

# The Foreign Exchange Market

## Organizations and participants

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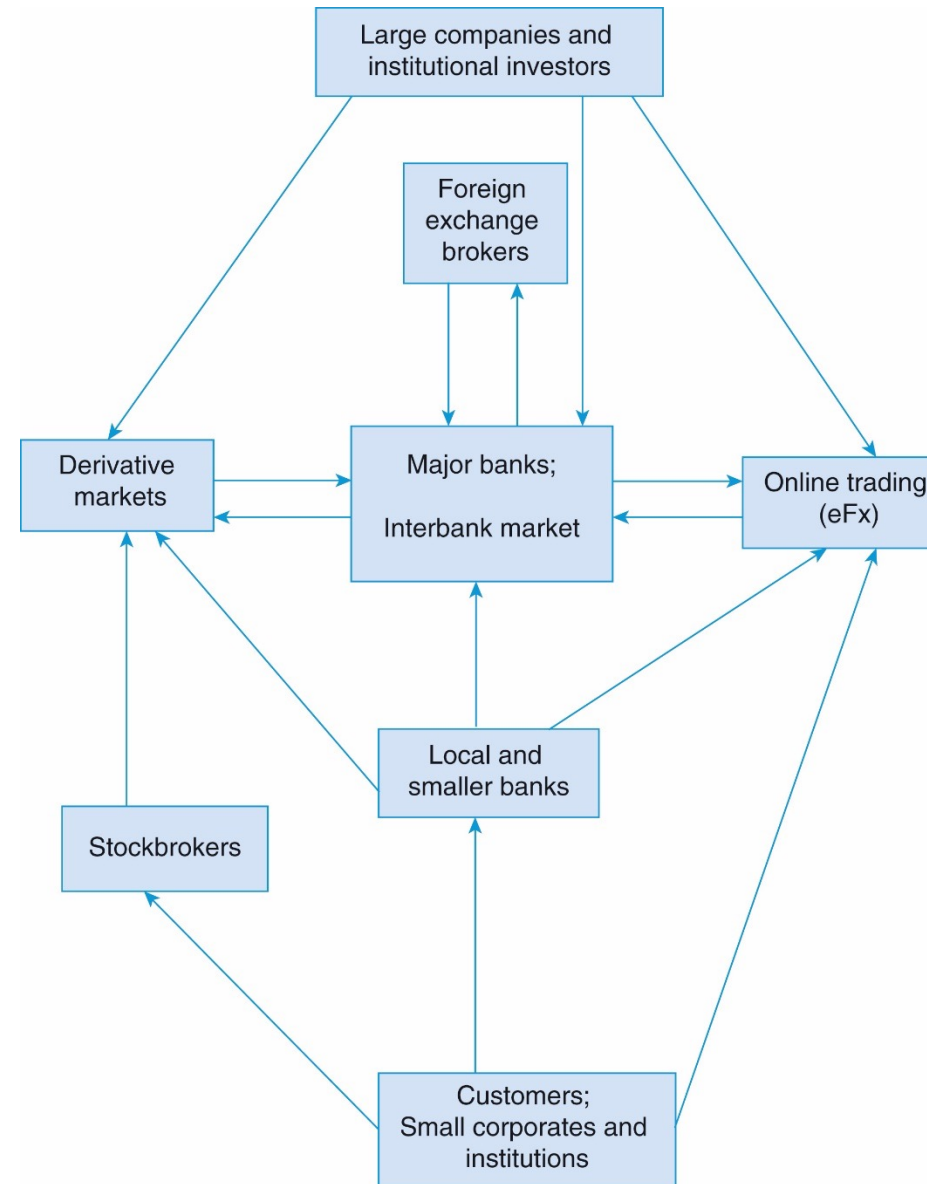
International Finance

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2. Currency Quotes and Prices
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# The Structure of the Foreign Exchange Market (FOREX)

