

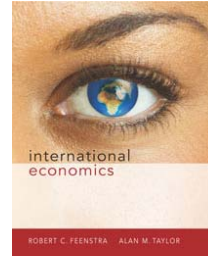
# Advanced International Economics

## ECON 758

Professor Yamin Ahmad

Lecture 8:

- Exchange Rates
- Foreign Exchange Market
- Asset Market Approach



## Preview

- The basics of exchange rates
- Exchange rates and the prices of goods
- The foreign exchange markets
- The demand for currency and other assets
- A model of foreign exchange markets
  - role of interest rates on currency deposits
  - role of expectations about the exchange rates

Note: These lecture notes are incomplete without having attended lectures.

8-2

## Definitions of Exchange Rates

- Exchange rates are quoted as **foreign currency per unit of domestic currency** or **domestic currency per unit of foreign currency**.
  - Foreign price of domestic currency: how much of the foreign currency can be exchanged for one unit of the domestic currency, e.g. per dollar? ¥102/\$1
  - Domestic price of foreign currency: how much of the domestic currency can be exchanged for one unit of the foreign currency, e.g. per Yen? \$0.0098/¥1
- Exchange rate allow us to denominate the cost or price of a good or service in a common currency.
  - How much does a ¥3,000,000 Honda cost?
  - Or, ¥3,000,000 x \$0.0098/¥1 = \$29,400

Note: These lecture notes are incomplete without having attended lectures.

8-3

## Depreciation and Appreciation

- **Depreciation** is a decrease in the value of a currency relative to another currency.
  - A depreciated currency is **less valuable** (less expensive) and therefore can be exchanged for (can buy) a smaller amount of foreign currency.
- Consider the following change in the dollar-euro exchange rate: from €1/\$1 to €0.80/\$1
  - This represents a dollar depreciation (relative to the euro). A single dollar buys fewer euros, so the dollar is less valuable.
  - The euro has appreciated relative to the dollar: it is now more valuable (in euro terms: from \$1/ €1 to \$1.25/ €1)

Note: These lecture notes are incomplete without having attended lectures.

8-4

## Depreciation and Appreciation (cont.)

- **Appreciation** is an increase in the value of a currency relative to another currency.
  - An appreciated currency is *more valuable* (more expensive) and therefore can be exchanged for (can buy) a larger amount of foreign currency.
- Consider the following change in the dollar-euro exchange rate: from €1/\$1 to €1.2/\$1
  - This represents a dollar appreciation (relative to the euro). A single dollar buys more euros, so the dollar is more valuable.
  - The euro has depreciated relative to the dollar: it is now less valuable (in euro terms: from \$1/€1 to \$0.83/€1)

Note: These lecture notes are incomplete without having attended lectures.

8-5

## Depreciation and Appreciation (cont.)

- A **depreciated currency is less valuable**, and therefore it can buy fewer foreign produced goods that are denominated in foreign currency.
- Example: How much does a ¥3,000,000 Honda cost in dollars after the dollar depreciation?
  - Before:  $¥3,000,000 \times \$0.0098/¥1 = \$29,400$
  - After:  $¥3,000,000 \times \$0.0100/¥1 = \$30,000$

Note: These lecture notes are incomplete without having attended lectures.

8-6

## Depreciation and Appreciation (cont.)

- A depreciated currency means that *imports are more expensive* and domestically produced goods and *exports are less expensive*.
- A depreciated currency lowers the price of exports relative to the price of imports, i.e. lowers the terms of trade.

Note: These lecture notes are incomplete without having attended lectures.

8-7

## Depreciation and Appreciation (cont.)

- An **appreciated currency is more valuable**, and therefore it can buy more foreign produced goods that are denominated in foreign currency.
- Example: How much does a ¥3,000,000 Honda cost after the dollar has appreciated?
  - Before:  $¥3,000,000 \times \$0.0098/¥1 = \$29,400$
  - After:  $¥3,000,000 \times \$0.0090/¥1 = \$27,000$

Note: These lecture notes are incomplete without having attended lectures.

8-8

## Depreciation and Appreciation (cont.)

- An appreciated currency means that *imports are less expensive* and domestically produced goods and *exports are more expensive*.
- An appreciated currency raises the price of exports relative to the price of imports, i.e. raises the terms of trade.

Note: These lecture notes are incomplete without having attended lectures.

