

5. The Open Economy

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

Attila Gyetvai | University of Florida, Department of Economics



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In an open economy

- Spending need not equal output
- Saving need not equal investment

National income identity

$$\underbrace{NX}_{\text{net exports}} = \underbrace{X}_{\text{exports}} - \underbrace{IM}_{\text{imports}}$$

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

$$\Rightarrow \underbrace{NX}_{\text{net exports}} = \underbrace{Y}_{\text{output}} - \underbrace{(C + I + G)}_{\text{domestic spending}}$$

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 trade surplus is NX
- *Trade deficit*
 - Output $Y <$ spending $(C + I + G)$
 - Exports $X <$ imports IM
 - $NX < 0$, size of trade deficit is $-NX$

International capital flows

- *Net capital outflow*

$$= S - I$$

= net outflow of “loanable funds”

= net purchases of foreign assets

= domestic purchases of foreign assets - foreign purchases of domestic assets

- When $S > I$, country is a net lender
- When $S < I$, country is a net borrower

Trade and capital flows

1 of 2

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

$$\implies NX = (Y - C - G) - I = S - I$$

- Trade balance equals net capital outflow
- Thus, a country with a trade deficit ($NX < 0$) is a net borrower ($S < I$)

Trade and capital flows

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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

U.S. as the world's largest debtor

1 of 2

- Every year since the 1980s: huge trade deficits and net capital inflows
- As of 2025 Q3:
 - US residents owned \$41.3 trillion worth of foreign assets
 - Foreigners owned \$68.9 trillion worth of US assets
 - US net indebtedness to the rest of the world: \$27.6 trillion
 - Higher than any other country, hence, the US is the “world’s largest debtor nation”

U.S. as the world's largest debtor

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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

Small open economy

- An open-economy version of the loanable funds model
- 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

