CHAPTER 13

Management of Transaction Exposure

CHAPTER OUTLINE

AS DISCUSSED in Chapter 12, **transaction exposure** arises when a firm faces contractual cash flows that are fixed in a foreign currency. For example, suppose that CHC Helicopters of St John's, Newfoundland, a world leader in supply logistics to offshore oil rigs, has billed British Petroleum (BP) for services provided to BP's sites on the North Sea. CHC's invoice is for £1 million, due in three months.[1] When CHC Helicopters receives £1 million three months from now, it will convert these British pounds into Canadian dollars at the spot rate of exchange prevailing at that time. The future spot rate cannot be known in advance. Consequently, in dollar terms, the value of the settlement is uncertain. If the British pound appreciates (depreciates) against the Canadian dollar, the dollar receipt will be higher (lower). The uncertain end-result suggests that if CHC Helicopter does nothing to address this uncertainty, it is effectively speculating on the future course of the exchange rate. It is as if CHC is willing to take a bet that the British pound will appreciate against the Canadian dollar.

Consider another example. Say, Mitsubishi of Japan enters into a loan contract with the Swiss bank UBS that calls for payment of SF100 million for principal and interest in one year. To the extent that the yen/Swiss franc exchange rate is uncertain, Mitsubishi does not know how much yen will be required to buy SF100 million spot in one year's time. If the yen appreciates (depreciates) against the Swiss franc, a smaller (larger) yen amount will be needed to retire the SF-denominated loan.

These examples suggest that whenever a firm has foreign-currency-denominated receivables or payables, it is subject to transaction exposure, and the eventual settlements have the potential to affect the firm's cash flow position. Since modern firms are often involved in commercial and financial contracts denominated in foreign currencies, management of transaction exposure has become an important function of international financial management.

Unlike economic exposure, transaction exposure is well defined. Transaction exposure is simply the amount of foreign currency that is receivable or payable.

[1]There may be some question as to why CHC Helicopters would invoice BP in pounds, rather than in Canadian dollars. It is quite likely that the original contract was tendered by BP in a global competition that specified that settlement would be in British pounds.

This chapter focuses on alternative ways of hedging transaction exposure using various financial contracts and o*perational techniques*:

Financial contracts:

- Forward market hedge
- Money market hedge
- Option market hedge
- Swap market hedge

Operational techniques:

- Choice of the invoice currency
- Lead/lag strategy
- Exposure netting

As we proceed to describe and illustrate various ways to address transaction exposure, it is useful to establish another specific business situation that gives rise to exposure. Let us say that Bombardier of Montreal exports commuter aircraft to Austrian Airlines. A payment of €10 million will be received by Bombardier in one year. Money market and foreign exchange rates relevant to the financial contracts that we will examine are:

Canadian interest rate	6.10 % per annum
European interest rate	9.00 % per annum
Spot exchange rate	$1.50/€
Forward exchange rate	$1.46/€

Let us now look at the various techniques for managing Bombardier's transactions exposure involving €10 million to be received one year from now.

13.1 Forward Market

www.gsm.uci.edul~jorion/pachet/case.html

A case study by Prof. Philippe Jorion presents the situation of a company with transaction exposure to the Deutsche mark/dollar exchange rate.

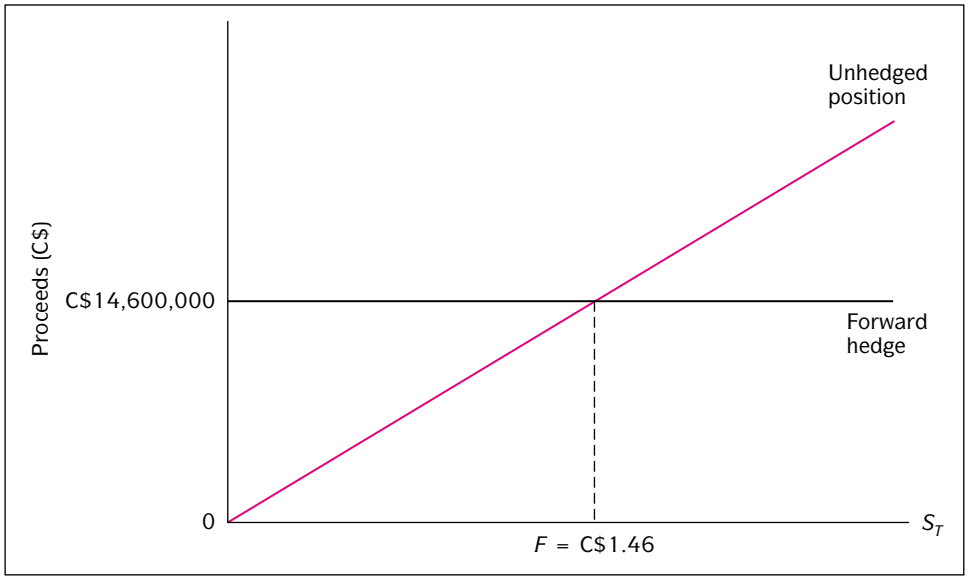
Perhaps the most direct and popular way of hedging transaction exposure is by currency forward contracts or **forward market hedge**. Generally speaking, the firm may sell (buy) its foreign currency receivables (payables) forward to eliminate its exchange risk exposure. In the above example, in order to hedge foreign exchange exposure, Bombardier may simply sell forward its euros receivable, €10 million for delivery in one year, in exchange for a given amount of Canadian dollars. On the maturity date of the contract, Bombardier will have to deliver €10 million to the bank, which is the counterparty of the contract, and, in return, take delivery of C$14.6 million (C$1.46 × 10 million), regardless of the spot exchange rate that may prevail on the maturity date. Bombardier will, of course, use the €10 million that it is going to receive from Austrian Airways to fulfill the forward contract. Since Bombardier's euro receivable is exactly offset by the euro payable (created by the forward contract), the company's net euro exposure becomes zero.

Since Bombardier is assured of receiving a given dollar amount, $14.6 million, from the counterparty of the forward contract, the dollar proceeds from this European sale will not be affected at all by future changes in the exchange rate. This point is illustrated in Exhibit 13.1. Once Bombardier enters into the forward contract, exchange rate uncertainty becomes irrelevant for Bombardier. Exhibit 13.1 also illustrates how the dollar proceeds from the European sale will be affected by the future spot exchange rate when exchange exposure is not hedged. The exhibit shows that the dollar proceeds under the forward hedge will be higher than those under the unhedged position if the future spot exchange rate turns out to be less than the forward rate, that is, $F = \$1.46/€$, and the opposite will hold if the future spot rate becomes higher than the forward rate. In the latter case, Bombardier forgoes an opportunity to benefit from a strong euro.

Suppose that on the maturity date of the forward contract, the spot rate turns out to be $1.40/€, which is less than the forward rate, $1.46/€. In this case, Bombardier would have received C$14.0 million, rather than C$14.6 million, had it not entered into the

EXHIBIT 13.1

Dollar Proceeds from the European Sale: Forward Hedge versus Unhedged Position



forward contract. Thus, one can say that Bombardier gained C$0.6 million from forward hedging. Needless to say, Bombardier will not always gain in this manner. If the spot rate is, say, C$1.50/€ on the maturity date, then Bombardier could have received C$15.0 million by remaining unhedged. Thus, one can say *ex post* that forward hedging cost Bombardier $0.40 million.

The gains and losses from forward hedging can be illustrated as in Exhibits 13.2 and 13.3. The gain/loss is computed as follows:

$$\text{Gain} = (\text{F} - S_T) \times €10 \text{ million} \qquad \textbf{(13.1)}$$

Obviously, the gain will be positive as long as the forward exchange rate is greater than the spot rate on the maturity date, that is, $F > S_T$, and the gain will be negative (that is, a loss will result) if the opposite holds. As Exhibit 13.3 shows, the firm theoretically can gain as much as C$14.6 million when the euro becomes worthless, which, of course, is unlikely, whereas there is no limit to possible losses.

It is important, however, to note that the above analysis is *ex post* in nature and that no one can know for sure what the future spot rate will be beforehand. The firm must decide whether to hedge or not to hedge *ex ante.* To help the firm decide, it is useful to consider the following three alternative scenarios:

1. $\overline{S}_T \approx F$
2. $\overline{S}_T < F$
3. $\overline{S}_T > F$

where $\overline{S}_T$ denotes the firm's expected spot exchange rate for the maturity date.

Under the first scenario, where the firm's expected future spot exchange rate, $\overline{S}_T$, is about the same as the forward rate, F, the "expected" gains or losses are approximately zero. But forward hedging eliminates exchange exposure. In other words, the firm can eliminate foreign exchange exposure without sacrificing any expected Canadian dollar proceeds from the foreign sale. Under this scenario, the firm would be inclined to hedge as long as it is averse to risk. Note that this scenario becomes valid when the forward exchange rate is an unbiased predictor of the future spot rate.[2]

[2]As mentioned in Chapter 5, the forward exchange rate will be an unbiased predictor of the future spot rate if the exchange market is informationally efficient and the risk premium is not significant. Empirical evidence indicates that the risk premium, if it exists, is generally not very significant. Unless the firm has private information that is not reflected inthe forward rate, it would have no reason for disagreeing with the forward rate.

