


**MS&E247s International Investments** 

**MWF 1:15-2:05 Skilling 193**  
Problem Session Tu 1:15-2:05 Skilling 193

**Handout #5**  
**Foreign Exchange Markets**  
**Market Structure and Institutions**

Course web page:  
<http://www.stanford.edu/class/msande247s>

Reading Assignments for This Week




	<u>Scan</u>	<u>Read</u>
Levich	Chaps 3-5	Pages
Luenberger	Chap	Pages
Solnik	Chap	Pages
Blanchard	Chap 18	Pages
	Openness in Goods and Financial Markets	
Wooldridge	Chap 4	Pages
	Multiple Regression Analysis: Inference	

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**Foreign Exchange Markets**  
**Market Structure and Institutions**




MS&E247s International Investments  
Yee-Tien Fu

**Overview** 


- **Money plays many roles.**
  - It is a unit of account, in invoicing and pricing.
  - It is a store of value, in savings and other portfolios. It has high liquidity. However, it is subjected to inflation and exchange rate changes. The value of money depends on its purchasing power.
  - It is a medium of exchange, when used to pay for goods and services.

Manual 3-4

**Overview** 

- Traditionally, market players used the money markets for their short-term borrowing or lending requirements and the foreign exchange markets when they needed to buy or sell currencies. [The connection between money market instruments and foreign exchange rates is interest rates.]
- The **foreign exchange market** allows currencies to be exchanged. Such markets have existed for centuries.

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**Overview** 

- **Why does the foreign exchange market exist?**
  - For international trade and investment.
  - For hedging by market participants who need to minimize their currency risk.
  - For speculation. Speculation implies financial transactions undertaken when an individual's expectations differ from that of the market.
  - Only 15% of the global foreign exchange turnover is due to trade and investment. The bulk of 85% is due to hedging and speculation.

Reuters 3-6

**Why does the foreign exchange market exist?**

- **Trade and investment**
  - Companies who import or export goods are buying them in one currency and selling them in another. They therefore need to convert some of the money they receive into the currency in which they pay for goods.
  - Similarly, a company that buys an asset in a foreign country has to pay for it in the local currency, and so will need to convert its home currency into the local foreign currency.

Reuters 3-7

**Why does the foreign exchange market exist?**

- **Speculation**
  - The foreign exchange rate between two currencies varies in line with the relative supply and demand for the two currencies.
  - Traders can make profits buying a currency at one rate and selling it at a more favorable rate.
  - Speculation makes up by far the largest proportion of trading in the foreign exchange market.

Reuters 3-8

**Why does the foreign exchange market exist?**

- **Hedging**
  - Companies who have assets in foreign countries are exposed to the risk of those assets varying in value in their home currency due to fluctuations in the exchange rate.
  - While the foreign assets may retain the same value over time in the foreign currency, they produce a profit or loss in the company's domestic currency if the rate changes.
  - Companies can eliminate these potential profits or losses by hedging. This involves executing a transaction that will exactly offset the profit or loss of the foreign asset caused by changes in the exchange rate.

Reuters 3-9

**Overview** 

**For most of this century ...**

- The list of market participants was static, consisting of commercial banks in the U.S. and universal banks elsewhere.
- The product list was also static, consisting of spot and forward contracts with fixed, short-term maturities.
- Competition from exchange-traded products was nonexistent, and the market structure was well-defined and static as well.

3-10

**Overview** 

**Over the last 20 years ...**

- Financial innovation and competitive pressures have forced massive changes.
- Banks now offer longer-term forward contracts.
- Currency options are the fastest-growing segment of the market.
- Other products that combine characteristics of options and forwards have also been introduced.

3-11

**Overview** 

**Over the last 20 years ...**

- New centralized markets for exchange-traded currency and interest rate futures and options have developed in countries around the world. These often offer deep and liquid markets, and stiff competition to traditional bank products.
- New players like investment banking firms in the U.S. and securities firms worldwide support trading activities in foreign exchange and interest rate products.

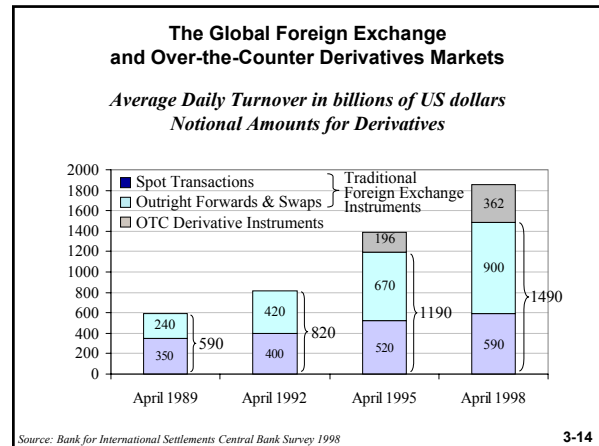
3-12

### Overview

**Over the last 20 years ...**

- Many corporate customers have well-developed subsidiaries that seek a more direct role in the market.
- New communications technology that link market participants and automate transactions threaten the traditional role of foreign exchange brokers.

**3-13**



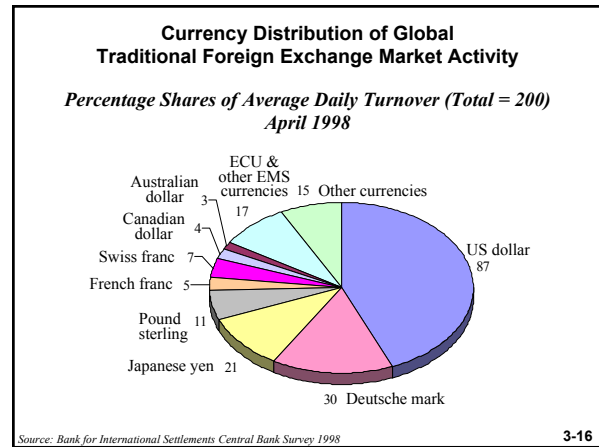
### Global foreign exchange market turnover<sup>1</sup>

