Ch. 6 International Parity Conditions

Topics

- Purchasing Power Parity
- Exchange Rate Pass-Through
- International Fisher Effect
- Covered Interest Arbitrage
- Uncovered Interest Arbitrage
- Interest Rate Parity

International Parity Conditions

- An exchange rate represents the price of a currency, which is determined by the demand for that currency relative to the supply for that currency.
- International Parity Conditions: The economic theories which link exchange rates, price levels, and interest rates together.
  - These theories may not always work out to be "true" when compared to what students and practitioners observe in the real world, but they are central to any understanding of how multinational business is conducted.

Factors that Influence Exchange Rates

1. Relative Inflation Rates
   U.S. inflation ↑
   - U.S. demand ↑ for British goods ➔ £?
   - British demand ↓ for U.S. goods ➔ Supply of £?
2. Relative Interest Rates
   U.S. interest rates ↑
   - U.S. demand ↓ for British bank deposits ➔ £?
   - British demand ↑ for U.S. bank deposits ➔ Supply of £?
3. Relative Income Levels
   U.S. income level ↑
   - No expected change for the supply of £.
   - U.S. demand ↑ for British goods ➔ £?

Factors that Influence Exchange Rates

4. Governments may influence the equilibrium exchange rate by
   - imposing foreign exchange barriers,
   - imposing foreign trade barriers,
   - intervening in the foreign exchange market, and
   - affecting macro variables such as inflation, interest rates, and income levels.
5. Expectations
   - Foreign exchange markets react to any news that may have a future effect.
   - Institutional investors often take currency positions based on anticipated interest rate movements in various countries.

Factors that Influence Exchange Rates

- Interaction of Factors
  - Trade-related factors and financial factors sometimes interact. Exchange rate movements may be simultaneously affected by these factors.
  - Over a particular period, different factors may place opposing pressures on the value of a foreign currency.
  - The sensitivity of the exchange rate to these factors is dependent on the volume of international transactions between the two countries.
  - Because of speculative transactions, foreign exchange rates can be very volatile.

Prices and Exchange Rates

- **The Law of One Price**: All else being equal (no transaction costs), a product's price should be the same in all markets.
- Even if prices for a particular product are in different currencies, the law of one price states that

$$P^{\$} \times S = P^{¥}$$

where,

the price of the product in US dollars ($P^{\$}$), multiplied by the spot exchange rate (S, yen per dollar), equals the price of the product in Japanese yen ($P^{¥}$)

Prices and Exchange Rates

- Conversely, if the prices were stated in local currencies, and markets were efficient, the exchange rate could be deduced from the relative local product prices:

$$S = \frac{P^{¥}}{P^{\$}}$$

Purchasing Power Parity

- Purchasing Power Parity (PPP): The purchasing power of a consumer will be similar when purchasing goods in a foreign country or in the home country.
- Absolute purchasing power parity: The spot exchange rate is determined by the relative prices of similar basket of goods.
  - If inflation in a foreign country differs from inflation in the home country, the exchange rate will adjust to maintain equal purchasing power.
  - Currencies in countries with high inflation will be weak according to PPP.

The Hamburger Standard

- The "Big Mac Index," as it has been christened by *The Economist* is a prime example of this law of one price:
  - Assuming that the Big Mac is identical in all countries, it serves as a comparison point as to whether or not currencies are trading at market prices.
  - Big Mac costs 16 yuan in China and $4.56 in the U.S.
  - Actual exchange rate CNY 6.1341/$.

The Hamburger Standard

- The price of a Big Mac in Chinese Yuan in U.S. dollar-terms was therefore:

- The Economist then calculates the implied purchasing power parity rate of exchange using the actual price of the Big Mac in China over the price of the Big Mac in U.S. dollars:

The Hamburger Standard

- Now comparing the implied PPP rate of exchange, Yuan 3.509/$, with the actual market rate of exchange at that time, Yuan 6.1341/$, the degree to which the Chinese yuan is either undervalued or overvalued versus the U.S. dollar is calculated:

Purchasing Power Parity

$$e_f = \frac{(1 + I_h)}{(1 + I_f)} - 1 = \frac{(I_h - I_f)}{(1 + I_f)}$$

where,

e_f = % change in the value of the foreign currency

I_h = inflation rate in the home country

I_f = inflation rate in the foreign country

Relative Purchasing Power Parity

- Relative purchasing power parity: The relative change in prices between countries over a period of time determines the change in exchange rates.
  - Moreover, if the spot rate between 2 countries starts in equilibrium, any change in the differential rate of inflation between them tends to be offset over the long run by an equal but opposite change in the spot rate.
  - The relative form of PPP accounts for market imperfections like transportation costs, tariffs, and quotas.

