Test yourself

Solutions in file „Introductory questions_solutions.xlsx"

1. You are investing 100 EUR for 3 years at 12% p.a.. What is the value of your capital after these 3 years?

2. The current interest rate is 3%. What is the present value of 100€ which you will be receiving in 3 years?

3. For 5 years in a row, the German inflation rate is equal to 5%. By how much have prices been rising over the entire period?

4. ABC-Land has the following inflation rates

2012	3%
2013	4%
2014	1%
2015	6%

By how much has the price level risen over these 4 year?

Test yourself

5. You are investing 100EUR in Turkey at an interest rate of 20%. After 1 year, the Turkish Lira has depreciated by 15%. What is the EUR-value of your investment after one year?

6. In Germany interest rates for real estate loans are 5%. In Switzerland interest rates for similar loans are just 1%. A German households decides to finance a house purchases in Swiss Frances (SFR). Suppose, a household has borrowed SFR one year ago and has to repay the loan today. Given the exchange rates below, do you think it was a good idea to borrow SFR rather than Euro?

   Exchange rate 1 year ago   1.14 SFR/EUR
   Exchange rate today   1.06 SFR/EUR

Test yourself

7. The exchange rate of the US-dollar over the past 5 years [USD/EUR]:

2014	1.45
2015	1.30
2016	1.32
2017	1.18
2018	1.09

   a. Calculate an exchange rate index with a value of 100 for the year 2014.

   b. Calculate an exchange rate index with a value of 100 for the year 2016.

Some more BOP-Accounting

1. German tourists spending 6m EUR on holidays in Florida

CA	
	Im of services -6m€

2. Germany receives 1m EUR from the UN heritage fund

CA	
transfers +1m€	

3. A German buys a house in Spain financed 100% by a loan of a Spanish bank

FA	
loan: cap. im	house: cap. ex

4. A German works for a hotel in Mallorca during the holidays

CA	
income received	

5. A German company pays for advice of a French lawyer

CA	
	import of services

6. A German buys an apartment in Greece

FA	
	cap. ex

Some more BOP-Accounting

7. A German bank pays back a loan from a French bank

FA

cap. ex

8. An American hedge fund purchases Lufthansa shares at the Frankfurt stock exchange

FA

cap. im

9. A German student pays tuition fees in the US

CA

services im

10. A German student receives a loan from a Canadian uncle

FA

cap. im

11. A German tourist is eating lunch in a restaurant in Greece

CA

services im

Assuming the German student lives only briefly in the US, say 1 term.

Exercises

1. What are the main components of the balance of payments (including sub-balances)?

See script.

2. Assuming that the capital account is balanced and that there are no errors and omissions: What is the relationship between the current account and the financial account?

CA balance = - FA balance

(CA surplus = FA deficit   or   CA deficit = FA surplus)

Ch.1, slide 55, part 2

3. Show that CA = S – I

Total income (=total spending) can be written as $Y = C + I + G + CA$

Aggregate saving: $S = Y - (C+G)$ (income minus private and public consumption)

Replacing Y in the S-function yields

$S = C + I + G + CA - (C+G) = I + CA \Longleftrightarrow CA = S - I$

4. During the 1980s, the US experienced "twin deficits" in the current account and government budget. Do government budget deficits lead to current account deficits? Identify other possible sources of the current account deficits. Do current account deficits necessarily indicate problems in the economy?

We know that
$CA = (Sg - Ig) + (Sp - Ip)$
CA = government surplus + excess of private savings over private investment
So a CA deficit can go hand in hand with high government deficits, high private investment and low saving. Thus, a large public deficit may contribute to a CA deficit.
A CA deficit need not be a problem if it is caused by high investment.

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?
4.40 USD / 1.1 [USD/EUR] = 4 EUR
4.20 EUR • 1.1 [USD/EUR] = 4.62 USD