Daily averages in April, in billions of US dollars

	1989	1992	1995	1998 <sup>2</sup>	2001
Spot transactions	317	394	494	568	387
Outright forwards	27	58	97	128	131
Foreign exchange swaps	190	324	546	734	656
Estimated gaps in reporting	56	44	53	60	26
Total "traditional" turnover	590	820	1,190	1,490	1,200
Memo: Turnover at April 2001 exchange rates <sup>3</sup>	570	750	990	1,400	1,200

<sup>1</sup> Adjusted for local and cross-border double-counting. <sup>2</sup> Revised since the previous survey. <sup>3</sup> Non-US dollar legs of foreign currency transactions were converted from current US dollar amounts into original currency amounts at average exchange rates for April of each survey year and then reconverted into US dollar amounts at average April 2001 exchange rates. Table B.1

**3-15**



### Currency distribution of reported foreign exchange market turnover<sup>1</sup>

Percentage shares of average daily turnover in April  
Source: BIS Central Bank Survey 2001

	1989	1992	1995	1998 <sup>2</sup>	2001
US dollar	90.0	82.0	83.3	87.3	90.4
Euro	...	...	...	...	37.6
Deutsche mark <sup>3</sup>	27.0	39.6	36.1	30.1	...
French franc	2.0	3.8	7.9	5.1	...
ECU and other EMS currencies	4.0	11.8	15.7	17.3	...
Japanese yen	27.0	23.4	24.1	20.2	22.7
Pound sterling	15.0	13.6	9.4	11.0	13.2
Swiss franc	10.0	8.4	7.3	7.1	6.1
Canadian dollar	1.0	3.3	3.4	3.6	4.5
Australian dollar	2.0	2.5	2.7	3.1	4.2
Swedish krona <sup>4</sup>	...	1.3	0.6	0.4	2.6
Hong Kong dollar <sup>4</sup>	...	1.1	0.9	1.3	2.3
Singapore dollar <sup>4</sup>	...	0.3	0.3	1.2	1.1
Emerging market currencies <sup>4,5</sup>	...	0.5	0.4	3.0	5.2
Other	22.0	8.5	7.9	9.3	10.1
All currencies	200.0	200.0	200.0	200.0	200.0

<sup>1</sup> 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, i.e. they are adjusted for both local and cross-border double-counting, except for 1989 data, which are available only on a "gross-gross" basis. More details about emerging market and other currencies are provided in Annex Tables E.1.1 and E.1.2. <sup>2</sup> Revised since the previous survey. <sup>3</sup> Data for April 1989 exclude domestic trading involving the Deutsche mark in Germany. <sup>4</sup> For 1992-98, the data cover home currency trading only. <sup>5</sup> For 1992 and 1995, South African rand; for 1998 and 2001, Brazilian real, Chilean peso, Czech koruna, Indian rupee, Korean won, Malaysian ringgit, Mexican peso, Polish zloty, Russian rouble, Saudi riyal, South African rand, Taiwan dollar and Thai baht. Table B.4

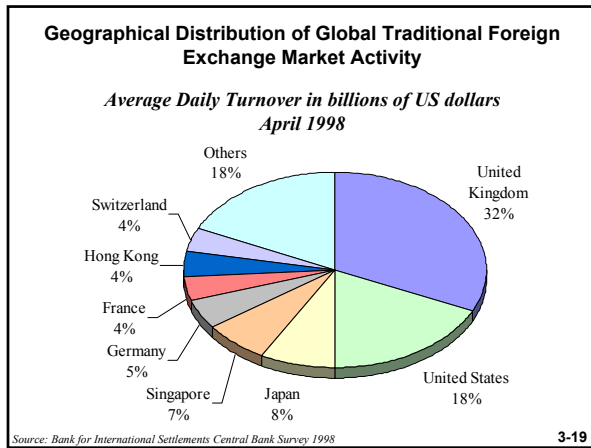
### Reported foreign exchange market turnover by currency pair<sup>1</sup>

Daily averages in April, in billions of US dollars and percentages  
Source: BIS Central Bank Survey 2001

	1992		1995		1998		2001	
	Amount	% share	Amount	% share	Amount	% share	Amount	% share
US dollar/euro	...	...	...	...	...	...	354	30
US dollar/mark	192	25	254	22	290	20	...	...
US dollar/French franc	19	2	51	4	56	4	...	...
US dollar/ECU	13	2	18	2	17	1	...	...
US dollar/other EMS	43	6	104	9	172	12	...	...
US dollar/yen	198	20	242	21	296	18	231	20
US dollar/sterling	77	10	78	7	117	8	125	11
US dollar/Swiss franc	49	6	61	5	79	5	57	5
US/Canadian dollar	25	3	28	3	50	3	50	4
US/Australian dollar	18	2	29	3	42	3	47	4
US dollar/other	48	6	72	6	167	12	195	17
Euro/yen	...	...	...	...	...	...	39	3
Euro/sterling	...	...	...	...	...	...	24	2
Euro/Swiss franc	...	...	...	...	...	...	12	1
Euro/other	...	...	...	...	...	...	21	2
Mark/yen	18	2	24	2	24	2	...	...
Mark/sterling	23	3	21	2	31	2	...	...
Mark/Swiss franc	13	2	18	2	18	1	...	...
Mark/French franc	10	1	34	3	10	1	...	...
Mark/ECU	6	1	6	1	3	0	...	...
Mark/other EMS	21	3	38	3	34	2	...	...
Mark/other	20	3	16	1	20	1	...	...
Other EMS/other EMS <sup>3</sup>	3	0	3	0	4	0	...	...
Other currency pairs	23	3	30	3	38	2	27	2
All currency pairs	776	100	1,137	100	1,430	100	1,173	100

<sup>1</sup> Adjusted for local and cross-border double-counting. Data in this table are not directly comparable with Table B.4 for currency groups. <sup>2</sup> Revised since the previous survey. <sup>3</sup> The data cover home currency trading only. Table B.6