2 of 2

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

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

$$NX = S - I$$

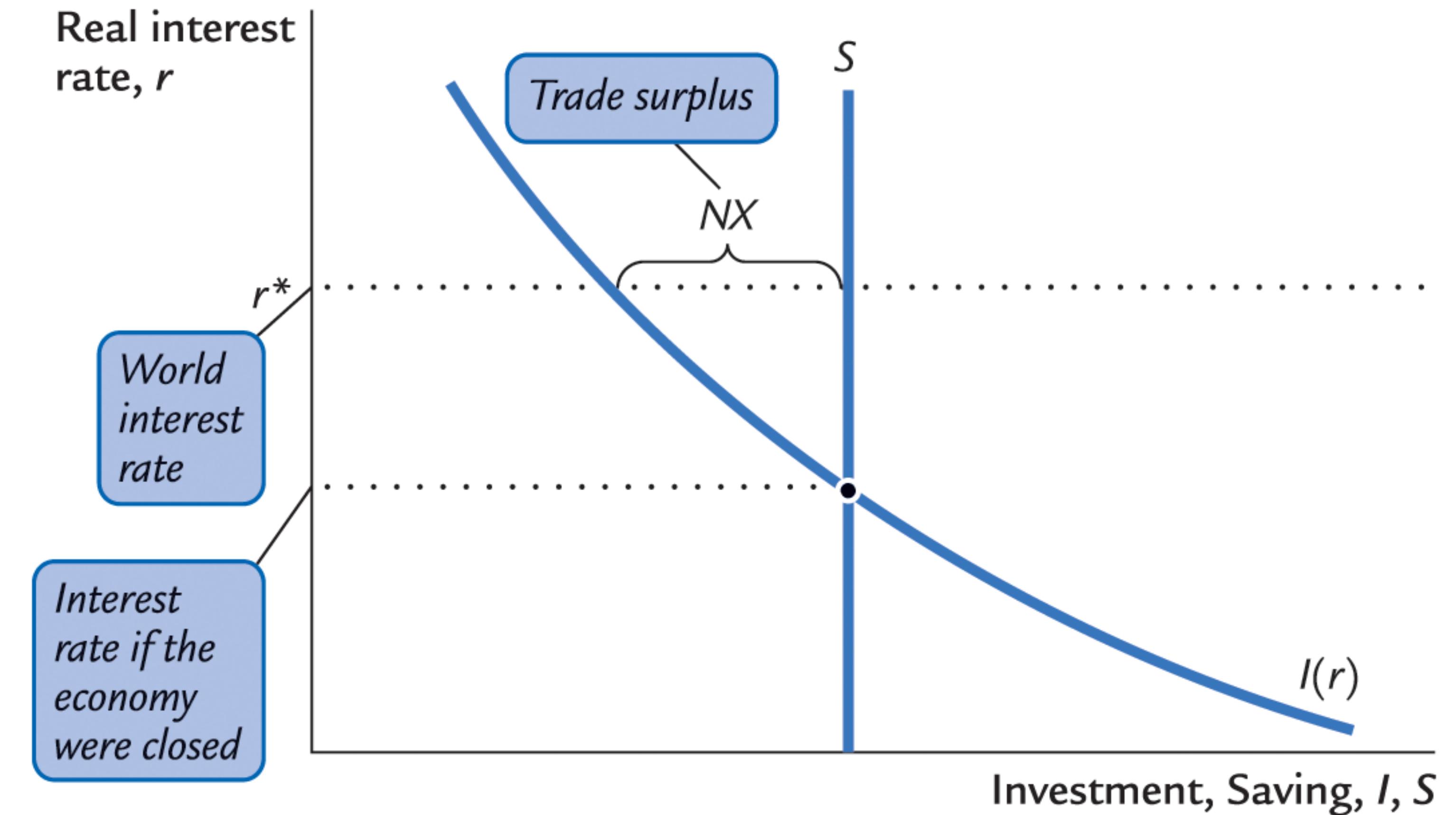
- Assuming that $r = r^*$

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

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

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

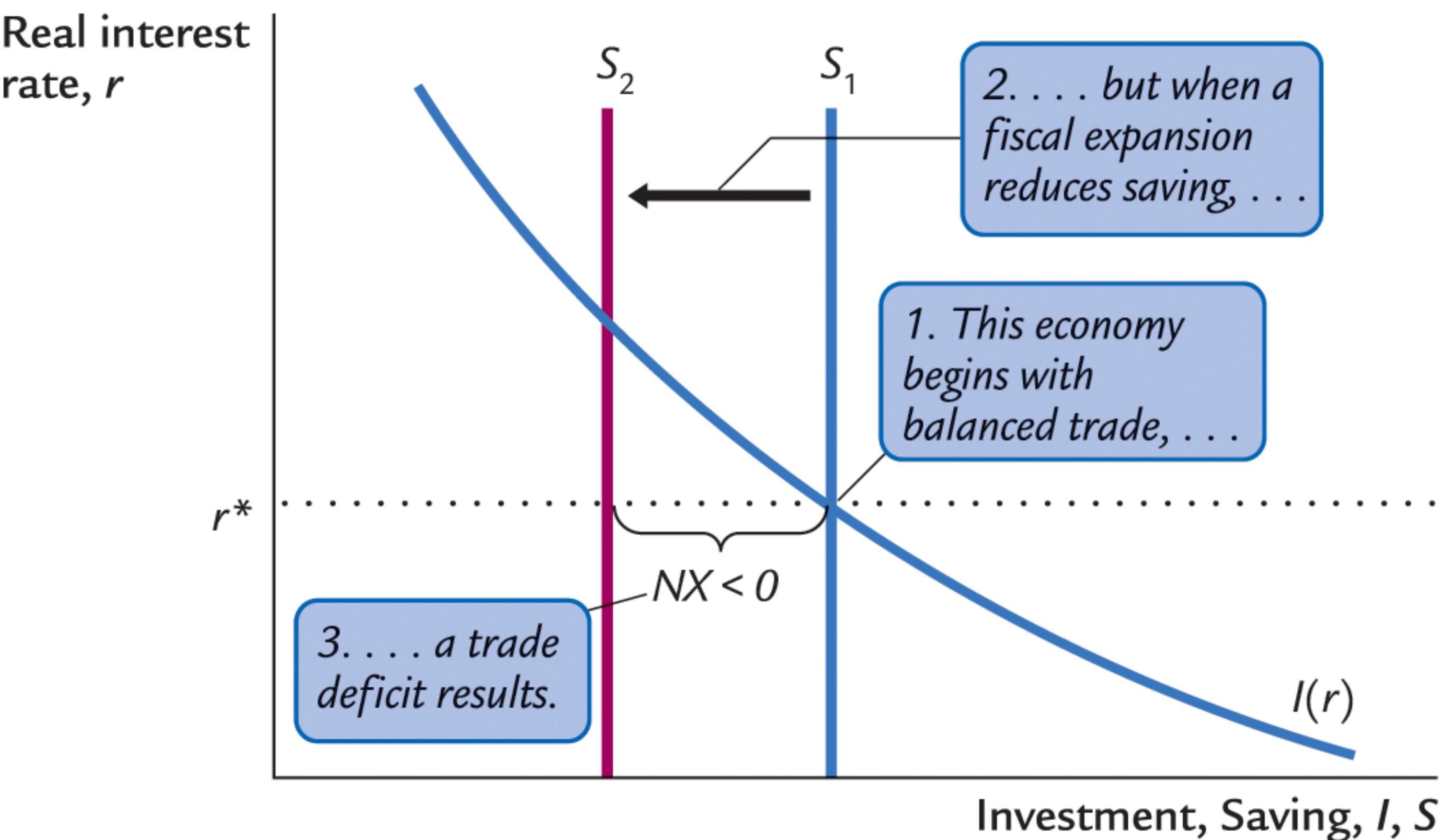


Three experiments

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

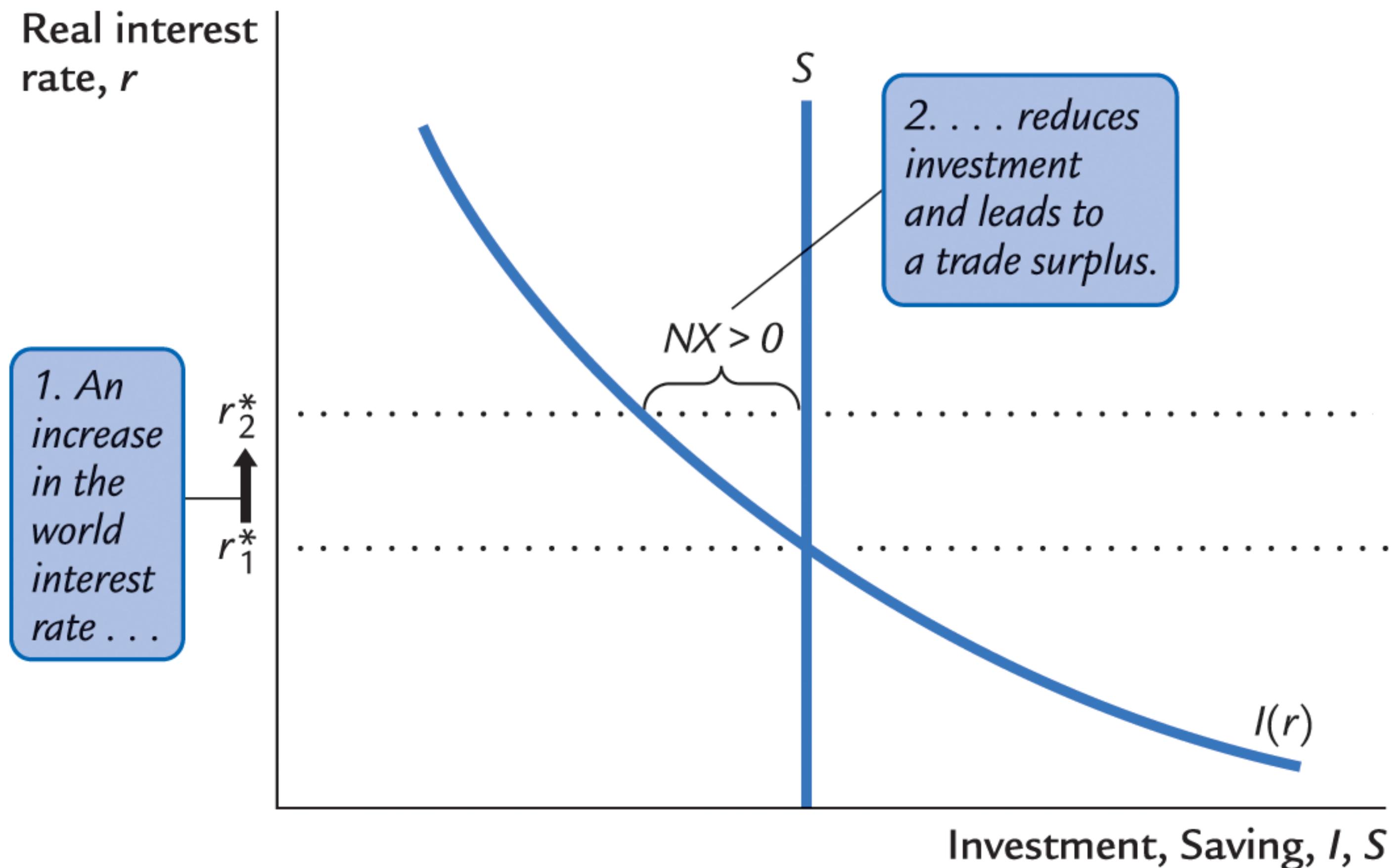
1. Fiscal policy at home

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

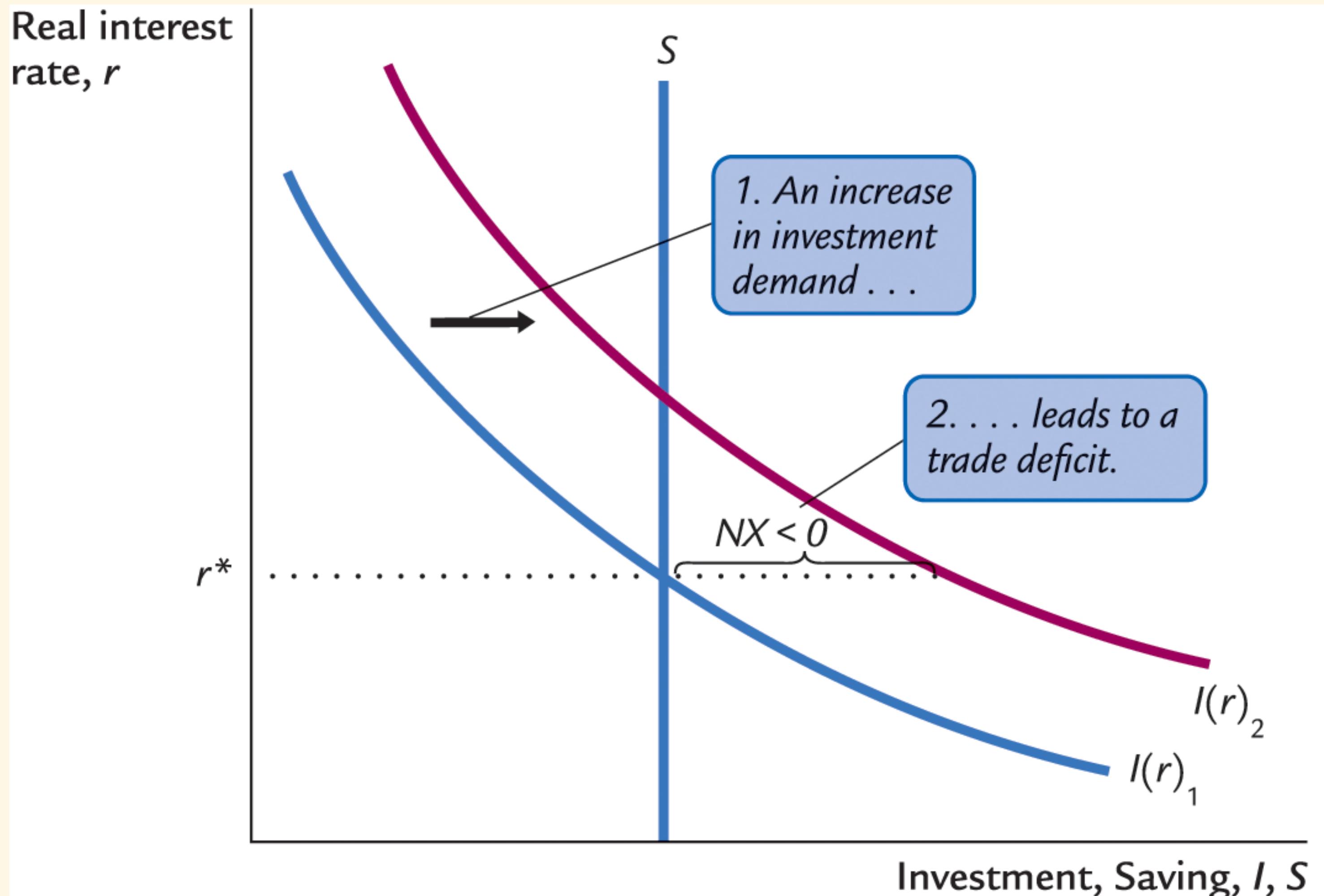


NOW YOU TRY

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

NOW YOU TRY

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



The nominal exchange rate

- e : nominal exchange rate
 - The relative price of domestic currency in terms of foreign currency
- Example: euro per US dollar
- An increase in e implies that one US dollar would buy more euros
- An increase in e therefore means an appreciation of the dollar

