Interest Rate Parity

Interest rate parity states that the forward rate premium (or discount) of a currency should reflect the differential in interest rates between the two countries.

The discounted interest rates differential equals the percentage forward discount. The spot rate is the present value of the forward rate. The interest rate is a bridge. Interest rate parity is equivalent to the statement that one unit of foreign currency, deliverable on a particular future date, must cost the same amount independently of whether it is obtained through the forward market or by means of the spot market.
The difference in the spot and forward rates for currencies are due solely to differentials in interest rates.

Covered Interest Arbitrage

A simple currency swap in which the counterparties exchange currencies at both the spot and forward rates simultaneously. The forward swap restores currency exposures to the original position without a currency gain or loss-making this a way to adjust exposure to a narrowing or widening of interest rate differentials rather than adjusting currency exposures. Covered interest arbitrage also insures interest rate parity because this relationship prevents speculators from profiting by borrowing in a low inter est rate country and simultaneously lending in a high interest rate country and hedging the currency risk.

Covered interest rate parity

Covered interest parity: interest rates denominated in different currencies are the same once you "cover" yourself against possible currency changes. The argument follows the standard logic of arbitrage in finance.

Consider two relatively riskless strategies for investing a Dollar for one year:

1. Invest dollar in US deposit. After one year, you have **(1+i)** dollars where i is the dollar rate of interest.
2. Alternate strategy has several steps:
   - Convert the $ to DM, giving **e DMs** where e is the spot exchange rate.
   - Invest the money in a DM deposit, earning i^f which leaves you with $\mathbf{(1+i^f)e}$ **DMs** at the end of the year.
   - We could convert back to $ at whatever the exchange rate happens to be at the end of the year, but that exposes you to the risk that the DM will fall.
   - To protect against a DM depreciation, you could sell DMs forward. You will have $\mathbf{(1+i^f)e}$ **DM** at the end of the year that you will want to convert back to $ which can be arranged with a one year forward contract at the exchange rate f. Thus, at the end of the year, you would have $\mathbf{(1+i^f)e/f}$ **$.**

Which strategy is better?

Yield of $(1 + i)$ or yield of $(1+i^f)e/f$?

Well, if either strategy had a higher payoff, you could short one and go long the other, earning huge profits with no risk. We should make sure that the **forward exchange** rate is set so that the returns are equal:

$$\mathbf{(1 + i) = (1 + i^f) e/f}$$

OR: $$\mathbf{f = e (1 + i^f) / (1 + i)}$$

Covered interest parity condition.

Example: If the US interest rate is i = 8% and the German rate i^f = 6% and the exchange rate is e =2.0, then, the forward exchange rate is f = 1.96 (future Marks are more expensive, the dollar is expected to depreciate).

The covered interest parity can be also written in a simpler form:

$$(1 + i^f) = (1+i)f/e = (1 + i) [1 + (f-e)/e] = (1 + i)(1 + fp) =$$

$$= (1+ i + fp + i\ fp)$$

Where fp (the forward premium) is the percentage difference of the forward rate from the spot rate. Since the term (i fp) is close to zero, this parity condition becomes approximately:

$$\mathbf{i = i^{f} - fp}$$

$$\textbf{Where} \quad \mathbf{fp = (f - e)/e}$$

i.e. the domestic interest rate is equal to the foreign rate less the forward premium.

This gives you a simple rule:
If the domestic interest rate is above the foreign rate by x%, the forward exchange rate (for the maturity equivalent to the interest rate) will be less than (i.e. depreciated relative to) the spot rate by x%.
If we cover the foreign positions with a forward contract, than it makes no difference whether we invest in dollars or DMs financial markets are very efficient and arbitrage keeps things the same (except for transactions costs).

But what if, in strategy two, we converted your dollar to DMs, invested in Germany and took your chances on the exchange rate?
Your actual return at the end of the year would then be

$$\mathbf{(1+i_t^{f})\, e_t / e_{t+1}}$$

Where e_{t+1} is the spot rate one year from now.

Suppose now that agents, are risk-neutral, i.e. they care only about expected returns. Then, expected return on investing in a domestic asset is (1 + i) while the expected return (as of today time t) of investing in a foreign asset is:

$$\mathbf{(1+i_t^{f})\, e_t \;/\, E(e_{t+1})}$$

Where $E(e_{t+1})$ is the expectation I have today (time t) of what the spot exchange rate will be one year from now.