Try to find out how the Japanese Yen has evolved against the EUR since the end
of 2014. Has the Yen become stronger?
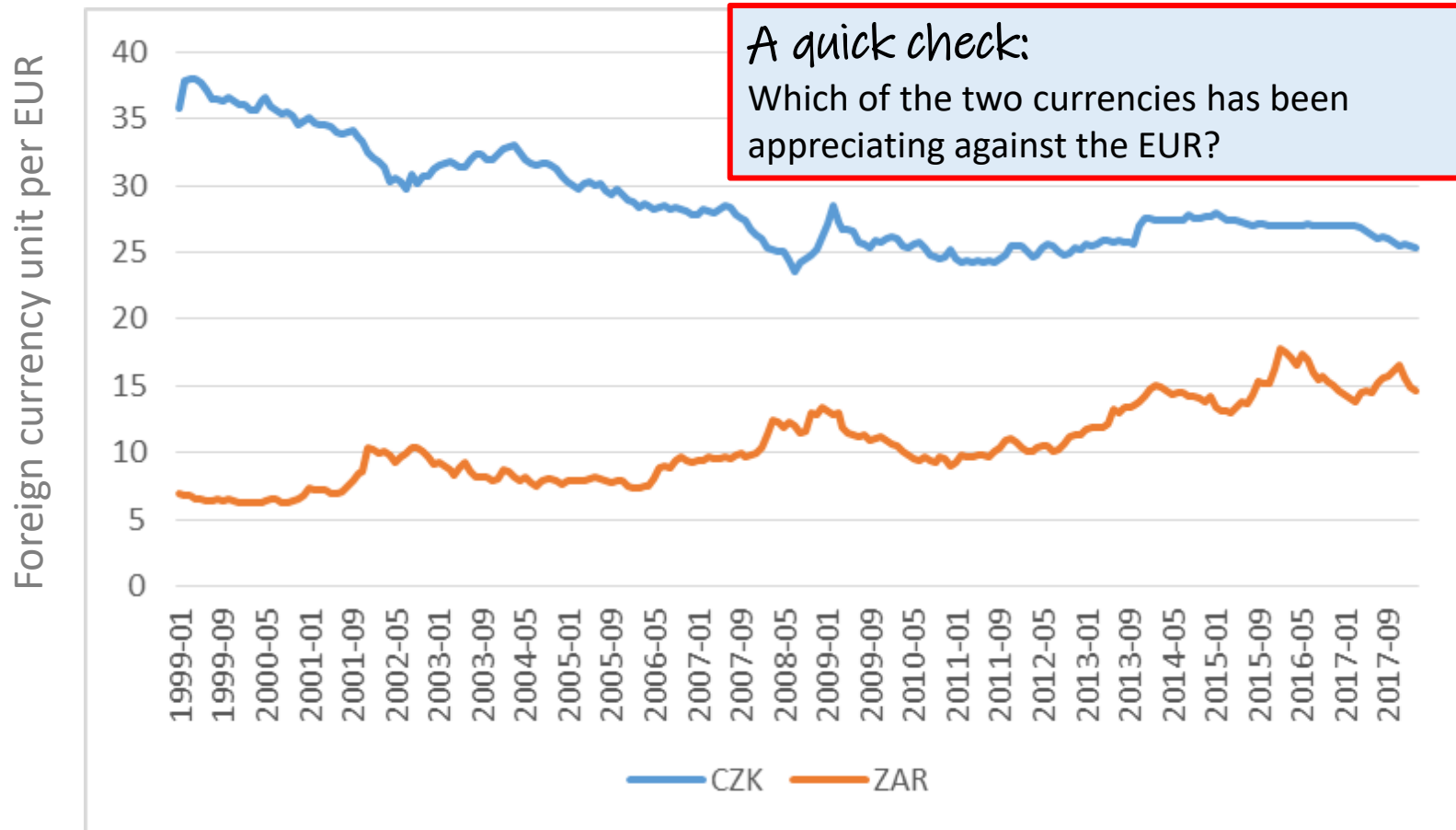(Hint: Check out the website of the Bundesbank: -> Statistics/ExchangeRates/Time Series)

12-2014
147.06

12-2014
142.38
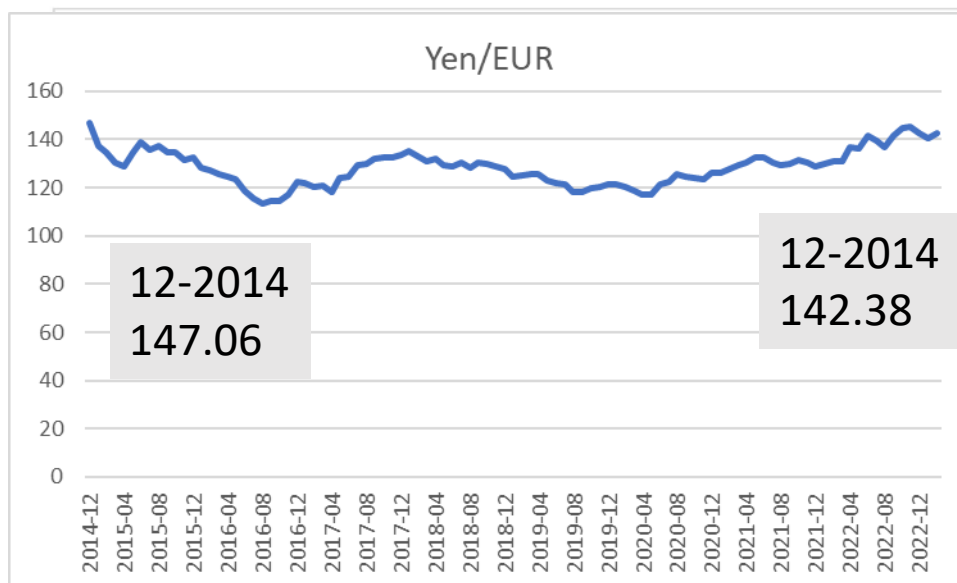
The Yen has become a little stronger, the Euro a little weaker. One Euro buys fewer Yen.

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?

The Kroon as appreciated, the Rand has depreciated.

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!

See Excel file
„Ch.2_Solution_Slide 70.xlsx"

Questions from slide 30

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

Number of x-rates = n(n-1)/2 for n=150 we get 11,175

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

Number of x-rates = n(n-1)/2

Why is it useful to use a vehicle currency?