EXHIBIT 13.2

Gains/Losses from Forward Hedge

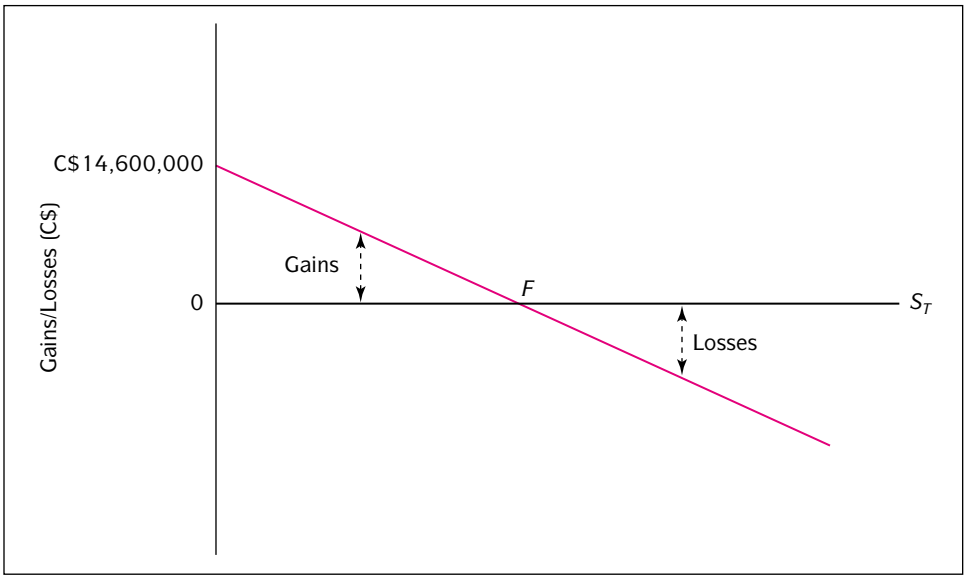
Spot Exchange Rate on the Maturity Date (S_T)	Receipts from the British Sale		
	Unhedged Position	Forward Hedge	Gains/Losses from Hedge[b]
C$1.30	C$13,000,000	C$14,600,000	C$1,600,000
C$1.40	C$14,000,000	C$14,600,000	C$ 600,000
C$1.46[a]	C$14,600,000	C$14,600,000	0
C$1.50	C$15,000,000	C$14,600,000	−C$ 400,000
C$1.60	C$16,000,000	C$14,600,000	−C$1,400,000

[a]The forward exchange rate (F) is C$1.46/€

[b]The gains/losses are computed as the proceeds under the forward hedge minus the proceeds from the unhedged position at the various spot exchange rates on the maturity date.

EXHIBIT 13.3

Illustration of Gains and Losses from Forward Hedging



Under the second scenario, where the firm's expected future spot exchange rate is less than the forward rate, the firm expects a positive gain from forward hedging. Since the firm expects to increase the Canadian dollar proceeds while eliminating exchange exposure, it would be even more inclined to hedge under this scenario than under the first scenario. The second scenario, however, implies that the firm's management dissents from the market's consensus forecast of the future spot exchange rate as reflected in the forward rate.

Under the third scenario, on the other hand, where the firm's expected future spot exchange rate is more than the forward rate, the firm can eliminate exchange exposure via the forward contract only at the cost of reduced expected Canadian dollar proceeds from the foreign sale. Thus, Bombardier would be less inclined to hedge under this scenario, other things being equal. Despite lower expected Canadian dollar proceeds, however, the firm may still end up hedging. Whether Bombardier actually hedges or not depends on the degree of risk aversion; the more risk averse the firm is, the more likely it is to hedge. From the perspective of a hedging firm, the reduction in the expected Canadian dollar proceeds can be viewed implicitly as an "insurance premium" paid for avoiding the hazard of exchange risk.

Bombardier can use a currency futures contract, rather than a forward contract, to hedge. However, a futures contract is not as suitable as a forward contract for the purpose of hedging for two reasons. First, unlike forward contracts that are tailor made to the firm's specific needs, futures contracts are standardized instruments in terms of contract size, delivery date, and so forth. In most cases, therefore, the firm can only

hedge approximately. Second, due to the marking-to-market property, there are interim cash flows prior to the maturity date of the futures contract that may have to be invested at uncertain interest rates. As a result, exact hedging again would be difficult.

13.2 Money Market Hedge

Transaction exposure can also be hedged by lending and borrowing in the domestic and foreign money markets—that is, **money market hedge**. Generally speaking, the firm may borrow (lend) in foreign currency to hedge its foreign currency receivables (payables), thereby matching its assets and liabilities in the same currency. Again using the same example presented above, Bombardier can eliminate the exchange exposure arising from the European sale by first borrowing in euros, then converting the loan proceeds into Canadian dollars, which then can be invested at the dollar interest rate. On the maturity date of the loan, Bombardier will use the euro receivable to pay off the euro loan. If Bombardier borrows a particular euro amount so that the maturity value of this loan becomes exactly equal to the euro receivable from the European sale, Bombardier's net euro exposure is reduced to zero, and Bombardier will receive the future maturity value of the dollar investment.

The first important step in money market hedging is to determine the amount of euros to borrow. Since the maturity value of borrowing should be the same as the euro receivable, the amount to borrow can be computed as the discounted present value of the euro receivable, that is, €10 million/(1.09) = €9,174,312. When Bombardier borrows €9,174,312, it then has to repay €10 million in one year, which is equivalent to its euro receivable. The step-by-step procedure of money market hedging can be illustrated as follows:

Step 1: Borrow €9,174,312 in Europe

Step 2: Convert €9,174,312 into $13,761,468 at the current spot exchange rate of C$1.50/€

Step 3: Invest C$13,761,468 in Canadian Treasury bills.

Step 4: Collect €10 million from Austrian Airways and use it to repay the euro loan.

Step 5: Receive the maturity value of the dollar investment, that is, C$14,600,918 = C$13,761,468(1.061), which is the guaranteed Canadian dollar proceeds from the European sale.

Exhibit 13.4 provides a cash flow analysis of money market hedging. The table shows that the net cash flow is zero at the present time, implying that, apart from possible transaction costs, the money market hedge is fully self-financing. The table also clearly shows how the 10 million euro receivable is exactly offset by the 10 million euro payable (created by borrowing), leaving a net cash flow of C$14,600,918 on the maturity date.[3]

EXHIBIT 13.4

Cash Flow Analysis of a Money Market Hedge

Transaction	Current Cash Flow	Cash Flow at Maturity
1. Borrow euros	£ 9,174,312	−£10,000,000
2. Buy dollar spot	C$13,761,468	
with euros	−£ 9,174,312	
3. Invest in Canadian TBs	−C$13,761,468	C$14,600,918
4. Collect euro receivable		£10,000,000
Net cash flow	0	C$14,600,918

[3]In the case where the firm has an account payable denominated in euro, the money market hedge calls for borrowing in Canadian dollars, buying euro spot, and investing at the euro interest rate.

Managing Currency Exposure: The Perspective of a Bank

Our extensive example of Bombardier's purchase of a forward contract illustrates the arrangement from Bombardier's perspective. Bombardier starts the process by contacting a bank. Once the forward contract is established, the bank has taken on the risk that Bombardier had faced.

Banks, however, are not in the business of taking large speculative positions on foreign currencies. The foreign exchange desk of a bank is there to serve its clients. When a bank makes a forward foreign exchange commitment to a customer, the bank typically tries to quickly neutralize the exposure that it has taken on. This note illustrates how this is done. The setting is a Canadian firm that purchases American dollars six months forward from a Canadian bank.

All forward foreign currency transactions are done by banks. More than 95 percent of all foreign currency transactions are done *within* banks. Thus, banks are foreign exchange *brokers* to the industrial and commercial world. The foreign exchange desks of banks are not in the business of speculating, that is, taking exposed positions on foreign currencies.

A typical transaction that a bank might encounter in dealing with a customer looks like this: Someone phones the bank to enquire about *buying* one million American dollars six months from now. Perhaps it is a Canadian company retiring an American dollar– denominated corporate bond.

The bank's customer wants US$1,000,000 six months forward.

Today, June 1, the six-month *forward* rate is 0.7500. Of course, this is in American dollars per Canadian dollar.

The bank officer at the foreign exchange desk says, "O.K., one million December American dollars at 0.7500. That will be 1,333,333 Canadian dollars. Done!"

The customer's problem is solved.

Now, the bank has a problem. The bank is *short* of American dollars. The bank must provide US$1,000,000 six months from now. The bank is exposed.

How does the bank manage *its* risk?

Immediately, the bank will reverse its American dollar forward position by an offsetting transaction in the spot market. The bank will immediately *buy* US$1,000,000 spot.