The real exchange rate

- ε : real exchange rate
 - The relative price of domestic goods in terms of foreign goods
- *Example:* Japanese Big Macs per US Big Mac

Understanding the units of ϵ

$$\begin{aligned}\epsilon &= \frac{e \times P}{P^*} \\&= \frac{(\text{Yen per \$}) \times (\$ \text{ per unit US goods})}{\text{Yen per unit Japanese goods}} \\&= \frac{\text{Yen per unit US goods}}{\text{Yen per unit Japanese goods}} \\&= \frac{\text{Unit Japanese goods}}{\text{Unit US goods}}\end{aligned}$$

A commonly used example

- Big Mac (the Big Mac index)
- Price in Japan: $P^* = 500$ yen
- Price in US: $P = \$5.40$
- Nominal exchange rate: $e = 150$ yen/\$
- For the price of a Big Mac in the US, you could buy 1.62 Big Macs in Japan

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

ε in the real world vs. in our model

- Reality: relative price of a basket of domestic goods in terms of foreign goods
- Our 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

Purchasing-power parity (PPP)

1 of 3

- Two definitions:
 1. A doctrine stating that goods must sell at the same (currency-adjusted) price in all countries
 2. Nominal exchange rates adjust to equalize the cost of a basket of goods across countries
- *Why?* Arbitrage, the law of one price

Purchasing-power parity (PPP)

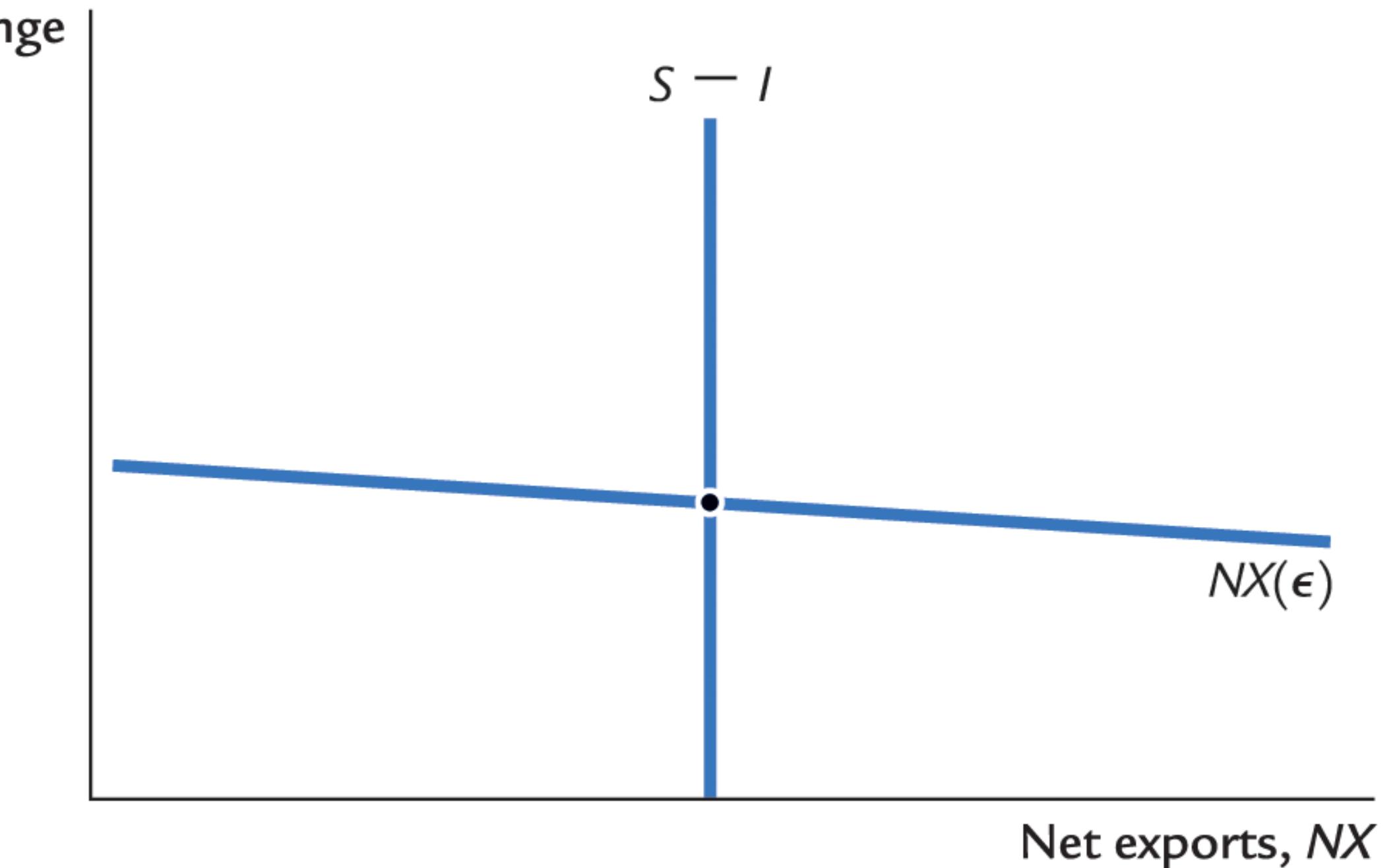
- PPP: $e \times P = P^*$
 - P : cost of a basket of domestic goods in domestic currency
 - $e \times P$: cost of a basket of domestic goods in foreign currency
 - P^* : cost of a basket of foreign goods in foreign currency
- Solve for e : $e = \frac{P^*}{P}$
- I.e., the nominal exchange rate equals the ratio of price levels

Purchasing-power parity (PPP)

- Under PPP:

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

- Therefore, the NX curve is horizontal
 - Changes in $(S - I)$ have no impact on ϵ



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 in the long run

How NX depends on ϵ

- If ϵ rises:
 - U.S. goods become more expensive relative to foreign goods
 - \Rightarrow exports fall, imports rise
 - \Rightarrow net exports fall