Fewer x-rates → fewer markets → each market is more liquid → more liquidity means lower costs

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

The spread between sales' and purchasde price (the bid-ask spread) is lower. It is easier (less costly) to buy or sell large amounts of foreign exchange

Additional question

1. Please explain the economic intuition underlying the law of one price.

The law of one price relies on goods' arbitrage. People or companies have an incentive to buy goods where prices are lowest (and to sell them where they are highest). So if there are no impediments to trade tehn any price differences will be eliminated by arbitrage.

2. In the chart below, we see the effects of a decrease in the $-supply.
In general, what could be the factors leading to such a decrease?
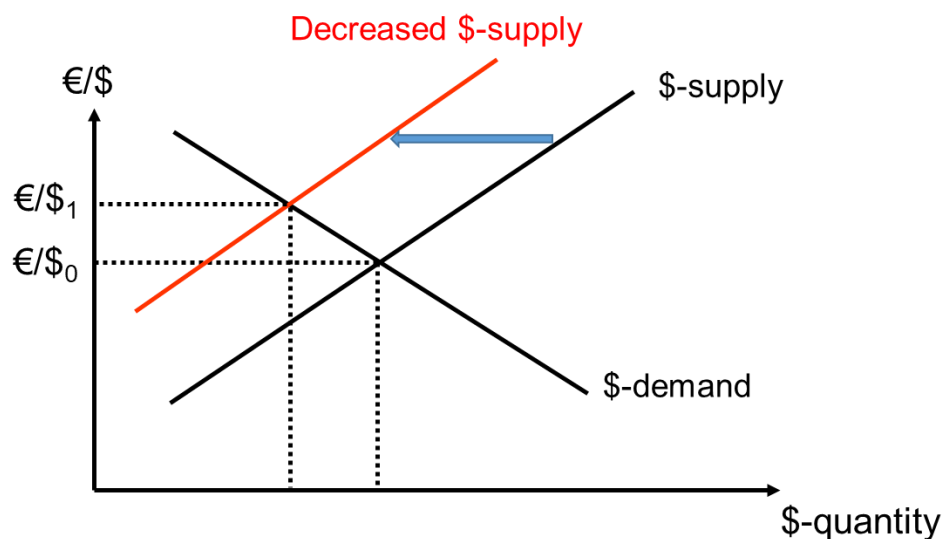
One way to answer this question is to go through the items of the balance of payments.
A decrease in the $-supply could be due to a decline in
a) ex of goods and services
b) transfers received
c) capital imports

Suppose wheat costs (per metric ton)
in the US: 200$
in euroland: 190€
The x-rate is: 0.92 €/$
Assume that there are no costs of transportation and that international trade is completely free.
- Where would grain traders rather buy wheat?
- What would be the consequences for the x-rate?

The USD-price in EUR = 200$ · 0.92 €/$ = 184€ < 190€
 Wheat is cheaper in the US. So traders would rather buy wheat in the US. Foreign wheat traders would demand USD. So, $-demand rises and the x-rate gies up (the $ appreciates). (Note: wheat is only one good of many 1000s that are traded internationally. So, the x-rate effect is likely to be small.)

Alternative calculation: (you do not have to do both)
The EUR-price in USD = 190€ / 0.92 €/$ = 206.5$ > 200$.
Same result: Wheat is cheaper in the USA.

Ch. 3 slide 110   **I have not updated the results. We will do that together.**

1. Try to find the July 2023 results of currency valuations based on the Big Mac index. (Try to go to the original source, The Economist.)

    https://www.economist.com/big-mac-index

Access to the entire data set can be found under:

https://github.com/TheEconomist/big-mac-data/

2. Relative to the US dollar, by how much were the following currencies under- or overvalued in July 2022

Switzerland   18.4% overvalued   /   28.8% overv.

Canada   8.6% undervalued   /   6.6% underv.

Mexico   53.1% undervalued   /   52.6% underv.

Euro area   19.2% undervalued   7   8.8% underv.

> Not updated. Jan 2020 and Jan. 2021 results.

3. Relative to the EUR, by how much is the UK Pound under- or overvalued?

Unfortunately, I did not notice that the Economist has become much more user friendly so that you can get the result directly by choosing the Euro as reference currency. (2020/2021)

If you select the Euro as base currency, the UK Pound is 3.8% / 14.1% undervalued.

But I had planned that you do the calculation für yourself!!!

Ch. 3 slide 110

3. Relative to the EUR, by how much is the UK Pound under- or overvalued?

How can you calculate that on your own?

First, you need the data. As pointed out above, the Economist also provides the underlying data in an Excel spreadsheet. Try to download it yourself.

In case you have problems getting the data or if you do not have Excel or a comparable spreadsheet software you can use the data I am providing below.

Country	iso_a3	currency_code	local_price	dollar_ex	dollar_price	dollar_ppp
Euro area	EUZ	EUR	4.25	0.823011399	5.1639625	0.7508834
Britain	GBR	GBP	3.29	0.74137228	4.4377165	0.5812721

All x-rates are foreign money per USD

As a "warming up exercise" let's look at the valuation vis-á-vis the USD.

