

International Finance: Lecture 4

Foreign Exchange Markets & Derivatives

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Outline

- 1 FX Market Overview
- 2 Exchange Rate Measures
- 3 Foreign Exchange Derivatives

The Foreign Exchange Market

- The market in which international currency trades take place is called the foreign exchange market.
- The major participants in the Forex market are commercial banks, corporations that engage in international trade, nonbank financial institutions such as asset-management firms and insurance companies, and central banks.
- Individuals may also participate in the Forex market - for example, the tourist who buys foreign currency at a hotel's front desk - but such cash transactions are an insignificant fraction of total foreign exchange trading.
- Forex trading takes place in many financial centers, with the largest volumes of trade occurring in such major cities as London (the largest), New York, Tokyo, Frankfurt, and Singapore.

FX Markets: Institutions (w)



<https://www.xtb.com/en/learn-to-trade/what-is-forex>

The Foreign Exchange Market

- This market is not in a centralized location; instead, it is a **decentralized network (OTC)** that is nevertheless highly integrated via modern information and telecommunications technology.
 - Telephone, fax, and Internet links among the major foreign exchange trading centers make each a part of a single world market on which the sun never sets.
 - Economic news released at any time of the day is immediately transmitted around the world and may set off a flurry of activity by market participants.
 - Even after trading in New York has finished, New York-based banks and corporations with affiliates in other time zones can remain active in the market.

FX Markets: Characteristics

Characteristics of Foreign Exchange Market

- Market Transparency
 - Dollar is Extensively Traded
 - Most Dynamic Market
 - International Network of Dealers
 - "Over-The-Counter" Market
 - High Liquidity
 - Twenty-Four Hour Market

<https://theinvestorsbook.com/foreign-exchange-market.html>

FX Markets: Size

- The actual flow of currencies from one nation to another is an insignificant element of the foreign exchange market.
- The financial assets people typically trade in foreign exchange markets are foreign-currency-denominated financial instruments such as bonds, stocks, and especially bank deposits.
- Over the last thirty-five years, the volume of world trade in goods and services has grown by almost 6 percent annually.
- Foreign exchange turnover has grown to more than sixty times the volume of world trade in goods.
- With an average daily volume of over \$6.5 trillion it is the world's largest market.

BIS Triennial 2019 Survey: Highlights (w)

- Trading in foreign exchange markets averaged \$6.6 trillion per day in April 2019. FX swaps were the most actively traded instruments in April 2019, accounting for 49% of total FX market turnover, followed by spot trading 30%.
- The US dollar retained its dominant status, being on one side of 88% of all trades. Euro expanded to 32%. and Yen fell to 17% of all trades.
- In April 2019, sales desks in five countries – the United Kingdom, the United States, Hong Kong SAR, Singapore and Japan – facilitated 79% of all foreign exchange trading. UK and HK grew by more than the global average. Mainland China is the eighth largest FX trading center.
- The growth of foreign exchange trading was driven by financial institutions other than reporting dealers, mounting to \$3.6T. (turnover breakdown: non-reporting banks 24%, institutional investors 12%, hedge funds and PTFs 9%).

Global Foreign Exchange Turnover – Daily OTC Averages

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

Table 1

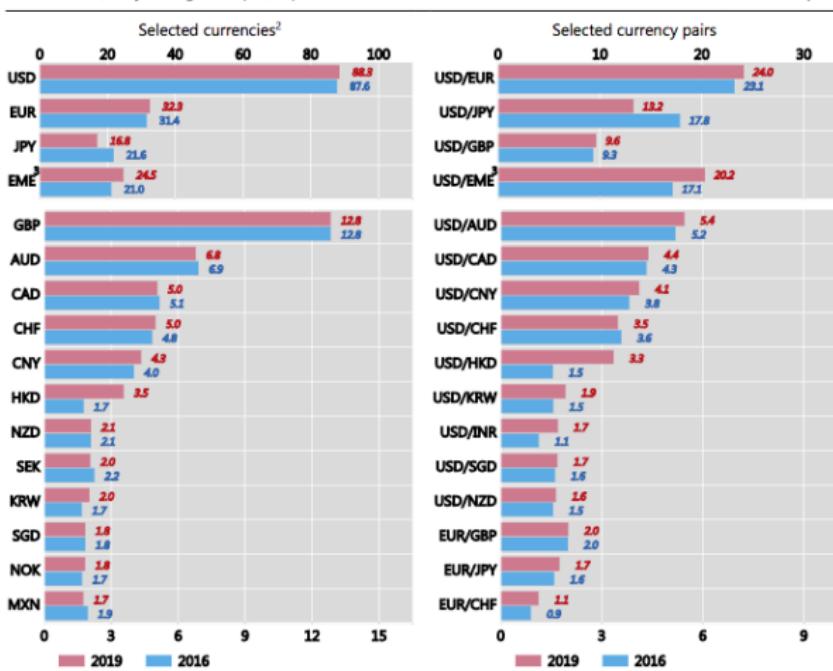
Instrument	2004	2007	2010	2013	2016	2019
Foreign exchange instruments	1,934	3,324	3,973	5,357	5,066	6,590
Spot transactions	631	1,005	1,489	2,047	1,652	1,987
Outright forwards	209	362	475	679	700	999
Foreign exchange swaps	954	1,714	1,759	2,240	2,378	3,202
Currency swaps	21	31	43	54	82	108
Options and other products ²	119	212	207	337	254	294
<i>Memo:</i>						
Turnover at April 2019 exchange rates ³	1,854	3,071	3,602	4,827	4,958	6,590
Exchange-traded derivatives ⁴	25	77	144	145	115	127

¹ Adjusted for local and cross-border inter-dealer double-counting (ie "net-net" basis). ² The category "other FX products" covers highly leveraged transactions and / or trades whose notional amount is variable and where a decomposition into individual plain vanilla components was impractical or impossible. ³ Non-US dollar legs of foreign currency transactions were converted into original currency amounts at average exchange rates for April of each survey year and then reconverted into US dollar amounts at average April 2019 exchange rates. ⁴ Sources: Euromoney Tradedata; Futures Industry Association; The Options Clearing Corporation; BIS derivatives statistics. Foreign exchange futures and options traded worldwide.

Global Foreign Exchange Turnover – By Currency

Net-net basis, daily averages in April, in per cent

Graph 1

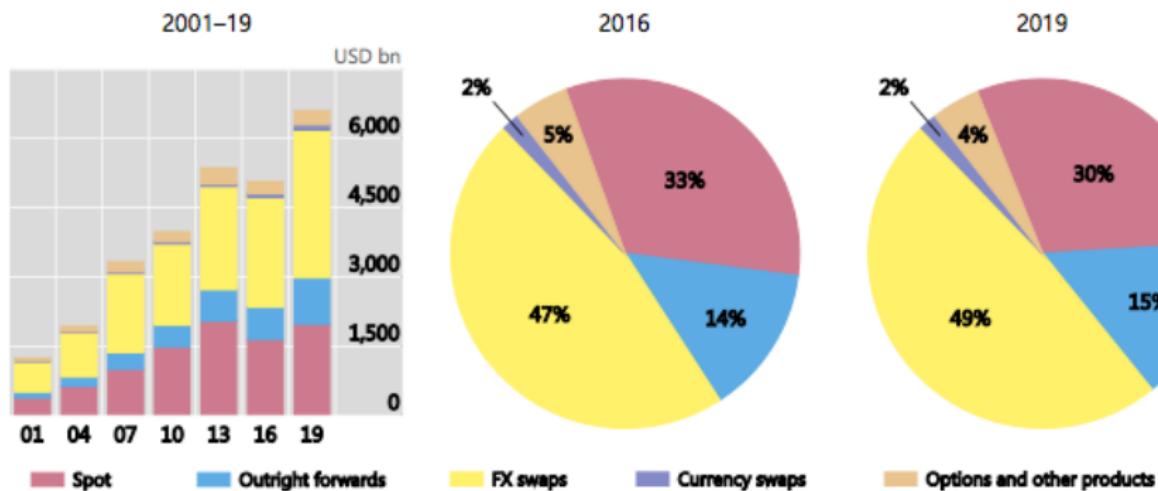


Source: BIS.

