Chapter 6: The Open Economy

Prof. Dr. Georg Stadtmann
stadtmann@europa-uni.de

Chapter 6: The Open Economy

1. Introduction
   - Some remarks
2. 6.1 The international flows of capital and goods
   - Role of net exports (NX)
   - International capital flows and the trade balance
   - Irrelevance of bilateral trade balances
3. 6.2 Saving and investment in a small open economy
   - Introduction
   - Capital mobility and the world interest rate
   - The model
   - How policies influence the trade balance
   - Empirical evidence
4. 6.3 Exchange Rates
   - Nominal exchange rates
   - Real exchange rates
   - Determinants of the real exchange rate
   - Determinants of the nominal exchange rate
   - The special case of purchasing power parity

Introduction

Open economies

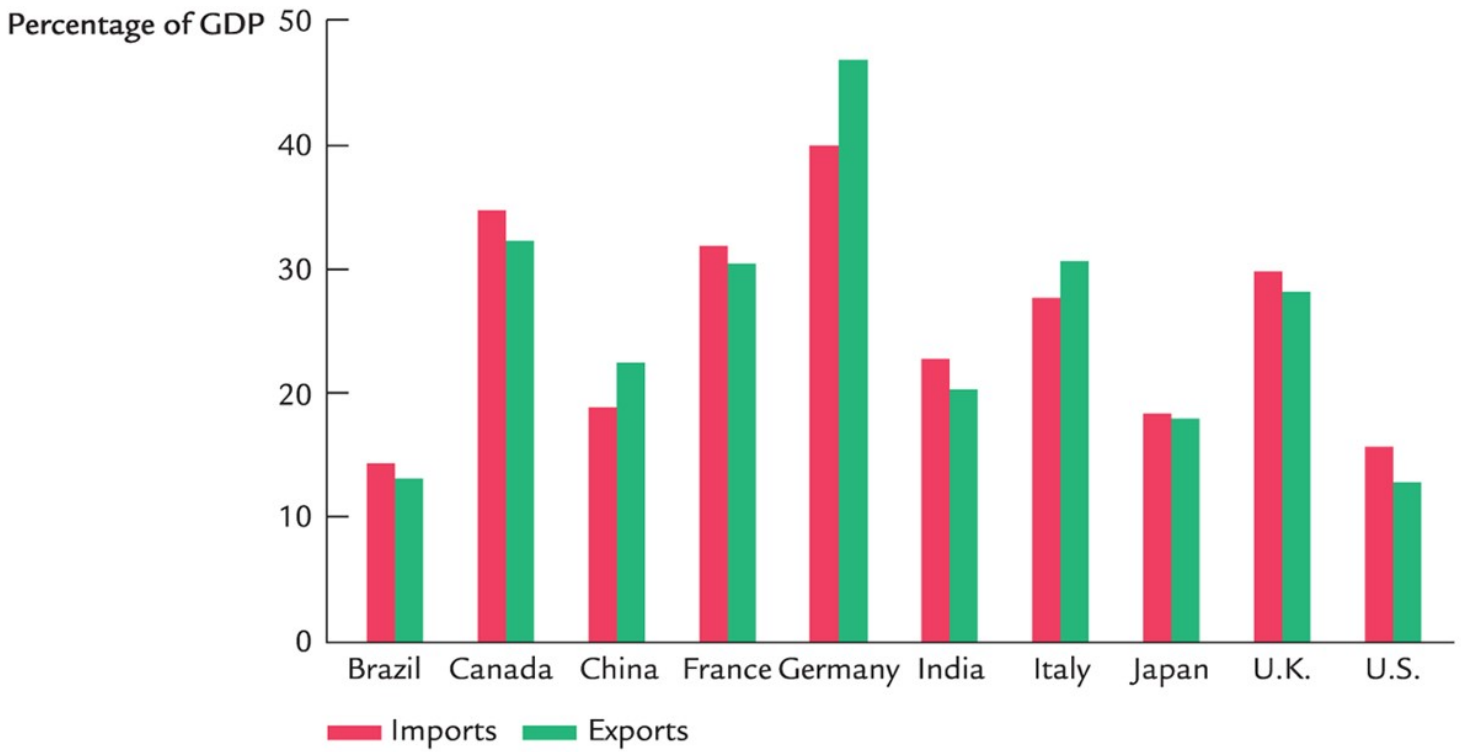
- export and import goods and services and
- borrow and lend in the world financial markets.

Accounting identity reveals:

- Flow of goods and services across borders is always matched by
- an equivalent flow of capital.

- What determines the foreign exchange rate and
- how does a protectionist trade policy affect the exchange rate?

Import and exports as a percentage of output



Mankiw, *Macroeconomics*, 10e, © 2019 Worth Publishers

Output in the open economy

- In a closed economy: Output = expenditure
- $Y = C + I + G$
- In an open economy: Some of the output is sold domestically and some is exported.
- Therefore, we have to add exports (X) on the right hand side of the equation:
- $Y = C + I + G + X$
- Some of the goods which are consumed, invested or used as government spending, are not produced at home but imported from abroad.
- Therefore, we have to subtract the value of imports: $C + I + G - IM$.

$$Y = C + I + G + X - IM \tag{1}$$

Net exports

$$Y = C + I + G + X - IM$$

- The difference between exports and imports is defined as *net exports*: $X - IM = NX$

$$Y = C + I + G + NX \tag{2}$$

- Relationship between net exports, output and domestic spending:

$$NX = Y - (C + I + G) \tag{3}$$

$$\text{Net exports} = \textit{Output} - \text{Domestic spending} \tag{4}$$

Savings, investment and net exports

$$Y = C + I + G + NX \quad \Big| - C - G - I$$

$$Y - C - G - I = NX \quad \Big| - T + T \text{ on the left hand side} \tag{5}$$

$$Y - T - C + T - G - I = NX \quad \Rightarrow \quad (Y - T - C) + (T - G) - I = NX \tag{6}$$

- The first term in brackets is private savings: $S_{priv} = (Y - T - C)$.
- The second term in brackets is public savings: $S_{publ} = (T - G)$.
- Since national savings is defined as: $S = S_{priv} + S_{publ}$:

$$S - I = NX \tag{7}$$

Savings, investment and net exports

$$S - I = NX$$

- Net exports = Difference between savings and investment.
- Net exports = Trade balance
- $S - I$: Net capital outflow

$$S - I = NX$$

Net capital outflow = Trade balance

$S - I = NX$

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

Bilateral trade balances do not matter: Example

- US exports machine tools to Australia for 100 $.
- US imports toys from China for 100 $.
- China imports wheat from Australia for 100 $.
- All countries have a bilateral trade deficit.
- But the overall trade balance of each country is balanced.

Bilateral trade balances do not matter: Example

Robert Solow

- I have a chronic deficit with my barber.
- He does not buy a single thing from me.

- But that does not stop Mr. Solow from getting a hair cut when he needs it.
- Solow is still *living within his means*!

