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Ch. 2 Exchange rates and the fx-market

Suggested reading:
Robert C Feenstra; Alan M. Taylor: International Economics, third Edition, Macmillan, 2015, Ch. 13: “Introduction to exchange rates and the foreign exchange market”
(An electronic copy of this chapter can be found in Moodle.)

Weithers, Tim (2006): Foreign Exchange: A Practical Guide to the FX Markets, Wiley Finance Editions.
Ch. 1 “Trading Money”
A good introduction to exchange rates and the fx market.
Ch. 2 “Markets, Prices and Marketmaking”
Relevant for us: sections “What is a market” and “What is a price”
The rest is interesting but not essential for this lecture.
(Online access via the TH library.)

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2.1 Introduction to exchange rates

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- The foreign exchange (fx) market is the market where various currencies (Euro, Dollar, Yen, Canadian Dollar, Pounds etc.) are traded against each other.
- Based on the value of trade, the fx market is one of the biggest markets in the world.
- The exchange rate, the price of one currency in terms of another, is one of the most important prices in an economy.

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The exchange rate

The exchange rate is a relative price of two monies, for example the relative price of the Euro and the US dollar. There are two ways to quote this price:

Option 1: **"American quotation" or "Price quotation"**
This says that you have to pay 0.7 EUR in order to buy one US dollar. In a way, the US dollar is priced like any other good in the Eurozone.

$$0.7 \left[\frac{EUR}{USD}\right]$$

Option 2: "European quotation" or "Quantity quotation"
This tells you that you get 1.43 US dollars for one Euro. So, here the Euro which is treated like a commodity.

$$1.43 \left[\frac{USD}{EUR}\right]$$

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The exchange rate

"American quotation" or "Price quotation"

$$0.7 \left[\frac{EUR}{USD}\right]$$

A rise (say to 0.8) implies that the EUR has depreciated.
A decline (say to 0.6) implies that the EUR has appreciated.

"European quotation" or "Quantity quotation"

$$1.43 \left[\frac{USD}{EUR}\right]$$

A rise (say to 1.50) implies that the EUR has appreciated.
A decline (say to 1.30) implies that the EUR has depreciated.

There is no standard. The price notation is used in many text books.
Before the introduction of the Euro, it was also used by the Bundesbank.
Today, the Eurosystem (incl. the Bundesbank) uses the quantity quotation.

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The exchange rate

Appreciation of the EUR

I get more USD for one EUR.
I have to pay less EUR for one USD.
IF the prices of goods in the US and the euro zone do not change, an appreciation implies that US goods are becoming cheaper for people from the euro zone.

Depreciation of the EUR

I get less USD for one EUR.
I have to pay more EUR for one USD.
IF the prices of goods in the US and the euro zone do not change, a depreciation implies that US goods are becoming more expensive for people from the euro zone.

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The exchange rate

Relationship between price and quantity notation

The following exchange rate is given in price notation.

$$0.7 \left[\frac{EUR}{USD}\right]$$

Simply find the inverse value

$$\frac{1}{0.7}\left[\frac{1}{\frac{EUR}{USD}}\right] \Longleftrightarrow 1.42857 \left[\frac{USD}{EUR}\right]$$

Do not forget to invert the dimension as well.
(EUR/USD becomes USD/EUR).

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Box 1:

Dimension

In order to understand a variable, we need to know its „dimension“. The dimension tells us in what units a variable is expressed.
For instance, the exchange rate below has the dimension „EUR per USD“.
Dimensions are usually written in square brackets.

$$0.7\left[\frac{EUR}{USD}\right]$$

The dimension

When we perform mathematical operations with variables, we have to do the same with the corresponding dimensions. For instance

$$0.7\left[\frac{EUR}{USD}\right]\cdot 10\left[\frac{USD}{kg}\right]=7\left[\frac{EUR}{USD}\right]\cdot\left[\frac{USD}{kg}\right]=7\left[\frac{EUR}{kg}\right]$$

$$\text{or } 10\left[\frac{USD}{kg}\right]/1.43\left[\frac{USD}{EUR}\right]=(10/1.43)\cdot\left(\left[\frac{USD}{kg}\right]/\left[\frac{USD}{EUR}\right]\right)=7\left[\frac{EUR}{kg}\right]$$

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The exchange rate

- The price quotation makes it easier to convert foreign prices into EUR.
- In different countries, prices are quoted in different currencies.
- If you want to know whether a certain book is cheaper in the US than in Germany, it is not enough to simply compare a price of, say, 15$ in the US with a price of 10€ in Germany.

In order to make a meaningful comparison you need to know the exchange rate. Using the exchange rate quoted above we get

(15$/book) × (0.7 EUR/$) = 10.50 EUR/book

whereas the German price is only 10 EUR.

To check whether you used the right exchange rate take a look at the dimensions of the variables.

$$\left[\frac{\$}{book}\right] \times \left[\frac{EUR}{\$}\right] = \left[\frac{EUR}{book}\right]$$

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Problems to solve.

The current x-rate is 1.1 [USD/EUR]

In the US, a Big Mac costs 4.40 USD.
What does it cost in EUR?

In Germany it costs 4.20 EUR.
What does it cost in USD?

Try to find out how the Japanese Yen has evolved against the EUR since the end of 2014.
Has the Yen become stronger?