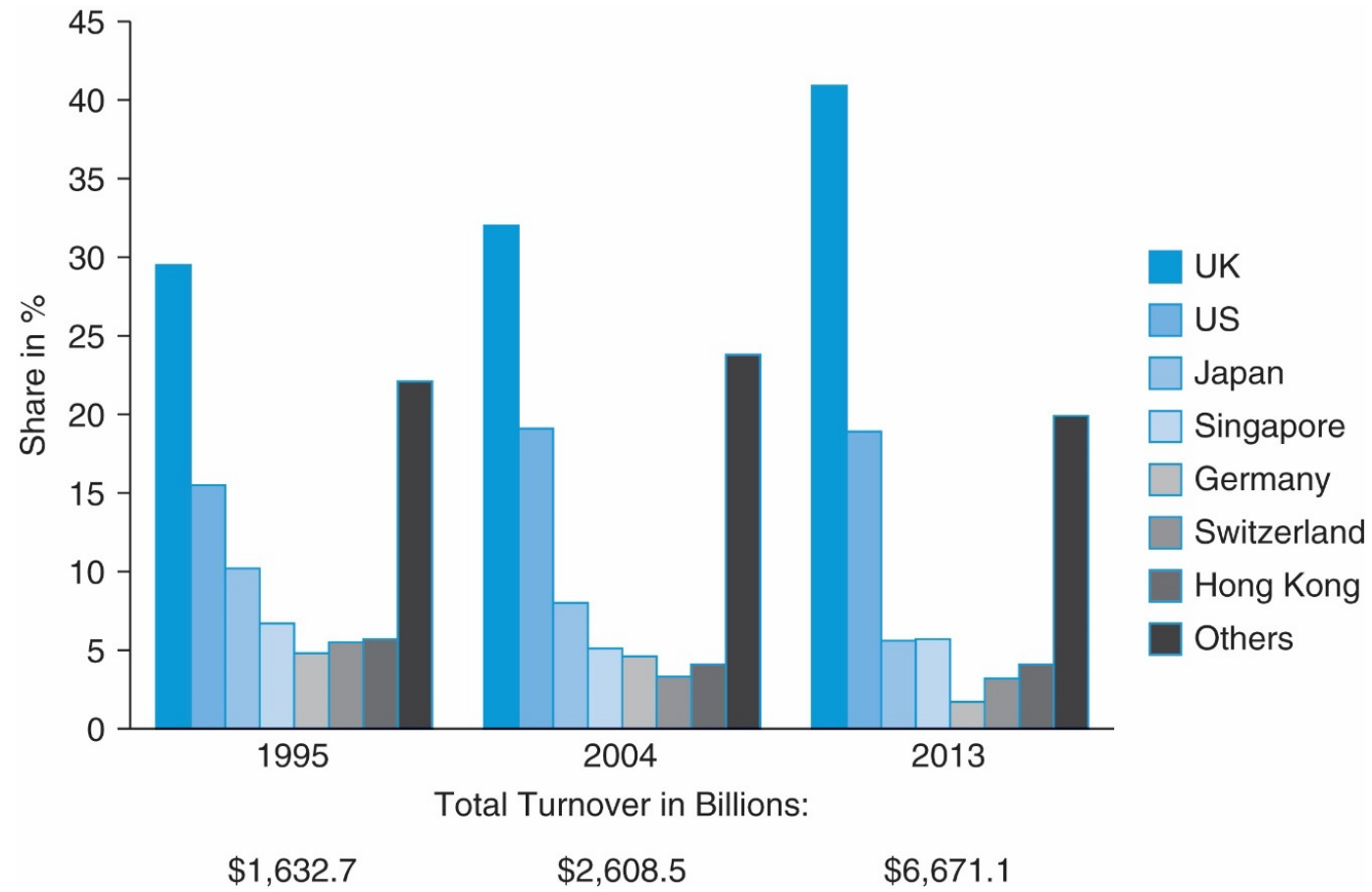
- Most important cities:
  - London, New York, Tokyo
- ForEx (or FX) operates 24 hrs/day
  - OTC market
  - Interbank market (39%)
  - Corporations (9%)
  - Other financial institutions (53%)
  - Most trades are \$1M or more!
  - Only large banks and corporates has direct access to the market



## 2.1 The Organization of the Foreign Exchange Market

- Size of the market
  - Largest financial market in the world (measured by the dollar volume of trades)
    - \$5.3 trillion a day (as of April 2013)
    - Compared to only \$36 billion on NYSE (in 2013)

# Foreign Exchange Trading Activity Across the World



# Global foreign exchange market turnover

Interactive graph

Net-net basis  
Daily averages, in millions of US dollars

help

### Filters

Risk category

Foreign exchange [B]

Reporting country

All countries (total) [5J]

Counterparty sector

Total (all counterparties) [A]

