4.1 The Forward Exchange Rate

People often know in advance that they will have a need to exchange currencies at a future date. Many international activities, particularly KFA flows, are undertaken knowing that the activity will require them to trade currencies at a future date. For example, someone who invests their saving by converting their currency and purchasing a foreign bond naturally expects to receive a stream of payments in the foreign currency. If the person plans to consume or reinvest these proceeds in the domestic country, he or she anticipates exchanging the foreign currency when it is received for domestic currency. But given uncertainty regarding what the spot rate \( e \) will be at those future dates, the value of the future foreign payments in terms of domestic currency is uncertain. The risk in the form of uncertainty regarding what the exchange rate will be is exchange rate risk.

Because many businesses and individuals know that they will want to carry out foreign exchange transactions in the future and, because people naturally prefer less risk to more (****), there is an incentive to reduce or eliminate the exchange rate risk. This can be done by making a promise today to deliver a given amount of one currency at some specified date in the future to somebody else who promises to give, in return, an amount of another currency on that same date. In fact, there are so many people willing to make these kind of promises, that markets for such promises have been established: the forward (foreign exchange) markets and the futures (foreign exchange) markets.

Forward and futures markets are theoretically equivalent as places where agents can trade promises (i.e., enter into contracts) of future currency transactions, but in practice they differ in their flexibility. Forward markets are made up of large contracts (e.g., millions of $’s worth of one currency for another) that are generally tailored to meet the desires of the two parties entering into the contract together. Futures markets are where highly standardized contracts are exchanged. These contracts specify one of a set of possible amounts, mature on one of four days in any particular year (the third Wednesday of March, June, September, and December), and must be traded at the exchange where the contract was issued. This standardization allows them to be readily exchanged, whereas forward contracts rarely change hands. Since the following discussion is concerned with theory and not practice, all the references to the “forward market” hold equally true for the futures market.

For example, it is possible for two parties to enter into a contract where one promises to deliver $10,000 in exchange for £5,000 to be provided by the other party on a specified day one year into the future. In this example the one-year forward exchange rate \( e_f \) in terms of £/$ would be 0.50. Actually, the determination of the forward exchange rate depends on the basic forces of demand and supply in the forward (foreign exchange) market (see Figure 4.1). As the forward rate increases, the amount of a currency that people promise to buy (by selling another) at a particular future date falls. Also, as the forward rate increases the quantity of the currency promised to be sold (for the other) at that same time rises. An equilibrium forward rate results as shown in Figure 4.1.

When \( e_f > e \), the forward (domestic) currency is said to be selling at a premium, where the exact forward premium \( \rho_f \) is

\[
\rho_f = \frac{(e_f - e)}{e}
\]  

(4.1)

Alternative, if \( e_f < e \) the forward currency is considered to be selling at a discount, where the forward discount is just the negative of the premium.
Because the forward market is a market of promises, one might expect people from time to time to renege on the promise and not honor the contract. If this were to occur, then participating in the forward market would be risky. But forward market contracts are backed by large financial institutions that would not jeopardize their reputation in the financial markets by being delinquent on a forward contract obligation, and futures market contracts are backed by margin requirements (deposits) with the exchange where the contracts are traded, all but assuring that the contracts will be honored. Therefore, participating in the forward and futures foreign exchange markets has been and continues to be effectively riskless.

Even though two parties create a particular forward contract, each side of the contract is transferable once it is created. Although this may not happen often with forward contracts, the standardization of the futures contracts greatly facilitates their exchange. The person who owns the other’s promise to deliver the £5,000 in exchange for the $10,000 at the specified future date can sell that side of the contract to another who agrees to fulfill the obligation. The going price of an existing contract usually varies between the time the agreement is reached and the date specified by the contract when the two parties honor the contract by exchanging the currencies. To illustrate, assume that a person agreed on 1/1/2000 to deliver $10,000 for £5,000 on 1/1/2001 (i.e., e=0.5). Also assume that by late December 2000 there is good reason to expect the spot rate (e) will be 0.4 on the maturity date of the contract, where $10,000 will only fetch £4,000. Therefore, the contract enabling the holder to get £5,000 instead of £4,000 has value (of roughly £1,000). If the expected e on the maturity date falls further, the value of the contract increases accordingly. Similarly, if e is expected to be 0.6 on the maturity date, the contract becomes a liability that would be worth paying £1,000 to unload. As a practical matter, when the specified date of exchange by a forward exchange rate contract arrives, the party who suffered a loss due to the agreement simply buys off the other party by paying them the value of their side of the contract on that date.

