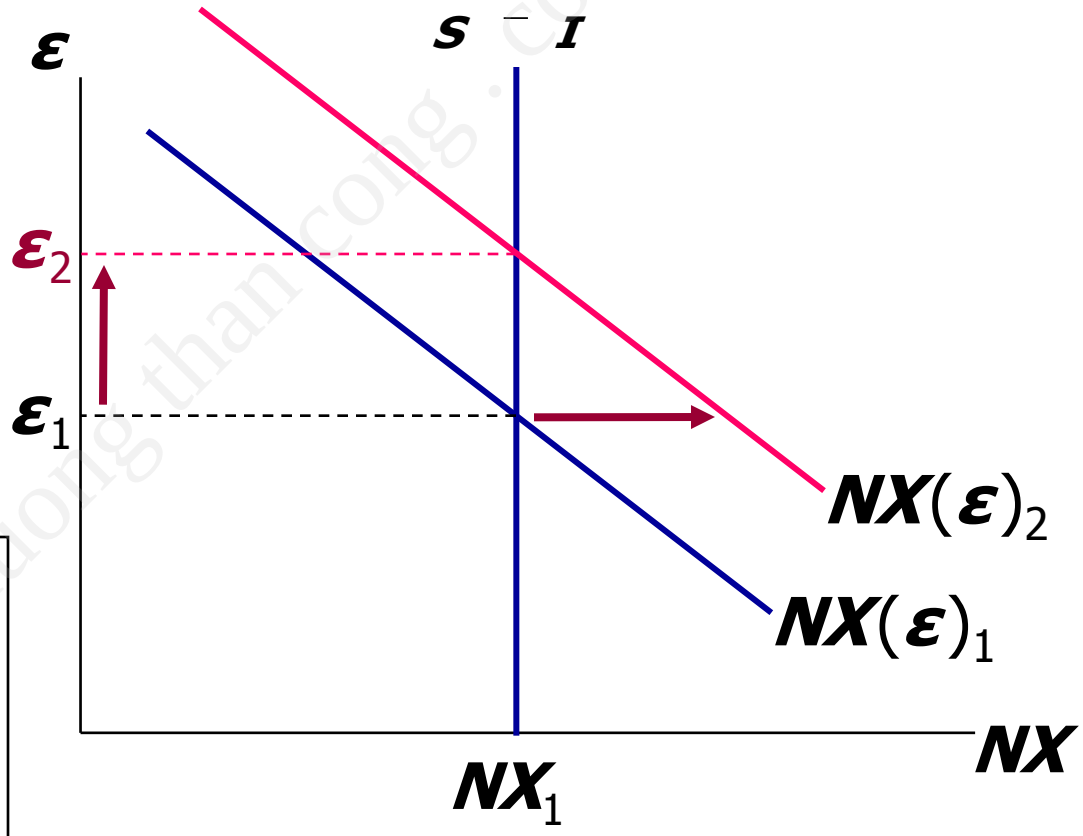
4. Trade policy to restrict imports

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.

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4. Trade policy to restrict imports