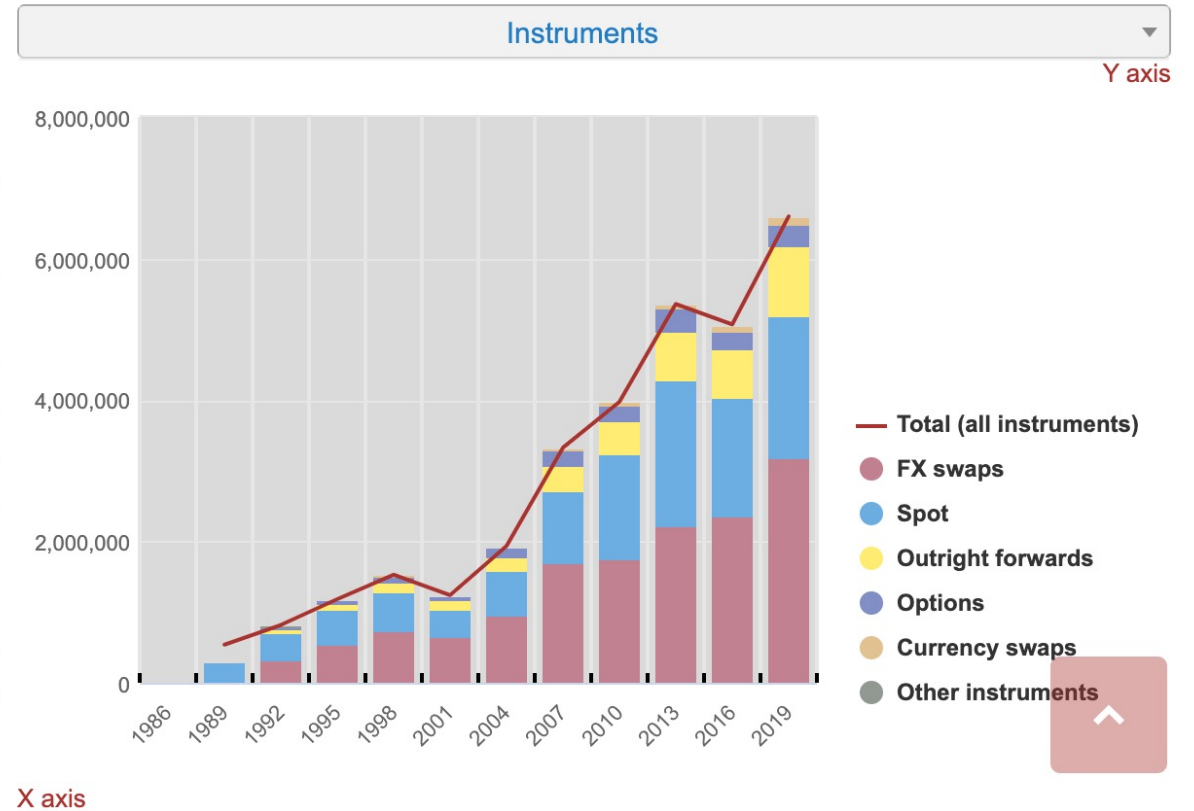
Currency of denomination (leg-1)

Total (all currencies) [TO1]

### Options

Chart type

stacked bars



Source: <https://www.bis.org/statistics/rpfx19.htm>

# 2.1 The Organization of the Foreign Exchange Market

- Types of contracts traded
  - Spot
  - Future transactions: swaps, forward contracts
  - Derivatives: futures and options
  - Conventions
    - Transactions completed/settled within 2 business days (T+2)
      - Exception 1: Exchanges between US Dollar, Mexican Peso, and Canadian Dollar (T+1)
      - Exception 2: Holidays don't count in U.S. dollar transactions
      - Exception 3: Fridays are not business days in Middle East but Saturdays/Sundays are so – non-Middle Eastern currencies settle on Fridays and Middle Eastern currencies settle on Saturdays

## 2.1 The Organization of the Foreign Exchange Market

- Foreign exchange dealers
  - Who?
    - Commercial banks
    - Investment banks
    - Brokerage firms (Intermediary – does not put own money at risk, match buyers and sellers)
- Market makers – provide liquidity. Stand ready to buy and sell the currencies in which they specialize.
  - They make it easier for buyers and sellers to come together
- Liquidity
  - Ease with which one can sell an asset at its fair value
  - Low transaction costs
- Other participants in the forex market
  - Central banks
  - Multinational corporations



## 2.1 The Organization of the Foreign Exchange Market

- The competitive marketplace
  - No product differentiation – money is money
  - Has been a lot of players (past)
    - Top 4 account for less than 30%
    - Top 20 less than 75%
  - Recently, there has been consolidation (2014)
    - Top 4 account for over 40%
    - Top 20 over 90%
  - Still exceedingly competitive with no signs of any dominant leader in this market

# The Top 20 Dealers in the Foreign Exchange Market

Exhibit 2.3 The top 20 dealers in the foreign exchange market

Rank 2015	Company	Market share	Rank 2014	Market share 2000 <sup>1</sup>
1	Citigroup	16.11%	1	8.07%
2	Deutsche Bank	14.54%	2	12.53%
3	Barclays	8.11%	3	2.07%
4	JPMorgan Chase <sup>2</sup>	7.65%	6	12.10%
5	UBS <sup>3</sup>	7.30%	4	5.02%
6	Bank of America Merrill Lynch	6.22%	7	1.86%
7	HSBC	5.40%	5	4.55%
8	BNP Paribas	3.65%	9	–
9	Goldman Sachs	3.40%	10	4.38%
10	Royal Bank of Scotland <sup>4</sup>	3.38%	8	2.71%
11	Société Générale	2.43%	13	0.60%
12	Standard Chartered	2.40%	14	0.62%
13	Morgan Stanley	1.97%	11	2.87%
14	Credit Suisse	1.66%	12	2.89%
15	State Street	1.55%	16	1.95%
16	Nomura	1.17%	15	–
17	Crédit Agricole	0.99%	22	–
18	Commerzbank	0.94%	18	–
19	RBC Capital Markets	0.74%	19	–
20	Westpac Banking Corporation	0.73%	17	–
	Total	91.26%		

## 2.2 Currency Quotes and Prices

Exchange rate:

- is the relative price of two monies, such as the Japanese yen price of the U.S. Dollar
- price of one currency in terms of another
- **abbreviations** are used (the International Organization for Standardization ISO sets standards)
- common **symbols** are used: \$ for the U.S. dollar, £ for the pound, € for the euro, ¥ for the yen.