Global Foreign Exchange Turnover – By Instrument

Net-net basis, daily averages in April

Graph 2



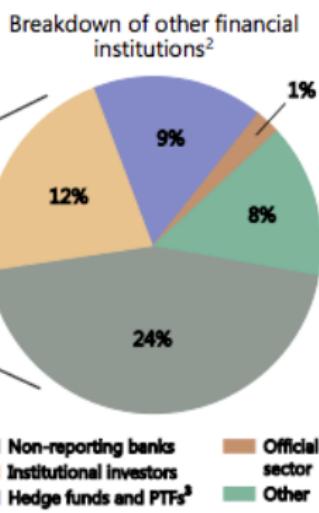
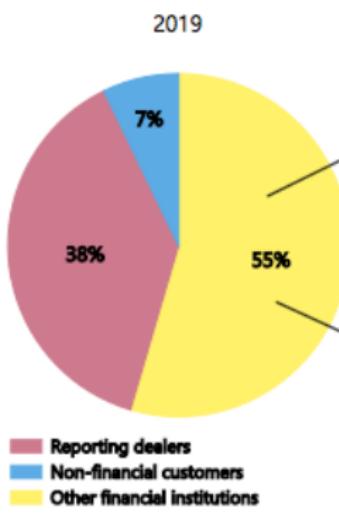
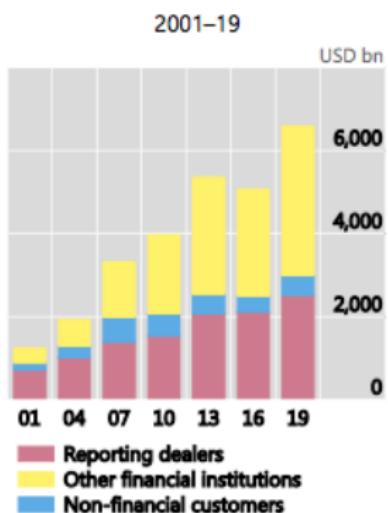
¹ Adjusted for local and cross-border inter-dealer double-counting, ie "net-net" basis.

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

Global Foreign Exchange Turnover – By Counterparty

Net-net basis, daily averages in April

Graph 3

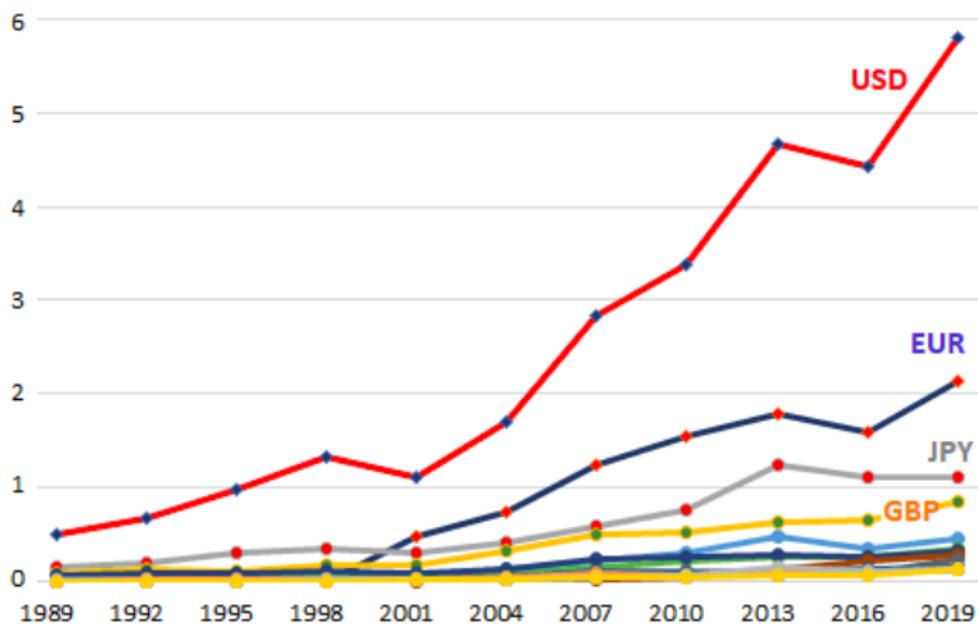


¹ Adjusted for local and cross-border inter-dealer double-counting, ie "net-net" basis. ² For definitions of counterparties, see page 19. ³ Proprietary trading firms.

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

Foreign Exchange Daily Turnover in Tn\$

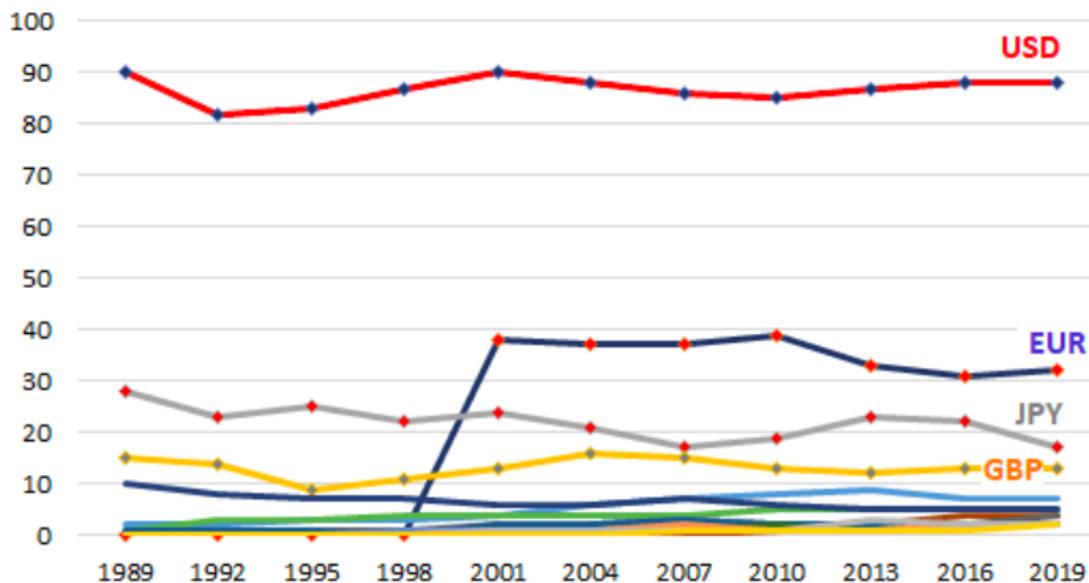
Amount a currency was on one side of a trade in April



<https://wolfstreet.com/2019/09/18/foreign-exchange-trading-soars-to-6-6-trillion-a-day-us-dollar-is-total-king/>

