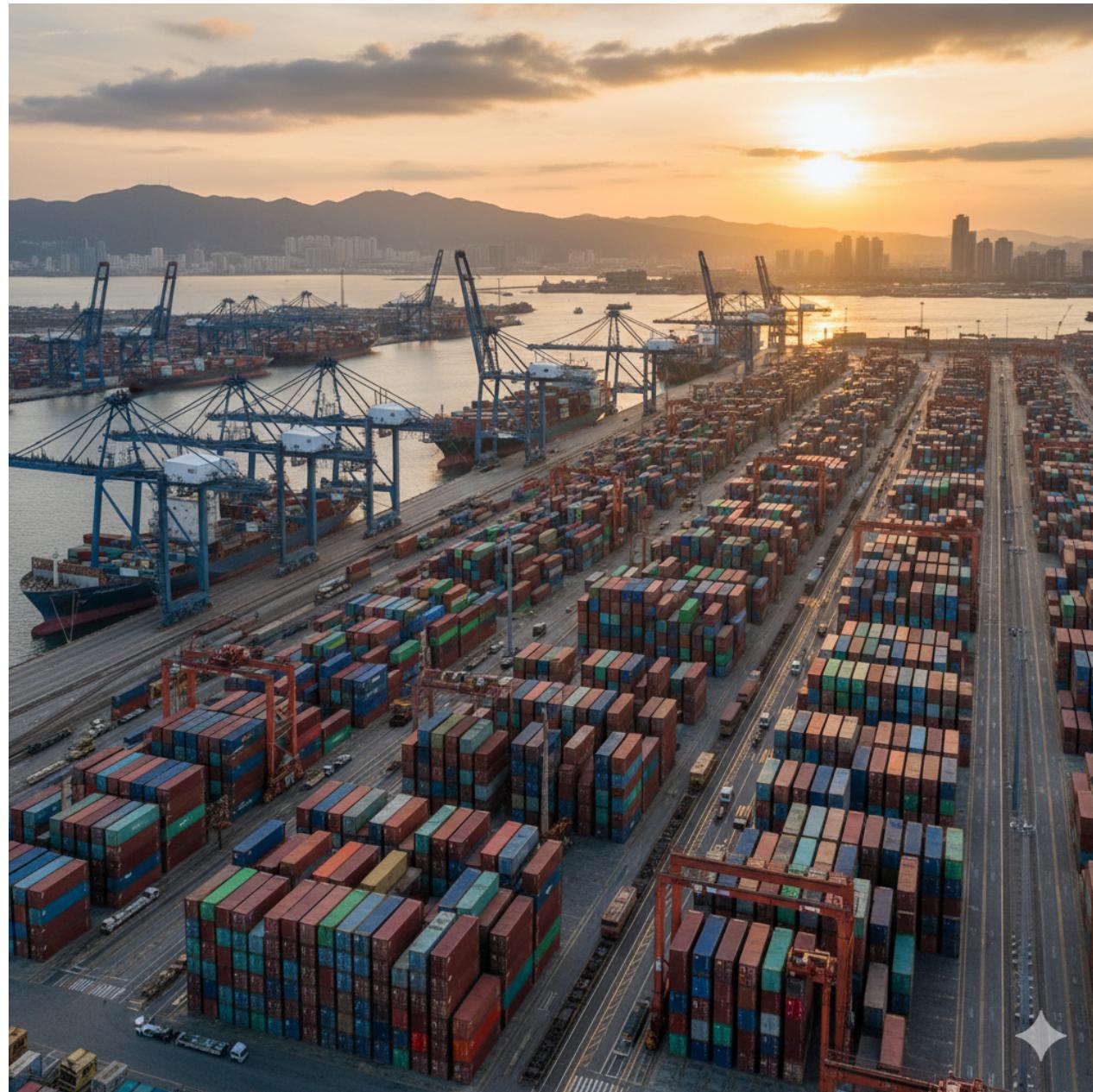


# 5. The Open Economy

Based on Mankiw, Chapter 7: *The Open Economy*

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## In an open economy

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

# The national income identity in an open economy

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

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

net exports

domestic  
spending

output

# Trade surpluses and deficits

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

- **Trade surplus:**

output ( $Y$ ) > spending ( $C + I + G$ )

exports ( $X$ ) > imports ( $IM$ )

$NX > 0$ , Size of the trade surplus =  $NX$

- **Trade deficit:**

spending ( $C + I + G$ ) > output ( $Y$ )

imports ( $IM$ ) > exports ( $X$ )

$NX < 0$ , 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 and capital flows (1 of 2)

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

*implies*

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

$$= S - I$$

***trade balance = net capital outflow***

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

## The link between trade and capital flows (2 of 2)

Trade Surplus	Balanced Trade	Trade Deficit
Exports > Imports	Exports = Imports	Exports < Imports
Net Exports > 0	Net Exports = 0	Net Exports < 0
$Y > C + I + G$	$Y = C + I + G$	$Y < C + I + G$
Saving > Investment	Saving = Investment	Saving < Investment
Net Capital Outflow > 0	Net Capital Outflow = 0	Net Capital Outflow < 0

## The United States: The world's largest debtor nation (1 of 2)

- Every year since the 1980s: huge trade deficits and net capital inflows (that is, net borrowing from abroad)
- As of 2025 Q1:
  - U.S. residents owned \$36.9 trillion worth of foreign assets.
  - Foreigners owned \$61.5 trillion worth of U.S. assets.
  - U.S. net indebtedness to the rest of the world: \$24.6 trillion—higher than any other country, hence, the United States is the “world’s largest debtor nation.”

# The United States: The world's largest debtor nation (2 of 2)

Country	Net indebtedness (billion USD)
United States 	-24,614
United Kingdom 	-1,121
Brazil 	-981
Spain 	-859
France 	-801
...	...
Norway 	1,611
Hong Kong 	1,797
China 	3,182
Japan 	3,587
Germany 	3,708

## Saving and investment in a small open economy (1 of 2)

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

# Small open economy

1. Domestic and foreign bonds are perfect substitutes (same risk, maturity, etc.).
2. **Perfect capital mobility:**  
no restrictions on international trade in assets
3. Economy is **small**:  
cannot affect the world interest rate, denoted  $r^*$