**3-18**



### Geographical distribution of reported foreign exchange market turnover<sup>1</sup>

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

	1989		1992		1995		1998		2001	
	Amount	% share	Amount	% share	Amount	% share	Amount	% share	Amount	% share
Australia	29	4.0	29	2.7	40	2.5	47	2.4	52	3.2
France	23	3.2	33	3.1	58	3.7	72	3.7	48	3.0
Germany	...	...	55	5.1	76	4.8	94	4.8	88	5.4
Hong Kong SAR	49	6.8	80	5.6	90	5.7	79	4.0	67	4.1
Japan <sup>2</sup>	111	15.5	120	11.2	161	10.2	136	6.9	147	9.1
Singapore	55	7.7	74	6.9	105	6.7	139	7.1	101	6.2
Switzerland	56	7.8	66	6.1	87	5.5	82	4.2	71	4.4
United Kingdom	184	25.6	291	27.0	464	29.5	637	32.5	504	31.1
United States	115	16.0	167	15.5	244	15.5	351	17.9	254	15.7
Total <sup>3</sup>	718	100.0	1,076	100.0	1,572	100.0	1,969	100.0	1,618	100.0

<sup>1</sup> Adjusted for local double-counting ("net-gross"). Estimated coverage of the foreign exchange market ranged between 90 and 100% in most countries. <sup>2</sup> Data for 1998 cover spot transactions only. <sup>3</sup> Data cover spot transactions only. <sup>4</sup> Data for 1992 not adjusted for local double-counting. <sup>5</sup> Revised for 1998. <sup>6</sup> Data cover interbank transaction only. Table B.7

Source: Bank for International Settlements Central Bank Survey 2001 3-20

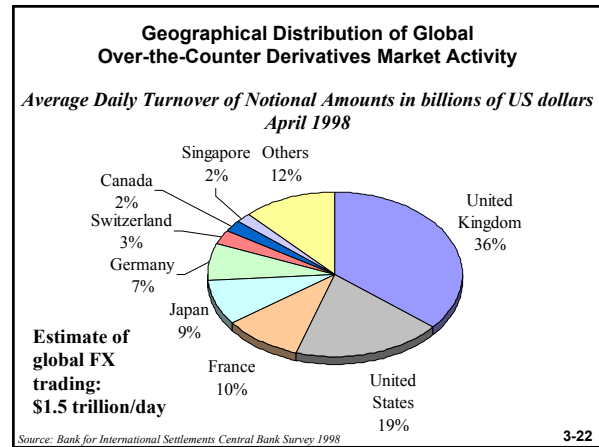
### Global OTC derivatives market turnover<sup>1</sup>

Daily averages in April, in billions of US dollars

Category	1995	1998	2001
Foreign exchange turnover	688	959	853
Outright forwards and foreign exchange swaps	643	862	786
Currency swaps	4	10	7
Options	41	87	60
Other	1	0	0
Interest rate turnover	151	265	489
FRAs	66	74	129
Swaps	63	155	331
Options	21	36	29
Other	2	0	0
Total derivatives turnover <sup>2</sup>	880	1,263	1,387
Memo:			
Turnover at April 2001 exchange rates	710	1,170	1,387
Exchange-traded derivatives <sup>3</sup>	1,222	1,373	2,179
Currency contracts	17	12	10
Interest rate contracts	1,205	1,361	2,169

<sup>1</sup> Adjusted for local and cross-border double-counting. <sup>2</sup> Including estimates for gaps in reporting. <sup>3</sup> Sources: FOW TRADeData; Futures Industry Association; various futures and options exchanges. Reported monthly data were converted into daily averages on the assumption of 18.5 trading days in 1995, 20.5 days in 1998 and 19.5 days in 2001. Table C.2

Source: Bank for International Settlements Central Bank Survey 2001 3-21



### Geographical distribution of reported OTC derivatives market activity<sup>1</sup>

Average daily turnover in billions of US dollars

	Total		Foreign exchange <sup>2</sup>		Interest rate <sup>3</sup>	
	April 1998	April 2001	April 1998	April 2001	April 1998	April 2001
Australia	31.6	50.7	28.8	40.9	2.8	9.8
Canada	33.6	43.3	27.2	33.4	6.4	9.9
France	98.5	106.0	57.9	40.6	40.6	65.1
Germany	86.7	159.2	57.6	65.2	29.1	94.0
Hong Kong SAR	51.4	52.0	48.9	49.4	2.4	2.6
Italy	21.2	36.1	17.1	12.4	4.1	23.7
Japan <sup>4</sup>	120.6	131.7	89.0	115.9	31.6	15.8
Netherlands	31.0	49.4	27.5	25.2	3.5	24.2
Singapore	90.7	72.5	85.4	69.3	5.3	3.2
Switzerland	63.0	62.6	57.2	53.0	5.9	9.6
United Kingdom	591.2	628.1	468.3	390.3	122.9	237.8
United States	293.8	284.7	235.4	169.1	58.4	115.7
Total "net-gross" turnover	1,681.7	1,862.2	1,338.1	1,186.1	343.6	676.1

<sup>1</sup> Adjusted for local double-counting ("net-gross"). Estimated coverage of derivatives markets in individual countries ranged between 73 and 100%. <sup>2</sup> Including outright forwards and foreign exchange swaps. <sup>3</sup> Single currency contracts only. <sup>4</sup> Revised for 1998. Table C.4

Source: Bank for International Settlements Central Bank Survey 2001 3-23

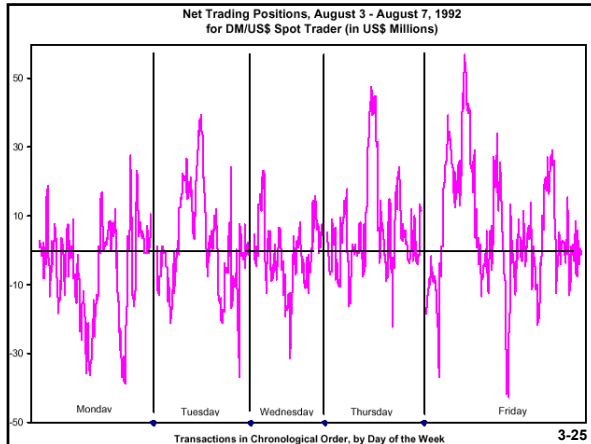
### Daily Trading Statistics for an Actual Spot DM Interbank Dealer

	Direct Transactions	Brokered Transactions	Total Transactions
Number of Transactions	190	77	267
Value of Transactions	\$0.8 billion	\$0.4 billion	\$1.2 billion
Median Transaction Size	\$3.0 million	\$4.0 million	na
Median Spread Size	DM 0.0003	na	na

Note: The above figures are daily averages for a single trader in the spot DM interbank market for the period Monday, August 3, 1992 - Friday, August 7, 1992.

