American Depositary Receipt (ADR)

Cross-rate

Eurocurrency (Eurodollars, Euroyen, etc.)

London Interbank Offer Rate (LIBOR)

Triangular Arbitrage

- We observe the following quotes
  - 1 Euro per $1
  - 2 Swiss Franc per $1
  - .4 Euro per 1 Swiss Franc
- What is the cross rate?
  - (1 Euro / $1) / (2 SF / $1) = .5 Euro / SF
- We have $100 to invest; buy low, sell high
  - Buy $100(1 Euro/$1) = 100 Euro, use Euro to buy SF
  - Buy 100 Euro / (.4 Euro / 1 SF) = 250 SF, use SF to buy dollars
  - Buy 250 SF / (2 SF/$1) = $125

  Make $25 risk-free

Currency market transactions

- Spot trade – exchange currency immediately
  - Spot rate – the exchange rate for an immediate trade
- Forward trade – agree today to exchange currency at some future date and some specified price (also called a forward contract)
  - Forward rate – the exchange rate specified in the forward contract
  - If the forward rate is higher than the spot rate, the foreign currency is selling at a premium (when quoted as $ equivalents)
  - If the forward rate is lower than the spot rate, the foreign currency is selling at a discount

Exchange Rate Determination

Absolute Purchasing Power Parity

- Price of an item is the same regardless of the currency used to purchase it
- Requirements for absolute PPP to hold
  - Transaction costs are zero
  - No barriers to trade (no taxes, tariffs, etc.)
  - No difference in the commodity between locations
- For most goods, Absolute PPP rarely holds in practice

Relative Purchasing Power Parity

- Provides information about what causes changes in exchange rates
- The basic result is that exchange rates depend on relative inflation between countries
- $E(S_t) = S_0[1 + (h_{FC} - h_{US})]^t$

- Suppose the Canadian spot exchange rate is 1.18 Canadian dollars per U.S. dollar. U.S. inflation is expected to be 3% per year and Canadian inflation is expected to be 2%.
  - Do you expect the U.S. dollar to appreciate or depreciate relative to the Canadian dollar?
    - Since expected inflation is higher in the U.S., we would expect the U.S. dollar to depreciate relative to the Canadian dollar.
  - What is the expected exchange rate in one year?
    - $E(S_1) = 1.18[1 + (.02 - .03)]^1 = 1.1682$

Covered Interest Rate Arbitrage

- Examines the relationship between spot rates, forward rates, and nominal rates between countries
- Again, the formulas will assume that the exchange rates are quoted in terms of foreign currency per U.S. dollar
- The U.S. risk-free rate is assumed to be the T-bill rate

- Consider the following information
  - S_0 = .8 Euro / $ R_{US} = 4%
  - F_1 = 1.7 Euro / $ R_E = 2%
- What is the arbitrage opportunity?
  - Borrow $100 at 4%
  - Buy $100(.8 Euro/$) = 80 Euro and invest at 2% for 1 year
  - In 1 year, receive 80(1.02) = 81.6 Euro and convert back to dollars
  - 81.6 Euro / (.7 Euro / $) = $116.57 and repay loan
  - Profit = $116.57 – 100(1.04) = $12.57 risk free

Interest Rate Parity

- Based on the covered interest arbitrage, there must be a forward rate that would prevent the arbitrage opportunity.
- Interest rate parity defines what that forward rate should be

$$\text{Exact}: \frac{F_1}{S_0} = \frac{(1+R_{FC})}{(1+R_{US})}$$

Unbiased Forward Rates

- The current forward rate is an unbiased estimate of the future spot exchange rate
- This means that on average the forward rate will equal the future spot rate
  - If the forward rate is consistently too high
    - Those who want to exchange yen for dollars would only be willing to transact in the future spot market
    - The forward price would have to come down for trades to occur
  - If the forward rate is consistently too low
    - Those who want to exchange dollars for yen would only be willing to transact in the future spot market
    - The forward price would have to come up for trades to occur

Uncovered Interest Rate Parity

- What we know so far
  - PPP: $E(S_1) = S_0[1 + (h_{FC} – h_{US})]$
  - IRP: $F_1 = S_0[1 + (R_{FC} – R_{US})]$
  - UFR: $F_1 = E(S_1)$
- Combining the formulas we get
  - $E(S_1) = S_0[1 + (R_{FC} – R_{US})]$ for one period
  - $E(S_t) = S_0[1 + (R_{FC} – R_{US})]^t$

International Fisher Effect

- Combining PPP and UIP we can get the International Fisher Effect
- $R_{US} – h_{US} = R_{FC} – h_{FC}$
- The International Fisher Effect tells us that the real rate of return must be constant across countries. If it is not, investors will move their money to the country with the higher real rate of return