CHAPTER 4

Foreign Exchange Risk

After reading this chapter you will be able to

- Assess ways to reduce foreign exchange exposure through rearranging business processes
- Compare foreign exchange hedging strategies
- Evaluate the risks associated with specific derivatives products and strategies

Although the discussion of hedging usually involves derivatives, it is sometimes possible to minimize currency exposure through prudent modification of business activities. The rearrangement of business processes to reduce risk is a form of internal hedging. It may involve effort but can be a viable means to reduce exposure and risk. Depending on the approach to foreign exchange risk, an organization might undertake internal hedging approaches where available and supplement with derivatives for some or all of the remaining exposure.

Currency Netting

On an organizational or centralized basis, it may be possible to net currency requirements internally. In effect, the organization centralizes some of its banking activities in-house, making excess currency available to other parts of the organization. Market prices, with or without a spread, can be used.

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Exposure Reduction

A number of techniques have been used to rearrange business activities to reduce foreign exchange exposure, including:

- Currency netting
- Proxy hedging
- Foreign currency debt
- Changes to purchasing/processing
- Transfer exchange rate risk

When an organization has foreign currency cash inflows and outflows, a cash forecast for each currency assists in identifying currency exposures. The forecast format should enable the user to determine a balance for each currency and whether there is a cumulative deficit or excess currency over time based on reasonably certain cashflows. Cumulative gaps between cash inflows and outflows are those that may require hedging. Cashflows that offset over time, for example, over a quarter or a fiscal year, effectively represent a timing issue.

Proxy Hedging

Proxy hedging is a strategy that introduces basis risk intentionally. Groups of currencies, such as those within regional areas, may sometimes exhibit a high correlation to one another. This correlation may be due to similar economic or political prospects or highly regional trade and often involves emerging markets. It is sometimes possible to exploit this correlation for hedging related currencies. If there is strong corre-

lation between the currencies, a proxy currency may be used for hedging purposes in place of one or more currencies.

There are risks inherent in a proxy currency strategy. Although past correlation can be assessed through analysis of historical data, future exchange rate relationships cannot be forecast with accuracy and may be quite different. Domestic factors, such as political instability, can dramatically affect a country's exchange rate in isolation from any regional factors.

As a result, there is no guarantee that historical correlation will have any relation to future correlation. A proxy hedge could result in an organization being unhedged, or under- or overhedged. Obviously, the tradeoff between protection and risk must be weighed carefully and the exposure managed accordingly.

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Proxy Hedging

There are several reasons why a proxy hedge might be used:

- An organization may find that it is difficult to obtain fair pricing on a particular currency if there is not a highly competitive market for the currency or the market is controlled.
- An organization might have exposure to several related currencies, each of which is too small for an effective hedging program.
- There might be significant regional effects on individual currencies.
- Currency hedging products for the particular currency of exposure may not be available.

Foreign Currency Debt

The issuance of foreign currency debt is sometimes used to reduce foreign exchange exposure. There are several reasons for borrowing in a foreign currency. Issuers may want to entice specific institutional investors by issuing in a desirable currency. Lower foreign interest rates might be seen as a way to reduce funding costs. Foreign currency debt may be required to finance an overseas expansion or investment in foreign plant and operations.

The exchange rate risk in foreign currency debt cannot typically be hedged using a forward without eliminating the interest rate savings, because forward rates are derived from interest rates. The forward rate is

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Foreign Currency Debt

The translated value of unhedged foreign currency debt, regardless of the attractiveness of the interest rate, can quickly increase if exchange rates move adversely. The effect of exchange rate changes on foreign currency debt can be seen in the following table, which shows the translated value of a 10 million liability in British pound sterling (GBP) to a U.S. organization under several exchange rate scenarios:

Exchange Rate (USD per GBP)	Translated Liability in U.S. Dollars
1.4300 USD/GBP	USD 14,300,000
1.6300 USD/GBP	USD 16,300,000
1.8300 USD/GBP	USD 18,300,000
2.0300 USD/GBP	USD 20,300,000

based on the interest rate differential between the two currencies before taking into account credit spreads.

