**Hedging Financial Risk Using Derivatives**

**Learning Outcomes**

After completing this module, students will be able to:

1. Differentiate between strategic, operational, hazard, and financial risk.
2. Explain the types of business insurance used to manage hazard risk.
3. Describe the structure of the foreign exchange market and how different exchange rates are quoted.
4. Hedge exchange rate risk using forwards, futures, swaps, options, and natural hedges.
5. Hedge interest rate risk using swaps, caps, floors, and collars.
6. Hedge commodity risk using futures, options, and long-term supply contracts.

**Introduction**

Companies are exposed to an array of business risks that can cause severe financial distress if not adequately controlled. In the past, these risks were managed piecemeal by lower-level managers working independently of each other. Today, most large corporations have comprehensive, company-wide Enterprise Risk Management (ERM) systems under the purview of a senior executive responsible for identifying, assessing, and monitoring all material business risks and taking appropriate actions to mitigate potential losses.

The key to effective risk management is early prevention. In-depth analysis of the business environment, meticulous strategic planning, strong harassment and workplace health and safety policies, detailed analysis of capital projects, and careful due diligence of all business dealings significantly reduce business risks. Additional risks can also be transferred to a third party using insurance or other hedging techniques if cost-effective. The risks that remain are shouldered by the company’s debt and equity investors, but the debtholders negotiate strict lending conditions, high collateral requirements, strong third-party guarantees, and liquidation preferences, so most of the remaining risks fall to the equity holders. According to the Capital Asset Pricing Model (CAPM), rational equity investors will eliminate all non-systematic risk by diversifying their portfolios, and they are fairly compensated for the systematic risk that remains.

The Canadian Risk Manager (CRM) designation offered by the Global Risk Management Institute (GRMI) is available for Chartered Professional Accountants (CPA) and Chartered Financial Analysts (CFA) who want to be part of this growing profession.

* 1. **| Categories of Business Risk**

Business risks can be categorized as strategic, operational, hazard, or financial.

**Strategic and operational risks.** Identifying, assessing, and monitoring strategic and operational risks is the responsibility of senior management and the line managers in marketing, supply chain, and human resources. Senior managers study major trends relating to consumer buying habits, technology, industry competition, social and demographic conditions, and the regulatory and political environment. Line managers look for operational problems such as an unstable supply chain, labour shortages, rising input costs, or an increase in harassment complaints.

All strategic and operational risks identified are prioritized, and appropriate actions are taken. For example, management might increase the R&D budget in response to changing consumer tastes or recent technological advancements. More could be done to recruit retired and disabled workers or new immigrants to address a labour shortage. Re-shoring parts production may help stabilize the supply chain during a period of global instability. Lobbying can be expanded to halt proposed new government regulations.

**Hazard risks.** These potential losses are caused by outside forces or lawsuits, such as:

* Fire and other property damage
* Windstorms, floods, and other natural perils
* Theft, vandalism, embezzlement, patent infringement, data breaches, identity theft and similar crimes
* Commercial, professional, and product liability
* Environmental violations
* Harassment and other workplace health and safety infractions
* Business interruptions caused by insured losses
* Loss of key employees.

A company can purchase coverage from an insurance provider to protect itself against these losses or may decide to self-insure if the premiums are too high or coverage is not available at any price. Self-insure means the organization does not carry insurance and absorbs any losses itself as they occur. It can also make regular contributions to a contingency fund or partner with other companies to cover future losses.

**Financial risks.** These are potential losses due to exchange rates, interest rates, and commodity price movements. A hedge allows a company or hedger to transfer its financial risks to a third party or speculator by entering a derivative contract. These contracts “derive” their value from an underlying asset, interest rate, or index that moves in the opposite direction to the hedger’s underlying position, offsetting any pre-existing risk. Speculators try to profit from forecasted short-term price movements and, in the process, absorb the hedger’s risk. These contracts include forwards, futures, swaps, and options.

