The International Monetary System

AND THE FOREIGN EXCHANGE MARKET

What is special about international finance?

- Foreign exchange risk
  - E.g., an unexpected devaluation adversely affects your export market…
- Political risk
  - E.g., an unexpected overturn of the government that jeopardizes existing negotiated contracts…
- Market imperfections
  - E.g., trade barriers and tax incentives may affect location of production…
- Expanded opportunity sets
  - E.g., raise funds in global markets, gains from economies of scale…

The Monetary System

- Bimetallism: Before 1875
  - Free coinage was maintained for both gold and silver
  - Gresham's Law: Only the abundant metal was used as money, diving more scarce metals out of circulation
- Classic gold standard: 1875-1914
  - Great Britain introduced full-fledged gold standard in 1821, France (effectively) in the 1850s, Germany in 1875, the US in 1879, Russia and Japan in 1897.
  - Gold alone is assured of unrestricted coinage
  - There is a two-way convertibility between gold and national currencies at a stable ratio
  - Gold may be freely exported and imported
  - Cross-border flow of gold will help correct misalignment of exchange rates and will also regulate balance of payments.
  - The gold standard provided a 40 year period of unprecedented stability of exchange rates which served to promote international trade.

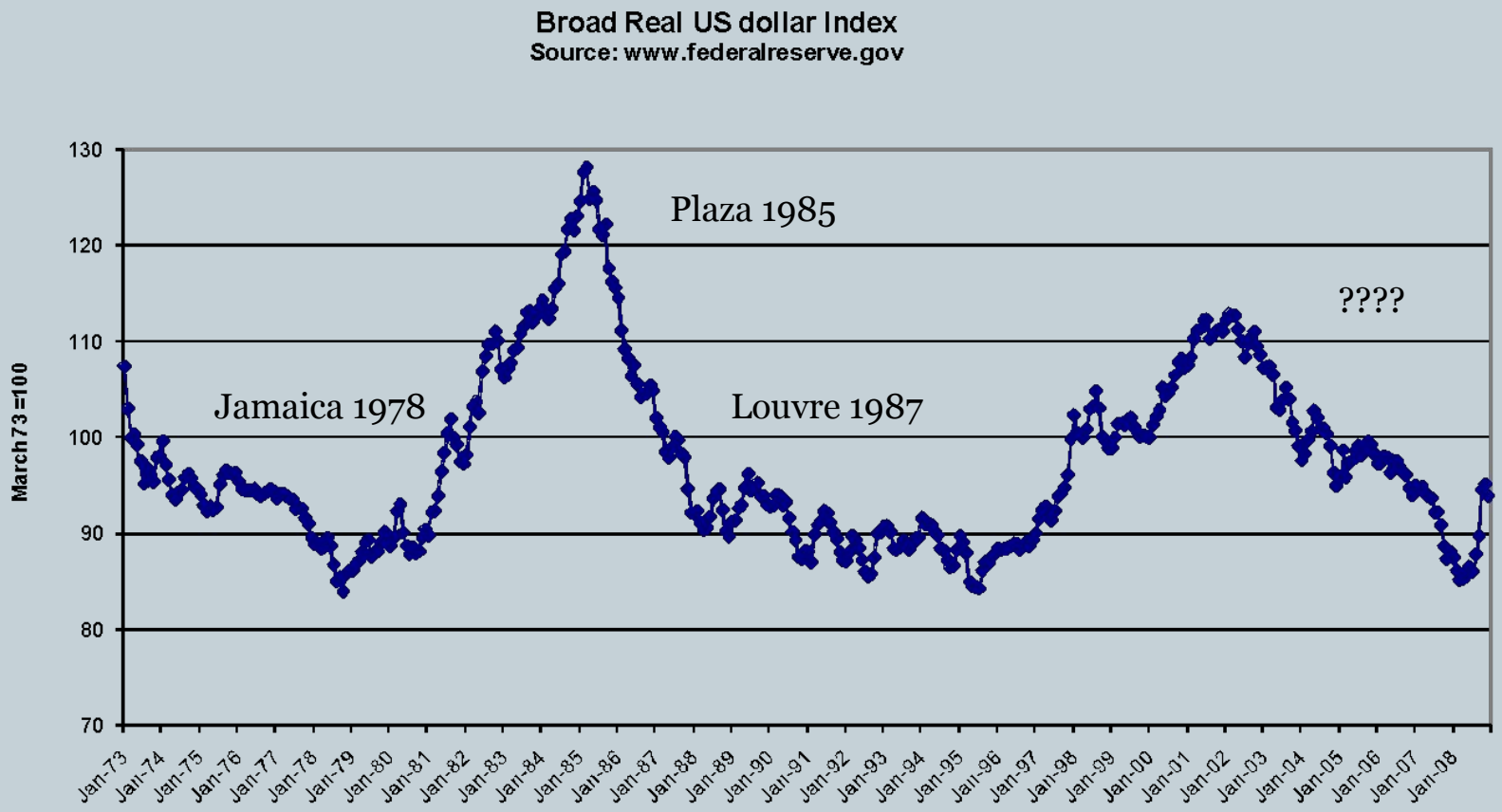
The Monetary System

- Interwar period: 1915-1944
  - World War I ended the classical gold standard in 1914
  - Trade in gold broke down
  - After the war, many countries suffered hyper inflation
  - Countries started to “cheat” (sterilization of gold)
  - Predatory devaluations (recovery through exports!)
  - The US, Great Britain, Switzerland, France and the Scandinavian countries restored the gold standard in the 1920s.
  - After the great depression, and ensuing banking crises, most countries abandoned the gold standard.
- Bretton Woods system: 1945-1972
  - U.S. dollar was pegged to gold at $35.00/oz.
  - Other major currencies established par values against the dollar. Deviations of ±1% were allowed, and devaluations could be negotiated.

The Monetary System

- Jamaica Agreement (1976)
  - Central banks were allowed to intervene in the foreign exchange markets to iron out unwarranted volatilities.
  - Gold was officially abandoned as an international reserve asset. Half of the IMF's gold holdings were returned to the members and the other half were sold, with proceeds used to help poor nations.
  - Non-oil exporting countries and less-developed countries were given greater access to IMF funds.
- Plaza Accord (1985)
  - G-5 countries (France, Japan, Germany, the U.K., and the U.S.) agreed that it would be desirable for the U.S. dollar to depreciate.
- Louvre Accord (1987)
  - G-7 countries (Canada and Italy were added) would cooperate to achieve greater exchange rate stability.
  - G-7 countries agreed to more closely consult and coordinate their macroeconomic policies.

The Monetary System



Current Exchange Rate Arrangements

- 36 major currencies, such as the U.S. dollar, the Japanese yen, the Euro, and the British pound are determined largely by market forces.
- 50 countries, including the China, India, Russia, and Singapore, adopt some forms of "Managed Floating" system.
