

Interest Rate Parity and Arbitrage

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Abstract

This case deals with interest rate parity and covered interest arbitrage. Students will learn about the balance between the forward rate and the spot rate between two currencies, as well as the interest rates on both currencies. The case teaches students how to check for the interest rate parity. If the interest rate parity does not hold, students will devise a strategy to do an arbitrage. They will learn the steps in a covered interest arbitrage. This is a hands-on experience for students who want to learn more about international finance and the balance between different rates like spot and forward exchange rates and interest rates.

Keywords: interest rate parity, arbitrage, forward rate, spot rate

JEL classifications: G15, G23, G31

Introduction

David Schultz is a small investor. He is interested in investments in international markets. In the past, in order to diversify his investments, he invested in foreign stocks as well as in foreign government bonds. When in college, he took an international finance class. He still remembers that he learned about formulas that relate interest rates in different countries, forward rates and spot rates between currencies, and inflation rates.

He remembers that there was a formula named “Purchasing Power Parity” that links the spot rate between two currencies to the product prices in those two currencies. That formula was saying that a product that sells for certain number of dollars in the U.S. should be sold for an equivalent amount of foreign currency in that foreign country (ignoring shipping costs and customs tax).

He also remembers a formula named the “Interest Rate Parity” (i.e. IRP). That formula was relating the forward and the spot rates between two currencies and the interest rates on the two currencies. The formula was saying that there should be a balance between all of these rates.

While checking out the rates given by his bank, David has noticed that something was not right. He has looked at the forward and the spot rates between the dollar and the euro. He has also seen the interest rates on the dollar and the euro. He has felt that these rates are not making sense with respect to the IRP formulas. David thinks “Maybe I should ask Mike about this. He is more active in international markets”. Mike is his co-worker at his firm.

If the IRP does not hold, David would like to do an arbitrage. For that, he would borrow from his bank. He calls Mike and explains the situation: “Mike, in my email, I have explained the numbers to you. Do you think there is an opportunity here? Or maybe, as you said in your response, one or more of these numbers are wrong. Maybe when copying the rates, I made a typo or something. Would you like to meet this weekend to look at these rates?”

Michael is interested in the topic so he has accepted the offer. They will meet on Saturday to look at the rates. In order to get more information on the IRP, David has already started looking at some financial websites. There are several websites that explain the IRP. He has learned that, if the IRP does not hold, there is an arbitrage opportunity, and that this type of arbitrage is called the “Covered Interest Arbitrage.”

“I want to spend some more time on researching the topic” he says to himself. “I want to be ready for my meeting with Mike.”

Interest Rate Parity And Covered Interest Arbitrage

Investopedia.com explains interest rate parity as follows:

“Interest rate parity is a theory in which the interest rate differential between two countries is equal to the differential between the forward exchange rate and the spot exchange rate. Interest rate parity plays an essential role in foreign exchange markets, connecting interest rates, spot exchange rates and foreign exchange rates.

If one country offers a higher risk-free rate of return in one currency than that of another, the country that offers the higher risk-free rate of return will be exchanged at a more expensive future price than the current spot price. In other words, the interest rate parity presents an idea that there is no arbitrage in the foreign exchange markets. Investors cannot lock in the current exchange rate in one currency for a lower price and then purchase another currency from a country offering a higher interest rate.”

Another website (www.theglobaleconomy.com) explains the parity as follows:

“The interest rate parity condition predicts that changes in the exchange rate between two countries equal the difference of the interest rates of the two countries.”

Let’s take bank deposits in the U.S. and Mexico as an example. An American investor has 100 dollars to put on a bank deposit, earning 5 percent interest over one year. Alternatively, he can convert the dollars into peso at the 1 dollar = 15 peso exchange rate and invest the 1,500 peso at 10 percent interest in a Mexican bank.

If the money is deposited in the U.S., at the end of the year the investor will have $100 * 1.05 = 105$ dollars.

If the money is invested in Mexico, at the end of the year the investor will receive $1,500 * 1.10 = 1,650$ peso. The peso will be converted at the new exchange rate which we assume is 15.7. At that exchange rate, the investor will receive back $1,650 / 15.7 = 105$ dollars.

Notice that the return on both bank accounts is the same when expressed in dollars. The interest rate on the U.S. bank account is $10 - 5 = 5$ percentage points lower. However, during the year

the Mexican peso depreciated by $0.7 / 15 = 5$ percent. Although the Mexican deposit has a higher interest rate, when expressed in dollars the return is reduced because the peso depreciated.

In the end, the yield on both investments is the same. That is the prediction of the interest rate parity condition. In other words:

$$\text{Mexican interest rate} - \text{U.S. interest rate} = \text{expected depreciation of the Mexican peso}$$

We can create a similar scenario for the dollar and the euro. Let's assume that we have \$1,000 to invest and that we have two investment alternatives. The first one is just depositing our dollars in a bank and earning the interest on those dollars (i.e. $i_{\$}$). In one year, our money would grow into $1,000 \cdot (1+i_{\$})$ dollars.