8-9

## The Foreign Exchange Market

### The participants

1. **Commercial banks and other depository institutions:** transactions involve buying/selling of bank deposits in different currencies for investment.
2. **Non bank financial institutions** (pension funds, insurance funds) may buy/sell foreign assets.
3. **Private firms:** conduct foreign currency transactions to buy/sell goods, assets or services.
4. **Central banks:** conduct official international reserves transactions.

Note: These lecture notes are incomplete without having attended lectures.

8-10

## The Foreign Exchange Market (cont.)

- Buying and selling in the foreign exchange market are dominated by commercial banks.
  - Inter-bank transactions of deposits in foreign currencies occur in amounts \$1 million or more per transaction.
  - Central banks sometimes intervene, but the direct effects of their transactions are usually small and transitory.

Note: These lecture notes are incomplete without having attended lectures.

8-11

## The Foreign Exchange Market (cont.)

### Characteristics of the market

- Trading occurs mostly in major financial cities: London, New York, Tokyo, Frankfurt, Singapore.
- The volume of foreign exchange has grown:
  - in 1989 the daily volume of trading was \$600 billion, in 2001 the daily volume of trading was \$1.2 trillion.
- About 90% of transactions in 2001 involved US dollars.

Note: These lecture notes are incomplete without having attended lectures.

8-12

## The Foreign Exchange Market (cont.)

- Computers transmit information rapidly and have integrated markets.
- The integration of markets implies that there is no significant **arbitrage** between markets.
  - if dollars are cheaper in New York than in London, people will buy them in New York and stop buying them in London. The price of dollars in New York rises and the price of dollars in London falls, until the prices in the two markets are equal.

Note: These lecture notes are incomplete without having attended lectures.

8-13

## The Foreign Exchange Market (cont.)

- **Triangular Arbitrage**: If you know any two exchange rates between three countries, you also know the third exchange rate
  - Otherwise arbitrage would occur!
- Example: Suppose that the dollar-sterling rate is \$2.081 per pound sterling, and that the dollar-euro rate is: \$1.448 per euro. Then, the euro-sterling rate is calculated as:
  - $(2.081 \text{ \$/\pounds}) / (1.448 \text{ \$/\pounds}) = 1.437 \text{ euros per sterling}$

Note: These lecture notes are incomplete without having attended lectures.

8-14

## The Foreign Exchange Market (cont.)

- **Vehicle Currency**: a currency that is widely used to denominate international contracts made by parties who do not reside in the country that issues the vehicle currency.
  - US Dollar is a vehicle currency
  - Euro is expected to evolve to become into a vehicle currency. As of April 2004, about 37 percent of foreign exchange trades were made with euros.
  - Prior to the advent of the euro, the pound sterling was second to the dollar as a key international currency.

Note: These lecture notes are incomplete without having attended lectures.

8-15

## 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 individual institutions in the present, but the exchange occurs in the future.

Note: These lecture notes are incomplete without having attended lectures.

8-16

## Spot and Forward Rates

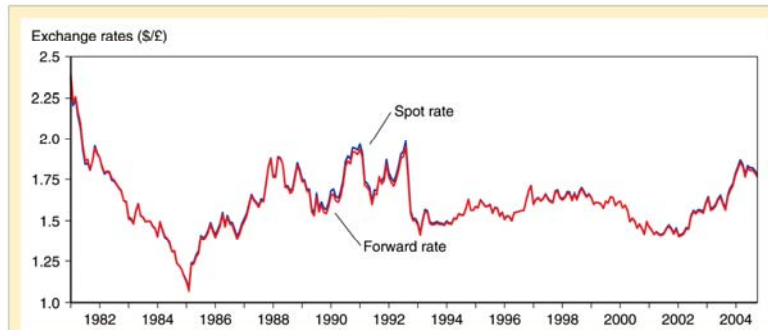


Figure 13-1

### Dollar/Pound Spot and Forward Exchange Rates, 1981–2004

Spot and forward exchange rates tend to move in a highly correlated fashion.

Source: Datastream. Rates shown are 90-day forward exchange rates and spot exchange rates, at end of month.

Note: These lecture notes are incomplete without having attended lectures.

8-17

## Other methods of currency exchange

- **Foreign exchange swaps:** a combination of a spot sale with a forward repurchase, both negotiated between individual institutions.
  - swaps often result in lower fees or transactions costs because they combine two transactions.
- **Futures contracts:** a contract designed by a *third party* for a *standard* amount of foreign currency delivered/received on a *standard* date.
  - contracts can be bought and sold in markets, and only the current owner is obliged to fulfill the contract.