(Hint: Check out the website of the Bundesbank:
-> Statistics/ExchangeRates/ Exchange rates, euro foreign exchange reference rates, gold/ Time Series)

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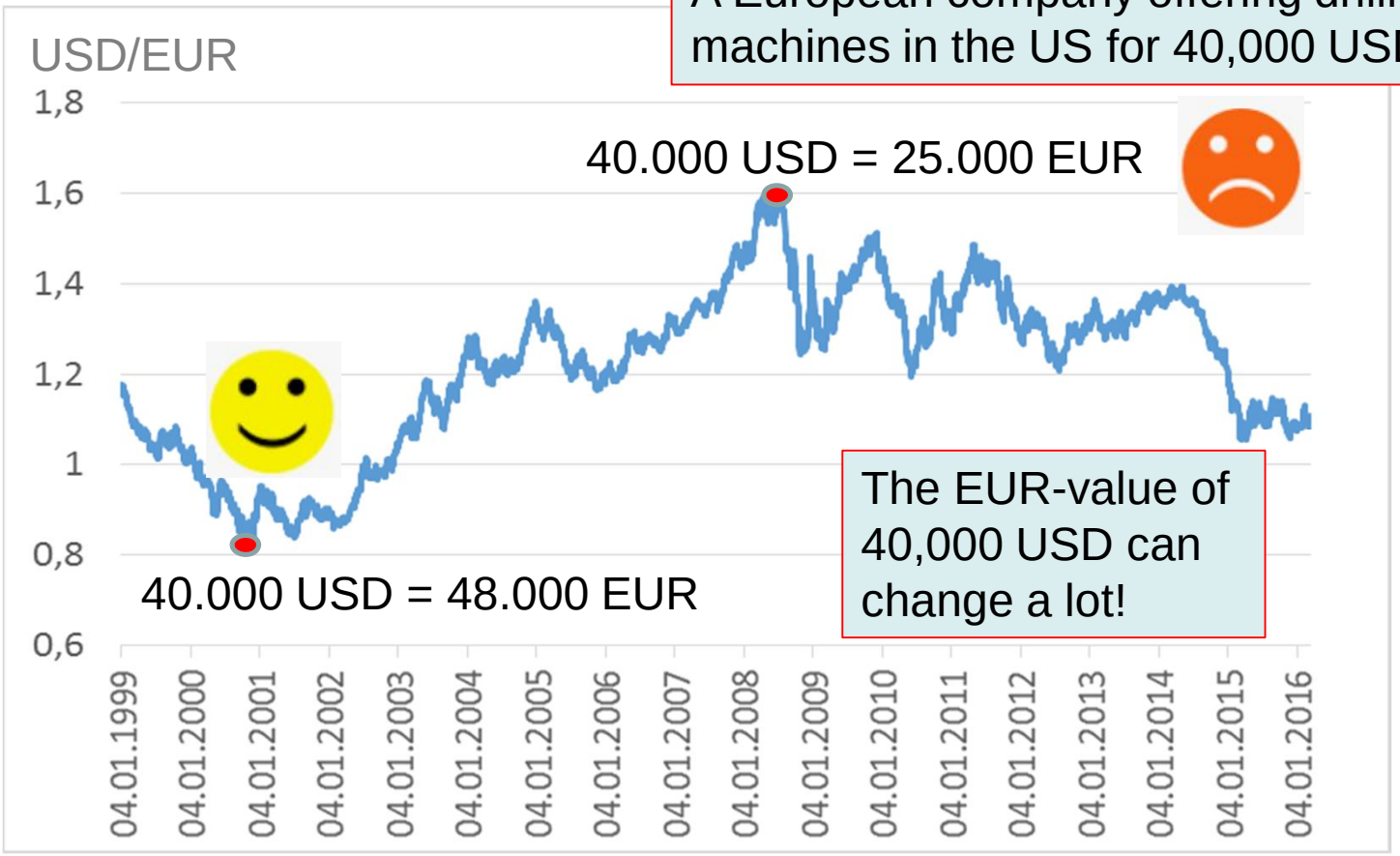
Exchange rates can be volatile

Why x-rates matter: An example:
A European company offering drilling machines in the US for 40,000 USD.



The EUR-value of 40,000 USD can change a lot!