Chapter 6: The Open Economy

Savings, investment and net exports

$$(Y - T - C) + (T - G) - I = NX \tag{8}$$

- What happens if...
- ... government increases government expenditures ($G \uparrow$)?

$$(Y - T - C) + (T - G \uparrow) - I = NX \tag{9}$$

- Income could increase?
- Interest rate could increase which decreases investment?
- Net exports decrease?

$$(Y \uparrow - T - C) + (T - G \uparrow) - I \downarrow = NX \downarrow \tag{10}$$

- The rearranged accounting identity does not help to answer the question!
- We need a macroeconomic model!

A small open economy does not affect the world interest rate

- Small open economy and
- perfect capital mobility.

- A small open economy does not effect the world interest rate.
- But: The world interest rate determines the domestic interest rate.

$$r = r^* \tag{11}$$

The world interest rate is exogenous.

Three assumptions

1. The economy's output is fixed by
   - Its factors of production and
   - its production function.

$$Y = \bar{Y} = F(\bar{K}, \bar{L}) \tag{12}$$

Three assumptions

2. Private consumption depends on disposable income.

$$C = C(Y - T) \tag{13}$$

3. Investment depends in a negative way on the interest rate.

$$I = I(r) \tag{14}$$

Combination of identity & assumptions ⇒ Model

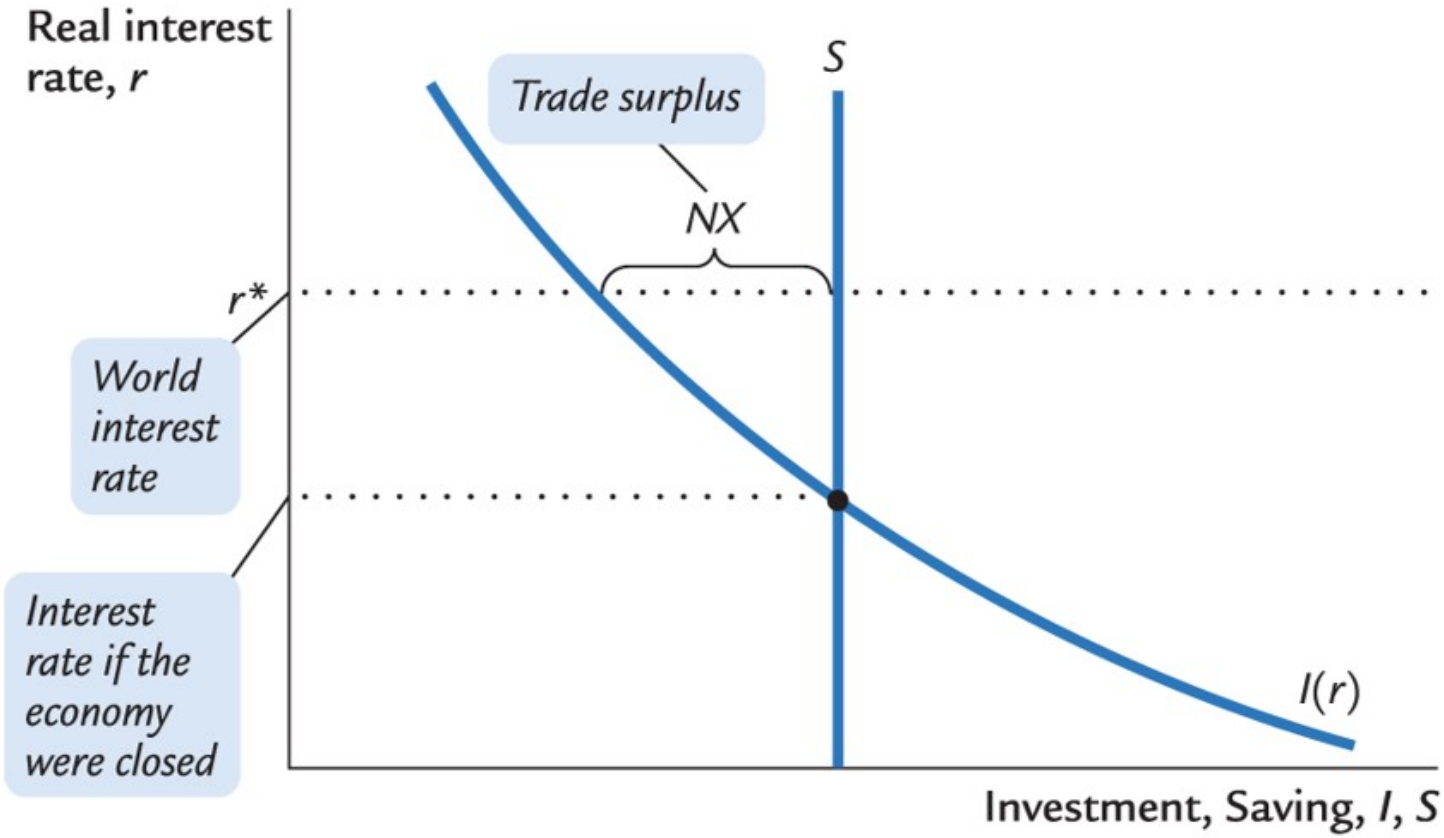
$$NX = Y - C - G - I \tag{15}$$

$$NX = \bar{Y} - C(\bar{Y} - T) - G - I(r) \tag{16}$$

$$NX = \bar{S} - I(r) \tag{17}$$

- National saving does not depend on the real interest rate.
- Investment depends in a negative way on the real interest rate.