The risk of debt denominated in a foreign currency can be reduced when the borrower has an offsetting asset denominated in the same currency, such as an income-producing subsidiary. If income from the asset is adequate to offset the payments on the liability, and it can be expected to continue for the life of the debt, the organization can take advantage of it. This may provide lower foreign currency borrowing rates while reducing the exchange rate risk already inherent in foreign currency receivables. If the foreign currency strengthens and the market value of the debt increases, the value of the offsetting foreign currency revenues should also increase.

However, offsetting foreign currency debt with foreign currency revenues does not take into account how demand and revenues change in response to exchange rates. Foreign currency revenues may be sensitive to exchange rates. If changes in exchange rates impact revenues and the ability to service foreign-currency-denominated debt, this must be taken into account.

Changes to Purchasing/Processing

Managing foreign exchange transaction risk can sometimes be accomplished through offsetting transactions to reduce currency exposure. This might involve different sources or locations for manufacturing. A company with foreign currency sales might use a supplier whose products are priced in the same currency.

Longer-term strategies might involve manufacturing in key customer locations or obtaining new customers where inputs are sourced. Exploiting exchange rate differences is often a reason to relocate manufacturing or sourcing, although there are other ramifications. A number of regions have experienced growth in manufacturing as a result of exchange rate differences.

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Project Bids

Bids on foreign projects often require a foreign exchange rate component to be embedded in the price of the contract. There is a risk that rates may change dramatically once the bid has been submitted but before notification to the winning bidder occurs. Some companies manage this risk by inserting a currency adjustment clause into the contract. If the exchange rate moves more than a predetermined amount, the contract price must be adjusted to reflect the exchange rate change. This shifts the exchange rate risk to the purchaser. Compound options, discussed later in this chapter, are also used for bid situations.

Transfer Exchange Rate Risk

It is sometimes possible to transfer exchange rate risk to customers or suppliers. For example, changes may be made to pricing methodology to better reflect exchange rates. In some industries, surcharges help to offset exchange rate risk and pass it on to the final customer. Alternatively, it might be possible to obtain fixed prices in two currencies from suppliers and pay the lower price when invoiced.

Other strategies include offering customers the opportunity to pay in another currency, which might help them offset their own currency exposure. Permanent migration of pricing transactions in currencies that are widely traded, such as U.S. dollars or euros, may be attractive to customers and reduce currency exposure. Prices should be offered in one currency, rather than a choice of currencies, since the latter increases uncertainty and exposure.

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Combined Commodity and Currency Exposure

Commodity prices often involve exchange rates, since many commodities trade in world markets in major currencies such as U.S. dollars. Some opportunities for managing combined commodity and currency exposure include:

- Where possible, request that commodities be priced in their normal currency of trade (e.g., U.S. dollars). A supplier might offer fixed prices in dual currencies, which provides flexibility and inherent value.
- Track and forecast net commodity exposure in the currency in which it trades.
- Track and forecast currency exposure that arises as a result of commodity-related transactions.
- Provide conservative currency and commodity rates for internal pricing and sales purposes.
- Ensure prices used for external purposes are kept current.
- Offer prices in major currencies. For example, non-U.S. customers may prefer prices in U.S. dollars to offset their other U.S. dollar exposures. This should be provided as a one-time choice, rather than on an ongoing basis.
- Avoid offering dual currency pricing to customers because it shifts currency risk back to the organization.

Fixed-price contracts are an alternative way to effectively shift foreign exchange risk to a supplier. However, if the supplier does a poor job of managing the risk, product prices may be expected to rise and slow to subsequently fall. At best, fixed-price contracts provide a lag time before exchange rate changes affect pricing.

Forward Contracts

Forward foreign exchange markets facilitate the movement of capital between domestic and international money markets and the hedging of foreign exchange risk. Hedging foreign exchange exposure with derivatives such as forward contracts replaces exposure to exchange rates with exposure to the performance of contractual counterparties. Therefore, it is important to understand credit risk, which is discussed in Chapter 5.

A foreign exchange forward is a customized contract that locks in an exchange rate for the purchase or sale of a predetermined amount of currency at a future delivery date. Since foreign exchange always involves two currencies, a contract to buy one currency is a contract to sell the other currency. Most contracts are outright forwards that lock in an exchange rate for a specific forward delivery date, but there are variations.