Source: Deutsche Bundesbank

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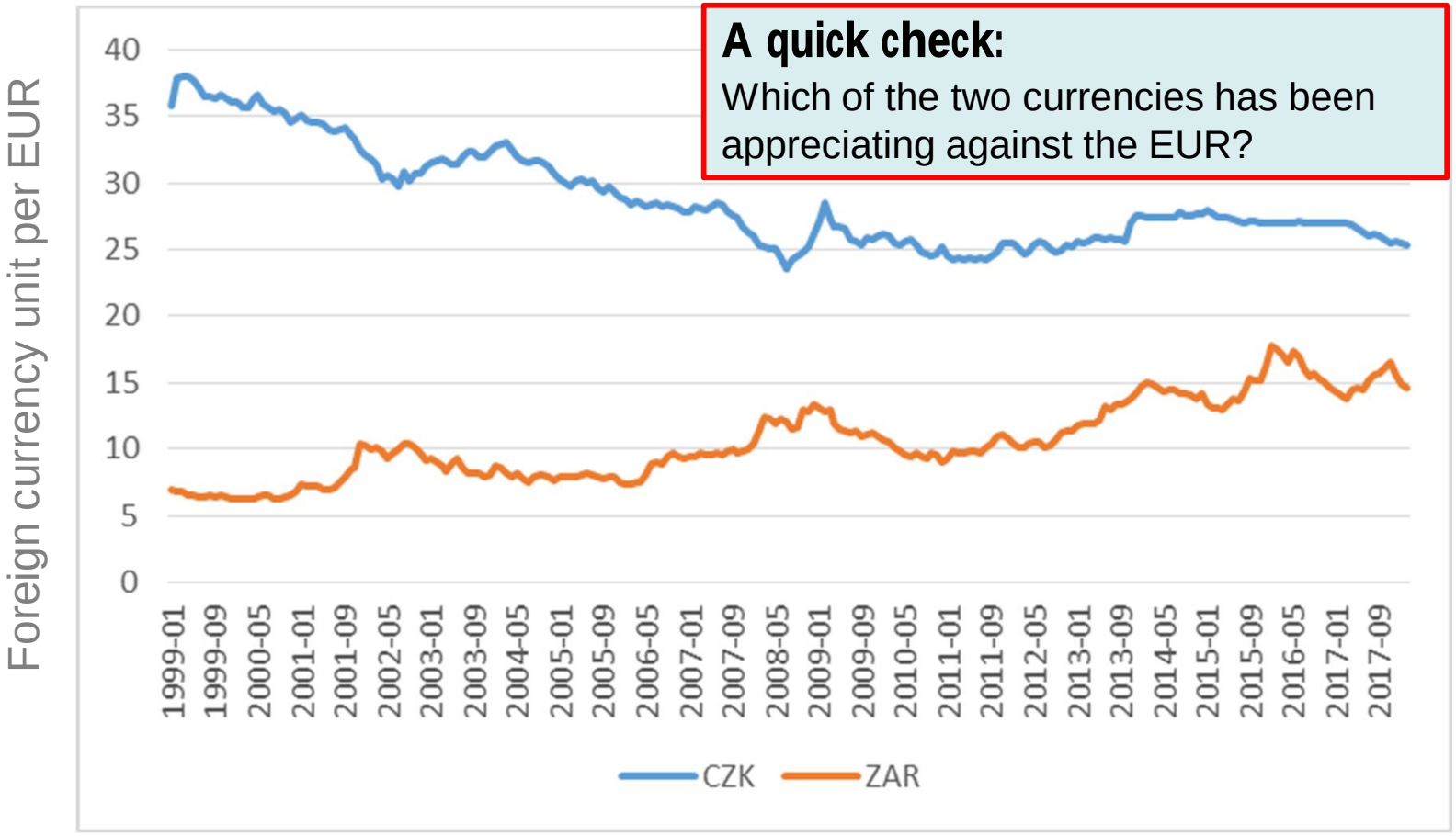
Some exchange rates can go up – while others go down

The Euro x-rate vis-á-vis the Czech Kroon and the South African Rand

A quick check:
Which of the two currencies has been appreciating against the EUR?



Source: Deutsche Bundesbank

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Bilateral versus effective exchange rates

Bilateral exchange rates: EUR/USD, EUR/YEN, YEN/USD

Bilateral exchange rates are providing only a very restricted view of the movement of the external value of a currency.

Some exchange rates may go up, others may go down, and yet others may remain constant. To get an overall picture, so-called „**effective exchange rates**“ are calculated (or: „multilateral exchange rates“).

The effective exchange rate:

$$w_{eff} = a_1\left(\frac{EUR}{USD}\text{-Index}\right) + a_2\left(\frac{EUR}{JPY}\text{-Index}\right) + a_3\left(\frac{EUR}{GBP}\text{-Index}\right) + \ldots$$

As we can see, w_{eff} is an index. **a_1, a_2 etc. are weights** reflecting the relative importance of trade relationships (for instance: a_1 = exports to US in % of all exports; a_2 = exports to Japan in % of all exports; …).