The Economist already provided the PPP x-rates (last column). So the USD should cost 75.1 €cents but it does cost 82.3 €cents. The PPP rate in % of the market rate is "dollar_ppp" divided by "dollar_ex". This results in a value of 91.2% - an undervaluation of the € of 8.8%. The same calculation for the GBP yields a value of 78.4% - an undervaluation of 21.6%.

As another "warming up exercise": How did the Economist calculate the PPPs on the last column? If you know that the Big Mac price in the US is 5.66$ you can calculate these rates on your own. Try!!!

3. continued

First, you should try this on your own.

Country	iso_a3	currency_code	local_price	dollar_ex	dollar_price	dollar_ppp
Euro area	EUZ	EUR	4.25	0.823011399	5.1639625	0.7508834
Britain	GBR	GBP	3.29	0.74137228	4.4377165	0.5812721

If the EUR is the reference currency, we need to calculate for Britain

GBP/€   € price   € PPP

GBP/EUR = GBP/$ / €/$ = 0.90080439

€ price = 4.25€ * 0.90080439 GBP/EUR = 3.83 GBP

€ PPP = UK Big Mac in GBP / EU Big Mac in GBP
       = 3.29 GBP / 3.83 GBP = 0.859 or 85.9%

So, we have an undervaluation the GBP of 14.1%.

You can always cut it down to 2-3 decimals.

This was the "long way". There is also a short-cut that you could use. Have another look at the table above. Can you spot it?

Country	iso_a3	currency_code	local_price	dollar_ex	dollar_price	dollar_ppp
Euro area	EUZ	EUR	4.25	0.823011399	5.1639625	0.7508834
Britain	GBR	GBP	3.29	0.74137228	4.4377165	0.5812721

4. What can we learn from the index? What does it imply if a currency is "overvalued"?

The limitations of the Big Mac index are the topic of the next question (Q5).

So what is the basic logic?

The Big Mac index tells us whether a Big Mac is cheaper or more expensive in the reference country (the US) compared to other countries. To make a comparison, prices have to be calculated in the same currency, in this case the USD.

People from countries that are undervalued, will find a Big Mac in the US expensive. People from countries that are overvalued, will find a Big Mac in the US cheap.

If Big Mac prices are representative for prices in general (a big "if") we could say that a country with an overvalued currency is generally expensive. In this case, we would expect the market exchange rate to move towards the PPP rate. That means, we would expect it to depreciate.

5. How useful is the Big Mac index? What do you think?

The Big Mac is only one good. If the Big Mac is relatively expensive in Canada, for example, that does not mean that all Canadian goods are relatively expensive. So if someone is truly believing in APPP, she should calculate such an index for a wide basket of goods.

We will later see, that not all goods are traded and that therefore, there may be persistent international price differences.

In fact, the Economist tries to take that into account by using a GDP-adjusted index.

	Inflation in %	Inflation in %	Inflation in %		
	US	Turkey	Euro zone	Trk.Lira/USD	EUR/USD
2016	1.26	7.78	0.183	3.022	0.903
2017	2.13	11.14	1.381	3.649	0.885
2018	2.44	16.33	1.703	4.840	0.846
2019	1.81	15.18	1.446	5.676	0.893

A. On the basis of the information above, calculate the changes of the real x-rate of the Turkish Lira against the USD and the EUR (for the years 2017 to 2019).

		x-rate change (%)		infl. differences (%)		real x-rate change (%)	
	Trk.Lira/EUR	Trk.Lira/EUR	Trk.Lira/USD	Trk - EU	Trk - US	Trk - EU	Trk - US
2016	3.347			7.59	6.51		
2017	4.127	23.31	20.71	9.76	9.01	13.55	11.70
2018	5.720	38.61	32.65	14.63	13.89	23.98	18.76
2019	6.356	11.12	17.30	13.73	13.36	-2.61	3.94

Changes of the real x-rate of the Turkish Lira = change of the nominal x-rate minus inflation difference (if you caluclated foreign inflation minus Turkish inflation it would be „plus inflation difference"). If the change is positive, there is a real depreciation. So, in 2017 and 2018 there were strong real depreciations of the Lira. In 2019, there was a mild real appriciation againts the EUR and a small reall depreciation against the USD. (See also file „ real x-rate_solution.xlsx")

19

B. In Nov. 2019 Argentiniens had to pay 59 Pesos for a USD. In April 2020 they had to pay 66 Peso per USD. Does that mean that the US has become relatively more expensive for Argentinians?

The US has **not necessarily** become relatively more expensive for Argentinians. If Argentina experiences high inflation (which is does), the depreciation can simpkly reflect the inflation differential. So, relative prices (US vs. Argentina) would be unchanged. It is even possible that the inflation difference is higher than the nominal depreciation. In this case, the US has become relatively cheaper for Argentinians.

Ch. 3 slide 130

People in Frugalia consume just 2 goods:

Wheat and meat.

