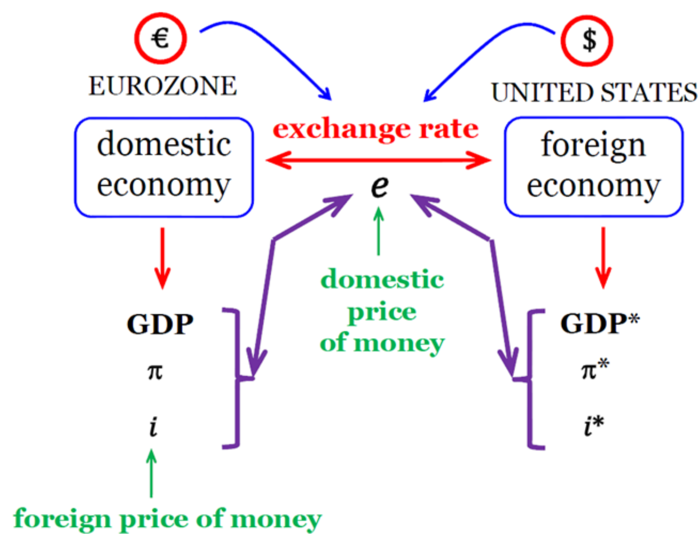
11. Exchange rate and exchange rate determination

1. The exchange rate

Definition 1.1. The nominal exchange rate e (exchange rate, foreign exchange rate, forex rate, FX rate) between two currencies is the price of one currency in terms of the other.

The exchange rate allows domestic purchasing power to be spent abroad. The exchange rate is the basic macroeconomic variable connecting economies with different currencies.

Example 1.2. If $e = 2$ \$/€, one euro can be traded for two dollars: the price in dollars of one euro is two dollars. The inverse $e' = 1/2$ \$/€ of $e = 2$ \$/€ shows how many euros can be traded for one dollar: the price in euros of one dollar is 0.5 euros. Both e and e' express the same information.



The figure on the left summarizes the role played by the exchange rate: it connects economies. Thanks to the exchange rate the domestic economy can make economic transactions with the foreign economy: domestic consumers/producers can buy foreign goods or financial assets, and sell domestic goods or financial assets. These transactions cannot be executed directly because the two economies have different currencies. American citizens are willing to sell American goods in exchange for dollars, not euros. Thus, Europeans willing to buy American goods must convert euros into dollars. This conversion is carried out in the currency (foreign exchange) market.

Therefore, the exchange rate links domestic macroeconomic variables (like GDP, inflation rate, interest rate) with foreign macroeconomic variables. In this module: (i) formulae connecting domestic and foreign interest rates (and domestic and foreing inflation rates) will be suggested; and (ii) the effect of fundamental variables (such as GDP, inflation rate, interest rate) on the exchange rate will be studied.

2. The currency (or foreign exchange) market

Definition 2.1. The currency market is the market for the trading of currencies.

The currency market is the largest and more liquid financial market in the world. Average trading in currency markets in April 2013 was \$5.3 trillion per day (\$4.0 trillion in April 2010; \$3.3 trillion in April 2007). 70% to 90% of all the transacctions are speculative. The main traders are banks (Citi, Deutsche Bank, Barclays Investment Bank, JP Morgan, UBS AG, Bank of America Merill Lynch, HSBC, BNP Paribas, Goldman Sachs…). Interbank trading accounts for more of the 50% of all transactions.

3. Quoting an exchange rate

Definition 3.1. Direct quotation method. The direct quotation (or price quotation) of an exchange rate expresses the exchange rate as domestic (home) currency units / foreign currency units.

Definition 3.2. Indirect quotation method. The indirect quotation (or quantity quotation) of an exchange rate expresses the exchange rate as foreign currency units / domestic (home) currency units.

Example 3.3. Taking the euro as the home currency, then e = 2 $/€ quotes the exchange rate indirectly. When the peseta was the Spanish currency, direct quotation was the norm: e = 150 Pts/$.

The method of quoting an exchange rate e chosen determines the units of e. Direct quotation is the 'natural' way of quoting. The domestic price of a good is expressed as domestic currency units per unit of the commodity (1.2 € per litre of orange juice). Considering the foreign currency as another good, the price of the foreign currency would then be expressed as domestic currency units per foreign currency unit. Despite this, indirect quotation is more convenient because an increase in the value of the domestic currency (with respect to the foreign currency) is represented by a rise in the exchange rate when quoted indirectly, whereas it is represented by a fall when quoted directly.

4. Currency appreciation

Definition 4.1. A currency X appreciates with respect to another currency Y if the number of units of Y that one unit of X can buy increases.

When X appreciates with respect to Y, currency X becomes more valuable in terms of Y. Under indirect quotation the home currency appreciates when the exchange rate rises. Under direct quotation, the home currency appreciates when the exchange rate falls. The chart below plots the rate $/€ between 4 Jan 1999 and 24 Mar 2017 (http://www.ecb.int/stats/eurofxref/eurofxref-hist.zip).

Example 4.2. In passing from e = 1 $/€ to e' = 2 $/€, the euro appreciates with respect to the dollar. Initially, one euro could be traded for only one dollar; after the exchange rate jump, one euro can be traded for two dollars, for which reason the euro has increased its value.

Example 4.3. In passing from e = 2 €/¥ to e' = 1 €/¥, the euro appreciates with respect to the yen. Initially, two euros were needed to buy one yen; after the fall of the exchange rate, only one euro is required to buy one yen, and consequently the euro has increased its value.

5. Currency depreciation

Definition 5.1. A currency X depreciates with respect to another currency Y if the number of units of Y that one unit of X can buy diminishes.

When X depreciates with respect to Y, currency X becomes less valuable in terms of Y. Under indirect quotation the home currency depreciates when the exchange rate falls. Under direct quotation, the home currency depreciates when the exchange rate rises.

Example 5.2. In passing from $e = 2$ \$/€ to $e' = 1$ \$/€, the euro depreciates with respect to the dollar. Initially, one euro could be traded for two dollars; after the rise in the exchange rate, one euro can only be traded for one dollar and, accordingly, the euro has reduced its value.

Example 5.3. In passing from $e = 1$ €/¥ to $e' = 2$ €/¥, the euro depreciates with respect to the yen. Initially, one euro could buy one yen; after the exchange rate falls, one euro can only buy 0.5 yen and, therefore, the euro has lost value.