Source: Richard K. Lyons, "Tests of Microstructural Hypotheses in the Foreign Exchange Market," Journal of Financial Economics 39 (1995): 321-351.

3-24



€ **What will be the impact on Europe's foreign exchange market share, given the euro?**

- **Global foreign exchange turnover = 15% trade and investment = 85% hedging and speculation**
- **Trade and investment:**
  - Because of lower transaction costs in the foreign exchange markets and/or higher degrees of acceptability, the currencies of big exporters are used disproportionately to invoice trade. Around 13% of world exports originate from the US but as much as 48% of world exports are invoiced in dollars.
  - After EMU day, 25% of world exports will originate from the Euroland. Assuming the ratio to be the same as in the case of the Deutschemark (1:1.5), there may be an increase in the proportion of exports invoiced in European core currencies from 21% to 38% (25% x 1.5).

The Euro: Paul Temperton 3-26

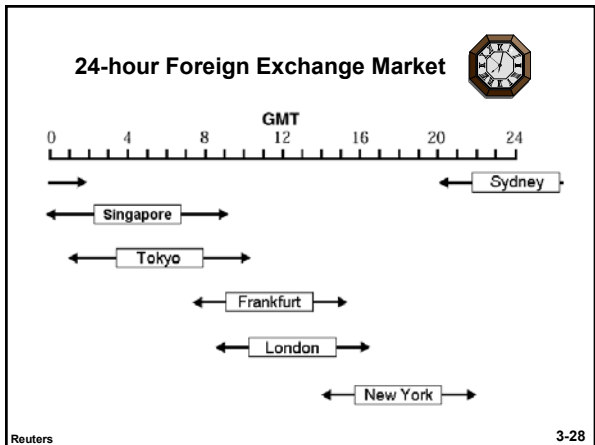
**Vehicle currencies**

Exporters and importers choose a currency for invoicing and settlement which can be bought or sold at low transaction costs in the foreign exchange market, or has a high degree of acceptability for other transactions.

Exporters or importers have a preference for invoicing in their home-currency, but if there is no home currency preference or agreement between importers and exporters, an already important international currency with a deep and broad foreign exchange market and a high degree of international acceptability is chosen.

As a result, there are "thick externalities" or concentration in the choice of invoicing currencies: the more a currency is used for trade and invoicing the more it will continue to be used.

The Euro: Paul Temperton 3-27



**Foreign Exchange Instruments**

- **spot contract**
  - Quoting conventions:
    - Direct terms (American terms): US\$/foreign currency
    - Indirect terms (European terms): foreign currency/US\$

3-29

**Foreign Exchange Instruments**

- **spot contract**
  - The market for immediate foreign exchange is known as the spot market.
  - The spot contract represents a binding commitment for an exchange of funds.
  - The normal settlement and delivery of bank balances follows in two business days (one day in the case of North American currencies).

3-30

**Foreign Exchange Instruments**

- **forward contract / outright forward**
  - The forward contract is an agreement made today for an obligatory exchange of funds at some specific time in the future.
  - The forward market for currencies is used mainly by firms in managing their exchange rate risks, since it enables them to lock in the rate (called the *forward rate*) at which they will buy or sell currencies.
  - The price of a forward is derived from the spot price and the borrowing and lending rates.

3-31

**Foreign Exchange Instruments**

- **forward contract / outright forward**
  - Agreement made today for obligatory exchange at specified time in future: 1, 2, 3, 6, 12 months from today.
  - No exchange of funds on agreement day, or at any time until settlement date.
  - Quoting conventions:
    - **Outright**
    - **% premium or discount relative to spot.**

3-32

**Foreign Exchange Instruments**

- **forward contract / outright forward**
  - Example:  
On 11/15/99 buy £1,000,000 1-month forward at \$1.60/£. On settlement date 12/15/99 when spot pound is \$1.55,
    - **Take delivery of £1,000,000, pay out \$1,600,000, or**
    - **"Cash settle", pay \$50,000 to cancel obligation.**

3-33

**Foreign Exchange Instruments**

- **foreign exchange swap**
  - A foreign exchange swap is the simultaneous sale of a currency for spot delivery and the purchase of that currency for forward delivery.
  - This transaction can be described as the simultaneous borrowing of one currency and the lending of another currency.
  - Foreign exchange swaps are used by commercial banks to manage the maturity structures of their currency positions.

3-34

**Foreign Exchange Instruments**

- **foreign exchange swap**
  - Simultaneous borrowing and lending of short-term bank balances in two currencies, for example
    - Bank A borrows \$10 million from Bank B for 1-month
    - Bank B borrows \$10 million worth of £ from Bank A for 1-month.
  - Used to construct forward contracts and manage risks

3-35

**Foreign Exchange Instruments**

- **foreign exchange swap**
  - Because each foreign exchange transaction involves two currencies and two "legs" -- a sale of DM is a purchase of dollars and a sale of dollars is a purchase of DM -- a foreign exchange swap can also be described as a simultaneous borrowing of one currency and lending of another currency.
  - A dealer who owns spot DM and then enters into a foreign exchange swap -- selling DM spot and buying it back for forward delivery -- is managing the maturity structure of his or her currency position.

3-36

### Foreign Exchange Instruments

- **foreign exchange swap**
  - Three types of swap are commonly used.
  - Spot against forward
    - In this case the first exchange - *first leg* - takes place on the spot date, two business days following the transaction, and the reverse of that exchange - *second leg* - takes place on the forward date, for example, 3 months from the spot date.