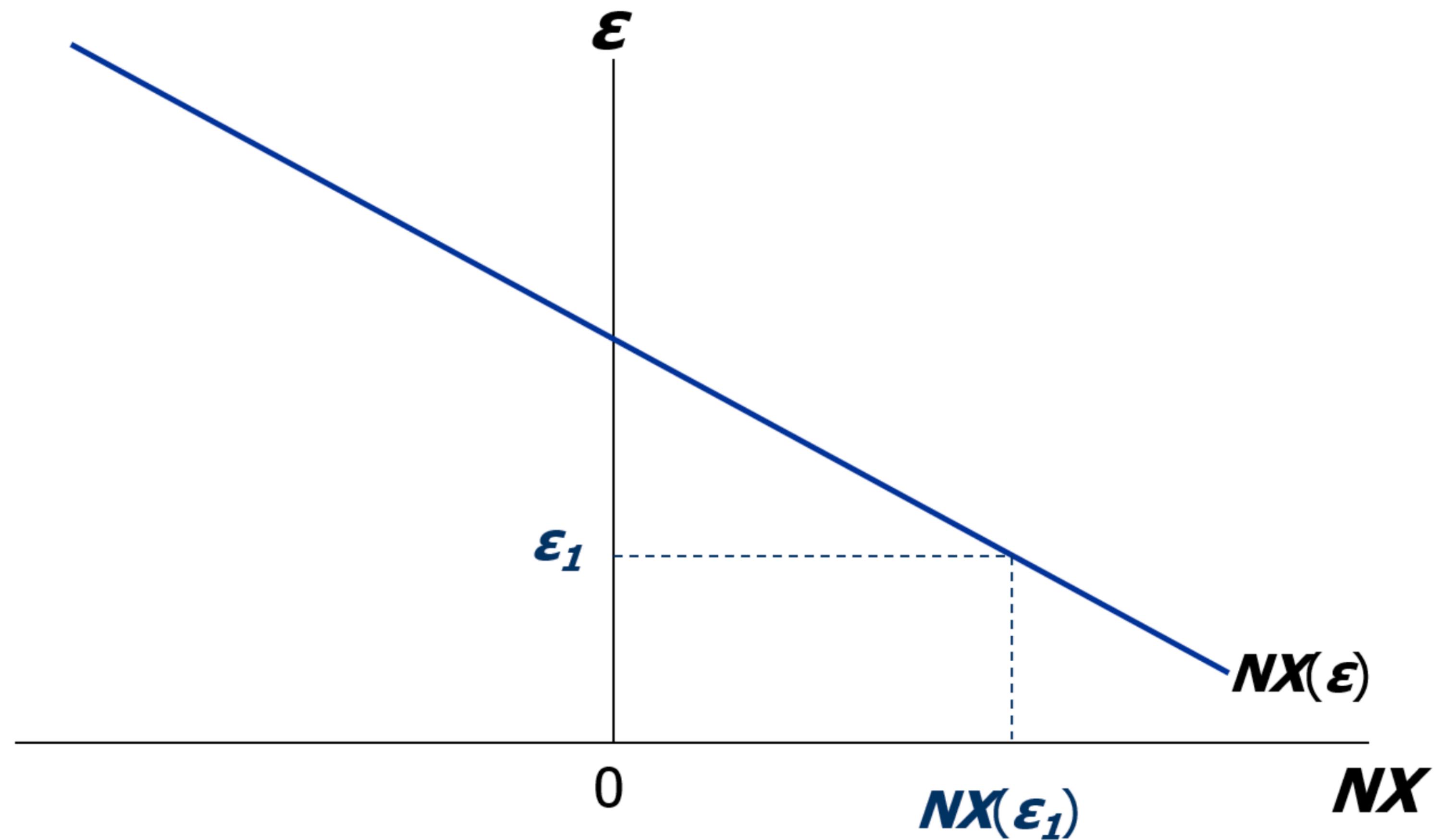
The net exports function

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

$$NX = NX(\varepsilon)$$

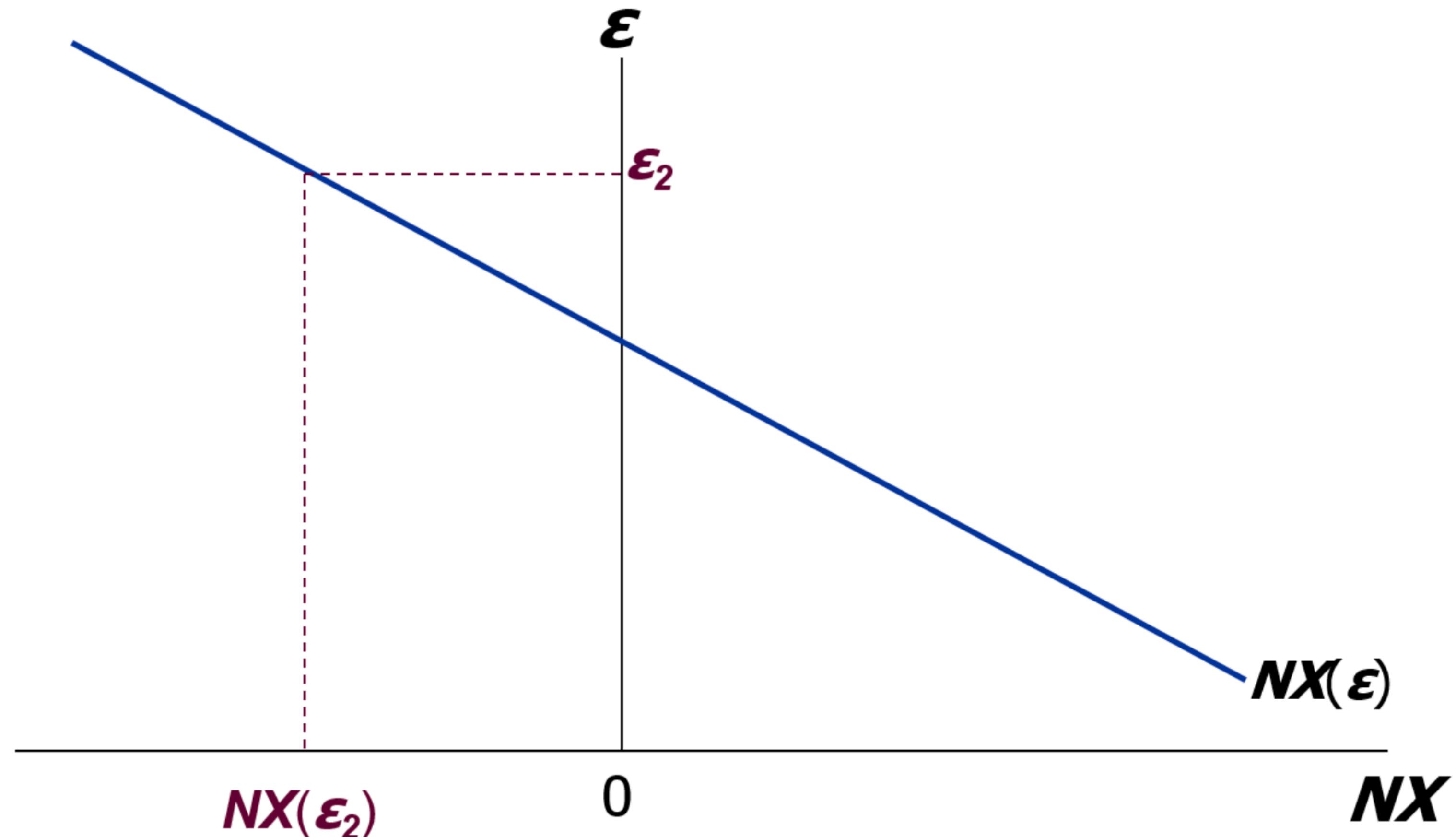
The NX curve for the US

- When ε is relatively low, US goods are relatively inexpensive
- ... so US net exports are high



The NX curve for the US

- At high enough values of ε , US goods become so expensive that we export less than we import



How ε is determined

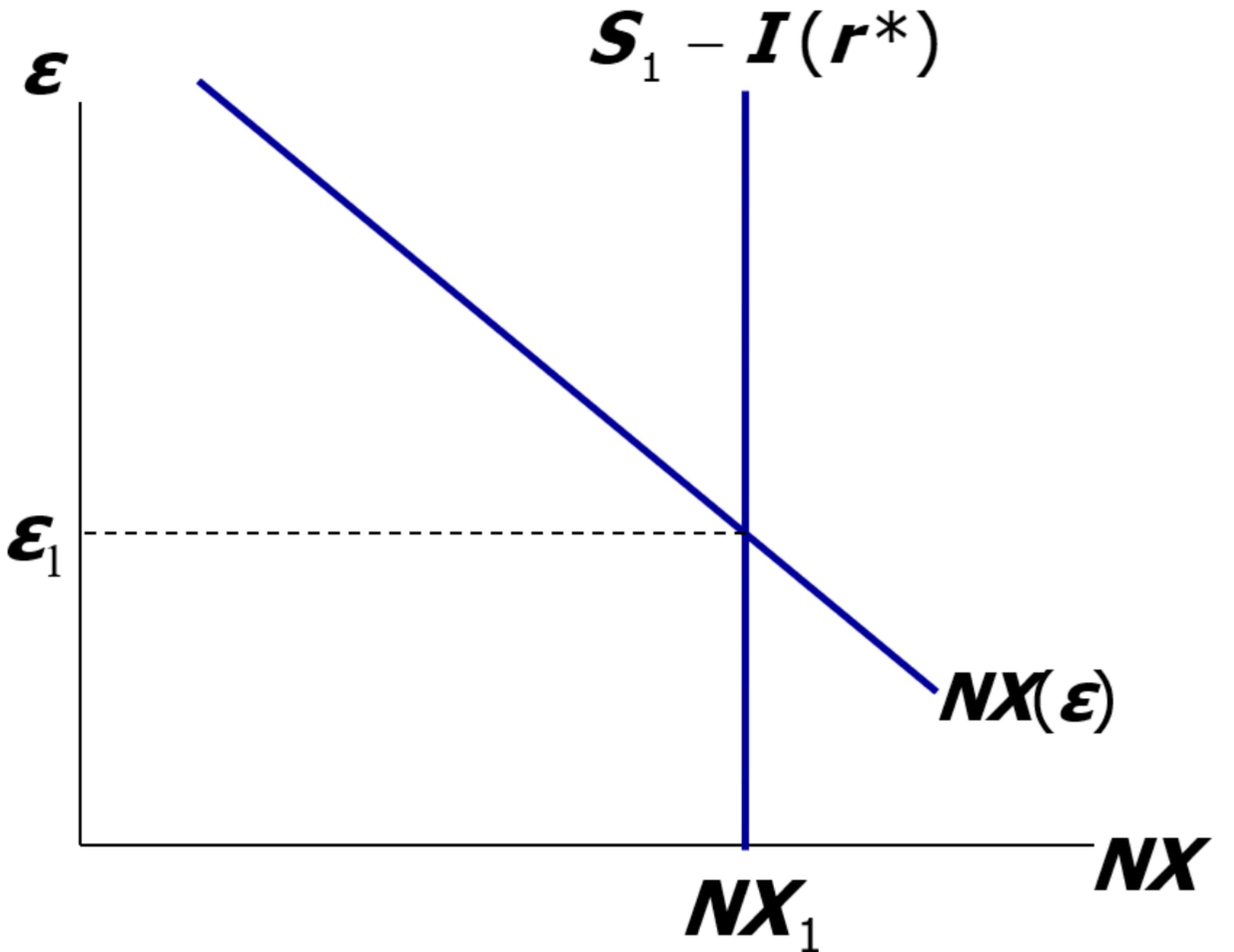
- The accounting identity says $NX = S - I$
- We saw earlier how $S - I$ is determined:
 - S depends on domestic factors (output, fiscal policy variables, etc.)
 - I is determined by the world interest rate r^*
- So, ε must adjust to ensure