- 41 countries do not have their own national currencies!
- 40 countries, including many islands in the Caribbean, many African nations, UAE and Venezuela, do have their own currencies, but they maintain a peg to another currency such as the U.S. dollar.
- The remaining countries have some mixture of fixed and floating exchange-rate regimes.

Note: As of July 31, 2005.

The Euro

- Product of the desire to create a more integrated European economy.
- Eleven European countries adopted the Euro on January 1, 1999:
  - Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain.
- The following countries opted out initially:
  - Denmark, Greece, Sweden, and the U.K.
- Euro notes and coins were introduced in 2002
- Greece adopted the Euro in 2001
- Slovenia adopted the Euro in 2007

The Euro

- Nowadays the euro (€) is the official currency of 17 out of 27 EU member countries. These countries, known collectively as the Eurozone are:

Austria	Germany	the Netherlands
Belgium	Greece	Portugal
Cyprus	Ireland	Slovakia
Estonia	Italy	Slovenia
Finland	Luxembourg	Spain
France	Malta	

- Over 175 million people worldwide use currencies which are pegged to the euro.

Will the UK (Sweden) join the Euro?

- Think about:
  - Potential benefits and costs of adopting the euro.
  - Economic and political constraints facing the country.
  - The potential impact of British adoption of the euro on the international financial system, including the role of the U.S. dollar.
  - The implications for the value of the euro of expanding the EU to include, e.g., Eastern European countries.

THE FOREIGN EXCHANGE MARKET

1. THE ORGANIZATION OF THE FOREIGN EXCHANGE MARKET
2. THE SPOT MARKET
3. THE FORWARD MARKET

The organization of the Foreign Exchange Market

Foreign exchange market - the market in which one country's currency is traded for another's.

- The foreign exchange market is an over-the-counter market, so there is no single location where traders get together. Instead, market participants are located in the major commercial and investment banks around the world. They communicate using computer terminals, telephones, and other telecommunications devices. For example, by the Society for Worldwide Interbank Financial Telecommunications (SWIFT).
- The many different types of participants in the foreign exchange market include the following:
  1. Importers who pay for goods using foreign currencies
  2. Exporters who receive foreign currency and may want to convert to the domestic currency
  3. Portfolio managers who buy or sell foreign stocks and bonds
  4. Foreign exchange brokers who match buy and sell orders
  5. Traders who "make a market" in foreign currencies
  6. Speculators who try to profit from changes in exchange rates

The organization of the Foreign Exchange Market

An **exchange rate is simply the price of one country's currency expressed in terms of** another country's currency.

Example: JAL every year needed to raise about $800 mln to purchase aircraft from Boeing (price ranges from $35 mln to $160 mln). JAL orders aircraft 2-6 years in advance and pays Boeing 10% deposit when ordering. In that period the value of the yen against the dollar may change. Consider an order placed for 747 aircraft that was to be delivered in 5 years. Dollar value - $100 mln.

0) $1=¥240, price - ¥2,4 billion.