Foreign exchange quotations:

- EUR/USD or EURUSD → the **first** currency is the **base** currency and the **second** currency is the **numerator** or **quote** currency.

to buy 1 euro → how many dollars you can buy with 1 euro / how many dollars you need

# Currency Quotes and Prices

- Exchange rate quotes (relative prices can be expressed in 2 ways)
  - Direct – quoting FX rate with domestic currency first, i.e., numerator of fraction
    - For American, the “interesting” part is in \$’s:
      - \$1.60 = £1 (This is called the American quote - dollar price of a foreign currency)
  - Indirect – quoting foreign currency first
    - For American, the “interesting” part is in £’s:
      - \$1 = £0.625 (Often called the European quote - the amount of foreign currency needed to buy dollars)
- Direct and indirect: inverse of each other
  - $Direct = \frac{1}{Indirect}$

# Currencies and Currency Symbols

**Exhibit 2.4** Currencies and currency symbols

Country	Currency	ISO currency code
Argentina	Peso	ARS
Australia	Dollar	AUD
Bahrain	Dinar	BHD
Brazil	Real	BRL
Canada	Dollar	CAD
Chile	Peso	CLP
China	Yuan	CNY
Colombia	Peso	COP
Czech Republic	Koruna	CZK
Denmark	Krone	DKK
Ecuador	US dollar	USD
Egypt	Pound	EGP

# Currencies and Currency Symbols

Country	Currency	ISO currency code
European Union	Euro (€)	EUR
Hong Kong	Dollar	HKD
Hungary	Forint	HUF
India	Rupee	INR
Indonesia	Rupiah	IDR
Israel	Shekel	ILS
Japan	Yen (¥)	JPY
Jordan	Dinar	JOD
Kuwait	Dinar	KWD
Lebanon	Pound	LBP
Malaysia	Ringgit	MYR
Mexico	Nuevo Peso	MXN
New Zealand	Dollar	NZD
Norway	Krone	NOK
Pakistan	Rupee	PKR
Peru	New Sol	PEN
Philippines	Peso	PHP
Poland	Zloty	PLZ
Russia	Ruble	RUR
Saudi Arabia	Riyal	SAR
Singapore	Dollar	SGD
South Korea	Won	KRW
South Africa	Rand	ZAR
Sweden	Krona	SEK
Switzerland	Franc	CHF
Taiwan	Dollar	TWD
Thailand	Baht	THB
Turkey	Lira	TRY
United Arab Emirates	Dirham	AED
United Kingdom	Pound (£)	GBP
United States	Dollar (\$)	USD
Uruguay	Peso	UYU
Venezuela	Bolivar	VEB
Vietnam	Dong	VND

# U.S. Dollar Currency Quotes from Tuesday, July 21, 2015

Think of direct and indirect quoting

<b>G-10 Currencies</b>	<b>Code</b>	<b>Per USD</b>	<b>In USD</b>	<b>Emerging Markets</b>	<b>Code</b>	<b>Per USD</b>	<b>In USD</b>
Australian dollar	AUD	1.3513	0.7400	Brazilian real	BRL	3.1877	0.3137
Canadian dollar	CAD	1.2985	0.7701	Brunei dollar	BWP	9.83468	0.1017
Swiss franc	CHF	0.9592	1.0425	Bulgarian lev	BGN	1.79002	0.5587
Euro	EUR	0.9153	1.0925	Cambodian riel	KHR	3987.03	0.0002508
UK pound	GBP	0.6412	1.5593	Chinese yuan	CNY	6.0847	0.1643
Japanese yen	JPY	123.84	0.008075	Columbian peso	COP	2728.64	0.0003665
Norwegian krone	NOK	8.1352	0.1229	Egyptian pound	EGP	7.8068	0.1281
New Zealand dollar	NZD	1.5138	0.6606	Hong Kong dollar	HKD	7.7505	0.1290
Swedish krona	SEK	8.5726	0.1167	Indian rupee	INR	63.4336	0.01576
				Indonesian rupiah	IDR	13369	0.0000748
				Iranian rial	IRR	29,535	0.0000339
				Jamaican dollar	JMD	84.052	0.0119
				Jordanian dinar	JOD	0.7061	1.4162
				Kazakhstan tenge	KZT	183.681	0.005444
				Kuwaiti dinar	KWD	0.3027	3.3036
				Lebanese pound	LBP	1477.49	0.0006768
				Malaysian ringgit	MYR	3.7942	0.2636
				Nigerian naira	NGN	196.412	0.005091
				Pakistani rupee	PKR	100.515	0.00995
				Peruvian new sol	PEN	3.1187	0.3206
				Philippines peso	PHP	45.1415	0.0222
				Russian ruble	RUB	57.0418	0.0175
				Saudi Arabian riyal	SAR	3.7489	0.2667
				Singapore dollar	SGD	1.3645	0.7329
				South African rand	ZAR	12.359	0.0809
				Taiwan dollar	TWD	31.1201	0.03213
				Tajikistani somoni	TJS	6.2597	0.1598
				Thai baht	THB	34.5612	0.02893
				UAE dirham	AED	3.6723	0.2723
				Uruguayan peso	UYU	26.9294	0.03713
				Venezuelan bolivar	VEF	6.29582	0.1588
				Vietnamese dong	VND	21443.7	0.00004663
<b>Other OECD</b>	<b>Code</b>	<b>Per USD</b>	<b>In USD</b>				
Chilean peso	CLP	653.886	0.001529				
Czech koruna	CZK	24.7753	0.0404				
Danish krone	DKK	6.88365	0.1453				
Estonian kroon	EEK	14.3212	0.0698				
Hungarian forint	HUF	281.89	0.003547				
Icelandic krona	ISK	134.45	0.007438				
Israeli shekel	ILS	3.8048	0.2628				
South Korean won	KRW	1152.07	0.0008680				
Mexican peso	MXN	16.0426	0.0623				
Polish zloty	PLN	3.7734	0.2650				
Turkish lira	TRY	2.6985	0.3706				
<b>Emerging Markets</b>	<b>Code</b>	<b>Per USD</b>	<b>In USD</b>				
Argentine peso	ARS	9.1685	0.1091				
Azerbaijan manat	AZN	1.049	0.9533				
Bahraini dinar	BHD	0.3744	2.6709				
Bangladeshi taka	BDT	75.8144	0.01319				
Belarusian ruble	BYR	15084.8	0.0000663				
Belize dollar	BZD	1.9568	0.5110				
Bhutan ngultrum	BTN	63.5799	0.01573				
Botswana pula	BWP	9.8347	0.1017				