Why wouldn't the bank make an offsetting transaction in the *forward* market—that is, why wouldn't it commit to *buy* US$1,000,000 in December? That is a rhetorical question. The bank would if it could. Imagine if the officer at the foreign exchange desk had simultaneous calls from two customers, one looking to *buy* US$1,000,000 in December and one wanting to *sell* the same amount at the same time. Of course, these two offsetting transactions would cancel each other out from the bank's perspective, and the bank would simply—and profitably—capture the bid-ask spread. Pure brokerage.

However, things are seldom that simple. The bank must *manage* its brokerage operations. That is the bank's skill.

The *spot* market is much more liquid and generally presents substantially smaller spreads than the *forward* market. So, the bank can more easily and more readily sell American dollars in the *spot* market.

Now, let us say that the *forward* exchange rate (expressed in American dollars per Canadian dollar) is greater than the *spot* exchange rate.

spot:	0.7450	Now, June
forward:	0.7500	December

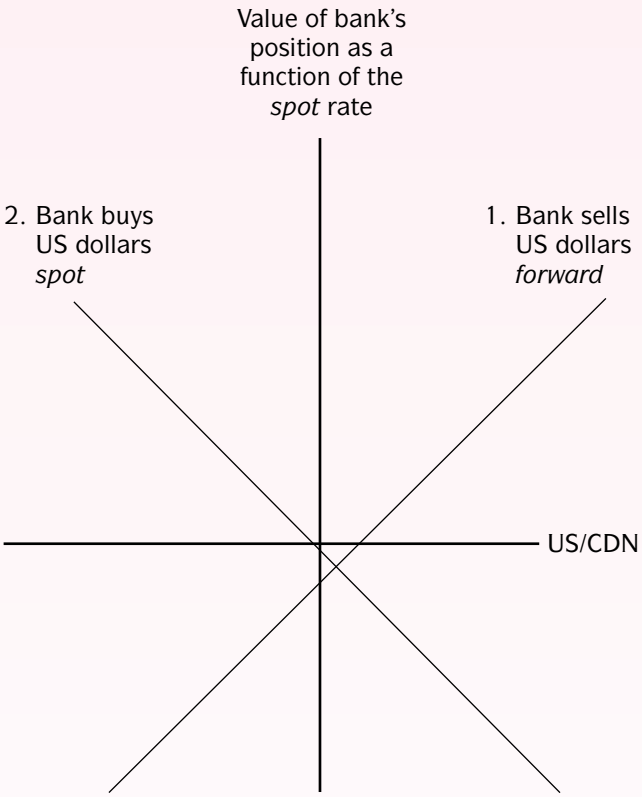
In the back of your mind—but not too far back—you should be asking yourself what this forward premium implies for (1) the expected future spot rate, and (2) the United States–Canada interest differential. The latter will soon become important.

The bank pays C$1,342,282 for US$1,000,000. This is a *spot* transaction.

After the offsetting transaction in the *spot* market (establishing a *long* position in the American dollar to offset the *short* forward position), the remaining net exposure is to the United States–Canada interest differential. That is foreign interest rate exposure. The bank can swap that risk away with a United States–Canada interest rate swap. The transactional cost of the United States–Canada interest rate swap is the cost of insurance for the remaining bit of risk. The swap assures the bank of receiving a flow of Canadian dollar interest despite the fact that it holds American dollars on account.

The maturity value of the dollar investment from the money market hedge turns out to be nearly identical to the dollar proceeds from forward hedging. This result is no coincidence. Rather, this is due to the fact that the interest rate parity (IRP) condition is approximately holding in our example. If the IRP is not holding, the dollar proceeds

The bank's three transactions can be illustrated with a simple diagram:



After Steps 1 and 2, that is, after the bank offsets its *forward* short position with a *spot* long, the remaining net exposure is to the United States–Canada interest differential for six months. The bank will swap that risk away with a United States–Canada interest rate swap.

In the diagram, the intersection of the two axes is the *spot* rate. A little to the right is the *forward* rate. The bank's exposure due to the first transaction is represented by an upward sloping 45-degree line passing through the *forward* rate. Why is the line sloping upward? Well, if the exchange rate (expressed as US$/C$) increases, it would take fewer Canadian dollars to buy the requisite US$1,000,000. Unhedged, the bank's value (on the vertical axis) would increase if US$/C$ increases, that is, if the Canadian dollar appreciates. The second (offsetting) transaction requires a downward sloping 45-degree line passing through the *spot* rate. The third transaction, the *swap*, eliminates the exposure associated with the gap between the *spot* and *forward* rates.

Finally, there is another way that the bank could handle its exposure to the exchange rate risk that it incurs in its function as a forward exchange broker.

The key point is that the bank must deliver US$1,000,000 in December, for which it will receive C$1,333,333. The C$1,333,333 is secure. The issue for the bank is how to structure the future delivery of US$1,000,000 while avoiding exchange rate risk.

Buying American dollars *spot* gets rid of most of the foreign exchange risk. However, buying the full US$1,000,000 may be overkill. The American-interest flow on the securities that the bank purchases with those funds leaves residual exchange rate risk associated with the American-interest that accrues between now and December.

Instead of buying US$1,000,000, the bank could purchase December American discount bonds in the amount of US$1,000,000/$(1 + r_{US}/2)$ where r_{US} is the yield on the discount bonds. In other words, the bank purchases riskless securities today that retire in December with a liquidation value of US$1,000,000.

Say r_{US} equals 5 percent. Then, US$1,000,000 / $(1 + r_{US}/2)$ equals US$975,610.

The purchase today of December American discount bonds in the amount of US$975,610 will result in US$1,000,000 in December.

In this way, the bank establishes its own "money market" hedge on its American-forward obligation.

What would determine whether the bank ought to "over-borrow" the full US$1,000,000 and swap the American-interest into Canadian dollars as opposed to buying US$975,610 of December American discount bonds? This type of decision generally turns on such considerations such as whether the bank has a substantial swap book that would make it easy (and cheap) to swap American interest into Canadian or whether the bank is heavily involved in the American discount securities market, in which case it may have an operational advantage in that market.

All in all, the difference between the two approaches is likely to be small. The advantage of purchasing American discount bonds is that it is neater and it reduces the bank's capital commitment.

Keep in mind that the bank is essentially operating as a broker in the forward market, and hence it ought to take advantage of any internal administrative efficiencies that it may have in managing its own risk.

from money market hedging will not be the same as those from forward hedging. As a result, one hedging method will dominate another. In a competitive and efficient world financial market, however, any deviations from IRP are not likely to persist.

13.3 Options Market Hedge

One possible shortcoming of both forward and money market hedges is that these methods completely eliminate exchange exposure. Consequently, the firm has to forgo the opportunity to benefit from favourable exchange rate changes. To elaborate on this point, let us assume that the spot exchange rate turns out to be C$1.60 per euro on the maturity date of the forward contract. In this instance, forward hedging would cost Bombardier C$1.4 million in terms of forgone dollar receipts (see Exhibit 13.2). If Bombardier had, indeed, entered into a forward contract, it would regret its decision to do so. With its euro receivable, Bombardier ideally would like to protect itself only if the euro weakens, while retaining the opportunity to benefit if the euro strengthens. Currency options provide such a *flexible* "optional" hedge against exchange exposure. Generally speaking, the firm may buy a foreign currency call (put) option to hedge its foreign currency payables (receivables), which is known as **options market hedge**.

To show how the options hedge works, suppose that in the over-the-counter market Bombardier purchased a put option on 10 million euros with an exercise price of C$1.46 and a one-year expiration. Assume that the option premium (price) was C$0.02 per euro. Bombardier thus paid C$200,000 (= C$0.02 × 10 million) for the option. This transaction provides Bombardier with the right, but not the obligation, to sell up to €10 million for C$l.46/€, regardless of the future spot rate.

Now, assume that the spot exchange rate turns out to be C$1.30 on the expiration date. Since Bombardier has the right to sell each euro for C$1.46, it will certainly exercise its put option on the euro and convert €10 million into C$14.6 million. The main advantage of options hedging is that the firm can decide whether to exercise the option based on the realized spot exchange rate on the expiration date. Recall that Bombardier paid C$200,000 upfront for the option. Considering the time value of money, this upfront cost is equivalent to C$212,200 (= C$200,000 × 1.061) as of the expiration date. This means that under the options hedge, the net dollar proceeds from the European sale become C$14,387,800:

$$\text{C\$14,387,800} = \text{C\$14,600,000} - \text{C\$212,200}$$

Since Bombardier is going to exercise its put option on the euro whenever the future spot exchange rate falls below the exercise rate of C$1.46, it is assured of a "minimum" dollar receipt of C$14,387,800 from the European sale.

