

# Lesson II: Overview

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



# Foreign exchange markets: everyday market practice



# Getting started I

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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

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**Ask rate - Bid rate = Bid/Ask Spread**

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

# Getting started III

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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

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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.

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

# Getting started V

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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

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

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



# Terminology

The screenshot shows a Bloomberg terminal window titled 'EBS Non-Premium Rates'. It displays two exchange rate pairs: USD/EUR and JPY/USD. The USD/EUR rates are shown in a 'Big Figure' format, with the integer part (1.37) in yellow and the fractional part (09 5 and 12 5) in blue boxes. The JPY/USD rates are shown in a 'Pips' format, with the integer part (101) in yellow and the fractional part (84 5 and 87 5) in blue boxes. A red box highlights the '101' in the JPY/USD rates, with two red arrows pointing from it to the 'BIG FIGURE' and 'PIPS' labels below. The bottom row of the table shows bid and ask prices for both pairs.

Pair	Rate 1	Rate 2	Rate 3	Rate 4	Rate 5	Rate 6	Rate 7	Rate 8
USD/EUR	1.37	09 5	12 5	1.37				
	1.36945	1.37240						
	1.36740	1.36745	1.37150	1.37150				
JPY/USD	101	84 5	87 5	101.				
	101.390	101.990						
	101.570	101.570	102.400	102.410				

Source: Bloomberg, 17<sup>th</sup> February 2014

**BIG FIGURE**

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

# Bid-ask quotations I

The screenshot shows a Bloomberg window titled "EBS Non-Premium Rates" with a "Properties" button in the top right. It displays two columns of data. The left column is for USD/EUR, showing a bid of 1.37095 and an ask of 1.37125. The right column is for JPY/USD, showing a bid of 101.845 and an ask of 101.875. Below these are several rows of smaller numbers in green and red, representing various market rates.

Pair	Rate 1	Rate 2	Rate 3	Rate 4	Rate 5	Rate 6	Rate 7	Rate 8
USD/EUR	1.37095	1.37125	1.36945	1.37240	1.36740	1.36745	1.37150	1.37150
JPY/USD	101.845	101.875	101.390	101.990	101.570	101.570	102.400	102.410

Source: Bloomberg, 17<sup>th</sup> February 2014

- **\$ 1.37095/bid€** means that the price provider is willing to buy EUR at 1.37095 USD;
- **\$ 1.37125/ask€** means that the price provider is willing to sell EUR at 1.37125 USD

# Bid-ask quotations II



USD/EUR				JPY/USD			
1.37	09 <sup>5</sup>	12 <sup>5</sup>	1.37	101.	84 <sup>5</sup>	87 <sup>5</sup>	101.
1.36945	1.37240			101.390	101.990		
1.36740	1.36745	1.37150	1.37150	101.570	101.570	102.400	102.410

Source: Bloomberg, 17<sup>th</sup> February 2014

- **¥ 101.845/bid\$** means that the price provider is willing to buy USD at 101.845 JPY;
- **¥ 101.875/ask\$** means that the price provider is willing to sell USD at 101.875 JPY

# Bid-ask quotations III

## Equivalent notations



**$\$/bid\pounds = ask\$/bid\pounds$**   $\rightarrow$  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 & bid-ask spread

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When bid-ask prices are taken into account:

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

and

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

# Evidence on the bid-ask spread

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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



# A practical insight 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)



# A practical insight II

## Indirect transaction:

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

1.  $S_{\$/bid\text{€}} = 1.1020$  (sell € to buy \$)
2.  $S_{\$/ask\text{£}} = 1.581$  (sell \$ to buy £)
3.  $S_{\text{£}/bid\text{€}} =$

$$\frac{S_{\$/bid\text{€}}}{S_{\$/ask\text{£}}} = \frac{1.1020}{1.581} = .6970$$

# A practical insight III

## Direct transaction:

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

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

# Cross rates, arbitrages, B-A spread I

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



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



# Cross rates, arbitrages, B-A spread II

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, arbitrages, B-A spread III

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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  $\text{€} \rightarrow \text{buy } \$ \rightarrow \text{sell } \$ \rightarrow \text{buy } \text{£}$ , thus driving  $\text{€}$  down and  $\text{£}$  up, until equilibrium is finally restored (**No free lunch principle**)



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

# 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

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- *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

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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

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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 II

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

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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

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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)**.