1) $1=¥300, price - ¥3,0 billion, 25% increase
2) $1=¥200, price - ¥2,0 billion, 16,7% decrease

The Foreign Exchange Market

- The FX market encompasses:
  - Conversion of purchasing power from one currency to another; bank deposits of foreign currency; credit denominated in foreign currency; foreign trade financing; trading in foreign currency options & futures, and currency swaps
- No central market place
  - World-wide linkage of bank currency traders, non-bank dealers (IBanks, insurance companies, etc.), and FX brokers—like an international OTC market
- Largest financial market in the world
  - Daily trading is estimated to be US$3.21 trillion
  - Trading occurs 24 hours a day
  - London is the largest FX trading center

Global Foreign Exchange Market Turnover

Table 1

Global foreign exchange market turnover[1]

Daily averages in April, in billions of US dollars

Instrument	1992	1995	1998	2001	2004	2007
Spot transactions	394	494	568	386	621	1,005
Outright forwards	58	97	128	130	208	362
Foreign exchange swaps	324	546	734	656	944	1,714
Estimated gaps in reporting	43	53	61	28	107	129
Total "traditional" turnover	**820**	**1,190**	**1,490**	**1,200**	**1,880**	**3,210**
Turnover at April 2007 exchange rates[2]	*880*	*1,150*	*1,650*	*1,420*	*1,950*	*3,210*

[1] Adjusted for local and cross-border double-counting. [2] 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 2007 exchange rates.

Source: BIS Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity in April 2007.

BIS (Bank for International Settlements) Triennial Survey…

Table 2

Foreign exchange market turnover by instrument, counterparty and maturity[1]

Daily averages in April, in billions of US dollars and percentages

Instrument/counterparty	1998		2001		2004		2007	
	Amount	% share	Amount	% share	Amount	% share	Amount	% share
Spot	**568**	**40**	**386**	**33**	**621**	**35**	**1,005**	**33**
with reporting dealers	348	61	216	56	300	48	427	42
with other financial institutions	121	21	111	29	213	34	394	39
with non-financial customers	99	17	58	15	108	17	184	18
Outright forwards	**128**	**9**	**130**	**11**	**208**	**12**	**362**	**12**
with reporting dealers	49	38	52	40	73	35	96	27
with other financial institutions	34	27	41	31	80	38	159	44
with non-financial customers	44	35	37	29	56	27	107	30
Up to 7 days	65	51	51	39	92	44	154	43
Over 7 days and up to 1 year	57	45	76	58	111	53	200	55
Over 1 year	5	4	4	3	5	3	7	2
Foreign exchange swaps	**734**	**51**	**656**	**56**	**944**	**53**	**1,714**	**56**
with reporting dealers	511	70	419	64	562	60	796	46
with other financial institutions	124	17	177	27	293	31	682	40
with non-financial customers	98	13	60	9	89	9	236	14
Up to 7 days	528	72	451	69	692	73	1,329	78
Over 7 days and up to 1 year	192	26	196	30	240	25	365	21
Over 1 year	10	1	8	1	10	1	18	1
Total[2]	**1,429**	**100**	**1,172**	**100**	**1,773**	**100**	**3,081**	**100**
with reporting dealers	908	64	688	59	936	53	1,319	43
with other financial institutions	279	20	329	28	585	33	1,235	40
with non-financial customers	242	17	156	13	252	14	527	17
Local	657	46	499	43	674	38	1,185	38
Cross-border	772	54	673	57	1,099	62	1,896	62

[1] Adjusted for local and cross-border double-counting. [2] Excludes the estimated gaps in reporting shown in Table 1.

Table 3

Currency distribution of foreign exchange market turnover[1]

Percentage shares of average daily turnover in April

Currency	1992	1995	1998	2001	2004	2007
US dollar	82.0	83.3	87.3	90.3	88.7	86.3
Euro	…	…	…	37.6	37.2	37.0
Deutsche mark	39.6	36.1	30.1	…	…	…
French franc	3.8	7.9	5.1	…	…	…
ECU and other EMS currencies	11.8	15.7	17.3	…	…	…
Japanese yen	23.4	24.1	20.2	22.7	20.3	16.5
Pound sterling	13.6	9.4	11.0	13.2	16.9	15.0
Swiss franc	8.4	7.3	7.1	6.1	6.1	6.8
Australian dollar	2.5	2.7	3.1	4.2	5.5	6.7
Canadian dollar	3.3	3.4	3.6	4.5	4.2	4.2
Swedish krona[2]	1.3	0.6	0.4	2.6	2.3	2.8
Hong Kong dollar[3]	1.1	0.9	1.3	2.3	1.9	2.8
Norwegian krone[3]	0.3	0.2	0.4	1.5	1.5	2.2
New Zealand dollar[3]	0.2	0.2	0.3	0.6	1.0	1.9
Mexican peso[3]	…	…	0.6	0.9	1.1	1.3
Singapore dollar[3]	0.3	0.3	1.2	1.1	1.0	1.2
Korean won[3]	…	…	0.2	0.8	1.2	1.1
South African rand[3]	0.3	0.2	0.5	1.0	0.8	0.9
Danish krone[3]	0.5	0.6	0.4	1.2	0.9	0.9
Russian rouble[3]	…	…	0.3	0.4	0.7	0.8
Polish zloty[3]	…	…	0.1	0.5	0.4	0.8
Indian rupee[3]	…	…	0.1	0.2	0.3	0.7
Chinese Renminbi	…	…	0.0	0.0	0.1	0.5
Taiwan dollar[3]	…	…	0.1	0.3	0.4	0.4
Brazilian real[3]	…	…	0.4	0.4	0.2	0.4
Hungarian forint[3]	…	…	0.0	0.0	0.2	0.3
Czech koruna[3]	…	…	0.3	0.2	0.2	0.2
Thai baht[3]	…	…	0.2	0.2	0.2	0.2
Israeli New Shekel[4]	…	…	…	0.1	0.1	0.2
Turkish New Lira[4]	…	…	…	0.0	0.1	0.2
Malaysian ringgit[4]	…	…	0.0	0.1	0.1	0.1
Chilean peso[4]	…	…	0.1	0.2	0.1	0.1
Philippine Peso[4]	…	…	0.0	0.0	0.0	0.1
Indonesian Rupiah[4]	…	…	0.1	0.0	0.1	0.1
Slovak Koruna[4]	…	…	…	0.0	0.0	0.1
Saudi Riyal[4]	…	…	0.1	0.1	0.0	0.1
Colombian Peso[4]	…	…	…	0.0	0.0	0.1
Other currencies	7.7	7.1	8.2	6.5	6.2	7.3
All currencies	**200.0**	**200.0**	**200.0**	**200.0**	**200.0**	**200.0**