Note: These lecture notes are incomplete without having attended lectures.

8-18

## Other Methods of Currency Exchange

- **Options contracts:** a contract designed by a *third party* for a *standard* amount of foreign currency delivered/received on or before a *standard* date.
  - contracts can be bought and sold in markets.
  - a contract gives the owner the option, but not obligation, of buying or selling currency if the need arises.

Note: These lecture notes are incomplete without having attended lectures.

8-19

## The Demand for Currency Deposits

- What influences the demand for (willingness to buy) deposits denominated in domestic or foreign currency?
- Factors that influence the return on assets determine the demand for those assets:
  - Rates of return on assets
  - Risk
  - Liquidity

Note: These lecture notes are incomplete without having attended lectures.

8-20

## The Demand for Currency Deposits (cont.)

- **(Nominal) Rate of return:** the percentage change in value that an asset offers during a time period.
  - The annual return for \$100 savings account with an interest rate of 2% is  $\$100 \times 1.02 = \$102$ , so that the rate of return =  $(\$102 - \$100)/\$100 = 2\%$
- **Real rate of return:** inflation-adjusted rate of return.
  - stated in terms of real purchasing power: the amount of real goods & services that can be purchased with the asset.
  - the real rate of return for the above savings account when inflation is 1.5%:  $2\% - 1.5\% = 0.5\%$ . The asset can purchase 0.5% more goods and services after 1 year.

Note: These lecture notes are incomplete without having attended lectures.

8-21

## The Demand for Currency Deposits (cont.)

- If prices are given at some level, inflation is 0% and (nominal) rates of return = real rates of return.
- For bank deposits in different currencies, we often assume that prices are given at some level. (A good short run assumption.)

Note: These lecture notes are incomplete without having attended lectures.

8-22

## The Demand for Currency Deposits (cont.)

- **Risk** of holding assets also influences decisions about whether to buy them.
- **Liquidity** of an asset, or ease of using the asset to buy goods and services, also influences the willingness to buy assets.

Note: These lecture notes are incomplete without having attended lectures.

8-23

## The Demand for Currency Deposits (cont.)

- But we assume that risk and liquidity of bank deposits in the foreign exchange market are the same, regardless of their currency denomination.
  - risk and liquidity are only of secondary importance when deciding to buy or sell currency.
  - importers and exporters may be concerned about risk and liquidity, but they make up a small fraction of the market.

Note: These lecture notes are incomplete without having attended lectures.

8-24

## The Demand for Currency Deposits (cont.)

- We assume that investors are primarily concerned about the **expected rates of return** on bank deposits.
- Rates of return are determined by
  - **interest rates** that the assets earn
  - **expectations** about appreciation or depreciation

Note: These lecture notes are incomplete without having attended lectures.

8-25

## The Demand for Currency Deposits (cont.)

- A currency's **interest rate** is the amount of a currency an individual can earn by lending a unit of the currency for a year.
- The rate of return for a deposit in domestic currency is the interest rate that the bank deposit earns.

Note: These lecture notes are incomplete without having attended lectures.

8-26

## Example Question

- Consider two currencies, euros and dollars.
- Question: Which type of deposit (i.e. euro deposits or dollar deposits) offers a higher expected rate of return?
- To answer this question, you have to calculate how many dollars you will get back (say after a year) if you use dollars to buy euro deposits (or vice versa).

Note: These lecture notes are incomplete without having attended lectures.

8-27

## The Demand for Currency Deposits (cont.)

- To compare the rate of return on a deposit in domestic currency with one in foreign currency, we need to know...
  - the **interest rate for the foreign currency deposit**
  - the **expected rate of appreciation or depreciation** of the foreign currency relative to the domestic currency.

Note: These lecture notes are incomplete without having attended lectures.

8-28

## The Demand for Currency Deposits (cont.)

- Suppose that:
  - the interest rate on a dollar deposit is 2%.
  - the interest rate on a euro deposit is 4%.
  - today the exchange rate is \$1/€1, and the expected rate 1 year in the future is \$0.97/€1.
- Does a euro deposit yield a higher expected rate of return?
  - To answer this, we need to do the following 5 steps...

Note: These lecture notes are incomplete without having attended lectures.