1. & 2. imply  $r = r^*$

3. implies  $r^*$  is exogenous

## Saving and investment in a small open economy (2 of 2)

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

$$NX = S - I$$

Assuming that  $r = r^*$

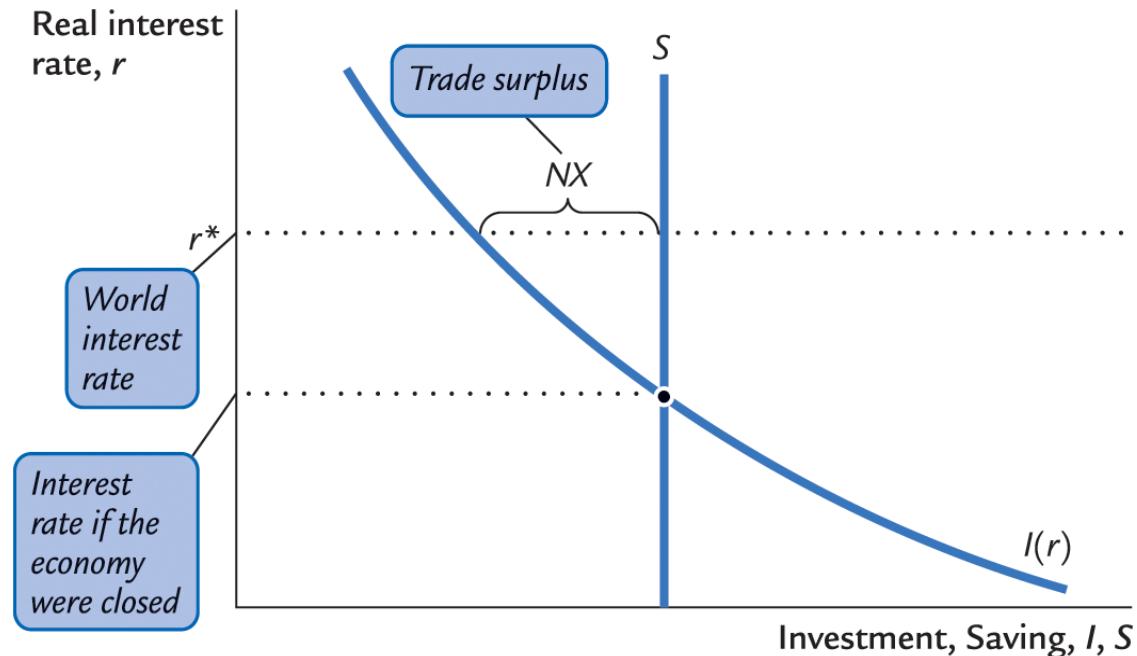
$$NX = (Y - C - G) - I = [\bar{Y} - C(\bar{Y} - T)] - I(r^*)$$

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

## *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



## Three experiments

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

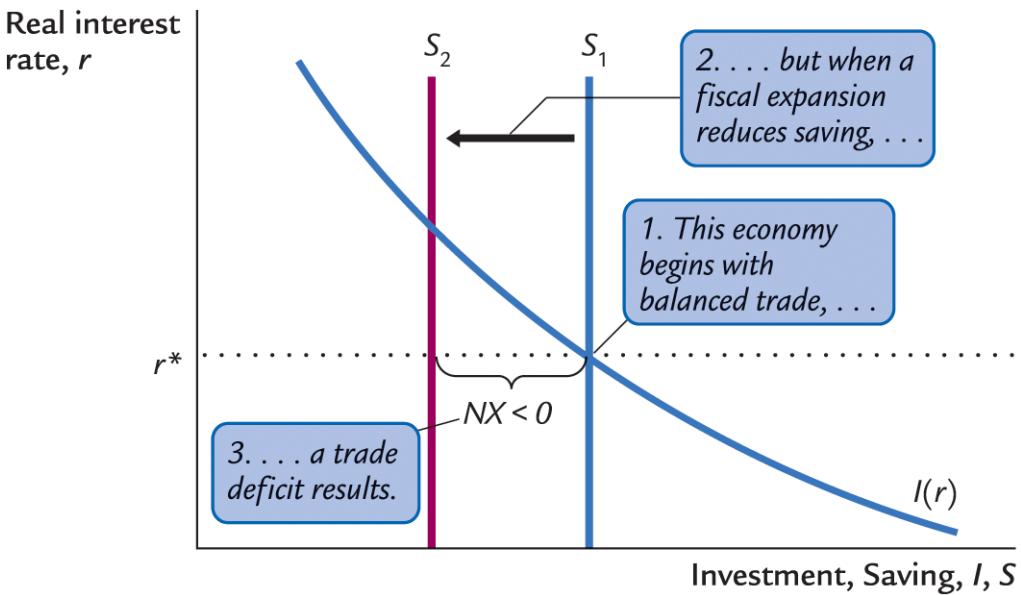
# 1. Fiscal policy at Home

An increase in  $G$  or decrease in  $T$  reduces saving.

Results:

$$\Delta I = 0$$

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



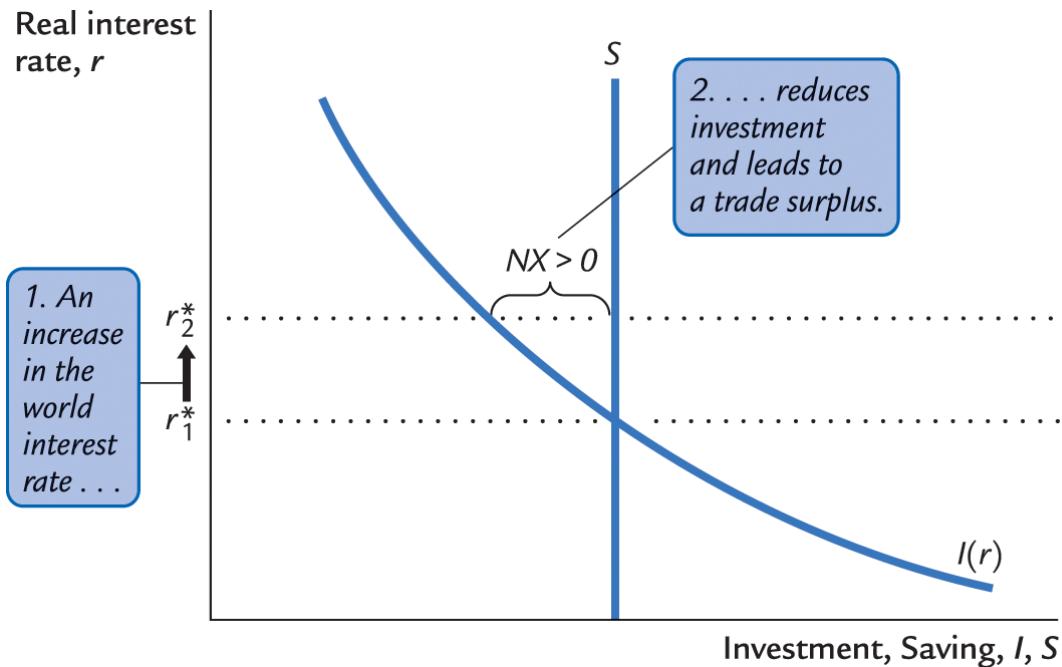
## 2. Fiscal policy abroad

Expansionary fiscal policy abroad raises the world interest rate.