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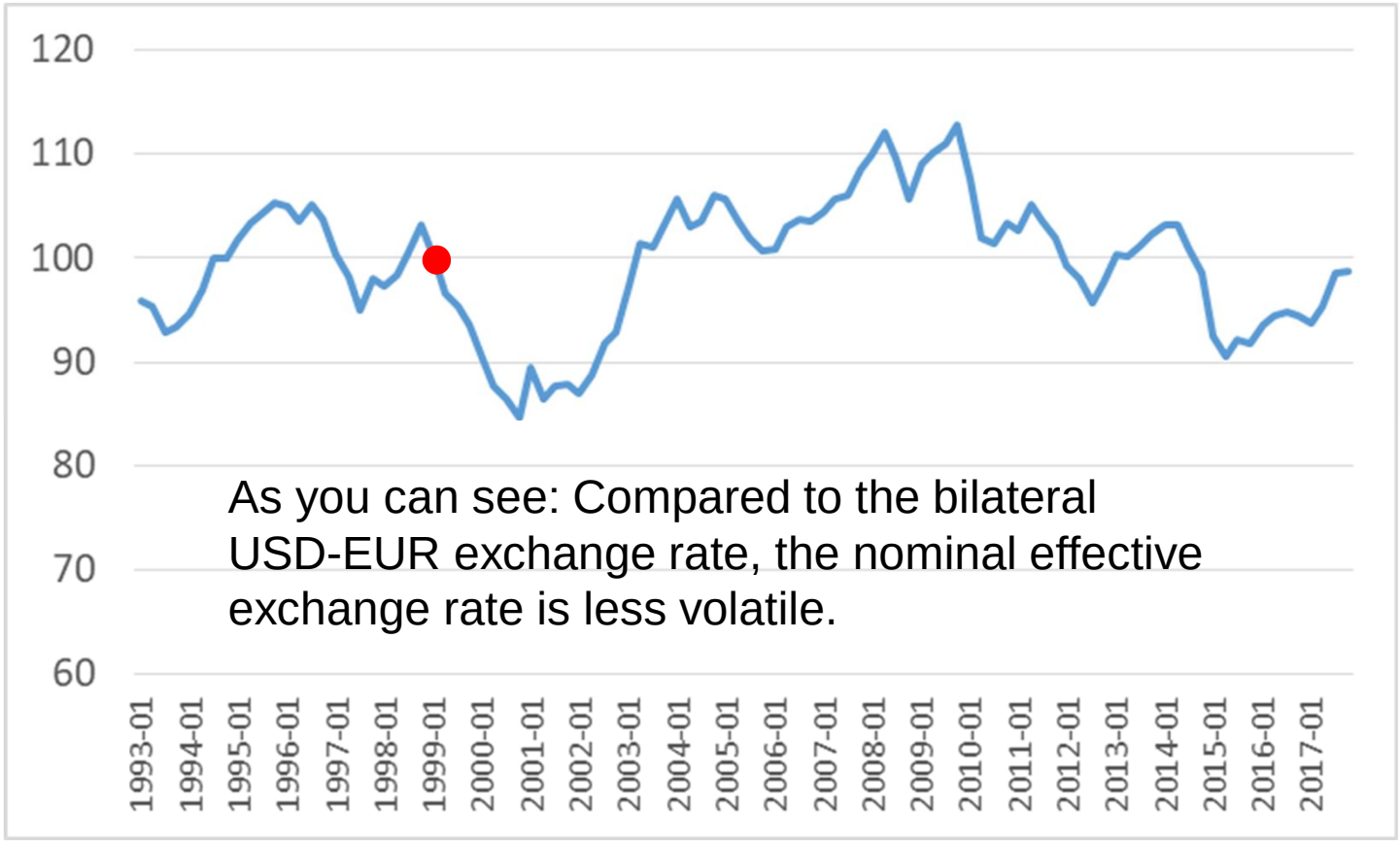
Nominal effective x-rate of the Euro*



*: Against 19 countries; 1Q99=100

Source: Deutsche Bundesbank

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Problems to solve.

Given are the $/€ x-rates for 7 years.

	$/€
1999	1,0658
2000	0,9236
2001	0,8956
2002	0,9456
2003	1,1312
2004	1,2439
2005	1,2441

Convert this sequence of x-rates into an x-rate index with 1999=100. Has the euro appreciated or depreciated?

Given are the following data. Assume that the Eurozone only trades with Japan and the US.

	Exchange rates		Value of foreign trade	
	YEN/EUR	USD/EUR	with Japan	with the US
t1	120	1,25	200	400
t2	130	1,10	180	440

Calculate the change of the effective x-rate. Interpret the result!

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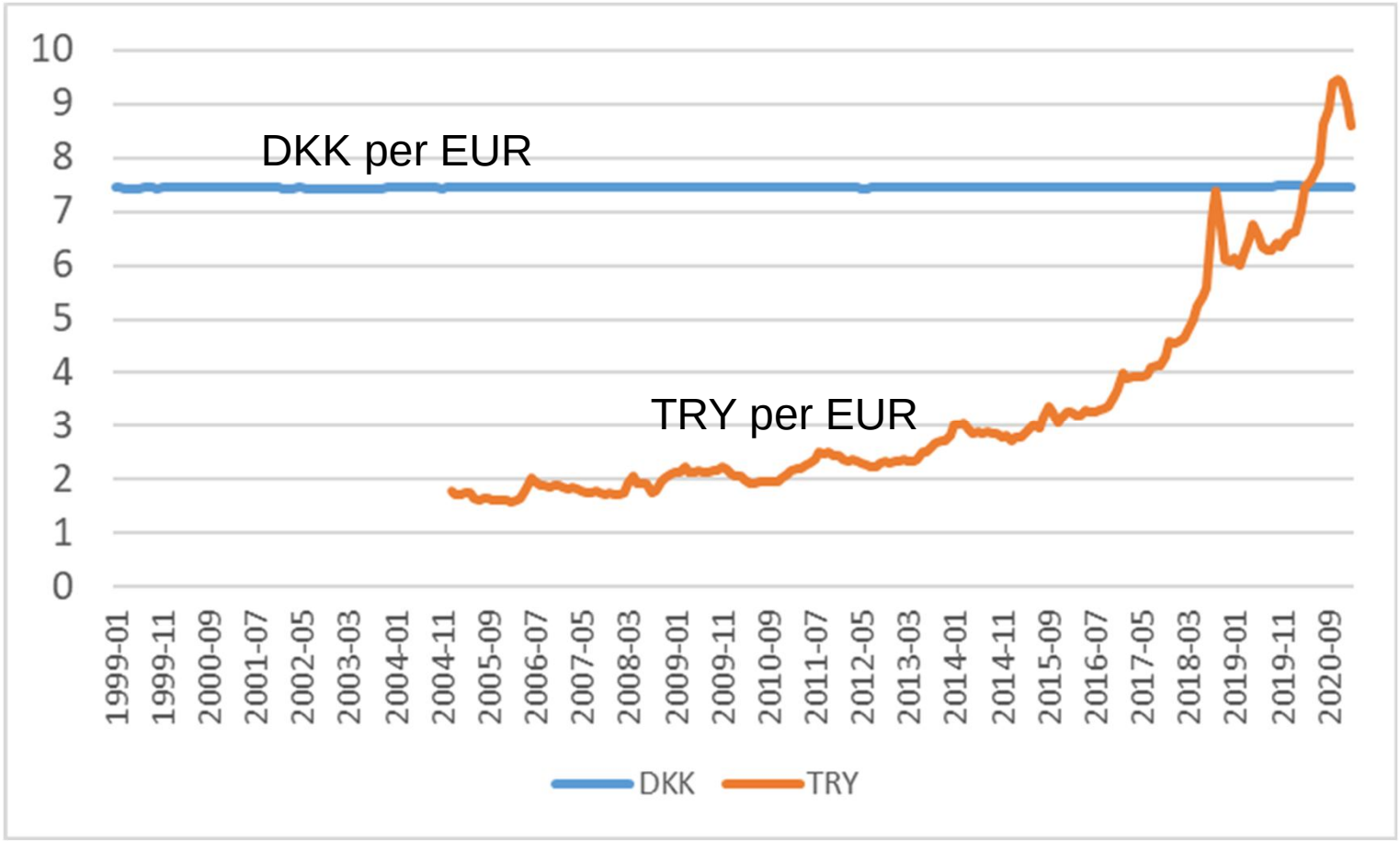
Exchange rates can be stable or exhibit a trend



