12. How do economies interact?

- The nominal exchange rate e (or, for short, exchange rate) between two currencies is the price of one currency in terms of the other. It allows domestic purchasing power to be spent abroad.
- If e = 2 \$/€, then one euro can be traded for two dollars: the price in dollars of 1 euro is 2 dollars.
- The inverse e' = ½ €/\$ of e = 2 \$/€ shows how many euros can be traded for one dollar: the price in euros of 1 dollar is 0.5 euros. Accordingly, both e and e' express the same information.

IV 1

Quoting an exchange rate

- The direct quotation of an exchange rate expresses the exchange rate as

$$\frac{\text{domestic (home) currency units}}{\text{foreign currency units}} .$$

- In indirect quotation, the exchange rate is quoted as

$$\frac{\text{foreign currency units}}{\text{domestic (home) currency units}} .$$

- If the euro is the home currency, e = 2 \$/€ expresses the exchange rate using indirect quotation (the quotation chosen determines the units of e).

IV 2

Currency appreciation

- A currency X appreciates with respect to another currency Y if the number of units of Y that one unit of X can buy is increased.
- If X appreciates with respect to Y, X becomes more valuable in terms of Y.
- Using indirect quotation, the home currency appreciates when the exchange rate rises.
- Using direct quotation, the home currency appreciates when the exchange rate falls.

IV 3

Examples of appreciation

- In passing from e = 1 \$/€ to e' = 2 \$/€, the euro appreciates with respect to the dollar. Initially, 1 euro could be traded for only 1 dollar; after the jump in the exchange rate, 1 euro can be traded for 2 dollars, so the euro has increased its value.
- In passing from e = 2 €/¥ to e' = 1 €/¥, the euro appreciates with respect to the yen. Initially, 2 euros were needed to buy one yen; after the fall of the exchange rate, only 1 euro is required to buy a yen, so the euro has increased its value.

IV 4

Currency depreciation

- A currency X depreciates with respect to another currency Y if the number of units of Y that one unit of X can buy is reduced.
- If X depreciates with respect to Y, currency X become less valuable in terms of Y.
- Using indirect quotation, the home currency depreciates when the exchange rate falls.
- Using direct quotation, the home currency depreciates when the exchange rate rises.

IV 5

Examples of depreciation

- In passing from e = 2 \$/€ to e' = 1 \$/€, the euro depreciates with respect to the dollar. Initially, 1 euro could be traded for 2 dollars; after the rise in the exchange rate, 1 euro can only be traded for 1 dollar, so the euro has reduced its value.
- In passing from e = 1 €/¥ to e' = 2 €/¥, the euro depreciates with respect to the yen. Initially, 1 euro could buy 1 yen; after the exchange rate falls, 1 euro can only buy 0.5 yen, so the euro has lost value.

IV 6

IV

Market exchange rates, 9 Feb 2013

7

	USD	GBP	CAD	EUR	AUD
USD	1	0.62990	0.99322	0.75169	0.95072
GBP	1.58756	1	1.57680	1.19336	1.50932
CAD	1.00682	0.63420	1	0.75682	0.95720
EUR	1.33033	0.83797	1.32131	1	1.26476
AUD	1.05184	0.66255	1.04471	0.79066	1

1 € exchanges for 1.33033 $
1 $ exchanges for 0.75169 €

Refresh in 0:52 | Jan 21, 2013 11:29 UTC

http://www.x-rates.com/

	USD	GBP	CAD	EUR	AUD
USD	1	1.58437	0.99672	1.33879	1.0683
GBP	0.631162	1	0.629092	0.844999	0.674273
CAD	1.00329	1.58959	1	1.3432	1.07182
EUR	0.746938	1.18343	0.744488	1	0.797957
AUD	0.936062	1.48307	0.932992	1.25319	1

Monday, February 27, 2012

1 € exchanges for 1.33879 $

1 $ exchanges for 0.746938 €

Alphabetical order — Jan 21, 2013 11:10 UTC

Euro ▲	1.00 EUR ▲▼	inv. 1.00 EUR ▲▼
Argentine Peso	6.584374	0.151875
Australian Dollar	1.264280	0.790964
Bahraini Dinar	0.501556	1.993795
Botswana Pula	10.641423	0.093972
Brazilian Real	2.714622	0.368375
British Pound	0.838164	1.193083
Bruneian Dollar	1.635636	0.611383
Bulgarian Lev	1.955129	0.511475
Canadian Dollar	1.321215	0.756879
Chilean Peso	628.034927	0.001592
Chinese Yuan Renminbi	8.279226	0.120784
Colombian Peso	2356.124402	0.000424
Croatian Kuna	7.578196	0.131958
Czech Koruna	25.579354	0.039094
Danish Krone	7.463196	0.133991
Emirati Dirham	4.885744	0.204677
Hong Kong Dollar	10.313085	0.096964
Hungarian Forint	292.753917	0.003416
Icelandic Krona	170.967649	0.005849
Indian Rupee	71.727447	0.013942
Indonesian Rupiah	12800.301851	0.000078
Iranian Rial	16324.564494	0.000061
Israeli Shekel	4.977133	0.200919
Japanese Yen	119.046752	0.008400
Malaysian Ringgit	4.036420	0.247744
Mauritian Rupee	40.875832	0.024464
Mexican Peso	16.880615	0.059240
Nepalese Rupee	114.989998	0.008696
New Zealand Dollar	1.591461	0.628354
Norwegian Krone	7.460848	0.134033
Omani Rial	0.511919	1.953434
Pakistani Rupee	130.008042	0.007692
Philippine Peso	53.978611	0.018526
Polish Zloty	4.178300	0.239332
Qatari Riyal	4.842909	0.206487
Romanian New Leu	4.352993	0.229727
Russian Ruble	40.285064	0.024823
Saudi Arabian Riyal	4.988599	0.200457
Singapore Dollar	1.635636	0.611383
South African Rand	11.811669	0.084662
South Korean Won	1415.720836	0.000706
Sri Lankan Rupee	168.433635	0.005937
Swedish Krona	8.702729	0.114906
Swiss Franc	1.240458	0.806154
Taiwan New Dollar	38.549246	0.025941
Thai Baht	39.554227	0.025282
Trinidadian Dollar	8.534559	0.117171
Turkish Lira	2.345200	0.426403
US Dollar	1.330178	0.751779
Venezuelan Bolivar	5.719765	0.174832