The fact that the value of forward (and futures) contracts depend on the value of the expected value of the spot exchange rate on the specified date of the exchange qualifies the contracts to be “derivatives.” A derivative is someone’s promise (in contract form that is transferable) to carry out a specified exchange at a future date. The value of the contract depends on – i.e., is “derivative” of – the expected relative market values of the assets or goods to be exchanged at the time the exchange is to occur.

Another kind of foreign exchange derivatives are foreign exchange options. Options are accurately named because they give the owner the option of making the specified exchange instead of being obliged to do so as with a forward contract. “Put” options give the owner a right to sell something for a specified price on (or by) a specified future date, whereas “call” options provide the owner the right to buy. For example, an entity (usually a large financial institution that sells many options) may issue and sell a financial instrument that enables the holder to sell $10,000 for £5,000 on some specified future date. This would be a put option in $’s, or a call option in £’s. Because the owner can only exercise the option on the specified date, this is referred to as a European Option. If, instead, the owner is allowed to exercise the option any time before the date specified on the option, it is an American Option. If e=0.4 on the day specified on the option, then the owner will be sure to exercise the option (i.e., the £5,000 received for the $10,000 using the option is better than the £4,000 that could be obtained in the spot market). In fact, the option would be worth £1,000 to whoever held it. If, alternatively, e was greater than the exchange rate implicit in the option contract, then the option owner would prefer to not exercise the option and the derivative would be worthless.
Other derivatives allow people to lock in interest rates on future loans. For example, a forward rate agreement (a.k.a. forward rate contract, or, forward-forward) specifies a future date when one party lends to the other, as well as the payment schedule for the borrower. This can reduce the risk regarding the interest rate for those who anticipate borrowing or lending in the future.

4.2 Hedging and Speculation

The forward foreign exchange market provides those who anticipate future foreign exchange transactions a means to evade exchange rate risk. One can enter into a forward contract today that locks in a particular exchange rate at a specified future date, instead of exchanging the currency at that future date at a spot exchange rate that is uncertain until that moment. Actually, this forward market, like all derivative markets, gives people the opportunity to hedge as well as the opportunity to speculate.

To differentiate between hedging and speculating, it is necessary to know the financial situation of the agent entering into the particular contract. If the agent is reducing the riskiness of his or her overall wealth profile, then the act constitutes hedging. For example, say an American merchant has signed a contract with a French winery to purchase X bottles of wine for €1000 the following year. (Of course, the great benefit of arranging this future exchange in advance for both the buyer and seller of the wine is reduced uncertainty.) Therefore, the American merchant, who calculates his or her wealth in terms of $, now has a future liability in €. If he or she waits to purchase the €1000 next year, the liability in terms of $ is not exactly known: there is exchange rate risk. The forward market offers the opportunity to sidestep the exchange rate risk by purchasing the €’s forward (i.e., selling the $’s forward) using a forward contract specifying the €/$. Now, since the liability is now known in $’s, the uncertainty regarding the merchant’s overall wealth is reduced: the forward market contract accomplished hedging in this case.

Alternatively, it may be that an American gambler (who has no liabilities in €’s) thinks that € differs from what he expects € to be at that future point in time (which is denoted by the symbol $). For example, if $= 0.80(€/$) while the gambler’s $ = 0.75(€/$), then the gambler might sell $’s forward as the wine merchant did. Given that $=0.8, then the gambler would promise to deliver $1,250 for the €1000. Upon the maturity date of the forward contract the gambler would honor the contract by selling the $ for the €, then, IF the gamblers expectation about $ proved correct, he or she could sell the €1000 in the spot market for $1,333. I.E., the gambler could turn $1,250 into $1,333 in a matter of seconds (with the forward contract). Of course, the gambler’s expectation could prove to be inaccurate, and $ at that time could be greater than 0.8, in which case the gambler would lose money. Because the gambler might win or lose depending on the exchange rate that prevails on the forward contract’s maturity date, the act of entering into the contract has added uncertainty regarding the gambler’s wealth in terms of his home currency. Actions such as this that add risk to an individual’s or institution’s portfolio of assets constitutes speculation.