3-37

### Foreign Exchange Instruments

- **foreign exchange swap**
  - Forward against forward
    - In this case, the first exchange - *first leg* - takes place on the forward date and the transaction is reversed - *second leg* - on a later forward date, known as the *forward forward date*.
    - For example, a forward against forward swap may begin in 3 months time from spot - first leg - and end in 6 months time from spot - second leg. This is known as a *3 x 6 forward/forward swap*.

3-38

### Foreign Exchange Instruments

- **foreign exchange swap**
  - Short dates
    - These are swaps which run for less than a month. For example, the first leg could be spot, and the second leg 7 days later (1 week).
    - Some short dates are even earlier than spot value, for example, the first leg could be today, and the second leg tomorrow.

3-39

### Foreign Exchange Instruments

- **foreign exchange swap**
  - To summarize, foreign exchange swaps are transactions involving:
    - a single OTC transaction involving two value dates
    - two legs to the trade: the second leg is the reverse of the first leg
    - two exchanges of funds: one at each leg
    - value dates one day to 12 months
    - base currency amounts usually identical on both legs
    - quotations in forward points

3-40

### FX Terminology: Appreciation and Depreciation

- Because every exchange rate involves two currencies
  - Appreciation of the US\$ against £ ⇔ Depreciation of £ against US\$
  - Depreciation of the US\$ against £ ⇔ Appreciation of £ against US
- Examples
  - Change from 1.50 \$/£ to 1.75 \$/£ ⇒ Appreciation of £ against US\$
  - Change from 1.50 \$/£ to 1.25 \$/£ ⇒ Depreciation of £ against US\$

3-41

### FX Terminology: Appreciation and Depreciation

- Exact percentage measures depend on the base rate
  - $x\%$  depreciation of the Mexican peso ⇔  $x\%$  more pesos to buy \$1
    - from 4 MP/\$ to 8 MP/\$ ⇒ 50% depreciation of the peso  $[(1/8 - 1/4)/(1/4) = -1/2]$
  - $y\%$  appreciation of the US\$ ⇔  $y\%$  fewer dollar to buy 1 peso
    - from \$0.25/MP to \$0.125/MP ⇒ 100% appreciation of the US\$  $[(1/0.125 - 1/0.25)/(1/0.25) = +1]$

3-42

### Foreign Exchange Instruments

- In many cases, a new financial product can be replicated by some combination of more elementary contracts.
- This has implications for the pricing of a product, the arbitraging of a new product against other contracts, and the laying off of risks in a new product.

3-43

### The Exchange Rate

- The **exchange rate** is the price of one currency as measured in the units of another currency.
- It is marked by two characteristics:
  - Convertibility refers to the ability to convert between the domestic currency and a foreign currency for current account transactions (current account convertibility) and capital account transactions (capital account convertibility).
  - Flexibility. The rate may be fixed or floating.

3-44

### Openness in Financial Markets

The Relation Between Trade and Financial Flows  
The U.S. Balance of Payments, 1998

Current Account		
Exports	931	
Imports	1100	
Trade balance (deficit = -) (1)		-169
Investment income received	242	
Investment income paid	265	
Net investment income (2)		-23
Net transfers received (3)		-41
Current account balance (deficit = -) (1)+(2)+(3)		-233
Capital Account		
Increase in foreign holdings of U.S. assets	542	
Increase in U.S. holdings of foreign assets	305	
Net increase in foreign holdings/net capital flow to the U.S		237
Statistical discrepancy		4

3-45

### Openness in Financial Markets

**The Balance of Payments**

**The Current Account (Above the Line)**  
All recorded payments to and from the rest of the world

1. Trade in Goods and Services
  - \* Exports: Payments from the rest of the world (\$931 Billion)
  - \* Imports: Payments to the rest of the world (\$1,100 Billion)
2. Investment Income
  - \* U.S. residents receive income on their holdings of foreign assets (\$242 Billion)
  - \* Foreign residents receive income on their holdings of U.S. assets (\$265 Billion)

3-46

### Openness in Financial Markets

**The Balance of Payments (Continued)**

**The Current Account (Above the Line)**  
All recorded payments to and from the rest of the world

3. Foreign Aid (-\$41 Billion)
  - \* Net transfers received
  - The difference between foreign aid received and given
4. Current account balance (+,-)= 1+2+3= **-\$233 Billion** (1998)

3-47

### Openness in Financial Markets

**The Balance of Payments**

**The Capital Account**

1. Increase in foreign holdings of U.S. assets (\$542 Billion)
2. Increase in U.S. holdings of foreign assets (\$305 Billion)
3. Net capital flows = 1-2  
(\$542 Billion - \$305 Billion = -237 Billion)

**Statistical discrepancy: Accounts for differences in data sources.**

3-48

### Openness in Financial Markets

#### The Balance of Payments

- The Current Account Balance (+,-) =  
Capital Account Balance (+,-)
- A Current Account Deficit increases foreign holdings of U.S. assets and vice versa.

3-49

### Balance of Payment Accounts

- The *balance of payment* is the difference between the sum of all the demands for and all the supplies of our dollar on the foreign exchange market. A *balance of payment surplus* occurs when the demand for our dollars on the foreign exchange market exceeds supply.
- The Bureau of Economic Analysis recently announced changes to the way in which the U.S. Balance of Payments is reported: The accounts are now divided into 3 main groupings instead of the standard *current* and *capital accounts*.

Krugman

3-50

### Balance of Payment Accounts

Originally,

- The *current account* measures the difference between the demand for and the supply of dollars arising from transactions that affect the current level of income here and abroad - including exports, imports, investment income payments (e.g., interest and dividend payments), and transfers (e.g., gifts and foreign aid).
- The *capital account* measures the difference arising from sales or purchases of assets to or from foreigners. It measures *capital flows* between a country and the rest of the world.

3-51

### Balance of Payment Accounts

- What was called the capital account (purchases and sales of assets, direct investment, etc.), is now called the *financial account*.
- The former current account has been split in two, the *current account* and the *capital account*, to better separate current income from changes in the stock of assets.
- The current account is still used for purchases and sales of goods and services and current income. The new capital account is primarily used for one time changes in the stock of assets.