Saving and investment in a small open economy



Mankiw, *Macroeconomics*, 10e, © 2019 Worth Publishers

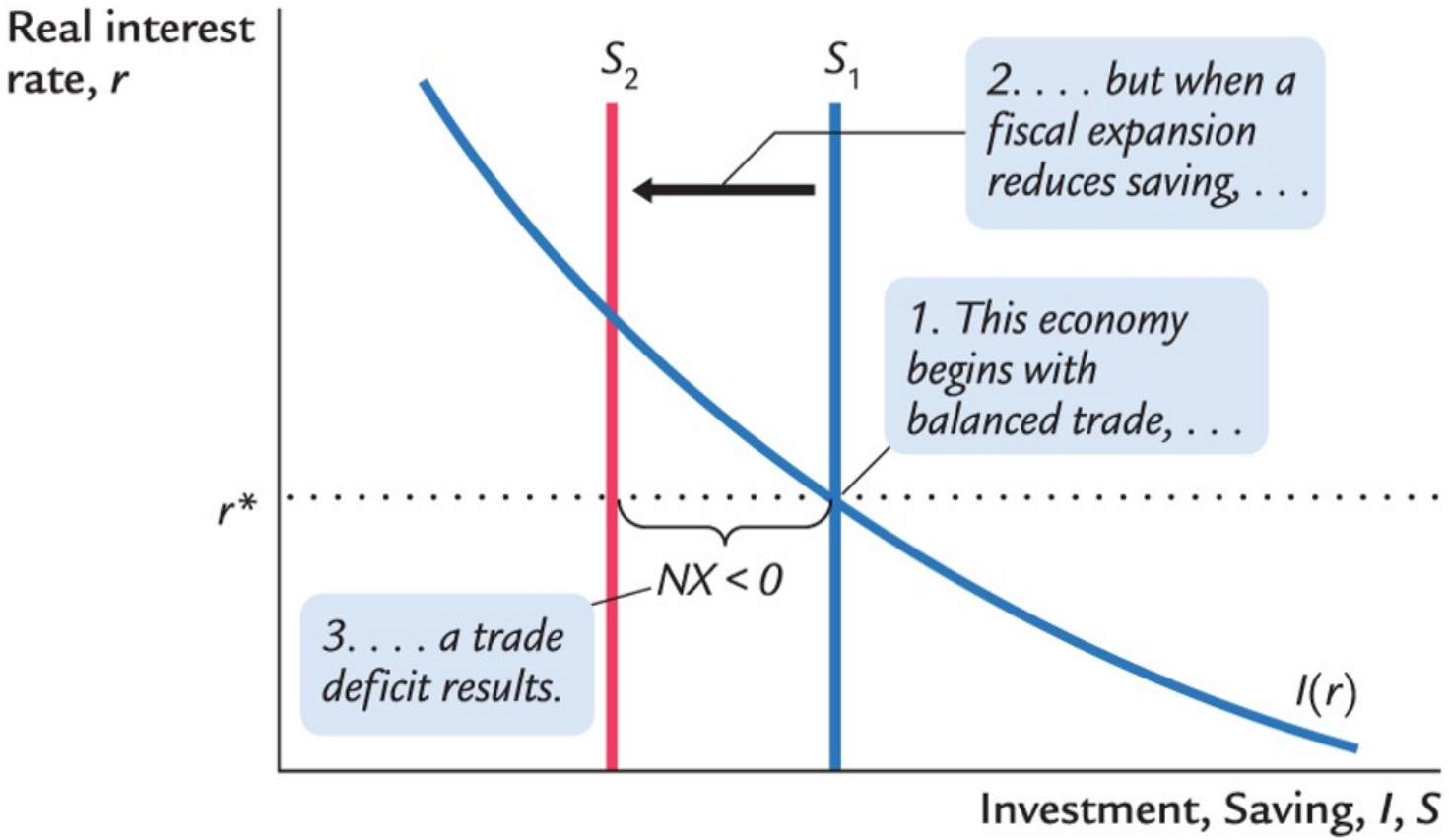
What happens if...

1. The domestic government increases government spending (or decreases taxes!).
2. The world interest rate increases (maybe due to the fact that the foreign government increases government spending).
3. Autonomous component of investment increases (=Shift in investment)

Form of analysis: Step by step!

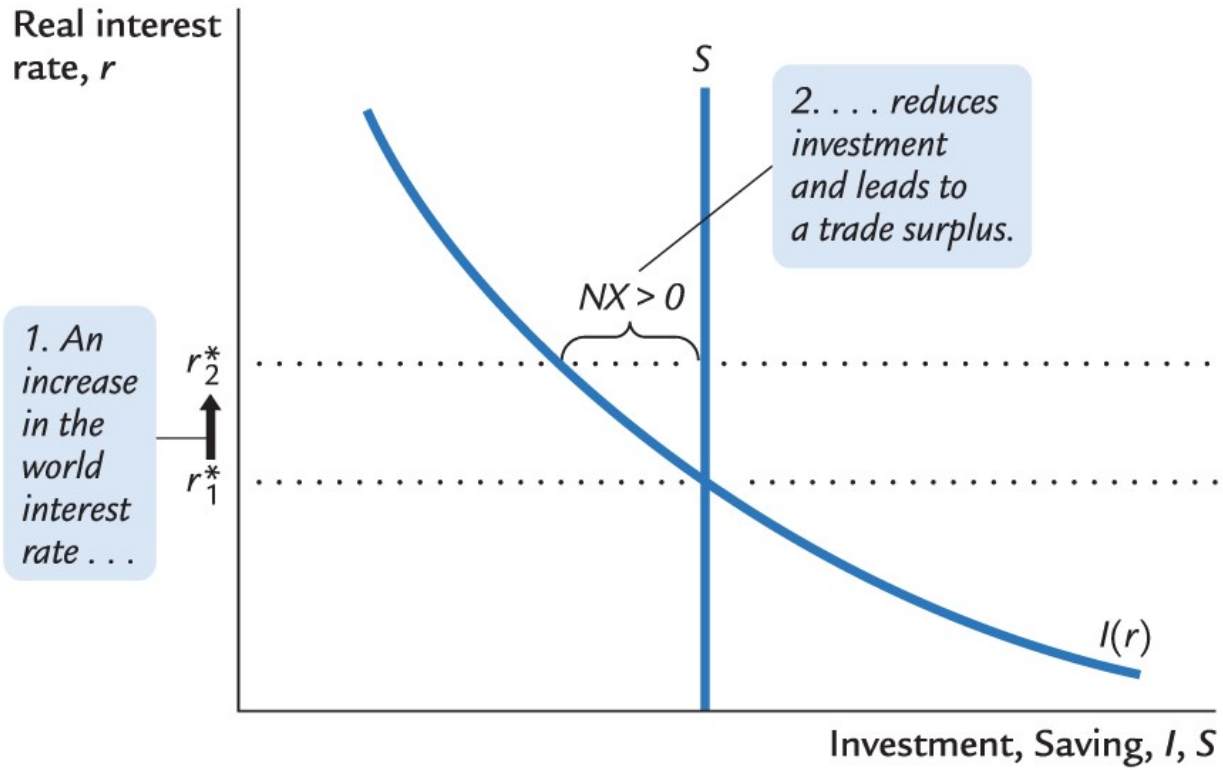
1. How *would* the shock be digested in a *closed* economy setting?
2. How *is* the shock digested in a small *open* economy setting?