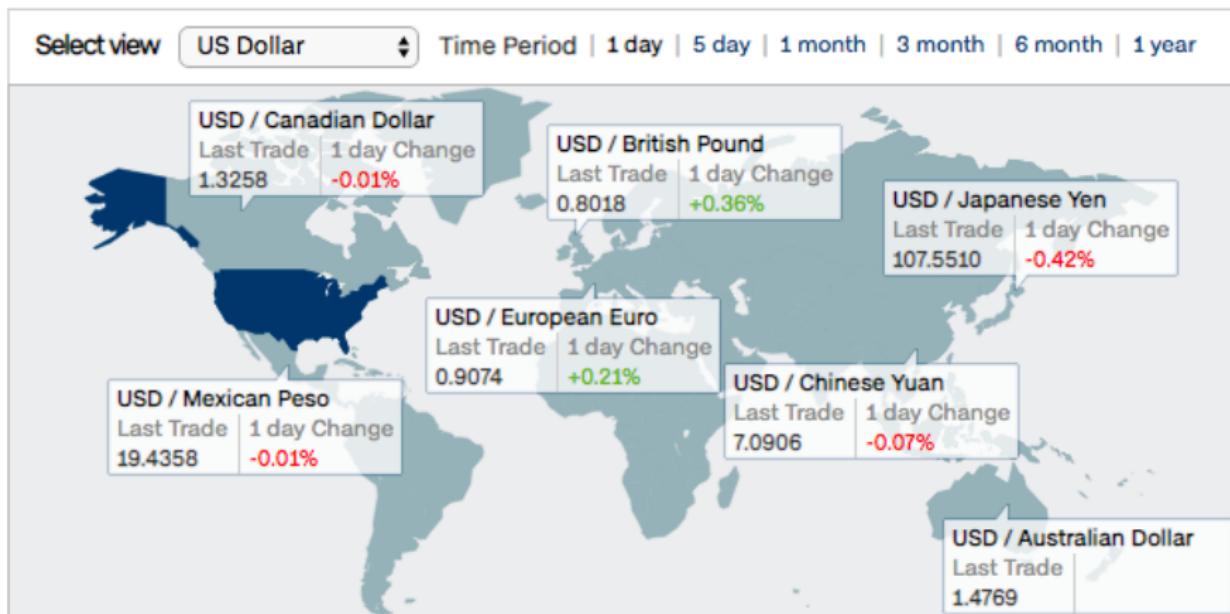
Foreign Exchange Daily Turnover Share

% a currency was on one side of a trade in April



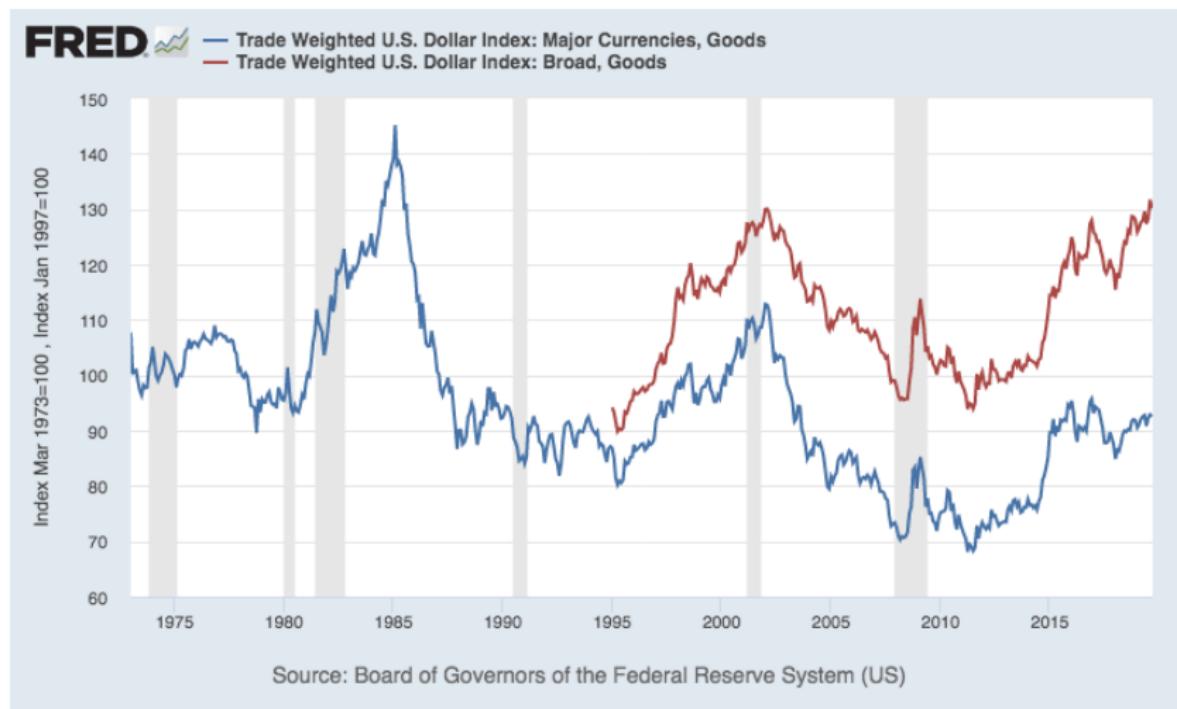
<https://wolfstreet.com/2019/09/18/foreign-exchange-trading-soars-to-6-6-trillion-a-day-us-dollar-is-total-king/>

US Dollar against Major Currencies (w)

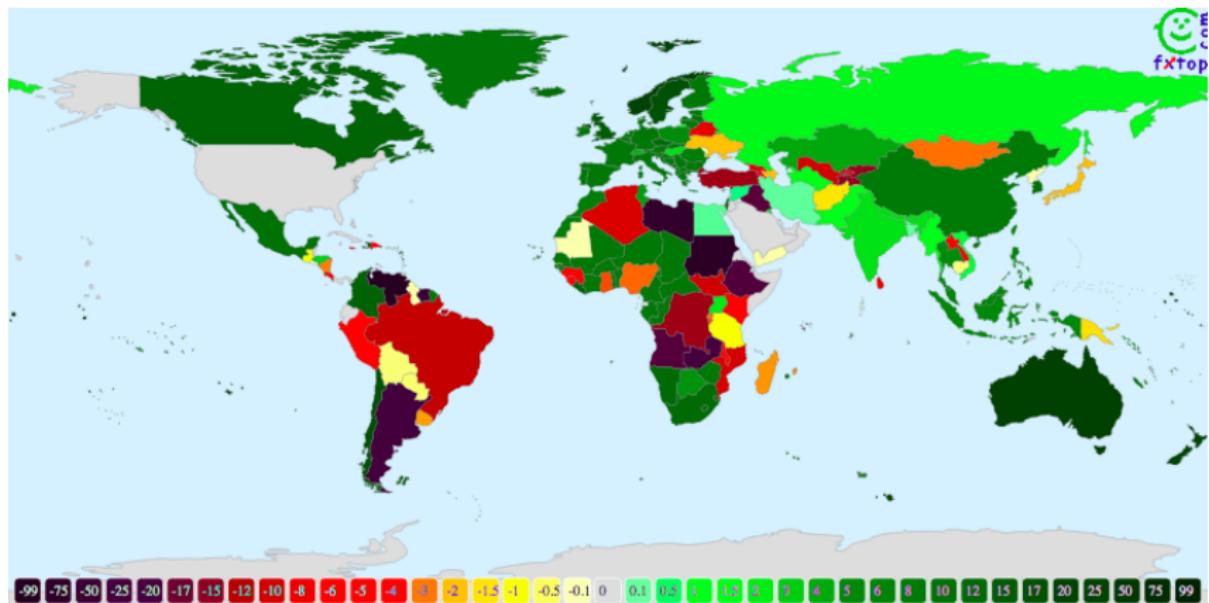


Source: CNN Business.

Trade Weighted US Dollar Indices (NEER)



Annual Changes against USD 2020-2021 (w)



<https://fxtop.com/en/forex-map.php>

Foreign Exchange Markets (w) (w)



Foreign Exchange Speculation (w)

"The money that I made on this particular transaction would be estimated at about \$1 Billion dollars. We very simply used the forward market – you borrow sterling and you sell the sterling that you've borrowed. And then you buy back the sterling when the loan expires."

—George Soros



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Exchange Rates Data

Real Time Market Data

- WSJ Market: Currency (w)
- TradingView: Forex Market (w)

Official Historical Data

- BIS Exchange Rate Data (w)
- IMF Exchange Rate Data (w)
- ECB Exchange Rate Data (w)
- OECD Exchange Rate Data (w)
- Federal Reserve Board H.10 (w)
- FRED Economic Research (w)

Currency ID Codes (w)

Major Developed Currencies

ISO	Currency Name	
USD	U.S. Dollar	
JPY	Japanese Yen	
EUR	Euro	
GBP	British Pound	
CHF	Swiss Franc	
NOK	Norwegian Krone	
SEK	Swedish Krona	
AUD	Australian Dollar	
NZD	New Zealand Dollar	
CAD	Canadian Dollar	

Select Emerging Currencies

ISO	Currency Name	
BRL	Brazilian Real	
CNY	Chinese Renminbi (Yuan)	
SGD	Singapore Dollar	
PHP	Philippine Peso	
MXN	Mexican New Peso	
INR	Indian Rupee	
IDR	Indonesian Rupiah	
MYR	Malaysia Ringgit	
PLN	Polish Zloty	
KRW	South Korean Won	

Source: PIMCO. Currencies are identified using ISO 4217 Currency Codes. By 1973, the International Organization for Standardization (ISO) established the three-letter codes for currencies we use today.

Market Exchange Rates

- **Bilateral exchange rate:** the price of one currency in terms of another currency. For instance, U.S. dollar per British pound (e.g. 1.3842\$/£); Euro per U.S. dollar (e.g. 0.7842€/\$.)
- **Cross exchange rate:** a bilateral exchange rate calculated from two other bilateral exchange rates, e.g., given 1.3842 \$/£ and 1.2752 \$/€, it is possible to calculate either the £/€ or €/£ rates.
- In cross-rate table, the numbers in the first row and first column are bilateral rates, cross rates are showed in-between.
- Pound-per-Euro cross rate: $\frac{1.2752}{1.3842} = 0.9213\text{£}/\text{€}$
- Euro-per-Pound cross rate: $1/0.9213 = 1.0855\text{€}/\text{£}$.
- **Currency index** is a weighted average of the value of currency against the currencies of its major trading partners. It is designed to measure changes in the value of the currency.

