Chapter 13
Exchange Rates and the Foreign Exchange Market: An Asset 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

Definitions of Exchange Rates
- Exchange rates are quoted as foreign currency per unit of domestic currency or domestic currency per unit of foreign currency.
- How much can be exchanged for one dollar? ¥102/$1
- How much can be exchanged for one 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 Honda cost? ¥3,000,000
  - Or, ¥3,000,000 x $0.0098/¥1 = $29,400

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.
  - $1/€1 → $1.20/€1 means that the dollar has depreciated relative to the euro. It now takes $1.20 to buy one euro, so that the dollar is less valuable.
  - The euro has appreciated relative to the dollar: it is now more valuable.
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.
  - $1/€1 ! $0.90/€1 means that the dollar has appreciated relative to the euro. It now takes only $0.90 to buy one euro, so that the dollar is more valuable.
  - The euro has depreciated relative to the dollar: it is now less valuable.

- **Depreciation** is a decrease in the value of a currency relative to another currency.
  - A depreciated currency is less valuable, and therefore it can buy fewer foreign produced goods that are denominated in foreign currency.
  - How much does a Honda cost? ¥3,000,000
  - ¥3,000,000 x $0.0098/¥1 = $29,400
  - ¥3,000,000 x $0.0100/¥1 = $30,000
  - A depreciated currency means that imports are more expensive and domestically produced goods and exports are less expensive.
  - An appreciated currency lowers the price of exports relative to the price of imports.

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.
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.

The Foreign Exchange Market (cont.)

Characteristics of the market:

- 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.

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.

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.
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.

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.

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.
The Demand for Currency Deposits (cont.)

- **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 = \( \frac{102 - 100}{100} = 2\% \)
- **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.

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.)

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.
- 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.

The Demand for Currency Deposits (cont.)

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

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

Suppose the interest rate on a dollar deposit is 2%.

Suppose the interest rate on a euro deposit is 4%.

Does a euro deposit yield a higher expected rate of return?

Suppose today the exchange rate is $1/€1, and the expected rate 1 year in the future is $0.97/€1.

$100 can be exchanged today for €100.

These €100 will yield €104 after 1 year.

These €104 are expected to be worth $0.97/€1 x €104 = $100.88.

The rate of return in terms of dollars from investing in euro deposits is ($100.88-$100)/$100 = 0.88%.

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 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

$$\hat{R}_e = \left( E_{E_{\$}} - E_{E_{\$}} \right) / E_{E_{\$}}$$
The Demand for Currency Deposits (cont.)

- The difference in the rate of return on dollar deposits and euro deposits is
  \[ R_S - (R_E + \left( E_{S/E} - E_{S/E} \right)/E_{S/E} ) = \]
  \[ = (E_{S/E} - E_{S/E})/E_{S/E} \]

The Demand for Currency Assets

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.
- The foreign exchange market is in equilibrium when deposits of all currencies offer the same expected rate of return: **interest parity**.
  - interest parity implies that deposits in all currencies are deemed equally desirable assets.

<table>
<thead>
<tr>
<th>Case</th>
<th>$R_S$</th>
<th>$R_E$</th>
<th>$E_{S/E} - E_{S/E}$</th>
<th>$R_E - R_S - \left( E_{S/E} - E_{S/E} \right)/E_{S/E}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.10</td>
<td>0.06</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>2</td>
<td>0.10</td>
<td>0.06</td>
<td>0.04</td>
<td>0.00</td>
</tr>
<tr>
<td>3</td>
<td>0.10</td>
<td>0.06</td>
<td>0.08</td>
<td>-0.04</td>
</tr>
<tr>
<td>4</td>
<td>0.10</td>
<td>0.12</td>
<td>-0.04</td>
<td>0.02</td>
</tr>
</tbody>
</table>

The Market for Foreign Exchange (cont.)

- Interest parity says:
  \[ R_S = R_E + \left( E_{S/E} - E_{S/E} \right)/E_{S/E} \]
- Why should this condition hold? Suppose it didn’t.
  - Suppose $R_S > R_E + \left( E_{S/E} - E_{S/E} \right)/E_{S/E}$.
  - 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.
How do changes in the current exchange rate affect expected returns in foreign currency?

Depreciation of the domestic currency today lowers the expected return on deposits in foreign currency.
- A current depreciation of the 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^{e}\$/€ = \$1.05 Per Euro

<table>
<thead>
<tr>
<th>Current exchange rate</th>
<th>Interest rate on euro deposits</th>
<th>Expected rate of dollar depreciation</th>
<th>Expected dollar return on euro deposits</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E^{e}_{t-1}$</td>
<td>$R_{t}$</td>
<td>$(1.05 - E^{e}<em>{t-1})R</em>{t}$</td>
<td>$(1.05 - E^{e}<em>{t-1})R</em>{t}$</td>
</tr>
<tr>
<td>1.07</td>
<td>0.05</td>
<td>-0.019</td>
<td>0.031</td>
</tr>
<tr>
<td>1.05</td>
<td>0.05</td>
<td>0.000</td>
<td>0.050</td>
</tr>
<tr>
<td>1.03</td>
<td>0.05</td>
<td>0.019</td>
<td>0.069</td>
</tr>
<tr>
<td>1.02</td>
<td>0.05</td>
<td>0.029</td>
<td>0.079</td>
</tr>
<tr>
<td>1.00</td>
<td>0.05</td>
<td>0.050</td>
<td>0.100</td>
</tr>
</tbody>
</table>

The Current Exchange Rate and the Expected Return on Dollar Deposits

Figure 13.3: The Relation Between the Current Exchange Rate and the Expected Return on Euro Deposits

Expected dollar return on euro deposits: $R_{t} = R^{e}_{t} - R^{d}_{t}$.
The Current Exchange Rate and the Expected Return on Dollar Deposits

\[ \text{Expected dollar return on dollar deposits, } R_d \]

Current exchange rate, \( E_{EU} \)

\[ 0.031 \quad 0.050 \quad 0.069 \quad 0.079 \quad 0.100 \]

\[ 1.00 \quad 1.02 \quad 1.03 \quad 1.05 \quad 1.07 \]

Determination of the Equilibrium Exchange Rate

No one is willing to hold euro deposits

No one is willing to hold dollar deposits

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.

The Effect of a Rise in the Dollar Interest Rate

- A depreciation of the euro is an appreciation of the dollar.
The Effect of a Rise in the Euro Interest Rate

If a rise in the euro interest rate and the dollar interest rate causes the dollar to depreciate from $E_s$ (point 1) to $E_s'$ (point 2), then:

- investment in the dollar will decrease.
- foreign investment in the US will decrease.
- the demand for dollars will decrease.
- the supply of dollars will increase.
- the dollar will depreciate.
- the euro will appreciate.
- the exchange rate $E_s$ will fall to $E_s'$.
- the rate of return on euros will decrease.
- the rate of return on dollars will increase.
- the expected return on the dollar will decrease.
- the expected return on euros will increase.

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)

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:

$R_s = R_e + (F_s - E_{S/E_e})/E_{S/E_e}$

where $F_s$ 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.

It says that rates of return on dollar deposits and "covered" foreign currency deposits are the same.
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.

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.

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.

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.