

Lesson II: Overview

1. Foreign exchange markets: everyday market practice
2. Forward foreign exchange market

Foreign exchange markets: everyday market practice

Getting started I

- The exchange rates printed in financial newspapers are normally mid-rates, standing half way between the quoted bid-ask rates.



- **Bid**: rate at which a certain market player is willing to **buy**
- **Ask**: rate at which a certain market player is willing to **sell**

Bid rate < Ask rate

Getting started II

Ask rate - Bid rate = Bid/Ask Spread

The bid-ask spread can be conceived as a transaction cost.

Getting started III

Apart from two notable exceptions (GBP and EUR), all the other major currencies are quoted in European terms, that is foreign currency per USD



F/USD → think of these exchange rates as the buying and selling prices of US dollars.

Getting started IV

For instance, **CHF/ bid\$** is the rate at which a certain mkt player is willing to buy USD against CHF and **CHF/ ask\$** is the rate at which the same mkt player sells USD against CHF.

$$\mathbf{CHF/ bid\$ < CHF/ ask\$}$$

Getting started V

Conversely, EUR and GBP are quoted in USD equivalent



USD/F → think of these exchange rates as the buying and selling prices of EUR or GBP.

Getting started VI

For instance, $\$/ \text{bid} \pounds (\text{€})$ is the rate at which a certain mkt player is willing to buy GBP (EUR) against USD and $\$/ \text{ask} \pounds (\text{€})$ is the rate at which the same mkt player sells GBP (EUR) against USD.

$$\$/ \text{bid} \pounds (\text{€}) < \$/ \text{ask} \pounds (\text{€})$$

Terminology



Source: Bloomberg, 18th January 2013

BIG FIGURE

PIPS (1 pip = $\frac{1}{100}$ of a percentage point)

Bid-ask quotations I

USD/EUR				JPY/USD			
1.33	14 ⁵	17 ⁵	1.33	89.	94 ⁵	97 ⁵	89.
1.32695	1.32700	1.33870	1.33875	88.135	88.140	90.130	90.140

Source: Bloomberg, 18th January 2013

- \$ 1.33145/bid€ means that the price provider is willing to buy EUR at 1.33145 USD;
- \$ 1.33175/ask€ means that the price provider is willing to sell EUR at 1.33175 USD

Bid-ask quotations II

USD/EUR				JPY/USD			
1.33	14 ⁵	17 ⁵	1.33	89.	94 ⁵	97 ⁵	89.
1.32965	1.33980		89.645	90.205			
1.32695	1.32700	1.33870	1.33875	88.135	88.140	90.130	90.140

Source: Bloomberg, 18th January 2013

- ¥ 89.945/bid\$ means that the price provider is willing to buy USD at 89.945 JPY;
- ¥ 89.975/ask\$ means that the price provider is willing to sell USD at 89.975 JPY

Bid-ask quotations III



Equivalent notations

- $\$/\text{bid}\pounds = \text{ask}\$/\text{bid}\pounds \rightarrow$ rate at which the price provider is willing to buy GBP against (selling) USD (i.e. the buying rate for GBP and the selling rate for USD)

Bid-ask quotations IV



Equivalent notations

- $\$/ask\pounds = bid\$/ask\pounds \rightarrow$ rate at which the price provider is willing to sell GBP against (buying) USD (i.e. the selling rate for GBP and the buying rate for USD)

Bid-ask quotations V



Given $\$/\text{bid}\pounds$ and $\$/\text{ask}\pounds$, **what if you were to sell/buy GBP?**

- $\$/\text{bid}\pounds$ = number of USD you will receive from the bank from the sale of GBP per USD
- $\$/\text{ask}\pounds$ = the price that you must pay to buy GBP from USD

Reciprocal rates and the bid-ask spread

When bid-ask prices are taken into account:

$$S_{i / askj} = \frac{1}{S_{j / bidi}}$$

and

$$S_{i / bidj} = \frac{1}{S_{j / aski}}$$

Some evidence on the bid-ask spread

The bid ask spread tends to:

- 1. vary throughout the day** → in particular, the spread is higher:
 - at the start/end of the trading day;
 - on Fridays (at closing), on Mondays (at opening) as well as on the last trading day of the month;
 - on market holidays (for big financial centers)
- 2. increase with the volatility of the spot rate**
- 3. decrease when more dealers are in the market:**
 - the larger the dealers, the thinner the spread

Cross rates, triangular arbitrages and the bid-ask spread I

Suppose you were to buy GBP from EUR and assume that:

S(\$/bid€)	S(\$/ask€)	S(\$/bid£)	S(\$/ask£)	S(£/bid€)	S(£/ask€)
1.1020	1.1050	1.5775	1.5810	.6960	.6965

In principle, you could either choose a direct transaction (you sell EUR to buy GBP) or an indirect transaction via USD (you first sell EUR to buy USD and then you sell USD to buy GBP)

Cross rates , triangular arbitrages and the bid-ask spread II

Indirect transaction:

$S(\$/bid\text{€})$	$S(\$/ask\text{€})$	$S(\$/bid\text{£})$	$S(\$/ask\text{£})$
1.1020	1.1050	1.5775	1.5810

- $S_{\$/bid\text{€}} = 1.1020$ (sell € to buy \$)
- $S_{\$/ask\text{£}} = 1.581$ (sell \$ to buy £)
- $S_{\text{£}/bid\text{€}} = \frac{S_{\$/bid\text{€}}}{S_{\$/ask\text{£}}} = \frac{1.1020}{1.581} = .6970$

Cross rates , triangular arbitrages and the bid-ask spread III

Direct transaction:

$S(\text{£/bid€})$	$S(\text{£/ask€})$
.6960	.6965

1. $S_{\text{£/bid€}} = .6960$ (sell € to buy \$)

Cross rates, triangular arbitrages and the bid-ask spread IV

The best available solution is the one that allows you to get more GBP per EUR.



As long as $S_{\text{£} / \text{bid} \text{€}} \geq \frac{S_{\text{\$/bid} \text{€}}}{S_{\text{\$/ask} \text{£}}}$, you are better off choosing the direct transaction.

Cross rates, triangular arbitrages and the bid-ask spread V

Conversely, whenever $S_{\text{£} / \text{bid} \text{€}} \leq \frac{S_{\text{\$/bid} \text{€}}}{S_{\text{\$/ask} \text{£}}}$, the

indirect transaction will give you a better return.

Cross rates, triangular arbitrages and the bid-ask spread VI

In practice, however, **triangular arbitrage opportunities** are very **unlikely to materialize**



An increasing number of people will try to profit from the price differential and will consequently sell € → buy \$ → sell \$ → buy £, thus driving € down and £ up, until equilibrium is finally restored (**No free lunch principle**)



$$S_{\text{£} / \text{bid} \text{€}} = \frac{S_{\$ / \text{bid} \text{€}}}{S_{\$ / \text{ask} \text{£}}}$$

To put it into practice

	Bid	Ask
USD/Currency 1	1.35135	1.35227
Currency 2/USD	83.3650	83.3925

- 1) How much would you lose if you converted \$1000 into Currency1 and then back into USD?
- 2) What is the bid-ask spread for Currency 2/USD?
- 3) What is the bid-ask spread of Currency1 in terms of Currency2?
- 4) How much would you lose if you converted \$1000 into Currency 1, then into Currency 2 and finally back into USD?

Forward foreign exchange market

Spot vs Forward markets

- *Spot exchange rate*: FX rate that is contracted today for immediate delivery (generally, $t+1$ or $t+2$)
- *Forward exchange rate*: rate that is contracted today for the exchange of currencies on a specific date in the future (1m, 3m, 6m...).