8-29

## 5 Steps to Calculate Expected Rate of Return

### Steps:

1. Use today's dollar/euro exchange rate to figure out the dollar price of a euro deposit of, say €1
2. Use the euro interest rate to calculate the amount of euros you would have if you purchase €1 worth of deposits today
3. Use the exchange rate you expect to prevail a year from today to calculate the expected dollar value of the euro amount calculated in step 2
4. Since you know the dollar price of a €1 deposit from step 1 and the expected dollar value from step 3, you can calculate the expected dollar rate of return
5. Compare the expected dollar rate of return to the interest offered on dollar deposits.

Note: These lecture notes are incomplete without having attended lectures.

8-30

## The Demand for Currency Deposits (cont.)

### Expected Return Holding Euros

- \$100 can be exchanged today for €100.
- These €100 will yield €104 after 1 year.
- These €104 are expected to be worth  $\$0.97/\text{€1} \times \text{€104} = \$100.88$ .
- The expected rate of return in terms of dollars from investing in euro deposits is  $(\$100.88 - \$100)/\$100 = 0.88\%$ .

Note: These lecture notes are incomplete without having attended lectures.

8-31

## The Demand for Currency Deposits (cont.)

### Holding Dollar Deposits

- Let's compare this rate of return with the rate of return from a dollar deposit.
  - rate of return is simply the interest rate
  - After 1 year the \$100 is expected to yield \$102:  $(\$102 - \$100)/\$100 = 2\%$
- The euro deposit has a lower expected rate of return: *all* investors will prefer dollar deposits and *none* are willing to hold euro deposits.

Note: These lecture notes are incomplete without having attended lectures.

8-32



## A Simple Rule

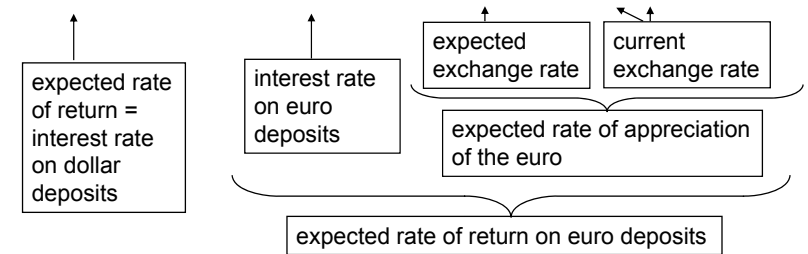
- Note that the expected rate of appreciation of the euro is  $(\$0.97 - \$1)/\$1 = -0.03 = -3\%$ .
- We simplify the analysis by saying that the dollar rate of return on euro deposits approximately equals
  - the interest rate on euro deposits
  - plus the expected rate of appreciation on euro deposits
  - $4\% + -3\% = 1\% \approx 0.88\%$
- $R_{\epsilon} + (E_{\$/\epsilon}^e - E_{\$/\epsilon})/E_{\$/\epsilon}$

Note: These lecture notes are incomplete without having attended lectures.



## The Demand for Currency Deposits (cont.)

- The difference in the rate of return on dollar deposits and euro deposits is
- $R_{\$} - (R_{\epsilon} + (E_{\$/\epsilon}^e - E_{\$/\epsilon})/E_{\$/\epsilon}) =$   
 $R_{\$} - R_{\epsilon} - (E_{\$/\epsilon}^e - E_{\$/\epsilon})/E_{\$/\epsilon}$



Note: These lecture notes are incomplete without having attended lectures.



## The Demand for Currency Assets

**TABLE 13-3** Comparing Dollar Rates of Return on Dollar and Euro Deposits

Case	Dollar Interest Rate $R_{\$}$	Euro Interest Rate $R_{\epsilon}$	Expected Rate of Dollar Depreciation Against Euro $\frac{E_{\$/\epsilon}^e - E_{\$/\epsilon}}{E_{\$/\epsilon}}$	Rate of Return Difference Between Dollar and Euro Deposits $R_{\$} - R_{\epsilon} - \frac{(E_{\$/\epsilon}^e - E_{\$/\epsilon})}{E_{\$/\epsilon}}$
1	0.10	0.06	0.00	0.04
2	0.10	0.06	0.04	0.00
3	0.10	0.06	0.08	-0.04
4	0.10	0.12	-0.04	0.02

Note: These lecture notes are incomplete without having attended lectures.



## The Market for Foreign Exchange

- We use the
  - demand for (rate of return on) dollar denominated deposits
  - and the demand for (rate of return on) foreign currency denominated deposits to construct a model of the foreign exchange market.