For example, a farm plants wheat and expects to receive CAD 710 per bushel in four months, but agricultural prices fluctuate a great deal due to weather and geopolitical factors. The farm is concerned that if the price falls far below CAD 710, it will not be able to cover its production costs and could go bankrupt. The farm enters a derivative contract with a speculator. The contract states that if the price rises above CAD 710, the speculator will receive an amount greater than CAD 710, but if it falls below CAD 710, the speculator will pay the farmer the difference. The farm benefits from being able to lock in CAD 710 regardless of what happens to the price of wheat, but it had to give up any profit above CAD 710 to the speculator for this protection. The speculator enters this contract because it forecasts wheat prices will rise above CAD 710. It makes a profit if it is right, but it loses if the price falls below CAD 710. Put another way, the farm has an underlying position in an asset, which is wheat. If the price of wheat rises, the value of the wheat asset is higher, but this is offset by the negative value of the derivative contract. If the value of the wheat asset falls, this will be offset by the positive value of the derivative contract.

Finance professionals, including the chief financial officer, controller, and treasurer, are responsible for managing hazard and financial risks. The remainder of the module will focus on these risks.

* 1. **Business Insurance**

**Insurance Fundamentals**

Insurance allows a party to protect itself from financial loss by purchasing coverage from another party in exchange for a fee. The legal agreement between the two parties is called an insurance policy. The party providing the coverage is the insurance company, also referred to as the insurance provider, insurance carrier, or underwriter. The party purchasing the coverage is the policyholder, while the one receiving the benefits is the insured. The policyholder and insured are usually the same, but the policy can name a different beneficiary, such as a commercial lender or spouse. The policyholder pays the insurance provider a premium for a specified coverage limit against a specific type of loss. The policy may have a deductible, which is the amount of damage a company must pay itself before an insurance provider reimburses a claim. A deductible reduces premiums and helps insurance companies deal efficiently with small claims. It also makes the policyholder better appreciate the high cost of insurance coverage and encourages them to take steps to mitigate losses, such as installing security cameras or sprinkler systems. Excessive premiums can be reduced by negotiating a high deductible, but this policy will only protect a company from large losses.

To qualify for insurance coverage, the insured party must have an insurable interest in an item, event, or action, which means they would directly suffer from any loss. The insurance provider is required to indemnify the insured party for the lesser of their insurable interest or the coverage limits in the policy. Both the policyholder and provider are required to act in good faith, providing all material information. Once a loss occurs, the policyholder is obligated to mitigate any damages by taking reasonable actions to reduce the loss, such as a landlord finding a new tenant when the lease is broken or a business finding a substitute supplier or contract when it is not able to perform on a contract. Benefits are only paid for accidents and not for intentional, negligent, or criminal acts.

Insurance pools the premiums of policyholders who are exposed to a random risk and uses the funds to cover the losses of the small number of policyholders who incurred a loss. Actual losses each year can be accurately estimated because of the large number of policyholders and are used to calculate the appropriate premium. For example, a company has a manufacturing facility that it wants to insure against fire. The facility has a replacement cost of CAD 250 million and actuaries for the insurance provider indicate there is a .015% probability it will be destroyed by fire in any year. The company’s expected loss from fire each year is CAD 37,500 (i.e., 99.985% x CAD 0 + .015% x CAD 250 million).

Although the probability of a fire is small, the potential loss is high and likely enough to cause the company severe financial distress. By paying an insurance premium of CAD 37,500 each year, the company can transfer the risk to the insurance company. Finding insurance is more difficult when the loss is non-random and possibly catastrophic. Non-random losses tend to happen all at once, while catastrophic losses mean the losses are significant enough to potentially bankrupt the insurance company. Potential losses from earthquakes, floods, hurricanes, and terrorism meet these conditions, which explains why they are excluded from most insurance policies, and governments must often step in to provide coverage. A few large, well-capitalized insurance companies called reinsurers also provide coverage to smaller insurers that are worried about high losses and need to diversify further.

General insurance companies sell a variety of products, but most insurers specialize in either life, property and liability or health insurance. Life insurance companies provide retirement annuities and pension plans in addition to insurance, so they are more like a wealth-management firm and have longer-term relationships with their clients. A mutual insurance company is a consumer cooperative owned by its policyholders. Any profits earned are passed on to the policyholders as dividends or a reduction of premiums. Many mutuals have been converted to for-profit companies as part of a trend called demutualization.