Next, consider an alternative scenario where the euro appreciates against the Canadian dollar. Assume that the spot rate turns out to be C$1.60 per euro on the expiration date. In this event, Bombardier would have no incentive to exercise the option. It will, rather, let the option expire and convert €10 million into C$16 million at the spot rate. Subtracting C$212,200 for the option cost, the net dollar proceeds will become C$15,787,800 under the option hedge. As suggested by these scenarios, the options hedge allows the firm to *limit the downside risk while preserving the upside potential.* The firm, however, has to pay for this flexibility in terms of the option premium. There rarely exist free lunches in finance! Note that neither the forward nor the money market hedge involves any upfront cost.

Exhibit 13.5 provides the net Canadian dollar proceeds from the European sale under options hedging for a range of future spot exchange rates. The same results are illustrated in Exhibit 13.6. As Exhibit 13.6 shows, the options hedge sets a "floor" for the Canadian dollar proceeds. The future Canadian dollar proceeds will be at least C$14,387,800 under the option hedge. Bombardier, thus, can be said to have an insurance policy against the exchange risk hazard; the upfront option cost, C$200,000, Bombardier incurred can be regarded as an insurance premium. When a firm has an account payable, rather than a receivable, in terms of a foreign currency, the firm can set a "ceiling" for the future dollar cost of buying the foreign currency amount by buying a call option on the foreign currency amount.

EXHIBIT 13.5

Dollar Proceeds from Options Hedge

Future Spot Exchange Rate (S_T)	Exercise Decision	Gross Dollar Proceeds	Option Cost	Net Dollar Proceeds
C$1.30	Exercise	C$14,600,000	C$212,200	C$14,387,800
C$1.40	Exercise	C$14,600,000	C$212,200	C$14,387,800
C$1.46	Neutral	C$14,600,000	C$212,200	C$14,387,800
C$1.50	Not exercise	C$15,000,000	C$212,200	C$14,787,800
C$1.60	Not exercise	C$16,000,000	C$212,200	C$15,787,800

Note: The exercise exchange rate (E) is C$1.46 in this example.

EXHIBIT 13.6

Dollar Proceeds from the European Sale: Option versus Forward Hedge

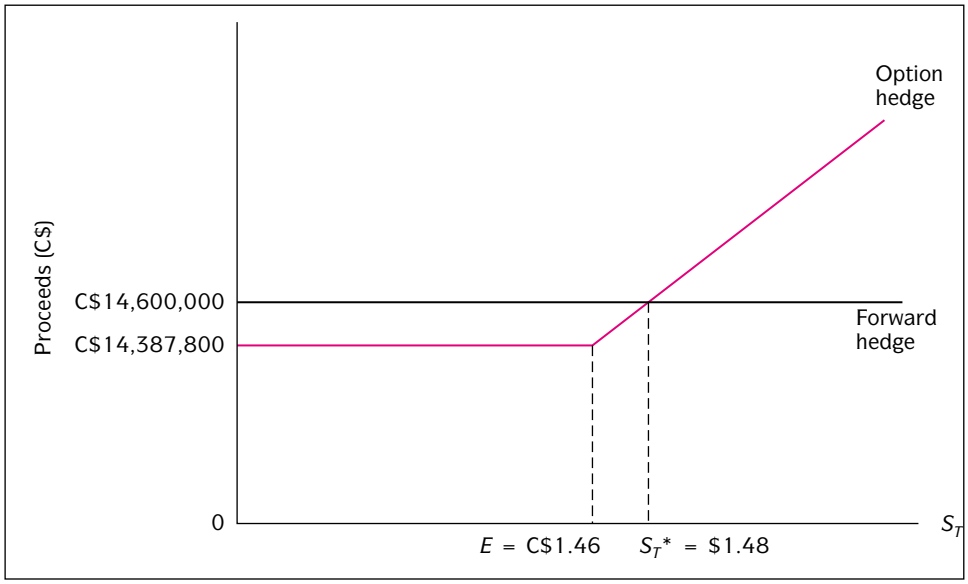


Exhibit 13.6 also compares the dollar proceeds from forward and options hedges. As indicated in the exhibit, the options hedge dominates the forward hedge for future spot rates greater than C$1.48 per euro, whereas the opposite holds for spot rates lower than C$1.48 per euro. Bombardier will be indifferent between the two hedging methods at the "break-even" spot rate of C$1.48 per euro.

The break-even spot rate, which is useful for choosing a hedging method, can be determined as follows:

$$\text{C\$}(10{,}000{,}000)S_T - \text{C\$}212{,}200 = \text{C\$}14{,}600{,}000$$

By solving the equation for S_T, we obtain the break-even spot rate, $S_T^* = \text{C\$}1.48$. The break-even analysis suggests that if the firm's expected future spot rate is greater (less) than the break-even rate, then the options (forward) hedge might be preferred.

Unlike the forward contract, which has only one forward rate for a given maturity, there are multiple exercise exchange rates (prices) for the options contract. In the preceding discussion, we worked with an option with an exercise price of C$1.46. Considering that Bombardier has a euro receivable, it is tempting to think that it would be a good idea for Bombardier to buy a put option with a higher exercise price, thereby increasing the minimum dollar receipt from the European sale. But it becomes immediately clear that the firm has to pay for it in terms of a higher option premium. Again, there is no free lunch. Choice of the exercise price for the options contract ultimately depends on the extent to which the firm is willing to bear exchange risk. For instance, if the firm's objective is only to avoid very unfavourable exchange rate changes (that is, a major depreciation of the euro in Bombardier's example), then it should consider buying an out-of-money put option with a low exercise price, saving option costs. The three alternative hedging strategies are summarized in Exhibit 13.7.

EXHIBIT 13.7 **Bombardier's Alternative Hedging Strategies: A Summary**

Strategy	Transactions	Outcomes
Forward market hedge	1. Sell €10,000,000 forward for dollars now. 2. In one year, receive €10,000,000 rate from the European client and deliver it to the counterparty of the forward contract.	Assured of receiving C$14,600,000 in one year; future spot exchange becomes irrelevant.
Money market hedge	1. Borrow €9,174,312 and buy C$13,761,468 spot now. 2. In one year, collect €10,000,000 from the European client and pay off the euro loan using the amount.	Assured of receiving C$13,761,468 now or C$14,600,918 in one year; future spot exchange rate becomes irrelevant.
Options market hedge	1. Buy a put option on €10,000,000 for an upfront cost of C$200,000. 2. In one year, decide whether to exercise the option upon observing the prevailing spot exchange rate.	Assured of receiving at least C$14,387,800 or more if the future spot exchange rate exceeds the exercise exchange rate; Bombardier controls the downside risk while retaining the upside potential.

13.4 Cross-Hedging Minor Currency Exposure

If a firm has receivables or payables in major currencies, such as the euro, British pound, or Japanese yen, it can easily use forward, money market, or options contracts to manage its exchange risk exposure. In contrast, if the firm has positions in minor currencies, such as the Korean won, Thai bhat, or Czech koruna, it may be either very costly or impossible to use financial contracts in these currencies. This is because the financial markets of the developing countries are relatively underdeveloped and often highly regulated. Facing this situation, the firm may consider using **cross-hedging** techniques to manage its minor currency exposure. Cross-hedging involves hedging a position in one asset by taking a position in another asset.

Suppose a Canadian firm has an account receivable in Korean won and would like to hedge its won position. If there were a well-functioning forward market in won, the firm would simply sell the won receivable forward. But the firm finds it impossible to do so. However, since the won/Canadian dollar exchange rate is highly correlated with the yen/dollar exchange rate, the Canadian firm may sell a yen amount, which is equivalent to the won receivable, forward against the Canadian dollar thereby cross-hedging its won exposure. Obviously, the effectiveness of this cross-hedging technique would depend on the stability and strength of the won/yen correlation. A study by Aggarwal and Demaskey (1997) indicates that Japanese yen derivative contracts are fairly effective in cross-hedging exposure to minor Asian currencies, such as the Indonesian rupiah, Korean won, Philippine peso, and Thai bhat. Likewise, German mark derivatives can be effective in cross-hedging exposures in some Central and East European currencies, such as the Czech koruna, Estonian kroon, and Hungarian forint.

Another study by Benet (1990) suggests that commodity futures contracts may be used effectively to cross-hedge some minor currency exposures. Suppose the Canadian dollar price of the Mexican peso is positively correlated to the world oil price. Note that Mexico is a major exporter of oil, accounting for roughly 5 percent of the world market share. Considering this situation, a firm may use oil futures contracts to manage its peso exposure. The firm can sell (buy) oil futures if it has peso receivables (payables). In the same vein, soybean and coffee futures contracts may be used to cross-hedge a Brazilian real exposure. Again, the effectiveness of this cross-hedging technique would depend on the strength and stability of the relationship between the exchange rate and the commodity futures prices.