Results:

$$\Delta I < 0$$

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



## NOW YOU TRY

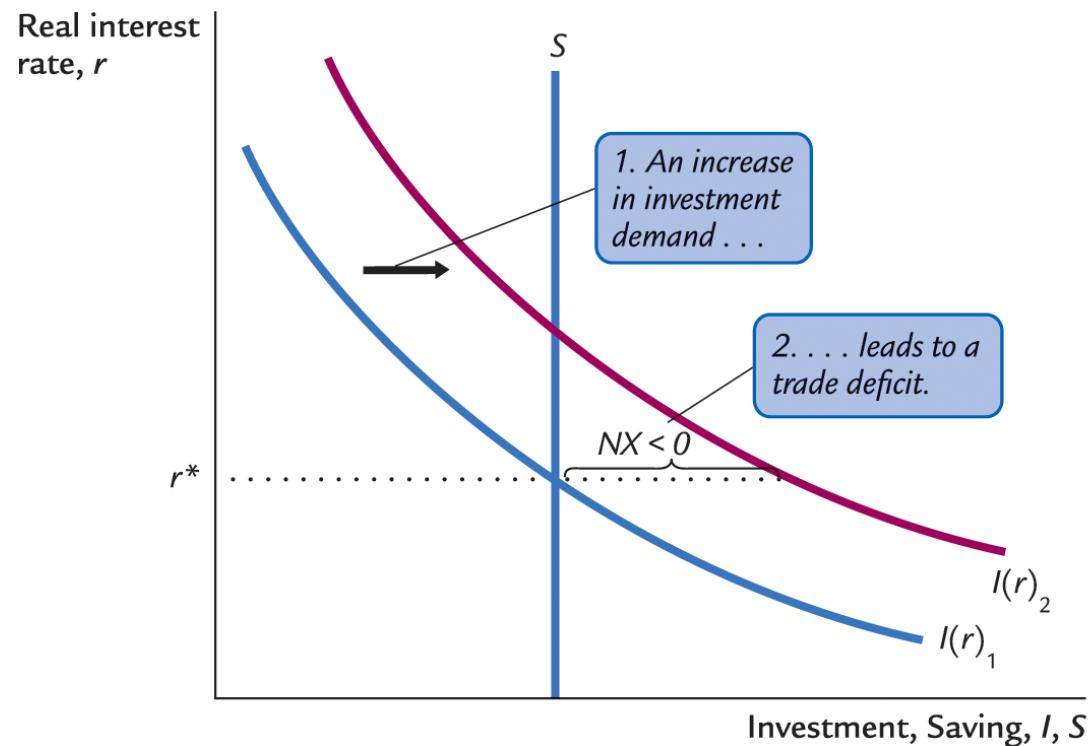
### 3. An increase in investment demand

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

## NOW YOU TRY

### 3. An increase in investment demand, answers

$\Delta I > 0$ ,  
 $\Delta S = 0$ ,  
net capital  
outflow  
and  $NX$   
fall by the  
amount  $\Delta I$



## The nominal exchange rate

$e$  = nominal exchange rate, the relative price of domestic currency in terms of foreign currency  
(example: euro per dollar)

An increase in  $e$  implies that one U.S. dollar would buy more euros or any other currency.

An increase in  $e$  therefore means an appreciation of the dollar.

# The real exchange rate ( $\varepsilon$ )

**$\varepsilon$**   
*the lowercase  
Greek letter  
epsilon*

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

## Understanding the units of $\epsilon$

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

## One commonly used example: Big Mac

- One good: Big Mac
- Price in Japan:  
 $P^* = 500$  yen
- Price in the United States:  
 $P = \$5.40$
- Nominal exchange rate  
 $e = 150$  yen/\$

$$\begin{aligned}\varepsilon &= \frac{e \times P}{P^*} \\ &= \frac{150 * \$5.40}{500 \text{ yen}} = 1.62\end{aligned}$$

*To buy a U.S. Big Mac, someone from Japan would have to pay an amount that could buy 1.62 Japanese Big Macs.*

## $\epsilon$ in the real world and our model

- In the real world:  
We can think of  $\epsilon$  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  $\epsilon$  is the relative price of one country's output in terms of the other country's output.

# Purchasing-power parity (PPP), part 1

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), part 2

$$\text{PPP: } e \times P = P^*$$

Cost of a basket  
of domestic  
goods, in foreign  
currency

Cost of a basket of  
foreign goods, in  
foreign currency

Cost of a basket of  
domestic goods, in  
domestic currency

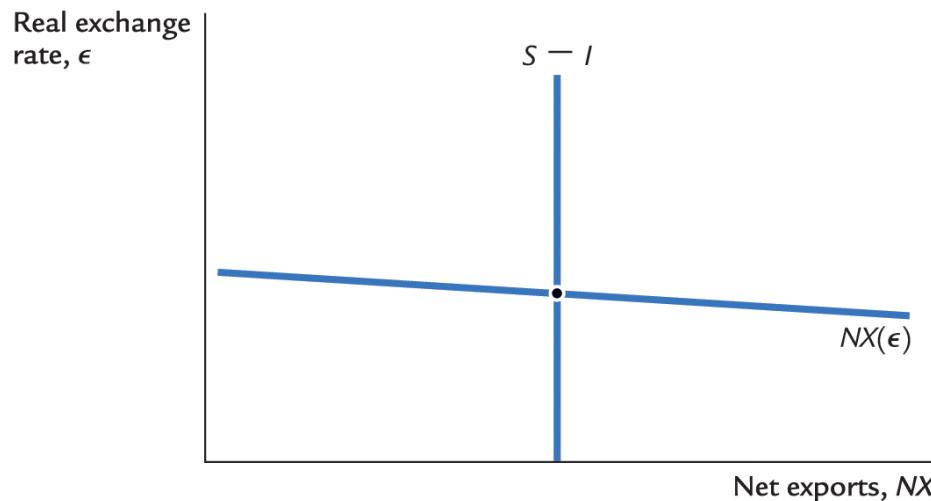
- Solve for  $e$ :  $e = P^*/P$
- PPP implies that the nominal exchange rate between two countries equals the ratio of the countries' price levels.

# Purchasing-power parity (PPP), part 3

If  $e = P^* / P$ ,

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

and the  $NX$  curve is horizontal :



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

# Does PPP hold in the real world?

No, for two reasons:

1. International arbitrage is not possible
  - nontraded goods
  - transportation costs
2. Different countries' goods are not perfect substitutes

Yet PPP is a useful theory:

- It's simple and intuitive.
- In the real world, nominal exchange rates tend toward their PPP values over the long run.