In 2018 there are the following prices:

PW = 1$/kg, PM = 6$/kg

In 2019 there are the following prices:

PW = 1.5$/kg, PM = 5$/kg

In the price index of Frugalia, the two goods have followings weights

Wheat: 60% and meat 40%. (Same weights in both years.)

Calcuate the rate of inflation.

Calculate the inflation rate assuming that the 2019 weights are

Wheat: 50% and meat 50%.

| | PW | PM | 2018 = 100 | | Weights | | | |
			PW index	PM index	Wheat	Meat	Price index	Infl. (%)
2018	1	6	100	100	0.6	0.4	100	
2019	1.5	5	150	83.33	0.6	0.4	123.33	23.33
							0.00	
2019	1.5	5	150	83.33	0.5	0.5	116.67	16.67

In the first case, the inflation rate in 23.33%. In the case with changing weights, the inflation rate is 16.67%

(Solution also included in file „ real x-rate_solution.xlsx")

Ch. 3, slide 141

For which range of nominal x-rate changes will there be a
real depreciation of the domestic currency?

π	π^*	$\pi - \pi^*$	local currency must depreciate by more than or appreciate by less than
10%	4%	6%	depr. of more than 6%
10%	10%	0%	any depr. (more than 0%)
4%	10%	-6%	appr. of less than 6% (or even depr.)

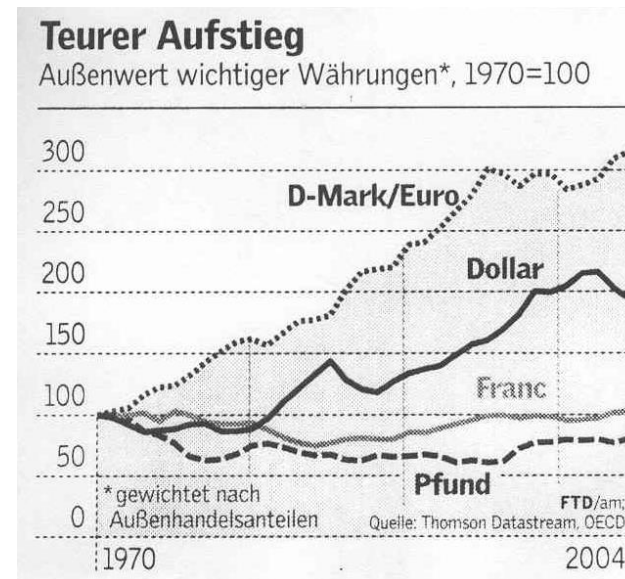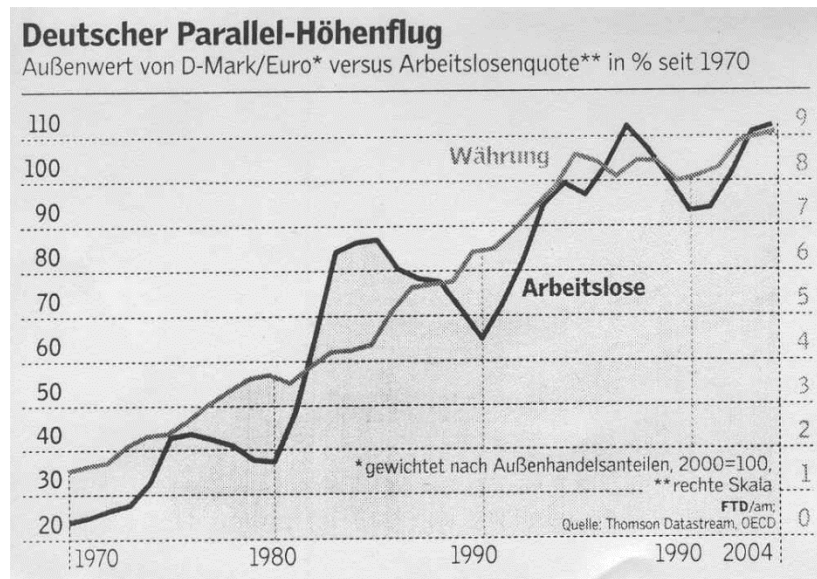## Ch. 3, slides 143-148

Looks like Mr. Fricke's argument is correct, isn't it?
What do YOU think?
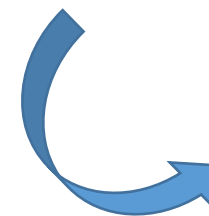Did the appreciation of the D-Mark destroy jobs?