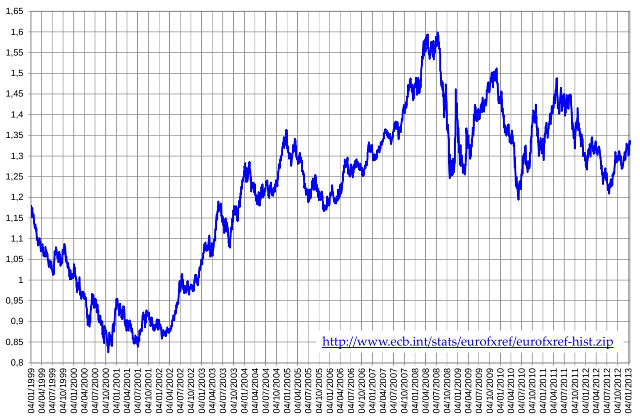
http://www.x-rates.com/table/?from=EUR&amount=1.00

IV 8

IV

Exchange rate $/€ (4 Jan 99 - 18 Jan 13)

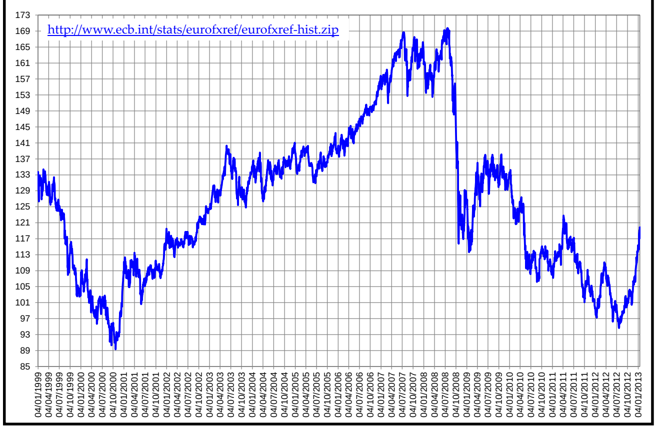
9



IV

Exchange rate ¥/€ (4 Jan 99 - 18 Jan 13)

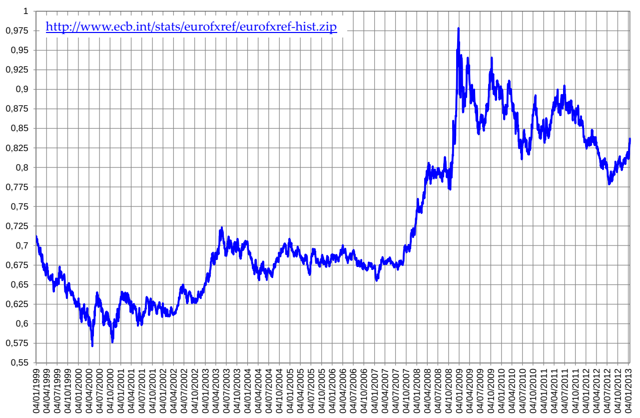
10



IV

Exchange rate £/€ (4 Jan 99 - 18 Jan 13)

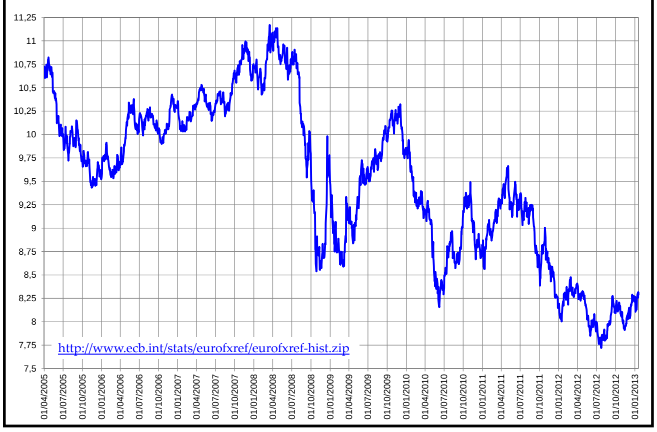
11



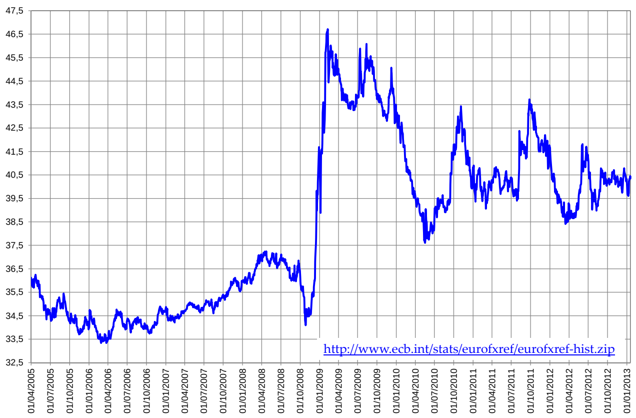
IV

CNY/EUR (1 Apr 05 - 18 Jan 13)