## 2.2 Currency Quotes and Prices

- Vehicle currencies and currency cross-rates
  - Vehicle currency
    - a currency that is actively used in many international financial transactions around the world
    - Used due to transaction costs of making markets in many currencies being too high
    - U.S. Dollar primary vehicle currency (85% of all transactions)
  - Cross-rates
    - Exchange rates between two currencies that do not involve the dollar



# Representative Cross-Rate Quotes from July 21, 2015

**Exhibit 2.6** Representative cross-rates from July 21, 2015

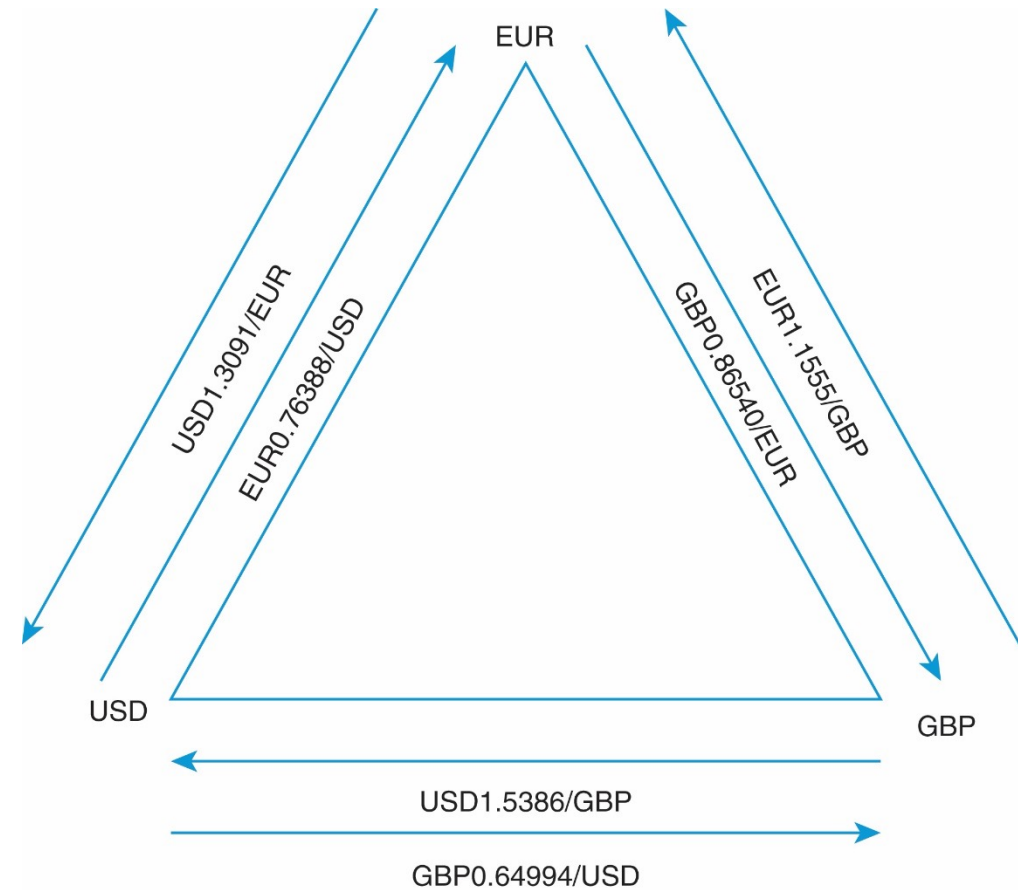
	USD	EUR	GBP	CHF	MXN	JPY	CAD
Canada CAD	1.2985	1.4185	2.0248	1.3533	0.08094	0.01049	...
Japan JPY	16.043	17.525	193.12	129.08	7.7200	...	95.360
Mexico MXN	16.043	17.525	25.015	16.719	...	0.12954	12.352
Switzerland CHF	0.95923	1.0479	1.4958	...	0.05979	0.00774	0.73857
UK GBP	0.64122	0.70047	...	0.66831	0.03995	0.00518	0.49371
Euro	0.91529	...	1.4272	0.95398	0.05702	0.00739	0.70474
US USD	...	1.0924	1.5593	1.04219	0.06230	0.00807	0.76997