It is very important to note that the same forward contract that allowed the merchant to hedge allowed the gambler to speculate. There is nothing inherent about forward contracts – or any other derivatives – that make them either a hedging or speculating instrument. It is the situation of the purchaser of the derivative that determines whether it is being used to hedge or speculate.
Speculators are motivated by the belief that they know something about the possible changes in an asset’s price that is not understood by the average investor. If they believe that the value of an asset is going to rise in the near future, then they want to own the asset now, i.e., they want a “net-asset position” or long position in that asset. Alternatively, if the speculator thinks the price of the asset is going to fall soon then they will “sell the asset short”, i.e., they will borrow the asset from someone and sell it. This is known as taking a “net-liability position” or short position in the asset. If, as they expect, the price of the asset does fall they will be able to buy it back for less than they sold it for, thus making a profit. Of course, someone who sells an asset short before a rise in the value of the asset losses money when they have to repurchase the asset in order to return it to its owner.

4.3 Efficient Markets

The above discussion on speculation has highlighted the possibility of making a profit or loss when $e_f$ is different from what $e$ turns out to be on the corresponding future date. If $e_f$ is greater than what many people believe $e$ will be, then many people will sell $s$’s forward like the gambler above in hopes of making a profit. If sufficient numbers sell $s$’s forward, the supply of $s$’s in the $s$-forward market shifts out (see Figure 4.2) pushing $e_f$ down. In fact, as long as the forward rate remains greater than the $e$ expected by the average speculator (i.e., $e_f > e^E$), then the increase in supply of $s$’s forward will continue to push $e_f$ down until it equals $e^E$. Therefore, it is said that the market’s expectation of what the spot rate will be at that future date determines the corresponding forward rate (i.e., $e_f = e^E$). Anybody who forecasts a different $e$ than what the $e_f$ predicts has the opportunity to put their money where their forecast is and, if correct, make money in the foreign exchange markets. Considering $e^E$ by the financial markets to be directly reflected by $e_f$ is consistent with the efficient markets hypothesis that maintains that there are no unexploited profit opportunities.

4.4 Covered Interest Parity

The basic idea of interest parity maintains that the interest rate on similar types of loans should be the same across lending markets. The basic force promoting interest parity is that any discrepancy between interest rates in different markets will send borrowers to the market where the interest rate is lower, while lenders prefer to participate in the market with the higher interest rate. All the additional borrowing activity in the former will push up interest rates in that market, and all the lending in the latter will drive down rates in the other, both promoting interest parity. In fact, many of those borrowing in the low rate market may also be lending in the high rate market. This is because the difference in interest rates provides an opportunity for a form of arbitrage called interest arbitrage, i.e., people borrow funds at the lower interest rate to lend at the higher interest rate and obtain a profit.

Modeling interest rates is accomplished in several different ways. One is to model the bond market where the demanders of bonds (i.e., lenders) and suppliers of bonds (i.e., borrowers) meet and exchange. If the market price of a bond (that promises to pay $100 in one year's time) sells in the bond market for $80, this corresponds to an interest rate of 25% (i.e., the $80 investment brings a $20 return). It is important to note that if the same bond were to sell for a higher price, the implicit interest rate falls (e.g., a price of $91 corresponds to an interest rate of approximately 10%). This bond market perspective on interest rates is employed extensively in Handout #6.
Another commonly used approach to specify interest rates as the price that clears the loanable funds market. Loanable funds are demanded by borrowers, with a higher interest rate causing them to borrow less. Loanable funds are supplied by lenders who choose to lend more when interest rates are greater. (Note that the loanable funds market is essentially the same model that determined an economy’s saving and investment in Handout #2.) Figure 4.3 depicts two loanable funds markets (one in Californian and the other in New York) that are assumed to initially have different interest rates – i.e., interest parity does not hold because \( i_\text{CAL} < i_\text{NY} \). But this discrepancy is not an equilibrium situation since borrowers will prefer to participate in the California market, causing the demand for loanable funds to increase there (as shown in Figure 4.3), while lenders will go to New York causing the supply of loanable funds to increase there (also shown in Figure 4.3). In fact, these reactions to the different interest rates could be almost instantaneous as interest arbitrageurs borrow in California to lend in New York to secure a profit. The effect of this activity, as shown in the Figure, is to drive the interest rates in the two locations together and bring about interest parity.