The forward market

Exactly **like** the **spot market**:

- No central location
- 24h trading
- *Direct interbank market* (decentralized, continuous, open-bid, double-auction) & *indirect broker market* (quasi-centralized, continuous, limit-book, single-auction market) [Lesson I]
- Bid-ask quotation

Conventions for fwd FX quotations I

Currencies London close on Jan. 9

	Per euro	In euros	Per U.S. dollar	In U.S. dollars
AMERICAS				
Argentina peso-a	5.5006	0.1818	1.5300	0.6527
Brazil real	2.3462	0.4262	1.8412	0.5431
Canada dollar	1.3092	0.7639	1.0274	0.9734
Chile peso	653.79	0.001530	513.06	0.001949
Colombia peso	2395.88	0.0004174	1880.00	0.0005319
Ecuador US dollar-f	1.2743	0.7847	1	1
Mexico peso-a	17.5050	0.0571	13.7370	0.0728
Peru sol	3.4316	0.2914	2.6930	0.3713
Uruguay peso-e	24.972	0.0400	19.597	0.0510
U.S. dollar	1.2743	0.7847	1	1
Venezuela bolivar	5.54	0.180401	4.35	0.229885
ASIA-PACIFIC				
Australia dollar	1.2477	0.8015	0.9792	1.0213
1-mo. forward	1.2525	0.7984	0.9829	1.0174
3-mos. forward	1.2602	0.7935	0.9890	1.0112
6-mos. forward	1.2711	0.7867	0.9975	1.0025
China yuan	8.0484	0.1242	6.3160	0.1583
Hong Kong dollar	9.8968	0.1010	7.7664	0.1288
India rupee	66.7739	0.0150	52.4005	0.0191
Indonesia rupiah	11664	0.0000857	9153	0.0001093
Japan yen	97.98	0.010206	76.89	0.013005
1-mo. forward	97.95	0.010210	76.86	0.013010
3-mos. forward	97.85	0.010220	76.79	0.013023
6-mos. forward	97.68	0.010238	76.65	0.013046
Malaysia ringgit-c	4.0181	0.2489	3.1532	0.3171
New Zealand dollar	1.6234	0.6160	1.2740	0.7849
Pakistan rupee	114.681	0.0087	89.995	0.0111
Philippines peso	56.120	0.0178	44.040	0.0227
Singapore dollar	1.6535	0.6048	1.2975	0.7707
South Korea won	1478.31	0.0006764	1160.10	0.0008620
Taiwan dollar	38.523	0.02596	30.231	0.03308
Thailand baht	40.507	0.02469	31.788	0.03146
EUROPE				
Euro zone euro	1	1	0.7847	1.2743
1-mo. forward	0.9999	1.0001	0.7847	1.2744
3-mos. forward	0.9993	1.0007	0.7842	1.2752
6-mos. forward	0.9982	1.0018	0.7834	1.2765
Czech Rep. koruna-b	25.742	0.0388	20.201	0.0495
Denmark krone	7.4556	0.1345	5.8351	0.1714
Hungary forint	316.04	0.003164	248.01	0.004032
Norway krone	7.6648	0.1305	6.0149	0.1663
Poland zloty	4.4917	0.2226	3.5240	0.2837
Russia ruble-d	40.665	0.02459	31.912	0.03134
Sweden krona	8.8172	0.1134	6.9192	0.1445
Switzerland franc	1.2135	0.8241	0.9523	1.0501
1-mo. forward	1.2130	0.8244	0.9519	1.0506
3-mos. forward	1.2114	0.8255	0.9507	1.0519
6-mos. forward	1.2089	0.8272	0.9487	1.0541
Turkey lira	2.3866	0.4190	1.8729	0.5339
U.K. pound	0.8256	1.2112	0.6479	1.5434
1-mo. forward	0.8259	1.2109	0.6481	1.5430
3-mos. forward	0.8263	1.2102	0.6485	1.5421
6-mos. forward	0.8271	1.2090	0.6491	1.5406
MIDDLE EAST/AFRICA				
Bahrain dinar	0.4803	2.0818	0.3770	2.6529
Egypt pound-a	7.6929	0.1300	6.0370	0.1656
Israel shekel	4.8997	0.2041	3.8450	0.2601
Jordan dinar	0.9041	1.1061	0.7095	1.4095
Kuwait dinar	0.3553	2.8142	0.2789	3.5862
Lebanon pound	1918.39	0.0005213	1505.45	0.0006643
Saudi Arabia riyal	4.7789	0.2093	3.7503	0.2666
South Africa rand	10.4221	0.0959	8.1787	0.1223
United Arab dirham	4.6805	0.2137	3.6730	0.2723