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

How ε is determined

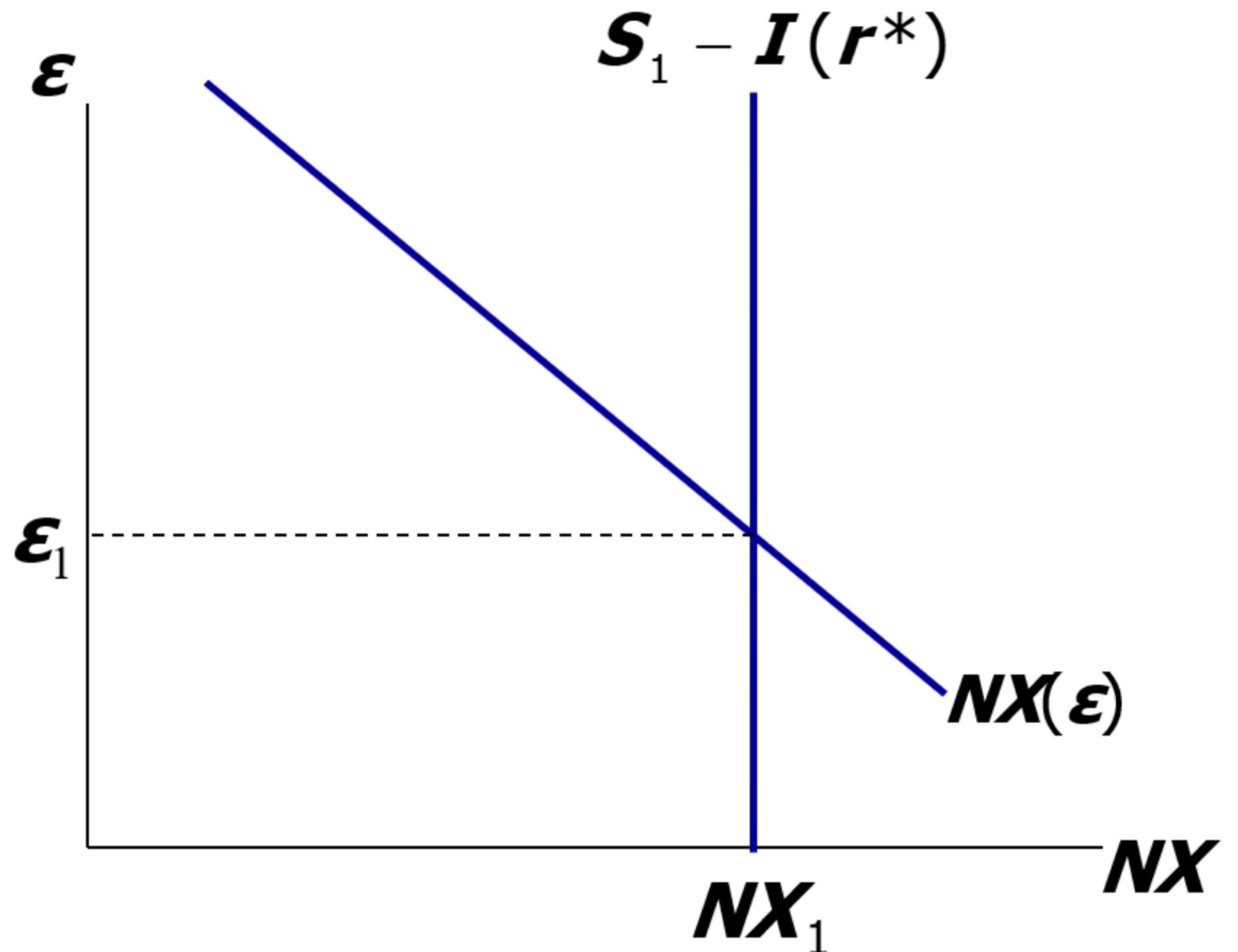
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- Neither S nor I depends on ε , so the net capital outflow curve is vertical
- ε adjusts to equate NX with net capital outflow $S - I$



Interpretation

- The foreign exchange market!
- Demand: foreigners need dollars to buy US net exports
- Supply: net capital outflow $S - I$ is the supply of dollars to be invested abroad

