

FOREIGN EXCHANGE (FX) MARKETS

Review, Organization & Central
Bank Intervention

FX Market: Exchange Rates

- **Definition**

An exchange rate is a price: the relative price of two currencies.

Example: On January 19, 2017, the price of a euro (EUR) in terms of USD was USD 1.2376 per EUR

⇒ the exchange rate, S_{p} , was 1.2376 USD/EUR.

- **Remark - Exchange Rate: Just a Price**

An exchange rate is just like any other price.

⇒ Price of a gallon of milk: USD 3.50 (or 3.50 USD/milk).

Think of the currency in the denominator as the good you buy/sell.

Q: What is confusing in the FX Market?

A simple price, $S_t = 1.2376$ USD/EUR.

But, a little bit different: Both, the numerator (USD) and the denominator (GBP), are easily exchanged for each other.

In the case of the price of milk, only one good (USD) can be used to buy the other. It'll be very difficult to go to Walmart with 10 gallons of milk and get USD 35.

What makes exchange rate quotes tricky is that any of the two goods traded (USD and GBP) can be exchanged for the other. You can go to a bank with GBP 1 and get USD or with USD 1 and get GBP.

• Just a Price, but an Important One

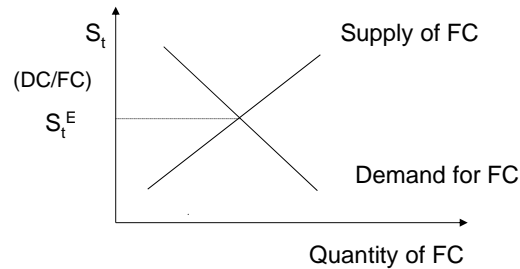
S_t plays a very important role in the economy since it influences imports, exports, cross-border investments, the domestic price level, P_d , and real wages.

For example:

- When $S_t \uparrow$, foreign imports become more expensive in USD and $P_d \uparrow$
 \Rightarrow real wages \downarrow (through a reduction in purchasing power).
- When $S_t \uparrow$, USD-denominated goods and assets are more affordable to foreigners. Foreigners buy more goods and assets in the U.S. (exports, real estate, bonds, companies, etc.).

• **Supply and Demand in the FX Market**

Like any other price, S_t is determined by supply and demand.

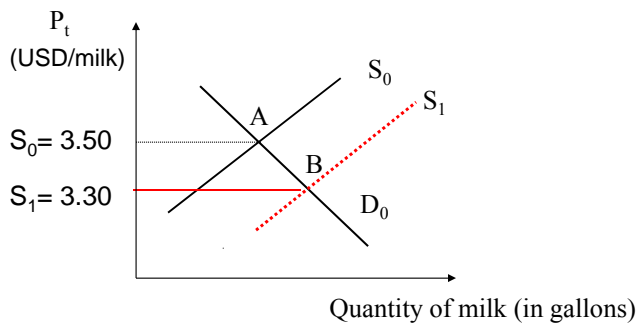


• Standard Demand and Supply graph:

- On the vertical axis, we have the price, S_t (=units of DC per unit of FC)
- On the horizontal axis, we have the quantity of the good we are buying, in this case, the foreign currency (say, GBP).

• **Similar to Supply and Demand in other Markets**

The price of milk, P_t (= units of DC per gallon of milk).

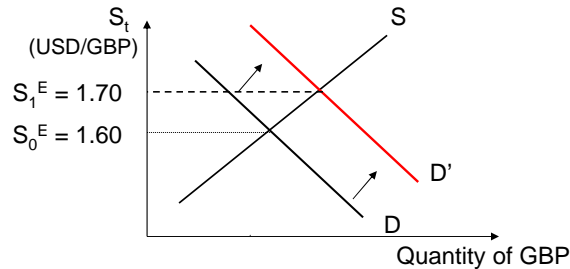


- New technology increases milk production (Supply \uparrow)

- S_t moves from A to B
 \Rightarrow Milk becomes less expensive in terms of USD.

• **Effect of a Change in Supply**

Suppose that there is a craze for British goods.



Then, the demand for GBP increases to pay for the British imports (D moves up to D').