## How NX depends on $\epsilon$

If  $\epsilon$  rises:

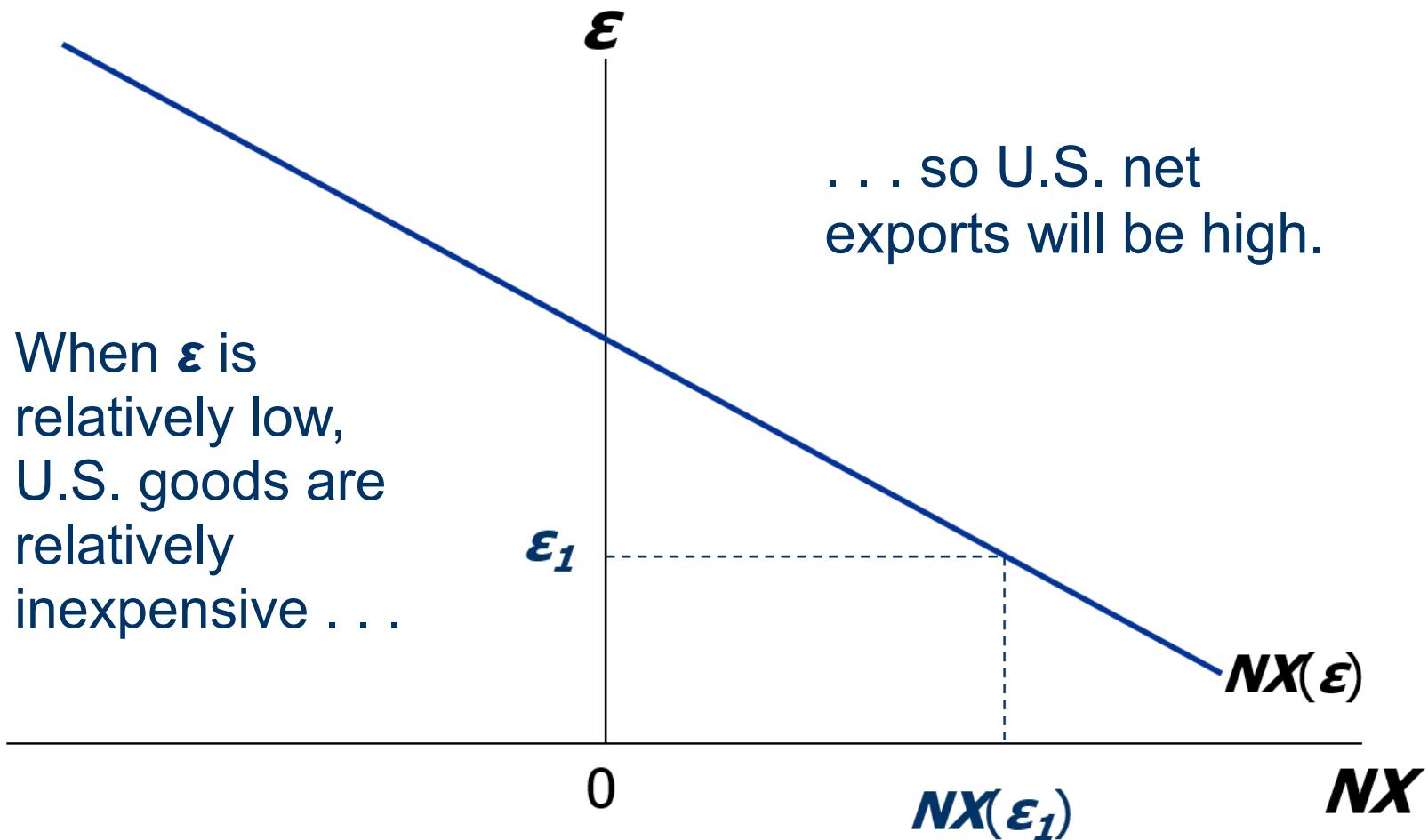
- U.S. goods become more expensive relative to foreign goods
- exports fall, imports rise
- net exports fall

## The net exports function

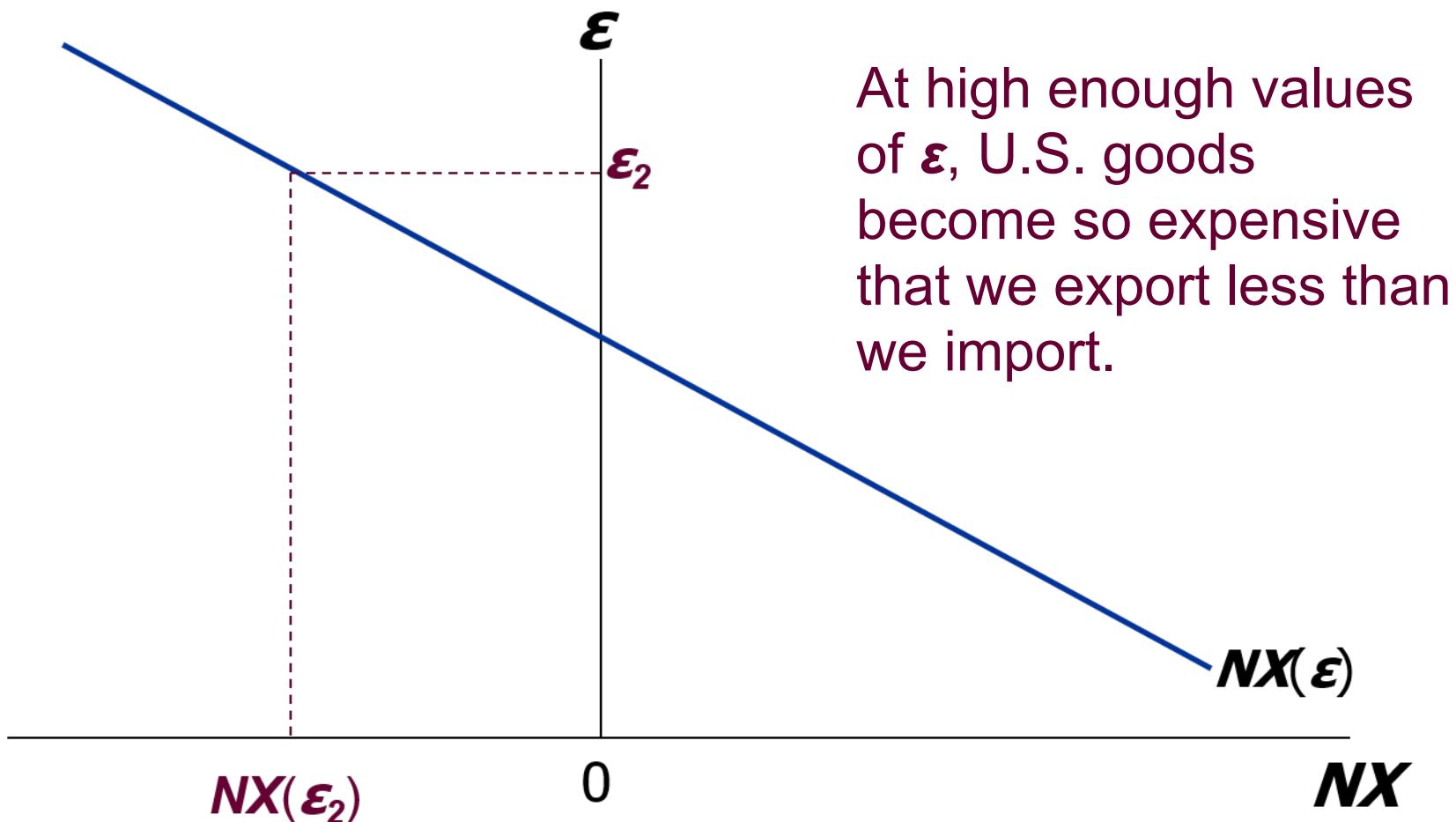
The **net exports function** reflects this inverse relationship between  $NX$  and  $\epsilon$  :

