4. International Parity Conditions

4.1 Purchasing Power Parity

The Purchasing Power Parity (PPP) theory is one of the early theories of exchange rate determination. This theory is based on the concept that the demand for a country's currency is derived from the demand for the goods that this country produces. Thus, the exchange rate for a certain country's currency depends on the demand for the goods produced in that country. If prices of goods are low relative to those in other countries, then this exchange rate will be high.

The PPP relationship is important because it tells us whether changes in the nominal exchange rate have an impact on real variables such as the value of a firm or the return on a portfolio of assets.

**Commodity Price Parity (CPP):**

Arbitrage in perfect goods market implies that a particular good must have the same price across different countries, after translation into a common currency. That is, if the price of the same commodity were not the same across countries, then one could make profits by buying the commodity in the country where it is cheap and selling it where it is more expensive.

CPP can be expressed as follows:

\[ P^\text{US}_k = S(USD / CAD)P^\text{C}_k \]

This relation states that the price of commodity "k" must be the same in both Canada and the United States.
In the real world, CPP may not hold for the following reasons:

**Imperfections:**

**Transaction Costs:** Tariffs, transportation costs, insurance fees, and other such costs mean that it may not be possible to make arbitrage profits even in the presence of price differences across countries.

**Nontraded Goods:** Several goods, such as services (haircuts) are nontradable.

**Quotas:** Quotas and other such barriers to trade restrict the ability to make arbitrage profits.

**Imperfect Competition:** Imperfect competition in commodity markets may prevent prices from being equalized across countries. For example, price discrimination, entry costs, and menu costs would prevent CPP.

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**Absolute Purchasing Power Parity:**

In an economy with many goods, purchasing power is defined in terms of a representative bundle of goods. It describes the number of baskets of goods you can buy.

One PPP condition, called Absolute PPP, relates the absolute price levels in two countries to the level of the exchange rate between them.

The Absolute PPP condition states that:

\[ P^{US} = S(USD / CAD)P^C \]

According to the Absolute PPP view of exchange rate determination, exchange rates must be such that there is equality between the domestic and foreign price levels.

The price level indicates the price of a particular basket of goods. The most common price index is the Consumer Price Index (CPI).

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PPP may not hold because:

**Imperfections:**

**Violations of CPP:** Absolute PPP is unlikely to hold if CPP is violated. That is, if the individual goods in the representative consumption basket do not satisfy CPP, then PPP is likely to be violated.

**Differences in Baskets:** Absolute PPP will not hold if the composition of the baskets differs across countries. For example, the presence of nontraded goods would make baskets different across countries.
**Relative Purchasing Power Parity:**

The Relative PPP hypothesis states that the percentage change in the exchange rate reflects the difference between inflation at home and abroad.

The Relative PPP condition is (t<T):

\[
\frac{P^\text{US}}{P^\text{t}} = \frac{S_r(\text{USD} / \text{CAD})}{S_t(\text{USD} / \text{CAD})} \times \frac{P^\text{C}}{P^\text{t}}
\]

The linear version of this relation is:

\[
S_{t,T} = \pi_{t,T}^\text{US} - \pi_{t,T}^\text{C}
\]

That is, the inflation differences between countries should be reflected in percentage changes in the exchange rate. For example, if the inflation rate is 5 % in the US and 2 % in Canada, then the Canadian dollar should appreciate by 3 %. That is, if prices in the US are rising faster than prices in Canada, then Canada's exports are becoming relatively cheaper. This should attract importers, thereby increasing Canadian net exports and reducing US net exports. This should generate a relatively higher demand for CAD and promote an appreciation of the CAD against the USD.

**The Real Exchange Rate:**

The empirical evidence suggests that CPP and PPP do not hold in the short run, and that they may hold in the long run. The information summarized by PPP, however, may still be useful to determine the competitive position of a particular country.

This empirical evidence also suggests that domestic and foreign baskets of goods on which price levels are computed are different across countries.

The Real Exchange Rate summarizes this information. The Real Exchange Rate is:

\[
Q(\text{US} / \text{C}) = \frac{S(\text{USD} / \text{CAD})P^\text{C}}{P^\text{US}}
\]

The real exchange rate is the relative price of a foreign basket of goods in terms of a domestic basket of goods.