⇒ The value of the GBP increases (more USD needed to buy GBP 1).

Terminology: We say the USD *depreciates* against the GBP (or the GBP *appreciates* against the USD).

Supply & Demand in the FX Market

• **Who supplies GBP in the (U.S.) FX market?**

- UK investors, investing in the U.S.
- US exporters, exporting to the U.K.
- UK tourism

• **Who demands GBP in the (U.S.) FX market?**

- US investors, investing in the U.K.
- US importers, importing from the U.K.
- US tourism

• **What moves Supply & Demand?**

International Investing, International Trade, International Tourism, and other factors (Central Banks needs, international transfers, etc.) All these activities are reflected in the Balance of Payments (BOP).

• **Balance of Payments**

At the national accounts level, these activities are reflected in the Balance of Payments (BOP):

$$\text{BOP} = \text{Current Account (CA)} + \text{Capital Account (KA)}$$

CA = Net Exports of goods and services (main component) + Net Investment Income + Net Transfers

KA = Financial capital inflows – Financial capital outflows

The BOP = 0 \Rightarrow The CA is financed by the KA.

• **The Real Exchange Rate (R_t)**

The nominal exchange rate, S_t , is a *nominal* variable: The price (in DC) of one unit of FC. Economists like to distinguish between the nominal and real values. After all, an increase in S_t does not necessarily mean that domestic goods are cheaper to foreigners: P_d can increase too.

To compare where things are more expensive, the real exchange rate, R_t , is used. R_t measures the cost of foreign goods relative to domestic goods:

$$R_t = S_t P_f / P_d,$$

where P_f is the price of foreign goods (in FC) and P_d is the price of domestic goods (in DC).

If R_t increases, we say the DC *depreciates in real terms* \Rightarrow domestic goods become more competitive relative to foreign goods.

R_t gives a measure of competitiveness.

FX Markets: Organization

Q: How is the FX market organized?

A: It is organized in two tiers:

- i. the *retail tier*
- ii. the *wholesale tier*

- Retail Tier: Where small agents buy and sell FX.
- Wholesale Tier: Informal network of 2,000 banks and big currency brokers that deal with each other and with large corporations.

The wholesale tier is where FX rates are determined (97% of volume).

• Wholesale Tier = The FX market

It is an OTC market, where brokers and dealers negotiate directly. There is no central exchange or clearinghouse.

FX Markets: Organization

Q: How is the FX market organized?

A: It is organized in two tiers:

- i. the *retail tier*
- ii. the *wholesale tier* (the "market")

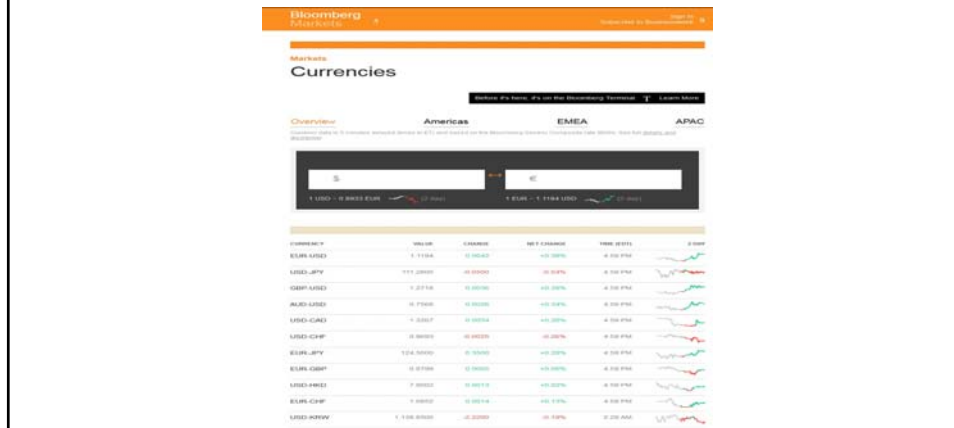
Retail Tier: Where small agents buy and sell FX.