A fiscal expansion (at home) in a small open economy



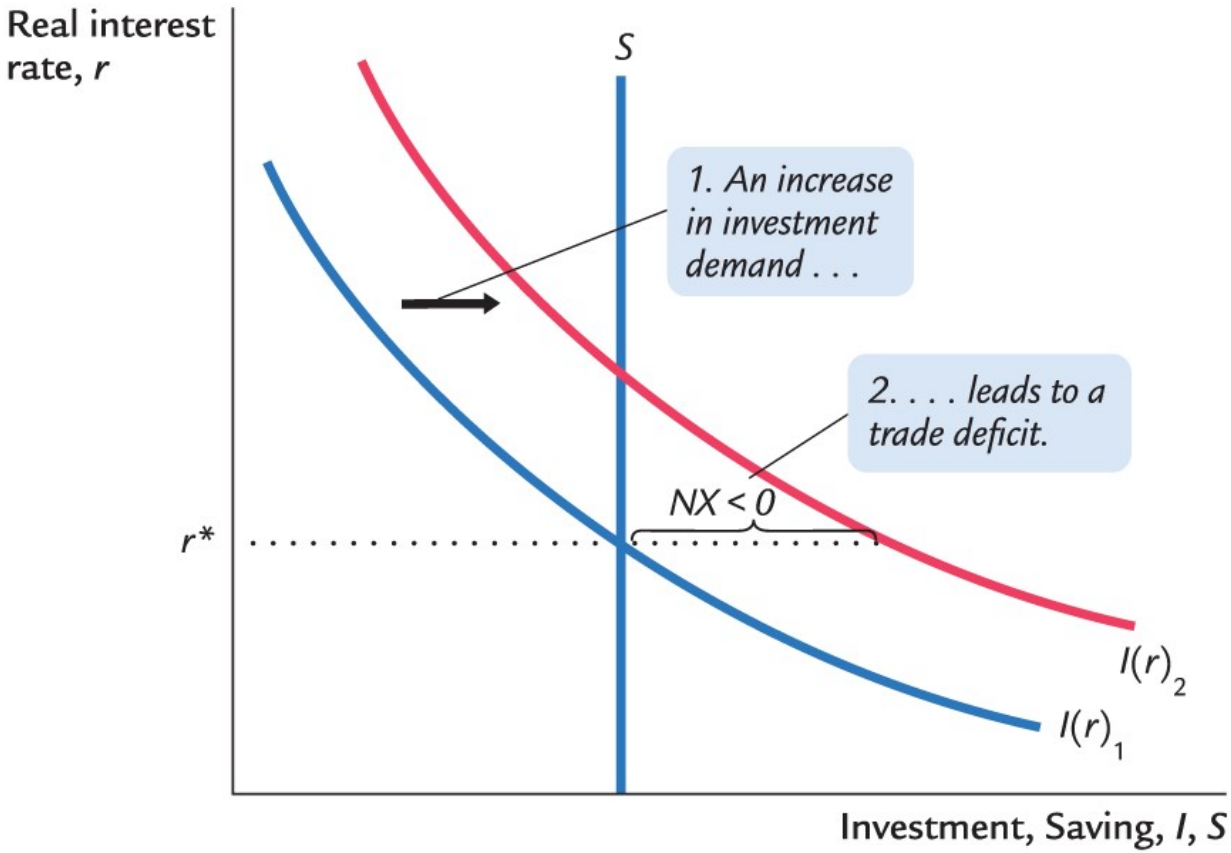
Mankiw, *Macroeconomics*, 10e, © 2019 Worth Publishers

Increase of the world interest rate



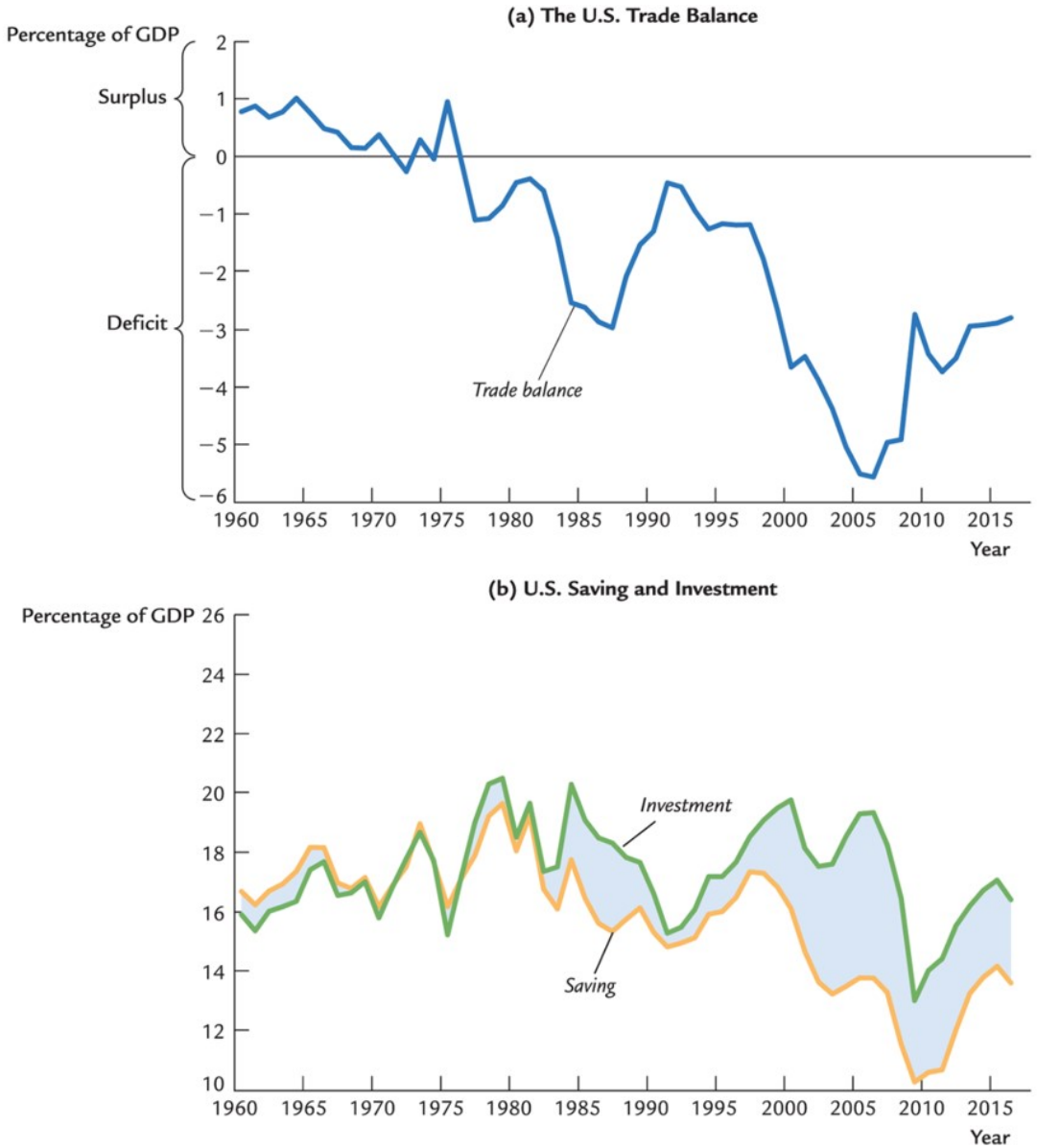
Mankiw, *Macroeconomics*, 10e, © 2019 Worth Publishers

Increase in investment



Mankiw, *Macroeconomics*, 10e, © 2019 Worth Publishers

Trade balance, saving, and investment (USA)



Chapter 6: The Open Economy

1. Introduction
   - Some remarks
2. 6.1 The international flows of capital and goods
   - Role of net exports (NX)
   - International capital flows and the trade balance
   - Irrelevance of bilateral trade balances
3. 6.2 Saving and investment in a small open economy
   - Introduction
   - Capital mobility and the world interest rate
   - The model
   - How policies influence the trade balance
   - Empirical evidence
4. 6.3 Exchange Rates
   - Nominal exchange rates
   - Real exchange rates
   - Determinants of the real exchange rate
   - Determinants of the nominal exchange rate
   - The special case of purchasing power parity

Nominal exchange rate

- Nominal exchange rate is the relative price of the currencies of two countries.
- Two ways of quoting an exchange rate:
  1. Price notation: How much is the Yen?
     - 0.01 USD /1 Yen: The price of one unit of the foreign currency (from an American perspective)
  2. Quantity notation: How much foreign currency do I get for one unit of the domestic currency?
     - 100 Yen / 1 USD: The quantity of foreign currency which can be bought by 1 unit of domestic currency (from an American perspective)
- This textbook: Quantity notation!
- This book always expresses the exchange rate in units of foreign currency per dollar!