[1] Because two currencies are involved in each transaction, the sum of the percentage shares of individual currencies totals 200% instead of 100%. The figures relate to reported "net-net" turnover, ie they are adjusted for both local and cross-border double-counting. [2] From 1992 to 1998, the data cover local home currency trading only. Included as main currency from 2007. [3] From 1992 to 1998, the data cover local home currency trading only. [4] Data previous to 2007 cover local home currency trading only.

The Foreign Exchange Market

- The FX market is a two-tiered market:
  - Interbank Market (Wholesale)
    - Accounts for about 83% of FX trading volume—mostly speculative or arbitrage transactions
    - About 100-200 international banks worldwide stand ready to make a market in foreign exchange
    - FX brokers match buy and sell orders but do not carry inventory and FX specialists
  - Client Market (Retail)
    - Accounts for about 17% of FX trading volume
- Market participants include international banks, their customers, non-bank dealers, FX brokers, and central banks

Note: Data is from 2007.

Central Banking

- The U.S. monetary authorities occasionally intervene in the foreign exchange (FX) market to counter disorderly market conditions.
- The Treasury, in consultation with the Federal Reserve System, has responsibility for setting U.S. exchange rate policy, while the Federal Reserve Bank New York is responsible for executing FX intervention.
- U.S. FX intervention has become less frequent in recent years.