By locking in an exchange rate, the organization has eliminated the potential for adverse currency movements, but it has also given up the potential for favorable movements. Whether the currency moves adversely or favorably, the forward contract provides exchange rate certainty for the amount hedged and obligates the parties to it.

An organization with foreign currency accounts receivable can sell its expected excess currency forward. Similarly, an organization with foreign currency accounts payable can buy its currency requirements forward.

Forwards typically have maturity dates as far as one to two years forward, although if credit concerns are not an issue they may be more

EXAMPLE

Foreign Exchange Forward

A company requires 100 million Japanese yen in three months to pay for imported products. The current spot exchange rate is 115.00 yen per U.S. dollar, and the forward rate is 114.50. The company books a forward contract to buy yen (sell U.S. dollars) in three months' time at a price of 114.50 and orders its merchandise.

In three months' time, the company will use the contract to buy yen at 114.50. At that time, if yen is trading at 117.00 per U.S. dollar, the company will have locked in a price that, with the benefit of hindsight, is worse than current market prices. If three months later yen is at 112.00 per U.S. dollar, the company will have successfully protected itself against a more expensive yen.

Regardless of price changes, the company has locked in its yen purchase price at the forward rate of 114.50, enabling it to budget its costs with certainty. Presuming that exchange rate certainty was the goal of the forward contract, it will have achieved that goal.

long-dated. Forwards trade in the over-the-counter market, and the forward price includes a profit for the dealer. The forward market for major currencies is very liquid, due in part to the fact that forwards can be replicated in the interest rate markets.

Credit facilities with a financial institution are required to transact forwards. This may be a separate credit facility specifically for foreign exchange, and it should be arranged in advance of the time that the forward is required.

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Forward Rates

The forward price is based on the spot exchange rate, plus or minus a forward spread (forward points). Sample spot and forward prices (Canadian dollars per U.S. dollar) for several delivery dates follow:

Delivery	Forward Points	All-in Rate
Spot	–	1.2895
1 month	+20	1.2915
2 months	+35	1.2930
3 months	+50	1.2945
6 months	+90	1.2985
1 year	+160	1.3055
2 years	+240	1.3135

Forward Pricing

The forward price reflects the difference in interest rates between the two currencies over the period of time covered by the forward. The interest rate differential may be positive or negative, resulting in a forward price that is at a premium or discount to the spot rate.

A change in either the spot rate or the underlying interest rates will change the forward price. The spot price, plus or minus the forward points, equals the forward price or *all-in* price.

Flexible Forwards

A variation on a standard forward contract is an option-dated or flexible forward. These contracts permit the forward to be used on a date of

the hedger's choice within an allowable date range. Some contracts permit up to three separate delivery dates, providing additional flexibility.

Flexible forwards can be useful for organizations that find it difficult to forecast a specific date for a forward. However, they are necessarily priced to the least favorable date from the customer's standpoint, so the flexibility involves a cost.

Nondeliverable Forwards

Nondeliverable forwards are contractual agreements where delivery of the currency does not occur. Similar to a cash-settled futures contract, at the forward date, the current spot rate is compared to the contracted forward rate and a cash payment changes hands. Nondeliverable forwards are often used for hedging emerging market currencies where delivery is difficult.

Closing Out a Forward Contract

Once a forward contract has been transacted, the exchange rate is fixed for the amount and delivery date. To take delivery under the terms of

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Foreign Exchange Points

Most currencies are quoted to four decimal places. The Japanese yen is a notable exception, quoted to two decimal places in the indirect (yen per U.S. dollars) method. A foreign exchange point is an increment or decrement of one at the last standard decimal place. For example, a point is the difference between 1.3501 and 1.3502 (Canadian dollars per U.S. dollar), or the difference between 120.11 and 120.12 (Japanese yen per U.S. dollar).

the forward at maturity, the organization should provide instructions to the financial institution at least one or two days prior to maturity.

A forward contract can be closed out in one of several ways:

- Undertake delivery according to the terms of the forward contract.
- Close out the forward contract by buying or selling an offsetting contract at prevailing market rates, with a resultant gain or loss.
- Extend or roll the contract forward to another date at current rates.