	USD	GBP	CAD	EUR	AUD
USD	1	0.59676	1.10661	0.72389	1.11928
GBP	1.67571	1	1.85436	1.21302	1.87559
CAD	0.90366	0.53927	1	0.65415	1.01145
EUR	1.38143	0.82439	1.52871	1	1.54621
AUD	0.89343	0.53317	0.98868	0.64674	1

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	USD	GBP	CAD	EUR	AUD
USD	1	0.67704	1.27736	0.94978	1.30688
GBP	1.47701	1	1.88668	1.40283	1.93028
CAD	0.78286	0.53003	1	0.74355	1.02311
EUR	1.05288	0.71285	1.34491	1	1.37599
AUD	0.76518	0.51806	0.97741	0.72675	1

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	USD	GBP	CAD	EUR	AUD
USD	1	0.70366	1.33127	0.91064	1.33984
GBP	1.42113	1	1.89191	1.29414	1.90409
CAD	0.75116	0.52857	1	0.68404	1.00644
EUR	1.09813	0.77271	1.46191	1	1.47132
AUD	0.74636	0.52518	0.99360	0.67966	1

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	USD	GBP	CAD	EUR	AUD
USD	1	▲0.79332	▼1.33494	▲0.91783	▲1.31045
GBP	▼1.26052	1	▼1.68272	▼1.15695	▼1.65185
CAD	▲0.74910	▲0.59428	1	▲0.68755	▲0.98166
EUR	▼1.08952	▲0.86434	▼1.45445	1	▲1.42776
AUD	▼0.76310	▲0.60538	▼1.01869	▼0.70040	1

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Example 5.4. The tables above are taken from http://www.x-rates.com. On 27 Mar 2017, €1 exchanged for \$1.08952. The euro depreciated against the dollar from 28 Feb 2014 to 27 Mar 2017 (the exchange rate decreased from 1.38 \$/€ to 1.08 \$/€). In the same period, the Canadian dollar appreciated against the British pound (the exchange rate increased from 0.53 £/C\$ to 0.59 £/C\$).

6. The orthodox currency market model

Definition 6.1. The orthodox currency market model is a competitive market model, represented in Fig. 2, that determines the nominal exchange rate between just two currencies: home and foreign currency.

In this model, quantity is the quantity of euros and price is the exchange rate \$/€ quoted indirectly. The interpretation is that the euro is the home currency and the dollar is the foreign currency. As in the liquidity market model, it will be assumed that: (i) the supply of euros function $S_€$ slopes upwards; (ii) the demand for euros function $D_€$ slopes downwards; and (iii) both functions intersect at only one point.

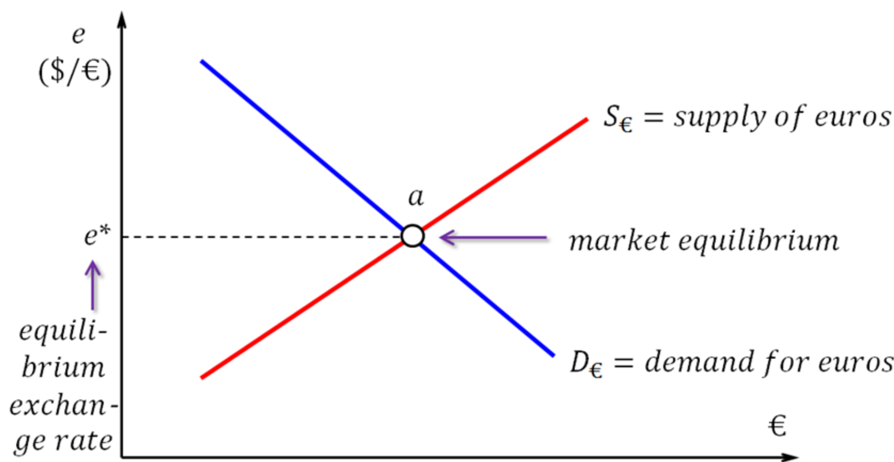


Fig. 1. Graphical representation of the currency market model.

Definition 6.2. The market equilibrium of the currency market model is the pair (e^*, $q_€{}^*$) such that, when the exchange rate is e^*, the supply of euros is $q_€{}^*$ and the demand for euros is also $q_€{}^*$. The value e^* is the equilibrium exchange rate.

7. Demand for euros

Definition 7.1. The demand for euros function associates with each value of the exchange rate e the total amount of euros $q_€$ demanded at that value.

In the model, most of the agents that demand euros are American residents. The agents demanding euros have dollars but want to buy European goods and/or financial assets. Hence, the demand for euros is, at the same time, supply of dollars.

The demand for euros function is assumed to slope 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, so more euros are demanded. The following sequence summarizes the argument leading from ↓e to ↑quantity demanded of euros:

> ↓e ⇒ fewer dollars required to buy one euro ⇒ ↓price in dollars of European goods and financial assets ⇒ ↑quantity demanded by Americans of European goods and financial assets ⇒ ↑quantity demanded by Americans of euros (to buy the additional European goods and financial assets)

8. Supply of euros

Definition 8.1. The supply of euros function associates with each value of the exchange rate e the total amount of euros $q_€$ suplied at that value.

In the model, most of the agents that supply euros are European residents. The agents supplying euros want dollars to buy American goods and/or financial assets. Thus, the supply of euros is, at the same time, demand for dollars.

The supply function is assumed to slope upward because a rise in e means that more dollars are given in exchange for one euro, making American goods and financial assets comparatively cheaper. To buy more such goods and assets, more dollars are needed, so more euros are supplied. The following sequence summarizes the argument leading from ↑e to ↑quantity demanded of euros:

↑e ⇒ more dollars received for one euro ⇒ ↓price in euros of American goods and financial assets ⇒ ↑quantity demanded by Europeans of American goods and financial assets ⇒ ↑quantity supplied by Europeans of euros (to buy the additional American goods and financial assets)

9. The currency market model: some examples

Example 9.1. Effect on the equilibrium exchange rate of a rise in the European GDP; see Fig. 2. A rise in the European GDP means that Europeans have more income to spend. It is likely than spending on goods will increase. In particular, Europeans will spend more on American goods. To buy the additional American goods, Europeans will demand more dollars. Accordingly, since demand for dollars can be identified with supply of euros when the only currencies are euros and dollars, Europeans will increase the supply of euros. This shifts the function $S_€$ to the right, thereby causing a fall in the exchange rate: rise in the European GDP leads to a depreciation of the euro.

Example 9.2. Effect on the equilibrium exchange rate of a rise in the American GDP; see Fig. 3. As shown in Example 10.1, the rise in an economy's GDP causes a depreciation of the domestic currency. Therefore, an increase in the US GDP depreciates the dollar against the euro. Having the dollar depreciated with respect to the euro is equivalent to having the euro appreciated with respect to the dollar. In sum: a rise in the American GDP leads to an appreciation of the euro.