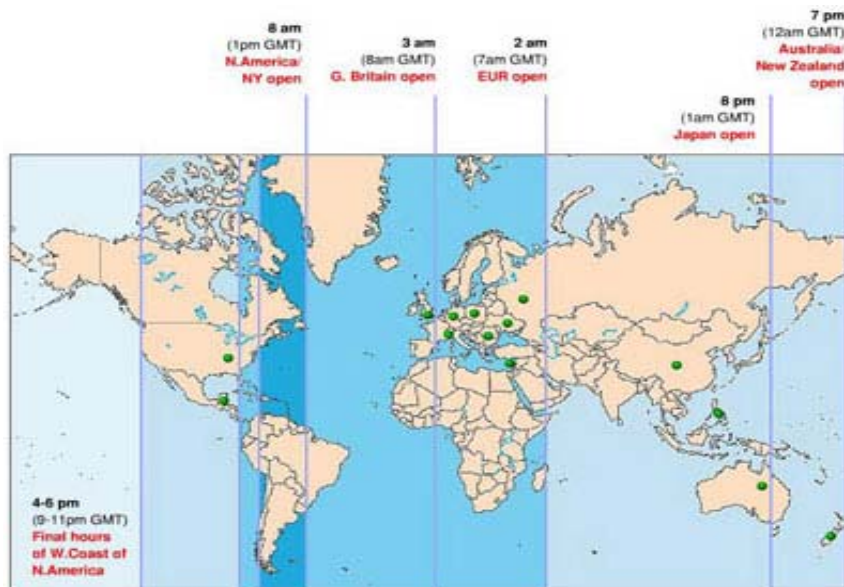
Wholesale Tier: Informal network of about 2,000 banks and currency brokerage firms that deal with each other and with large corporations.

The wholesale tier is where FX rates are determined (97% of volume),. These FX rates usually reported on financial websites and newspapers.

It is an OTC market. There is no central exchange or clearinghouse.



• FX Market: Geographically Dispersed => Always Open



• Characteristics of the FX market

- Largest of all financial markets in the world:

Daily volume USD 5.3 trillion (up from USD 4 trillion in 2010)

USD 5.3 trillion = 25 times daily volume of international trade flows.

= 85 times the U.S. daily GDP.

= 40% of total official foreign exchange reserves.

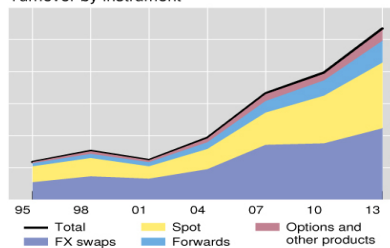
= 50 times daily volume on NYSE.

Global FX market turnover¹

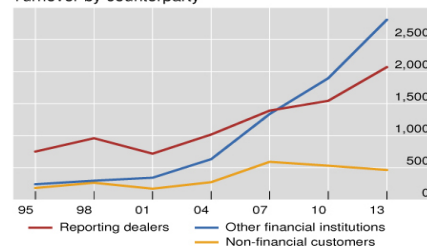
Net-net basis,¹ daily averages in April, in billions of US dollars

Graph 1

Turnover by instrument



Turnover by counterparty



¹ Adjusted for local and cross-border inter-dealer double-counting.

Sources: Triennial Central Bank Survey; BIS calculations.

© Bank for International Settlements

• Characteristics of the FX market (continuation)

- Geographically dispersed: Tokyo (6% of volume), HK (4%), Singapore (6%), Zurich, London (biggest market, 41%), NY (19%).

- Open 24 hours a day, 365 days a year.

- OTC market, where brokers and dealers negotiate directly.

- Currencies are noted by a three-letter code, the ISO 4217 (USD, EUR, JPY, GBP, CHF, AUD, CAD, SEK, HKD, MXN)

- Typical transaction in USD is about 1 million ("one dollar").

- Typical minimum trading size is 100K units (a standard "lot")

- USD, EUR, and JPY are the major currencies.