Rationale Behind PPP Theory

- Suppose inflation is high in a particular country.

→ Foreign demand for goods in that country will decrease.
→ In addition, that country's demand for foreign goods should increase.
→ Thus, the home currency of that country will weaken.
→ This tendency should continue until the currency has weakened to the extent that a foreign country's goods are no more attractive than the home country's goods.
→ Inflation differentials are offset by exchange rate changes.

Purchasing Power Parity

- For the most part, PPP tends to be inaccurate in predicting future exchange rates.
- PPP holds up well over the very long term but is poor for short term estimates.
- The theory holds better for countries with relatively high rates of inflation and underdeveloped capital markets.
- Incomplete exchange rate pass-through is one reason that a country's real effective exchange rate index can deviate for lengthy periods from its PPP-equilibrium level.

Exchange Rate Pass-Through

- Exchange Rate Pass-Through: The degree to which the prices of imported & exported goods change as a result of exchange rate changes.

Example

- Assume BMW produces a car in Germany and all costs are incurred in euros. When the car is exported to the US, the price of the BMW (€35,000) should be the euro value converted to dollars at the spot rate ($1.0000/ €).

  $P^{\$}_{BMW} = P^{€}_{BMW} \times (\$/€) =$
- Suppose the euro appreciates 20% against the dollar ($1.2000/ €).
- Complete pass-through price
  =

Exchange Rate Pass-Through

- But, if the price of the BMW in the US market rise to only $40,000, the pass-through is partial.
- Then, the degree of pass-through is measured by the proportion of the exchange rate change reflected in dollar prices:

- The degree of pass-through in this case is partial, _____or approximately _____. Only ___% of the change has been passed through to the US dollar price.

Interest Rates and Exchange Rates

- Fisher effect: Nominal risk-free interest rates contain a real rate of return and an anticipated inflation. As a formula, The Fisher Effect is

  $$i = r + \pi + r\pi$$

  where, i is the nominal rate, r is the real rate of interest, and π is the expected rate of inflation over the period of time. The cross-product term, $r\pi$, is usually dropped due to its relatively minor value.
- If the same real return is required, differentials in interest rates may be due to differentials in expected inflation.
- According to PPP, exchange rate movements are caused by inflation rate differentials.

International Fisher Effect

- International Fisher Effect (IFE): A currency's value will adjust in accordance with the differential in interest rates between two countries. The spot exchange rate should change in an amount equal to but in the opposite direction of the difference in interest rates between countries.
- According to the IFE, E(r_f), the expected effective return on a foreign money market investment, should equal r_h, the effective return on a domestic investment.
- With unrestricted capital flows, an investor should be indifferent between investing in dollar or yen bonds, since investors worldwide would see the same opportunity and compete it away.

International Fisher Effect

$$e_f = \frac{(1 + i_h)}{(1 + i_f)} - 1 = \frac{(i_h - i_f)}{(1 + i_f)}$$

where,

e_f = % change in the value of the foreign currency

i_h = interest rate in the home country

i_f = interest rate in the foreign country

Testing the IFE

- Since the IFE is based on PPP, it will not hold when PPP does not hold.
- For instance, if there are factors other than inflation that affect exchange rates, the rates will not adjust in accordance with the inflation differential.

Forward Rate

- Forward Rate: An exchange rate quoted today for settlement at some future date.
  - The forward exchange agreement between currencies states the rate of exchange at which a foreign currency will be bought or sold forward at a specific date in the future (typically 30, 60, 90, 180, 270 or 360 days).