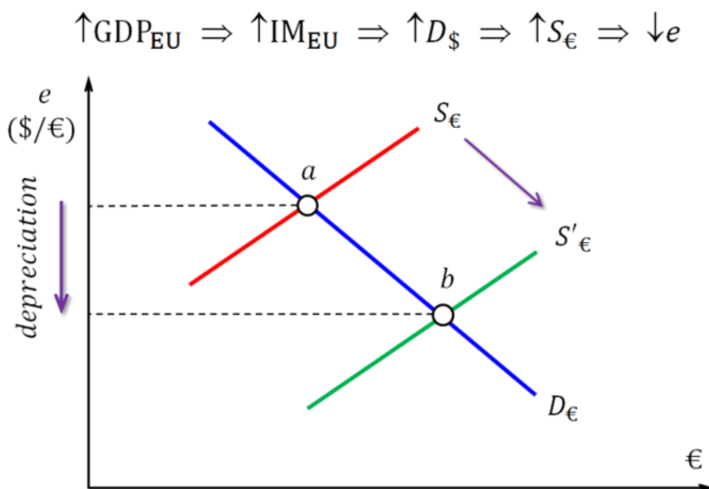


Fig. 2. Effect of a rise in the European GDP

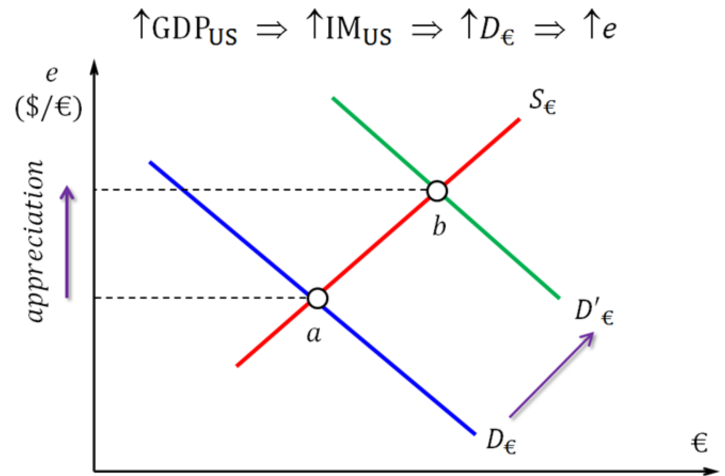


Fig. 3. Effect of a rise in the American GDP

Example 9.3. Effect on the equilibrium exchange rate of a rise in the European inflation rate; see Fig. 4. A rise in the European inflation rate (i) makes American goods comparatively cheaper than American goods to European consumers and (ii) makes European goods comparatively more expensive than American goods to American consumers. Fact (i) encourages European consumers to import more goods from the US, whereas (ii) causes a fall in the US imports from Europe. The increase in European imports from the US shifts the supply of euros function $S_€$ to the right (as Europeans ask for more dollars to purchase more American goods). The reduction in US imports from Europe shifts the demand for euros function $D_€$ to the left (as Americans ask for fewer euros to purchase less European goods). Both shifts lead to a fall in the exchange rate. In sum, a higher European inflation rate depreciates the euro.

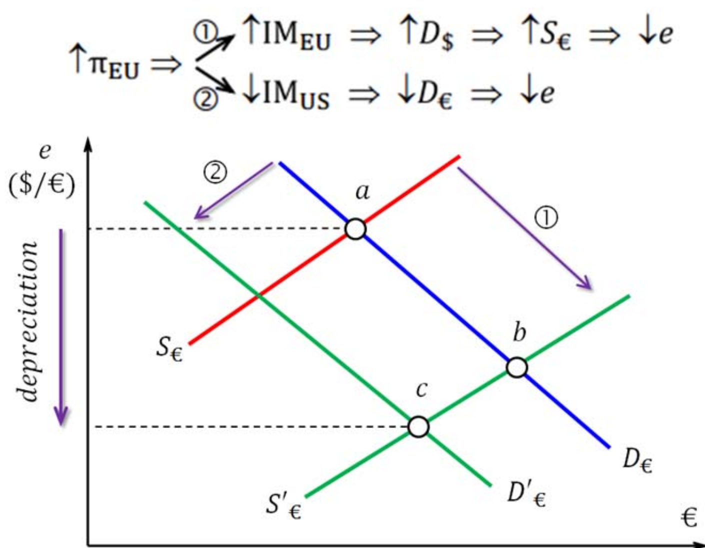


Fig. 4. Effect of a rise in the European inflation rate

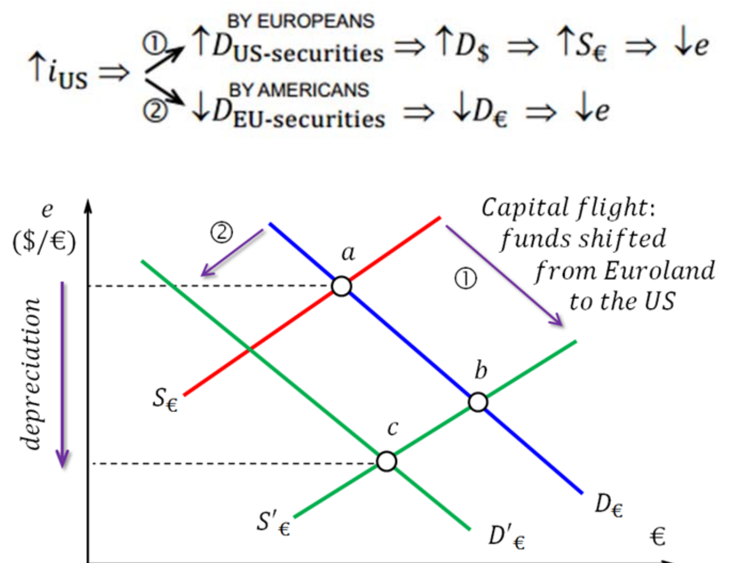


Fig. 5. Effect of a rise in the American interest rate

Example 9.4. Effect on the equilibrium exchange rate of a rise in the American interest rate; see Fig. 5. A rise in the US interest rate (i) makes American financial assets more attractive than European financial assets to European inverstors and (ii) makes European financial assets less attractive than American financial assets to American inverstors. By (i), Europeans increase the demand for American financial assets, the demand for dollars, and the supply of euros, thereby shifting function $S_€$ to the right. By (ii), Americans curtail the demand for European financial assets and reduce accordingly the demand for euros, so the function $D_€$ shifts to the left. All in all, a higher US interest rate depreciates the euro.

10. Arbitrage and speculation

Definition 10.1. Arbitrage refers to market transactions that, taking advantage of price differences, generate a sure profit.

Definition 10.2. 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…

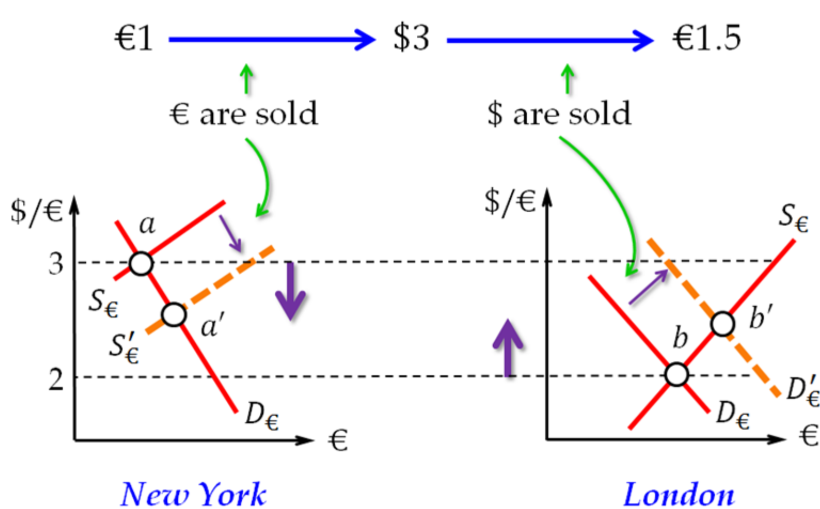
11. Spatial arbitrage

Definition 11.1. Spatial arbitrage exploits price differences in different locations.