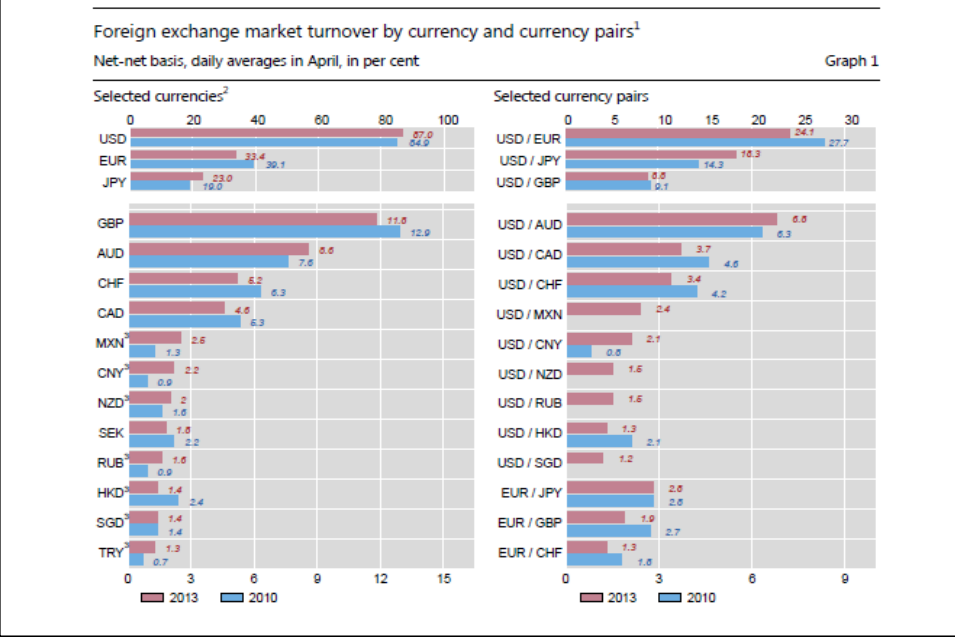
- USD involved in 87% of transactions (EUR 33%, JPY 23%).

- USD/EUR most traded currency pair (24% of turnover).

- Emerging market currencies: 20% of turnover (MXN 2.5%).

- 58% of transactions involve a cross-border counterpart (65% in 2010)

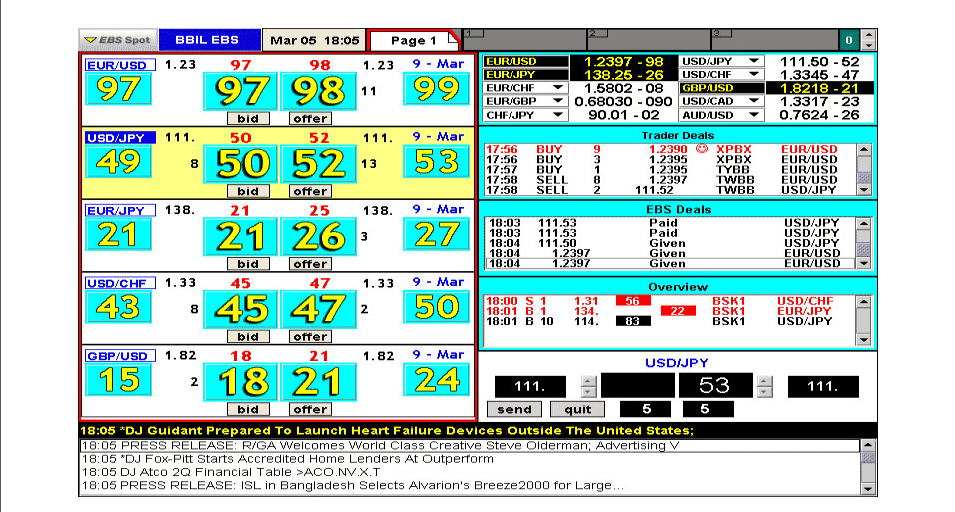
• Characteristics of the FX market (continuation)



• Characteristics of the FX market (continuation)

- Very small *bid-ask* spreads for actively traded pairs, usually no more than 3 *pips* –i.e., 0.0003.

Example: A bid/ask quote of EUR/USD: 1.2397/1.2398 (spread: one *pip*). See screenshot from electronic trading platform EBS below:



• Characteristics of the FX market (continuation)

Example (continuation): Explanation of EBS screenshot.