Swaps

Swaps trade in the over-the-counter market between large financial institutions and their customers. Although they are similar, there are some significant differences between foreign exchange and currency swaps. Foreign exchange swaps tend to have shorter terms to maturity and have only two exchanges between counterparties. Currency swaps tend to cover longer periods and involve multiple exchanges between counterparties.

Foreign Exchange Swaps

Foreign exchange swaps are used extensively, particularly by financial institutions, to manage cash balances and exposures in various currencies. Traders also use swaps to facilitate the trading of forwards or the interest rate differential between two currencies.

A foreign exchange swap consists of a spot transaction and forward transaction. One currency is bought at the spot date, with a reversing sale at the forward date. Both the spot price and the forward price are set when the trade is made, and the difference (the forward points) is the net cost of, or gain resulting from, the swap.

For nonfinancial institutions, foreign exchange swaps are often used to facilitate short-term investing or borrowing in nondomestic currencies. They effectively create an investment in one currency and a loan in another. Foreign exchange swaps terms are typically about a year or less.

Currency Swaps

Currency swaps enable swap counterparties to exchange payments in different currencies, changing the effective nature of an asset or liability without altering the underlying exposure. Currency swaps usually have periodic payments between the counterparties for the term of the swap and cover a longer period of time than foreign exchange swaps.

A currency swap might be useful for a company that has issued long-term foreign currency debt to finance capital expenditures. If the company prefers to make debt payments in its domestic currency, it can enter into a currency swap to effectively exchange its required foreign currency payments for domestic currency payments. Currency swaps can also be used to lock in the cost of existing foreign currency debt or change the revenue stream on an asset.

A currency swap is similar to a loan combined with an investment. An exchange takes place at the beginning of the currency swap. Over the term of the swap, each party makes regular periodic payments in the desired currency and receives periodic payments in the other currency. As a result, currency swap payments are not usually netted. At the swap's maturity, there is an exchange back to the original currencies.

Currency swaps come in three basic forms. The classic currency swap involves a change in the currency. A currency basis (floating-to-floating) swap involves a change in the currency and the type of floating interest rate (the basis). Alternatively, and most commonly, a cur-

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Currency Swaps

Currency swaps permit companies to borrow in markets where they have the greatest advantage and then swap to effectively obtain the desired currency of payment. The following are reasons companies may have an advantage borrowing in a foreign currency:

- A well-known issuer name
- Foreign investor demand for assets in the currency
- Regulatory or tax advantages
- Local government programs that favor a particular type of debt
- Subsidies of various kinds

rency swap involves both a change in the currency and a change from floating to fixed (or vice versa).

Closing Out a Swap

Currency swaps are relatively liquid instruments that can be assigned, terminated, or overlaid with another swap. A currency swap can be closed out by settling the net present value of remaining payments between the counterparties. Existing swaps can also be blended with new swaps or extended, where the cost of closing out the swap is embedded into the new agreement.

Foreign exchange swaps can be closed out by settling with an offsetting swap, resulting in a gain or a loss depending on forward prices at the time of closing out the swap.

Currency Futures

Currency futures are exchange-traded forward contracts to buy or sell a predetermined amount of currency on a future delivery date. Contract size, expiry dates, and trading are standardized by the exchange on which they trade.

Several exchanges offer currency futures, including the following:

- International Monetary Market (IMM) division of the Chicago Mercantile Exchange
- New York Board of Trade
- Philadelphia Stock Exchange

The futures contract allows a currency buyer or seller to lock in an exchange rate for future delivery, removing the uncertainty of exchange rate fluctuations prior to the contract's expiry. Unlike forward contracts, there is no need for a foreign exchange line of credit with a financial institution because contracts are transacted through a broker or futures commission merchant. Both commissions and margin requirements apply.

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Reporting Limits

Reporting limits are used by exchanges as part of their market intelligence operations. Reporting limits help exchanges prevent the kind of aggressive market manipulation that hampers legitimate hedging and trading. Member firms of the exchange are required to report individuals or firms whose futures positions exceed exchange reporting limits.