Example 11.2. Suppose $e_L = 2$ \$/€ in London and $e_N = 3$ \$/€ in New York; see the figure next. 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).



The cycle may be continued: €1 → $3 → €1.5 → $4.5 → €2.25 → $6.75 → €3.375 → … These transactions eventually alter prices.

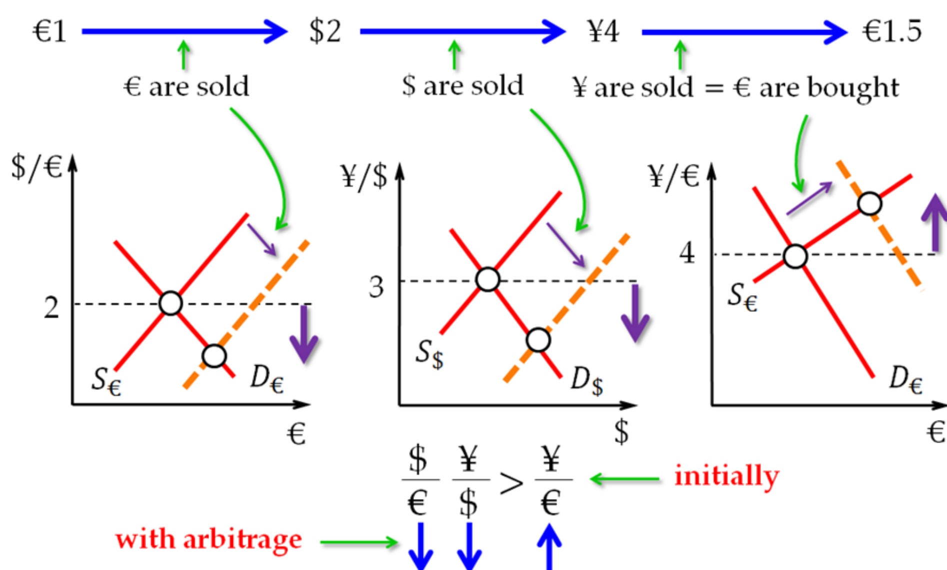
• By buying euros in London, $D_€$ shifts to the right and ↑e in London: the euro appreciates where it is "cheap" (right-hand of the figure on the left).

• By selling euros in New York, arbitrageurs shift $S_€$ to the right in New York, so ↓e in New York : the euro depreciates where it is "expensive" (left-hand side of the figure on the left).

Summing up, $e_L = 2$ $/€ rises and $e_N = 3$ $/€. Eventually (even in minutes), both prices will converge to some value between $e = 2$ and $e = 3$. Reached that value, spatial arbitrage is no longer be possible and, as a result, the exchange rate in both markets, in New York and in London, will coincide.

12. Triangular (or triangle) arbitrage

Definition 12.1. Triangular arbitrage takes advantage of price imbalances involving at least three currencies to obtain a sure profit by buying/selling the three currencies.



Example 12.2. Let exchange rates be 2 $/€, 3 ¥/$, and 4 ¥/€; see the figure on the left. Triangular arbitrage can only occur if the product of two rates is not equal to the third one (the product of the three rates is meaningful if one currency cancels out). The product 3 ¥/$ · 4 ¥/€ is not meaningful, as no currency cancels out. By taking the inverse $\frac{1}{3}$ $/¥ of 3 ¥/$ a meaningful product obtains: $\frac{1}{3}$ $/¥ · 4 ¥/€ = $\frac{4}{3}$ $/€ ≠ 2 $/€.

This means that there are arbitrage opportunities. There are six exchange sequences:

(1) € → $ → ¥ (2) € → ¥ → $ (3) $ → € → ¥
(4) $ → ¥ → € (5) ¥ → $ → € (6) ¥ → € → $.

But (1) is equivalent to both (3) and (5) because all generate the cycle € → $ → ¥ → €. And (2), (4), and (6) are equivalent because all generate the cycle € → ¥ → $ → €. As a a consequence, there are two ways of trying to exploit price differences, represented by the two exchange cycles shown just above. One the cycles generates profits; the other, losses. The right-hand cycle produces a loss: €1 → ¥4 → $4/3 → €2/3. The left-hand

one yields a profit: €1 → $2 → ¥6 → €1.5. As noticed, $\frac{\$}{¥} \cdot \frac{¥}{€} < \frac{\$}{€}$: going directly from $ to € is more profitable than going indirectly through ¥. The step '€1 → $2' makes the dollar appreciate: $/€ falls. The step '$2 → ¥6' makes the yen appreciate: $/¥ rises. The step '¥6 → €1.5' makes the euro appreciate: ¥/€ rises. Thus the gap between going directly or indirectly between any two currencies tends to close.

13. How to become a millionaire in one day

Example 13.1. Let $e = 2$ $/€ today and suppose I expect $e' = 1.9$ $/€ tomorrow. Imagine that the overnight (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 exchange rate $e = 2$ $/€, I purchase $200 million. I could lend those dollars for a day, but since the day has been hard enough I just wait for tomorrow.

Tomorrow comes and I am right. I then sell the $200 million at the rate $e' = 1.9$ $/€ and get €105,263,157 (the 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 the rate e', I can only obtain €95,238,095.23 from my $200 million. That means that I incur a big loss.

Definition 13.2. Short-selling consists of (i) borrowing some good or financial asset to (ii) sell it, expecting to make a profit by (iii) buying the good or asset later, when it is time to return it to the lender, at a smaller price (so the short-seller expects to make a profit from a price decline).

Definition 13.3. Going long is the strategy opposite to short-selling: an asset is bought expecting that its price will rise.

Example 13.1 illustrates short selling: I assumed a debt in euros because I expected a depreciation of the euro. Hence, by purchasing dollars, I expected to obtain next more euros for the same dollars, so that the debt could be repaid with cheaper euros.

Remark 13.4. To limit market volatility, some restrictions to short selling were imposed in September 2008. In fact, short selling is capable of triggering currency crises.

14. Fixed vs floating exchange rates

There are two basic exchange rate regimes: fixed exchange and floating exchange regime.

Definition 14.1. 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. If the value of the domestic currency is pegged to the value of another currency, the latter is known as the anchor currency.

Definition 14.2. In a floating (or flexible) exchange rate regime, the government lets the currency market determine the value of the exchange rate.

The remaining regimes combine the previous two in different degrees. Such intermediate regimes are called managed float regime.