## 2.2 Currency Quotes and Prices

- Triangular arbitrage
  - An arbitrage process involving three currencies
  - Keeps cross-rates in line with exchange rates quoted relative to the U.S. dollar
  - Occurs when one can trade three currencies and make a profit (versus two)
    - $\text{€}/\text{£} < \text{€}/\text{\$} \times \text{\$/£}$
    - Notice that the \$ signs on the RHS cancel out
    - Trader might start with euros, buy pounds with the euros, then simultaneously sell those pounds for dollars and sell those dollars for euros (if he ends up with more euros than he had in the beginning of the process, he makes risk free profit. Not possible in perfectly competitive markets).
    - To be an effective arbitrage, the transactions must all be conducted simultaneously.
    - Market forces will bring the market into equilibrium

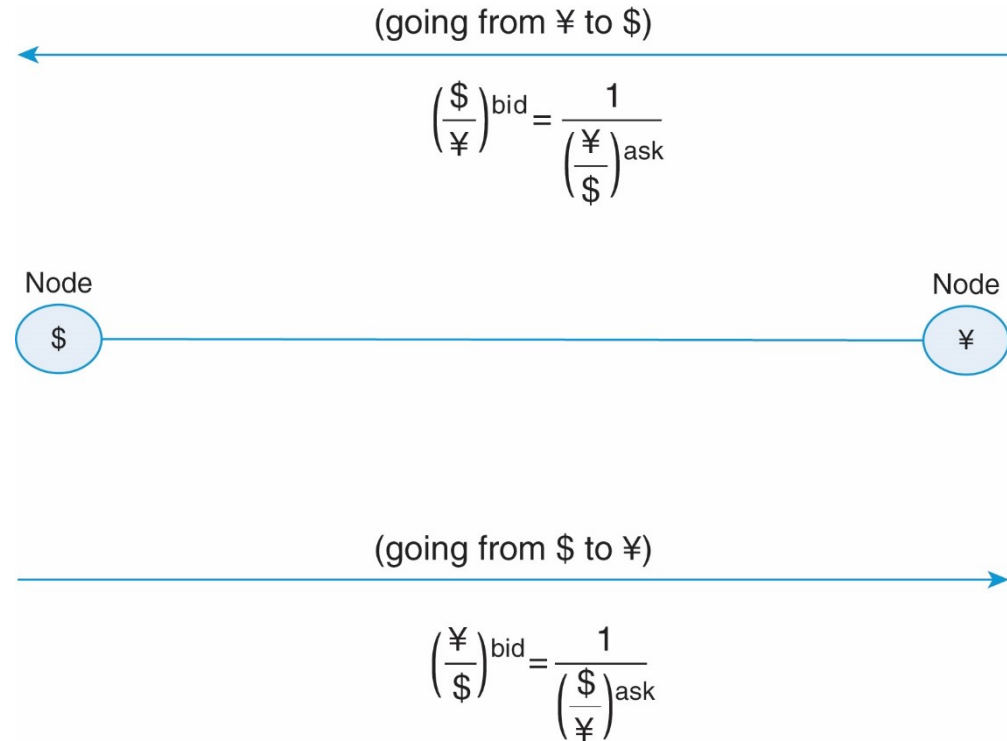
# Triangular Arbitrage Diagram

- David starts with EUR 10 000 000 and buys GBP:  
 $\text{EUR } 10\,000\,000 \times (\text{GBP } 0.86543/\text{EUR}) = \text{GBP } 8\,654\,300$
- sell GBP 8 654 300 for dollars:  
 $\text{GBP } 8\,654\,300 \times \text{USD } 1.5386/\text{GBP} = \text{USD } 13\,315\,506$
- sell the USD 13 315 506 for euros:  
 $\text{USD } 13\,315\,506 \times \text{EUR } 0.76388/\text{USD} = \text{EUR } 10\,171\,449$
- Profit:  
 $\text{EUR } 10\,171\,449 - \text{EUR } 10\,000\,000 = \text{EUR } 171\,449$
- Rate of return:  
 $1.71\% = \text{EUR } 171\,449/\text{EUR } 10\,000\,000$