Interest parity across different countries also exists, but the fact that the different interest rates are in terms of different currencies that may appreciate or depreciate during the life of the loan complicates the relationship. To illustrate, consider two different lending opportunities for an American investor: he or she can lend to the US government or to the UK government, where it is assumed that both governments are equally unlikely to default on (i.e., not make) their payments. But the American can lend to the US government without committing to exchanging currencies at a future date, whereas lending to the foreign government requires buying £’s in the foreign exchange market to make the loan, and more importantly, the earned £’s will need to be exchanged back into $’s in the future. Therefore, in order to consider the two investments as comparable in the eyes of the American, the loan to the UK government would have to be accompanied by the sale of the £’s forward that are returned on the investment, i.e., forward contracts would have to eliminate the exchange rate risk associated with the foreign loan.

With the same default risk and lack of exchange rate risk, the two loans can be considered comparable investments and interest parity can now be expected to hold. The term covered interest parity is used to distinguish this international form of interest parity in which the forward market can be used to eliminate exchange rate risk.

To give an even more specific example, assume that the US and UK governments borrow by selling one year, zero-coupon bonds (where all the interest and principle are paid when the bond matures). Then for every $X invested by the American, he or she will receive $X(1 + i_\text{US})$ in one year’s time when the bond matures (e.g., if \( X = 100 \) and \( i_\text{US} = .06 = 6\% \), then the $100 would grow to $106 via the investment). The other possibility would be to take the $X, convert it to £’s, and purchase the UK bond while simultaneously entering a contract to sell £’s forward (i.e., buy $’s forward). Because the amount of the bond and the interest rate is known, the investor would know how exactly many £’s they need to sell forward. In this case the $X would purchase $X(e_{\text{US}})$ in the spot foreign exchange market (e.g., if \( X=100 \) and \( e_{\text{US}} = 0.5 \), then $100(£0.5/$) = £50). With this many £’s invested, the value at the time of maturity will be the number of £’s times \( (1 + i_\text{UK}) \), or, $X(e_{\text{US}})(1 + i_\text{UK})$. And, again, because the investor knows when purchasing the UK bond the amount of this payoff, they sell those £’s forward at \( e_t \). Therefore, the number of $ they end up with at the end of the year is $X(e_{\text{US}})(1 + i_\text{UK})(1/e_{\text{US}})$. Given the comparability of these opportunities, covered interest parity would predict that the end of year payoffs from both investments will be the same:

\[
X(1 + i_\text{US}) = X(e_{\text{US}})(1 + i_\text{UK})(1/e_{\text{US}}) \quad (4.2)
\]
or, dividing each side by $X$

\[(1 + i_{US}) = e_{US}(1 + i_{UK})(1/e_{US})\]  

(4.3)

which is a specific example of the more general relationship

\[(1 + i_{DOM}) = e (1 + i_{FOR})(1/e)\]  

(4.4)

where, as is the convention in these handouts, $e$ represents the value of the domestic currency. Equation 4.4 is known as the covered interest parity condition (CIPC).

One set of exchange and interest rates that obeys the CIPC is: $i_{US} = 6.25\%$, $i_{UK} = 2.00\%$, $e=0.50$, and $e_f = 0.48$. Given these numbers, one could invest $100$ in the US and have $106.25$ at the end of the year, or:

1) exchange the $100$ for £50 (i.e., $100(e_{US}) = £50$), and
2) purchase a £50 UK bond, knowing that it will return £51 ($(e_{US})(1 + i_{UK}) = £51$), and
3) sell the anticipated £51 forward, which, given $e_f$, is the same as buying $106.25$ forward.

In this example $i_{US}$ exceeds $i_{UK}$ by 4.25\%, yet there is no opportunity for interest arbitrage nor any regret by those borrowing at the 6.25\% rate instead of the 2.0\% rate. This is because the forward premium on the $ ($ ($\rho_f$ as defined in Equation 4.1) is – 4.0\% (which amounts to a forward discount of 4\%), and effectively compensates for the interest rate differential. The reason $\rho_f$ does not equal $i_{UK} - i_{US}$ exactly is because the simple difference between the interest rates only approximates the relevant relationship between the two rates.\(^1\) However, accepting the approximation leaves a simple, if imprecise representation of the CIPC:

\[\rho_f \approx i_{FOR} - i_{DOM}\]  

(4.5)

which effectively highlights a very important point about international investments: Expected appreciations or depreciations of currencies cause the interest rates in different countries to differ accordingly.