Definition 14.3. In the managed float exchange rate regime (or "dirty float") the government seeks to influence the exchange rate by buying and selling currencies at will.

15. Currency market intervention by the central bank (CB)

Let e' be the fixed exchange rate, with the CB instructed by the government to sustain that value. Imagine that the exchange rate in the market is actually $e < e'$; see point a in Fig. 6. Having e' as a fixed exchange rate means that the CB must intervene to place the market equilibrium along the horizontal line with value e'. The problem is that, at point a, the market does not value the euro as the government intends. The solution is to demand more euros to rise its value.

It may appear that the CB may either shift $S_€$ to reach point b or shift $D_€$ to reach point c. The first option is not available, since the CB cannot force a reduction in the supply of euros. What the CB can do is to expand the demand for euros. Thus, to reach value e' from point a, the CB must demand enough euros to shift the market demand function from $D_€$ to $D'_€$. But the purchase of euros to rise the value from e to e' must be paid in dollars. Accordingly, in passing from a to c, the CB spends dollars. Obviously, to sell dollars the CB must have them (or arrange a dollar loan, in general granted by other CBs).

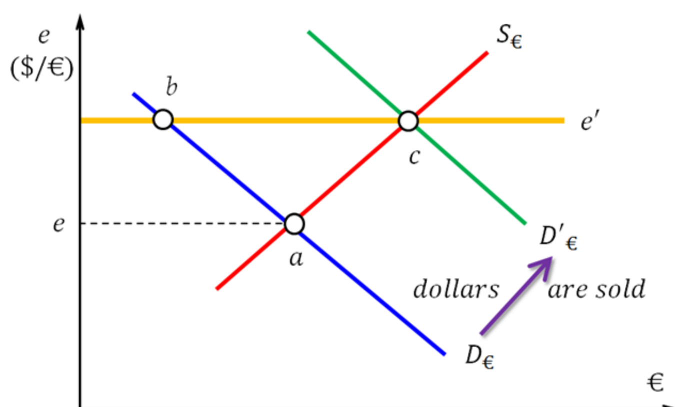


Fig. 6. CB intervention when the currency is undervalued

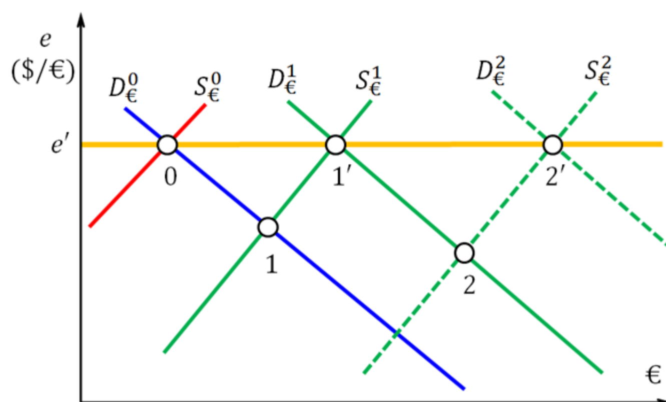


Fig. 7. Trying to avoid a currency crisis

16. Currency crises and speculative attacks

Definition 16.1 (imprecise). A currency crisis typically arises when a fixed exchange rate cannot be defended, that is, achieved through central bank intervention in the currency market.

What if market participants believe that a given exchange rate cannot be defended? They will probably engage in short-selling: expecting the euro to lose value, they will ask for loans in euros, and buy dollars with them. This shifts $S_€$ to the right, so the euro loses value. And here it is a self-fulfilling prophecy: what agents do in response to what they expect to occur contributes to cause what they expect to occur.

Example 16.2. Fig. 7 represents the events that hasten a currency crises. The fixed exchange rate is e' and the market is initially at point 0. A speculative attack unfolds through a massive sale of euros, to repurchase them later cheaper, at a smaller rate. This attack shifts $S_€$ from $S_€^0$ to $S_€^1$, moving the market equilibrium from point 0 to point 1. To defend the fixed rate, the central bank reacts by selling dollars, shifting $D_€$ from $D_€^0$ to $D_€^1$. Market equilibrium then moves from 1 to 1′.

Excursus 16.3. A priori, a currency is equally likely to appreciate or depreciate. In this respect, mounting a speculative attack without further information is a 50-50 bet, which does not look promising for a speculator. Moreover, in this case, some speculators may bet that the currency is going to depreciate and others that it is going to appreciate, so the two attacks may cancel each other or, in any event, may make the defense of the fixed rate easier. Therefore, to ignite a speculative attack some reason must point to a specific unidirectional and persistent modification in the exchange rate. There must be some objective feature of the economy creating a tendency for the currency to either appreciate or depreciate. That feature will coordinate all speculators to bet in only one direction: either all believe that an appreciation will occur or all believe that it will be a depreciation. Accordingly, a speculative attack is most likely to be conducted for some objective reason whose effects on the currency the attack exacerbates. It is worth noticing as well that it is easier for the central bank to fight a speculative attack based on the bet that the currency is going to appreciate: in that case, to sustain the fixed exchange rate, the CB needs only to sell what it owns in abundance, namely, the domestic currency. Consequently, the archetypal currency crisis will arise when a speculative attack is launched against the currency because some feature in the economy automatically leads the currency to depreciate (for instance, a domestic inflation rate higher than the inflation rate in the rest of the world).

Example 16.2 (continued). A second attack shifts $S_€$ from $S_€^1$ to $S_€^2$, reaching point 2. If the central bank still has enough dollar reserves, equilibrium may be moved to 2′. If not, the attack is successful and market equilibrium remains at 2: the attack has been successful and has led to a sharp decline in the exchange rate. In this case, the government accepts the new exchange and devaluates the currency (reduces the fixed exchange rate).

17. Revaluation and devaluation

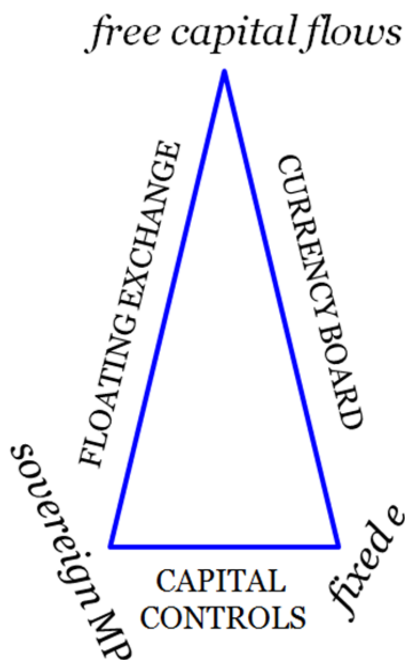
Definition 17.1. A devaluation is a reduction of the fixed exchange rate and occurs when the government accepts that the former fixed rate cannot be upheld as it makes the domestic currency to be overvalued with respect to its market (or sustainable or 'fundamental') value.