$$NX = NX(\epsilon).$$

# The $NX$ curve for the United States, part 1



## The $NX$ curve for the United States, part 2



## How $\varepsilon$ is determined (1 of 2)

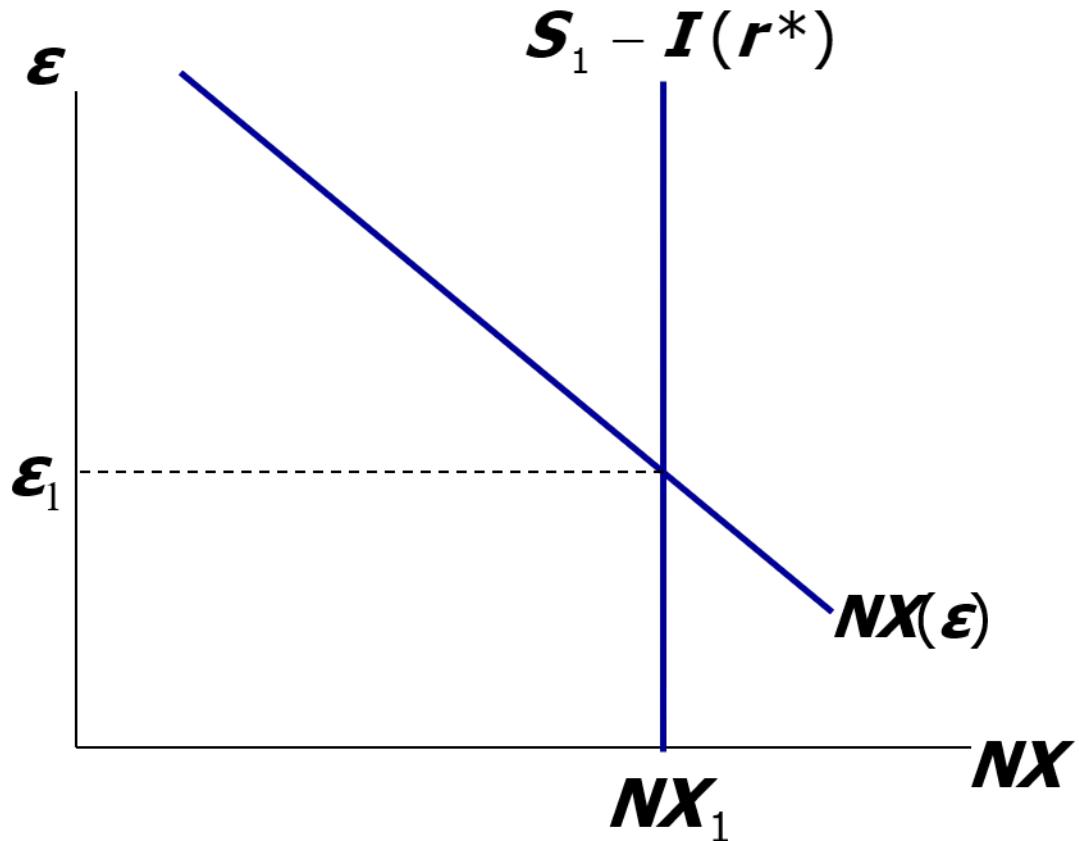
- The accounting identity says  $NX = S - I$
- We saw earlier how  $S - I$  is determined:
  - $S$  depends on domestic factors (output, fiscal policy variables, etc.)
  - $I$  is determined by the world interest rate  $r^*$
- So,  $\varepsilon$  must adjust to ensure

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

## How $\epsilon$ is determined (2 of 2)

Neither  $S$  nor  $I$  depends on  $\epsilon$ , so the net capital outflow curve is vertical.

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



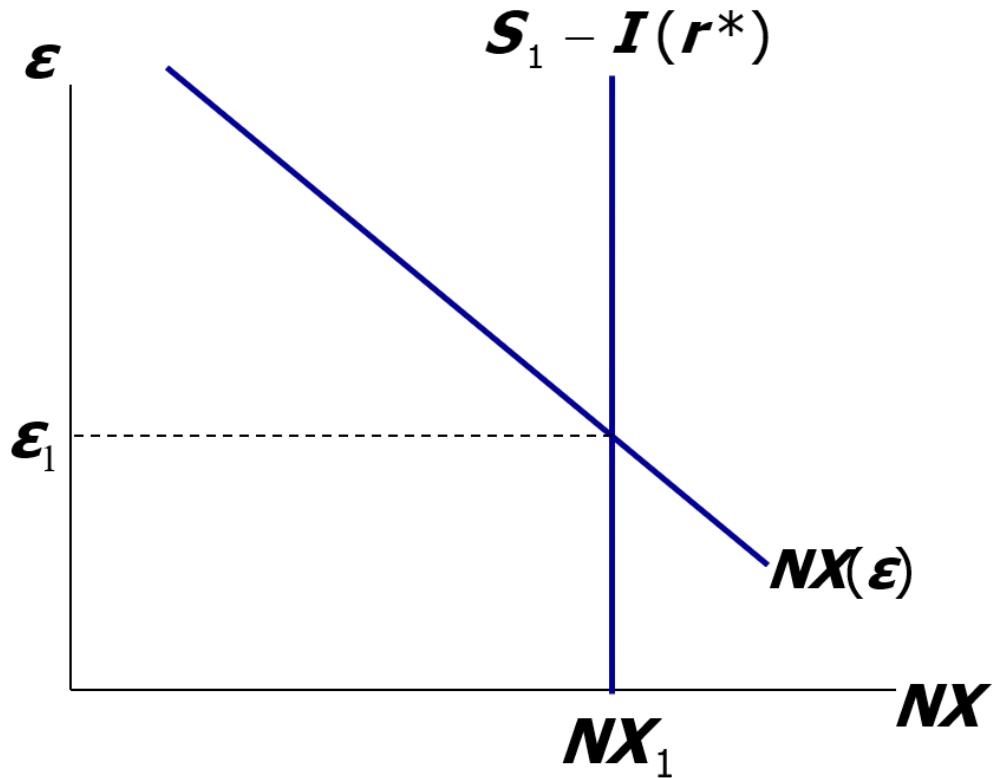
# Interpretation: Supply and demand in the foreign exchange market