Forward Market

- As with the case of spot rates, there is a bid/ask spread on forward rates.
- Forward rates may also contain a premium or discount.
  - If the forward rate exceeds the existing spot rate, it contains a premium.
  - If the forward rate is less than the existing spot rate, it contains a discount.
  - The forward premium/discount reflects the difference between the home interest rate and the foreign interest rate, so as to prevent arbitrage.

Forward Market

- The forward market facilitates the trading of forward contracts on currencies.
- Forward contract: Agreement between a corporation and a commercial bank to exchange a specified amount of a currency at a specified exchange rate (called the forward rate) on a specified date in the future.
  - When MNEs anticipate future need or future receipt of a foreign currency, they can set up forward contracts to lock in the exchange rate.
  - Forward contracts are often valued at $1 million or more, and are not normally used by consumers or small firms.

Forward Market

- Long and short positions
  - The party agreeing to buy is said to take a long position.
  - The party agreeing to sell is said to take a short position.
- A forward contract is an obligation for each of the contracting parties.
- No money exchanges hands until maturity.

Forward Market

- Contracting Issues in the Forward Market
  - Default risk
  - Liquidity risk

  → Mitigated by financial intermediaries using customized forward contracts.

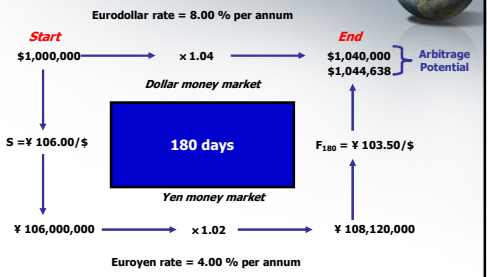
Covered Interest Arbitrage

- Covered interest arbitrage: Process of capitalizing on the interest rate differential between two countries, while covering for exchange rate risk.
  - Covered interest arbitrage tends to force a relationship between forward rate premiums and interest rate differentials.
- Because the spot and forward markets are not always in a state of equilibrium, the opportunity for arbitrage exists.
- The arbitrageur who recognizes this imbalance can invest in the currency that offers the higher return on a covered basis.

Covered Interest Arbitrage (CIA)

- Rule of Thumb:
  - If the difference in interest rates is greater than the forward premium (or expected change in the spot rate), invest in the higher yielding currency.
  - If the difference in interest rates is less than the forward premium (or expected change in the spot rate), invest in the lower yielding currency.

Covered Interest Arbitrage (CIA)

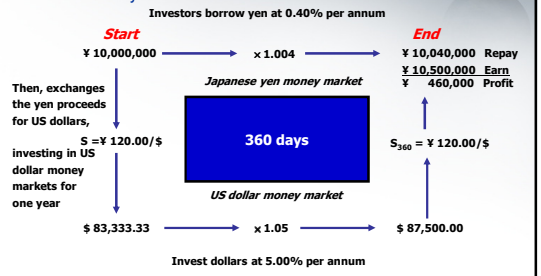


Uncovered Interest Arbitrage (UIA)

- A deviation from CIA is uncovered interest arbitrage, UIA, wherein investors borrow in currencies exhibiting relatively low interest rates and convert the proceeds into currencies which offer higher interest rates.
- The transaction is "uncovered" because the investor does not sell the currency forward, thus remaining uncovered to any risk of the currency deviating.
- Rule of Thumb:
  - If the difference in interest rates is greater than the forward premium (or expected change in the spot rate), invest in the higher yielding currency.
  - If the difference in interest rates is less than the forward premium (or expected change in the spot rate), invest in the lower yielding currency.

Uncovered Interest Arbitrage

- The Yen Carry Trade



Interest Rate Parity (IRP)

- Interest rate parity (IRP): The ratio between the risk free interest rates in two different countries is equal to the ratio between the forward and spot exchange rates.
  - Market forces cause the forward rate to differ from the spot rate by an amount that is sufficient to offset the interest rate differential between the two currencies.
  - Then, covered interest arbitrage is no longer feasible, and the equilibrium state is achieved.
  - When IRP exists, the rate of return achieved from covered interest arbitrage should equal the rate of return available in the home country.