Currency futures prices are normally quoted in the inverted or direct method. U.S. futures exchanges quote rates as U.S. dollars per foreign currency unit. This is in contrast to the over-the-counter market where most currencies are normally quoted in the indirect method as foreign currency units per U.S. dollar.

Performance of parties to a futures contract is guaranteed by a clearing corporation, replacing exposure to any individual contract holder. Exposure to the clearing corporation still exists.

Mark-to-Market and Margin

Futures contracts involve contractual obligations between a buyer and seller and permit control of a larger position in the underlying currency. Margin is a performance bond, required by both buyers and sellers, to ensure their performance to the contract. Exchanges determine minimum initial and maintenance margin, and exchange members (brokers) may require additional margin, depending on the contract and type of position.

Margin cash is deposited with the broker that facilitated the transaction. Futures contracts are repriced or marked-to-market daily, and each margin account is debited or credited with the day's losses or gains. When the market value of a futures position declines and losses are incurred, additional margin may be required to maintain the position. Failure to respond to a margin call will result in the position being closed out at the cost of the account holder.

Closing Out a Futures Contract

A futures contract can be closed out in one of several ways:

- Take delivery of the currency per the terms of contract.
- Close out the contract by buying (or selling) an offsetting contract at prevailing market rates, with a resultant gain or loss.

- Extend or roll the contract forward to another delivery date.

A long futures contract is closed out by selling a futures contract with the same delivery date. A sold futures contract can be offset by buying a futures contract with the same expiry date. Exchange rules determine the latest date at which an outstanding contract can be closed out.

The majority of futures contracts do not involve delivery. Most are closed out or rolled forward prior to expiry. Rolling forward involves closing out existing contract and entering into a new contract with another delivery date.

Foreign Exchange Options

Foreign exchange options can be a useful adjunct to a foreign exchange hedging program. The purchase of options can reduce the risk of an adverse currency movement, while maintaining the ability to profit from favorable exchange rate changes. The sale of options can be used to produce option premium income, though not providing a hedge.

Foreign exchange options are similar to insurance. The option buyer pays an option premium for protection from adverse exchange rate changes, while the option seller accepts the risk in exchange for receiving option premium. The contract permits the notional amount of a currency to be bought or sold at the strike rate, until or at the expiry date.

Most foreign exchange options trade in the over-the-counter market. However, they also trade in the exchange-traded market at the Chicago Mercantile Exchange, the Philadelphia Stock Exchange, and the New York Board of Trade. For exchange-traded options, contracts are accessed through a broker, and commissions and margin requirements apply.

A put option gives the option buyer the right to sell the underlying currency at the strike rate. If the option buyer exercises the put, the option seller has the obligation to accept the currency at the strike rate.

A call option gives its buyer the right to purchase the underlying currency at the strike rate. If the option buyer exercises the call, the option seller has the obligation to deliver the currency at the strike rate.

Since foreign exchange options always involve currency pairs, a call on one currency is necessarily a put on the other currency. For example, an option that permits the purchase of Swiss francs against Japanese yen is a call option on francs and a put option on yen.

Exotic options are over-the-counter options with special attributes. *Path dependent options,* such as average rate options, have a payoff that depends on the activity of the underlying currency before the option's expiry. *Barrier options,* such as knock-in and knock-out options, are dependent on the achievement of a predetermined exchange rate barrier prior to expiry.

Fundamentals

Options normally possess one of two standard exercise features, although others do exist. An American-style option is exercisable at any time before expiry of the option. A European-style option is exercisable on the expiry date. All else being equal, European-style options cost less than American-style options because there is less opportunity for them to be exercised.

Options are available in major currencies, and generally in any currency with an actively traded spot and forward market. Over-the-counter option contracts are customized with respect to strike price, contract size, and expiry date.

Exchange-traded currency options have standardized expiry dates, contract amounts, and strike prices. There are also a few customizable

products. The underlying interest may be the currency itself or a currency futures contract.

The relationship between the strike rate and current exchange rate helps to determine option premium and how much the option's value will respond to exchange rate changes. An at-the-money option permits the option holder to exercise it at a rate equivalent to current market rates (usually the forward rate). An in-the-money option has a strike rate that is more favorable exchange than current rates. An out-of-the-money option has a strike rate that is worse than current exchange rates. The out-of-the-money option's value is based on the probability of it being in-the-money before expiry.