For example, assume that the price level is CAD 150 per basket of Canadian goods in Canada and USD 100 per basket of US goods in the US. Also assume that the exchange rate is USD 0.65/CAD. The real exchange rate is then:

\[
Q(\text{US} / \text{C}) = \frac{\text{USD}0.65 / \text{CAD} \times \text{CAD}150 / B^\text{C}}{\text{USD}100 / B^\text{US}} = B^\text{US} 0.975 / B^\text{C}
\]
It costs 0.975 basket of US goods to purchase 1 basket of Canadian goods. That is, the Canadian basket is cheaper than the American basket, which suggests that the American economy is somewhat less competitive than the Canadian economy. Another interpretation is that the costs of living are lower in Canada.

Fluctuations in the real exchange rate thus give information about the relative competitiveness of different countries. For example, if the real exchange rate is increasing, then the domestic economy's competitive position is improving. If the real exchange rate is decreasing, then the domestic economy's competitive position is slipping.

The real exchange rate is the relative price of a foreign basket of goods. In the long run, this relative price is determined by the supply and demand for baskets of goods. These market forces can be summarized by:

- An increase in world relative demand for Canadian goods causes an increase in the price of the Canadian basket of goods and an increase in the real exchange rate.
- An increase in world relative supply of Canadian goods causes a reduction in the price of the Canadian basket of goods and a reduction in the real exchange rate.

### 4.2 Covered Interest Parity

The arbitrage condition called the Interest Rate Parity (IRP) condition or Covered Interest Parity (CIP) condition states that the prices from risk-free assets with identical maturity should be equated across countries, after translation in a common currency.

This condition can be simply derived from the following investment example. Suppose that a US investor has to decide between investing at home or in Canada. If she invests at home, her output will be:

\[
USDX^h_T = (1 + r_{US}^t)USDX_t
\]

If she invests abroad, her output will depend not only on the investment, but also on both a spot and a forward transaction. The output of the spot transaction will be:

\[
USDX_t = S_t(USD/CAD)CADY_t
\]

The output of the investment transaction will be:

\[
CADY_T = (1 + r_{CAD}^t)CADY_t
\]
Finally, the output of the forward transaction will be:

\[ \text{CADY}_i = F_{i,T} \left( \text{CAD} / \text{USD} \right) \text{USDX}^f_T = \frac{\text{USDX}^f_T}{F_{t,T} \left( \text{USD} / \text{CAD} \right)} \]

The output of this overall investment is then:

\[ \text{USDX}^f_T = \frac{F_{i,T} \left( \text{USD} / \text{CAD} \right)}{S_i \left( \text{USD} / \text{CAD} \right)} (1 + r^C_{i,T}) \text{USDX}_i \]

Our arbitrage argument requires that:

\[ \frac{\text{USDX}^h_T}{\text{USDX}_i} = \frac{\text{USDX}^f_T}{\text{USDX}_i} \]

The CIP condition is then:

\[ (1 + r^{US}_{i,T}) = (1 + r^C_{i,T}) \frac{F_{i,T} \left( \text{USD} / \text{CAD} \right)}{S_i \left( \text{USD} / \text{CAD} \right)} \]

These transactions can be shown on a diagram.

### 4.3 Uncovered Interest Parity

Another widely discussed interest parity condition is called the Uncovered Interest Parity (UIP) condition. To understand UIP, we must first discuss the forward rate as an unbiased predictor of future spot rate.

**The Forward Rate as an Unbiased Predictor of Future Spot Rates:**

UIP is based on the notion that, under efficient and perfect markets, the forward exchange rate must be an unbiased predictor of the future spot exchange rate. That is, if the forward rate is an unbiased predictor of the future spot rate, the expected value of the future spot rate given all the information available today must equal the present forward rate:

\[ F_{i,T} = E_i \{ S_T \} \]
An unbiased predictor, however, does not mean that the future spot rate will actually be equal to the forward rate. Unbiased prediction only means that the future spot rate will, on average, equal the forward rate.

The rationale for this relationship is based on the hypothesis that the foreign exchange market is efficient. Market efficiency assumes that all relevant information is quickly reflected in both the spot and forward exchange markets, that transaction costs are low or nonexistent, and that instruments denominated in different currencies are perfect substitutes for one another.