These are the two main pieces of evidence that Fricke is using:

Deutscher Parallel-Höhenflug
Außenwert von D-Mark/Euro* versus Arbeitslosenquote** in % seit 1970

Teurer Aufstieg
Außenwert wichtiger Währungen*, 1970=100

The problem is that both are showing the evolution of the **nominal** value of D-Mark. But the increase of the nominal value of the D-Mark does not imply that Germany has become relatively more expensive. In order to find that out we also need to look at the inflation rate in Germany compared to other countries. In other words: We need to look at **real x-rates**.
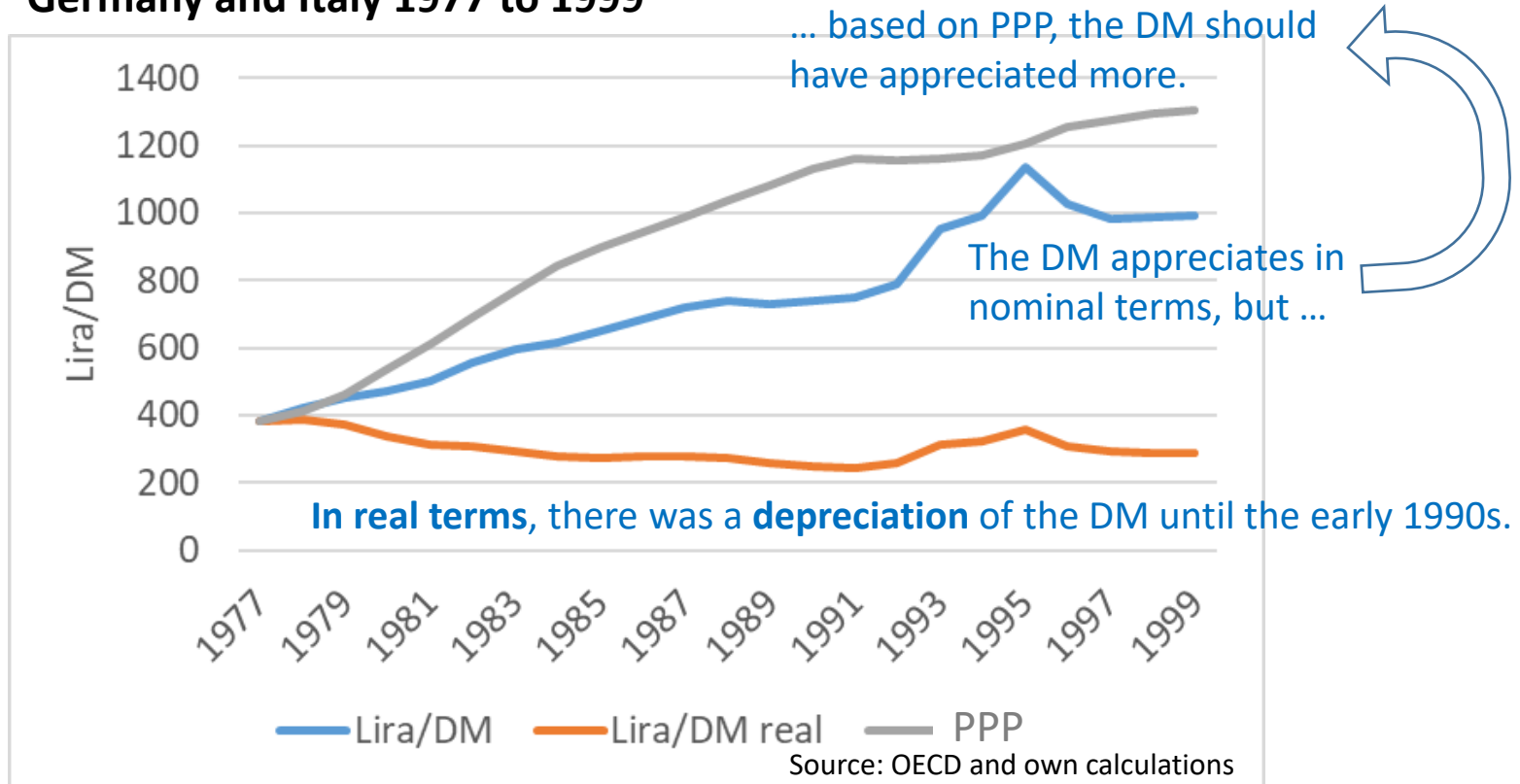
The argument above would be sufficient to answer my question.
But let's have a look at what actually happened.

Let's look at some <u>real</u> data!!!

Germany and Italy 1977 to 1999

... based on PPP, the DM should have appreciated more.

The DM appreciates in nominal terms, but ...

In real terms, there was a **depreciation** of the DM until the early 1990s.