## **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.



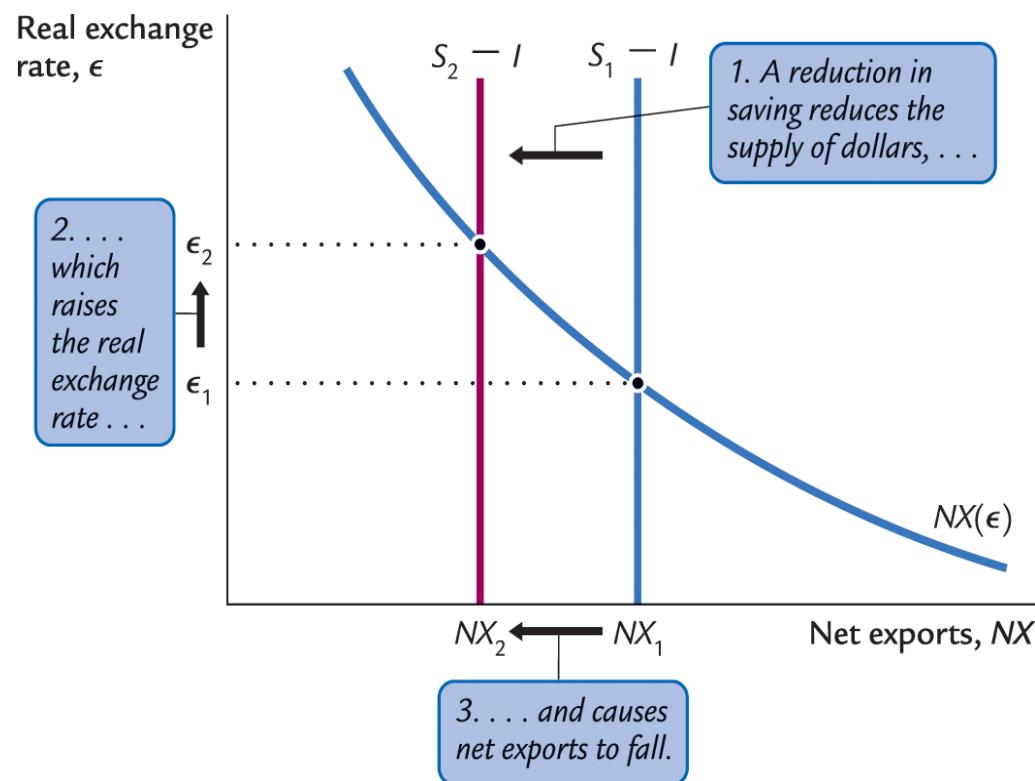
# Four experiments

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

# 1. Fiscal policy at home

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

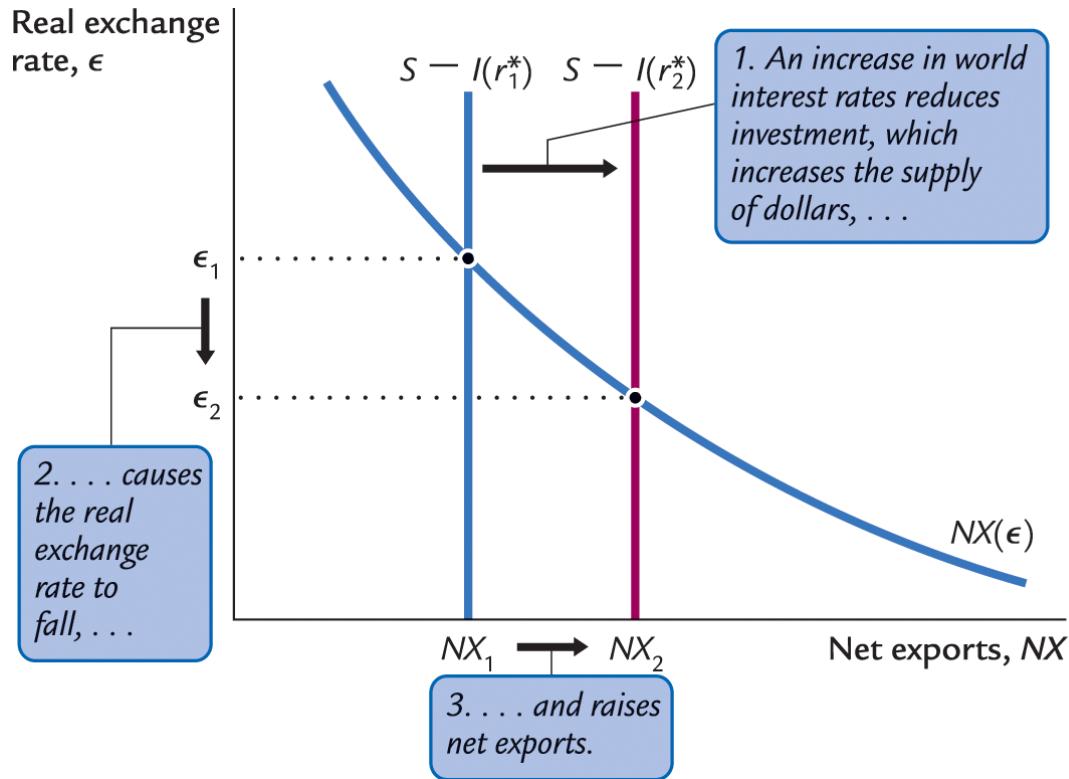
. . . causing the real exchange rate to rise and  $NX$  to fall.