Note: These lecture notes are incomplete without having attended lectures.

## Uncovered Interest Rate Parity (UIP)

- The foreign exchange market is in equilibrium when deposits of all currencies offer the same expected rate of return: **uncovered interest parity**.

- Uncovered Interest Parity (UIP) says:

$$R_{\$} = R_{\text{€}} + (E^e_{\$/\text{€}} - E_{\$/\text{€}})/E_{\$/\text{€}}$$

- interest parity implies that deposits in all currencies are deemed equally desirable assets.

## The Market for Foreign Exchange (cont.)

- Why should this condition hold? Suppose it didn't.
  - Suppose  $R_{\$} > R_{\text{€}} + (E^e_{\$/\text{€}} - E_{\$/\text{€}})/E_{\$/\text{€}}$ .
  - Then no investor would want to hold euro deposits, driving down the demand and price of euros.
  - Then all investors would want to hold dollar deposits, driving up the demand and price of dollars.
  - The dollar would appreciate and the euro would depreciate, increasing the right side until equality was achieved (- arbitrage).

## The Market for Foreign Exchange (cont.)

- How do changes in the current exchange rate affect expected returns in foreign currency?

## The Market for Foreign Exchange (cont.)

- Depreciation of the domestic currency today **lowers the expected return on deposits in foreign currency**.
  - A current depreciation of domestic currency will raise the initial cost of investing in foreign currency, thereby lowering the expected return in foreign currency.
- Appreciation of the domestic currency today **raises the expected return of deposits in foreign currency**.
  - A current appreciation of the domestic currency will lower the initial cost of investing in foreign currency, thereby raising the expected return in foreign currency.



## Expected Returns on Euro Deposits when $E_{\$/\epsilon}^e = \$1.05$ Per Euro

Current exchange rate	Interest rate on euro deposits	Expected rate of dollar depreciation	Expected dollar return on euro deposits
$E_{\$/\epsilon}$	$R_\epsilon$	$(1.05 - E_{\$/\epsilon})/E_{\$/\epsilon}$	$R_\epsilon + (1.05 - E_{\$/\epsilon})/E_{\$/\epsilon}$
1.07	0.05	-0.019	0.031
1.05	0.05	0.000	0.050
1.03	0.05	0.019	0.069
1.02	0.05	0.029	0.079
1.00	0.05	0.050	0.100

Note: These lecture notes are incomplete without having attended lectures.

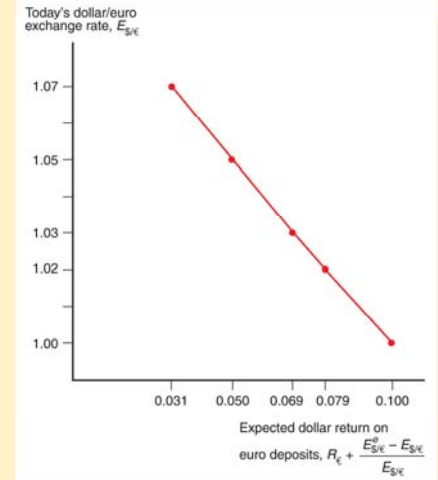


## The Current Exchange Rate and the Expected Return on Dollar Deposits

Figure 13-3

**The Relation Between the Current Dollar/Euro Exchange Rate and the Expected Dollar Return on Euro Deposits**

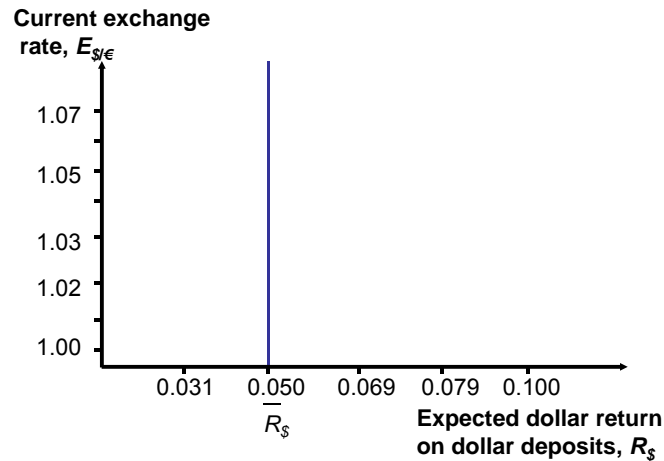
Given  $E_{\$/\epsilon}^e = 1.05$  and  $R_\epsilon = 0.05$ , an appreciation of the dollar against the euro raises the expected return on euro deposits, measured in terms of dollars.