Source: OECD and own calculations

Lira/DM: A rise indicates an appreciation of the DM

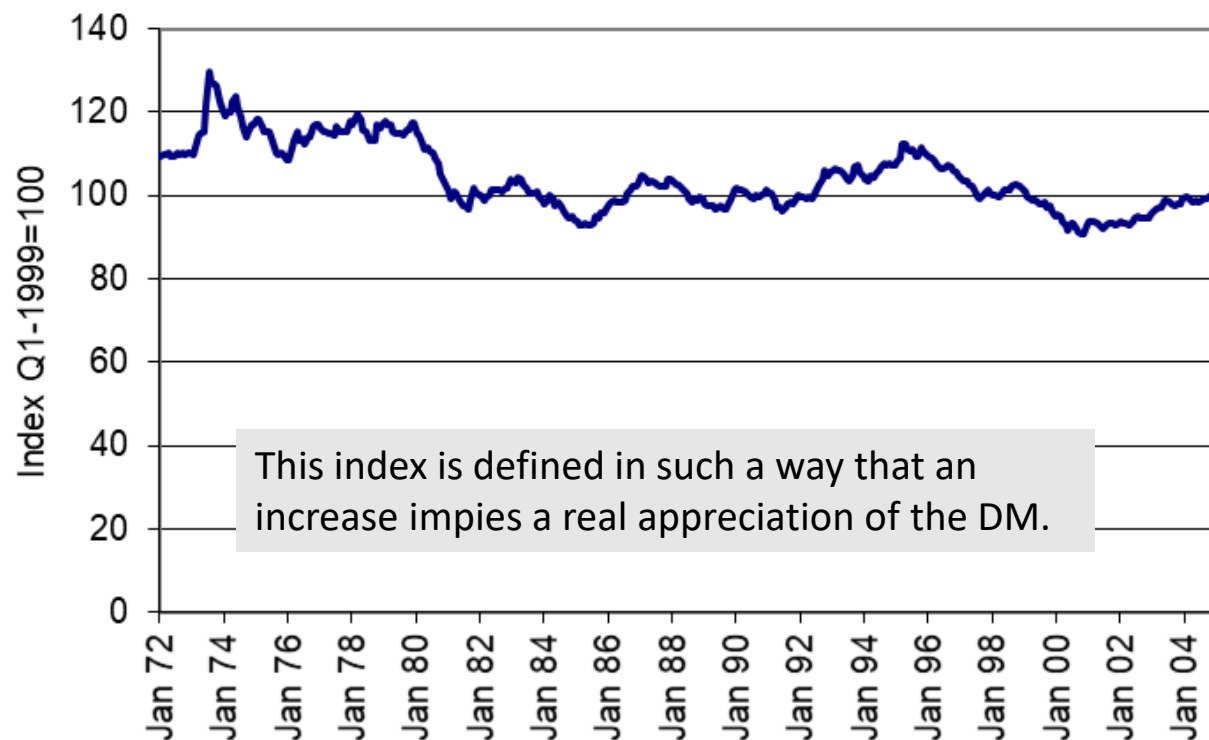Lira/DM real = w[Lira/DM] * $P_{Germany}$ / P_{Italy}

A decrease of Lira/DM real implies a real depreciation of the DM.

So, in this example the DM did appreciate (as noted by Mr. Fricke). However, the appreciation did not fully neutralise the effects of higher inflation in Italy. So, compared to Italy, Germany became cheaper. Hardly a reason for rising unemployment.

24

Even-though the Lira/DM x-rate is a typical case, it is <u>just one</u> bilateral x-rate. More informative are effective x-rates. Again, to understand what happened one needs to look at <u>real</u> rates.

The real effective x-rate of the DM

When looking at the real effective x-rate of the DM, we see that there was a real <u>depreciation</u> in the early 1980s. But since then, the effective real x-rate has been going up and down without discernable trend.

This index is defined in such a way that an increase impies a real appreciation of the DM.

Source: Deutsche Bundesbank.

So, whatever were the reasons for Germany's increase in the unemployment rate, it certainly was not the x-rate.

This is the UIP condition.

$$\frac{(1 + i_{€})}{(1 + i_{\$})} = \frac{w^e}{w}$$

1. What is the underlying economic logic of this condition?

The underlying economic logic is the following:
A risk-neutral investor will always invest in the currency that yields the highest expected return. So, in equilibrium, expected returns have to be equal when expressed in the same currency. This is the case when UIP is fulfilled. A euro invested in Europe yields the same return as a euro exchanged into dollars, invested in the US and exchanged back into euros at the expected exchange rate.

2. How does it differ from CIP?

CIP relies on investors taking advantage of <u>riskless</u> profit opportunities. Since there are no risks involved, it is highly likely that CIP will be fulfilled under normal market conditions. UIP relies on investors to take x-rate risks. Since x-rates fluctuate substantially, it is much more questionable that investors are prepared to take on enough risks to equate expected returns.

3. How can this condition be transformed into a theory of exchange rate determination?

One has to make two assumptions:
Short-term interest rates are determined by monetary policy and the expected future x-rate is determined by news. In this case we can solve UIP for the spot rate:

$$w = w^e \frac{(1 + i_\$)}{(1 + i_€)}$$

4. How can this condition be transformed into a theory of interest rate determination?

One has to make two assumptions:
For a small country, the foreign interest rate is given.
Economic agents are forming expectations with respect to the rate of change of the x-rate (not the level). In this case, we can solve UIP for $i_€$:

$i_€ = (1 + i_\$) (w^e/w) - 1$ or approximately $i_€ = i_\$ + dw^e$

5. Given the values below, should a German investor with a 3-year time horizon rather have invested in Germany or in Australia?