12



RUB/EUR (1 Apr 05 - 18 Jan 13)



The currency (foreign exchange) market

- It is the market for the trading of currencies.
- It is the largest and more liquid financial market in the world (http://en.wikipedia.org/wiki/Currency_market).
- In April 2010, average daily turnover was almost 4 trillion dollars (4×10^{12} = 4,000,000,000,000 dollars). It is estimated that 70%-90% of all the transacctions are speculative.
- The main traders are banks. Inter-bank trading accounts for more of the 50% of all the transactions.

Most traded currencies & currency traders

% daily share (April 2010)

United States dollar	84.9%
Euro	39.1%
Japanese yen	19.0%
Pound sterling	12.9%
Australian dollar	7.6%
Swiss franc	6.4%
Canadian dollar	5.3%
Hong Kong dollar	2.4%
Swedish krona	2.2%
New Zealand dollar	1.6%
South Korean won	1.5%

Top 10 currency traders (May 2012)

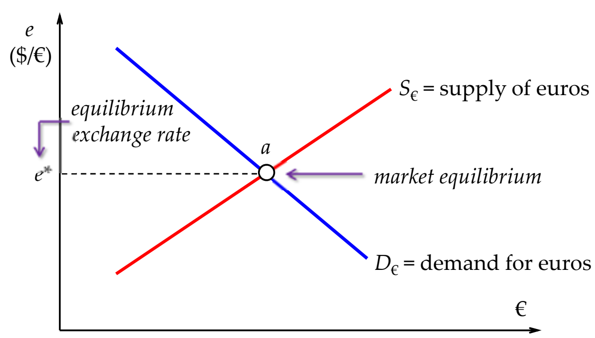
Rank	Name	Market share
1	Deutsche Bank	14.57%
2	Citi	12.26%
3	Barclays Investment Bank	10.95%
4	UBS AG	10.48%
5	HSBC	6.72%
6	JPMorgan	6.6%
7	Royal Bank of Scotland	5.86%
8	Credit Suisse	4.68%
9	Morgan Stanley	3.52%
10	Goldman Sachs	3.12%

 http://en.wikipedia.org/wiki/Currency_market

13. What determines the exchange rate?

- Like the loan market, the currency market is modelled as a competitive market.
- In this market, the euro is the home currency and the dollar is the foreign currency.
- Quantity is the quantity of euros. Price is the exchange rate $/€ quoted indirectly.
- The market demand function $D_€$ is the demand for euros and slopes downward. The upward sloping market supply function $S_€$ is the supply of euros.

Equilibrium exchange rate



Demand for euros

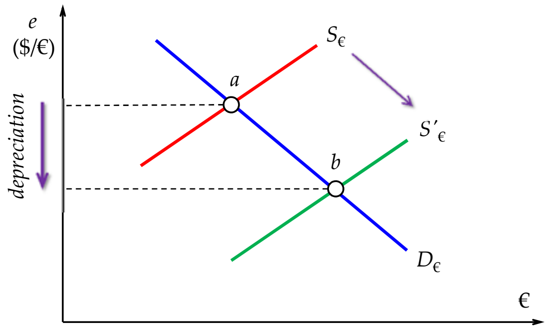
- The demand for euros is, at the same time, a supply of dollars.
- The agents demanding euros have dollars but want to buy European goods and/or financial assets.
- The demand function slopes downward because a reduction in e means that fewer dollars are needed to purchase an euro. This makes European goods and financial assets comparatively cheaper. To buy more such goods and assets, more euros are demanded, so $\downarrow e \Rightarrow \uparrow$quantity demanded of €.

Supply of euros

- The supply of euros is, at the same time, a demand for dollars.
- The agents supplying euros want dollars to buy American goods and/or financial assets.
- The supply function slopes upward because a rise in e means that more \$ are given in exchange for one €, making American goods and financial assets comparatively cheaper. To buy more such goods and assets, more dollars are needed, so more euros are supplied. In sum, $\uparrow e \Rightarrow \uparrow$quantity supplied of €.

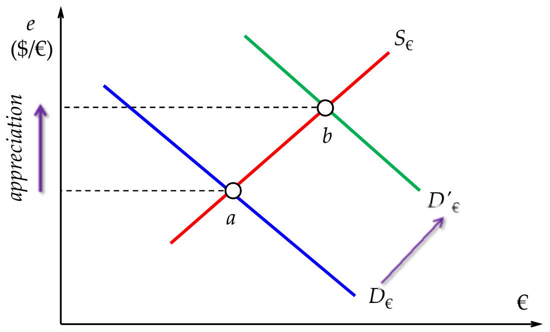
Effect of a GDP increase in Euroland

$$\uparrow GDP_{EU} \Rightarrow \uparrow IM_{EU} \Rightarrow \uparrow D_{\$} \Rightarrow \uparrow S_{€} \Rightarrow \downarrow e$$