The screenshot shows two market panels. The top panel is for USD/JPY with a bid of 111.50 and an offer of 111.52. The bottom panel is for EUR/JPY with a bid of 138.21 and an offer of 138.26. Annotations explain the 'big figure' price, bid and offer amounts, and 'regular' amounts available for dealing.

USD/JPY Market Data:

USD/JPY	111.	50	52	111.	9 - Mar
49	8	50	52	13	53
		bid	offer		

EUR/JPY Market Data:

EUR/JPY	138.	21	25	138.	9 - Mar
21		21	26	3	27
		bid	offer		

Annotations:

- "big figure", so price is 111.50/52
- Bid and offer available to be hit
- These are bid and offer for 'regular' amounts, as opposed to the 8 and 13 available at 50/52. The 'regular' amounts might be 20 million USD or whatever the user defines when setting up the screen
- Amounts available to be dealt, 8 million USD on bid, 13 million USD on offer
- Note the price available for dealing is 138.21/26, with a regular amount on the bid but only 3 mio on the offer - the best regular offer is 138.27.
- Note also there is an inside offer at 138.25 (circled in blue) - this is due to credit limits in place in the FX market and would not be relevant in futures

• Characteristics of the FX market (continuation)

Example (continuation): EBS Keypad.

The diagram shows the EBS Keypad with various buttons and their functions. Annotations explain the 'Panel' selection key, Buy and Sell buttons, numeric keypad, and Send button.

Keypad Buttons and Functions:

- 1: Panel selection key (Panel 1-6)
- 2: Buy button
- 3: Bid button
- 4: SELL REG, BUY REG buttons
- 5: Numeric keypad (0-9, *, #)
- 6: Off All button
- 7: Send button

Annotations:

- 'Panel' selection key - i.e. selects which currency pair to actively display - in our case would be which contract
- Buy at market, amount is normally pre-selected but can be changed using numerical keypad. Buy and Sell buttons normally used in conjunction with the Send button to confirm the trader really wants to deal.
- Used to place orders in the market in conjunction with the numeric keypad
- Cancel all open orders

(Source: EBS)

- **Players:** Big Corporations, Speculators, Banks, Central Banks

- ⇒ Financial institutions are involved in 91% of transactions:

- 39% Reporting dealers (“interbank”)

- 53% Other financial institutions (hedge funds 11%)

- A large bank may trade billions of dollars daily.

- Largest dealer bank: Citi (9.69%, 2015 Euromoney survey)

- In 2015, the top 5 include Deutsche Bank (9.66%), UBS (8.86%), Barclays (8.45%), and HSBC (7.83%).

- The interbank market gets the majority of commercial turnover.

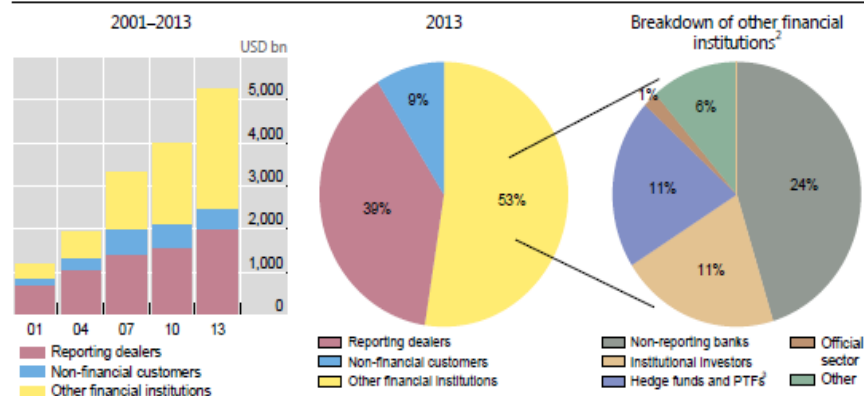
- Banks trade on behalf of customers and for themselves.

- HFT (high frequency trading) accounts for 25% of volume.

Foreign exchange market turnover by counterparty¹

Net-net basis, daily averages in April

Graph 2



¹ Adjusted for local and cross-border inter-dealer double-counting, ie “net-net” basis. ² For definitions of counterparties, see page 19. ³ Proprietary trading firms.

Source: BIS Triennial Central Bank Survey. For additional data by counterparty, see Tables 4 and 5 on pages 12-13.