Note: These lecture notes are incomplete without having attended lectures.



## The Current Exchange Rate and the Expected Return on Dollar Deposits



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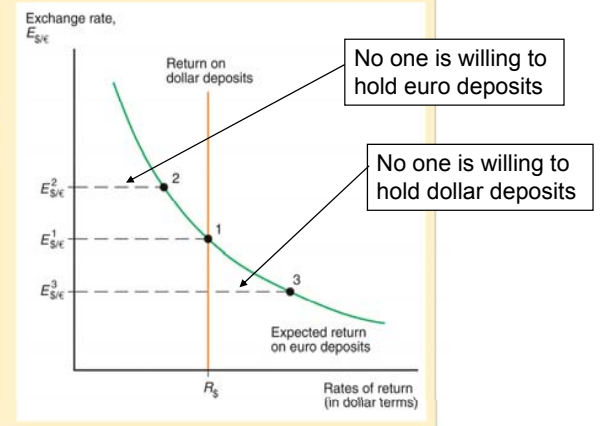


## Determination of the Equilibrium Exchange Rate

Figure 13-4

**Determination of the Equilibrium Dollar/Euro Exchange Rate**

Equilibrium in the foreign exchange market is at point 1, where the expected dollar returns on dollar and euro deposits are equal.



Note: These lecture notes are incomplete without having attended lectures.

# The Market for Foreign Exchange

## The effects of changing interest rates:

- An increase in the interest rate paid on deposits denominated in a particular currency will increase the rate of return on those deposits.
- This leads to an appreciation of the currency.
  - A rise in dollar interest rates causes the dollar to appreciate.
  - A rise in euro interest rates causes the dollar to depreciate.

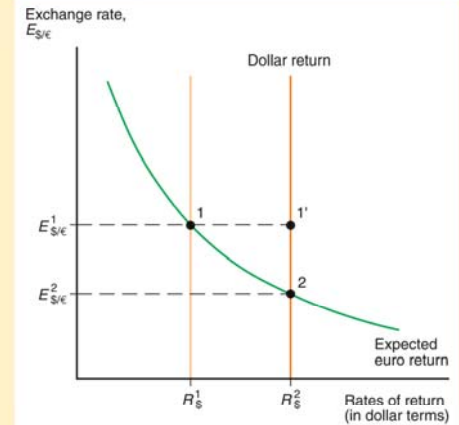
Note: These lecture notes are incomplete without having attended lectures.

# The Effect of a Rise in the Dollar Interest Rate

**Figure 13-5**  
Effect of a Rise in the Dollar Interest Rate

A rise in the interest rate offered by dollar deposits from  $R_S^1$  to  $R_S^2$  causes the dollar to appreciate from  $E_{\$/\text{€}}^1$  (point 1) to  $E_{\$/\text{€}}^2$  (point 2).

A depreciation of the euro is an appreciation of the dollar.

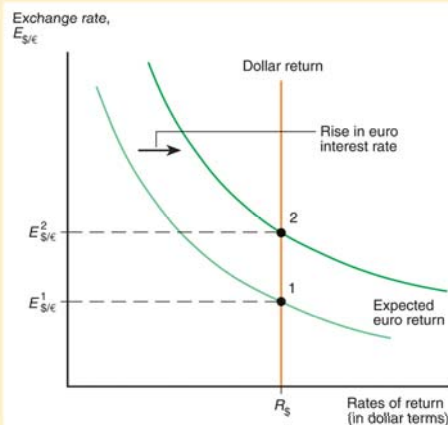


Note: These lecture notes are incomplete without having attended lectures.

# The Effect of a Rise in the Euro Interest Rate

**Figure 13-6**  
Effect of a Rise in the Euro Interest Rate

A rise in the interest rate paid by euro deposits causes the dollar to depreciate from  $E_{\$/\text{€}}^1$  (point 1) to  $E_{\$/\text{€}}^2$  (point 2). (This figure also describes the effect of a rise in the expected future  $\$/\text{€}$  exchange rate.)