http://www.ny.frb.org/

- **WEDNESDAY, NOVEMBER 8, 2000**
  U.S. INTERVENES IN THIRD QUARTER TO BUY 1.5 BILLION EUROS NEW YORK FED REPORTS

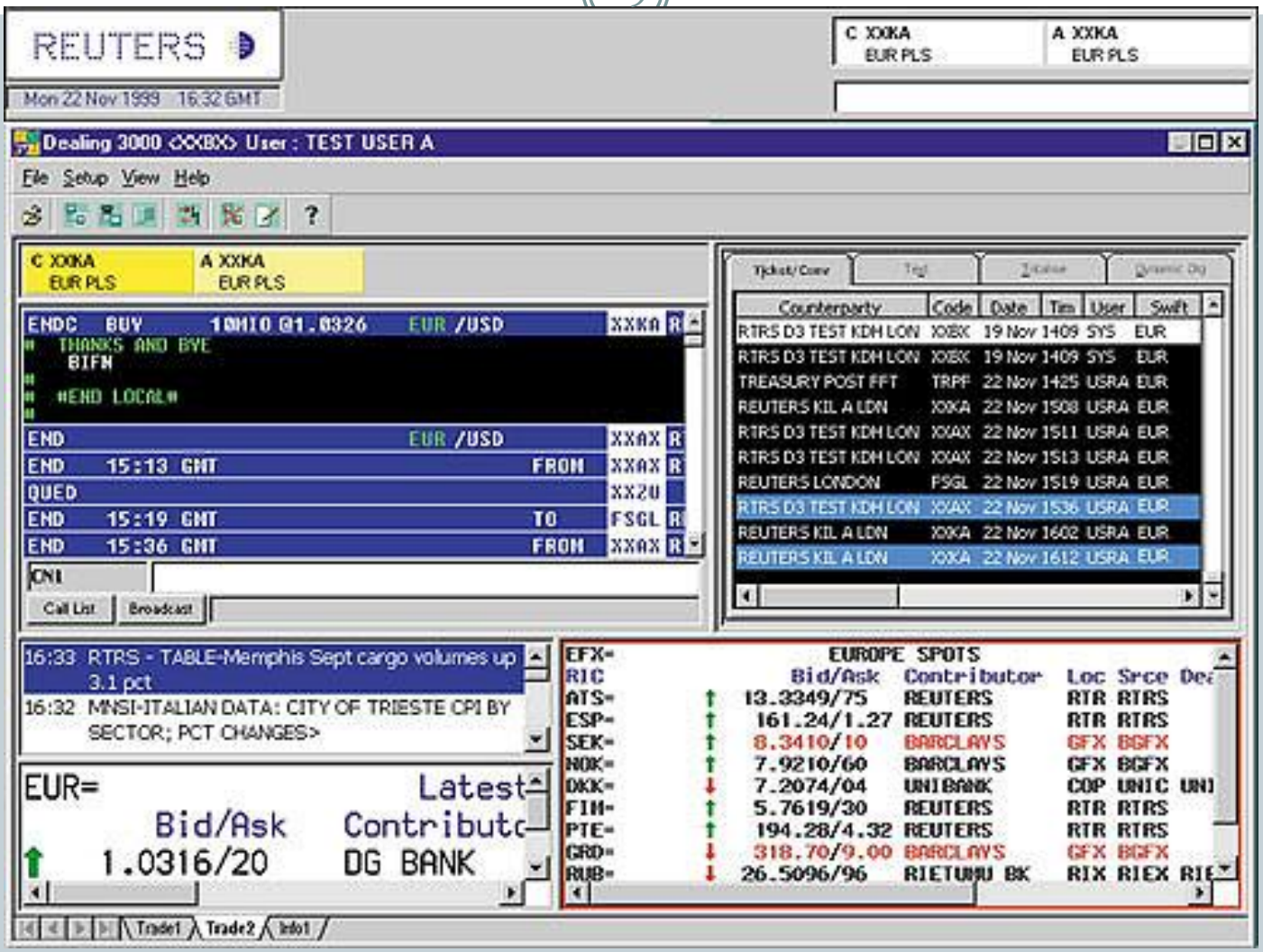
NEW YORK – The U.S. monetary authorities intervened in the foreign exchange markets on one occasion during the third quarter, on September 22nd, buying a total of 1.5 billion euros, the Federal Reserve Bank of New York said today in its quarterly report to the U.S. Congress.

According to the report, the dollar appreciated 8.2 percent against the euro and appreciated 2 percent against the Japanese yen during the three month period that ended September 30, 2000.

The intervention was carried out by the foreign exchange trading desk at the New York Fed, operating in coordination with the European Central Bank (ECB) and the monetary authorities of Japan, Canada, and the United Kingdom. The amount was split evenly between the Federal Reserve System and the U.S. Treasury Department's Exchange Stabilization Fund (ESF).

The report was presented by Peter R. Fisher, executive vice president of the New York Fed and the Federal Open Market Committee's (FOMC) manager for the system open market account, on behalf of the Treasury and the Federal Reserve System.

The Foreign Exchange Market



Overview

Currency Table

Curren-cy	Last	Day High	Day Low	% Change	Bid	Ask
EUR/ USD	1.2937	1.2945	1.2933	-0.04%	1.2937	1.2940
GBP/ USD	1.6018	1.6025	1.6013	-0.02%	1.6018	1.6022
USD/ JPY	82.050	82.160	82.030	-0.09%	82.050	82.080
USD/ CHF	0.93100	0.93120	0.92970	+0.09%	0.93100	0.93130
USD/ CAD	0.99390	0.99460	0.99370	-0.06%	0.99390	0.99440
AUD/ USD	1.0444	1.0455	1.0438	-0.01%	1.0444	1.0448

The Spot Market

- The spot market involves the immediate purchase or sale of foreign exchange
  - Cash settlement occurs 1-2 days after the transaction
- Currencies are quoted against the US dollar
- Interbank FX traders buy currency for their inventory at the *bid price*
- Interbank FX traders sell currency for their inventory at the *ask price*
- Bid price is less than the ask price
- Bid-ask spread is a transaction cost

The Spot Market – Direct Quotes

- US dollar price of 1 unit of foreign currency—$ are in the numerator (foreign currency is priced in terms of dollars)
  - $/€ = 1.5000 (1€ costs $1.5000)
  - $/£ = 2.0000 (1£ costs $2.0000)
- Currency changes
  - Suppose that today, $/€ = 1.5000 and in 1 month, $/€ = 1.5050
    - The $ has *depreciated* in value
    - Alternatively, the € has *appreciated* in value
  - Suppose that today, $/£ = 2.0000 and in 1 month, $/£ = 1.9950
    - The $ has *appreciated* in value
    - Alternatively, the £ has *depreciated* in value