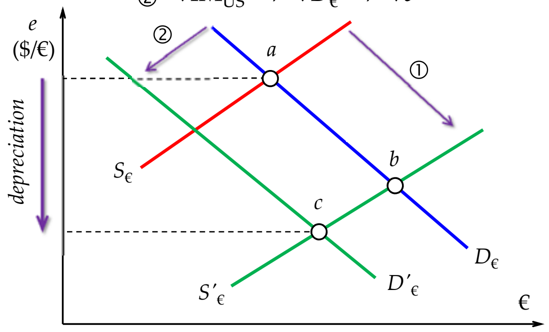
Effect of a GDP increase in the US

$$\uparrow GDP_{US} \Rightarrow \uparrow IM_{US} \Rightarrow \uparrow D_{€} \Rightarrow \uparrow e$$



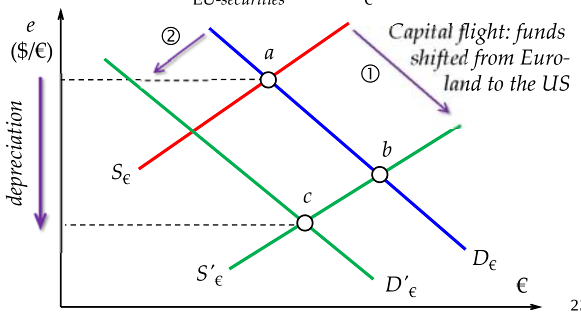
Effect of a rise in Euroland's inflation

$$\uparrow \pi_{EU} \Rightarrow \begin{cases} ① \uparrow IM_{EU} \Rightarrow \uparrow D_{\$} \Rightarrow \uparrow S_{€} \Rightarrow \downarrow e \\ ② \downarrow IM_{US} \Rightarrow \downarrow D_{€} \Rightarrow \downarrow e \end{cases}$$



Effect of a rise in the US interest rate

$$\uparrow i_{US} \Rightarrow \begin{cases} ① \uparrow D^{\text{BY EUROPEANS}}_{\text{US-securities}} \Rightarrow \uparrow D_{\$} \Rightarrow \uparrow S_{€} \Rightarrow \downarrow e \\ ② \downarrow D^{\text{BY AMERICANS}}_{\text{EU-securities}} \Rightarrow \downarrow D_{€} \Rightarrow \downarrow e \end{cases}$$



14. Why is there arbitrage & speculation?

- Arbitrage refers to transactions that, taking advantage of price differences, generate a sure profit.
- Speculation is the same as arbitrage with the only difference that transactions do not guarantee a sure profit: whereas a speculator is taking a risk, an arbitrageur obtains a risk-free profit.
- Almost nothing lies outside the scope of arbitration and speculation: commodities, bonds, currencies, shares, options, real estate, derivatives, futures contracts...

Spatial arbitrage /1

- Spatial arbitrage exploits price differences in different locations.
- Suppose e_L = 2 \$/€ in London and e_N = 3 \$/€ in New York. An arbitrageur would buy euros where they are "cheap" (in London, where buying 1 € just takes 2 \$) to sell them were they are "expensive" (in NY, where you need 3 \$ to get 1 €).
- The sequence 1 € $\rightarrow^{\text{sold in NY}}$ 3 \$ $\rightarrow^{\text{sold in L}}$ 1.5 € generates a sure profit of 0.5 € per euro (a 50% profit rate). It may be continued: 1 € → 3 \$ → 1.5 € → 4.5 \$ → 2.25 € → 6.75 \$ → 3.375 € → …

Spatial arbitrage /2

- Those transactions eventually alter prices. By buying € in London, $D_€$ shifts to the right and ↑e in London: the € appreciates where it is "cheap".
- By selling € in NY, arbitrageurs shift $S_€$ to the right in NY, so ↓e in NY: the € depreciates where it is "expensive".
- So e_L = 2 \$/€ rises and e_{NY} = 3 \$/€ falls. Eventually (may in a matter of minutes), both prices will converge to some value between 2 and 3. Reached that point, spatial arbitrage is no longer possible.

Triangular (or triangle) arbitrage /1

- Based on the idea of taking advantage of price imbalances involving at least three currencies.
- Let exchange rates be 2 \$/€, 3 ¥/\$, and 4 ¥/€. Triangular arbitrage can only occur if the product of two rates is not equal to the third one (in making the product one of the currencies should cancel out).
- The 2nd and 3rd cannot be meaningfully multiplied, as no currency cancels out in 3 ¥/\$ · 4 ¥/€. By taking the inverse 1/3 \$/¥ of 3 ¥/\$ a meaningful product obtains: 1/3 \$/¥ · 4 ¥/€ = 4/3 \$/€ ≠ 2 \$/€. This means that there are arbitrage opportunities.

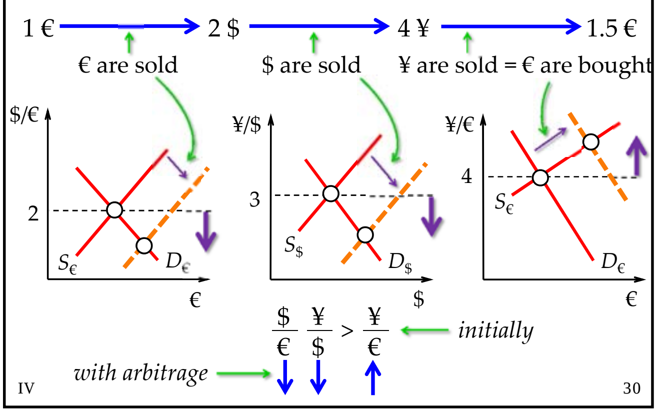
Triangular arbitrage /2

- There are six exchange sequences: € → \$ → ¥, € → ¥ → \$, \$ → € → ¥, \$ → ¥ → €, ¥ → \$ → €, ¥ → € → \$.
- But the 1st is equivalent to both the 3rd and the 5th because all generate the same cycle € → \$ → ¥ → €.
- And the 2nd, 4th, and 5th are equivalent because all generate the same cycle € → ¥ → \$ → €. So there are two ways of trying to exploit price differences, represented by these two exchange cycles.