• Dealers:

- *Market-makers* (hold inventories to provide liquidity. Give a two-way quote: bid and ask,)
- *Traders* (buy and sell on their own accounts)
- *Brokers* (finds the best price for another player)

Until recently, FX brokers did large amounts of business, facilitating interbank trading and matching anonymous counterparts for small fees.



Today, much of the trading has moved to electronic platforms, like EBS (Electronic Broking System), Reuters Dealing 3000 Matching (D2), and Bloomberg Tradebook. The major trading banks (Barclays, UBS) have their own electronic platforms (*single-bank trading systems*). There are also multi-bank trading platforms (FXall, Currenex, Hotspot).

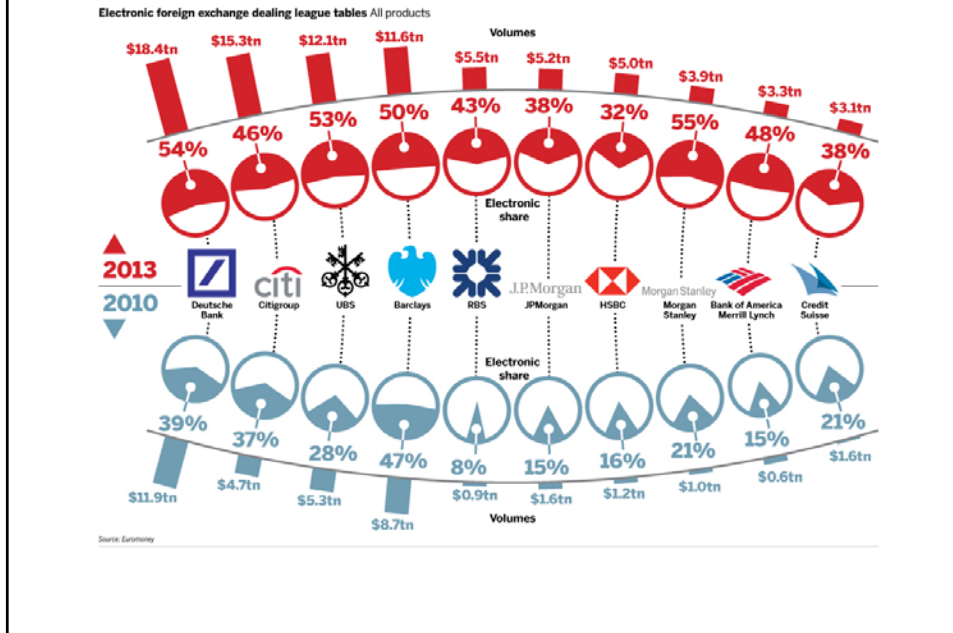
In 2013, electronic trading capture 66% of all FX transactions (up from 20% in 2001). This move towards electronic trading should lower costs and increase transparency (better price discovery).

For many years, the main trading platforms were EBS and Reuters.

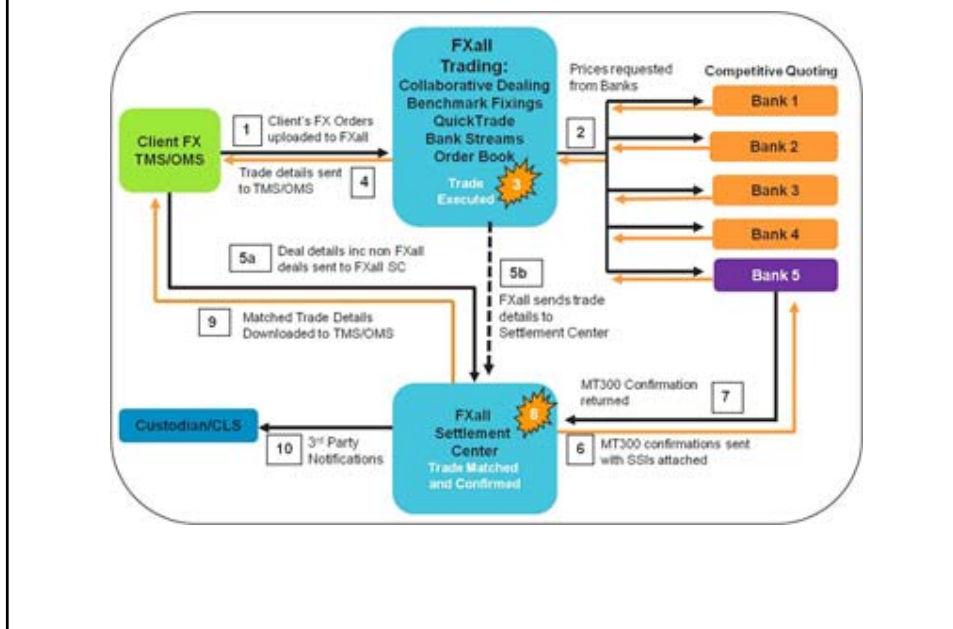
- EBS: main venue for EUR/USD, USD/JPY, EUR/JPY, USD/CHF and EUR/CHF. (the main bulk of the interbank spot market.)
- Reuters D2: primary venue for all other interbank currency pairs.