13.5 Hedging Contingent Exposure

In addition to providing a flexible hedge against exchange exposure, options contracts can also provide an effective hedge against what might be called **contingent exposure**. Contingent exposure refers to a situation in which the firm may or may not be subject to exchange exposure. Let us consider an example from the perspective of an American firm with Canadian dollar transaction exposure. Suppose General Electric (GE) is bidding on a hydroelectric project in Quebec. If the bid is accepted, which will be known in three months, GE is going to receive C$100 million to initiate the project. Since GE may or may not face exchange exposure depending on whether its bid will be accepted, it faces a typical contingent exposure situation.[4]

It is difficult to deal with contingent exposure using traditional hedging tools, such as forward contracts. Suppose that GE sold C$100 million forward to hedge the contingent exposure. If GE's bid is accepted, then GE will have no problem because it will have C$100 million to fulfill the forward contract. However, if the bid is rejected, GE now faces an unhedged short position in Canadian dollars. Clearly, a forward contract does not provide a satisfactory hedge against contingent exposure. A "do-nothing" policy does not guarantee a satisfactory outcome either. The problem with this policy is that if GE's bid is accepted, the firm ends up with an unhedged long position in Canadian dollars.

An alternative approach is to buy a three-month put option on C$100 million. In this case, there are four possible outcomes:

1. The bid is accepted, and the spot exchange rate turns out to be less than the exercise rate: In this case, the firm will simply exercise the put option and convert C$100 million at the exercise rate.
2. The bid is accepted, and the spot exchange rate turns out to be greater than the exercise rate: In this case, the firm will let the put option expire and convert C$100 million at the spot rate.
3. The bid is rejected, and the spot exchange rate turns out to be less than the exercise rate: In this case, although the firm does not have Canadian dollars, it will exercise the put option and make a profit.
4. The bid is rejected, and the spot rate turns out to be greater than the exercise rate: In this case, the firm will simply let the put option expire.

The above scenarios indicate that when the put option is purchased, each outcome is adequately covered; the firm will not be left with an unhedged foreign currency position. Again, it is stressed that the firm has to pay the option premium upfront. The preceding discussion is summarized in Exhibit 13.8.

13.6 Hedging Recurrent Exposure with Swap Contracts

Firms often have to deal with a "sequence" of accounts payable or receivable in terms of a foreign currency. Such recurrent cash flows in a foreign currency can best be hedged using a currency swap contract, which is an agreement to exchange one currency for another at a predetermined exchange rate, that is, the swap rate, on a sequence of future dates. As such, a swap contract is like a portfolio of forward

[4]These days, it is not unusual for the exporter to let the importer choose the currency of payment. For example, in the Bombardier case, Bombardier may allow Austrian Airways to pay either C$15 million or €10 million. To the extent that Bombardier does not know in advance which currency it is going to receive, it faces a contingent exposure. Given the future spot exchange rate, Austrian Airways will choose to pay with a cheaper currency. It is noteworthy that in this example, Bombardier provides Austrian Airways with a free option to buy up to C$15 million using euros (which is equivalent to an option to sell euros for dollars) at the implicit exercise rate of C$1.50/€.

EXHIBIT 13.8

Contingent Exposure Management: The Case of GE Bidding for a Quebec Hydro-electric Project

Alternative Strategies	Bid Outcome: Bid Accepted	Bid Outcome: Bid Rejected
Do nothing	*An unhedged long position in C$100 million*	No exposure
Sell C$ forward	No exposure	*An unhedged short position in C$100 million*
Buy put option on C$[a]	If the future spot rate becomes less than the exercise rate, ($S_T < E$)	
	Convert C$100 million at the exercise price	Exercise the option and and make a profit
	If the future spot rate becomes greater than the exercise rate, ($S_T > E$)	
	Let the option expire and convert C$100 million at the spot exchange rate	Simply let the option expire

[a]If the future spot rate turns out to be equal to the exercise price, that is, $S_T = E$, *GE will be indifferent between (i) exercising the option and (ii) letting the option expire and converting C$100 million at the spot rate.*

contracts with different maturities. Swaps are very flexible in terms of amount and maturity; the maturity can range from a few months to 20 years.

Suppose that Bombardier is scheduled to deliver an aircraft to Austrian Airways at the beginning of each year for the next five years, starting in 2004. Austrian Airways, in turn, is scheduled to pay €10,000,000 to Bombardier on December 1 of each year for five years, starting in 2004. In this case, Bombardier faces a sequence of exchange risk exposures. As previously mentioned, Bombardier can hedge this type of exposure using a swap agreement by which Bombardier delivers €10,000,000 to the counterparty of the contract on December 1 of each year for five years and takes delivery of a predetermined dollar amount each year. If the agreed swap exchange rate is $1.50/€, then Bombardier will receive $15 million each year, regardless of the future spot and forward rates. Note that a sequence of five forward contracts would not be priced at a uniform rate, $1.50/€; the forward rates will be different for different maturities. In addition, longer-term forward contracts are not readily available.

13.7 Hedging through Invoice Currency

While such financial hedging instruments as forward, money market, swap, and options contracts are well known, **hedging through invoice currency**—an operational technique—has not received much attention. The firm can *shift, share,* or *diversify* exchange risk by appropriately choosing the currency of invoice. For instance, if Bombardier invoices C$15 million, rather than €10 million for the sale of the aircraft, then it does not face exchange exposure anymore. Note, however, that the exchange exposure has not disappeared; it has merely shifted to the European importer. Austrian Airways now has an account payable denominated in Canadian dollars.

Instead of shifting the exchange exposure entirely to Austrian Airways, Bombardier can share the exposure with Austrian Airways by, for example, invoicing half of the bill in Canadian dollars and the remaining half in euros, that is, C$7.5 million and €5 million. In this case, the magnitude of Bombardier's exchange exposure is reduced by half. As a practical matter, however, the firm may not be able to use risk shifting or sharing

as much as it wishes to for fear of losing sales to competitors. Only an exporter with substantial market power can use this approach. In addition, if the currencies of both the exporter and the importer are not suitable for settling international trade, neither party can resort to risk shifting/sharing to deal with exchange exposure.

The firm can diversify exchange exposure to some extent by using currency basket units, such as the SDR, as the invoice currency. Often, multinational corporations and sovereign entities are known to float bonds denominated either in the SDR or in the ECU prior to the introduction of the euro. For example, the Egyptian government charges for the use of the Suez Canal using the SDR. Obviously, these currency baskets are used to reduce exchange exposure. As previously noted, the SDR now comprises four individual currencies, the American dollar, the euro, the Japanese yen, and the British pound. Because the SDR is a portfolio of currencies, its value should be substantially more stable than the value of any individual constituent currency. Currency basket units can be a useful hedging tool, especially for long-term exposure for which no forward or options contracts are readily available. The International Finance in Practice box on page 316 "The LCBO and Foreign Exchange Risk Management" shows how companies deal with exchange risk exposure using various operational techniques.

13.8 Hedging via Lead and Lag

Another operational technique the firm can use to reduce transaction exposure is leading and lagging foreign currency receipts and payments. To "lead" means to pay or collect early, and to "lag" means to pay or collect late. The firm would like to lead soft currency receivables and lag hard currency receivables to avoid the loss from depreciation of the soft currency and benefit from the appreciation of the hard currency. For the same reason, the firm will attempt to lead the hard currency payables and lag soft currency payables.

To the extent that the firm can effectively implement the **lead/lag strategy**, the transaction exposure the firm faces can be reduced. However, a word of caution is in order. Suppose, concerned with the likely depreciation of the euro, Bombardier would like Austrian Airways to prepay €10 million. Bombardier's attempt to lead the euro receivable may encounter difficulties. First of all, Austrian Airways would like to lag this payment, which is denominated in the soft currency (the euro), and thus has no incentive to prepay unless Bombardier offers a substantial discount to compensate for the prepayment. This, of course, reduces the benefits of collecting the euro receivable early. Second, pressing Austrian Airways for prepayment can hamper future sales efforts by Bombardier. Third, to the extent that the original invoice price, €10 million, incorporates the expected depreciation of the euro, Bombardier is already partially protected against the depreciation of the euro.

The lead/lag strategy can be employed more effectively to deal with intrafirm payables and receivables, such as material costs, rents, royalties, interests, and dividends, among subsidiaries of the same multinational corporation. Since managements of various subsidiaries of the same firm are presumably working for the good of the entire firm, the lead/lag strategy can be applied more aggressively.

13.9 Exposure Netting

In 1984, Lufthansa, a German airline, signed a contract to buy US$3 billion worth of aircraft from Bombardier and entered into a forward contract to purchase US$1.5 billion forward for the purpose of hedging against the expected appreciation of the dollar against the German mark. This decision, however, suffered from a major flaw: A significant portion of Lufthansa's cash flows was also American dollar-denominated. As a result, Lufthansa's net exposure to the exchange risk might not have been significant. Lufthansa had a so-called natural hedge. In 1985, the American dollar depreciated

INTERNATIONAL FINANCE IN PRACTICE

The LCBO and Foreign Exchange Risk Management

The Liquor Control Board of Ontario (LCBO) is the single largest importer of wines, spirits, and beer in the world. In 2003, the LCBO imported liquor worth more than C$800 million. These imports come from many sources. Wines come from Australia, Chile, France, Italy, the United States, and several other warm countries. Ireland, Sweden, and the United Kingdom are important providers of spirits. Jamaica sends us strong rum.