Empirical studies on market efficiency have yielded conflicting results. That is, there appear to be a risk premium on the forward market:

\[ F_{t,T} = E_t\{S_T\} + RP_{t,T} \]

**The Uncovered Interest Parity Condition:**

The UIP condition is simply:

\[ (1 + r_{t,T}^{US}) = (1 + r_{t,T}^C) \frac{E_t\{S_T\}}{S_t} \]

The linear version of this condition is widely used in exchange rate determination models. The linear version is (a * denotes foreign country variables):

\[ r_{t,T} = r_{t,T}^* + \frac{E_t\{S_T\} - S_t}{S_t} \]

This condition has a diagrammatic exposition. This diagram is useful to understand the impact of news on exchange rates. The left side of the equation represents domestic return and the left side of the equation is the foreign return. Other things being equal, any news you obtain about the future spot exchange rate will be reflected in the current spot rate.

**4.4 Real Interest Parity**

This last condition is based on both UIP and PPP. It is called real in that it relates the real returns from assets across countries.
The Fisher Effect:
The Fisher effect states that the nominal interest rate is equal to the real interest rate plus compensation for expected inflation. The Fisher relation is:

\[(1 + \rho_{t,T})(1 + \pi_{t,T}) = (1 + r_{t,T})\]

Where \(\rho\) is the real interest rate and \(\pi\) is the expected inflation rate.

The nominal interest rate describes the rate of return from an asset, in terms of units of currency. The real interest rate, however, is the rate of return from this asset, in terms of units of a basket of goods that can be purchased. Inflation erodes the real value of a currency, because it is a general and sustained increase in the price level of the basket of goods. Thus, to obtain the real interest rate, we must subtract inflation from the nominal return.

The linear version of this relation is:

\[r_{t,T} = \rho_{t,T} + \pi_{t,T}\]

The International Fisher Effect:
The international Fisher effect, or Fisher-open, states that the spot exchange rate should change in an equal amount but in the opposite direction to the difference in interest rates between two countries.

This relation is based on UIP, Relative PPP, and the Fisher effect. For example, UIP is:

\[(1 + r_{t,T}) = (1 + r^*_t) \frac{E_t(S_{T})}{S_t}\]

The best forecast of Relative PPP is:

\[(1 + \pi_{t,T}) = (1 + \pi^*_t) \frac{E_t(S_{T})}{S_t}\]

Finally, the Fisher effect is:

\[(1 + \rho_{t,T}) = \frac{(1 + r_{t,T})}{(1 + \pi_{t,T})}\]

The international fisher relation is:

\[(1 + \rho_{t,T}) = (1 + \rho^*_t)\]
**The Real Exchange Rate:**

The previous derivation was undertaken with the idea that PPP holds. If this is not the case, there is a real version of UIP that can be established. This new condition states that the real return from risk-free assets with identical maturity should be equated across countries, after translation in a basket of goods.

This parity condition relates the real return to investment at home and abroad, and changes in the real exchange rate. This parity is:

\[(1 + \rho_{T,T}^*) = (1 + \rho_{T,T}^*) \frac{E_t(Q_t^*)}{Q_t}\]

### 4.5 Summary

- CPP states that a particular commodity must have the same price across different countries, after translation into a common currency. Several reasons might explain violations of CPP: transaction costs, nontraded goods, quotas, and imperfect competition.

- Absolute PPP states that a particular commodity basket must have the same price across different countries, after translation into a common currency. PPP will likely be violated if CPP is itself violated and if baskets are different across countries.

- The Relative PPP hypothesis states that the percentage change in the exchange rate reflects the difference between inflation at home and abroad.

- The real exchange rate is the relative price of a foreign basket of goods. It provides information about the competitiveness and the costs of living of countries. In the long run, this real exchange rate is determined by the supply and demand for baskets of goods.
• The arbitrage condition called the Covered Interest Parity (CIP) condition states that the prices from risk-free assets with identical maturity should be equated across countries, after translation in a common currency.

• Uncovered Interest Parity (UIP) is based on the notion that, under efficient and perfect markets, the forward exchange rate must be an unbiased predictor of the future spot exchange rate.

• The Fisher effect states that the nominal interest rate is equal to the real interest rate plus compensation for expected inflation.