## 2.3 Inside the Interbank Market I: Bid-Ask Spreads and Bank Profits

- Bid-ask spreads
  - **Bid:** Rate at which **banks** will **buy** the **base** currency
  - **Ask:** Rate at which **banks** will **sell base** currency
  - **Bid–ask spread:** the difference between bid and ask rate
  - **Bid price is always less than the ask price**
  - What are the dollar per yen bid and ask rates? Bid rate is buy yen with dollars from the market. Ask rate is the dollar price at which the bank trader is willing to sell yen for dollars to the market. Buying yen from the market is equivalent to selling dollars to the market, the dollar per yen bid rate must be the reciprocal of the yen per dollar ask rate
  - *Always keep in mind that you transact with the bank to your disadvantage.*



## 2.3 Inside the Interbank Market I: Bid-Ask Spreads and Bank Profits

- **Bid-ask spread**
    - **Bid:** Rate at which **banks** will **buy** the **base** currency
    - **Ask:** Rate at which **banks** will **sell base** currency
    - **Bid–ask spread:** the difference between bid and ask rate
    - Bid price is always less than the ask price
    - Example EUR/CZK rate:
      - Bid = 24.10. ASK = 24.15 Spread = 0.05
      - Bank buys 1 Euro for 24.10 CZK (Bid) and sell 1 Euro for 24.15 CZK (Ask)
      - You buy 1 Euro for 24.15 CZK (Ask) and sell 1 Euro for 24.15 CZK (Ask)
      - Always keep in mind that you transact with the bank to your disadvantage.
      - EUR/CZK bid price =  $1/(\text{CZK/EUR})$  ask price
- Bank buys 1 Euro from market = bank sell CZK to market

## 2.3 Inside the Interbank Market I: Bid-Ask Spreads and Bank Profits

- Magnitude of bid-ask spreads
  - Interbank market
    - Pip is fourth decimal point in a currency quote, or 0.0001 (1.3095 vs. 1.3097 = 2 pips)
    - The most liquid currencies trade at less than 10 pips
    - Higher spreads for less liquid currencies (volatility)
  - Physical exchange
    - 5% or more
      - Banks have to have inventory, which means it is not interest bearing
      - Banks must transact with brokers
    - Use credit cards to exchange when in another country – this is the best possible rate for you
  - Differs across the day

## 2.3 Inside the Interbank Market I: Bid-Ask Spreads and Bank Profits

- Treasurer of a U.S. company purchases pounds with dollars to hedge a British goods purchase.
  - Directly after, he is told that they no longer need to purchase the goods, so he sells the £ back for \$
    - Assume that the bid-ask spread is 4 pips.
    - If the ask rate is \$1.50/£, the bid rate is \$1.4996/£ and the percentage spread is:
      - Percentage spread = (ask-bid)/midpoint
      - $[(\$1.50/\text{£}) - (\$1.4996/\text{£})] \div (\$1.4998/\text{£}) = 0.0267\%$
    - If the treasurer bought £1M at \$1.50/£ (ask rate), the cost would be:
      - $\text{£}1\text{M} \times (\$1.50/\text{£}) = \$1,500,000$
    - Selling back:
      - $\text{£}1\text{M} \times (\$1.4996/\text{£}) = \$1,499,600$
      - A loss of \$400 on the two transactions, or 0.0267% of \$1.5M

## 2.4 Inside the Interbank Market II: Communications and Fund Transfers

- Communication systems
  - Society of Worldwide Interbank Financial Telecommunications (SWIFT)
    - Links more than 7500 banks in 200 countries
  - Clearing House Interbank Payments System (CHIPS)
    - Clearing house in U.S. for dollars
  - Fedwire
    - Links computers of more than 7500 institutions that have deposits with the U.S. Federal Reserve
  - Trans-European Automated Real-time Gross Settlement Express Transfer (TARGET2)
    - Euro counterpart to Fedwire



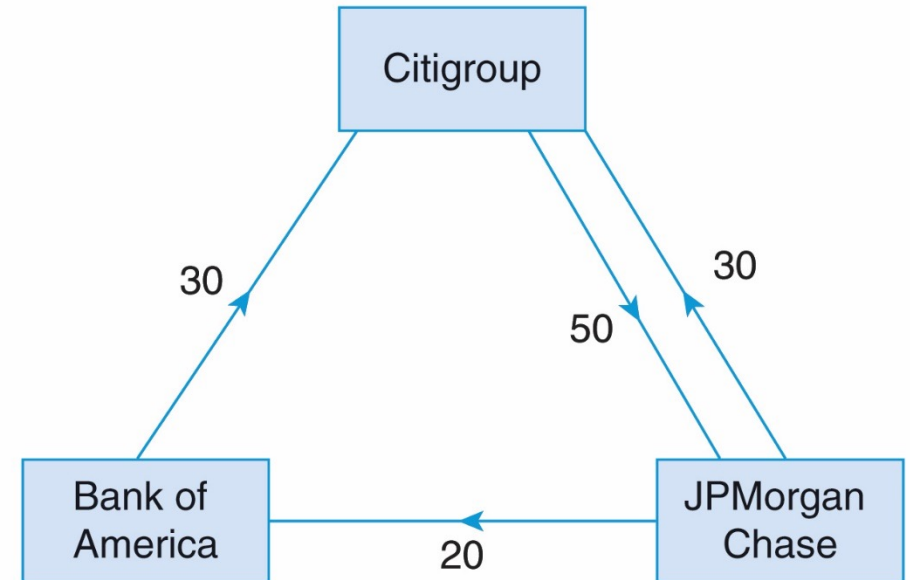
## 2.4 Inside the Interbank Market II: Communications and Fund Transfers