Changes in the nominal exchange rate: Appreciation and depreciation

- From 100 to 110 Yen / 1 USD: Appreciation of the dollar
- From 100 to 90 Yen / 1 USD: Depreciation of the dollar
- $e \uparrow$: Appreciation of domestic currency and depreciation of foreign currency
- $e \downarrow$: Depreciation of domestic currency and appreciation of foreign currency
- The exchange rate can increase or decrease. BUT the exchange rate does not depreciate or appreciate.
- It is always a currency which depreciates or appreciates.

ALWAYS BE CAREFUL WITH EXCHANGE RATES!!!!

- This exchange rate quotation goes against the Danish *'intuition'*.
- Danish students are used to the price notation of foreign currency:
- What is the price of 1 EUR? $\Rightarrow$ 7.44 DKK/EUR.
- When THIS exchange rate increases to 8 DKK/EUR: Depreciation of DKK!
- WE (HAVE TO) STICK TO THE TEXTBOOK!

Real exchange rate

- Real exchange rate is the relative price *of the goods* of two countries.
  - $P = 30$ USD for an American car.
  - $P^* = 6000$ YEN for a Japanese car.
  - $e = 100$ YEN/USD
- Price of the American car measured in YEN:

$$e \cdot P = 100 \text{ YEN/USD} \cdot 30 \text{ USD/American car} \tag{18}$$

$$e \cdot P = 3000 \text{ YEN/American car}$$

- Real exchange rate is the relative price *of the goods* of two countries:

$$\epsilon = \frac{e \cdot P}{P^*} = \frac{3000 \text{ YEN/American car}}{6000 \text{YEN/Japanese car}} = 0.5 \frac{\text{Japanese car}}{\text{American car}} \tag{19}$$

Interpretation: Real exchange rate

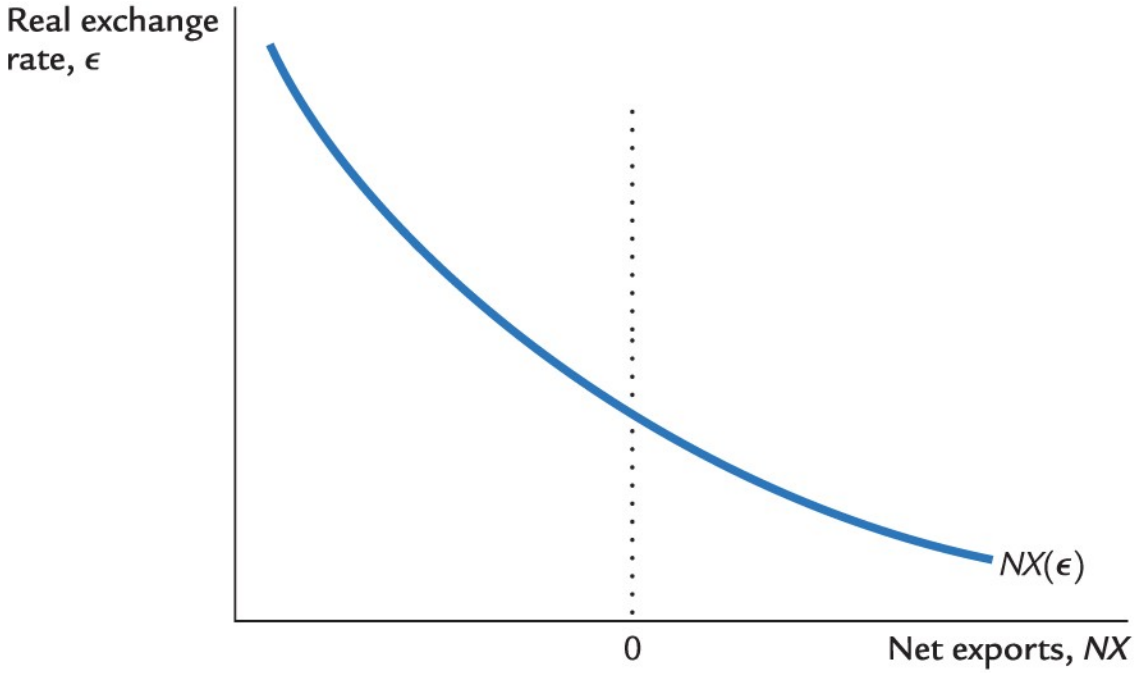
$$\epsilon = \frac{e \cdot P}{P^*} = 0.5 \frac{\text{Japanese car}}{\text{American car}}$$

- For one American car, you get 0.5 Japanese cars.
- When the real exchange rate is below 1: *"Japanese goods are relatively expensive."*
- The real exchange rate (or in some textbooks $(1/\epsilon)$ is called the *terms of trade*.
- If the real exchange rate is high, foreign goods are relatively cheap and domestic goods are relatively expensive.
- If the real exchange rate is low, foreign goods are relatively expensive and domestic goods are relatively cheap.

- When the real exchange rate decreases, domestic goods become cheaper $\Rightarrow$ Net exports increase!

Interpretation: Real exchange rate

- When the real exchange rate decreases, domestic goods become cheaper $\Rightarrow$ Net exports increase!



Mankiw, *Macroeconomics*, 10e, © 2019 Worth Publishers

Interpretation: Real exchange rate

- When the real exchange rate decreases, domestic goods become cheaper $\Rightarrow$ Net exports increase!

$$NX \uparrow = NX(\epsilon \downarrow) \tag{20}$$

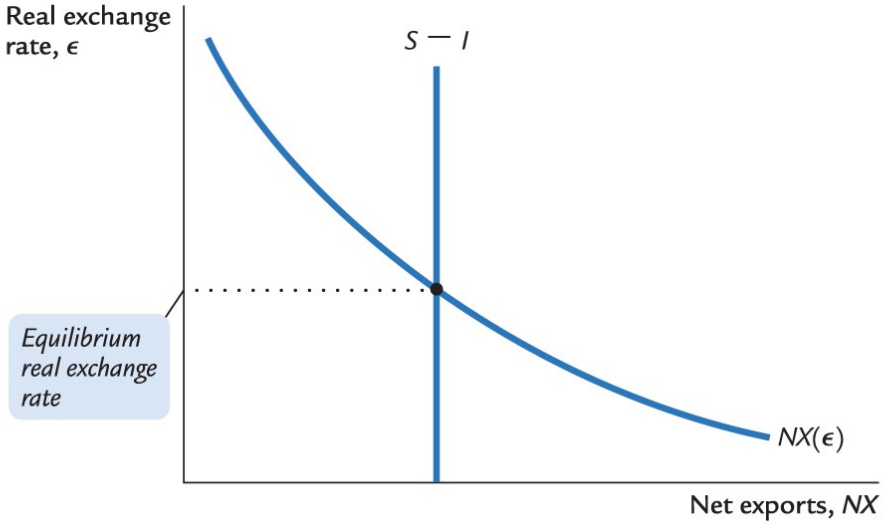
- Mankiw, p. 167, Assignment 2:

$$NX = 1500 - 250 \cdot \epsilon \tag{21}$$

Determinants of the real exchange rate

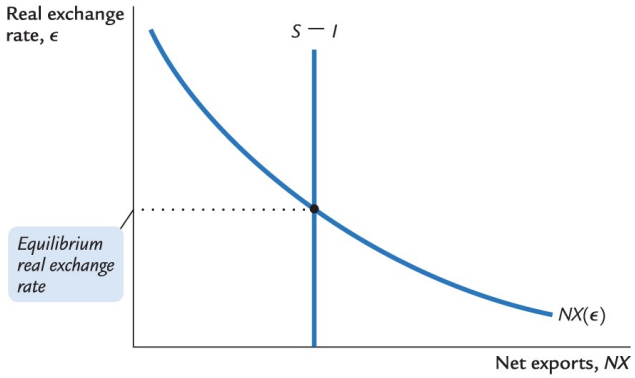
$$NX \uparrow = NX(\epsilon \downarrow)$$
$$NX = \bar{S} - I(r^*)$$

- Saving is fixed by the GDP level, the consumption function, and fiscal policy (G, T).
- Investment is determined by the world interest rate.
- $S - I$ does not depend on the real exchange rate!