Krugman [http://ocw.awfonline.com/bookbind/pubbooks/krugman\\_awf/chapter98/deluxe.html](http://ocw.awfonline.com/bookbind/pubbooks/krugman_awf/chapter98/deluxe.html)

3-52

### Balance of Payment Accounts

- The new capital account includes unilateral current transfers which were in the current account but are really shifts in assets, not current income.
- The most significant item is debt forgiveness, which if kept in the current account could generate misleading swings in the current account. Also included are migrant transfers - those assets which are brought with a migrant when they move, as well as the sale or purchase of rights to natural resources or patents.

Krugman [http://ocw.awfonline.com/bookbind/pubbooks/krugman\\_awf/chapter98/deluxe.html](http://ocw.awfonline.com/bookbind/pubbooks/krugman_awf/chapter98/deluxe.html)


3-53

### The Exchange Rate

- The system for establishing exchange rates has changed over time:
  - 1879-1913: International Gold Standard
  - WWI & Great Depression: period of instability
  - 1945: Bretton Woods Agreement
  - 1950-1970: fixed-rate dollar standard
  - 1973-1984: floating-rate dollar standard
  - 1985-1996: Plaza-Louvre Intervention Accords
  - 1979: European Monetary System
  - 1999: launch of the Euro

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In his economic viewpoint column for Business Week dated June 28, 1999, Gary S. Becker (the 1992 Nobel laureate) said in "What We Can Learn from the Asian Mess" that financial crises are more likely when exchange rates are pegged to one of the major currencies. In his words: "...pegged exchange rates have been a very weak part of the international financial architecture. Free-floating or rigidly fixed exchange rates should be adopted, but the choice depends more on domestic politics than on international economics."

3-55

### Exchange Rate Quotations

Assuming that the US\$ is the domestic currency (d.c.) and that the British pound £ is the foreign currency (f.c.):

<b>American terms</b>	\$'s per unit of f.c.	<b>\$2.00/£</b>
<b>European terms</b>	units of f.c. per \$	<b>£0.50/\$</b>
<b>direct quote</b>	units of d.c. per f.c.	<b>\$2.00/£</b>
<b>indirect quote</b>	units of f.c. per d.c.	<b>£0.50/\$</b>

3-56

### Exchange Rate Quotations

The Big Figure or Handle, which is not usually quoted by dealers.

Bid: The market-maker will buy \$1 for DEM 1.4123.      Offer: The market-maker will sell \$1 for DEM 1.4133.

Bid
1.41
23 /
33
Offer

Pips or Points, which are the smallest price movements.

The currencies involved:  
 USD = Base currency  
 DEM = Quote currency

The Spread is the variable unit difference between the Bid and Offer prices, which is usually about 10 pips as in this case.

Reuters 3-57

### Bid / Ask Spread


- **bid price**
  - This is the price at which a market-maker is willing to buy a currency.
- **ask price / offer price**
  - This is the price at which a market-maker is willing to sell a currency.

**bid/ask(offer) spread = | ask price - bid price |**

**percent spread =  $\frac{|ask price - bid price|}{ask price} \times 100$**

3-58

### Bid / Ask Spread



Given \$1.7019-36, what is the percent spread?

**Answer:**

$$\text{percent spread} = \frac{|1.7036 - 1.7019|}{1.7036} \times 100 = 0.1\%$$

The spread for widely traded currencies, such as the £, DM and ¥, is smaller than those that are traded less heavily.

3-59

### Cross Rates ✗

- **cross rate**
  - This is an exchange rate between two currencies, neither of which is the US\$.
  - A cross rate is usually constructed from the individual exchange rates of the currencies with respect to the US\$.

**value of 1 unit of currency A in units of currency B =  $\frac{\text{value of currency A in \$}}{\text{value of currency B in \$}}$**

3-60

### Cross Rates

Given \$1.5561/£, \$0.7293/C\$, and ¥110.36/\$, what are the exchange rates between the £ and the Canadian \$ (C\$), and between the £ and the ¥?

Answer:

Canadian dollars per British pound

$$= \frac{\$1.5561}{\text{£}} \times \frac{\text{C\$}}{\$0.7293} = \text{C\$}2.1337/\text{£}$$

Japanese yen per British pound

$$= \frac{\$1.5561}{\text{£}} \times \frac{\text{¥}110.36}{\$} = \text{¥}171.73/\text{£}$$

3-61

### Arbitrage

- **Arbitrage** is the simultaneous, or nearly simultaneous, purchase of securities in one market for sale in another market with the expectation of a risk-free profit.
- A triangular arbitrage opportunity exists if a cross rate is inconsistent with the exchange rates between the two currencies and the dollar.

example:

$$\text{C\$/DM} > \text{C\$/US\$} \times \text{US\$/DM}$$

3-62

### Arbitrage

Example:

New York: \$1.9809/£  
Frankfurt: \$0.6251/DM  
London: DM3.1650/£

Using the direct quotes:  
DM per £ = \$1.9809/\$0.6251 = DM3.1689/£

Since the price of £ in London is lower, a risk-free profit can be earned by:

- buying £ with DM in London;
- selling £ in New York for \$; and
- selling \$ in Frankfurt for DM .

3-63

### Arbitrage

- Spatial arbitrage implies an arbitrage of the same financial instrument between two different geographic places, such as arbitrage between two different banks, between two different cities, or between two different markets that trade the same instrument.
- Covered interest arbitrage implies an arbitrage between an interest bearing security in one currency (say DM) and an interest bearing security in another security (say £).

3-64

### Arbitrage

- Spatial arbitrage ensures that quoted exchange rates are similar across banks in different locations.
- Triangular arbitrage ensures that cross exchange rates are set properly.
- Covered interest arbitrage ensures that forward exchange rates are set properly.
- Any discrepancy will trigger arbitrage, which will then eliminate the discrepancy. Arbitrage thus makes the foreign exchange market more orderly.

Madura 3-65

### Risks

- **Liquidity risk** is the risk of having to take a significant discount from the current market value in liquidating an investment position.
  - Liquidity risk can be a significant problem with lightly traded securities.
- **Counterparty risk** is the risk of default by a counterparty, such that the original terms for delivery and settlement cannot be met.
  - Rate risk applies to the case of default on an outstanding contract, while delivery risk is associated with default on a contract in the process of settlement across time zones.