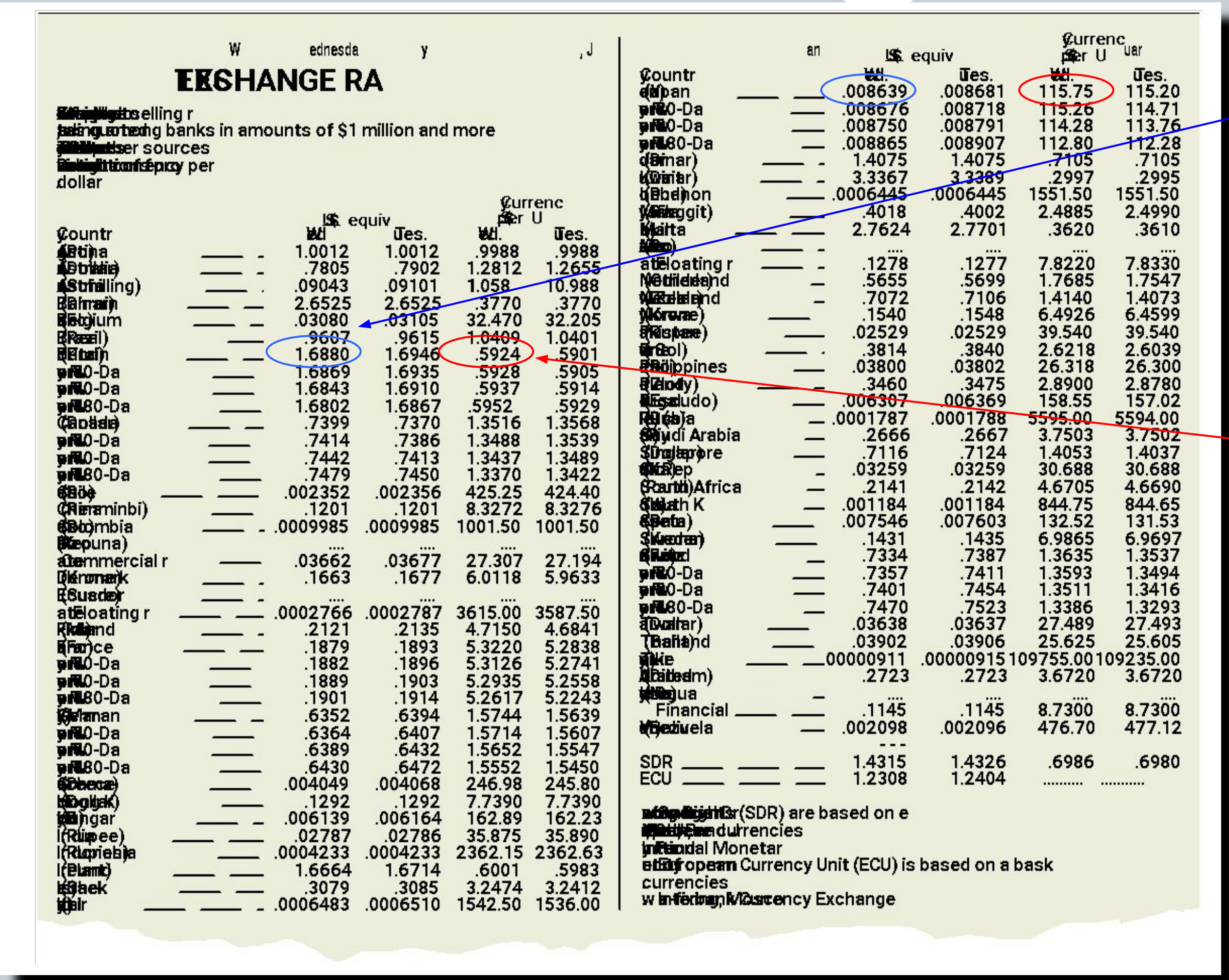
The Spot Market – Indirect Quotes

- Foreign currency price of $1—$ are in the denominator (US dollar is priced in terms of foreign currency)
  - €/$ = 0.6667 ($1costs €0.6667)
  - £/$ = 0.5000 ($1 costs £0.5000)
- Currency changes
  - Suppose that today, €/$ = 0.6667 and in 1 month, €/$ = 0.6600
    - The $ has *depreciated* in value
    - Alternatively, the € has *appreciated* in value
  - Suppose that today, £/$ = 0.5000 and in 1 week, £/$ = 0.5050.
    - The $ has *appreciated* in value
    - Alternatively, the £ has *depreciated* in value

The Spot Market - Conventions

- Denote the spot rate as S
- For most currencies, use 4 decimal places in calculations
  - With exceptions: i.e. S(¥/$)=109.0750, but S($/¥)=0.009168
- If we are talking about the US, always quote spot rates as the dollar price of the foreign currency
  - i.e. as direct quotes, S($/€), S($/C$), S($/£), etc
- Increase in the exchange rate ⇒ the US dollar is depreciating
  - Costs more to buy 1 unit of foreign currency
- Decrease in the exchange rate ⇒ the US dollar is appreciating
  - Costs less to buy 1 unit of foreign currency

The Spot Market



EXCHANGE RATES

Wednesday, January

... selling rates ... among banks in amounts of $1 million and more ... other sources ... foreign currency per dollar