Mankiw, *Macroeconomics*, 10e, © 2019 Worth Publishers

Endogenous?



Mankiw, *Macroeconomics*, 10e, © 2019 Worth Publishers

$$NX = NX(\epsilon)$$

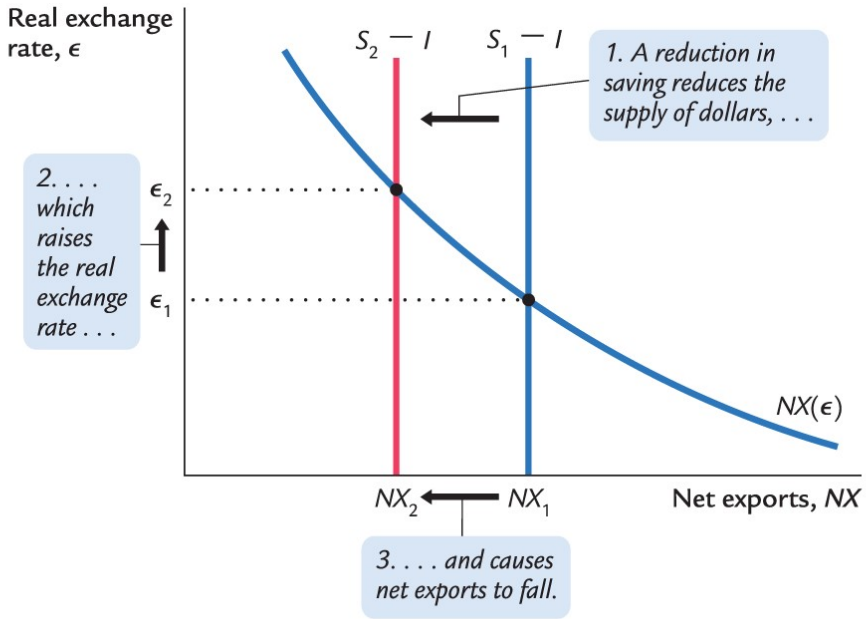
$$NX = \bar{S} - I(r^*)$$

- We have two equations – we can solve for 2 unknown (=endogenous) variables!
- What is endogenous?
  - Net exports!
  - The real exchange rate!

Expansionary fiscal policy

$$NX = NX(\epsilon)$$

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

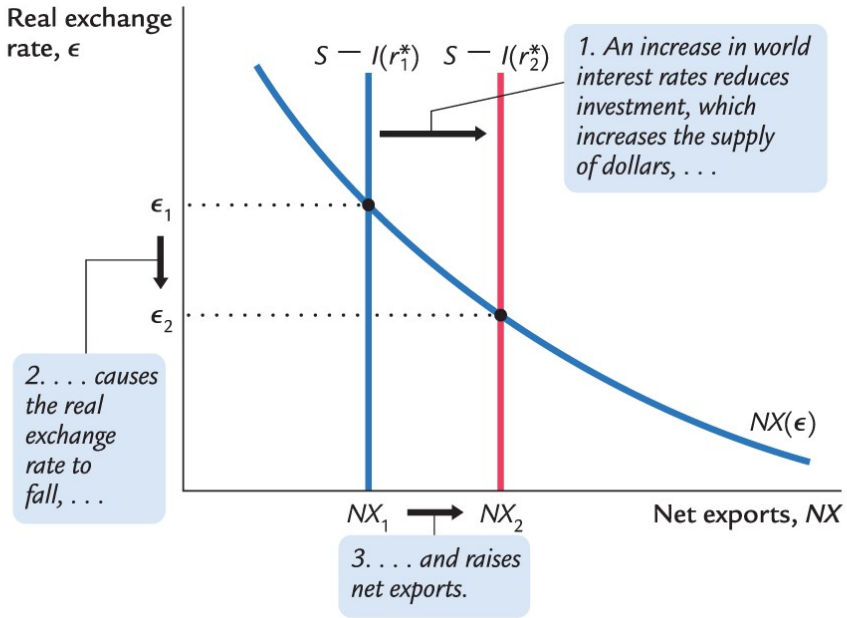


Mankiw, *Macroeconomics*, 10e, © 2019 Worth Publishers

Increase of the world interest rate (=expansionary fiscal policy abroad)