If agents are risk-neutral and care only about expected returns, the expected return to investing in a domestic asset must be equal to the expected return on investing in the foreign asset:

$$(1+i_t) = (1+i_t^{f})\, e_t \;/\; E(e_{t+1})$$

Uncovered interest parity condition

Note: this is not a riskless arbitrage opportunity as the ex-post future spot, e_t, and what we expect it to be may differ; $E(e_{t+1})$ is uncertain as of today.
Rearranging the expression above and simplifying, we can rewrite the uncovered interest parity condition as:

$$\mathbf{i = i^{f} - [E(e_{t+1}) - e_t] / e_t = i^{f} - de^{exp}/e}$$

Where $\mathbf{de^{exp}/e}$ is the expected rate of change in the exchange rate.

In the above example, if the expected DM exchange rate was 1.96, then the US interest rate equals the German interest rate less the expected rate of change of the exchange rate: 8% = 6% - [1.96 - 2]/2.

If the condition holds, a x% difference between the interest rate at home and abroad must imply that investors expect that the domestic currency will depreciate by x%. Given that covered interest parity works, uncovered interest parity amounts to saying that the forward rate today (delivery of currency at time t+1) is the market's expectation of what the spot rate will be a period from now:

$$\mathbf{f_t = E(e_{t+1}).}$$

This expectations hypothesis implies that if the forward rate is less than the current spot rate ($f_t < e_t$, as in the example above), we should expect the spot rate to depreciate: $E(e_{t+1}) < e_t$.

Uncovered interest parity condition:

The condition implies that the expected depreciation of a currency is equal to the differential between domestic and foreign interest rates:
Expected rate of change in exchange rate = $\mathbf{de^e/e = i^f - i}$

High domestic interest rate ($i > i^f$) should lead to depreciation. If this happens we recall, the Fisher relationship.
Nominal interest rate = real rate + expected inflation rate

$$\mathbf{i = rreal + dp/p}$$

Combining Fisher relationship and parity condition:

$$\mathbf{de^e/e = (rreal^f - rreal) + (dp^f/p^f - dp/p)}$$

1. If the domestic **real** interest rate is equal to foreign real interest rates then, the domestic **nominal** interest rate can be above the foreign rate only if the domestic country is expected to have a higher inflation rate than the foreign country. In this case, it makes sense to believe that higher interest rate at home will lead to a currency depreciation.

$i^f < i$ because $dp^f/p^f < dp/p$ and $de^e/e < 0$ (depreciation)

This is consistent with PPP, higher inflation is associated (sooner or later) with a currency depreciation and the higher interest rate at home reflects only the higher expected inflation of the home country.
This implication is confirmed by the data: countries with high inflation have, on average, higher nominal interest rates than countries with lower inflation and, on average, the currencies of such high inflation countries tend to depreciate at a rate close to the interest rate (or inflation) differential relative to low inflation countries.

2. Domestic **inflation** is equal (or close to) the foreign inflation rate. In this case higher interest rates at home do not reflect higher domestic inflation but rather higher real interest rates due for example to a tight monetary policy by the central bank. In this case, we would expect that high domestic interest rates would be associated with an appreciating currency (as the high interest rates lead to an inflow of capital to the high yielding country). The prediction of the uncovered interest parity condition is not valid.

High real interest rates can lead to an appreciation of the currency, a contradiction of the uncovered interest rate parity condition.
From 1995 to 1997 the $ appreciated against the Yen by 29% (the Yen went from 94 per $ to 121). Throughout this period, interest rates in the US were higher (with a relatively tight monetary policy) than in Japan (with a loose monetary policy). The expectations hypothesis predicted a $ depreciation but it did not occur.
Good rules of thumb are (i) high interest rate currencies (of countries with low inflation) generally increase in value and therefore (ii) expected returns are higher in the high interest rate currency.

The failure to achieve exact covered interest parity could occur because in actual financial markets there are:

1. Transaction costs
2. Political risks
3. Potential tax advantages to foreign exchange gains
4. Liquidity differences between foreign securities and domestic securities.

Conclusion:

In this paper we started by giving the definitions of interest rate parity and interest arbitrage. Continuing we saw covered interest parity through examples and if we should invest dollar in US deposit or convert the $ to DM. Moreover we saw that uncovered interest parity involves risk and that interest differential should approximately equal the expected rate of the spot exchange rate. Finally, the reasons why exact interest parity is difficult to occur were given namely.

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