Source: Deutsche Bundesbank

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Ch. 2.1 Main concepts

- Price and quantity quotation
- Appreciation and depreciation
- Dimensions
- Bilateral and effective x-rates
- Calculating effective x-rates

Don‘t forget:

Problems to solve : page 65 and 70
Quick check: page 67
And of course: read the recommended literature!

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2.2 The fx-market

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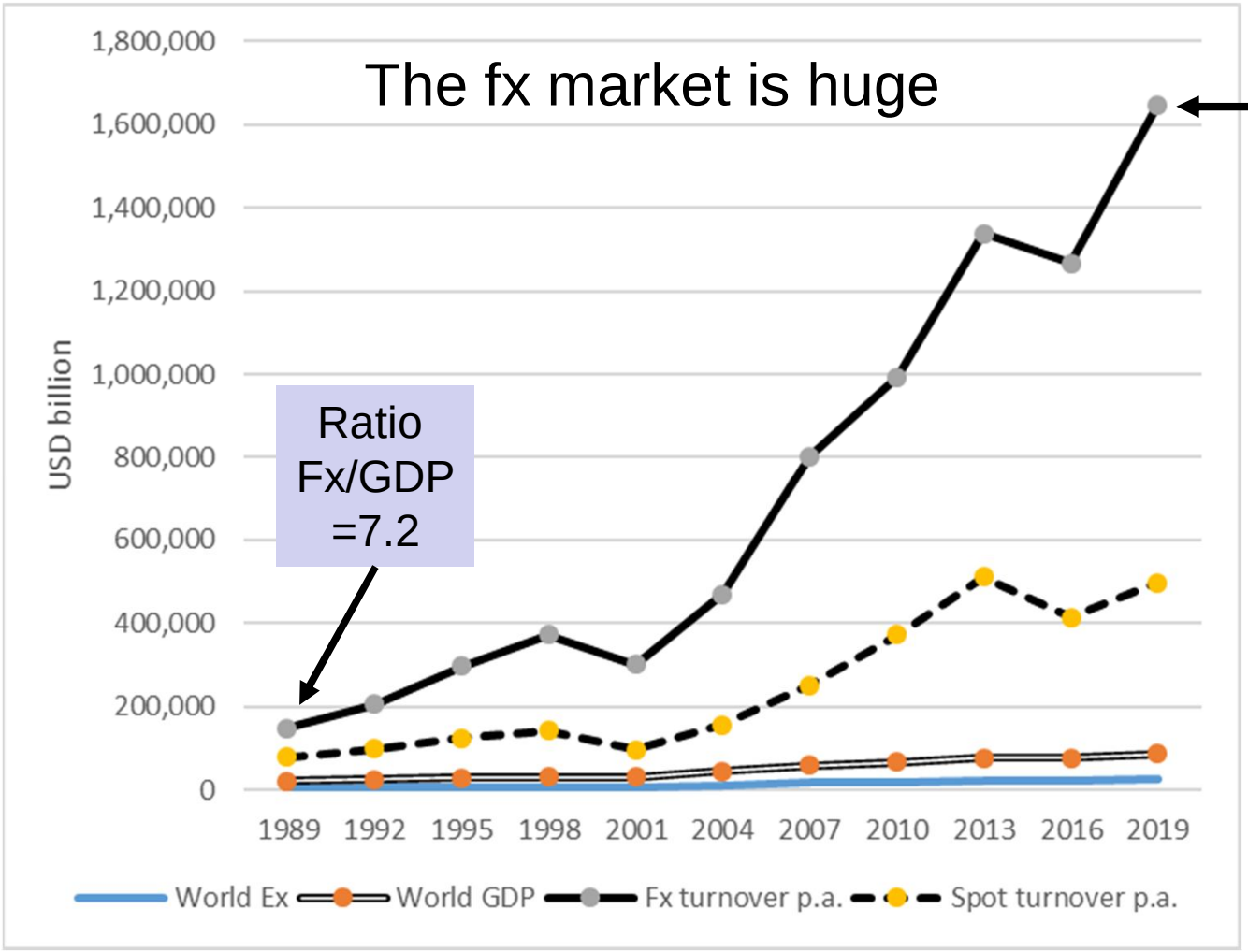
Fx market turnover