If the CIPC did not hold, then once again borrowers would flock to the market with lower interest rates, while lenders would go to the high interest rate market. For example assume that

\[(1 + i_{DOM}) > e (1 + i_{FOR})(1/e)\]  

(4.6)

If this were the case, borrowers would all prefer to borrow in the foreign country (causing $i_{FOR}$ to rise) while lenders would all want to lend in the domestic markets (causing $i_{DOM}$ to fall). But these are not the only changes promoting covered interest parity. Those foreigners lending in the domestic market would need to buy the domestic currency to lend, just as the domestic people borrowing in the foreign currency would need to exchange the borrowed funds into the domestic currency, both of which would increase $e$ and, as can be seen in Equation 4.6, promote covered interest parity. Finally, all those foreigner lending in the domestic market would be expecting returns in the domestic currency and would sell the domestic currency forward, just as the domestic people who borrowed abroad would need to pay back their foreign creditors and would want to buy the foreign currency (sell the domestic currency) forward. These actions would push $e_f$ down and again, as shown in Equation 4.6, promote covered interest parity.

If the CIPC was to not hold at a given moment and transactions costs were sufficiently small, then an international form of interest arbitrage would occur. To demonstrate, assume again that the situation in Equation 4.6 exists and assume, initially, that transactions costs in the financial markets are zero. One feature of a financial market with zero transactions costs is that the interest rate that people borrow at is the same rate earned by lenders (since banks and other

\(^1\) ……
financial intermediaries either are not needed or impose no “intermediation costs” when directing lenders’ funds to viable borrowers). In this case, everybody would:

1) borrow in the foreign country
2) purchase domestic currency in the spot foreign exchange market
3) lend in the domestic country, and, at the same moment;
4) sell the domestic currency (by the foreign currency) forward

Then the agent receives payment on the domestic loan, honors the forward contract by exchanging the domestic currency for foreign, and pays off the debt in the foreign country with profit to spare. The four financial market transactions that generate the profit constitute covered interest arbitrage.

Figures 4.4 and 4.6 depict the domestic and foreign loanable funds market, respectively. Figures 4.5 and 4.7 show the spot and forward foreign exchange markets. The covered interest arbitrage just described for the case when would, as indicated, affect all of these markets:

1) borrowing in the foreign country increases the demand for loanable funds in the foreign country, causing \( i_{\text{FOR}} \) to rise (see Figure 4.6).
2) purchasing the domestic currency in the spot market would increase the demand in the spot market, causing \( e \) to rise (see Figure 4.5)
3) lending in the domestic country would increase the supply of loanable funds there, and cause \( i_{\text{DOM}} \) to fall (see Figure 4.4)
4) selling the domestic currency forward would increase the supply in the forward market and cause \( e_f \) to fall (see Figure 4.7)

Note how the resulting changes to the rates in all four of these markets (i.e., \( i_{\text{FOR}} \uparrow, e \uparrow, i_{\text{DOM}} \downarrow \), and \( e_f \downarrow \)) all promote the return to covered interest parity given that initially \( (1 + i_{\text{DOM}}) > e (1 + i_{\text{FOR}}) \).

The CIPC maintains a strong relationship between four very important financial prices: the spot exchange rate, the forward exchange rate, and the interest rates in the two countries. Essentially any shock that affects any one of these four rates, necessarily affects all of them due to the dependable forces ensuring covered interest parity. For simplicity, many researchers and analysts focus on just one of these four rates at a time and ignore the other three. But, it is important to remember the intimate way these four rates are continuously connected.

The example above demonstrating covered interest arbitrage explicitly assumed that transactions costs were zero. But, of course, there are transactions costs in financial markets and, since covered interest arbitrage requires activity in four different financial markets (i.e., the four shown in Figures 4.4 – 4.7), the transactions costs can be significant. If the revenue from the covered interest arbitrage is sufficient to pay the transactions costs and have profit leftover, then the covered interest arbitrage will occur and the four markets will be affected as shown. If we represent the sum of the transactions costs in all four markets in percentage terms as \( t.c. \), then if

\[
\left| (1 + i_{\text{DOM}}) - e(1 + i_{\text{FOR}})/(1/e_f) \right| > t.c. \tag{4.7}
\]