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Delta Hedging

An option's delta is the rate of change of the option's value given a change in the underlying exchange rate. It is a measure of the option's sensitivity to movements in the exchange rate and is based on the probability that the option will be worth exercising before it expires. An option's value depends on the relationship of the strike price to the market exchange rate, in addition to other factors that affect the option's price.

Delta hedging involves rebalancing a position in the underlying currency to hedge the option exposure. Delta hedging is one of the ways that options traders hedge their option positions. When the underlying currency moves by more than a small amount, the option's delta changes and the hedge must be adjusted. Gamma measures the rate of change of delta.

An option's strike price is important from a hedging perspective. When an option is purchased as a hedge, it is possible the exchange rate will move adversely but not enough to make the option worth exercising. If the option is out-of-the-money at expiry, it will expire worthless, resulting in a loss on the underlying exposure and the amount of option premium paid.

Volatility measures the market's perception of the variability of the exchange rate. Option traders often speculate on volatility as a component of the underlying currency. Volatility is an important component of an option's price, and an increase in volatility increases option premiums, all else being equal. The result is that options are most expensive when their protection is most desirable. As volatility rises, the option

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Foreign Exchange Option Prices

Foreign exchange option prices, or premiums, are based on:

- Current exchange rate
- Exercise or strike rate
- Risk-free foreign interest rate
- Risk-free domestic interest rate
- Volatility of the exchange rate
- Whether the option is a put or a call
- Time until expiration of the option
- Exercise privileges (e.g., American-style or European-style)

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Intrinsic Value and Time Value

Option premiums consist of intrinsic value plus time value. Intrinsic value is the amount an option is in-the-money, if any. Time value is the market's measure of the probability of an option becoming in-the-money if it is not already. An option's time value does not change in a linear fashion with the passage of time but erodes more rapidly as expiry approaches. Presuming the option is not yet in-the-money, the chances of it being exercisable become smaller as expiry approaches, and this is reflected by the option's diminishing time value.

seller's risk increases, offsetting the higher premium received. Although historical volatility is tracked and monitored, traders use implied volatility in pricing decisions, which is the level of volatility implied by options prices.

Buying Options

An option buyer achieves protection against adverse exchange rates beyond the strike rate for a specified currency amount and expiry date. The option buyer maintains the flexibility to take advantage of favorable exchange rates should they materialize. For this benefit, the option buyer pays option premium to the option seller.

At the option's expiry, if the option is in-the-money, the option holder can exercise it or sell it. The exercise privilege rests with the option buyer. If an organization wishes to exercise a purchased option, it must inform the financial institution or broker that it wishes to do so

by providing instructions. Although some exchange-traded options offer automatic exercise if certain conditions are met, the responsibility to exercise an in-the-money option rests with the option buyer.

The maximum loss with the purchase of a currency option is the premium paid for it, while the organization can participate in subsequent favorable exchange rate movements. From a hedging perspective, the option premium is the cost of hedging.

EXAMPLE

Purchase of Currency Option

A U.S. company sells medical equipment to Canada and wants to protect its exposure to a decline in the value of its Canadian dollar receivables. The company has been budgeting an exchange rate of U.S.$0.7500, but the Canadian dollar is projected to weaken. The company expects to receive about C$10 million in about six months.

The company buys a Canadian dollar put option (U.S. dollar call) that provides the right, but not the obligation, to sell Canadian dollars at U.S.$0.7500 strike price. The option premium of $200,000 reduces the company's effective selling rate for its Canadian dollars.

- *Scenario 1*. Six months later, the Canadian dollar has strengthened to U.S.$0.8000. The company lets the option expire and sells Canadian dollars in the market at U.S.$0.8000.
- *Scenario 2*. Six months later, the Canadian dollar has weakened to U.S.$0.7000. The company exercises its option and sells Canadian dollars at the strike price of U.S.$0.7500.

Selling Options

In general, the sale of options entails significantly more risk than the purchase of options. The seller receives option premium and is obligated to the terms of the option. Since exchange rates can move dramatically, a worst-case scenario may not be quantifiable in advance.