Triangular arbitrage /3

- One the cycles generates profits; the other, losses.
- The right-hand cycle yields a loss: 1 € → 4 ¥ → 4/3 \$ → 2/3 €. The left-hand one produces a profit: 1 € → 2 \$ → 6 ¥ → 1.5 €.
- As noticed, $\frac{\$}{¥}\frac{¥}{€} < \frac{\$}{€}$: going directly from \$ to € is better than going indirectly through ¥. The step "1€ → 2\$" makes the dollar appreciate, so \$/€ falls. The step "2\$ → 6¥" makes the yen appreciate, so \$/¥ raises. And the step "6 ¥ → 1.5 €" makes the euro appreciate, so ¥/€ rises. Hence, the gap between going directly or indirectly is being closed.

Triangular arbitrage /4



How to become a millionaire in 1 day /1

- Let e = 2 \$/€ today and suppose I expect e = 1.9 \$/€ tomorrow. Imagine that the daily interest rate is 3‰. If my expectation is correct, I can become a millionaire tomorrow. This is the recipe.
- I ask for a loan of, say, 100 million €. Tomorrow I will have to return this amount plus 300,000 €. With my 100 million €, and given the rate e = 2 \$/€, I purchase 200 million \$. I could lend those dollars for a day, but the day has been hard enough. So I just wait for tomorrow.

IV 31

How to become a millionaire in 1 day /2

- Tomorrow comes and I am right. I then sell my 200 million \$ at the rate e = 1.9 \$/€ and get 105,263,157 € (the almost 90 additional cents, left as a tip).
- I next repay my 100 million € debt plus the loan interest of 300,000 €.
- And I finally search for a fiscal paradise that would welcome my remaining 4,963,157 €…
- What if I am wrong and, for instance, e = 2.1 \$/€. Then I have a little problem, since, at that rate, I can only obtain 95,238,095.23 € from my 200 million \$.

IV 32

Short selling (shorting, going short)

- Wikipedia: "Short-selling […] is the practice of selling assets, usually securities, that have been borrowed from a third party […] with the intention of buying identical assets back at a later date to return to the lender" and make a profit.
- "The short seller hopes to profit from a decline in the price of the assets between the sale and the repurchase, as the seller will pay less to buy the assets than the seller received on selling them. Conversely, the short seller will incur a loss if the price of the assets rises."

IV 33

Going short vs going long

- Going long is the opposite strategy: an asset is bought expecting that its price will raise.
- The millionaire example is an instance of short selling: I assumed a debt in € because I expected a depreciation of the €. Hence, by purchasing \$, I expected to obtain next more € for the same dollars, so that the debt could be repaid with cheaper €.
- To limit market volatility, some restrictions to short selling were imposed in September 2008. Short selling is capable of triggering currency crises.

IV 34

Fixed vs floating exchange rates

- There are two basic exchange rate regimes.
- In a fixed exchange rate regime, the government picks an official value of the exchange rate between the domestic currency and some foreign currency (or group of them) and assumes the compromise of defending that value in the foreign exchange market by buying or selling the domestic currency.
- In a floating exchange rate regime, the government lets the market determine the exchange rate. The rest of regimes combine these two (for instance, a floating rate within a fixed fluctuation band).

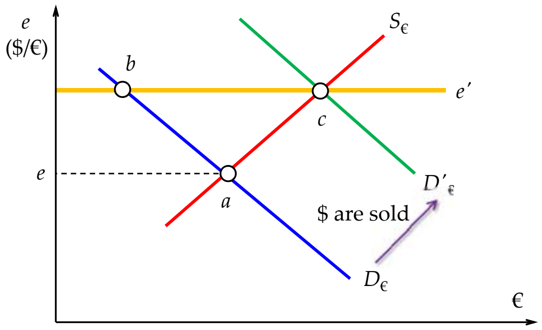
IV 35

Currency market intervention /1

- Let e' be the fixed exchange rate, with the central bank instructed by the govt. to sustain that value.
- Imagine that, for some reason, the exchange rate in the market is $e < e'$ (point a in the graph on slide 57). Having e' as fixed exchange rate means that the central bank must intervene to place the market equilibrium along the horizontal line with value e'.
- It may appear that the central bank may either shift $S_€$ to reach point b or shift $D_€$ to reach point c. The first option is not available, because the central bank cannot force a reduction in the supply of €.

IV 36

Currency market intervention /2



IV 37

Currency market intervention /3

- What the central bank can do is to increase the demand for €. Hence, to reach value e' from point a, <u>the central bank must demand enough €</u> to shift the market demand function from $D_€$ to $D'_€$.
- The problem is that, at point a, the market does not value the euro as the government intends. The solution is to demand more € to raise its value.
- But <u>the purchase of € to raise the value from e to e' must be paid in $</u>. Thus, in passing from a to c, the central bank is spending dollars. Obviously, to sell $ the central bank must have them.