Bid-Ask Spread and Trading Margin

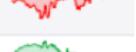
- Banks offering foreign exchange service either quote two rates or ask whether customers are buying or selling.
- The quoted rates will incorporate an allowance for a dealer's margin. Or else, the margin may be recovered in the form of a "commission" or in some other way.
- The rate at which the bank is willing to buy the currency from you is the **bid price**. The rate at which the bank is willing to sell the currency to you is the **ask price**.
- **Bid-ask spread**: the difference between the bid (purchase) price and the ask (offer) price.
- **Bid-ask margin**: expresses the bid-ask spread as a percentage, and represents the cost and risk associated with the foreign exchange transaction.

Example: Calculating the Bid-Ask Margin

Suppose that when you call your local bank and ask for a quote on the British pound, the reply is "840 and 844." (Because bankers want to economize on everything, including words, the banker is quoting only the last three decimal points of the spot rate.)

- What was meant, then, is $1.3840 \text{ \$/\pounds}$ and $1.3844 \text{ \$/\pounds}$. The lower rate is the bid price or buying price. The higher rate is the ask price or selling price.
- We can calculate the bid-ask margin as the difference between the ask price and the bid price, divided by the ask price, and multiplied by 100%. The margin is very small at 0.0289%.
- Currencies with a high trading volume and low exchange variability typically have lower bid-ask margins.

Bilateral Rates (w)

Symbol	Name	Last Price	Change	% Change	52 Week Range	Day Chart
BTCUSD=X	Bitcoin USD	10,149.8604	-131.21	-1.2762%	3,271.76 - 12,117.31	
ETHUSD=X	Ethereum USD	215.94	-5.08	-2.2984%	85.27 - 314.13	
EURUSD=X	EUR/USD	1.1030	0.0000	-0.0000%	1.09 - 1.18	
JPY=X	USD/JPY	107.5150	0.0000	0.0000%	104.87 - 114.51	
GBPUSD=X	GBP/USD	1.2469	0.0000	-0.0000%	1.20 - 1.33	
AUDUSD=X	AUD/USD	0.6771	0.0000	-0.0000%	0.67 - 0.74	
NZDUSD=X	NZD/USD	0.6261	0.0000	-0.0000%	0.63 - 0.70	
EURJPY=X	EUR/JPY	118.4900	0.0000	0.00%	115.87 - 133.11	
GBPJPY=X	GBP/JPY	134.2300	0.0000	0.00%	126.66 - 149.71	
EURGBP=X	EUR/GBP	0.8827	0.0000	0.00%	0.85 - 0.94	
EURCAD=X	EUR/CAD	1.4602	0.0000	0.00%	1.45 - 1.56	
EURSEK=X	EUR/SEK	10.6851	0.0000	0.00%	10.13 - 10.85	
EURCHF=X	EUR/CHF	1.0913	0.0000	0.00%	1.08 - 1.31	

Source: Yahoo

Cross Rates: Prices (w)

	🌐 EUR	🇺🇸 USD	🇦🇺 AUD	🇬🇧 GBP	🇳🇿 NZD	🇨🇦 CAD	🇨🇭 CHF	🇯🇵 JPY	🇭🇰 HKD	🇸🇬 SGD
🌐 EUR		1.10171	1.62849	0.8829	1.7601	1.46119	1.09186	118.506	8.63606	1.51664
🇺🇸 USD	0.9067		1.47807	0.80167	1.5974	1.32622	0.99066	107.536	7.83623	1.37641
🇦🇺 AUD	0.61397	0.67626		0.54249	1.08017	0.89696	0.67006	72.733	5.30325	0.9313
🇬🇧 GBP	1.1318	1.24695	1.84208		1.99067	1.65325	1.23541	134.055	9.77704	1.71701
🇳🇿 NZD	0.568	0.62575	0.92514	0.50186		0.82994	0.61999	67.299	4.90686	0.86162
🇨🇦 CAD	0.68411	0.75387	1.1139	0.604	1.2042		0.74686	81.07	5.90932	1.0377
🇨🇭 CHF	0.9153	1.00912	1.49152	0.8082	1.6121	1.3372		108.497	7.90907	1.38981
🇯🇵 JPY	0.00844	0.0093	0.01373	0.00745	0.01485	0.01232	0.00921		0.07267	0.01278
🇭🇰 HKD	0.11572	0.12754	0.18844	0.10218	0.20365	0.16911	0.1264	13.72352		0.17583
🇸🇬 SGD	0.65804	0.725	1.07152	0.58106	1.1551	0.9876	0.71996	78.1485	5.69468	

Source: TradingView

Cross Rates: Heatmap (w)

	🌐 EUR	🇺🇸 USD	🇦🇺 AUD	🇬🇧 GBP	🇳🇿 NZD	🇨🇦 CAD	🇨🇭 CHF	🇯🇵 JPY	🇭🇰 HKD	🇸🇬 SGD
🌐 EUR		-0.21%	0.19%	0.16%	0.45%	-0.18%	-0.38%	-0.64%	-0.12%	-0.37%
🇺🇸 USD	0.15%		0.4%	0.44%	0.69%	0.01%	-0.2%	-0.44%	0.07%	-0.17%
🇦🇺 AUD	-0.21%	-0.43%		0.02%	0.22%	-0.39%	-0.63%	-0.87%	-0.31%	-0.56%
🇬🇧 GBP	-0.22%	-0.41%	-0.07%		0.18%	-0.41%	-0.62%	-0.89%	-0.32%	-0.56%
🇳🇿 NZD	-0.46%	-0.68%	-0.25%	-0.25%		-0.64%	-0.87%	-1.11%	-0.56%	-0.83%
🇨🇦 CAD	0.18%	0%	0.4%	0.42%	0.71%		-0.2%	-0.43%	0.09%	-0.17%
🇨🇭 CHF	0.37%	0.22%	0.62%	0.56%	0.87%	0.14%		-0.24%	0.27%	0.08%
🇯🇵 JPY	0.64%	0.55%	0.83%	0.83%	1.13%	0.41%	0.33%		0.53%	0.47%
🇭🇰 HKD	0.1%	-0.09%	0.29%	0.29%	0.59%	-0.12%	-0.24%	-0.52%		-0.1%
🇸🇬 SGD	0.2%	0%	0.39%	0.4%	0.7%	1.02%	-0.02%	-0.27%	0.26%	

<https://www.tradingview.com/markets/currencies/cross-rates-overview-heat-map/>

Currency Indices (w)

Overview	Performance	Oscillators	Trend-Following	LAST	CHG %	CHG	HIGH	LOW	RATING
TICKER 8 matches				98.46	0.11%	0.10	98.64	98.14	↗ Buy
DXY U.S. DOLLAR CURRENCY INDEX				110.1	-0.33%	-0.4	110.3	110.0	↘ Sell
EXY EURO CURRENCY INDEX				124.8	-0.38%	-0.5	125.1	124.6	↘ Sell
BXY BRITISH POUND CURRENCY INDEX				100.9	0.17%	0.2	102.8	100.6	↘ Sell
SXY SWISS FRANC CURRENCY INDEX				93.0	0.40%	0.4	93.0	92.6	↘ Sell
CXY CANADIAN DOLLAR CURRENCY INDEX				67.7	0.01%	0.0	75.5	75.2	↘ Sell
AXY AUSTRALIAN DOLLAR CURRENCY INDEX				62.6	-0.34%	-0.2	67.9	67.6	↘ Sell
ZXY NEW ZEALAND DOLLAR CURRENCY INDEX					-0.71%	-0.5	62.8	62.5	↘ Sell

Source: TradingView

International Price Comparison with Exchange Rates

Scenario		1	2	3	4
Cost of the tuxedo in local currency	London	£2,000	£2,000	£2,000	£2,000
	Hong Kong	HK\$30,000	HK\$30,000	HK\$30,000	HK\$30,000
	New York	\$4,000	\$4,000	\$4,000	\$4,000
Exchange rates	HK\$/£	15	16	14	14
	\$/£	2.0	1.9	2.1	1.9
Cost of the tuxedo in pounds	London	£2,000	£2,000	£2,000	£2,000
	Hong Kong	£2,000	£1,875	£2,143	£2,143
	New York	£2,000	£2,105	£1,905	£2,105

Source: FT (2017)

Now pay attention, 007! This table shows how the hypothetical cost of James Bond's next tuxedo in different locations depends on the exchange rates that prevail. Apply bilateral rates to compare prices in a common currency.