Selling an option does not provide a hedge against currency exposure, although the premium received provides some cushion against adverse exchange rates. The risk of an adverse currency fluctuation must be managed and the option seller may have to take additional measures if the currency begins to move adversely.

The premium received depends on factors including volatility and time value. The more volatile the currency, the greater the chance for it to be exercised and the more premium it will generate, all else being equal.

An organization with foreign currency sales could sell a call option and receive option premium. If the currency subsequently rallies, the call option will be exercised against the option seller and the option seller will be obligated to sell the underlying currency at the strike rate. This may be unattractive compared with current exchange rates. Alternatively, if the underlying currency declines (the exposure of greatest concern

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Notable Quote

"The financial markets have some complicated features, but good common sense goes a lot further than mathematical flash and dash."

Source: Charles W. Smithson, respected risk management author, educator, and executive, in *Managing Financial Risk,* copyright Richard D. Irwin Inc., 1995.

to the organization), the call option will not be exercised and the hedger will need to take other steps to protect against losses.

Although the maximum gain from the sale of an option is the option premium, the maximum loss cannot be determined in advance. The maximum loss from the sale of an unhedged call is theoretically unlimited, since the option seller does not obtain any protection as a result of the sold option beyond option premium received. The maximum loss from the sale of an unhedged put is potentially very large,

EXAMPLE

Foreign Exchange Collar

A company needs protection against a rising U.S. dollar (declining Canadian dollar) one month from now. The current exchange rate is 1.2500 CAD/USD. The company enters into a zero-cost collar with its bank by purchasing a call option with a strike price of 1.2700 CAD/USD and selling a put option with a strike price of 1.2300 CAD/USD. Both options are European-style with the same one-month expiry dates.

There are three potential scenarios. If the exchange rate moves above 1.2700 CAD/USD, the company will exercise the call option and buy U.S. dollars at 1.2700. The sold put option will expire worthless. Alternatively, if the exchange rate moves below 1.2300, the bank will exercise the sold put option and the company will be required to buy U.S. dollars from the bank at 1.2300. The company's call option will expire worthless. If the exchange rate remains between 1.2300 and 1.2700, neither option will be exercised, both will expire worthless, and the company's U.S. dollar requirements will be purchased at current market rates.

although the currency can only fall to zero. As a result, the sale of options has a much higher risk profile than the purchase of options.

Foreign Exchange Collar

Options can be costly if the exchange rate is volatile. To reduce the cost of hedging, *collars* are often used. Various names have been applied to a collar, including range forward, cylinder option, tunnel option, and zero-cost collar. A collar combines the purchase of a call option and the sale of a put option with the same expiry date on the same currency pair.

European-style options are normally used to ensure that only one of the two options is exercised. The sold option generates option premium to pay for the purchased option. Strike prices are often chosen so that the premium of the sold option offsets the premium of the purchased option and the collar has a zero cost. Since only one option will be exercised, collars limit the effective exchange rate, the upper exchange rate by the call, and the lower exchange rate by the put.

Average Rate Options

Average rate or Asian options have a payoff that depends on the average exchange rate over the option's term to expiry. They allow an organization to hedge an exchange rate for a number of currency transactions over a period of time such as one year. At expiry of the option, the average rate is calculated from the periodic fixings made during the term and compared with the strike price.

There are several different variants, including fixed strike and floating strike rate types. For a fixed strike average rate option, if the average rate is worse than the strike rate, the option buyer is compensated for the difference between the average rate and the strike rate.

Average rate options are often used where foreign exchange transactions occur on an ongoing and regular basis. Depending on the type

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Pegged Exchange Rates

Pegged exchange rates, where a currency's exchange rate is pegged to another currency or a basket of currencies, appear to provide a simple solution to exchange rate risk. The foreign central bank manages the exchange rate and prevents it from moving beyond the target peg rate or range. From a hedging perspective, however, pegged exchange rates should be approached with caution. A significant market move or even a currency crisis may result if there is aggressive selling of the currency and the foreign central bank cannot defend the pegged rate. What previously appeared to be a low-volatility currency can quickly become a high-volatility currency.

of average rate option, they may provide a lower cost hedge than other options, which makes them attractive to hedgers.