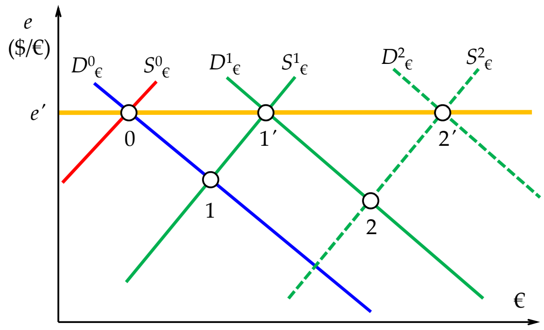
IV 38

Currency crises /1

- A currency crises <u>occurs when a fixed exchange rate cannot be defended</u> (achieved through the intervention of the central bank).
- What if market participants believe that a given rate cannot be defended? They will engage in short-selling: expecting the € to lose value, they will ask for loans in €, and convert the € in $.
- That behaviour shifts $S_€$ to the right, so the € loses value. And a <u>self-fulfilling prophecy</u> emerges: <u>what agents do in response to what they expect to occur contributes to cause what they expect to occur</u>.

IV 39

Currency crises /2



IV 40

Currency crises /3

- On slide 60, the market is initially at 0. A <u>speculative attack</u> unfolds through a massive sale of € (to repurchase them later at a smaller rate). This attack shifts $S_€$ from $S^0_€$ to $S^1_€$, moving the market equilibrium from point 0 to point 1.
- The central bank reacts by selling $, shifting $D_€$ from $D^0_€$ to $D^1_€$. Equilibrium moves from 1 to 1′.
- A second attack shifts $S_€$ from $S^1_€$ to $S^2_€$, reaching 2. If the central bank still has enough $ reserves, equilibrium may be moved to 2′. If not, the attack is successful and market equilibrium remains at 2.

IV 41

Revaluation and devaluation

- A devaluation is a <u>reduction of the fixed exchange rate</u>. It occurs when the government accepts that the former fixed rate cannot be upheld.
- In the previous example, if market participants believe the "right" value to be the one associated with point 2 and the central bank has not enough $ to sustain any other higher value, declaring the market value to be the new fixed exchange rate means devaluating the exchange rate.
- A revaluation is the opposite of a devaluation: an <u>increase of the fixed exchange rate</u>.

IV 42

A famous successful speculative attack

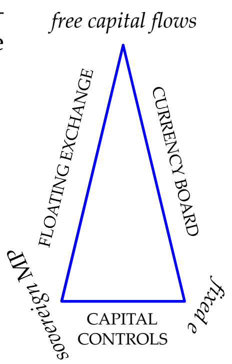
- Took place on the 16th of September, 1992: the Black Wednesday.
- On that date, George Soros became famous for forcing the British government to withdraw from the European Exchange Rate Mechanism (a fixed exchange rate agreement), the predecessor of the €.
- Soros made over 1 billion $ by short selling pound sterlings. Newspapers revealed that the British Treasury spent 27 billion £ trying to sustain the value of the pound.

The impossible trinity

- Due to R. Mundell, it is the trilemma according to which it is not possible to simultaneously have
  - a fixed exchange rate,
  - an independent monetary policy, and
  - free international capital mobility = no capital control.
- Justification: if e is fixed and a monetary policy that expands M1 is applied, then domestic i falls, so e falls. To defend e, domestic currency must be bought in the currency market, so M1 is reduced.

Only two out of three possible

- Independent monetary policy + no capital control ⇒ exchange rate must float (UK, Canada).
- Fixed exchange rates + free mobility of capital ⇒ no independent monetary policy (the countries of the eurozone).
- Fixed exchange rates + independent monetary policy ⇒ capital controls needed (China until recently).



15. What determines competitiveness?

- The real exchange rate e_r is the nominal exchange rate expressed in terms of goods.
- Interpreting "goods" as the basket of goods in the CPI, e_r is the price of the basket in one economy in terms of the basket of the other. Specifically:

$$e_r = e\frac{P}{P^*}$$

where e is quoted indirectly, P is the domestic CPI, and P^* is the foreign CPI. So e_r is e adjusted by the price indices of the two economies. Note that e_r is measured in foreign baskets/domestic basket.

The real exchange rate: an example

- Suppose e = 4 $/€, P = 100 €/basket$_{EU}$, and P^* = 200 $/basket$_{US}$. With these values, how many baskets$_{US}$ could be obtained from 1 basket$_{EU}$?
- As P = 100, 1 basket$_{EU}$ could be sold for 100 €. At the rate e = 4 $/€, 100 € exchange for 400 $. With 400 $ and P^* = 200, 2 baskets$_{US}$ can be purchased.
- This says that the purchasing power of 1 basket$_{EU}$ is 2 baskets$_{US}$. That is, e_r = 2 baskets$_{US}$/baskets$_{EU}$.
- Applying the formula, $e_r = 4 \cdot 100/200 = 2$ (observe that 4·100 is the cost in $ of the basket$_{EU}$).

Competitiveness of an economy

- The real exchange real is a measure of competitiveness: the smaller e_r, the higher the competitiveness of the domestic economy.
- For instance, in passing from e_r = 1 to e_r = 2 domestic competitiveness is eroded: with e_r = 1, foreigners could obtain a domestic basket with just one of their baskets; with e_r = 2, they must deliver 2 of their baskets to get a domestic basket.
- Going from e_r = 1 to e_r = 2 means that it is more expensive for foreigners to purchase our basket, so our economy becomes less competitive.