The LCBO's foreign exchange exposure creates a complex risk management problem. When the Canadian dollar rises or falls, it does not move to the same degree against all currencies. The LCBO is exposed to risk from a variety of foreign exchange movements.

The LCBO has devised a method to simplify its currency dealings with foreign suppliers of wines and spirits. First, the LCBO makes known to agents that the LCBO deals only in a small number of foreign currencies—primarily the American dollar and the Euro. For suppliers from the United States or Europe, this is not an issue. On the other hand, agents for Chilean wine or Swedish vodka must quote prices to the LCBO either in American dollars or euros—or perhaps Canadian dollars. This pushes foreign exchange transactional exposure (between, say, the Swedish krone and the Canadian dollar) on to suppliers of wines and spirits from countries other than the United States or Europe. This is a policy that only a very large importer could sustain.

The second feature of the LCBO's exchange risk management takes the form of "announced exchange rates" for purchases of imported wines and spirits. Again, this arrangement is workable because the LCBO is an important customer for its suppliers. The LCBO announces exchange rates that it will apply in processing invoices in foreign currencies over the subsequent quarter. For example, in July 2004, the LCBO announced that it will process all Euro-denominated invoices received in August, September, and October at C$1.65/€. The LCBO orders a shipment of wine from a French supplier at an invoice price of, say, €100,000 specified at the time of the order. The supplier accepts the LCBO's "offer exchange rate" scheme. Compared with what the French supplier would receive in euro if he were to take payment in Canadian dollars on the spot market at the time of delivery, under the LCBO "offer exchange rate" scheme, a change in the exchange rate between the time of the order and the time of delivery results in a foreign exchange *gain* (recorded in euro) for the exporter if the Canadian dollar appreciates against the euro or a foreign *loss* if the Canadian dollar depreciates.

Finally, during each three-month span of its "announced rates" the LCBO protects itself with forward contracts and foreign exchange options. The policy is to hedge approximately 50 percent of the exposure.

substantially against the mark and, as a result, Lufthansa experienced a major foreign exchange loss from settling the forward contract. This episode shows that when a firm has both receivables and payables in a given foreign currency, it should consider hedging only its *net* exposure.

So far, we have discussed exposure management on a currency-by-currency basis. In reality, a typical multinational corporation is likely to have a portfolio of currency positions. For instance, a Canadian firm may have an account payable in euros and, at the same time, an account receivable in Swiss francs. Considering that the euro and Swiss franc move against the dollar almost in lockstep, the firm can just wait until these accounts become due and then buy euros spot with Swiss francs. It can be wasteful and unnecessary to buy euros forward and sell Swiss francs forward. In other words, if the firm has a portfolio of currency positions, it makes sense to hedge residual exposurem, rather than hedge each currency position separately.

If the firm would like to apply **exposure netting** aggressively, it helps to centralize the firm's exchange exposure management function in one location. Many multinational corporations are using a **reinvoice centre**, a financial subsidiary, as a mechanism for centralizing exposure management functions. All the invoices arising from intrafirm transactions are sent to the reinvoice centre, where exposure is netted. Once the residual exposure is determined, then foreign exchange experts at the centre determine optimal hedging methods and implement them.

13.10 Should the Firm Hedge?

We have discussed how the firm can hedge exchange exposure if it wishes. We have not discussed whether the firm should try to hedge to begin with. As can be seen from the International Finance in Practice box on page 318, "To Hedge or Not to Hedge," there hardly exists a consensus on whether the firm should hedge. Some would argue that exchange exposure management at the corporate level is redundant when shareholders can manage the exposure themselves. Others would argue that what matters in the firm valuation is only systematic risk; corporate risk management may only reduce the total risk. These arguments suggest that corporate exposure management would not necessarily add to the value of the firm.

While the above arguments against corporate risk management may be valid in a "perfect" capital market, one can make a case for it based on various market imperfections:

1. Information asymmetry: Management knows about the firm's exposure position much better than shareholders. Thus, the management of the firm, not its shareholders, should manage exchange exposure.
2. Differential transaction costs: The firm is in a position to acquire low-cost hedges; transaction costs for individual shareholders can be substantial. Also, the firm has hedging tools like the reinvoice centre that are not available to shareholders.
3. Default costs: If default costs are significant, corporate hedging would be justifiable because it will reduce the probability of default. Perception of a reduced default risk, in turn, can lead to a better credit rating and lower financing costs.
4. Progressive corporate taxes: Under progressive corporate tax rates, stable before-tax earnings lead to lower corporate taxes than volatile earnings with the same average value. This happens because under progressive tax rates, the firm pays more taxes in high-earning periods than it saves in low-earning periods.

The last point merits elaboration. Suppose the country's corporate income tax system is such that a tax rate of 20 percent applies to the first C$10 million of corporate earnings and a 40-percent rate applies to any earnings exceeding C$10 million. Firms thus face a simple progressive tax structure. Now consider an exporting firm that expects to earn C$15 million if the dollar depreciates, but only C$5 million if the dollar appreciates. Let us assume that the dollar may appreciate or depreciate with equal chances. In this case, the firm's expected tax will be C$2.5 million:

$$\begin{aligned}\text{Expected tax} &= \tfrac{1}{2}[(0.20)(\text{C\$5,000,000})] + \tfrac{1}{2}[(0.20)(\text{C\$10,000,000}) \\ &\quad + (0.40)(\text{C\$5,000,000})] \\ &= \text{C\$2,500,000}\end{aligned}$$

Now, consider another firm, B, that is identical to firm A in every respect except that, unlike firm A, firm B aggressively and successfully hedges its risk exposure and, as a result, it can expect to realize certain earnings of C$10,000,000, the same as firm A's expected earnings. Firm B, however, expects to pay only C$2 million as taxes. Obviously, hedging results in a C$500,000 tax saving. Exhibit 13.9 illustrates this situation.

While not every firm is hedging exchange exposure, many firms are engaged in hedging activities, suggesting that corporate risk management is relevant to maximizing the firm's value. To the extent that for various reasons, shareholders themselves cannot properly manage exchange risk, the firm's managers can do it for them, contributing to the firm's value. Some corporate hedging activities, however, might be motivated by managerial objectives; managers may want to stabilize cash flows so that the risk to their human capital can be reduced.

To Hedge or Not to Hedge

"Most value-maximising firms do not hedge." Thus Merton Miller and Christopher Culp, two economists at the University of Chicago, said in a recent article[1] about Metallgesellschaft, a firm that saw its value plunge after its oil-price hedging strategy came a cropper. Yet the vast majority of firms that use derivatives do so to hedge. Last year's survey of big American non-financial companies by the Wharton School and Chase Manhattan bank found that, of those firms that used derivatives (about one-third of the sample), some 75% said they did so to hedge commitments. As many as 40% of the derivatives users said they sometimes took a view on the direction of markets, but only 8% admitted to doing so frequently.

To justify speculation, managers ought to have good reason to suppose that they can consistently outwit firms for which playing the financial markets is a core business. Commodity businesses, such as oil or grain companies taking positions on the direction of their related commodity markets, may have such reason, but non-financial firms taking bets on interest rates or foreign-exchange rates almost certainly do not—though some claim to make a profit on it. But why might hedging be wrong?

In the 1950s, Merton Miller and Franco Modigliani, another financial economist, demonstrated that firms make money only if they make good investments—the kind that increase their operating cash flows. Whether those investments are financed through debt, equity or retained earnings is irrelevant. Different methods of financing simply determine how a firm's value is divided between its various sorts of investors (e.g., shareholders or bondholders), not the value itself. This surprising insight helped win each of them a Nobel prize. If they are right, it has crucial implications for hedging. For if methods of financing and the character of financial risks do not matter, managing them is pointless. It cannot add to the firm's value; on the contrary, as derivatives do not come free, using them for hedging might actually lower that value. Moreover, as Messrs Miller and Modigliani showed, if investors want to avoid the financial risks attached to holding shares in a firm, they can diversify their portfolio of holdings. Firms need not manage their financial risks; investors can do it for themselves.

In recent years, other academics have challenged the Miller-Modigliani thesis—at least in its pure form—and demonstrated that hedging can sometimes add value. That is because firms may be able to manage certain risks internally in ways that cannot be replicated by outside investors. Some investors may not want, or be able, to hold diversified share portfolios (for instance, if the firm is family-owned). It may be possible to use derivatives to reduce profits in good years and raise them in bad years in order to cut the firm's average tax bill. Hedging can also be used to prevent the firm getting into financial difficulties, or even going bust.