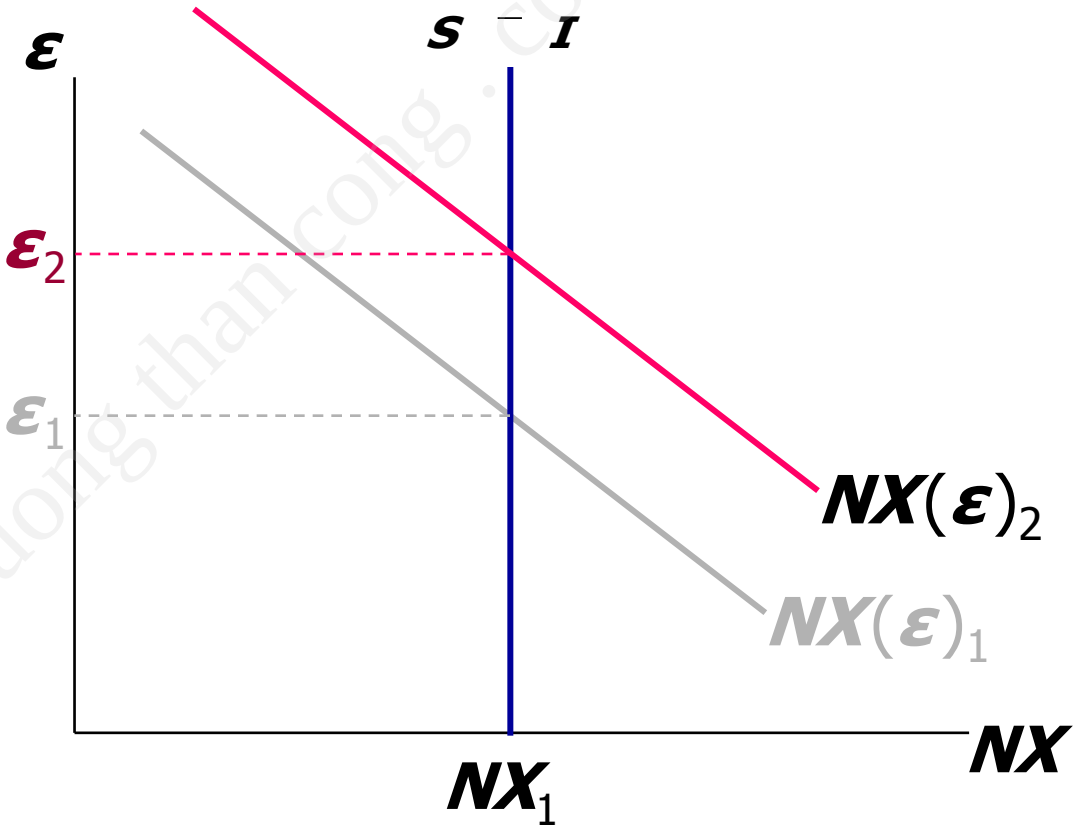
Results:

$\Delta\varepsilon > 0$
(demand increase)

$\Delta NX = 0$
(supply fixed)

$\Delta IM < 0$
(policy)

$\Delta EX < 0$
(rise in ε)



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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:

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

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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:

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

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

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

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

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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.

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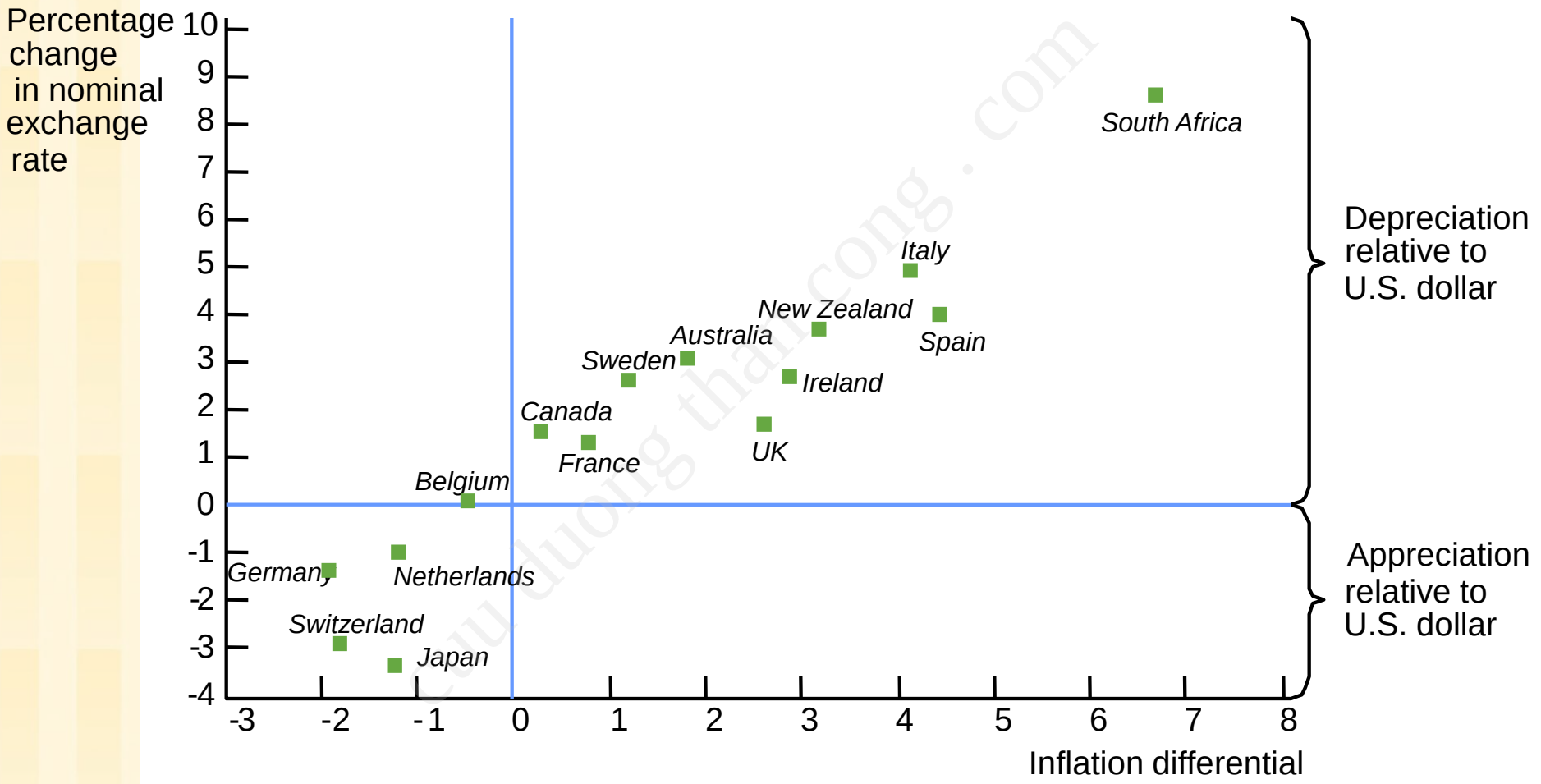
Inflation and nominal exchange rates