$$NX = NX(\epsilon)$$

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

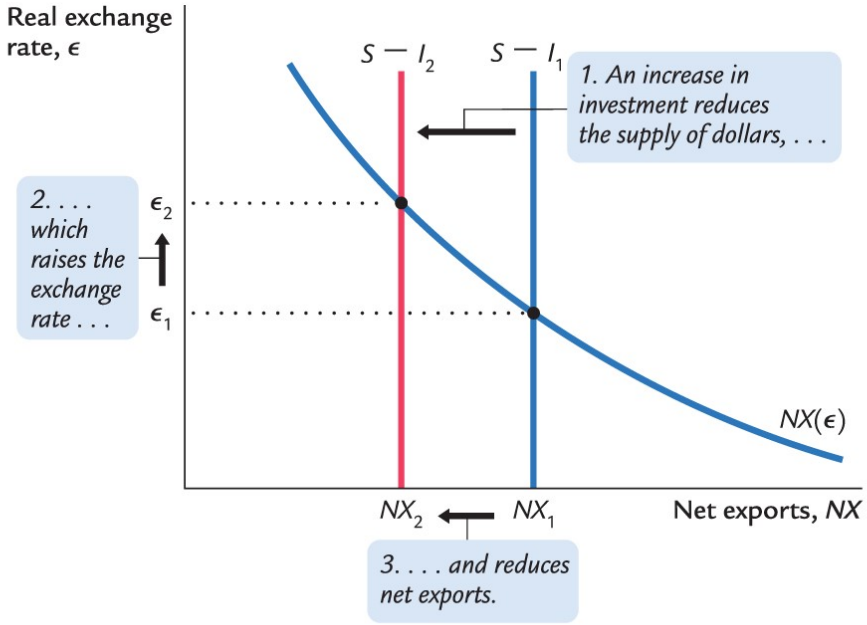


Mankiw, *Macroeconomics*, 10e, © 2019 Worth Publishers

Increase of investment

$$NX = NX(\epsilon)$$

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

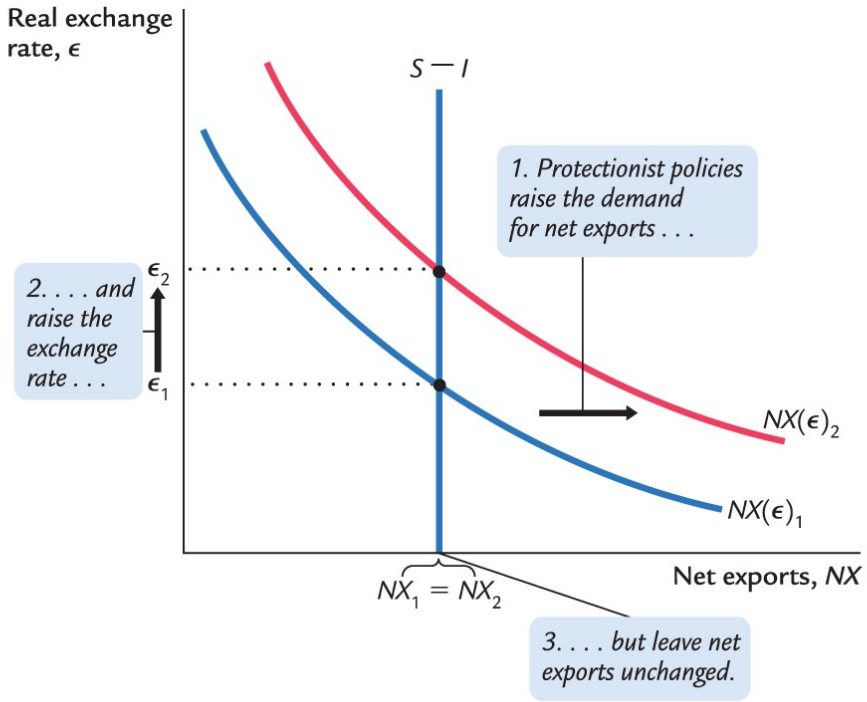


Mankiw, *Macroeconomics*, 10e, © 2019 Worth Publishers

Protectionist trade policy

$$NX = NX(\epsilon) \quad \Rightarrow \quad NX = 1500 \uparrow -250 \cdot \epsilon$$

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



Mankiw, *Macroeconomics*, 10e, © 2019 Worth Publishers

Change in the nominal exchange rate is driven by inflation differential

$$\epsilon = e \cdot \frac{P}{P^*} \tag{22}$$

$$e = \epsilon \cdot \frac{P^*}{P} \tag{23}$$

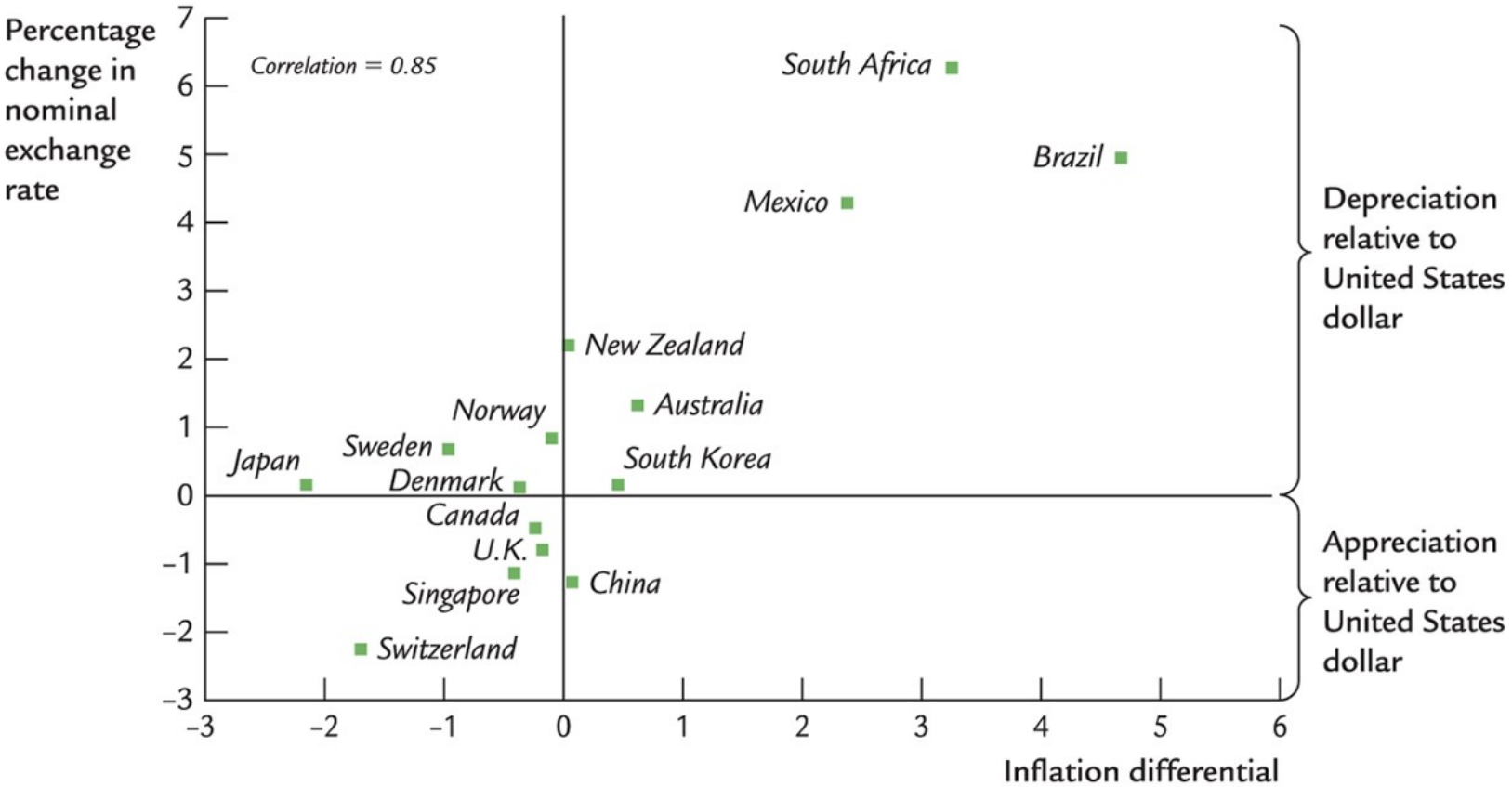
Change in e in % = Change in ϵ in % + Change in P^* in % − Change in P in %

Change in e in % = Change in ϵ in % + $(\pi^* - \pi)$

Change in the nominal exchange rate is driven by inflation differential

Change in e in % = Change in ϵ in % + $(\pi^* - \pi)$ %

- If a country has a higher rate of inflation relative to the USA $(\pi^* > \pi)$,
- a dollar will buy an increasing amount of foreign currency over time $(e \uparrow)$.