Recently, another view has been winning converts. According to Kenneth Froot, David Sharfstein and Jeremy Stein, three Boston-based economists, firms should hedge to ensure they always have sufficient cash flow to fund their planned investment programme.[2] Otherwise some potentially profitable investments may be missed because of inefficiencies in the bond and equity markets that prevent the firm raising the funds, or the reluctance of managers to tap these markets when internal cash is tight. Merck, an American pharmaceuticals firm, has helped to pioneer the use of derivatives to ensure that investment plans—particularly in R&D—can always be financed. In a paper explaining the firm's strategy, Judy Lewent and John Kearney observed that "our experience, and that of the [drugs] industry in general, has been that cash-flow and earnings uncertainty caused by exchange-rate volatility leads to a reduction in research spending."[3]

Though apparently simple, such a strategy has some intriguing implications. As Messrs Froot, Scharfstein and Stein point out, the factors that cause cash flow to fall below expectations may also cut the number of

A study by Allayannis and Weston (2001) provides direct evidence on the important issue of whether hedging actually adds to the value of the firm. Specifically, they examine whether firms with currency exposure that use foreign currency derivative contracts, such as currency forward and options, increase their valuation. The authors find that American firms that face currency risk and use currency derivatives for hedging have, on average, about 5 percent higher value than firms that do not use currency derivatives. For firms that have no direct foreign involvement but may be exposed to exchange rate movements via export/import competition, they find a small hedging valuation premium. In addition, they find that firms that stop hedging experience a decrease in firm valuation compared with those firms that continue to hedge. Their study thus clearly suggests that corporate hedging contributes to firm value.

profitable investment opportunities, so lessening the need to hedge. For instance, an oil company's cash flow may suffer due to a fall in oil prices. However, that fall in prices also reduces the value of investing in developing new oil fields. With fewer profitable projects to invest in, the firm will need less cash to finance investment.

All about Cash Flow

Rene Stulz, an economist at Ohio State University, sees even more powerful implications.[4] He says that there are only a couple of good reasons why a firm should hedge. One is to cut its tax bills, which is likely to happen only if the firm's profits tend to yo-yo between lower and higher tax bands. The other one is being unable to get cash when it needs it, or facing a serious risk of running short. By this rule, reckons Mr. Stulz, a firm with little debt or with highly-rated debt has no need to hedge, as the risk of it getting into financial trouble is tiny. If he is right, many of America's biggest hedgers—including some of those that have revealed losses on derivatives, such as Procter & Gamble—may be wasting their energies, or worse. By contrast, Mr. Stulz thinks that if a firm is highly geared, hedging can boost its value significantly. Indeed, during the leveraged buy-out craze of the 1980s, when firms were taken over by buying off shareholders and loading up on debt, tough risk-management requirements were standard in any borrowing arrangement.

Messrs. Culp and Miller, of the University of Chicago, take this argument a step further in defending the management of Metallgesellschaft from some of the wilder accusations of recklessness (a matter that is now before the American courts). Instead of analysing the firm's hedging strategy (which involved selling oil for up to ten years ahead and hedging this exposure with futures contracts) in terms of its effectiveness in reducing risk, Messrs. Culp and Miller argue that the company had no need to reduce its risk-exposure because it had no reason to suppose it could not get hold of cash if needed. After all, the mighty Deutsche Bank, as its principal creditor and controlling shareholder, was behind the firm, ensuring that it could not go bust; and, as it turned out, it did not. Rather, the aim of the hedging strategy was to exploit what Metallgesellschaft thought was its superior understanding of the relationship between spot prices and futures prices—risky but not obviously foolish.

Not everyone agrees that firms with little debt should not hedge. Myron Scholes, an economist at Stanford University, reaches the opposite conclusion: firms with little debt could reduce their riskiness by hedging, and so be able to borrow more and rely less on equity. Equity can be expensive compared with debt; it is inherently riskier, offering no guaranteed payout, so investors require a higher average return on it than they do on bonds. Ultimately, through risk-reducing hedging and borrowing, more firms might be able to remain (or become) privately owned, reckons Mr. Scholes. But to do this well, managers will need a very good understanding of the risks to which their firm is exposed, and of opportunities to hedge.

However, the way firms typically use derivatives to reduce the cost of capital is different from that described above. Rather than hedge and borrow more, they substitute for traditional debt a hybrid of bonds and options and/or futures that will pay off in certain circumstances, thus lowering capital costs. This is speculation dressed up as prudence, because if events take an unexpected turn, capital costs go up by at least the cost of the options.

[1]"Hedging in the Theory of Corporate Finance: A Reply to Our Critics." By Christopher Culp and Merton Miller. *Journal of Applied Corporate Finance*; Spring 1995.

[2]"A Framework for Risk Management." By Kenneth Froot, David Scharfstein and Jeremy Stein. *Harvard Business Review*; November 1994.

[3]"Identifying, Measuring and Hedging Currency Risk at Merck." By Judy Lewent and John Kearney. In *The New Corporate Finance*, edited by Donald Chew, McGraw-Hill; 1993.

[4]"Rethinking Risk Management" By Rene Stulz. Ohio State University working paper; 1995.

13.11 What Risk Management Products Do Firms Use?

In a recent survey, Jesswein, Kwok, and Folks (1995) documented the extent of knowledge and use of foreign exchange risk management products by American corporations. On the basis of a survey of *Fortune* 500 firms, they found that the traditional forward contract is the most popular product. As Exhibit 13.10 shows, about 93 percent of respondents of the survey used forward contracts. This old, traditional instrument has not been supplanted by recent "fancy" innovations. The next commonly used instruments are foreign currency swaps (52.6 percent) and over-the-counter currency options (48.8 percent). Such recent innovations as compound options (3.8 percent) and lookback options (5.1 percent) are among the least extensively used instruments. These

EXHIBIT 13.9

Tax Savings from Hedging Exchange Risk Exposure

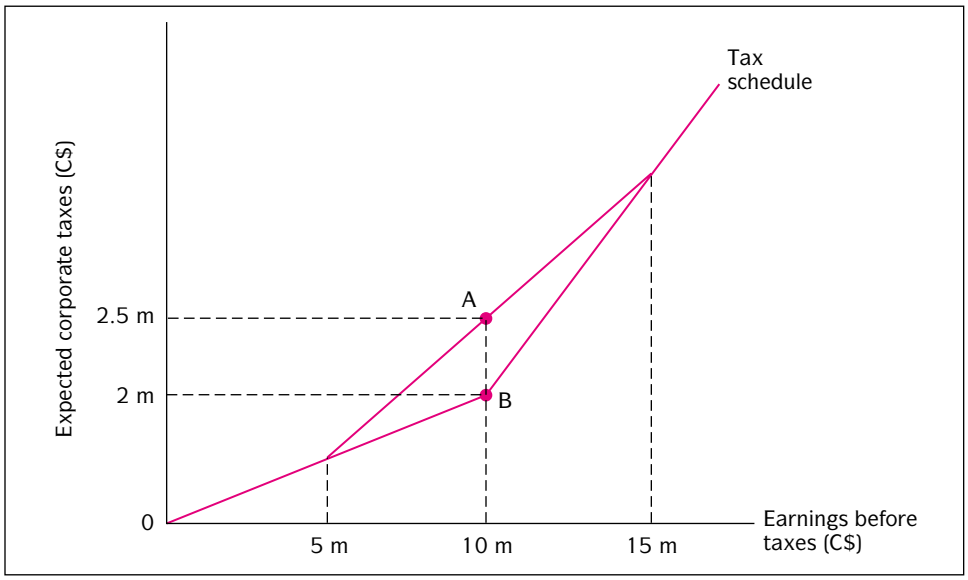


EXHIBIT 13.10

A Survey of Knowledge and Use of Foreign Exchange Risk Management Products[a]

Type of Product	Heard of (Awareness)	Used (Adoption)
Forward contracts	100.0%	93.1%
Foreign currency swaps	98.8	52.6
Foreign currency futures	98.8	20.1
Exchange-traded currency options	96.4	17.3
Exchange-traded futures options	95.8	8.9
Over-the-counter currency options	93.5	48.8
Cylinder options	91.2	28.7
Synthetic forwards	88.0	22.0
Synthetic options	88.0	18.6
Participating forwards, etc.	83.6	15.8
Forward exchange agreements, etc.	81.7	14.8
Foreign currency warrants	77.7	4.2
Break forwards, etc.	65.3	4.9
Compound options	55.8	3.8
Lookback options, etc.	52.1	5.1
Average across products	84.4%	23.9%

[a]The products are ranked by the percentages of respondents who have heard of products. There are 173 respondents in total.
Source: Kurt Jesswein, Chuck Kwok, and William Folks, Jr., "Corporate Use of Innovative Foreign Exchange Risk Management Products," *Columbia Journal of World Business* (Fall 1995).

findings seem to indicate that most American firms meet their exchange risk management needs with forward, swap, and options contracts.

The Jesswein, Kwok, and Folks survey also shows that among the various industries, the finance/insurance/real estate industry stands out as the most frequent user of exchange risk management products. This finding is not surprising. This industry has more finance experts who are skillful at using derivative securities. In addition, this industry handles mainly financial assets, which tend to be exposed to exchange risk. The survey further shows that the corporate use of foreign exchange risk management products is positively related to the firm's degree of international involvement. This finding is not surprising either. As the firm becomes more internationalized through cross-border trade and investments, it is likely to handle an increasing amount of foreign currencies, giving rise to a greater demand for exchange risk hedging.