Effective Exchange Rate (Currency Index)

- In the course of a typical trading day, a currency may appreciate against some currencies and depreciate against others. What do you say about its aggregate value? How to measure the overall value of a currency?
- An **effective exchange rate** (EER) is an index that measures the weighted average value of a currency relative to a basket of other currencies, which is a more informative measure of the strength of a currency than any bilateral rates.

Four steps to construct an EER:

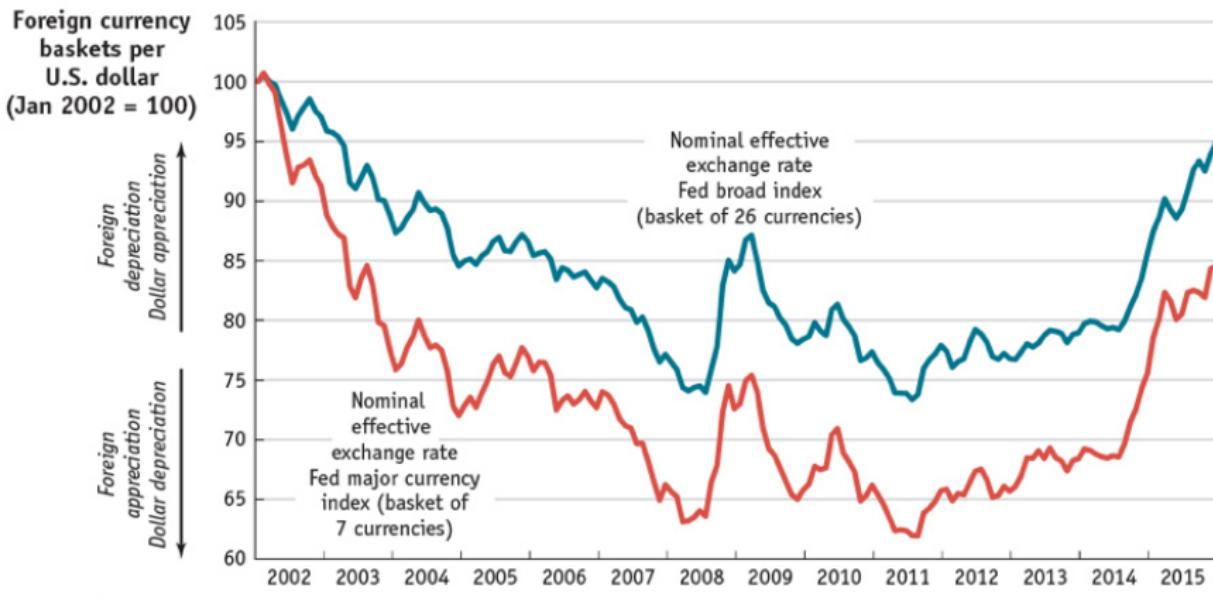
- ① chose a basket of currencies
- ② select a base year (a reference point 100)
- ③ decide the weights based on the trade flows
- ④ calculate the weighted average of the current rate over the base year

A Two-Country Example: Constructing EER

Select 2010 as the base year and construct a simple EER for the US between 2010 and 2012. For illustrative purpose, we only consider two of its main trading partners, Canada and Mexico, to compute the weights.

- In 2010, US exports to CA 248.8B\$ and imports from CA 276.5B\$; US exports to MX 163.3B\$ and imports from MX 229.7B\$.
 - In 2010, CA-US ER=1.001C\$/\\$ and MX-US ER=12.195P/\$
 - In 2012, CA-US ER=0.989C\$/\\$ and MX-US ER=13.123P/\$
- ① Bilateral weights calculation by trade volume:
 $W_C = (EX_C + IM_C) / [(EX_C + IM_C) + (EX_M + IM_M)] = 0.57$
 $W_M = (EX_M + IM_M) / [(EX_C + IM_C) + (EX_M + IM_M)] = 0.43$
 - ② $EER_{2010} : [W_C * 1 + W_M * 1] * 100 = 100$. Base year is always 100.
 - ③ $EER_{2012} : [W_C * (0.989/1.001) + W_M * (13.123/12.195)] * 100 = 102.58$
 - ④ What is the rate of appreciation of the US dollar in the period examined?

Nominal Effective Exchange Rates: US Dollar Prices



Source: FT (2017)

Nominal v.s. Real Exchange Rate

- FX market quotes are **nominal exchange rates**. It tells us the purchasing power of one currency in exchange for another currency. These exchange rates do not reflect changes in price levels in those two nations.
- What if we are more interested in the amount of foreign goods and services that our currency will buy, however?
- The **real exchange rate** adjusts the nominal exchange rate for changes in nations' price level and thereby measures the purchasing power of domestic goods and services in exchange for foreign ones.
- To calculate RE, the idea is to convert the foreign currency price of a basket of goods to home currency price, and then compare with domestic price for an equivalent basket. It measures which basket is more expensive, foreign relative to home.

The Real Exchange Rate

- The relative price of baskets is one of the most important variables in international macroeconomics.
- The real exchange rate: $RE_{H/F} = NE_{H/F} * (P_F/P_H)$. In effect, it is the price of foreign goods relative to the price of domestic goods denominated in the domestic currency.
- It is the price of the Foreign basket in terms of Home basket, i.e., **how many Home baskets are equivalent to a Foreign basket?**
- If the RE rises (more home goods are needed in exchange for foreign goods), we say H has experienced **a real depreciation**;
- If the RE falls (fewer home goods are needed in exchange for foreign goods), we say H has experienced **a real appreciation**.

The Real Exchange Rate: Example

$$RE_{H/F} = E_{H/F} * (P_F / P_H)$$

- Home country: U.S. and Foreign country: E.U.
- A representative basket of U.S. goods and services costs \$50;
- A representative basket of E.U. goods and services costs €40;
- The dollar/euro exchange rate is 1.1 \$/€;
- What is the real exchange rate?
- $RE_{H/F} = E \times P_F / P_H = (1.1 \text{ } \$/\text{€}) \times 40\text{€}/50\$ = 0.88$.
- The price of the European basket in terms of U.S. basket is 0.88.
- One European basket is worth 0.88 U.S. basket. Which is cheaper?

Which Rate Matters? An Example

The spot rate for the Mexican peso per U.S. dollar was 15.29 P/\$ in March 2009 and 13.12 P/\$ in March 2012. The peso, therefore appreciated relative to the dollar.

- 1) Which nation was getting better off, Mexicans or Americans, in terms of its purchasing power in international trade?

Meanwhile, the CPI for the United States was equal to 108.9 in March 2009 and 117.5 in March 2012. In Mexico, the CPI was equal to 118.5 in March 2009 and 139.2 in March 2012.

- 2) Which country experienced higher price inflation?
- 3) What were the inflation rates in each country during this period?

Calculating the Real Exchange Rate

For US consumers, relatively higher price inflation in Mexico added to the currency loss brought about by the depreciation of the U.S. dollar. The real exchange rate is calculated by dividing nominal exchange rate by the ratio of Mexican prices to U.S. prices. Mexicans were better off.

$$RE_t = \frac{NE_t}{(P_t^{MX}/P_t^{US})} = NE_t \times \frac{P_t^{US}}{P_t^{MX}}$$

Date	March 2009	March 2012	Percentage Change
NomiER	15.29 P/\$	13.12 P/\$	-14.2%
US CPI	108.9	117.5	7.9%
MX CPI	118.5	139.2	17.5%
RealER	14.05	11.08	-21.14%

Special Drawing Right (SDR) (w)

- SDRs were created in 1969 to supplement a shortfall of preferred foreign exchange reserve assets, namely gold and U.S. dollars.
- In the 1960's, policymakers at the IMF and in the sponsoring nations believed that there would not be sufficient gold reserves to provide the liquidity needed for international transactions. They intended for the SDR to serve as a reserve currency, or the currency that central banks would use to settle transactions. First Proposed in 1968 and allocated in 1970.
- Special Drawing Right (SDR) is a composite currency of the International Monetary Fund (IMF) in which the value is based on a weighted average of the currencies of 5 member nations.
- The weights assigned to each currency in the SDR basket are adjusted to take into account their current prominence in terms of international trade and national foreign exchange reserves.