In Example 16.2, if market participants believe the 'right' value to be the one associated with point 2 and the central bank has not enough dollars to sustain any other higher value, declaring the market value to be the new fixed exchange rate means devaluating the exchange rate.

Definition 17.2. Revaluation is the opposite of devaluation: fixed exchange rate reset at a higher level.

Example 17.3. 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, predecessor of the euro). Soros made a gain of 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.

18. The impossible trinity (or open economy trilemma)



Definition 18.1. Due to Nobel Prize in Economics recipient Robert Mundell, the impossible trinity 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 (that is, no capital control).

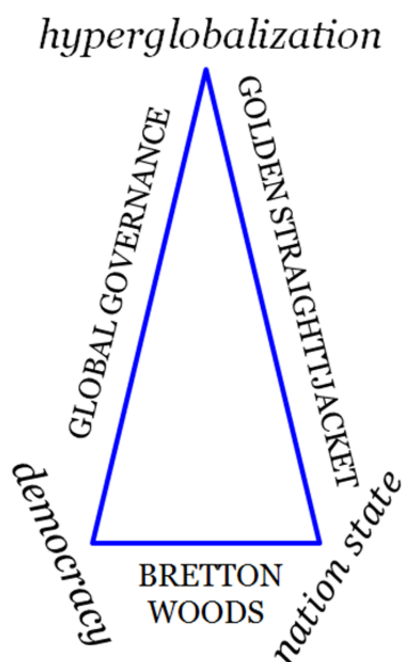
The justification of the impossibility is as follows: if e is fixed and a monetary policy that expands **M1** is applied, then domestic i falls, so e falls. To defend e, domestic currency must be bought in the currency market, so **M1** is reduced. The figure on the left depicts the options.

• **Option 1. Floating exchange.** If an independent monetary policy and no capital control are chosen, the exchange rate must float (UK, Canada).

• **Option 2. Currency board.** Opting for fixing the exchange rate and allowing the free mobility of capital implies that monetary policy can no longer be independent. It can be interpreted that the countries in the eurozone have chosen this option: their monetary policy was been handed to a supranational authority, the European Central Bank. When it is a single country that takes this option, the resulting monetary authority is called a currency board, and its goal is merely to adopt the monetary policy of the country (or countries) to which the exchange rate is pegged and be willing to convert into the pegged currency any request of conversion of any amount of domestic currency. Argentina had a currency board in the 1990s when the fixed exchange rate was set as one Argentinian peso per US dollar.

• **Option 3. Capital controls.** If it is chosen to control both the foreign value of the domestic currency, by fixing the exchange rate, and its domestic value (the interest rate), by deciding which monetary policy to conduct, then capital controls must be established (China until recently).

19. Rodrik's trilemma



Definition 19.1. The term 'globalization' refers to the process and consequences of the opening up of domestic markets (from both the real and the financial sector) to the international markets.

Definition 19.2. Rodrik's fundamental political trilemma of the world economy (tension between national democracy and global markets); see the left figure. "We cannot have hyperglobalization, democracy, and national self-determination all at once […] If we want hyperglobalization and democracy, we need to give up on the nation state. If we must keep the nation state and want hyperglobalization too, then we must forget about democracy. And if we want to combine democracy with the nation state, then it is bye-bye deep globalization." Dani Rodrik (2011): *The globalization paradox: democracy and the future of the world economy*.

There are three options to handle the tension between national democracy and global markets that the trilemma expresses. "We can restrict democracy in the interest of minimizing international transaction costs, disregarding the economic and social whiplash that the global economy occasionally produces. We can limit globalization, in the hope of building democratic legitimacy at home. Or we can globalize democracy, at the cost of national sovereignty." Dani Rodrik (2011): *The globalization paradox*.

• **Option 1. The Golden Straightjacket.** Hyperglobalization means that national borders do not interfere at all with the circulation of goods, services, and capital. If a nation state becomes hyperglobalized, then domestic regulations and taxes must be consistent with the requirements of hyperglobalization and, in particular, with ensuring that the domestic economy remains attractive to, and earns the confidence of, international investors and traders. Therefore, domestic policy must be subordinated to comply with the conditions of economic globalization by adopting such policies as:

- a strict monetary policy ('tight money');
- "flexible" labour markets;
- deregulation, privatization, and minimize public intervention ('small government');
- keep taxes (particularly, capital and corporate taxes) low;
- maintain the economy sufficiently open to the rest of the world ('open borders').

When this set of policies is adopted it is said that the nation state wears The Golden Straightjacket on. The government putting on this jacket is free from domestic (economic or social) obligations or constraints. The requirements of the global economy dictate the domestic policy. Signs of wearing the jacket:

- economic policy-making institutions (central banks, market regulators) turn 'independent' from democratic control;
- social insurance is reduced (privatized);
- corporate taxes and the top income taxes lowered; and
- policy goals are subordinated to keep market confidence.

• **Option 2. Bretton Woods compromise** ('thin' version of globalization). This compromise merely implies a reduced international discipline: each nation state enjoys sufficient freedom to pursue domestic goals, like development levels, as long as restrictions on capital flows are implemented. Since nation states can follow their own paths of development, domestic differences can be maintained and enlarged.

• **Option 3. Global governance**. The global governance option involves removing the nation state in order to have democratic policies and hyperglobalization. This option amounts to relocating politics to the global level, in the sense that rule making becomes supranational (the European Union is a regional example). The difficulties with option 3 emerge from the possibility that there is too much diversity among nation states to make global federalism a practical option.

Rodrik (*One economics, many recipes: globalization, institutions, and economic growth*, 2007, p. 43) claims that "Sustaining growth is more difficult than igniting it". A generalization of this observation is that it is harder for an economy to remain in a (non-spontaneous) state than to achieve it. Globalization seems to illustrate this generalization: more effort is necessary for an economy to remain globalized than to become globalized. Argentina in the mid-1990s become hyperglobalized very quickly, but the cost of maintaining that state turned out to be unsustainable and led to the catastrophic crisis of 2001.

20. Real exchange rate

Definition 20.1. The real exchange rate e_r is the relative price of the basket of goods defined in the CPI in two economies: e_r is the price of the basket in one economy in terms of the basket of the other. Specifically:

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

where e is quoted indirectly, P is the domestic CPI, and P^* is the foreign CPI.

Loosely speaking, the real exchange is the nominal exchange rate expressed in terms of good, where the term 'goods' is interpreted as the basket of goods in the CPI. More precisely, the real exchange rate expresses the rate at which the domestic basket (domestic goods) can be exchanged for the foreign basket (foreign goods). Equivalently, the real exchange rate e_r is the nominal exchange e adjusted by the price indices of the two economies. Note that e_r is measured in foreign baskets/domestic basket.