Country	U.S. $ equiv. Wed.	U.S. $ equiv. Tues.	Currency per U.S. $ Wed.	Currency per U.S. $ Tues.
Argentina (Peso)	1.0012	1.0012	.9988	.9988
Australia (Dollar)	.7805	.7902	1.2812	1.2655
Austria (Schilling)	.09043	.09101	1.058	10.988
Bahrain (Dinar)	2.6525	2.6525	.3770	.3770
Belgium (Franc)	.03080	.03105	32.470	32.205
Brazil (Real)	.9607	.9615	1.0409	1.0401
Britain (Pound)	1.6880	1.6946	.5924	.5901
30-Day Forward	1.6869	1.6935	.5928	.5905
90-Day Forward	1.6843	1.6910	.5937	.5914
180-Day Forward	1.6802	1.6867	.5952	.5929
Canada (Dollar)	.7399	.7370	1.3516	1.3568
30-Day Forward	.7414	.7386	1.3488	1.3539
90-Day Forward	.7442	.7413	1.3437	1.3489
180-Day Forward	.7479	.7450	1.3370	1.3422
Chile (Peso)	.002352	.002356	425.25	424.40
China (Renminbi)	.1201	.1201	8.3272	8.3276
Colombia (Peso)	.0009985	.0009985	1001.50	1001.50
Czech. Rep. (Koruna)	....	....	....	....
Commercial rate	.03662	.03677	27.307	27.194
Denmark (Krone)	.1663	.1677	6.0118	5.9633
Ecuador (Sucre)	....	....	....	....
Floating rate	.0002766	.0002787	3615.00	3587.50
Finland (Markka)	.2121	.2135	4.7150	4.6841
France (Franc)	.1879	.1893	5.3220	5.2838
30-Day Forward	.1882	.1896	5.3126	5.2741
90-Day Forward	.1889	.1903	5.2935	5.2558
180-Day Forward	.1901	.1914	5.2617	5.2243
Germany (Mark)	.6352	.6394	1.5744	1.5639
30-Day Forward	.6364	.6407	1.5714	1.5607
90-Day Forward	.6389	.6432	1.5652	1.5547
180-Day Forward	.6430	.6472	1.5552	1.5450
Greece (Drachma)	.004049	.004068	246.98	245.80
Hong Kong (Dollar)	.1292	.1292	7.7390	7.7390
Hungary (Forint)	.006139	.006164	162.89	162.23
India (Rupee)	.02787	.02786	35.875	35.890
Indonesia (Rupiah)	.0004233	.0004233	2362.15	2362.63
Ireland (Punt)	1.6664	1.6714	.6001	.5983
Israel (Shekel)	.3079	.3085	3.2474	3.2412
Italy (Lira)	.0006483	.0006510	1542.50	1536.00
Japan (Yen)	.008639	.008681	115.75	115.20
30-Day Forward	.008676	.008718	115.26	114.71
90-Day Forward	.008750	.008791	114.28	113.76
180-Day Forward	.008865	.008907	112.80	112.28
Jordan (Dinar)	1.4075	1.4075	.7105	.7105
Kuwait (Dinar)	3.3367	3.3389	.2997	.2995
Lebanon (Pound)	.0006445	.0006445	1551.50	1551.50
Malaysia (Ringgit)	.4018	.4002	2.4885	2.4990
Malta (Lira)	2.7624	2.7701	.3620	.3610
Mexico (Peso)	....	....	....	....
Floating rate	.1278	.1277	7.8220	7.8330
Netherland (Guilder)	.5655	.5699	1.7685	1.7547
New Zealand (Dollar)	.7072	.7106	1.4140	1.4073
Norway (Krone)	.1540	.1548	6.4926	6.4599
Pakistan (Rupee)	.02529	.02529	39.540	39.540
Peru (new Sol)	.3814	.3840	2.6218	2.6039
Philippines (Peso)	.03800	.03802	26.318	26.300
Poland (Zloty)	.3460	.3475	2.8900	2.8780
Portugal (Escudo)	.006307	.006369	158.55	157.02
Russia (Ruble)	.0001787	.0001788	5595.00	5594.00
Saudi Arabia (Riyal)	.2666	.2667	3.7503	3.7502
Singapore (Dollar)	.7116	.7124	1.4053	1.4037
Slovak Rep. (Koruna)	.03259	.03259	30.688	30.688
South Africa (Rand)	.2141	.2142	4.6705	4.6690
South Korea (Won)	.001184	.001184	844.75	844.65
Spain (Peseta)	.007546	.007603	132.52	131.53
Sweden (Krona)	.1431	.1435	6.9865	6.9697
Switzerland (Franc)	.7334	.7387	1.3635	1.3537
30-Day Forward	.7357	.7411	1.3593	1.3494
90-Day Forward	.7401	.7454	1.3511	1.3416
180-Day Forward	.7470	.7523	1.3386	1.3293
Taiwan (Dollar)	.03638	.03637	27.489	27.493
Thailand (Baht)	.03902	.03906	25.625	25.605
Turkey (Lira)	.00000911	.00000915	109755.00	109235.00
United Arab (Dirham)	.2723	.2723	3.6720	3.6720
Uruguay (New Peso)	....	....	....	....
Financial	.1145	.1145	8.7300	8.7300
Venezuela (Bolivar)	.002098	.002096	476.70	477.12
SDR	1.4315	1.4326	.6986	.6980
ECU	1.2308	1.2404	....	....