3-66

### Cross Rates with Bid/Ask Spread

**Rule**

The trader (market maker) will choose the advantageous price in each transaction, so each time, the customer (market taker) will have to accept the unfavorable price.

Example:



Given \$1.7019-36 per £, and \$0.6250-67 per DM, what is the number of DM per £ ?

3-67

### Cross Rates with Bid/Ask Spread

\$1.7019-36/£, \$0.6250-67/DM, ?DM/£

**bid rate: (the trader's buying price of £)**

- customer sells £ for \$ / trader buys £ with \$ at \$1.7019/£
- customer sells \$ for DM / trader buys \$ with DM at \$0.6267/DM

$$\frac{\$1.7019}{\text{£}} \times \frac{\text{DM}}{\$0.6267} = \text{DM}2.7157/\text{£}$$

**ask rate: (the trader's selling price of £)**

- customer sells DM for \$ / trader buys DM with \$ at \$0.6250/DM
- customer sells \$ for £ / trader buys \$ with £ at \$1.7036/£

$$\frac{\$1.7036}{\text{£}} \times \frac{\text{DM}}{\$0.6250} = \text{DM}2.7258/\text{£}$$

⇒ DM 2.7157-2.7258/£

3-68

*Regarding foreign exchange market transactions*

(1) "The customer is always swimming against the tide", meaning that when the customer buys, he/she buys at the dealer's "ASK" price, and when the customer sells, he/she receives the "BID" price. By definition, the ASK price is higher than the BID price. A customer who buys (at the ASK price, 1.6020 \$/GBP) and then immediately sells (at the BID price, 1.6010 \$/GBP), in effect pays the bid-ask spread (\$0.0010 or about 0.06%) for executing two transactions, one buy and one sell.

Tips -- Intuition Check from Professor Levich

3-69

(2) In the FX market, like in engineering, be sure to write down the units in any calculation you make to be sure you are making the right calculation. In engineering, if I drive 100 miles on 4 gallons of gas, I am getting 100 miles / 4 gallons = 25 miles per gallon.

Tips -- Intuition Check from Professor Levich

3-70

In FX, that means

(2a) if I buy GBP500,000 at a price of \$1.60/GBP, then I expect to get a bill for GBP500,000 x \$1.60/GBP = \$800,000. Or

(2b) if I win JPY420,000,000 in a lawsuit, and I can convert it back to dollars at a rate of 105 JPY/\$, then I expect to receive JPY420,000,000 / JPY105/\$ = \$4,000,000.

So always write down the units associated with the numbers in a problem, and you'll be less likely to make a mistake when multiplying or dividing FX rates.

Tips -- Intuition Check from Professor Levich

3-71

### Forward Market

Forwards are quoted in two ways :

- *outright rate* - this is the actual price
- *swap rate* - this is the forward discount/premium points to be subtracted from/added to the spot rate

Example: spot yen sold at \$0.006879  
90-day forward at \$0.006902  
then swap rate = \$0.006902-\$0.006879  
= 23-point premium

spot £ sold at \$1.7015  
90-day forward at \$1.6745  
then swap rate = \$1.6745-\$1.7015  
= 270-point discount

3-72

### Swap Rates with Bid/Ask Spread

**Rule** → The bid/ask spread will always widen as we go forward.

spot rate	DM2.4273/90	spread = 0.0017
swap rate	30/20	high/low => subtract
forward	DM2.4243/70	spread = 0.0027

spot rate	DM2.5005/10	spread = 0.0005
swap rate	95/100	low/high => add
forward	DM2.5100/110	spread = 0.0010

3-73

### Swap Rates with Bid/Ask Spread

Forward points	Base currency trading	Forward rate =
Greater value first High / Low	at a discount	Spot minus forward points
Smaller value first Low / High	at a premium	Spot plus forward points

Reuters  
3-74

### Forward Premium / Discount

$$\text{forward premium} = \frac{\text{forward} - \text{spot}}{\text{spot}} \times 100$$

**Example:**

Given spot: \$0.6604/DM  
180-day forward: 0.6690

The 180-day forward premium for DM  
=  $\frac{.6690 - .6604}{.6604} \times 100 = 1.3022\%$

3-75

### Spot v.s. Forward

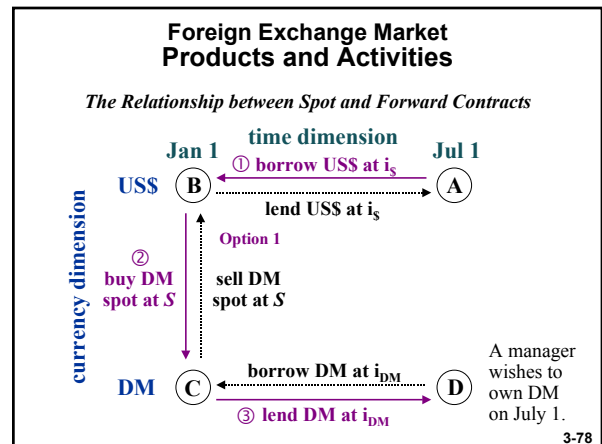
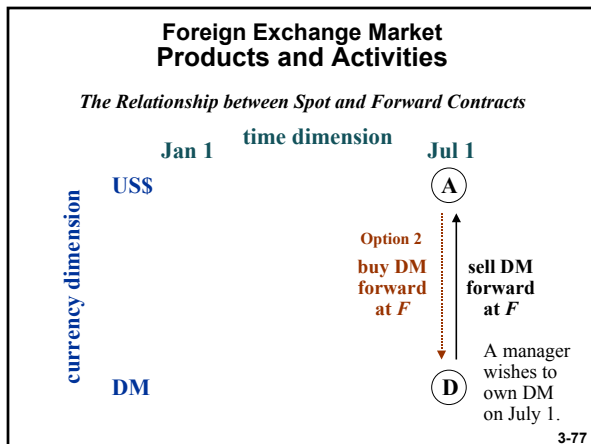
Suppose you need DM in 180 days.