## 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.



## NOW YOU TRY

### 3. Increase in investment demand

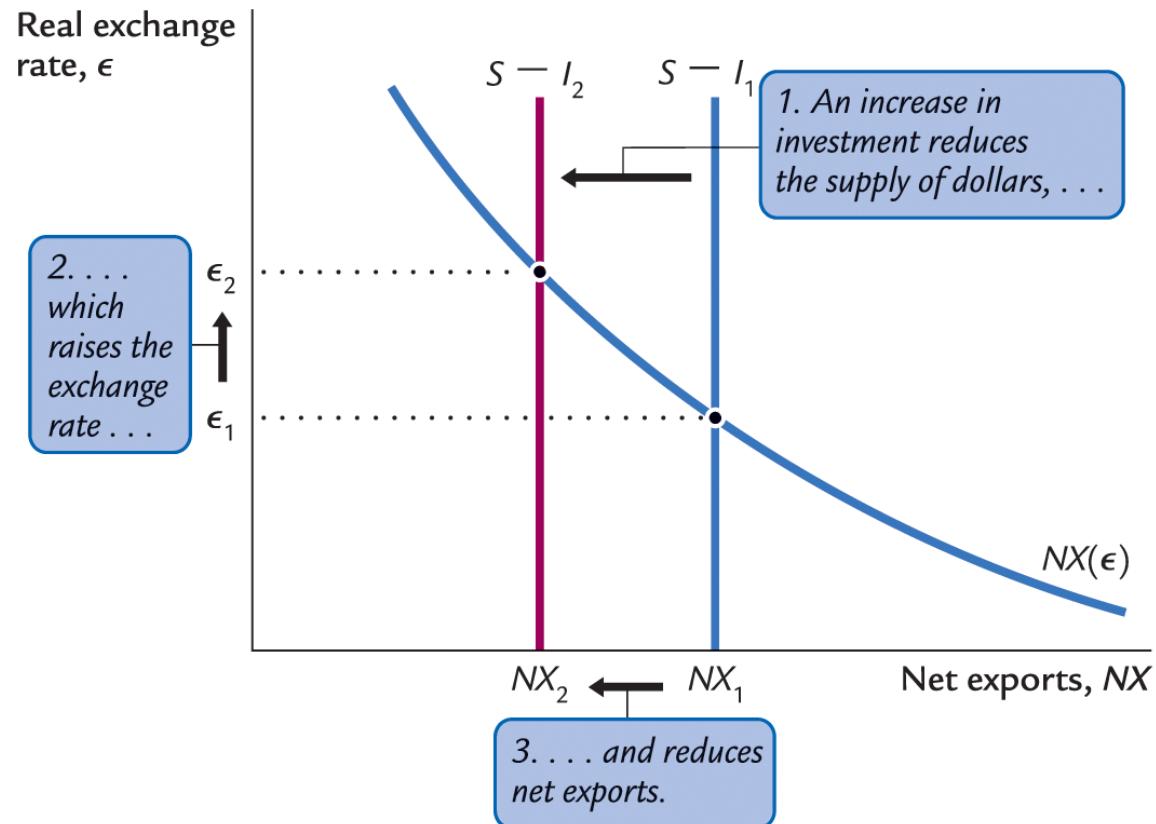
Determine the impact of an increase in investment demand on net exports, net capital outflow, and the real exchange rate.

## NOW YOU TRY

### 3. Increase in investment demand, answers

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

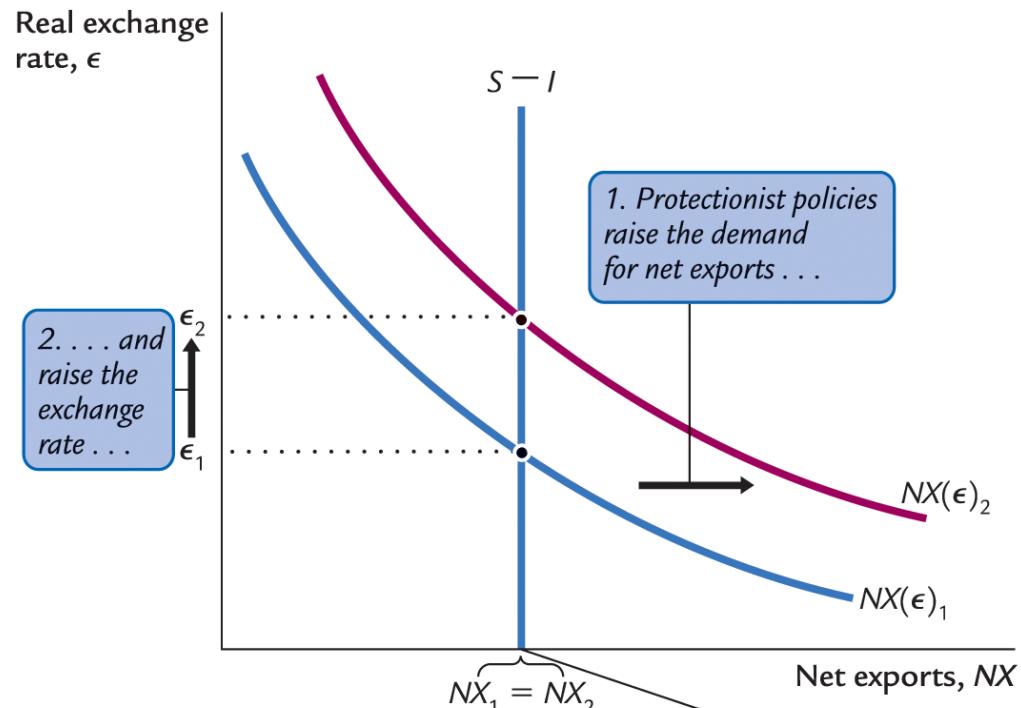
. . . causing the real exchange rate to rise and  $NX$  to fall.



## 4. Trade policy to restrict imports, part 1

At any given  $\epsilon$ , an import tariff reduces **IM**, increases **NX**, and 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, part 2

Results:

$$\Delta\epsilon > 0$$

(demand increase)

$$\Delta NX = 0$$

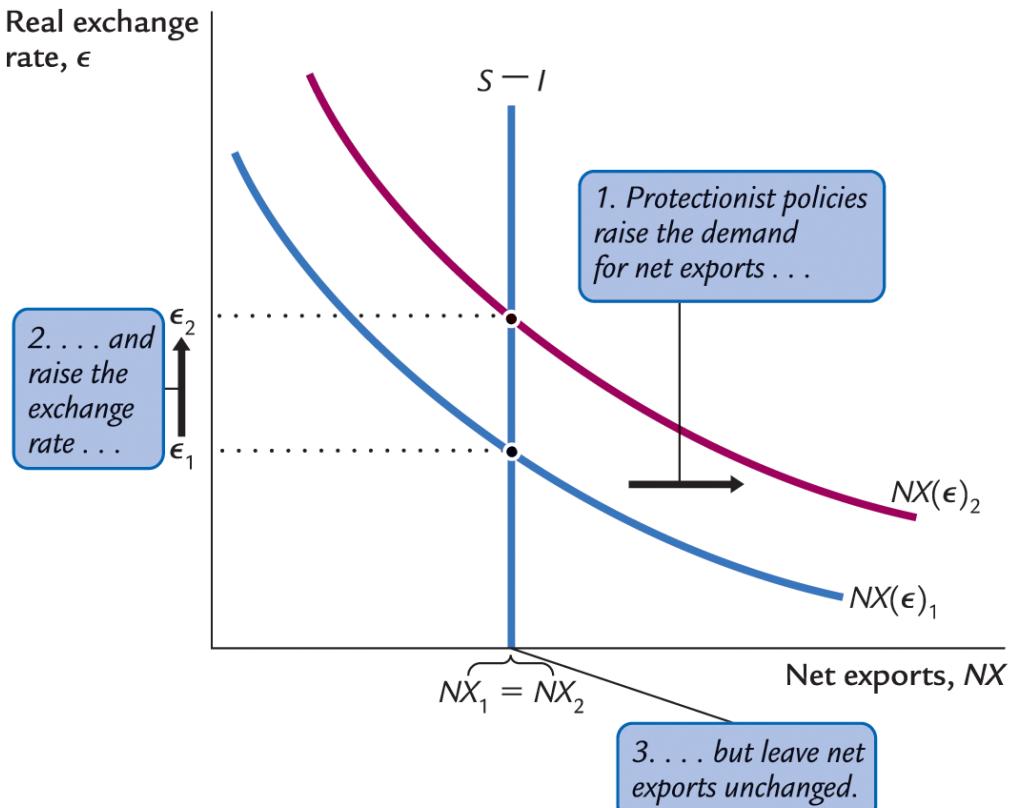
(supply fixed)

$$\Delta IM < 0$$

(policy)

$$\Delta EX < 0$$

(rise in  $\epsilon$ )