Source: IMF, Worldbank and BIS

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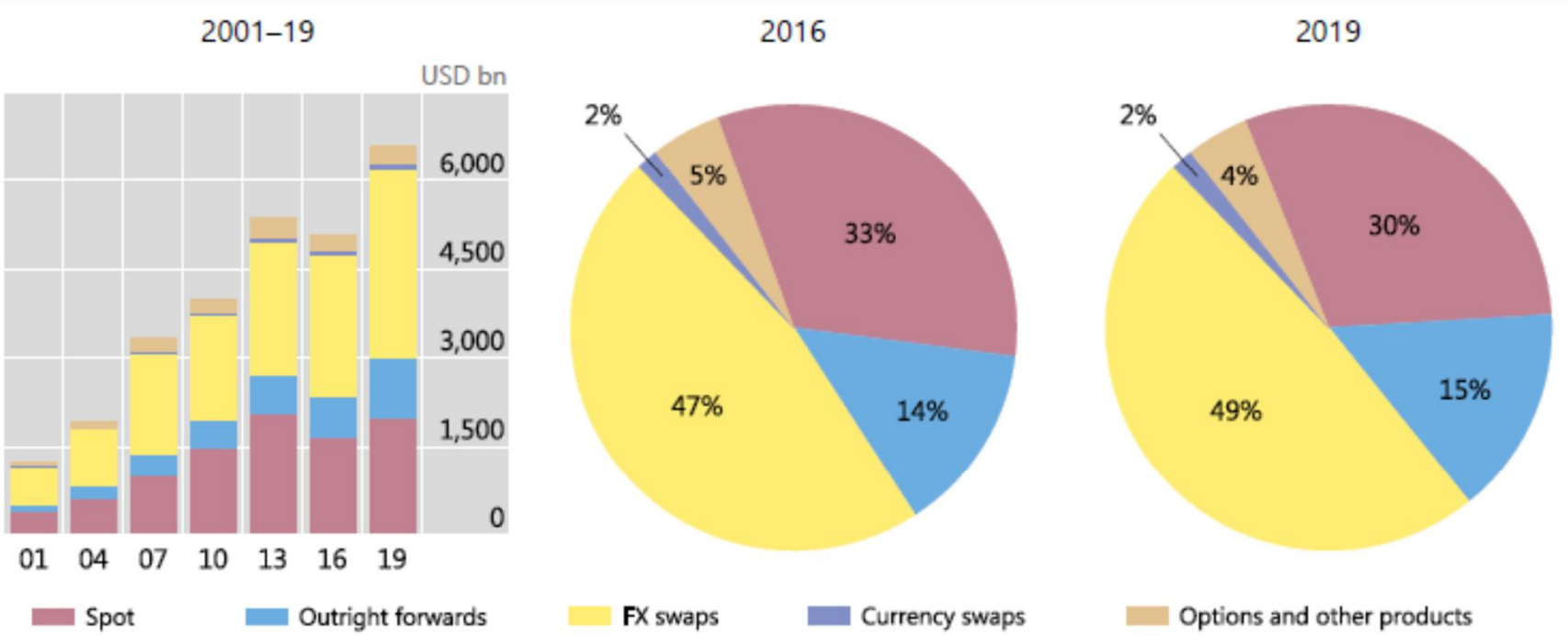
Fx turnover: rising and rising

Foreign exchange market turnover by instrument[1]

Net-net basis, daily averages in April

Graph 2



[1] Adjusted for local and cross-border inter-dealer double-counting, ie "net-net" basis.

Source: BIS Triennial Central Bank Survey. For additional data by instrument, see Table 1 on page 9.