SUMMARY

1. The firm is subject to a transaction exposure when it faces contractual cash flows denominated in foreign currencies. Transaction exposure can be hedged by financial contracts, such as forward, money market, and options contracts, as well as by such operational techniques as the choice of invoice currency, lead/lag strategy, and exposure netting.
2. If the firm has a foreign-currency-denominated receivable (payable), it can hedge the exposure by selling (buying) the foreign currency receivable (payable) forward. The firm can *expect* to eliminate the exposure without incurring costs as long as the forward exchange rate is an unbiased predictor of the future spot rate. The firm can achieve equivalent hedging results by lending and borrowing in the domestic and foreign money markets.
3. Unlike forward and money market hedges, currency options provide flexible hedges against exchange exposure. With the options hedge, the firm can limit the downside risk while preserving the upside potential. Currency options also provide the firm with an effective hedge against contingent exposure.
4. The firm can shift, share, and diversify exchange exposure by appropriately choosing the invoice currency. Currency basket units, such as the SDR and ECU, can be used as an invoice currency to partially hedge long-term exposure for which financial hedges are not readily available.
5. The firm can reduce transaction exposure by leading and lagging foreign currency receipts and payments, especially among its own affiliates.
6. When a firm has a portfolio of foreign currency positions, it makes sense only to hedge the residual exposure, rather than hedging each currency position separately. The reinvoice centre can help implement the portfolio approach to exposure management.
7. In a perfect capital market where shareholders can hedge exchange exposure as well as the firm, it is difficult to justify exposure management at the corporate level. In reality, capital markets are far from perfect, and the firm often has advantages over the shareholders in implementing hedging strategies. There, thus, exists room for corporate exposure management to contribute to the firm value.

KEY WORDS

contingent exposure, *313*
cross-hedging, *312*
exposure netting, *316*
forward market hedge, *304*
hedging through invoice currency, *314*
lead/lag strategy, *315*
money market hedge, *307*
options market hedge, *310*
reinvoice centre, *316*
transaction exposure, *303*

QUESTIONS

1. How would you define *transaction exposure*? How is it different from economic exposure?
2. Discuss and compare hedging transaction exposure using the forward contract versus money market instruments. When do alternative hedging approaches produce the same result?
3. Discuss and compare the costs of hedging by forward contracts and options contracts.
4. What are the advantages of a currency options contract as a hedging tool compared with the forward contract?
5. Suppose your company has purchased a put option on the euro to manage exchange exposure associated with an account receivable denominated in that currency. In this case, your company can be said to have an "insurance" policy on its receivable. Explain in what sense this is so.

6. Recent surveys of corporate exchange risk management practices indicate that many American firms simply do not hedge. How would you explain this result?
7. Should a firm hedge? Why, or why not?
8. Using an example, discuss the possible effect of hedging on a firm's tax obligations.
9. Explain *contingent exposure* and discuss the advantages of using currency options to manage this type of currency exposure.
10. Explain cross-hedging and discuss the factors determining its effectiveness.

PROBLEMS

The spreadsheet TRNSEXP.xls may be used in solving parts of problems 2, 3, 4, and 6.

1. Celestica of Toronto sold an advanced computer system to the Max Planck Institute in Germany on credit and invoiced €10 million payable in six months. Currently, the six-month forward exchange rate is C$1.50/€ and the foreign exchange adviser for Cray Research predicts that the spot rate is likely to be C$1.42/€ in six months.
   a. What is the expected gain/loss from a forward hedge?
   b. If you were the financial manager of Celestica, would you recommend hedging this euro receivable? Why, or why not?
   c. Suppose the foreign exchange adviser predicts that the future spot rate will be the same as the forward exchange rate quoted today. Would you recommend hedging in this case? Why, or why not?
2. RIM of Waterloo purchased computer chips from NEC, a Japanese electronics concern, and was billed ¥250 million payable in three months. Currently, the spot exchange rate is ¥105/C$, and the three-month forward rate is ¥100/C$. The three-month money market interest rate is 8 percent per annum in Canada and 7 percent per annum in Japan. The management of RIM decided to use a money market hedge to deal with this yen account payable.
   a. Explain the process of a money market hedge and compute the Canadian dollar cost of meeting the yen obligation.
   b. Conduct a cash flow analysis of the money market hedge.
3. You plan to visit Geneva, Switzerland, in three months to attend an international business conference. You expect to incur a total cost of SF5,000 for lodging, meals, and transportation during your stay. As of today, the spot exchange rate is C$1.10/SF and the three-month forward rate is C$1.13/SF. You can buy the three-month call option on SF with an exercise price of C$1.14/SF for the premium of C$0.05 per SF. Assume that your expected future spot exchange rate is the same as the forward rate. The three-month interest rate is 6 percent per annum in Canada and 4 percent per annum in Switzerland.
   a. Calculate your expected dollar cost of buying SF5,000 if you choose to hedge by a call option on SF.
   b. Calculate the future dollar cost of meeting this SF obligation if you decide to hedge using a forward contract.
   c. At what future spot exchange rate will you be indifferent between the forward and option market hedges?
   d. Illustrate the future dollar cost of meeting the SF payable against the future spot exchange rate under both the options and forward market hedges.
4. Bombardier just signed a contract to sell aircraft to Air France. Air France will be billed €20 million payable in one year. The current spot exchange rate is C$1.05/€

and the one-year forward rate is C$1.10/€. The annual interest rate is 6 percent in Canada and 5 percent in France. Bombardier is concerned with the volatile exchange rate between the dollar and the euro and would like to hedge exchange exposure.

a. It is considering two hedging alternatives: sell the euro proceeds from the sale forward or borrow euros from Crédit Lyonnaise against the euro receivable. Which alternative would you recommend? Why?

b. Other things being equal, at what forward exchange rate would Bombardier be indifferent between the two hedging methods?

5. Suppose that Kitchener Machinery sold a drilling machine to a Swiss firm and gave the Swiss client a choice of paying either C$10,000 or SF9,000 in three months.

a. In the example, Kitchener Machinery effectively gave the Swiss client a free option to buy up to C$10,000 using Swiss francs. What is the "implied" exercise exchange rate?

b. If the spot exchange rate turns out to be C$1.08/SF, which currency do you think the Swiss client will choose to use for payment? What is the value of this free option for the Swiss client?

c. What is the best way for Kitchener Machinery to deal with exchange exposure?

6. The Bay of Fundy Cruise Company (BofC) purchased a ship from Mitsubishi Heavy Industry for 500 million yen payable in one year. The current spot rate is ¥100/C$, and the one-year forward rate is 110/C$. The annual interest rate is 5 percent in Japan and 8 percent in Canada. BofC can also buy a one-year call option on yen at the strike price of C$0.01 per yen for a premium of 0.014 cents per yen.

a. Compute the future dollar costs of meeting this obligation using the money market and forward hedges.

b. Assuming that the forward exchange rate is the best predictor of the future spot rate, compute the expected future dollar cost of meeting this obligation when the option hedge is used.

c. At what future spot rate do you think BofC may be indifferent between the option and forward hedge?

7. Airbus sold an A400 aircraft to Air Canada and billed C$30 million payable in six months. Airbus is concerned about the euro proceeds from international sales and would like to control exchange risk. The current spot exchange rate is C$1.50/€, and the six-month forward exchange rate is C$1.575/€. Airbus can buy a six-month put option on Canadian dollars with a strike price of €1.45/C$ for a premium of €0.02 per Canadian dollar. Currently, six-month interest, rate is 5 percent in the euro zone and 6 percent in Canada.

a. Compute the guaranteed euro proceeds to Air Canada if Airbus decides to hedge using a forward contract.

b. If Airbus decides to hedge using money market instruments, what action does Airbus need to take? What would be the guaranteed euro proceeds from the sale in this case?

c. If Airbus decides to hedge using put options on Canadian dollars, what would be the "expected" euro proceeds from the sale? Assume that Airbus regards the current forward exchange rate as an unbiased predictor of the future spot exchange rate.

d. At what future spot exchange do you think Airbus will be indifferent between the option and money market hedge?

INTERNET EXERCISE

BankWare, an Ottawa-based company specializing in banking-related softwares, exported its software for automatic teller machines (ATM) to Oslo Commerce Bank, which is trying to modernize its operation. Facing competition from European software vendors, BankWare decided to bill the sales in the client's currency, Norwegian krone 500,000, payable in one year. Since there are no active forward currency markets for the Norwegian currency, BankWare is considering selling a euro or British pound amount forward for cross-hedging purpose. Assess the hedging effectiveness of selling the euro versus pound amount forward to cover the company's exposure to the Norwegian currency. In solving this problem, consult exchange rate data available from the following website: www.pacific.commerce.ubc.ca/xr/

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