i.e., if the absolute value of the difference between the domestic return (in $) and the foreign return (in terms of $) is greater than the transactions cost, then there exists a covered interest arbitrage opportunity, with the resulting arbitrage driving all four rates towards values consistent with the CIPC. If alternatively,

\[
\left| (1 + i_{\text{DOM}}) - e(1 + i_{\text{FOR}})/(1/e_f) \right| \leq t.c. \tag{4.8}
\]

then the returns from arbitrage are outweighed by the transactions costs. In this case, the financial markets are said to be in equilibrium since there is no covered interest arbitrage forces affecting the four rates.
4.5 Interest Parity and Risk: Uncovered Interest Parity

The concept of *covered* interest parity directly eliminates exchange rate risk by assuming that forward contracts are used to carry out all anticipated currency exchanges. However, the concept as presented above also implicitly assumes away all other forms of risk. But the general principle behind interest parity – i.e., that returns in different countries’ investments will be driven towards parity – remains legitimate even when risks of all kinds are present. The version of interest parity that accounts for these different types of risks is referred to as *uncovered interest parity*.

One common risk associated with bonds is default risk and, as with all risks, the existence of risk reduces the value of the asset. Financial market theorists have envisioned hypothetical bonds that are completely risk free (i.e., with zero doubt that the borrowers will make their promised payments). The closest that the real world has to risk-free bonds are government bonds from financially strong, central governments. Central governments have the advantage over other borrowers of being able to print up currency in order to fulfill their promised payments, which greatly reduces default risk (although, it does threaten the inflation that would accompany money created to make bond payments).

For example, if the US government issued a bond that promised to pay $1000 in one year that sold for $980, the resulting interest rate on the bond would be 2.04%. As the most reliable possible borrower, this government bond rate of 2.04% would stand as the “risk-free” rate, and serve as the benchmark with which to compare other interest rates. For instance, if a professor also sold a promise to pay $1000 after one year, she would almost certainly receive less than $980 for it given the greater possibility – even if still remote – of her defaulting on the payments. If the professor sold her bond for $950 the corresponding rate of return would be 5.26%. The difference between the rate the professor pays and the risk-free rate (represented by the US government rate) is referred to as the professor’s *risk premium*. For this example in which the professor is paying 5.26% and the risk-free rate is 2.04%, the professor’s risk premium is 3.22% (i.e., 5.26% – 2.04%). Someone else that was even less reliable than the professor might only be able to sell a $1000 promise for $930, which would require them to pay 7.53% on their loan which includes a risk premium of 5.49%. Note that the less dependable the bond issuer (i.e., the borrower), the greater return that has to be promised to induce the bond buyer (i.e., the lender) to lend the money.

There are many factors that contribute to possible defaulting on loans and, accordingly, many sources of default risk. To the extent that a country has a particular government, particular fiscal (including tax) policies, particular monetary policies, a particular regulatory climate, a particular judicial structure, a particular working definition and protection of property rights, a particular social structure, a particular level of violence, etc., all the investments in that country share certain risks. Because we can think of each country having its own brand of overall default risk, we can then compare the relative default risk between any two countries. For example, if the foreign country’s default risk was greater than the domestic country’s, then investors would need to reasonably expect a greater return from those investments in the foreign country to compensate them for bearing the greater risk.

Another type of risk that can vary between different countries’ investments emanates from the range of possible returns on the investments. As a very simple example, consider the case in which a typical investment in Country A has a 50% probability of earning 8% and a 50% probability of earning 6%. Therefore, the (mathematical) expectation of the return in Country A
is 7% (= \(\frac{1}{2} \times 8\% + \frac{1}{2} \times 6\%\)). Alternatively, Country B has a 50% probability of earning 14%, with the remaining possibility being that it earns nothing (i.e., 0%), in which case the expected return is also 7%. Yet the level of risk associated with investments in Country B is greater due to the greater variance of possible outcomes. Again, the greater risk will lower the value of Country B’s assets relative to Country A’s and, therefore, cause the return on B’s assets to be greater: The greater risk requires greater expected returns from Country B’s investments to compensate the investors for shouldering the risk.