Special Drawing Rights (SDR) are based on exchange rates for ... currencies ... International Monetary Fund. European Currency Unit (ECU) is based on a basket of ... currencies ... Moscow Interbank Currency Exchange

US dollar price:

$S(\$/£)=1.6880$

£1 costs $1.6880

UK pound price:

$S(£/\$)=0.5924$

$1 costs £0.5924

And note that

$$S(\$/£)=\frac{1}{S(£/\$)}$$

The Spot Market

- The current exchange, S($/€)=1.5000. In 1 month, it is S(€/$)=0.6689
  - Has the US dollar appreciated or depreciated?
  - By what % has the exchange rate changed?
- Convert S(€/$)=0.6689 to:
  1/S(€/$)=S($/€)=1.4950.
  - Now we see that the exchange rate has decreased ⇒ US dollar has appreciated.
  - The % change per month is:

$$\frac{1.4950 - 1.5000}{1.5000} = -0.33\%$$

Cross Exchange Rates

- The exchange rate between 2 currencies where neither currency is the US dollar
- We know the dollar rates. What if we want to know other rates, i.e. S(€/£) ?
  - Calculate cross-rates from dollar rates
  - S($/€)=1.5000 and S($/£)=2.0000. What is S(€/£), i.e. the € price of £?

$$\frac{\in}{£} = \frac{\in}{\$} \times \frac{\$}{£} = \frac{1}{1.5000} \times 2.0000 = \frac{\in 1.3333}{£1}$$

$$\Rightarrow S(\in / £) = 1.3333$$

Cross-Exchange Rates

- Cross-rates must be internally consistent; otherwise arbitrage profit opportunities exist.
- Suppose that:

$$\frac{€}{£} \neq \frac{€}{\$} \times \frac{\$}{£}$$

- A profit opportunity exists. Either S(€/£) is too high or S(€/$) or S($/£) is too low.
- How does this work?
- Sell high and buy low.

Cross-Exchange Rates Example

- Bank1: S($/¥)=0.0084; Bank2: S($/€)=1.0500; Bank3: S(€/¥)=0.0081.
- The implied cross rate between Bank 1 and 2 is: S(€/¥)=0.0080.
- You have ¥1,250,000. What should you do?
  - Go to Bank 3.
    Convert ¥1,250,000 to €10,125.00 @ 0.0081
  - Go to Bank 2.
    Convert €10,125 to $10,631.25 @ 1.0500.
  - Go to Bank 1.
    Convert $10,631.25 to ¥1,265,625.00 @ (1/0.0084)
  - The initial ¥1,250,000 becomes ¥1,265,625. You earn a risk-free profit of ¥15,625, or 1.25%.

Sell ¥ high!

Buy ¥ low!

The Forward Market

- Forward market involves contracting today for the future purchase or sale of foreign exchange
- Forward prices are quoted the same way as spot prices
- Denote the forward price maturing in N days as F_N
  - i.e. $F_{30}(\$/£)$, $F_{180}(\$/€)$, $F_{90}(€/¥)$, etc
- The forward dollar price of the euro can be:
  - Same as the spot price
  - Higher than the spot price (euro at a premium)
  - Lower than the spot price (euro at a discount)

The Forward Market

For example, the spot exchange rate for the Swiss franc is SF 1 $.5871. The 180-day (6-month) forward exchange rate is SF 1 $.5887. This means that you can buy a Swiss franc today for $.5871 or you can agree to take delivery of a Swiss franc in 180 days and pay $.5887 at that time.

Notice that the Swiss franc is more expensive in the forward market ($.5887 versus $.5871). Because the Swiss franc is more expensive in the future than it is today, it is said to be selling at a *premium relative to the dollar*. *For the same reason, the dollar is* said to be selling at a *discount relative to the Swiss franc.*

Wrap-Up

- The foreign exchange market is by far the largest financial market in the world.
- Currency traders trade currencies for spot and forward delivery.
- Exchange rates are by convention quoted against the U.S. dollar, but cross-rates can easily be calculated from bilateral rates.
- Triangular arbitrage forces the cross-rates to be internally consistent.
- The euro has enhanced trade within Europe, and the currency has the potential of becoming a major world currency.

Assignment

- Suppose you are Professor Paul Krugman (Princeton University Economics Professor and NYT columnist (Op-Ed Page)).
- On October 13, 2008, at 5am you receive a phone call from the Royal Swedish Academy informing you that you have been awarded the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel for your work on international trade and economic geography.
- After first thinking this is a practical joke – "that is surely a fake Swedish accent" - the news sink in and you realize you have a small problem.
- The prize will be awarded at a ceremony on December 10th in Stockholm, at which time you will receive the a medal, a diploma, and a prize check for SEK 10,000,000 or US$ 1,394,136 at the current spot rate (SEK 7.1729US$).
- What should you do?

Nobel Prize Problem...