The second investment alternative would start with converting our dollars into euros first. So, after the conversion, we would have $1,000/S(\$/\epsilon)$ euros today. At the same time, we could take a short position on euros 1-year forward (i.e. we could sign a forward contract to sell euros at the forward rate). Then, we could deposit those euros in a bank and earn interest rate on euros (i.e. i_{ϵ}) for 1 year. Our euros would grow into $(1,000/S(\$/\epsilon)) \cdot (1+i_{\epsilon})$ euros next year. Finally, using our short position on these euros, we could convert those euros back into dollars at the forward rate (i.e. this is the rate that we signed our forward contract on). After reconverting our euros into dollars, we would have $(1,000/S(\$/\epsilon)) \cdot (1+i_{\epsilon}) \cdot F(\$/\epsilon)$ dollars next year.

To summarize, with the first alternative, we would have $1,000 \cdot (1+i_{\$})$ dollars next year. In the second (i.e. long) alternative, we would have $(1,000/S(\$/\epsilon)) \cdot (1+i_{\epsilon}) \cdot F(\$/\epsilon)$ dollars next year. Normally, the two alternatives should yield the same amount of dollars next year.

Therefore,

$$1,000 \cdot (1+i_{\$}) = (1,000/S(\$/\epsilon)) \cdot (1+i_{\epsilon}) \cdot F(\$/\epsilon)$$

$$(1+i_{\$}) = (1/S(\$/\epsilon)) \cdot (1+i_{\epsilon}) \cdot F(\$/\epsilon)$$

After rearranging the terms in the above equation, we can find the IRP (i.e. Interest Rate Parity) equation between the dollar and the euro:

$$F(\$/\epsilon) / S(\$/\epsilon) = (1+i_{\$}) / (1+i_{\epsilon})$$

If this equation (i.e. the IRP) holds, then there is no arbitrage opportunity. In other words, there is no advantage of one of the above alternatives to the other one, so borrowing some money and then following one of these alternatives and then repaying the loan and its interest would not yield us any profit. On the other hand, if the above equation (i.e. the IRP) does not hold, then it is possible for a person or a company to do an arbitrage (i.e. to make a profit by borrowing money and then following one of these alternatives).

How to do an arbitrage?

Below is an example for a covered interest arbitrage:

1. Suppose that the annual interest rate is 5.0 percent in the United States and 3.5 percent in Germany, and that the spot exchange rate is \$1.12/€ and the forward exchange rate, with one-

year maturity, is \$1.16/€. Assume that an arbitrageur can borrow up to \$1,000,000. Does the interest rate parity hold? Is there an arbitrage opportunity?

Checking for the IRP (i.e. Interest Rate Parity) is easy:

$$F(\$/\text{€}) / S(\$/\text{€}) = (1+i_{\$}) / (1+i_{\text{€}})$$
$$(1+0.05) / (1+0.035) = 1.16 / 1.12$$

1.014 is not equal to 1.036
IRP does not hold, so there is an arbitrage opportunity.

2. If there is an arbitrage opportunity, what steps should we take in order to make an arbitrage profit? What will be our maximum profit if we can borrow \$1,000,000?

1. Borrow \$1,000,000 and take a short position in 1-year euro forward contract,
 2. Convert it into euros at the spot rate, you will have 892,857.14 euros (=1 mil/1.12)
 3. Deposit 892,857.14 euros in Germany and get 924,107.14 euros in 1 year (=892,857.14*1.035)
 4. Convert 924,107.14 euros into dollars at the forward rate. You will have \$1,071,964.29.
 5. Pay back \$1,050,000 out of \$1,071,964.29.
- Our profit will be \$21,964.29 (= \$1,071,964.29 - \$1,050,000)

The Decision

David wants to do an arbitrage. He wants to make money without taking any risk and he has decided to borrow from his bank. The spot and 1-year forward rates provided by his bank are as follows. Below, we also have the interest rates for euro and dollar for 1-year deposits.

$$S(\$/\text{€}) = \$1.20/\text{€}$$
$$F_{365}(\$/\text{€}) = \$1.22/\text{€}$$
$$i_{\$} = 2\%$$
$$i_{\text{€}} = 3\%$$

He can borrow up to €1,000,000 or the equivalent in dollars which is \$1,200,000. In order to maximize his profit, he wants to borrow as much as he can. He has requested help from his friend Michael. They are working on it together. They want to answer the following questions:

1. What does “arbitrage” mean? Is it the same as “profit” or is it different?
2. David wants to check whether there is an arbitrage opportunity. How can he check for it? Is there an arbitrage opportunity here?
3. David wants to make money here. He is not sure which currency to borrow. He can borrow \$1,200,000 or the equivalent in euros which is €1,000,000. How can he decide which currency to borrow? Is there a way to decide?
4. If David borrows the wrong currency, what will happen?
5. He has now decided what to do. He thinks he knows which currency to borrow. How can he make money here? What are the steps that he needs to follow?
6. When following these steps, is he undertaking any risk?

7. What will be his profit when he follows these steps?
8. If he borrows the other currency, what steps would he take? In that case, what would be his profit/loss?

References

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