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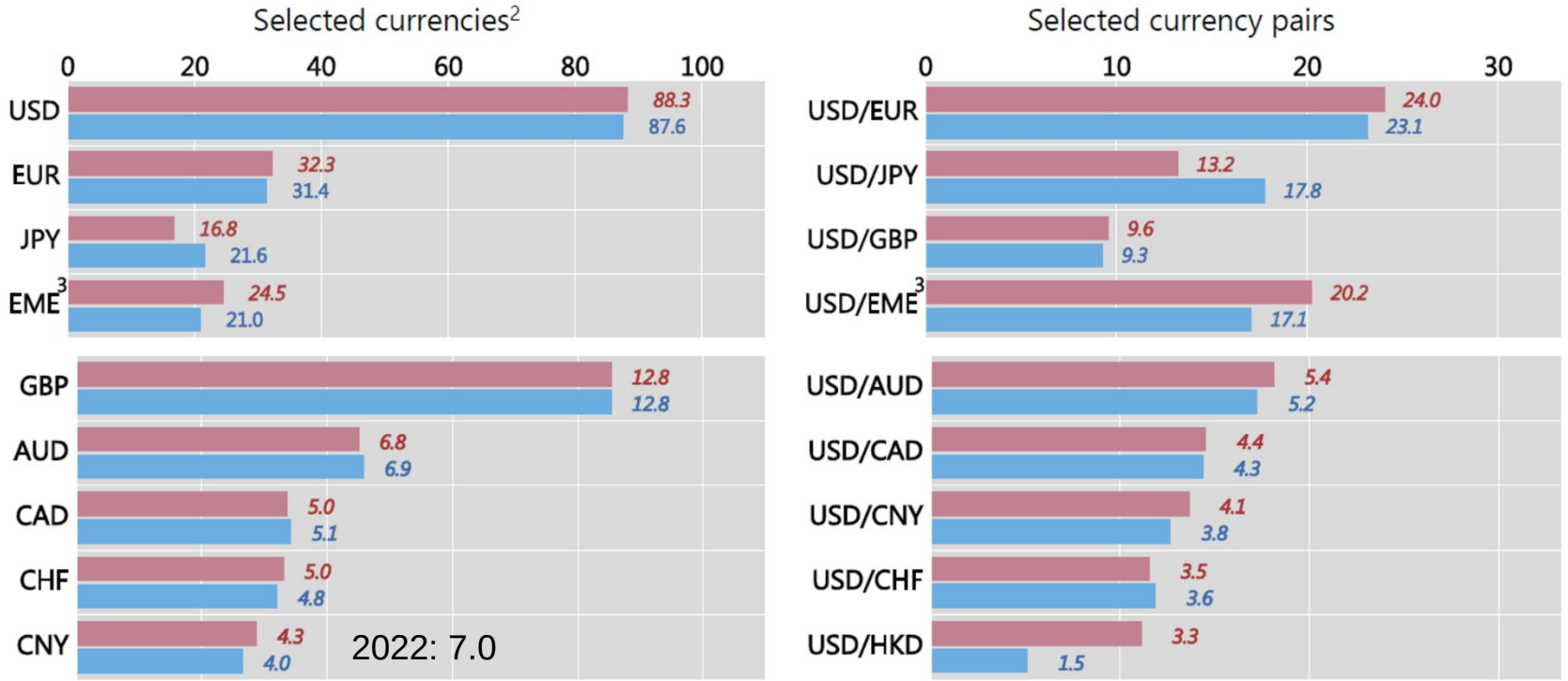
Foreign exchange turnover



Source BIS; EMEs: emerging market economies

Net-net basis, daily averages in April, in per cent

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Currency composition of worldwide fx turnover

Only 11.7% of all transactions are non-dollar.

Only 3.4% of all transactions are non-dollar and non-euro.

Only 1.5% of all transactions are non-dollar, non-euro and non-yen.

⇒ There is very little direct trade of other currencies.

⇒ In almost 90% of transactions, the US-dollar is on one side.

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Why is the USD on one side of most transactions?

About 88% of all transactions are USD-transactions.

Explanation: Transaction costs

- For n currencies there are n(n-1)/2 exchange rates and market segments. So, for instance, for 100 currencies: 4950 exchange rates.
- If there are many market segments in each segment there is little trade. The non-$ rates are called „**cross rates**“.
- Thus, costs would be high.
- Using one currency as a „**vehicle currency**“ (a kind of international money) reduces the number of markets to (n-1).
- This makes markets more liquid and drives down transaction costs.
- As a result, it is cheaper to carry out 2 transactions in liquid markets than one transaction in an illiquid market.
- Example: AUD→USD and USD→Yen is cheaper than AUD→Yen.

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Use of a vehicle currency

➡ Reduction of the number of x-rates

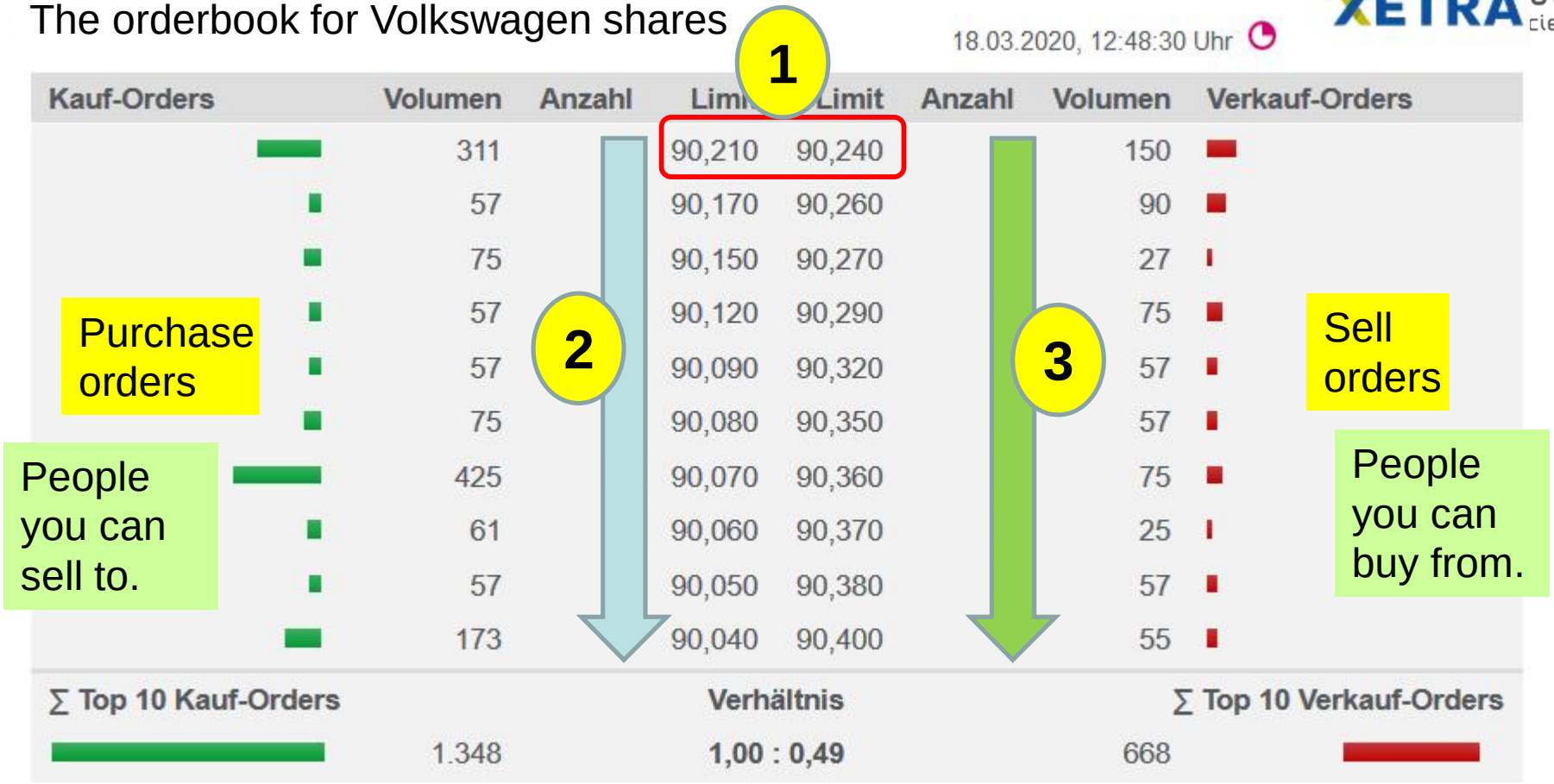
		USD	EUR	SFR	YEN	CNY	UKP
1	USD						
2	EUR	x					
3	SFR	x	x				
4	YEN	x	x	x			
5	CNY	x	x	x	x		
6	UKP	x	x	x	x	x	