Example 20.2. Suppose $e = 4$ $/€, $P = 100$ €/basket$_{\text{EU}}$, and $P^* = 200$ $/basket$_{\text{US}}$. With these values, how many baskets$_{\text{US}}$ could be obtained from one basket$_{\text{EU}}$? As $P = 100$, basket$_{\text{EU}}$ could be sold for €100. At the rate $e = 4$ $/€, €100 exchange for $400. With $400 and $P^* = 200$, 2 baskets$_{\text{US}}$ can be purchased. This says that the purchasing power of 1 basket$_{\text{EU}}$ is 2 baskets$_{\text{US}}$. That is, $e_r = 2$ baskets$_{\text{US}}$/basket$_{\text{EU}}$. Applying the formula, $e_r = 4 \cdot 100/200 = 2$ baskets$_{\text{US}}$/basket$_{\text{EU}}$ ($4 \cdot 100$ is the cost in dollars of the basket$_{\text{EU}}$).

The real exchange real can be considered a measure of the competitiveness of an economy: the smaller e_r, the higher the competitiveness of the domestic economy.

Example 20.1. 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 the domestic economy becomes less competitive.

21. Real appreciation and real depreciation

Definition 21.1. 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.

Definition 21.2. 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.

22. Purchasing power parity (PPP)

Definition 22.1. The purchasing power parity exchange rate e_{PPP} is the nominal exchange rate e that makes $e_r = 1$; that is, $e_{\text{PPP}} = P^*/P$.

Definition 22.2. Purchasing power parity theory (PPP) is the theory according to which, in the long run, e is automatically adjusted to make e_r equal to 1 (so $e = e_{PPP}$) and, as a result, one domestic basket exchanges for one foreign basket (which implies that both baskets have the same purchase power).

With domestic and foreign baskets being the same, PPP holds that the price of the basket should be the same in both economies when expressed in the same currency: $e \cdot p = P^*$, which holds if $e = e_{PPP}$.

Definition 22.3. If $e > e_{PPP}$, then the domestic currency is said to be overvalued (with respect to its parity value). If $e < e_{PPP}$, it is said to be undervalued. The percentage of overvaluation is $\frac{e - e_{PPP}}{e_{PPP}}$.

Example 22.4. With $p^* = \$100$, $p = €50$, and $e = 4$ \$/€, the euro is overvalued with respect to the dollar. 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 euro has more purchasing power than it should: with €50, one book can be bought in Euroland; given $e = 4$, €50 can buy 2 books in the US. The euro is then a 100% overvalued: $\frac{e - e_{PPP}}{e_{PPP}} = \frac{4-2}{2} = 1 = 100\%$.

23. PPP and commercial arbitrage

Definition 23.1. Commercial arbitrage consists of buying goods where they are cheap and selling them where they are expensive.

In the absence of transportation costs, PPP can be justified by commercial arbitrage.

Example 23.2. 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, $p = €50$. Letting $e = 4$ \$/€, the price in dollars of a Euroland textbook is 4 \$/€ · €50 = \$200. Consequently, textbooks are cheap in the US. Commercial arbitrageurs would proceed as shown in Fig. 8 (it is assumed that textbooks can be sent from one economy to the other at no transport cost).

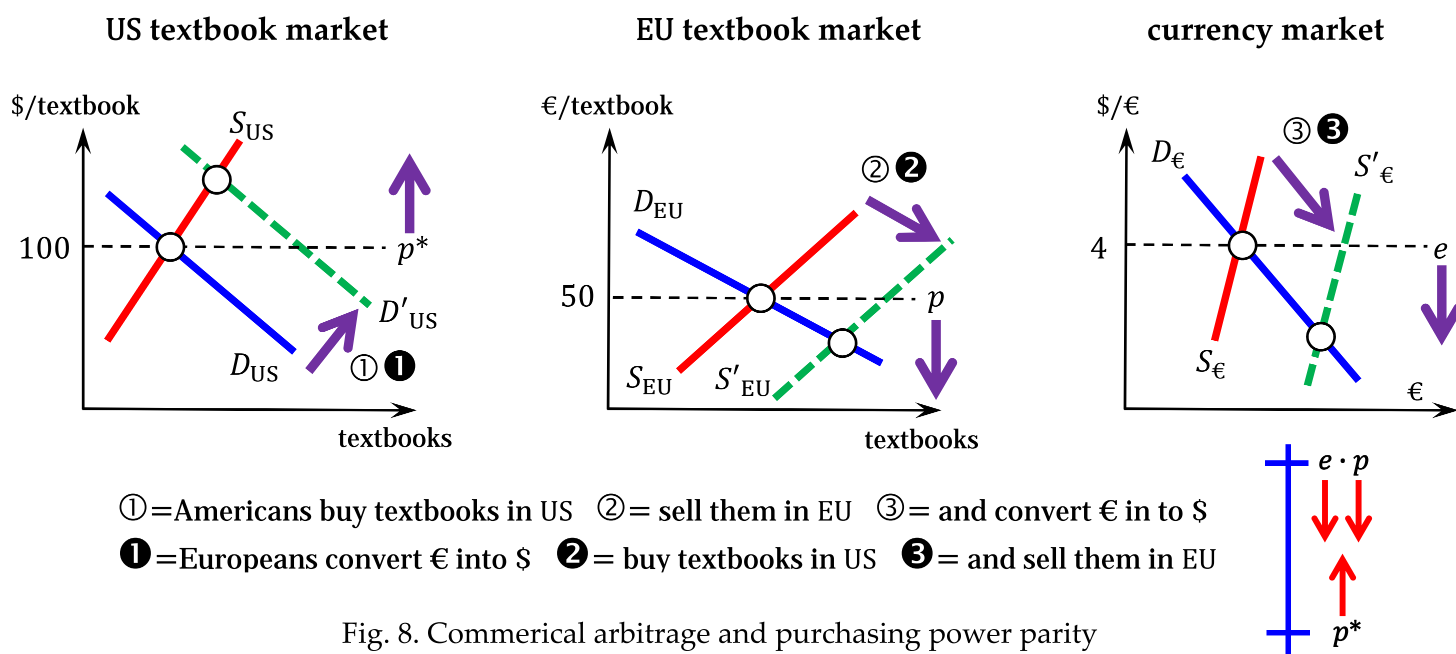


Fig. 8. Commerical arbitrage and purchasing power parity

- If the arbitrageur is an American, then he or she will buy textbooks in the US to subsequently ship them to Euroland; once sold there, euros are converted into dollars.
- If the arbitrageur is a European, then he or she will first convert euros are converted into dollars, buy textbooks in the US to finally ship them to Euroland and sell them there.

The purchase of books in the US tends to rise p^*. The sale of those books in Euroland make p fall. More dollars demanded lower e. Initially, $4{\cdot}50 = e \cdot p > p^* = 100$. By arbitrage, $e \cdot p$ tends to fall and p^* tends to rise. Eventually, $e \cdot p = p^*$. This condition stops arbitrage and makes e reach the PPP value p^*/p .