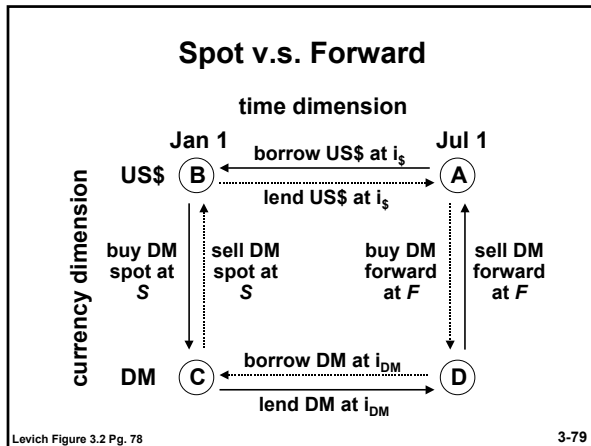
**Option 1**  
buy DM in the spot market  
- and earn interest in DM (money market hedging)

**Option 2**  
buy DM in the forward market (hedging with forward)  
- will have to pay 1.3022% more than the spot price

**Option 3**  
buy DM in the spot market 180 days later  
- but is exposed to foreign exchange rate risk

3-76





Wasn't it the Rolling Stones who sang - "I can't get no ... intuition."  
Well, if you're in the same boat, and you try and you try ... but you can't get any intuition about international finance, here are some ideas that may help you.

Tips -- Intuition Check from Professor Levich 3-80

#### Regarding the "Box" Diagram

- (1) An arrow from DM to US\$, can be thought of as **SELLING DM or BUYING US\$**.
- (2) The reverse arrow from US\$ to DM represents the reverse transaction, **SELLING US\$ or BUYING DM**.
- (3) An arrow from right to left (from the future to the present), can be thought of as **borrowing - taking cash from the future and bringing it to the present**.
- (4) The reverse arrow from left to right (from the present to the future), can be thought of as **investing - taking cash that you have now and putting it away until the future**.

Tips -- Intuition Check from Professor Levich 3-81

### Spot v.s. Forward

- A forward purchase of DM (equivalent to a forward sale of US\$) is shown by the arrow **AD**. This outright forward contract can be replicated by borrowing US\$ (arrow **AB**), buying DM in the spot market (arrow **BC**), and lending the DM (arrow **CD**). The maturity of the forward contracts is identical to the maturity of the borrowing and lending contracts.
- A forward sale of the DM can be described by reversing the direction of the arrows.

Levich 3-82

### Spot v.s. Forward

Given spot  $\$/DM$ , forward  $F/DM$ ,  
\$ interest rate  $r_s$ , DM interest rate  $r_{DM}$

Beginning with 1 DM,  
 Buy \$ in the spot market  $\Rightarrow$  final \$ =  $S \times (1 + r_s)$   
 Buy \$ in the forward market  $\Rightarrow$  final \$ =  $(1 + r_{DM}) \times F$

Leaving no room for arbitrage, the final \$ obtained should be the same.

$$\Rightarrow S \times (1 + r_s) = (1 + r_{DM}) \times F$$

$$\Rightarrow S \times \frac{(1 + r_s)}{(1 + r_{DM})} = F$$

3-83

### Spot v.s. Forward

Buy DM in the spot or forward market?  
 Spot: \$0.6604/DM, 180-day forward: 0.6690  
 Suppose \$'s interest rate = 12% (6% when adjusted for 180 days) and DM's interest rate = 8% (4% when adjusted for 180 days).

In 180 days (i.e. consider future values),  
 unit cost of buying forward = \$0.6690  
 unit cost of buying spot  
 =  $\$0.6604 \times \frac{1+0.06}{1+0.04} = \$0.6731$   
 $\Rightarrow$  buy DM in the forward market

3-84

### Annualized Forward Premium / Discount

- Previously, we adjusted the interest rates to be consistent with the forward premium.
- Very often, the practice is to adjust the forward premium to match interest rates. Interest rates are almost always quoted on an annual basis.

$$\text{annualized forward premium} = \frac{\text{forward} - \text{spot}}{\text{spot}} \times \frac{360}{N} \times 100$$

3-85

### Annualized Forward Premium / Discount

Example:

Given spot: 109.085¥/\$  
30-day forward: 108.64¥/\$

The annualized forward premium

$$= \frac{|108.64 - 109.085|}{109.085} \times \frac{360}{30} \times 100$$

$$= 4.9\%$$

3-86

### Synthetic Forward and Arbitrage

Given: £ interest rate 12%  
\$ interest rate 7%  
spot rate \$1.75/£  
1 year forward rate \$1.68/£

synthetic forward =  $\$1.75 \times \frac{1+0.07}{1+0.12} = \$1.6719 < \$1.68$

⇒ £ is overvalued in the forward market  
arbitrage opportunity exists:

- buy £ in spot market
- earn £ interest in money market
- then sell £ forward

3-87

### Spot, Forward and Interest Rates

As derived earlier, at equilibrium :

$$S \times \frac{(1 + r_{\$})}{(1 + r_{DM})} = F \Rightarrow \frac{F}{S} = \frac{(1 + r_{\$})}{(1 + r_{DM})}$$

Subtracting 1 from both sides :

$$\frac{\text{forward} - \text{spot}}{\text{spot}} = \frac{\text{domestic } r - \text{foreign } r}{1 + \text{foreign } r}$$

where r = interest rate  
domestic = domestic currency  
foreign = foreign currency

This is known as the interest rate parity condition.

3-88

### Interest Rate Parity

- When market forces cause interest rates and exchange rates to be such that covered interest arbitrage is no longer feasible, the equilibrium state achieved is referred to as **interest rate parity (IRP)**.
- When IRP exists, the rate of return achieved from covered interest arbitrage should equal the rate available in the home country.

3-89

### Symbols Used

$S_t$  - the spot rate at time t

$F_{t,n}$  - the forward rate at time t for delivery in n periods

\$/FC - the number of dollars per foreign currency

t - current time

Assignment For Chapter 3: Exercises 1, 2, 6, 7, 10.

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