## **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)

# Fwd & 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

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

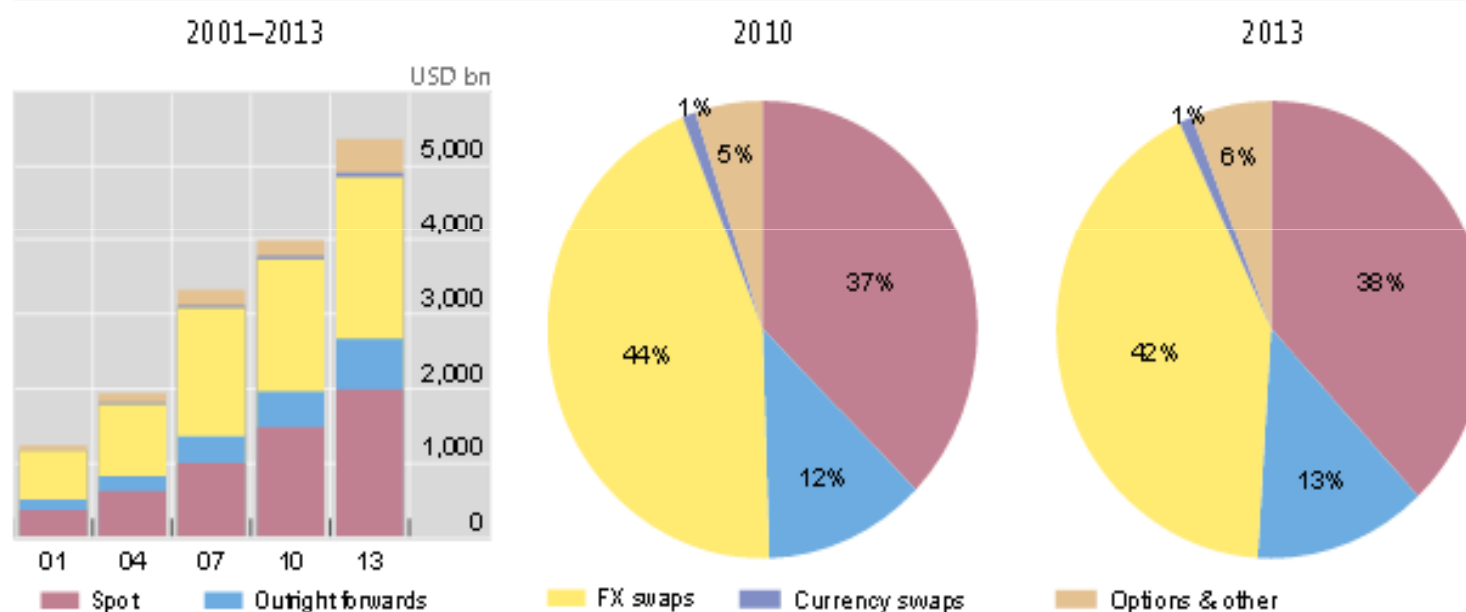


# FX net turnover by mkt segment

## Foreign exchange market turnover by instrument<sup>1</sup>

Net-net basis, daily averages in April

Graph 3



<sup>1</sup> Adjusted for local and cross-border inter-dealer double-counting, ie "net-net" basis.

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

# 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

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- **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

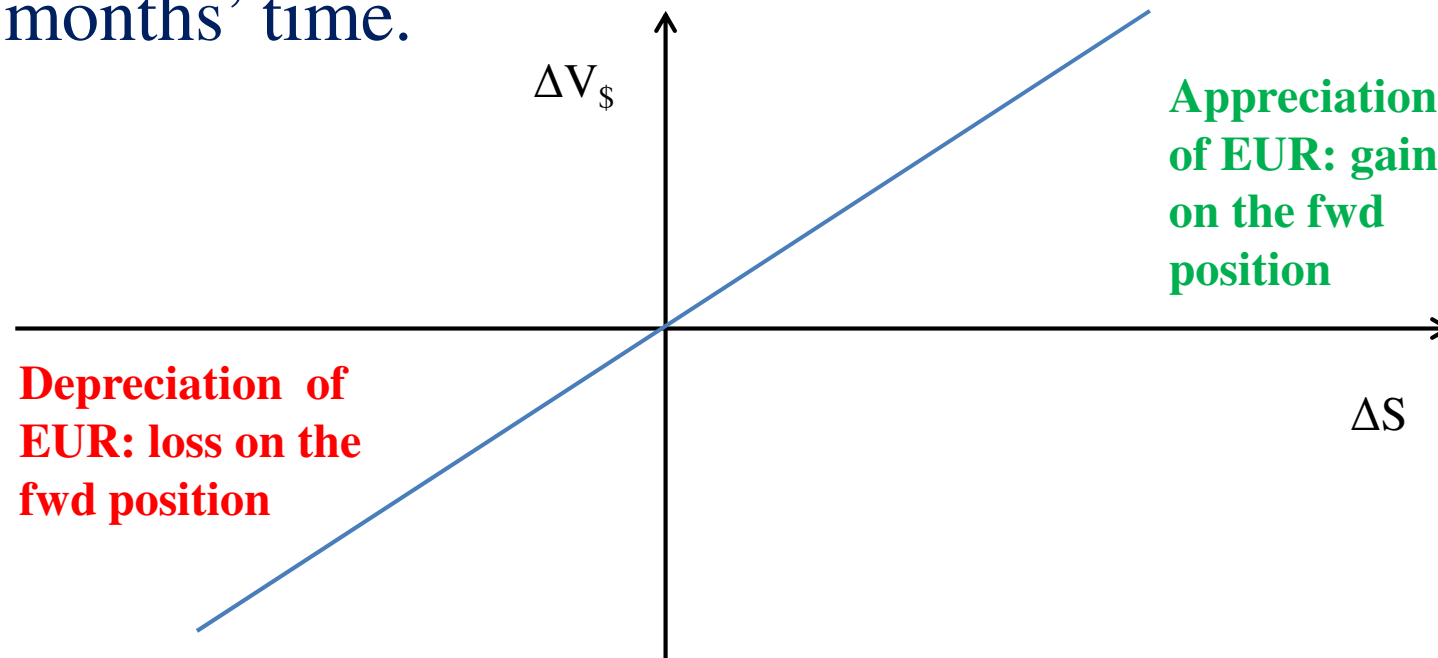
# Forwards' payoff profile I

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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.



$F_{\$/\epsilon} = E[S_{\$/\epsilon}]$ ,  $\Delta S = (\text{Realized } S_{\$/\epsilon} - F_{\$/\epsilon})$  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