European terms

USD equivalent

Conventions for fwd FX quotations II

Forward rates are generally quoted in terms of the corresponding spot rate \pm a suitable number of swap points, depending on the forward maturity taken into consideration



Swap points will be added to (subtracted from) the spot bid-ask quotes whenever they are ascending (descending)

Conventions for fwd FX quotations III

Given the spot rates and the swap points below, how to find the corresponding fwd bid-ask quotation?

Spot	6-month swap
1.3965-70	27-23

Descending swap points \rightarrow to be subtracted

$$F_{\text{bid}} = 1.3965 - .0027 = 1.3938$$

and

$$F_{\text{ask}} = 1.3970 - .0023 = 1.3947$$

Fwd FX quotations

The bid-ask spread for forward quotations is wider as time to maturity increases → this is mostly due to market “**thinness**”



Thinness: smaller trading volumes for longer maturity forwards → it is more difficult for banks to offset positions in the interbank forward market after taking orders to buy or sell forwards

Fwd notation

Forward exchange rate: rate that is contracted today for the exchange of currencies on a specific date in the future.

$F_n(i/j)$ is the n-year forward exchange rate of currency i per unit of currency j

Forward premium and discount I

When it is necessary to pay more (less) for forward delivery than for spot delivery of a currency, we say that the currency is at a **forward premium (discount)**.

Forward premium and discount II

N-year forward premium/discount (on a yearly basis)

$$\frac{F_{ni/j} - S_{i/j}}{nS_{i/j}}$$

Forward premium and discount III

$$S_{¥/\$} = 76.89 \text{ and } F_{.5 \text{ ¥}/\$} = 76.65$$

$$\text{premium / discount} = \frac{76.65 - 76.89}{.5 \cdot 76.89} = -.00624$$



Fwd discount of the Dollar versus the Yen (\equiv fwd premium of the Yen versus the Dollar)

Forwards and expected future spot rates

Assuming **risk neutrality** and **no transaction costs**, forward rates must be equal to expected future spot rates (to prevent all arbitrage opportunities):

$$F_{ni/j} = E[S_{i/j}]$$

Indeed, what would happen if

$$F_{ni/j} > (\text{or } <) E[S_{i/j}]?$$

FX net turnover by mkt segment and mkt instrument

Global foreign exchange market turnover by instrument¹

Average daily turnover in April, in billions of US dollars

Instrument	1998	2001	2004	2007	2010
Foreign exchange instruments	1,527	1,239	1,934	3,324	3,981
Spot transactions ²	568	386	631	1,005	1,490
Outright forwards ²	128	130	209	362	475
Foreign exchange swaps ²	734	656	954	1,714	1,765
Currency swaps	10	7	21	31	43
Options and other products ³	87	60	119	212	207
<i>Memo:</i>					
<i>Turnover at April 2010 exchange rates⁴</i>	<i>1,705</i>	<i>1,505</i>	<i>2,040</i>	<i>3,370</i>	<i>3,981</i>
<i>Exchange-traded derivatives⁵</i>	<i>11</i>	<i>12</i>	<i>26</i>	<i>80</i>	<i>166</i>

Source: www.bis.org

Terminology I

- **Outright fwd contract:** agreement to exchange currencies at a pre-determined price on a future date.
- **FX Swap:** agreement to buy and sell foreign exchange at pre-specified exchange rates, where the buying and selling are separated in time (two major components: a spot transaction plus a forward transaction in the reverse direction).