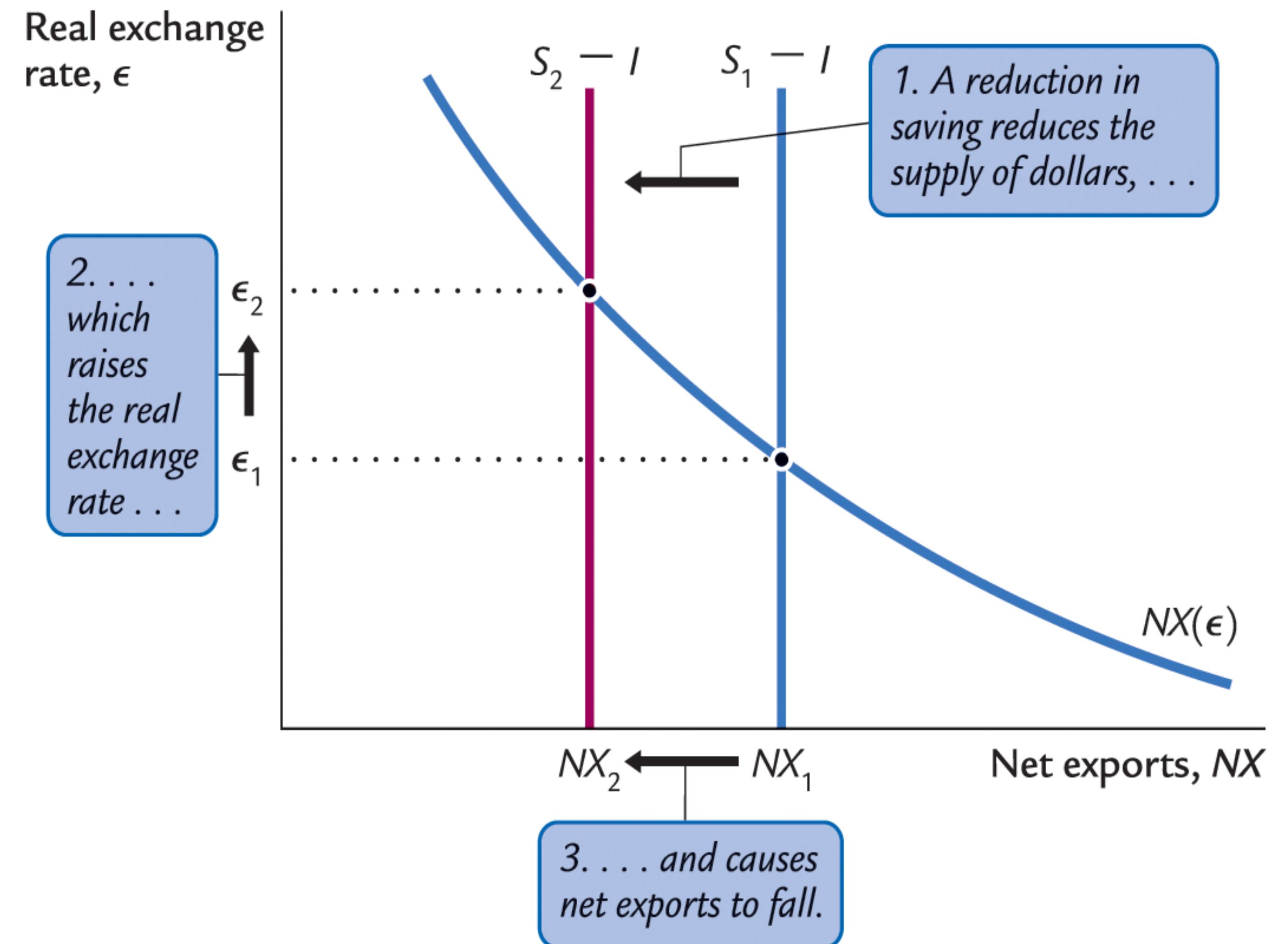


Four experiments

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

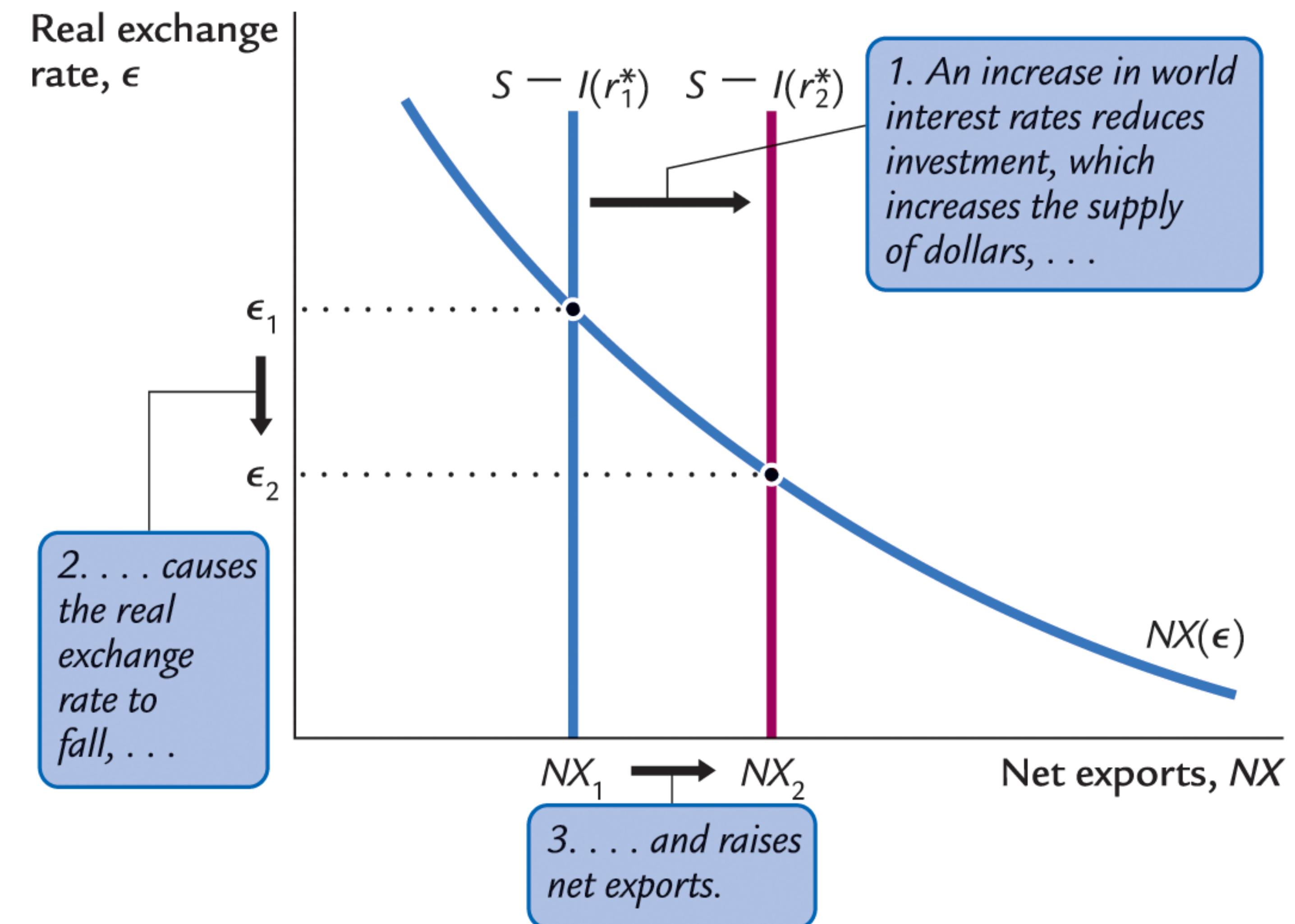
1. Fiscal policy at home

- 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

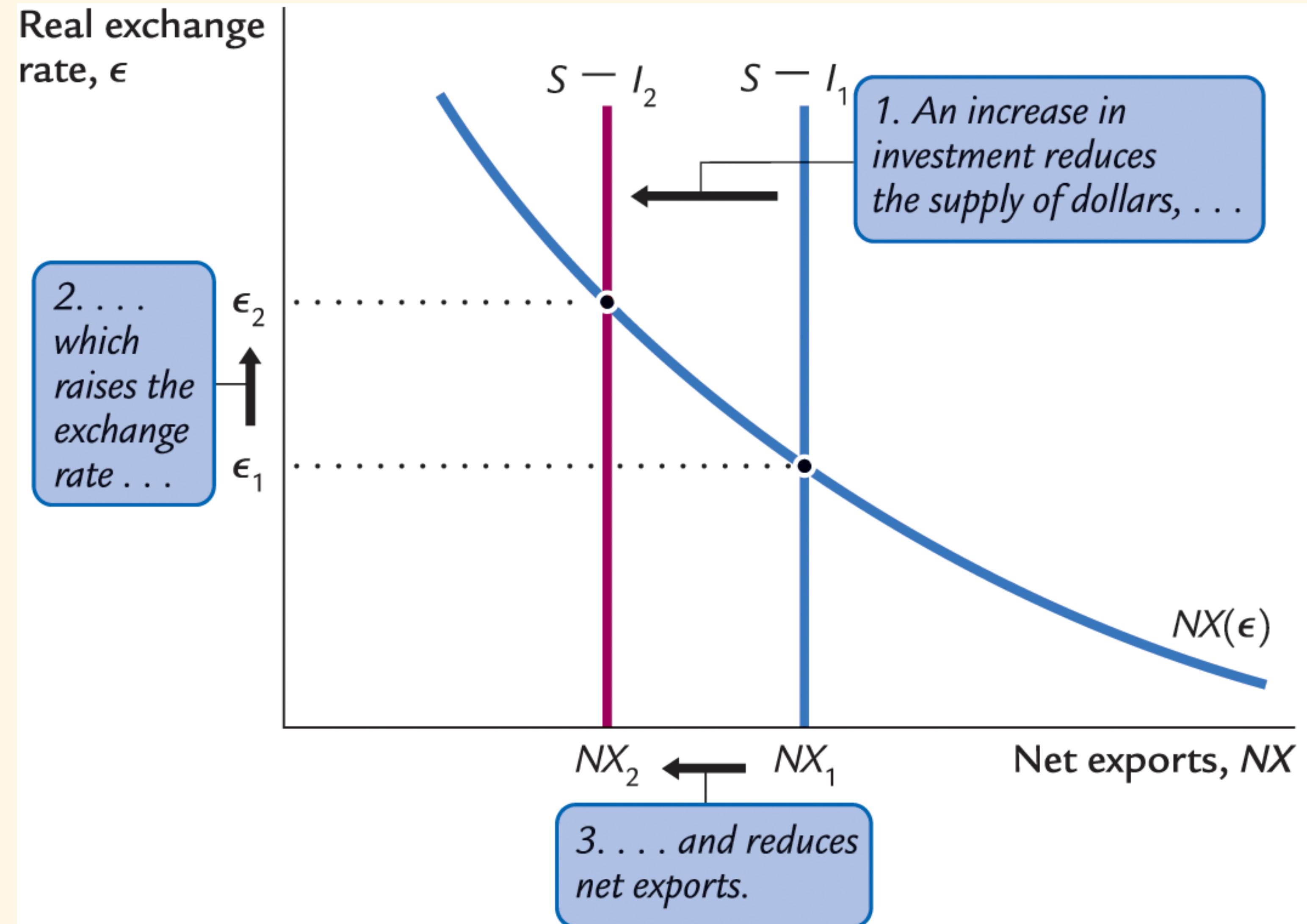


NOW YOU TRY

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

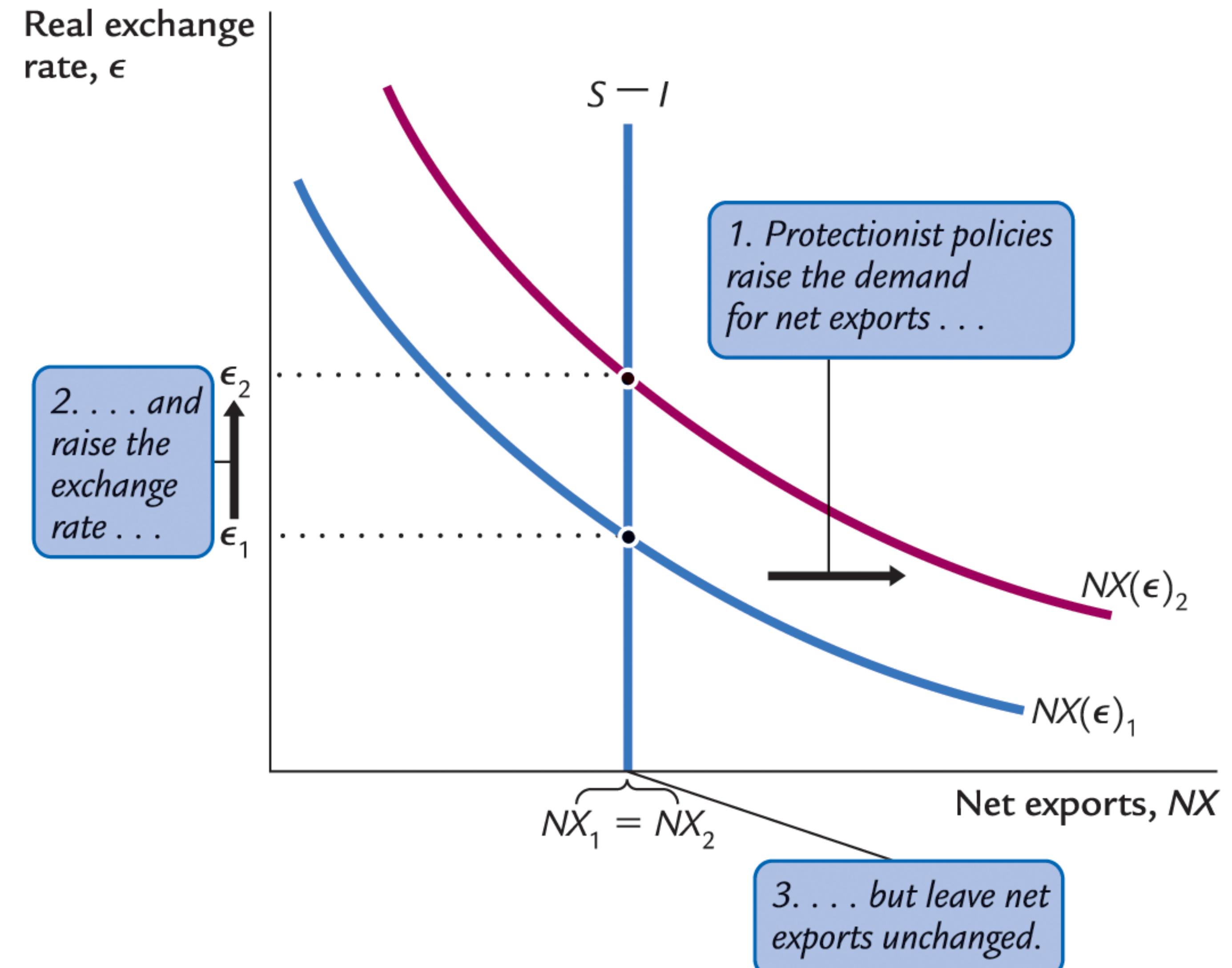
NOW YOU TRY

- 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

- At any given ϵ , 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