Real appreciation & real depreciation

- A real appreciation is an increase of e_r (a loss of domestic competitiveness).
- A real appreciation of the exchange rate means that the domestic basket can buy more foreign baskets: the purchasing power of the domestic basket raises.
- A real depreciation is a decrease of e_r (an improvement of domestic competitiveness).
- A real depreciation of the exchange rate means that the domestic basket can buy fewer foreign baskets: the purchasing power of the domestic basket falls.

IV 49

Purchasing power parity

- PPP is the theory that, in the long run, e moves to make e_r equal to 1, so 1 domestic basket exchanges for 1 foreign basket (same purchase power).
- The value of e that makes $e_r = 1$ is $e_{PPP} = P^*/P$.
- Letting domestic and foreign baskets be the same, PPP holds that the price of the basket should be the same in both economies when expressed in the same currency: $eP = P^*$, which is achieved if $e = e_{PPP}$.
- If $e > e_{PPP}$, then domestic currency is said to be overvalued (with respect to its parity value). If $e < e_{PPP}$, it is said to be undervalued.

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PPP and commercial arbitrage /1

- In the absence of transportation costs, PPP can be justified by commercial arbitrage: to buy goods where cheap and to sell them where expensive.
- To illustrate the idea with a simple example, suppose that only one good can be traded between Euroland and the US: Macroeconomic textbooks.
- The price of a textbook in the US is $p^* = 100$ \$; in Euroland, $p = 50$ €. Imagine that $e = 4$ \$/€. Hence, the price in \$ of a Euroland textbook is $4 \cdot 50 = 200$ \$.
- This suggests that textbooks are cheap in the US.

IV 51

PPP and commercial arbitrage /2

- Commercial arbitrageurs would buy textbooks in the US to subsequently ship them to Euroland. Once sold there, euros are converted into dollars.
- Those activities produce the following changes. The purchase of books in the US tends to rise p^*. The sale of those books in Euroland make p fall. And the demand for \$ induces a reduction of e.
- Initially, $ep > p^*$. Thanks to the arbitrage, ep tends to fall and p^* tends to rise. Eventually, $ep = p^*$. This condition stops arbitrage.

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Over and undervaluation: an example

- With $p^* = 100$ \$, $p = 50$ €, and $e = 4$ \$/€, the € is overvalued with respect to the \$. In fact, $e_{PPP} = p^*/p = 100/50 = 2$ \$/€. This is reasonable: since the price of a book in the US doubles the price of a book in Euroland, purchasing power parity demands that 1 € be capable of purchasing 2 \$.
- Having $e = 4$ instead of $e = 2$ implies that the € has more purchasing power than it should have: with 50 €, one book can be bought in Euroland; given $e = 4$, those 50 € can buy 2 books in the US. So the € is a 100% overvalued: $(e - e_{PPP})/e_{PPP} = (4 - 2)/2 = 1 = 100\%$.

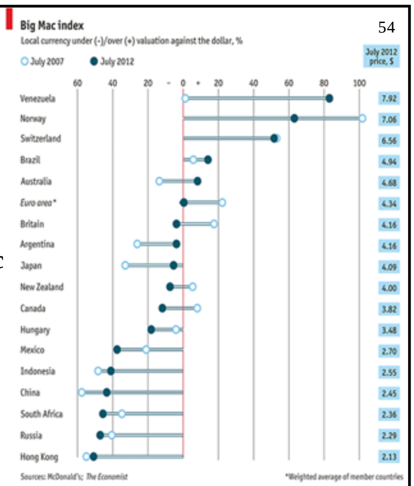
IV 53

IV

Big Mac index

- It is an index set by *The Economist* to test PPP.
- The basket chosen is the BigMac
- The chart & slide 55 show the last data published (25th July 2012).

http://www.economist.com/blogs/graphicdetail/2012/07/daily-chart-17



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IV

Interpreting the Big Mac index data /1

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US = home economy	P^* = BM home price	BM price in \$ = P^*/e	PPP of \$ = P^*/P	market e on 25 July 2012	Over (+) under (-) valuation against \$
US	P = 4.33	–	–	–	–
Brazil	10.08 R\$	4.94	2.33	2.04	8
UK	2.69 £	4.16	1.61 \$/£	1.55 \$/£	-4
China	15.65 ¥	2.45 \$	3.62 ¥/\$	6.39 ¥/\$	-43
Eurozone	3.58 €	5.34	1.21 \$/€	1.21 \$/€	0
India	89 ₹	1.58	20.57	56.17	63
Russia	75 *руб*	2.29	17.33	32.77	-47
Sweden	48.4 kr	6.94	11.18	6.98	60
Venezuela	34 Bs.F.	7.92	7.86	4.29	83

Interpreting the Big Mac index data /2

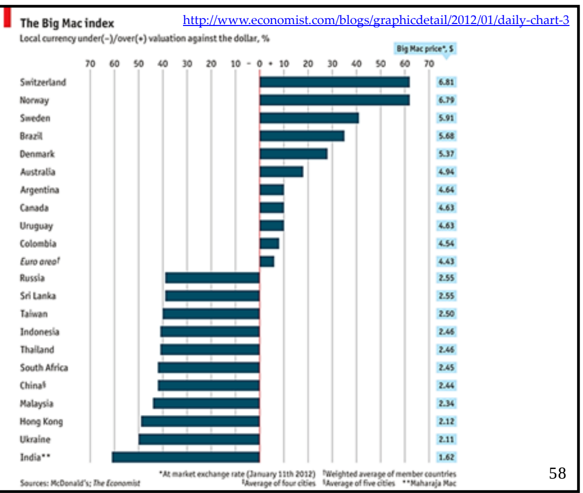
- In Venezuela, the BM was priced at 34 Bs.F. Given the market rate of 4.29 Bs.F./\$, the price in \$ of a BM is 7.92 \$. If parity between the Bs.F. and the \$ held, it should had been 4.33 \$ (the US price). With respect to the \$, the Bs.F. is overvalued a 82.9%.
- At the market exchange rate on 25 July 2012, the price in \$ of a Big Mac in China was 2.45 \$. Since the price of the Big Mac in the US was 4.33 \$, the yuan was undervalued a 43.4% with respect to the \$. PPP predicts that the Bolívar fuerte will eventually depreciate and the yuan will appreciate.