A **swap-in (swap-out) €** consists of an agreement to buy (sell) € spot and to sell (buy) them forward

Terminology II

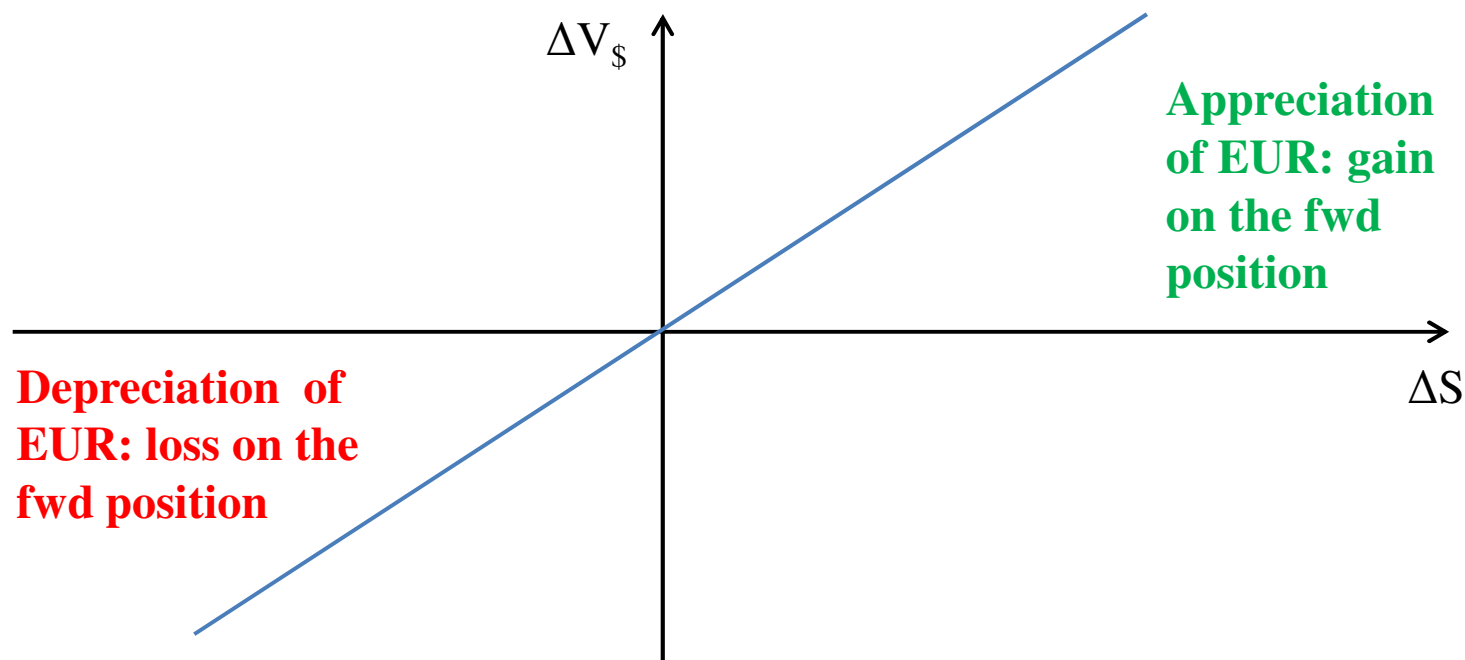
- **Currency Swap:** agreement involving two parties in the exchange of principal and interest payments on a loan in one currency for principal and interest payments in another currency.
- **Options:** derivative contracts that give the buyer the opportunity to buy (call) or to sell (put) the underlying asset at a given price sometime in the future

Forwards' payoff profile I

When the forward contract matures, its value is determined by the realized spot rate at that time.

Forwards' payoff profile II

Long forward position to buy 1 million € with \$ in n-months' time.



$F_{\$/\text{€}} = E[S_{\$/\text{€}}]$, $\Delta S = (\text{realized } S_{\$/\text{€}} - F_{\$/\text{€}})$ and $\Delta V_{\$} = \$ \text{ gain or loss on the forward position}$

Benefits and Risks of Forwards

- High flexibility (not only major currencies, tailor-made maturities, deliverable vs non-deliverable);
- No central counterparty → higher settlement risk