- Cross-currency **settlement** (or Herstatt) **risk**
  - The risk that a financial institution may not deliver the currency on one side of a completed transaction
  - How this risk is addressed:
    - Bank of International Settlements (BIS) has studied this and encouraged the restriction of transaction amounts to limit this form of risk
    - Simultaneity of both transactions – to this end, Continuous Linked Settlement, owned by 71 of the world's largest financial groups, acts as a global clearing house
    - Netting arrangements

# Netting Arrangements

- Situation
  - Citigroup owes JPMorgan Chase \$50M from a foreign exchange deal
  - JPMorgan Chase owes Citigroup \$30M from another foreign exchange deal
  - Bank of America Owes Citigroup \$30M from a foreign exchange deal
  - JPMorgan Chase owes Bank of America \$20M from another foreign exchange transaction

## Cash flows under no-netting

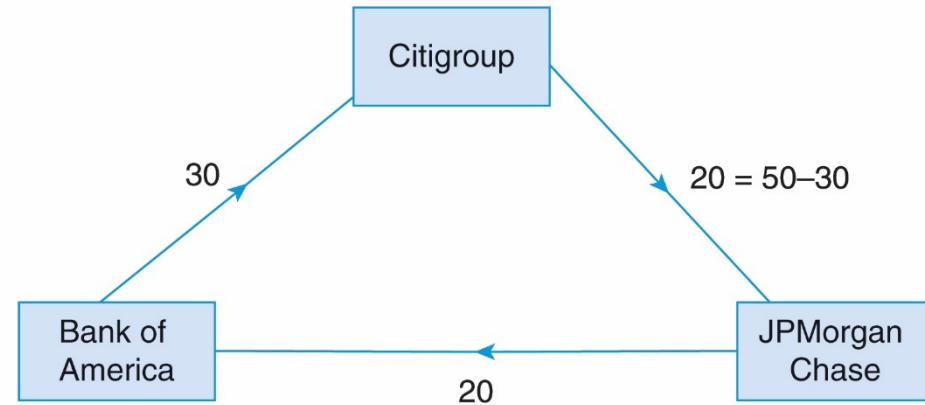


Total flows:  $30 + 20 + 50 + 30 = 130$  million

# Netting Arrangements

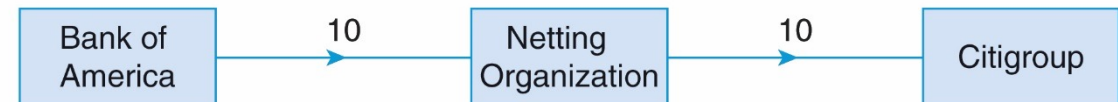
- Situation
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  - JPMorgan Chase owes Bank of America \$20M from another foreign exchange transaction

Cash flows under bilateral netting



Total flows:  $30 + 20 + 20 = 70$  million

Cash flows under multi-lateral netting



Total flows:  $10 + 10 = 20$  million

## 2.5 Describing Changes in Exchange Rates

- Appreciate / depreciate
  - The value of a currency increases/decreases in terms of another
- Devalue / Revalue
  - The value of a currency is changed by the domestic government
- Exchange rate between the dollar and the yen changes from ¥ 120/\$ to ¥ 100 /\$. It takes fewer yen to purchase the dollar, the **yen** is said to have strengthened , or **appreciated**, in value relative to the dollar and vice versa.

## 2.5 Describing Changes in Exchange Rates

- Rate of change:
  - The rate of appreciation or depreciation of one currency relative to another can be calculated as the percentage rate of change of the exchange rate:
    - $\frac{(new-old)}{old}$ 
      - Refers to the currency in the denominator of the exchange rate (for \$/£, we're talking about £)
  - Rate will not necessarily be the same if you calculate the rate for the £ and the rate for the \$ due to perspective
    - The denominators are different
  - Continuously compounded rates of appreciation reconcile the difference in the two rates:
    - $Old \times e^a = New$
    - The rate of appreciation on a compound monthly basis
    - $(\$2.00/£ (1 + (a/12))^{12} = (\$2.50/£)$
    - Annualized compound monthly rate of appreciation of the pound is 22.56%.

# Questions

1. Find the current spot price of USD/JPY?
2. How large are the bid–ask spreads in the interbank spot market? What is their purpose?
3. What is an appreciation of the dollar relative to the pound? What happens to the dollar price of the pound in this situation?
4. What is a depreciation of the Thai baht relative to the Malaysian ringgit? What happens to the baht price of the ringgit in this situation?