Barrier Options

The payoff for a barrier option is contingent on the exchange rate reaching the barrier level. Once reached, the option may become exercisable (knock-in option) or become unexercisable (knock-out option). Knock-in options may be "up-and-in" or "down-and-in," while knock-out options may "up-and-out" or "down-and-out," depending on the terms of the contract. Knock-in options normally become conventional European-style options if the knock-in rate is reached. Barrier options have both a strike rate and a barrier (knock-in or knock-out) rate.

The buyer of a knock-out option pays option premium for a European-style option that exists unless the exchange rate passes a predetermined level, at which point the option knocks out and becomes

unexercisable. The knock-out level is chosen by the option buyer and may be a rate at which a hedge is no longer required. If a knock-out option becomes unexercisable and has to be replaced because a hedge is still needed, this will increase the cost of hedging.

Both knock-out options and knock-in options are popular due to their cost and simplicity. Since there is no guarantee that the option will be exercisable, there is less risk to the option seller, and they normally cost less than a conventional option as a result. Protection is provided

IN THE REAL WORLD

Knock-Out Option

An importer is concerned that British pound sterling will increase against the U.S. dollar, reducing the company's profit margins. The treasurer buys a knock-out call option on sterling with a strike price of $1.8500. The knock-out rate is set at 1.8100, at which rate the treasurer would be more comfortable locking it in with a forward. The option premium paid for the option effectively increases sterling's cost under all scenarios:

- If sterling increases, the option can be exercised at $1.8500 if needed.
- If sterling decreases, the option may get knocked out, but rates will be more attractive.
- The worst-case scenario is that the option gets knocked out and sterling subsequently rises, leaving the company without rate protection. The company should consider another hedge if the option gets knocked out and protection is still required.

against unfavorable exchange rates, while allowing full participation in any favorable movements.

The closer the knock-out level is to the current market price, the less premium will need to be paid for the option. Clearly, the closer the knock-out level to the market price, the more likely it is that the option will be knocked out and not be exercisable. The reverse is true for a knock-in option.

However, if the exchange rate does not reach the barrier level (in the case of a knock-in) or is knocked out (in the case of a knock-out), the hedger has no option, and therefore no protection against exchange rates. Therefore, a strike price should be chosen carefully.

Compound Options

Compound options are options on options. Normally European-style, they give the option buyer the right, but not the obligation, to buy or sell an option contract at the compound option's expiry date at a pre-determined option premium. Although they are initially cheaper than standard options, if both the compound option and its underlying

TIPS & TECHNIQUES

Compound Options

Compound options are often used to protect against the currency exposure inherent in major bids, where there may be a significant time lag between pricing and the announcement of the successful bid winner. In exchange for option premium, the organization can protect a worst-case option premium cost for the option that might be required if the contract is won.

option are purchased, the total hedging cost may be greater than with an ordinary put or call option.

Closing Out an Option

If not exercised, a purchased option may be allowed to expire, at which time it will be worthless if it is not in-the-money. The decision to exercise the option rests with the option buyer. A sold option remains a potential obligation to the option seller until it has been purchased back and the obligation canceled.

An option contract can be closed out in one of several ways:

- Take/make delivery per terms of option contract at discretion of option holder.
- Sell a purchased option at current market value.
- Buy back a sold option at current market value.
- Allow the option to expire at discretion of option holder.

Closing out a foreign exchange collar—which involves both purchased and sold options—requires buying back the sold options and selling the purchased options. There may be a cost to exit from the collar if the sold options are worth more than the purchased options. Therefore, the cost to close out the collar may be greater than its original cost.

Summary

- Foreign exchange hedging using derivatives replaces exposure to foreign exchange rates with exposure to foreign exchange counterparties.
- There are a number of ways to reduce exchange rate exposure that do not involve the use of derivatives. However, they

typically involve renegotiating or changing process and as a result, they may take time and organizational resources to implement.

- Forwards and futures lock in an exchange rate for a particular delivery date. Option buyers obtain protection from adverse exchange rate changes, while option sellers accept risk in exchange for receipt of option premium.