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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

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Purchasing Power Parity (PPP)

- 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.

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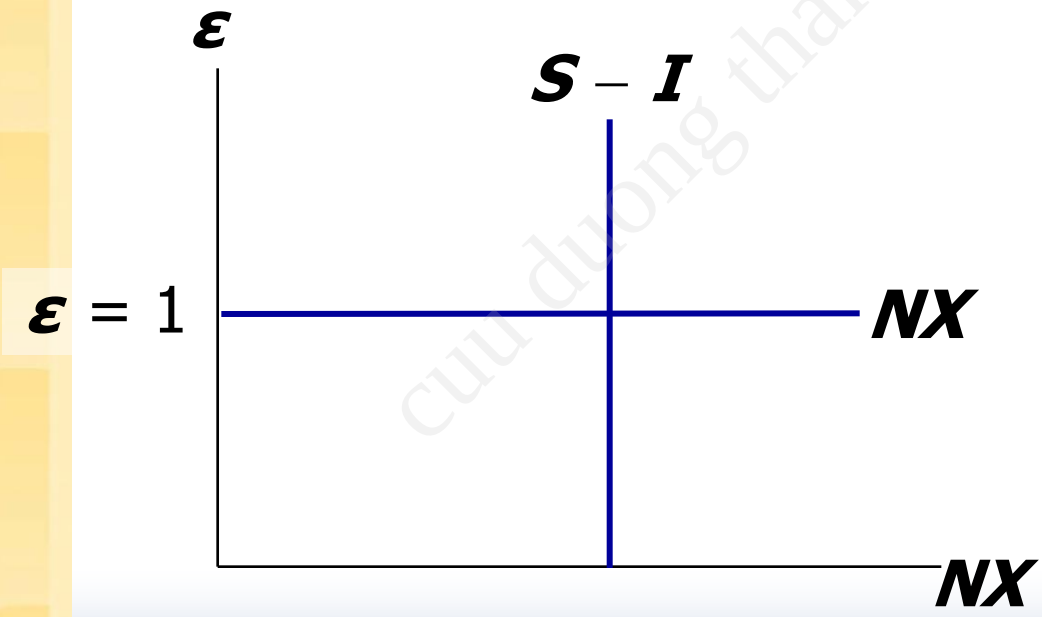
Purchasing Power Parity (PPP)

- 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 ε or e.

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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.

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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.*

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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…

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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

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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

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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.

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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.

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