SDR: Functions and Construction

- The expected liquidity crisis did not occur, so the SDR did not become the primary reserve currency.
- Nonetheless, it does fulfill some limited functions: 1) a means for some countries to finance short-term liquidity shortage; 2) served for some nations as a currency basket for pegging national currencies.
- Currently the SDR is based on the Dollar, Euro (replaced Franc and Mark on Jan 1, 99), Pound, Yen, and RMB.
- Multilateral weights, which reflect relative export volumes of the four countries, as well as relative balances of these four currencies held by all member countries of the IMF, are used in the construction of the SDR.
- Watch a video explaining how SDRs function: ([web](#))

Example: SDR Valuation (w)

Currency Amount	Currency Amount in SDR	U.S.-Dollar-per-Currency Rate	U.S. Dollar Equivalent
Euro	0.423	1.2752	0.5394
Japanese yen	12.100	0.0123	0.1488
British pound	0.111	1.3842	0.1536
U.S. dollar	0.660	1.0000	0.6600
SDR1 = \$1.5019			1.5019
\$1 = SDR0.6658			0.6658

- Convert currency amount to their dollar equivalents using spot rates. Then add them up to give the U.S. dollar rate per SDR.
- Can use it to calculate cross rate for other currencies.

Outline

- 1 FX Market Overview
- 2 Exchange Rate Measures
- 3 Foreign Exchange Derivatives

Foreign Exchange Risks

International trade and investment involve currency exchanges. Individuals, companies, and governments can manage the risk of fluctuations in exchange rates via financial derivatives. Examples:

- ① Individuals plan a European vacation for their family. The exchange rate they pay when converting their money is shaped by euro futures.
- ② An international company sees its profits from global commerce rise and fall due to swings in these exchange rates. It uses currency futures to stabilize its profits.
- ③ A manufacturer has a number of investments in foreign factories. It uses currency futures to protect its holdings against currency fluctuations in the countries where these factories are based.

Basic Derivatives: Functions

- An important use of derivatives is to hedge, or reduce risk. Typically, hedging involves the purchase of a derivative that increases in value if there is an adverse price change in the underlying asset in the derivatives contract.
- Investors can also use derivatives to speculate, or place financial bets on movements in asset prices.
- Speculators play two roles in the financial market: i) hedgers are able to transfer risk to speculators; ii) studies of derivatives markets have shown that speculators provide essential liquidity.
- Most derivatives are traded over-the-counter (OTC) or on an exchange such as the Chicago Mercantile Exchange (CME), while most insurance contracts have developed into a separate industry.

Basic Derivatives Contracts: Forwards and Futures

Forwards

A forward contract differs from a spot contract in that the two parties make the contract today, but the settlement date for the delivery of the currencies is in the future, or forward. The time to delivery, or maturity, varies. The settlement price is fixed as of today, thus the contract carries no price risk. Forward contracts are subject to counterparty risk.

Futures

A futures contract is a promise that the two parties holding the contract will deliver currencies to each other at some future date at a prespecified exchange rate, just like a forward contract. Unlike the forward contract, futures contracts are standardized, mature at certain regular dates, and can be traded on an organized futures exchange.

Basic Derivatives Contracts: Options and Swaps

Options

An option provides one party, the buyer, with the right to buy (call) or sell (put) a currency in exchange for another at a prespecified exchange rate at a future date. The buyer is under no obligation to trade and will not exercise the option if the spot price on the expiration date turns out to be more favorable.

Swaps

A swap contract combines a spot sale of foreign currency with a forward repurchase of the same currency. This is a common contract for counterparties dealing in the same currency pair over and over again. Combining two transactions reduces transaction costs.

Terminology in Trading Derivative

- **Hedge**: to insure against risk of future price fluctuation, e.g., purchasing a derivative contract that will increase in value when another asset in an investor's portfolio decreases in value.
- **Speculate**: to place financial bets, as in buying or selling futures or option contracts, in an attempt to profit from price movements.
- **A long position**: the right and obligation of the buyer to receive or buy the underlying asset on the specified future date. In most case, the buyer (seller) expects future price will go up.
- **A short position**: the right and obligation of the seller to sell or deliver the underlying asset on the specified future date. In most case, the seller expects future price will go down.

Terminology in Trading: Short Selling

- **Short selling:** when a trader or investor borrows a stock (paying a borrow rate dependent on the stock's availability) and sells it, with the expectation it's price will drop so they can buy back lower and pocket the difference. [NPR Explainer \(w\)](#)
- To close a short (whether at a loss or in profit), one must buy back the sold shares. When a stock's price rises and large amounts of shorts are at their limits and forced to close their position by buying shares, this can cause what is known as [short squeeze](#).
- In basic terms, short selling involves counting on a stock price dropping. With the strategy, the risk on the upside is unlimited.
- [CNBC: Why it's risky and how the "squeeze" happens \(w\)](#)
- [Visual Capitalist: The crazy world of stonks explained \(w\)](#)

Forward and Futures Contract: Definition (w)

- **Forward contract:** A private, cash-market agreement between a buyer and seller for the future delivery of a commodity, at an agreed upon price. Forward contracts are not standardized and are non-transferable.
- **Futures contracts:** Standardized contracts for the purchase and sale of financial instruments or physical commodities for future delivery on a regulated commodity futures exchange.
- **Problems with forward contracts:** 1) not organized through an exchange; 2) consequently, no price transparency; 3) double-coincidence-of-wants: need someone to take the opposite side!; 4) default risk of the counterparty.

Futures Contract – Market Practices

- Margin requirement is the minimum deposit that an exchange requires from the buyer or seller of a financial asset.
(Initial margin, maintenance margin, variation margin)
- Marking to market is a daily settlement in which the exchange transfers funds from a buyer's account to a seller's account or vice versa, depending on changes in the price of the contract.
- Daily settlement: futures contracts are marked-to-market on a daily basis; daily price limits restrict the maximum daily price movements.
- Price limits are set based on the previous day's settlement price. These limits are set by the Exchange and help to regulate dramatic price swings.

Mechanics of a Future Contract

- 1) Individuals open a margin account with a broker;
 - 2) Enter into N futures contracts with price F_0 ;
 - 3) Deposit initial margin: 5 to 10% of contract value;
 - 4) All profit/loss settled using margin account;
 - 5) Margin call if balance is low.
- Pros: 1) high leverage, high profit; 2) very liquid; 3) a wide variety of underlying assets.
 - Cons: 1) high leverage, high risk; 2) futures prices are approximately linear function of the underlying asset, only linear payoffs can be hedged; 3) may not be flexible enough; back to Forwards.

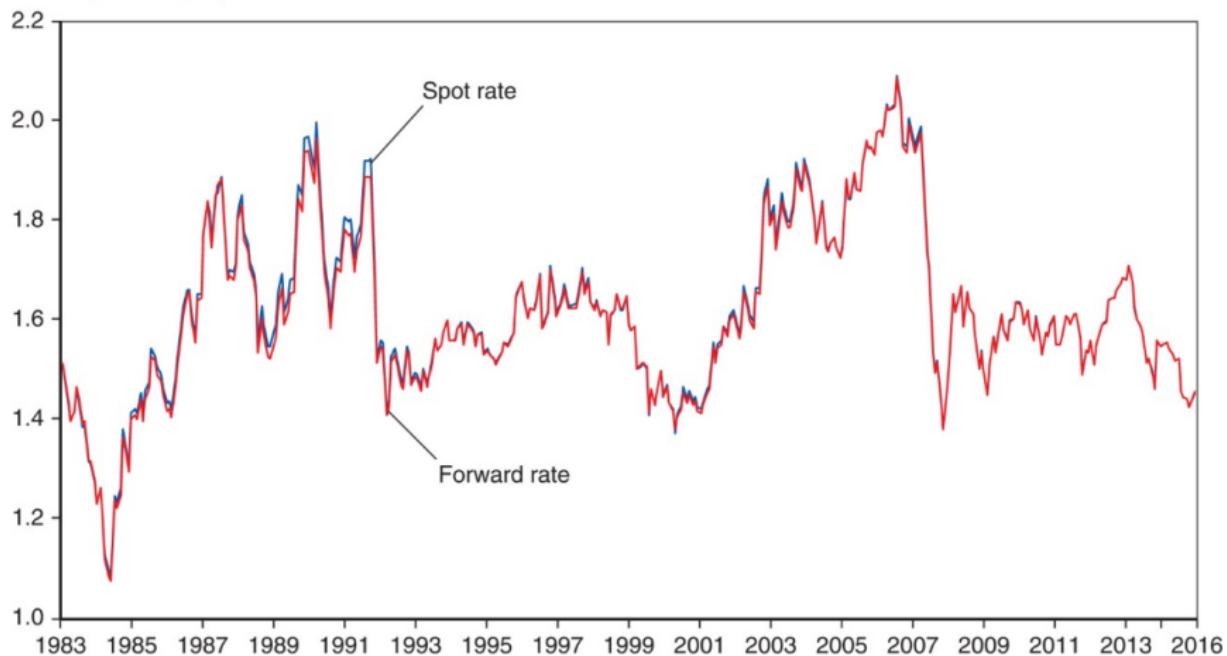
For an introduction to futures, check CME Education resources → [\(w\)](#)