Interest Rate Parity

$$p = \frac{1 + \left(i_H \times \frac{n}{360}\right)}{1 + \left(i_F \times \frac{n}{360}\right)} - 1$$

where,
p = Forward premium
i_H = Home interest rate
i_F = Foreign interest rate

Interest Rate Parity

Example

- Suppose i_{peso} = 12%, $i_{\$}$ = 10%. Current spot rate is $.10/peso. Compute the 6 month forward rate.
- From the U.S. investor's perspective:

  p = forward premium =
- Since S = $.10/peso, then

  $F_{6\text{-month}}$ = $S \times (1 + p)$

  ≈

  ≈

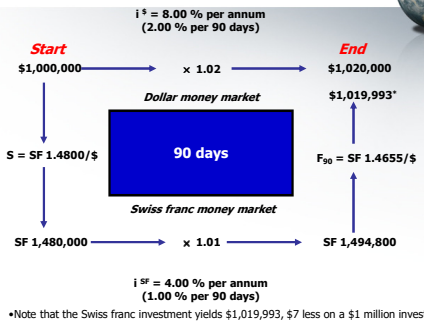
Interest Rate Parity

- The Forward Rate

$$\text{Direct Quote}: F_n^{\$/FC} = S^{\$/FC} \times \frac{\left[1 + \left(i^{\$} \times \frac{n}{360}\right)\right]}{\left[1 + \left(i^{f} \times \frac{n}{360}\right)\right]}$$

$$\text{Indirect Quote}: F_n^{FC/\$} = S^{FC/\$} \times \frac{\left[1 + \left(i^{f} \times \frac{n}{360}\right)\right]}{\left[1 + \left(i^{\$} \times \frac{n}{360}\right)\right]}$$

Interest Rate Parity



•Note that the Swiss franc investment yields $1,019,993, $7 less on a $1 million investment.

Interest Rate Parity

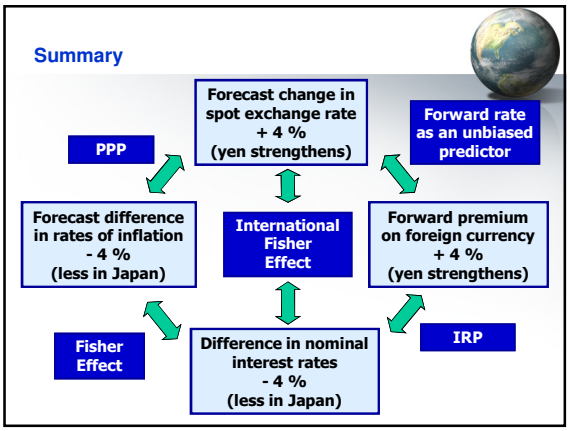
- Various empirical studies indicate that IRP generally holds.
- While there are deviations from IRP, they are often not large enough to make covered interest arbitrage worthwhile.
- This is due to the characteristics of foreign investments, including transaction costs, political risk, and differential tax laws.

Considerations When Assessing IRP

- Transaction Costs
  - IRP may not be feasible after taking into consideration transaction costs.
- Political Risk
  - A crisis in the foreign country could cause its government to restrict any exchange of the local currency for other currencies.
  - Investors may also perceive a higher default risk on foreign investments.
- Differential Tax Laws
  - If tax laws vary, after-tax returns should be considered instead of before-tax returns.

Forward Rates as an Unbiased Predictor

- If the foreign exchange markets are thought to be "efficient" then the forward rate should be an unbiased predictor of the future spot rate.
- This is roughly equivalent to saying that the forward rate can act as a prediction of the future spot exchange rate, and it will often "miss" the actual future spot rate, but it will miss with equal probabilities (directions) and magnitudes (distances).


Summary
Forecast change in spot exchange rate + 4 % (yen strengthens)
PPP
Forward rate as an unbiased predictor
Forecast difference in rates of inflation - 4 % (less in Japan)
International Fisher Effect
Forward premium on foreign currency + 4 % (yen strengthens)
Fisher Effect
Difference in nominal interest rates - 4 % (less in Japan)
IRP