But, competition from single-bank trading systems (*internalization of flows*) is big and driving significantly down volume at both venues (traded volume at EBS went from 60% in 2011 to 20% in 2014).

• FX Trading Quickly Moving to Electronic Trading



• Typical Electronic Trading Order Flow (from FXall):



• Typical Trading Day (from the early 90s):

For a DEM trader (DEM: German Mark):

Executed about 270 transactions a day (one every 67").

Average daily volume traded USD 1.2 billion.

For large transactions brokers were used.

Median spread: DEM .0003 (.02% of the spot rate).



• Speculation and Trading

A market participant that holds an open FX position at the end of the day is classified as a *speculator*.

An FX trader will attempt to be *square* or *flat* by the end of the day. That is, a trader is square when she has no exposure (or risk) on the FX market.

Terminology: Squaring up is when you have an open position and you are going to close. So if you have sold a currency, you are 'squaring up' when you are buying the currency and 'going flat' when you have bought a currency and you are now selling it.



• **Segments of the FX Mkt**

1. The Spot Market

The spot market is the exchange market for payment and delivery today. In practice, "today" means today only in the retailer tier. Usually, it means 2 business days.

The Spot Market represents 38% of total daily turnover.

Example: Bank of America (BOFA) buys GBP 1M in the spot market at $S_t = 1.60$ USD/GBP.

In 2 business days, BOFA will receive a GBP 1M deposit and will transfer to the counterparty USD 1.6M. ¶

- *Two quote systems:*

i. *indirect quote* or "European" quote

$S(\text{indirect})$ = units of FC that one domestic unit will buy.

ii. *direct quote* or "American" quote.

$S(\text{direct})$ = units of DC that one foreign unit will buy.

Remark: indirect quotation = reciprocal of the direct quotation.

Example: A U.S. tourist wishes to buy JPY at LAX.

(A) Indirect quotation (JPY/USD).

A quote of JPY 110.34-111.09 means the dealer is willing to buy one USD for JPY 110.34 (*bid*) and sell one USD for JPY 111.09 (*ask*).

For each round-trip USD transaction, she makes a profit of JPY .75.

(B) Direct quotation (USD/JPY).

If the dealer at LAX uses direct quotations, the bid-ask quote will be .009002-.009063 USD/JPY. ¶

Note: $S(\text{direct})_{\text{bid}} = 1/S(\text{indirect})_{\text{ask}}$,
 $S(\text{direct})_{\text{ask}} = 1/S(\text{indirect})_{\text{bid}}$.

Note: In class, we will use **direct** quotations. Think of the currency in the denominator as the currency you buy. For us, it will be the foreign currency.

Example: Quotes:

$S_t = 1.03 \text{ CHF/USD} \Rightarrow$ You are in Switzerland



$S_t = 0.70 \text{ USD/EUR} \Rightarrow$ You are in the U.S.



- *Cross-quotes*

Most currencies are quotes against the USD, so that *cross-rates* must be calculated from USD quotations. (Think of liquidity!)

