

4.4: Interpretation of the Rate of Return Formula

Learning objective

1. Break down the rate of return on foreign deposits into three distinct components.

Although the derivation of the rate of return formula is fairly straightforward, it does not lend itself easily to interpretation or intuition. By applying some algebraic “tricks,” it is possible to rewrite the British rate of return formula in a form that is much more intuitive.

Step 1: Begin with the British rate of return formula derived in [Chapter 4, Section 4.3](#):

Step 2: Factor out the term in parentheses. Add i_c and then subtract it as well. Mathematically, a term does not change in value if you add and subtract the same value:

Step 3: Change the (-1) in the expression to its equivalent, $.$. Also change $-i_c$ to its equivalent, $.$. Since, these changes do not change the value of the rate of return expression:

Step 4: Rearrange the expression:

Step 5: Simplify by combining terms with common denominators:

Step 6: Factor out the percentage change in the exchange rate term:

This formula shows that the expected rate of return on the British asset depends on two things, the British interest rate and the expected percentage change in the value of the pound. Notice that if i_c is a positive number, then the expected \$/£ ER is greater than the current spot ER, which means that one expects a pound appreciation in the future. Furthermore, i_c represents the expected rate of appreciation of the pound during the following year. Similarly, if i_c were negative, then it corresponds to the expected rate of depreciation of the pound during the subsequent year.

The expected rate of change in the pound value is multiplied by $(1 + i_c)$, which generally corresponds to a principal and interest component in a rate of return calculation.

To make sense of this expression, it is useful to consider a series of simple numerical examples.

Suppose the following values prevail,

	5% per year
	1.1 \$/£
	1.0 \$/£

Plugging these into the rate of return formula yields

which simplifies to

$$R_{\$} = 0.05 + (1 + 0.05) \times 0.10 = .155 \text{ or } 15.5\%$$

Note that because of the exchange rate change, the rate of return on the British asset is considerably higher than the 5 percent interest rate.

To decompose these effects suppose that the British asset yielded no interest whatsoever.

This would occur if the individual held pound currency for the year rather than purchasing a CD. In this case, the rate of return formula reduces to

$$R_{\$} = 0.0 + (1 + 0.0) \times 0.10 = .10 \text{ or } 10\% \quad (4.4.1)$$

This means that 10 percent of the rate of return arises solely because of the pound appreciation. Essentially an investor in this case gains because of currency arbitrage over time. Remember that arbitrage means buying something when its price is low, selling it

when its price is high, and thus making a profit on the series of transactions. In this case, the investor buys pounds at the start of the year, when their price (in terms of dollars) is low, and then resells them at the end of the year when their price is higher.

Next, suppose that there was no exchange rate change during the year, but there was a 5 percent interest rate on the British asset. In this case, the rate of return becomes

$$R_0 R_{\text{f}} = 0.05 + (1 + 0.05) \times 0.0 = .05 \text{ or } 5\% \quad (4.4.2)$$

Thus with no change in the exchange rate, the rate of return reduces to the interest rate on the asset.

Finally, let's look back at the rate of return formula:

The first term simply gives the contribution to the total rate of return that derives solely from the interest rate on the foreign asset. The second set of terms has the percentage change in the exchange rate times one plus the interest rate. It corresponds to the contribution to the rate of return that arises solely due to the exchange rate change. The one plus interest rate term means that the exchange rate return can be separated into two components, a principal component and an interest component.

Suppose the exchange rate change is positive. In this case, the principal that is originally deposited will grow in value by the percentage exchange rate change. But the principal also accrues interest and as the £ value rises, the interest value, in dollar terms, also rises.

Thus the second set of terms represents the percentage increase in the value of one's principal and interest that arises solely from the change in the exchange rate.

Key Takeaways

- The rate of return on a foreign deposit consists of three components: the interest rate itself, the change in the value of the principal due to the exchange rate change, and the change in the value of the interest due to the exchange rate change.
- Another formula, but one that is equivalent to the one in the previous section, for the rate of return on a foreign deposit is .

exercise

- Consider the following data. Suppose the expected exchange rates are the average expectations by investors for exchange rates in one year. Imagine that the interest rates are for equally risky assets and are annual rates.

	United States	Australia	Singapore
Current Exchange Rate	–	1.80 A\$/US\$	1.75 S\$/US\$
Expected Exchange Rate	–	1.90 A\$/US\$	1.65 S\$/US\$
Current Interest Rate (%)	2.0	4.0	1.0

- Calculate the rate of return for a U.S. dollar investor investing in the Australian deposit for one year.
 - Calculate the rate of return for a U.S. dollar investor investing in the Singapore deposit for one year.
 - Among these three options (United States, Australia, and Singapore), which is the best place for the investor to invest? Which is the worst place?
- The covered interest parity condition substitutes the forward exchange rate for the expected exchange rate. The condition is labeled "covered" because the forward contract assures a certain rate of return (i.e., without risk) on foreign deposits. The table below lists a spot exchange rate, a ninety-day forward rate, and a ninety-day money market interest rate in Germany and Canada. Use this information to answer the following questions.

	Germany	Canada
Spot Exchange Rate	0.5841 \$/DM	0.7451 US\$/C\$
90-Day Forward Exchange Rate	0.5807 \$/DM	0.7446 US\$/C\$
90-Day Interest Rate (%)	1.442	0.875

What would the U.S. ninety-day interest rate have to be for the United States to have the highest rate of return for a U.S. investor? (Use the exact formulas to calculate the rates of return.)

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