Finally, exchange rate risk compromises the forces that promote interest parity for those investments in which the forward market is either impractical or incapable of eliminating it. For example, investments with unpredictable future returns cannot be “covered” from exchange rate risk by forward contracts because the amount to be specified in a potential contract is unknown. Also, the longest forward contracts are five years (less for non-major currencies) so that the income earned past five years in the future by long term assets cannot be sold forward. Yet, the expected appreciation or depreciation of the investment’s currency still carries significant weight in an investor’s decision; although \(e\) may not be relevant, investors still take into account \(e^E\).

As with expected returns, there can be different risks associated with similar expected values. For example, it could be that there is 50% chance that \(e\) will be 11.0 at a future point in time, and a 50% probability that \(e\) will be 9.0. In this (unrealistically simple) case, the (mathematical) expectation of what \(e\) will be at that future time is 10.0 (i.e., \(e^E = \frac{1}{2} \times 11.0 + \frac{1}{2} \times 9.0 = 10.0\)). Or, it is possible that \(e\) is going to be either 15.0 with a probability of 50%, or 5.0 otherwise. Although \(e^E\) is also 10.0 in this second situation, the greater variance of possibilities in the second case constitutes greater exchange rate risk that would deter investments unless investors are compensated for accepting that risk.

The existence of the three types of risk just presented – i.e., relative default risk, rate of return risk, and exchange rate risk – complicates the concept of interest parity, but the general promotion of interest parity by investors choosing the most attractive investments across different countries remains. The difference is simply that the investors account for the risks in their decisions. Interest parity in the presence of these risks is captured by the uncovered interest parity condition (UIPC):

\[
(1 + i_{\text{DOM}}) = e (1 + i_{\text{FOR}})(1/e^E) - rrp
\]

which is the CIPC with two alterations. First, the replacement of \(e\) by \(e^E\) reflects the absence of forward contracts and their elimination of exchange rate risk. Secondly, there is a relative risk premium \((rrp)\) that captures all the risk premia associated with the three types of risks discussed above. A greater likelihood of the foreign asset’s default or failure relative to that of the domestic asset’s would cause the variable \(rrp\) – as defined in this class – to be greater. Increased variance of the foreign asset’s expected return would also make \(rrp\) greater, as would greater variance of \(e^E\). For example, an \(rrp\) of + 4% indicates that the risks associated with the foreign investment require domestic investors to be compensated by a promised 4% relative risk premium to compensate them for accepting the risks. Note that it is certainly possible for the \(rrp\) to be negative in cases where the domestic country is riskier with respect to default risk.

Given \(e^E\), we can specify the variable \(xa\) to be the expected appreciation of the domestic currency:

\[
xa = (e^E - e)/e
\]

which is computed similarly to the forward premium (\(\rho_f\)) except that \(e^E\) replaces \(e\). The shorthand approximation of the UIPC that is comparable to the approximation of the CIPC found in Equation (4.5) is:
\[ i_{\text{FOR}} - i_{\text{DOM}} \approx xa + rrp \] (4.11)

This approximation highlights the fundamental interest parity relationship that expected appreciations or depreciations of the currency and differences in the riskiness of the different countries’ investments each affect the difference between two countries’ interest rates. Although these equations capturing uncovered interest parity specify interest rates, they are equally meaningful when the yields on equities or any other kind of asset returns are used instead of interest rates.

Since the word “uncovered” is used to indicate exposure to exchange rate risk while “arbitrage” is defined as a riskless activity, the expression “uncovered interest arbitrage” is self-contradictory. But the actions suggested by the term – i.e., borrowing in one country, exchanging the borrowed funds for a second currency, lending in that currency, and then later collecting on those loans and returning to the foreign exchange market to purchase currency to pay back the original loan – occurs and is referred to as the carry trade. Of course, the flow of funds to markets where they earn higher returns (which tends to push the returns down in that market) and away from markets with lower returns (pushing returns up there) both promote uncovered interest parity.

**Key Terms:**

- carry trade
- covered interest arbitrage
- covered interest parity
- covered interest parity condition (CIPC)
- derivative
- efficient markets hypothesis
- exchange rate risk.
- forward (exchange) rate
- forward (foreign exchange) market
- forward premium
- forward rate agreement
- futures (foreign exchange) market
- hedging
- interest arbitrage
- interest parity
- loanable funds market
- long (or short) position
- options
- relative risk premium \((rrp)\)
- risk premium
- speculation
- uncovered interest parity
- uncovered interest parity condition \((\text{UIPC})\)