IV 56

Interpreting the Big Mac index data /3

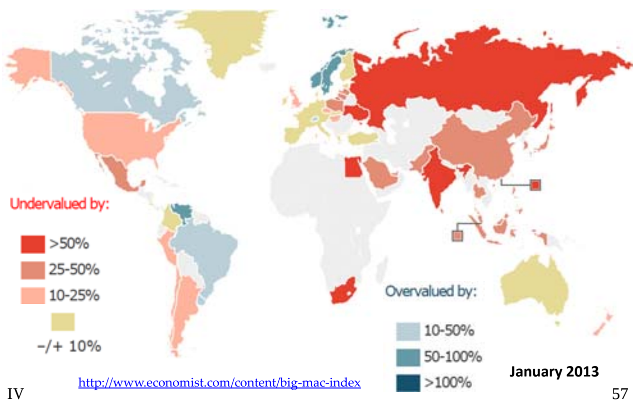
- In the China case, undervaluation results from the comparison of P (the US price of a BM) with P^*/e (the China price of a BM given the exchange rate).
- Undervaluation follows from the fact that $P^*/e < P$, since 2.45 < 4.33. Adopting the Chinese perspective as domestic, $1/e < P/P^*$. Whereas $1/e$ is the market exchange rate (in \$/¥ units), P/P^* is the PPP exchange rate (in \$/¥ units as well).
- Thus, $1/e$ and P/P^* can also be used to compute the undervaluation: $\%undervl = 100\cdot(1/e - P/P^*)/(P/P^*) \approx 100\cdot(0.156 - 0.276)/0.276 \approx -43'4\%$.

IV 57



IV 58

Big Mac index: € over/undervaluation



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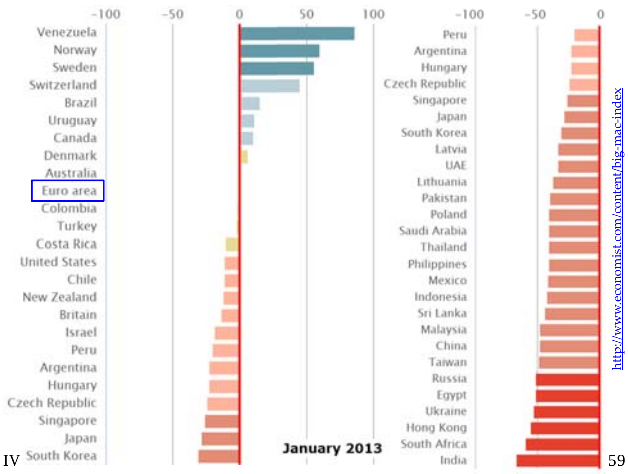

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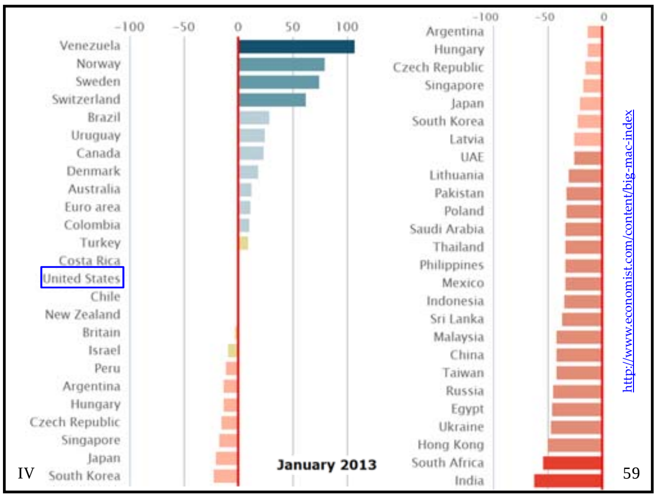
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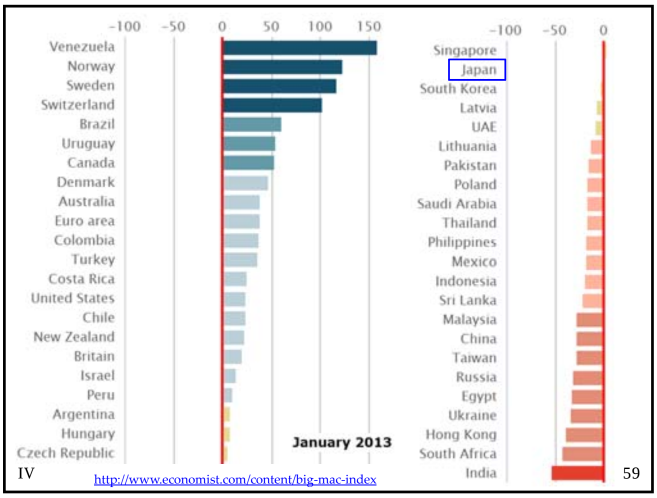
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