- Results:
 - $\Delta\epsilon < 0$ (demand increase)
 - $\Delta NX = 0$ (supply fixed)
 - $\Delta IM < 0$ (policy)
 - $\Delta X < 0$ (rise in ϵ)

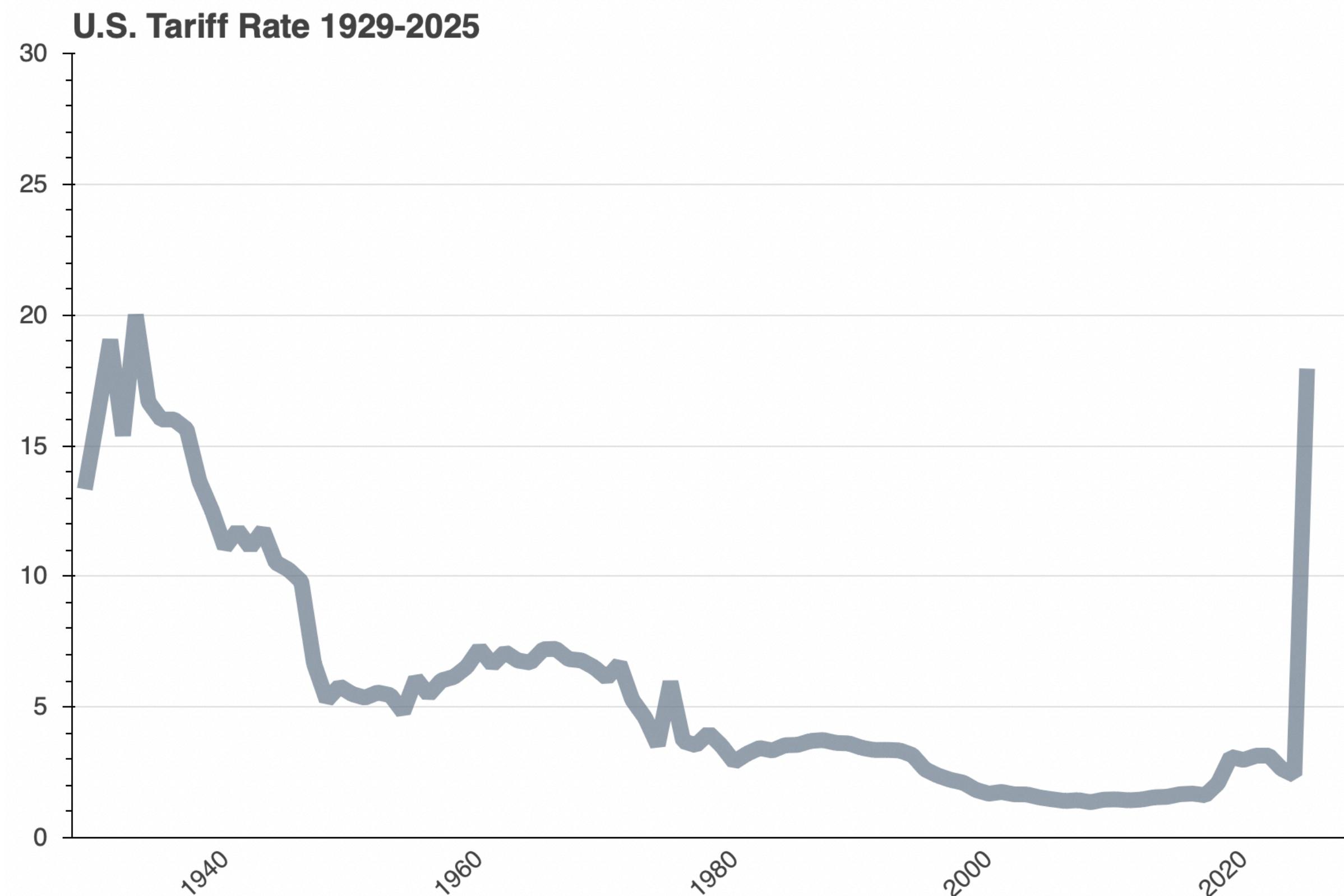


The US is a large open economy

- So far, we've learned long-run models for two extreme cases:
 - closed economy
 - small open economy
- A large open economy—like the US—falls between these two extremes
- Analysis results for large open economies also fall between these extremes