24. Relative purchasing power parity

Definition 24.1. Relative purchasing power parity, the dynamic version of the (absolute) purchasing power parity, holds that the exchange rate moves to neutralize inflation differentials. Concretely, define the rate of appreciation of the exchange rate between two currencies as $\hat{e} = \frac{e - e_{-1}}{e_{-1}}$, where e is the current value of the exchange rate and e_{-1} is its value in the immediately preceding period. Let π denote the domestic inflation rate, and π^* the foreign inflation rate, between these two periods. The exact version of the parity is given by (1), whereas its common formulation, an approximation of (1), is given by (2).

$$1 + \hat{e} = \frac{1 + \pi^*}{1 + \pi} \tag{1}$$

$$\hat{e} \approx \pi^* - \pi \tag{2}$$

If the euro is the domestic currency, the dollar is the foreign currency, and the units of e are \$/€, then (2) asserts that the rate of appreciation of the euro is approximately equal to the difference between the US inflation rate and the European inflation rate.

Example 24.2. Suppose $\pi^* = 5\%$ and $\pi = 25\%$. Then, by (2), $\hat{e} \approx 5 - 25 = -20\%$: the euro must depreciate by 20% to compensate for the fact that European prices grow 20 points faster than American prices.

Remark 24.3. Absolute PPP implies relative PPP but not vice versa. In fact, if absolute PPP holds, then (1) can be obtained as follows.

$$1 + \hat{e} = 1 + \frac{e - e_{-1}}{e_{-1}} = 1 + \frac{e}{e_{-1}} - 1 = \frac{e}{e_{-1}} \overset{\text{PPP}}{=} \frac{\frac{P^*}{P^*_{-1}}}{\frac{P}{P_{-1}}} = \frac{\frac{P^*}{P}}{\frac{P^*_{-1}}{P_{-1}}} = \frac{1 + \frac{P^*}{P} - 1}{1 + \frac{P^*_{-1}}{P_{-1}} - 1} = \frac{1 + \pi^*}{1 + \pi}$$

25. The uncovered interest rate parity

Definition 25.1. The uncovered interest rate parity establishes a relationship between the domestic interest rate i, the foreign interest rate i^*, and the expected rate of appreciation $\hat{e}^e = \frac{e^e - e}{e}$ of the domestic currency with respect to the foreign currency. The exact version of the uncovered interest rate parity is given by (3), whereas its usual formulation is given by (4) (taxes are expressed in per one terms).

$$\hat{e}^e = \frac{i^* - i}{1 + i} \tag{3}$$

$$\hat{e}^e \approx i^* - i \tag{4}$$

Equation (3) can be justified by the equality of returns from investing domestically and investing abroad. Specifically, suppose an investor has €1 to lend in period t and the loan is repaid in $t + 1$. The domestic interest rate between t and $t + 1$ is i. The foreign interest rate between t and $t + 1$ is i^*. The exchange rate in t is e \$/€. The investor faces at least the following two options; see Fig. 9.

• Option 1. To lend the euro at home in t. In this case, in $t + 1$, the investor receives €$(1 + i)$.

• Option 2. To lend the euro abroad in t. This option involves exchanging the euro for e dollars (since the exchange rate is e \$/€) in order to next lend the e dollars abroad. As a result, in $t + 1$, the investor receives \$$(1 + i^*)\cdot e$. If, in t, the investor expects the exchange rate in $t + 1$ to be e^e, then the investor expects to obtain €$(1 + i^*)\cdot e/e^e$.

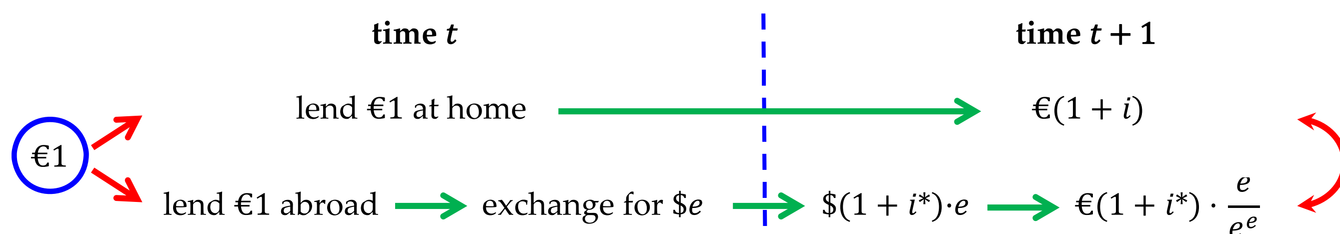


Fig. 9. Justification of the uncovered interest rate parity

The presumption that both options produce the same result implies that $1 + i = (1 + i^*)\cdot \frac{e}{e^e}$ or, equivalently, $\frac{e}{e^e} \cdot (1 + i) = 1 + i^*$, which is equivalent to $\left(1 + \frac{e}{e^e} - 1\right) \cdot (1 + i) = 1 + i^*$. That is, $(1 + \hat{e}^e) \cdot (1 + i) = 1 + i^*$. Therefore, $1 + \hat{e}^e + i + \hat{e}^e \cdot i = 1 + i^*$. Solving for $\hat{e}^e$ leads to (3). The approximation (4) of (3) follows if i is small enough. For sufficiently small i, $1 + i \approx i$ and consequently (4) approximates (3).

An interpretation of (4) is as follows. Suppose the foreign interest rate i^* abroad is larger than the domestic interest rate i. This means that $i^* - i > 0$. The interest parity condition (4) contends that, in this case, an appreciation of the domestic currency should be expected: $\hat{e}^e > 0$ (which means that $e^e > e$). This appreciation is required to compensate for the fact that investing abroad is, in terms of interest rates, more profitable. In other words, the higher return obtained by investing abroad is reduced by a loss when converting the foreign currency back into the domestic currency, so that the net result is the same as if investment had been at home.

Remark 25.2. The term "uncovered" refers to the fact that e^e is an expectation, not an actual value: the option of investing abroad is not covered against the risk of predicting the exchange rate wrongly.

If the domestic interest is higher than the foreign interest, $i^* - i < 0$, then what (4) demands is to expect a depreciation of the domestic currency: $\hat{e}^e < 0$ (that is, $e^e < e$).

Example 25.3. Suppose $i = 5\%$ and $i^* = 25\%$. Then, by (4) , it must be that $\hat{e}^e \approx i^* - i = 0.25 - 0.05 = 0.2 = 20\%$: the expectation should be that domestic currency will appreciate by 20%. Using the exact version (3) of the interest parity, $\hat{e}^e = \frac{i^* - i}{1 + i} = \frac{0.25 - 0.05}{1.05} = \frac{0.20}{1.05} = \frac{20}{105} = \frac{4}{51} \approx 0.238 = 23.8\%$. Since 5% is not a small value for the domestic interest, (3) and (4) differ significantly.

Remark 25.4. If parities (2) and (4) hold, and if expectations are correct, $\hat{e} \approx \pi^* - \pi$, $\hat{e}^e \approx i^* - i$, and $\hat{e}^e = \hat{e}$. Hence, $\pi^* - \pi \approx i^* - i$: the inflation differential between countries reflects the interest differential.