Rule for cross-rates (based on triangular arbitrage):

$$\Rightarrow \frac{\text{Quote}(X/Z)}{\text{Quote}(Y/Z)} = \text{Quote}(X/Y)$$

(=> currency Z has to cancel out!)

Example: Calculate the CHF/EUR cross rate:

$S_t = 1.03 \text{ CHF/USD}$

$S_t = 0.70 \text{ EUR/USD}$

$$S_{\text{CHF} / \text{EUR}, t} = \frac{1.03 \text{ CHF/USD}}{0.70 \text{ EUR/USD}} = 1.47 \text{ CHF/EUR} \quad \P$$

• Settlement of FX transactions

At the wholesale tier, no real money changes hands.

⇒ electronic transactions using the international clearing system.

Two banks involved in a FX transaction simply transfer bank deposits.

Example:

Parties: Argentine Bank: Banco de Galicia (BG),
Malayan Bank: Malayan Banking Berhard (MB).

Transaction: BG sells BRL (Brazilian real) to MBB for JPY.

Settlement: a transfer of two bank deposits:

- (1) BG turns over to MB a BRL deposit at a bank in Brazil,
- (2) MB turns over to BG a JPY deposit at a bank in Japan.

If BG doesn't have a branch in Brazil, an associated bank, called a *correspondent bank*, will hold the deposit in BG's name. Same for MB in Japan. ¶

2. The Forward Market

A forward transaction is generally the same as a spot transaction:

⇒ but settlement is deferred much further into the future.

"Further into the future": 7-day, 15-day, 1-, 2-, 3- and 12-month settlements (& up to 10 years).

Characteristics:

- Forward transactions are tailor-made.
- Forward contracts allow firms and investors to transfer risk.
- Forward transactions are classified into two classes:

Outright FX swap

- The (outright) Forward Market represents 13% of total daily turnover.
⇒ Outright forward transaction: an uncovered speculative position in a currency (though it might be part of a currency hedge to the other side).
 - 40% of outright forwards have a duration of less than 7 days.
- ° The FX Swap combines a forward transaction with a spot transaction.

Example: BOFA holds British bonds worth GBP 1,000,000. BOFA fears the GBP will lose value against the USD in 7 days. BOFA sells a 7-day GBP forward contract at $F_{t,7\text{-day}}=1.605$ USD/GBP to transfer the currency risk of her position.

In 7 days, BOFA will receive USD 1,605,000 and will transfer to the counterparty GBP 1M. ¶

Terminology: FX premium

• A foreign currency is said to be a *premium* (*discount*) currency if its forward rate is higher (lower) than the spot rate.

$F_{t,T} > S_t$ for a premium currency.

$F_{t,T} < S_t$ for a discount currency.

Example: From previous examples

$S_t = 1.60$ USD/GBP

$F_{t,7\text{-day}} = 1.605$ USD/GBP

$F_{t,7\text{-day}} > S_t \rightarrow$ the GBP trades at a premium in the forward market. ¶

3. The FX Swap

FX swap transaction: simultaneous sale (or purchase) of spot foreign exchange against a forward purchase (or sale) or approximately an equal amount of the foreign currency.

FX swap transaction: a position taken to reduce the exposure in a forward trade.

- The FX Swap Market represents 42% of total daily turnover.
- The majority of FX Swaps (70%) are short-term (7-day or less).

Example:

A U.S. trader wants to invest in GBP bond position for a 7-day period. (Assume the U.S. trader thinks interest rates in the U.K. will go down and is worried about the GBP/USD exchange rate.)

Simultaneously, the U.S. trader

- (1) Buys GBP 1M spot at $S_t = 1.60$ USD/GBP,
- (2) Buys the short-term GBP 1M bond position, and
- (3) Sells GBP 1M forward at $F_{t,7\text{-day}} = 1.605$ USD/GBP.

The sale of GBP 1M forward protects against an appreciation of the USD. ¶

The FX swap market is the segment of the FX market with the highest daily volume.

Q: How is the daily volume distributed among the segments?

This USD 5.3 trillion in global FX market turnover is broken down as:

- USD 2.0 trillion in spot transactions
- USD 680 billion in outright forwards
- USD 2.2 trillion in FX swaps
- USD 465 billion estimated gaps in options, currency swaps, etc