	AUD/EUR	i $_{AUS}$	i $_{GER}$
2016	1.4883	2.34	0.09
2017	1.4732	2.64	0.32
2018	1.5797	2.68	0.40

Yield of an investment in Germany after 3 years:

0.0163 or **0.81%**
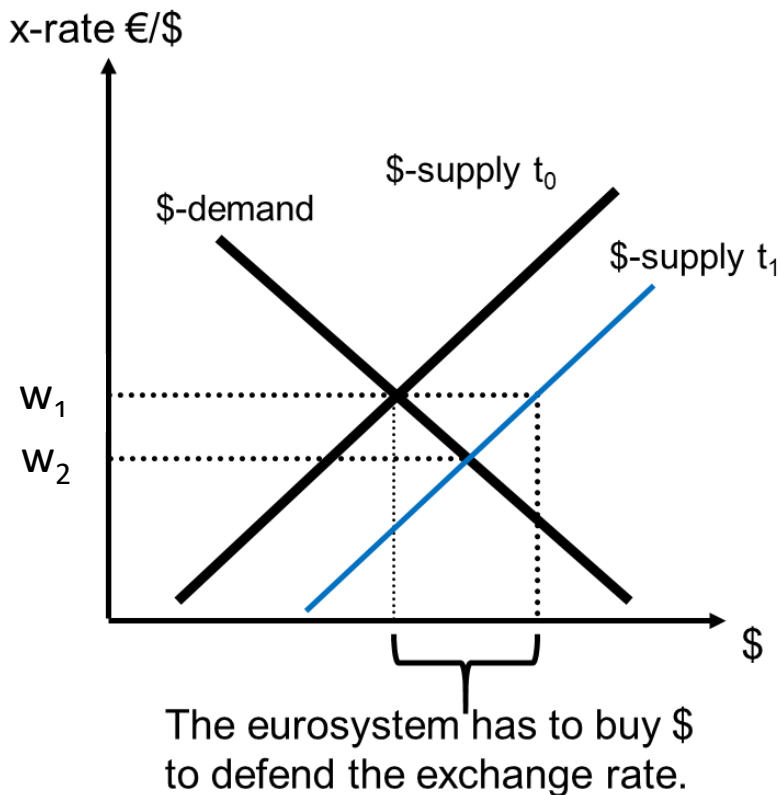
Yield of an investment in Australia after 3 years:

0.0162 or **1.62%**

The return of an investment in Germany is lower.

1. The eurosystem has the task to stabilise the €/$ x-rate at w_1. Show graphically what the eurosystem has to do in case of an increase of the $-supply from t_0 to t_1. How is the money supply affected?

w_2: The equlibrium x-rate if the central bank did nothing.

The eurosystem has to buy $ to defend the exchange rate.

The Eurosystem buys USD and pays with EUR. Therefore, the money supply is increasing.

2. What are the most important adjustment mechanisms that are triggered by foreign exchange intervention? (Short explanation of each of them.)

- the price effect
  Interventions are causing changes in the money supply. Money supply changes affect relative inflation, relative inflation affects exports and imports and thus demand and supply of foreign currency.
- the money-interest rate effect
  Interventions are causing changes in the money supply. Money supply changes affect short-term interest rates which in turn affect short-term capital movements.

Ch. 4, slide 190

Suppose that trust in the pegged rate declines and the EUR is expected to depreciate. For the moment, the EUR rises to the upper band (1.02 €/$) (it depreciates). At this value it is stabilised by central bank intervention. But markets expect the system to break down.

1. If the expected rate 1 year in ahead is equal to 1.15 €/$, how big will be the interest rate differential?

2. Assume that the x-rate of 1.15 €/$ is expected already 3 months ahead. How big will be the interest rate differential in this case?

1. The expected rate is 1.15 €/$ and the actual rate is 1.02 €/$. Thus the expected rate of change is equal to

$$\frac{w^e - w}{w} = 0.127 \quad \text{or} \quad 12.7\% \text{ (rounded)}$$

So, according to UIP, the Euro interest rate should be 12.7% higher than the USD interest rate.

2. If the change is expected within 3 months, the interest rate differential has to be 12.7% **per three months**. Using standard quotation of interest rates, the interest rate differential has to be 50.8% **per year** (4 times 12.7%).

As you can see, timing matters!!

31

Ch. 4, slide 201

We have here a table with inflation rates in 4 countries of the eurozone. Obviously, for eurozone countries there are no nominal x-rate changes. But what about real x-rates?

Definition of the real x-rate:

$$z = w \, (P^* / P)$$

Even if w is fixed, real x-rates may be changing if the tow price levels are changing in different ways. As we can see on slide 14, inflation rates within the eurozone have not been identical. Therefore, some countries have depreciated in real terms and others have appreciated in real terms. For instance, in the early years of monetary union, Germany's inflation rates have been relatively low. This implies that Germany depreciated in real terms against the other three countries.

Additional reading:
Krugman/Obstfeld, p. 488-490. (I have now uploaded to Moodle p. 489-490, p. 486-488 has been available already before.)
Additional material of Feenstra/Taylor: also uploaded to Moodle.

Ch. 4, slide 216

Give a brief overview of the pros and cons of fixed and flexible x-rate systems.

Flexible x-rates act as automatic stabiliser.

Flexible x-rates allow for monetary policy autonomy.

Fixed x-rate may help to gain credibility.

Fixed x-rate promote international trade.

There is often an asymmetry in fixed x-rate systems

In addition, one might add that flexible x-rate systems do not break down.