For six currencies there are 15 x-rates.
In general:
For n currencies there are n(n-1)/2 x-rates.
For n=1000: 499,500 x-rates.
Always calculating and transacting in USD reduces this number to 999!

Note: Economically „USD/EUR“ and „EUR/USD“ are just two different ways of quoting the same x-rate.

A small detour: „liquidity“

The orderbook for Volkswagen shares



„Liquidity“

(1) For a buyer the price is higher than for a seller.
(2) The more you want to sell, the lower prices get.
(3) The more you want to buy, the higher prices get.

The more liquid a market, the smaller are these effects.

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Problems to solve.

If there are 150 currencies, how many x-rates are there?

If trading is always carried out via a vehicle currency, what is the number of x-rates? Provide the general formula.

Why is it useful to use a vehicle currency?

What does liquidity have to do with the costs of buying and selling foreign exchange?

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The main instruments

- spot transactions
- outright forward transactions
- fx swap transactions
- futures
- options

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Spot-Transaction

Period	**Bank A**	**Bank B**
t_0	Receives USD in a bank account in New York (pays EUR)	Receives EUR in a bank account in Frankfurt (pays USD)
t_1	--	--

Payments have to be made within 2 business days.

The agreed price is the „spot exchange rate“ – for instance 1.1216 USD/EUR. This is the price normally referred to as „the exchange rate“.

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Outright forward

Period	**Bank A**	**Bank B**
t_0	--	--
t_1	Receives USD in a bank account in New York (pays EUR)	Receives EUR in a bank account in Frankfurt (pays USD)

t_1: Payments are made at a fixed date in the future, at a fixed exchange rate.

Agreed price: the forward rate
- for instance: 1.1756 USD/EUR agreed April 20th, 2017 exercised at June 20th, 2017 for a transaction of USD1.5 mn.

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Foreign exchange swap

Period	**Bank A**	**Bank B**
t_0	Receives EUR in a bank account in Frankfurt (pays USD)	Receives USD in a bank account in New York (pays EUR)
t_1	Receives USD in a bank account in New York (pays EUR)	Receives EUR in a bank account in Frankfurt (pays USD)

t_0: Payment within 2 business days
t_1: Payment at a fixed date in the future at a fixed exchange rate

A foreign exchange swap combines a spot transaction and a forward transaction.

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Futures Contracts

Forward transactions have a number of disadvantages:

- the risk that the counterparty does not fulfil its obligation ('credit risk')
- contracts are not liquid (they cannot be sold to third parties)
- high transaction costs
- It is difficult to 'get out' easily.

Therefore, a kind of forward trading on organised exchanges has emerged which is called futures trading.
These exchanges use a number of devices to reduce transaction costs. Most have to do with standardisation:

- limited number of delivery/expiry dates (usually 4 per year)
- standardized foreign currency amounts (f.i.125.000 EUR)
- central counter-party
- common rules and procedures

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Options

A foreign exchange option gives the owner the **right to buy or sell** a specified amount of fx for a specified price **at any time** up to expiry date.

- A **put** option gives the right to sell.
- A **call** option gives the right to buy.

Unlike futures and forwards, options involve an **asymmetry between buyer and seller**.

The buyer has the right, but not the obligation, to exercise the option.

The seller on the other hands is obliged to deliver if the buyer demands this.

American option: exercise is always possible
European option: exercise only at the expiry date