Spot Rates and Forward Rates

- **Spot rates** are exchange rates for currency exchanges “on the spot,” or when trading is executed in the present.
- **Forward rates** are exchange rates for currency exchanges that will occur at a future (“forward”) date.
 - Forward dates are typically 30, 90, 180, or 360 days in the future.
 - Rates are negotiated between two parties in the present, but the exchange occurs in the future.
- A foreign currency has the property that the holder of the currency can earn interest at the risk-free interest rate prevailing in the foreign country. Spot and forward exchange rates tend to move in a highly correlated fashion.
- **Interest rate parity:** $F = S e^{(r - r_f)(T - t)}$ at time $t < T$, where F is the forward rate, S is the spot rate, T is the contract maturity.

Dollar/Pound Spot and Forward Exchange Rates, 1983-2016

Exchange rates (\$/£)



Source: KOM (2018). 90-day forward exchange rates and spot exchange rates, at end of month.

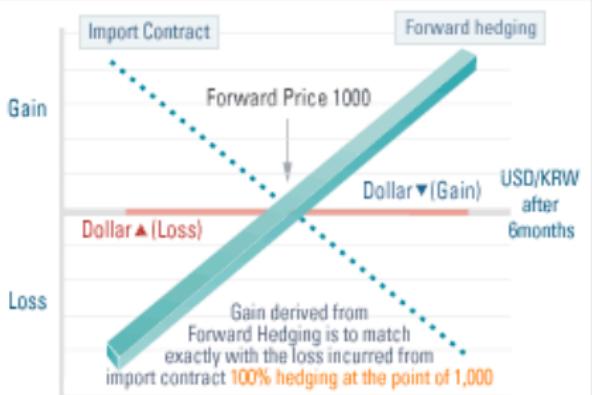
CME Real Time Futures Trading: A Snapshot (w)

Product	Code	Contract		Last	Change	Chart	Open	High	Low	Globex Vol
Euro FX Futures	6EZ9	DEC 2019	OPT	1.1010	-0.00755		1.10855	1.1088	1.1007	147,239
Japanese Yen Futures	6JZ9	DEC 2019	OPT	0.0093255	-0.000070		0.009389	0.009399	0.009321	118,651
British Pound Futures	6BZ9	DEC 2019	OPT	1.2397	-0.0138		1.2534	1.2534	1.2394	114,344
Australian Dollar Futures	6AZ9	DEC 2019	OPT	0.6764	-0.0053		0.6816	0.6822	0.6757	78,289
Mexican Peso Futures	6MZ9	DEC 2019	OPT	0.050410	-0.000300		0.050760	0.050760	0.050320	38,976
New Zealand Dollar Futures	6NZ9	DEC 2019	OPT	0.6280	-0.0062		0.6333	0.6360	0.6279	23,434
Russian Ruble Futures	6RZ9	DEC 2019	OPT	0.015415	-0.000060		0.015475	0.015475	0.015345	1,843
Brazilian Real Futures	6LV9	OCT 2019	OPT	0.2393	-0.0004		0.2403	0.2422	0.2384	6,081
Indian Rupee/USD Futures	SIRU9	SEP 2019		140.71	-0.09		140.63	140.86	140.57	3,388
Standard-Size USD/Offshore RMB (CNH) Futures	CNHz9	DEC 2019		7.1481	+0.0264		7.1217	7.1496	7.1187	821

<https://www.cmegroup.com/trading/fx/>

USD/KRW Forward Contract: Payoff Diagram (w)

Long Dollar - Import Company



Short Dollar - Export Company



Source: Citibank FX Options. Forward rate (strike price): \$1=W1000. Korean importers can hedge dollar appreciation risk (importers pay dollars in the future).

Manage FX Risk via Futures Contracts: Example (w)

Consider a Brazilian asset manager who decides to allocate R\$40 million into U.S. equities. By investing in U.S. equities, he has two risk exposures: U.S. equity price risk exposure and U.S. dollar versus Brazilian. real currency exposure.

- For this example, we focus exclusively on the currency risk exposure. In order to invest in U.S. equities, the Brazilian asset manager must first convert his cash from Brazilian reals to U.S. dollars.
- By converting from Brazilian real to a U.S. dollar, he is now exposed to a weaker U.S. dollar. If the dollar goes down in value versus the Brazilian real, when he converts back to his domestic currency, he will receive fewer reals, reducing the return on his investment.

Manage FX Risk via Futures Contracts: Computation (w)

Starting Position: R\$40,000,000 or \$10,000,000 (Spot rate: \$1=R\$4)

- Downside dollar risk exposed. How many contracts would he buy?
- Hedge ratio = value at risk / notional contract value (100,000)
- Hedge ratio = $40,000,000/100,000 = 400$ contracts
- BRL/USD futures contract trade at the inverse price to the spot convention. The spot rate was 4.0000, therefore the futures contract price would be 0.2500.

New Spot Rate: \$1=R\$3.5 (U.S. Dollar Weakens)

- BRL/USD Futures price = $1/3.5000=0.28570$
- Price movement = $0.2857-0.2500=0.0357$ (or 3570 points)
- Profit from hedging = $400*3570=\$1,428,000$ or R\$4,998,000

Net Gain from hedging: R\$4,988,000-R\$5,000,000=-R\$2000.

Manage FX Risk via Futures Contracts: Summary (w)

Cash Position

Initial
Exchange

$$R\$40M \div 4.00 = \$10M$$

After Dollar
Weakens

$$R\$35M = \$10M \times 3.5 \\ \text{Exchange} \\ \text{rate}$$

$$R\$40M - R\$35M =$$

-R\$5M

Futures Position

(400 Contracts)

Buy @ 0.25000

Sell @ 0.28570

3570 Point Gain

$$3570 \text{ Pt} \times 400 \text{ Contracts} = \\ = \$1,428,000$$

R\$4,998,000 = \$1,428,000 × 3.5
Exchange
rate

<https://www.cmegroup.com/education/courses/introduction-to-fx/how-to-manage-risk-in-fx.html>

Option Contracts: Terminology

An option is a security that **gives the holder the right** to buy (call) or to sell (put) an underlying asset on or before a particular date for a predetermined price. Correspondingly, the option **writer has the obligation**. Basic elements of an option:

- Two types of option: Call v.s. Put.
- Two types of trader: Buyer (holder) v.s. Seller (writer)
- Two types of position: Long (buy) v.s. Short (sell)
- Two prices: Spot v.s. Strike (exercise)
- Expiration (maturity) date: the holder can exercise on or before the date. (European v.s. American)
- Option fee (premium): the price of the option contract. The holder pays to the writer. (Tradable before maturity)

CME Real Time Options Trading: A Snapshot (w)

Clearing	Globex	Floor	ClearPort	Product Name	Product Group	Subgroup	Cleared As	Volume	Open Interest
EUU	EUU	EUU	EUU	EUR/USD Monthly Options	FX	Majors	Options	10,569	235,670
GBU	GBU	GBU	GBU	GBP/USD Monthly Options	FX	Majors	Options	17,619	109,088
JPU	JPU	JPU	JPU	JPY/USD Monthly Options	FX	Majors	Options	11,207	107,687
ADU	ADU	ADU	ADU	AUD/USD Monthly Options	FX	Majors	Options	6,203	53,927
CAU	CAU	CAU	CAU	CAD/USD Monthly Options	FX	Majors	Options	1,283	45,746
4EU	4EU	4EU	4EU	EUR/USD Weekly Friday Options - Wk 4	FX	Majors	Options	877	9,112
3EU	3EU	3EU	3EU	EUR/USD Weekly Friday Options - Wk 3	FX	Majors	Options	221	5,674
3JY	3JY	3JY	3JY	JPY/USD Weekly Friday Options - Wk 3	FX	Majors	Options	264	1,922
WE3	WE3	WE3	WE3	EUR/USD Weekly Wednesday Options - Wk 3	FX	Majors	Options	917	1,682
3AD	3AD	3AD	3AD	AUD/USD Weekly Friday Options - Wk 3	FX	Majors	Options	3	783

Trade Date: 24 Sep 2019 | FINAL

<https://www.cmegroup.com/trading/fx/>

USD/KRW FX Option Payoff: Call vs Put (w)

Dollar Call



Dollar Put



Source: Citibank FX Options. Strike price: \$1=W1000. Option provides a hedge against downside risk with a potential upside benefit. The cost is an option fee.