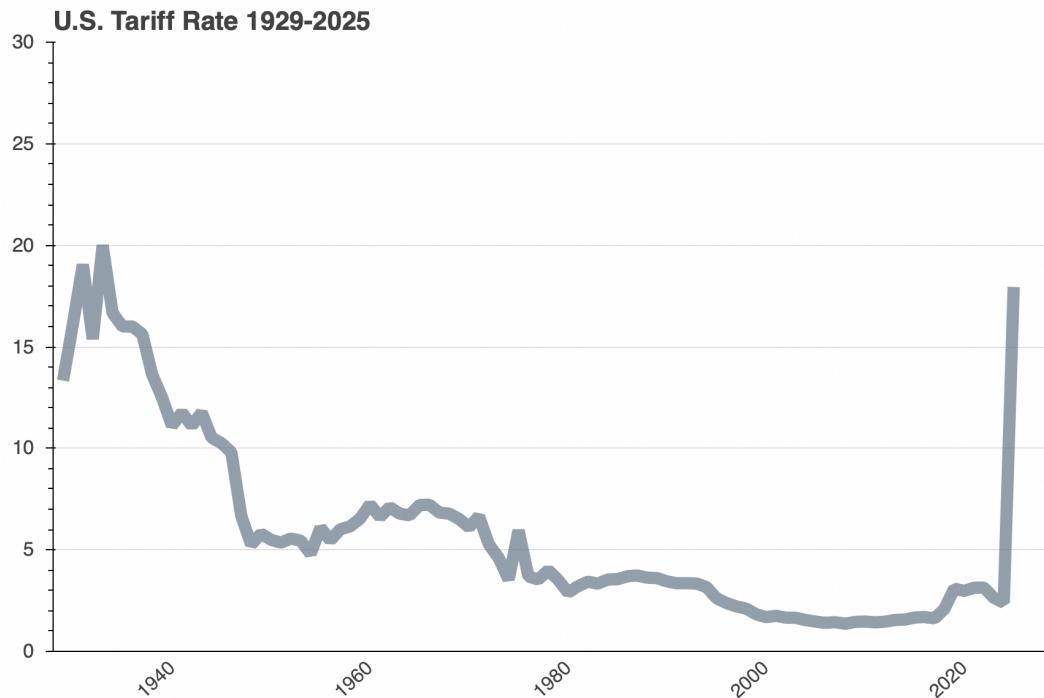


# The United States as a large open economy

- So far, we've learned long-run models for two extreme cases:
  - closed economy
  - small open economy
- A large open economy—like the United States—falls between these two extremes.
- The results from large open-economy analysis are a mixture of the results for the closed and small open-economy cases.

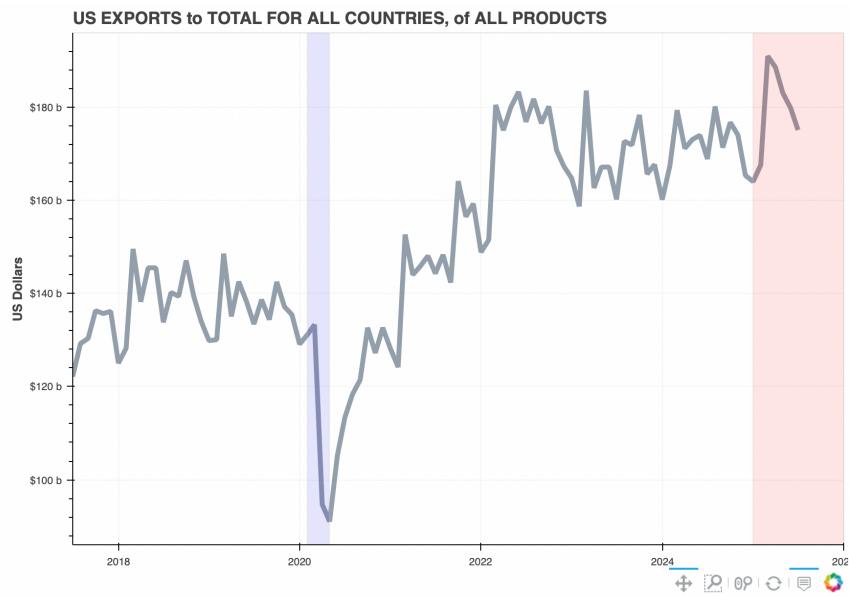
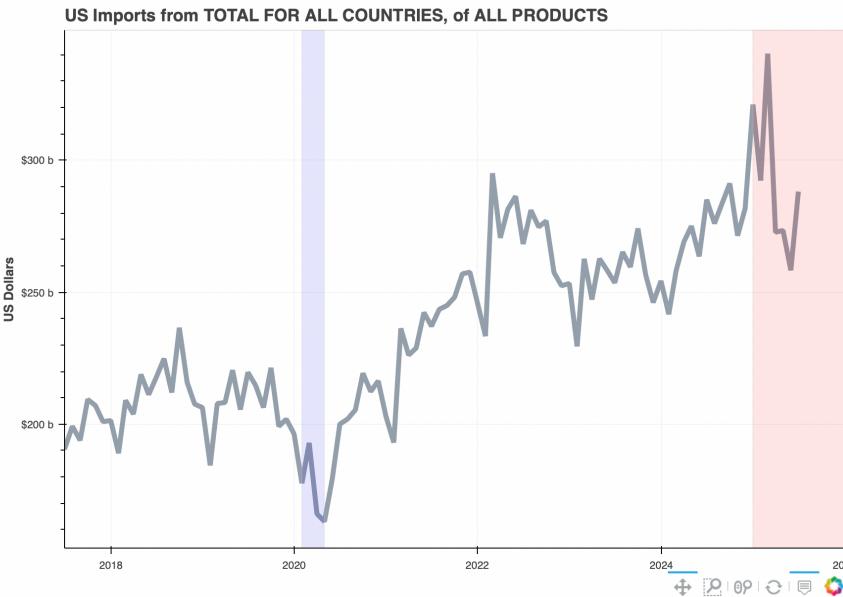
# Import tariffs

Pros	Cons
Address trade imbalance	Increase consumer prices
Protect domestic industries	Misallocate resources
Support emerging sectors	Trigger trade wars



Source: Mike Waugh, [TradeWarTracker.com](https://TradeWarTracker.com)

# US trade volume during recent period of tariff escalation



Source: Mike Waugh, [TradeWarTracker.com](https://TradeWarTracker.com)

# SUMMARY, PART 1

- 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

# SUMMARY, PART 2

- 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)

# SUMMARY, PART 3

- 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.

## SUMMARY, PART 4

---

- 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.