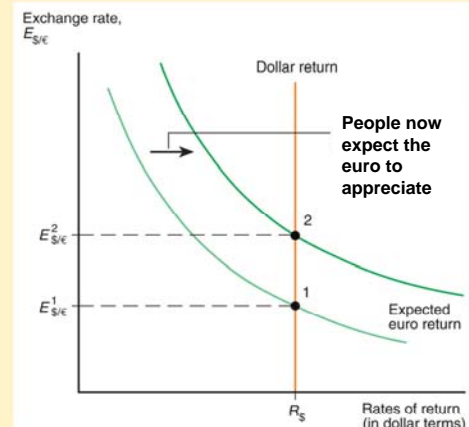
Note: These lecture notes are incomplete without having attended lectures.

# The Effect of an Expected Appreciation of the Euro

**Figure 13-6**  
Effect of a Rise in the Euro Interest Rate

A rise in the interest rate paid by euro deposits causes the dollar to depreciate from  $E_{\$/\text{€}}^1$  (point 1) to  $E_{\$/\text{€}}^2$  (point 2). (This figure also describes the effect of a rise in the expected future  $\$/\text{€}$  exchange rate.)

People now expect the euro to appreciate



Note: These lecture notes are incomplete without having attended lectures.

## The Effect of an Expected Appreciation of the Euro (cont.)

- If people expect the euro to appreciate in the future, then investment will pay off in a valuable (“strong”) euro, so that these future euros will be able to buy many dollars and many dollar denominated goods.
  - the expected return on euros therefore increases.
  - an expected appreciation of a currency leads to an actual appreciation (a self-fulfilling prophecy)
  - an expected depreciation of a currency leads to an actual depreciation (a self-fulfilling prophecy)

Note: These lecture notes are incomplete without having attended lectures.

8-49

## Covered Interest Parity

- Covered interest parity relates interest rates across countries and the rate of change between forward exchange rates and the spot exchange rate:

$$R_{\$} = R_{\epsilon} + (F_{\$/\epsilon} - E_{\$/\epsilon})/E_{\$/\epsilon}$$

where  $F_{\$/\epsilon}$  is the forward exchange rate.

- It says that rates of return on dollar deposits and “covered” foreign currency deposits are the same.
  - How could you make easy, risk-free money in the foreign exchange markets if covered interest parity did not hold?
  - Covered positions using the forward rate involve little risk.

Note: These lecture notes are incomplete without having attended lectures.

8-50

## A Couple More Terms...

- If the forward rate is greater (less) than the current spot exchange rate, then we say that the currency is at a **forward premium (discount)**

- Consider:

$$R_{\$} = R_{\epsilon} + (F_{\$/\epsilon} - E_{\$/\epsilon})/E_{\$/\epsilon}$$

- The amount of the forward premium (discount) equals  $(F_{\$/\epsilon} - E_{\$/\epsilon})/E_{\$/\epsilon}$

Note: These lecture notes are incomplete without having attended lectures.

8-51

## Summary

1. Exchange rates are prices of foreign currencies in terms of domestic currencies, or vice versa.
2. Depreciation of a country's currency means that it is less expensive (valuable) and goods denominated in it are less expensive: exports are cheaper and imports more expensive.
  - A depreciation will hurt consumers of imports but help producers of exports.

Note: These lecture notes are incomplete without having attended lectures.

8-52

## Summary (cont.)

3. Appreciation of a country's currency means that it is more expensive (valuable) and goods denominated in it are more expensive: exports are more expensive and imports cheaper.
  - An appreciation will help consumers of imports but hurt producers of exports.
4. Commercial banks that invest in deposits of different currencies dominate the foreign exchange market.
  - Expected rates of return are most important in determining the willingness to hold these deposits.

Note: These lecture notes are incomplete without having attended lectures.

8-53

## Summary (cont.)

5. Returns on bank deposits in the foreign exchange market are influenced by interest rates and expected exchange rates.
6. Equilibrium in the foreign exchange market occurs when returns on deposits in domestic currency and in foreign currency are equal: *interest rate parity*.
7. An increase in the interest rate on a currency's deposit leads to an increase in the rate of return and to an appreciation of the currency.

Note: These lecture notes are incomplete without having attended lectures.

8-54

## Summary (cont.)

8. An expected appreciation of a currency leads to an increase in the expected rate of return for that currency, and leads to an actual appreciation.
9. Covered interest parity says that rates of return on domestic currency deposits and "covered" foreign currency deposits using the forward exchange rate are the same.

Note: These lecture notes are incomplete without having attended lectures.

8-55