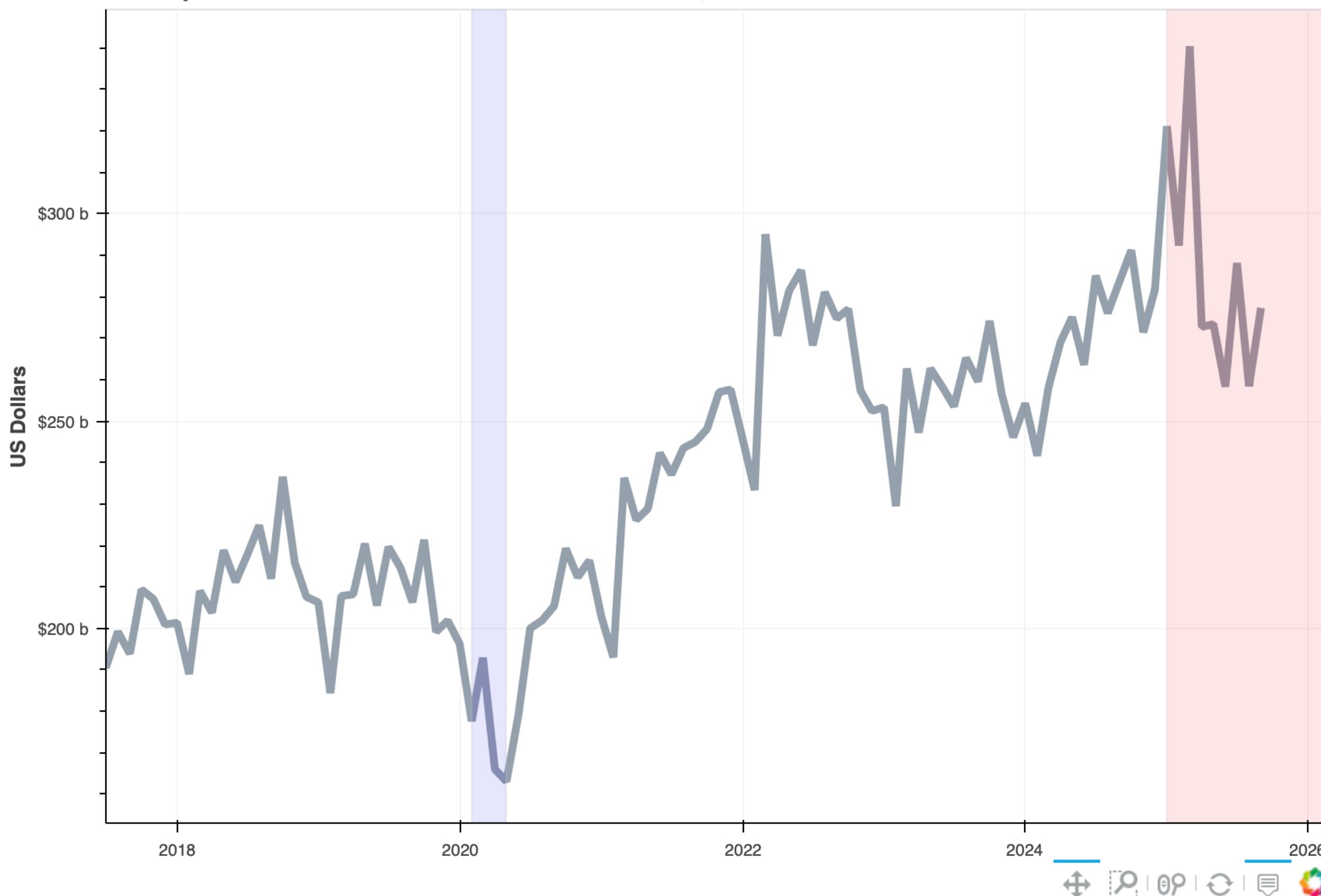
Import tariffs

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

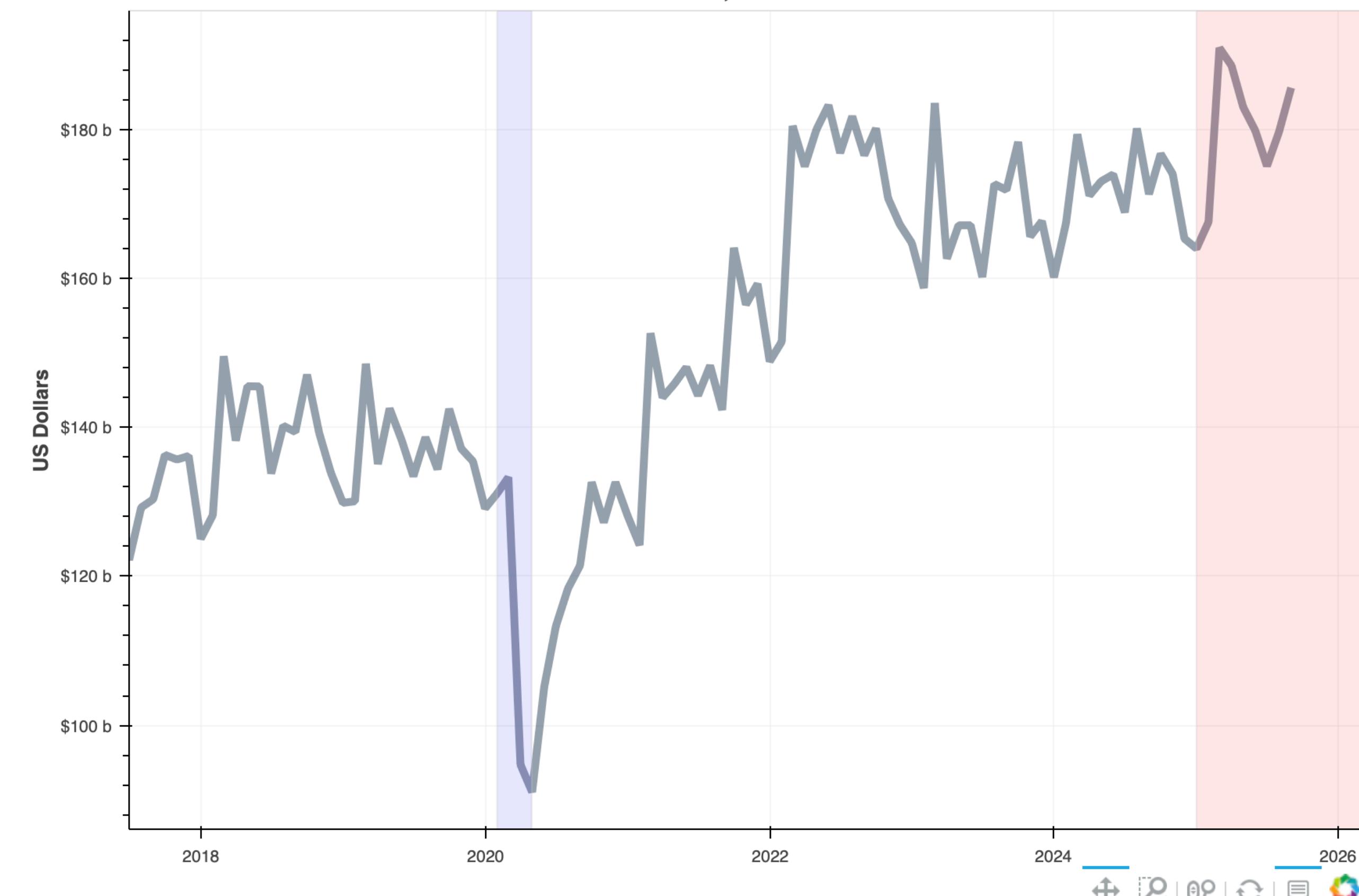


US trade during tariff escalation

US Imports from TOTAL FOR ALL COUNTRIES, of ALL PRODUCTS



US EXPORTS to TOTAL FOR ALL COUNTRIES, of ALL PRODUCTS



SUMMARY

1 of 4

- Net exports—the difference between exports and imports
 - Equivalently, the difference between 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, $S - I$

SUMMARY

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- National income accounting identities
 - $Y = C + I + G + NX$
 - trade balance $NX = \text{net capital outflow } S - I$
- 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 (e.g., trade policy)

SUMMARY

3 of 4

- 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

- 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