Swaps Markets (w)

- A swap is a derivative in which two counterparties **exchange cash flows** of one party's financial instrument for those of the other party's financial instrument.
- The cash flows are calculated over **a notional principal amount**. Contrary to a future, a forward or an option, the notional amount is usually **not** exchanged between counterparties. Consequently, swaps can be in cash or collateral.
- For example, in the case of a swap involving two bonds, the benefits in question can be the periodic interest (coupon) payments associated with such bonds.
- The five generic types of swaps, in order of their quantitative importance, are: interest rate swaps, currency swaps, credit swaps, commodity swaps and equity swaps.

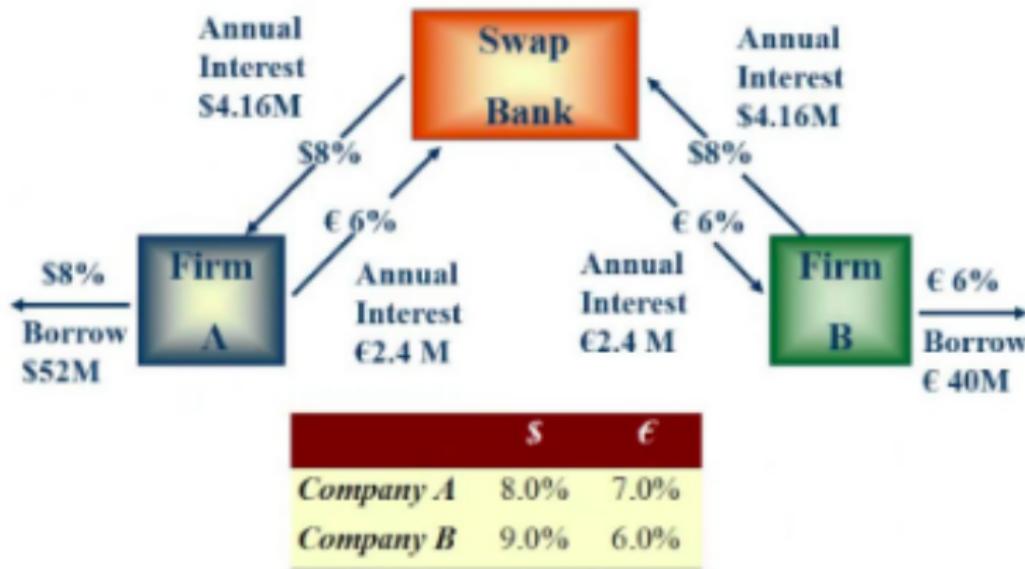
Swaps Contracts

- Most swaps are traded over-the-counter (OTC), "tailor-made" for the counterparties. Some can be traded on futures markets (CME).
- Why swaps? 1) change the nature of cash flows; 2) leverage strengths in different markets.
- Plain vanilla swap: fixed interest rate v.s. floating interest rate.
- Commodity swaps: exchange floating price for a fixed price (e.g. gold swaps, oil swaps).
- Currency swaps: exchange principal and fixed rate interest payments on a loan in one currency with another.
- Credit Default Swaps: A bilateral contract involving a protection buyer and a protection seller. The buyer seeks “protection” from the seller against the default of an underlying reference entity (e.g. a corporate bond), and in return for the protection services, the buyer pays a periodic sum of premium to the protection seller.

FX Swaps: Mechanics (w)

- An FX swap agreement is a contract in which one party borrows one currency from, and simultaneously lends another to, the second party.
- Each party uses the repayment obligation to its counterparty as collateral and the amount of repayment is fixed at the FX forward rate as of the start of the contract. Thus, FX swaps can be viewed as FX risk-free collateralized borrowing/lending.
- In a FX swap, one party A borrows X amount of a currency, say dollars, from the other party B at the spot rate and simultaneously lends to B another currency at the same amount X , say euros.
- In this case, each party has a repayment obligation to the other: A has to payback dollars; B has to payback euros. At maturity, A makes payments to B for X dollars at the forward rate as determined at the start of the contract. And B pays A his X amount of euros.

FX Swaps: Money Flows



<https://www.youtube.com/watch?v=MPQMm8JxpDE>

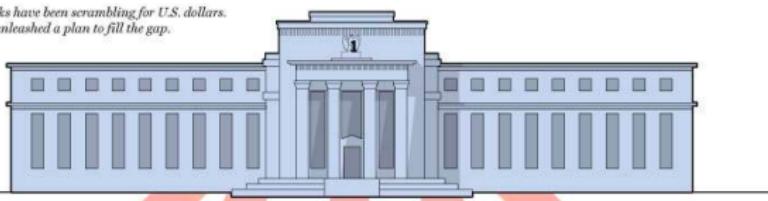
Central Bank Currency Swaps (w)

- Prior to the financial crisis of 2008, central banks around the world have entered into a multitude of bilateral currency swap agreements with one another.
- These agreements allow a central bank in one country to exchange currency, usually its domestic currency, for a certain amount of foreign currency.
- The recipient central bank can then lend this foreign currency on to its domestic banks, on its own terms and at its own risk.
- Swaps involving the U.S. Federal Reserve were the most important of all the cross-border policy responses to the crisis, helping to alleviate potentially devastating dollar funding problems among non-U.S. banks. Federal Reserve Board: (w). New York Fed: (w).

Central Bank Currency Swaps: How it Works (w)

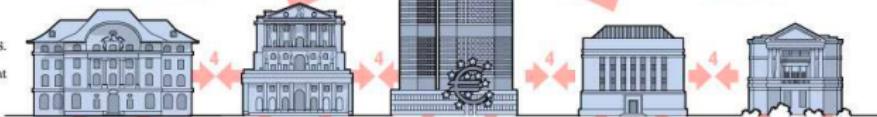
As the European credit crisis rages on, banks have been scrambling for U.S. dollars. On Wednesday, the world's central banks unleashed a plan to fill the gap.

- Under the program, the U.S. Federal Reserve allows five major central banks to swap their currencies for U.S. dollars on temporary emergency basis. The greenback is the world's reserve currency and a safe haven for investors who are uncertain about riskier currencies, which at this point includes the euro.

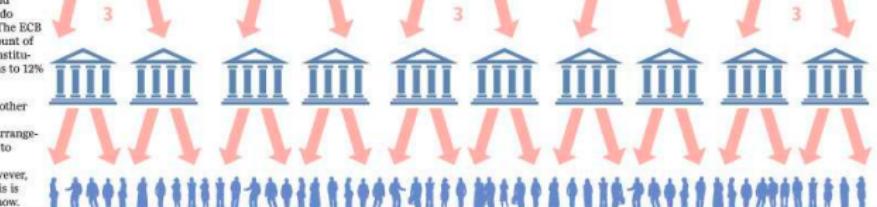


- The Fed lends dollars overnight to other central banks. The swaps are offered every three months at a set interest rate, with the next swap scheduled on Dec. 7. The interest rate the central banks pay is the swap rate, which has been cut to 50 basis points from 100 basis points over the standard rate to lower costs and increase access.

- The various central banks then take these U.S. dollars and loan them to companies and banks that need short-term cash to continue working. This is important for European banks as customers are shunning risky debt from such countries as Italy and Greece and only want to do business in U.S. dollars. The ECB has also lowered the amount of collateral necessary for institutions to access these loans to 12% from 20%.



- At the same time, the other central banks have also installed bilateral swap arrangements, allowing the ECB to trade euros for Canadian dollars, for example. However, the central banks said this is only a precaution — for now.



<https://business.financialpost.com/news/economy/how-swap-lines-work>

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