Mankiw, *Macroeconomics*, 10e, © 2019 Worth Publishers

Law of one price

- Law of one price: The same good cannot sell for different prices in different locations at the same time.
  - $P = 30$ USD for an American car.
  - $P^* = 6000$ YEN for a Japanese car.
  - $e = 100$ YEN/USD
- Price of the American car measured in YEN:
- $e \cdot P = 100$ YEN/USD $\cdot$ 30 USD/American car
- $e \cdot P = 3000$ YEN/American car
- Arbitrageurs: Buy low (in the US) – Sell high (in Japan)!

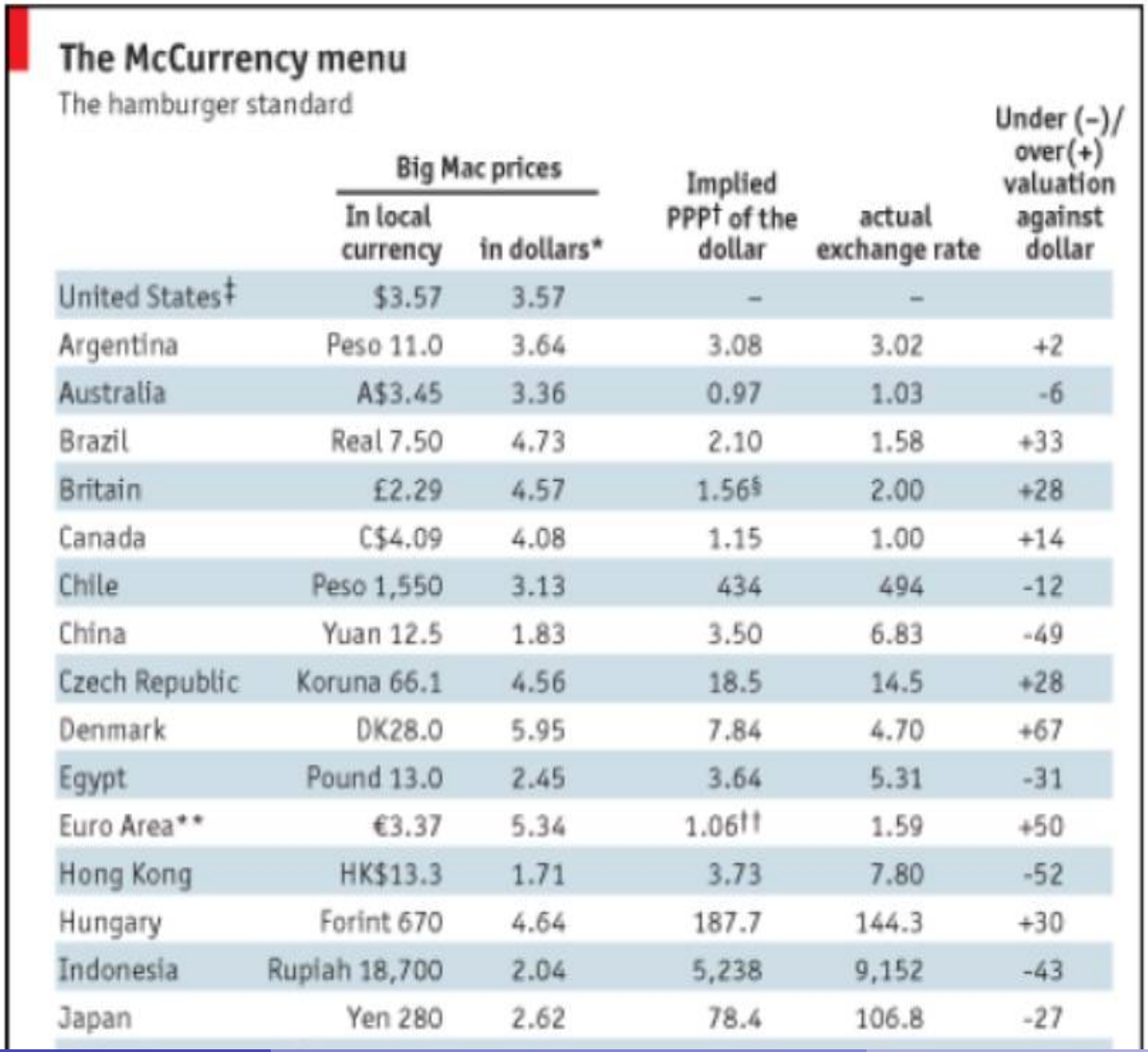
$$e \uparrow \cdot P \uparrow = P^* \downarrow \tag{24}$$

Law of one price versus absolute PPP

- Law of one price: We focus on the price of one single good.
- Absolute PPP: We focus on the price of a basket of goods.
- When APPP holds:

$$\epsilon = \frac{e \cdot P}{P^*} = 1 \tag{25}$$

Big Mac Index



The McCurrency menu

The hamburger standard

	Big Mac prices		Implied PPP† of the dollar	actual exchange rate	Under (–)/ over(+) valuation against dollar
	In local currency	in dollars*			
United States‡	$3.57	3.57	–	–	
Argentina	Peso 11.0	3.64	3.08	3.02	+2
Australia	A$3.45	3.36	0.97	1.03	-6
Brazil	Real 7.50	4.73	2.10	1.58	+33
Britain	£2.29	4.57	1.56§	2.00	+28
Canada	C$4.09	4.08	1.15	1.00	+14
Chile	Peso 1,550	3.13	434	494	-12
China	Yuan 12.5	1.83	3.50	6.83	-49
Czech Republic	Koruna 66.1	4.56	18.5	14.5	+28
Denmark	DK28.0	5.95	7.84	4.70	+67
Egypt	Pound 13.0	2.45	3.64	5.31	-31
Euro Area**	€3.37	5.34	1.06††	1.59	+50
Hong Kong	HK$13.3	1.71	3.73	7.80	-52
Hungary	Forint 670	4.64	187.7	144.3	+30
Indonesia	Rupiah 18,700	2.04	5,238	9,152	-43
Japan	Yen 280	2.62	78.4	106.8	-27

Big Mac Index

- A popular way of studying PPP is to use the Big Mac Index developed by the journal *The Economist*

Why using the Big Mac for studying PPP?

- The Big Mac is more or less homogeneous around the world (no differences in quality)
- Preferences are the same
- Unfortunately, the Big Mac is NOT an internationally traded good
- However, the Big Mac price can be interpreted as a Producer Price Index (PPI) because various domestically produced ingredients are used to produce a Big Mac

Equilibrium exchange rate: Danish example: DKK/USD

- A BigMac sells in Denmark at $P_{DKK} = 28 DKK$
- A BigMac sells in the US at $P_{USD} = 3.57 USD$
- Implied PPP of the dollar = equilibrium exchange rate.

$$equ = \frac{P_{DKK}}{P_{USD}} = \frac{28 DKK}{3.57 USD} = 7.84 DKK/USD \tag{26}$$

Degree of over-/undervaluation

- IMPORTANT (IMPLICIT) ASSUMPTION: Goods prices do not adjust!
- However on July 24th, 2008 the actual exchange rate was at a level of 4.70 DKK/USD
- If one compares the actual exchange rate with the equilibrium exchange rate the Danish Krona is overvalued.
- What is the degree of overvaluation?

$$\frac{equ - act}{act} = \frac{7.84 - 4.70}{4.70} = +0.668 \Rightarrow 67\%$$