Business insurance can be purchased as separate policies for each type of risk or as a package catering to a particular category of business. Small businesses often buy a standard business owner’s policy (BOP) that provides basic coverage at a lower premium than if the policies were purchased separately. A BOP may not cover all losses, so additional policies may need to be purchased. Larger businesses can also buy an insurance package, but are more likely to customize it to meet their unique requirements. Co-insurance is an insurance policy where multiple insurers share coverage. Dual insurance is when a company has two or more policies covering some of the same risks. When this occurs, the insurance companies typically pay any damages jointly, but can make dual payments in some cases, such as life insurance, providing the policyholder with additional coverage.

Policies can be written using a “named perils” format, where only the risks listed are covered or an “all-risk” format, where all risks are covered except those specifically excluded. Policyholders should carefully review their policies to ensure they meet their needs. What risks are covered? Which are excluded? Are any activities prohibited, thus negating coverage? Are the coverage limits adequate based on the value of the property, potential liability exposures, or previous losses? What are the premiums? Are there mitigating actions that can be taken to reduce premiums? How high are the deductibles? Are they adjustable, or are they set by the provider?

A business will likely need help answering these questions and should seek expert advice. Business insurance is sold through agents representing one insurance company and brokers representing multiple companies. Both agents and brokers counsel clients on their insurance needs and recommend the products they should buy, but they are paid on commission by the insurer, creating a conflict of interest. Insurance brokers have fewer conflicts as they represent multiple insurance providers and can search the market for the best coverage and premiums. More businesses are retaining independent insurance consultants to advise clients on how to best meet their insurance needs. They work on a fee-for-service basis, not a commission, and negotiate with the insurance providers for the client.

**Types of Business Insurance**

**Property insurance.** Covers property-related losses from fire, theft, vandalism, employee embezzlement, patent or copyright infringement, data breaches, identity theft, and weather-related damages such as windstorms, floods, lightning, and other natural perils. Property insurance covers not only a building or structure but also its contents, including office furnishings, inventory, raw materials, machinery, computers, computer data, and intellectual property. Additional coverage can be purchased for risks excluded from general property insurance policies, such as:

**Exhibit 1: Other Types of Property Insurance**

|  |  |
| --- | --- |
| Crop insurance | Losses due to fire, wind, hail, drought, frost, pests, or disease  |
| Landlord insurance | Residential or commercial property damages caused by tenants  |
| Air or marine transport insurance | Losses to equipment and cargo  |
| Boiler and equipment insurance | Accidental damage to boilers and equipment |
| Builder’s risk insurance | Damage to materials, fixtures, and equipment during construction |

**Liability insurance.** Covers damages to a party caused by a business’s operations, products, or employees. A customer may claim harm due to a faulty product, a service error, or deceptive advertising. Employees may claim a supervisor or co-worker harassed them. Outside parties may claim the company slandered, libelled, or harassed them, damaged their property, or caused them physical harm. Claims made against the company can be settled directly or in court. Liability insurance pays settlements up to the coverage limit as well as any legal costs, which can be substantial. Businesses typically carry general liability insurance that covers most liability claims, but additional coverage may be required if losses are excluded, such as:

**Exhibit 2: Other Types of Liability Insurance**

|  |  |
| --- | --- |
| Directors’ and officers’ liability insurance | Protects directors and officers against personal loss, including legal costs, if they are sued by investors, lenders, or other parties |
| Environmental liability insurance | Covers damages resulting from the dispersal, release, or escape of pollutants |
| Professional liability insurance | Protects professionals such as accountants or lawyers against loss, including legal costs, relating to negligence and other claims initiated by clients |
| Errors and omissions insurance | Protects any service provider, not just professionals, against claims of inadequate work or negligence by clients |

**Workers’ compensation insurance.** Covers the cost of work-related injuries, including death benefits, short-term and long-term disability, medical care, and re-training. Provincial governments in Canada are responsible for workers’ compensation insurance to ensure all employees are adequately covered and that employers provide a safe and healthy work environment. Premiums are determined by the employer’s industry and safety record. Employers cannot ask the employee to pay any portion of the premium, but employees give up the right to sue the employer except in exceptional cases.

**Vehicle insurance.** Covers the cost of vehicle accidents, including the loss or damage of the vehicle, death benefits, short-term and long-term disability, medical care, and third-party liability, as well as theft, vandalism, and weather-related damages. Auto insurance is controlled by the provinces, and it is mandatory in every province. Plans are administered publicly, privately or using a hybrid of the two systems, but each province still determines the required coverage and the options for additional insurance. Each province has adopted some form of no-fault system where policyholders only deal with their insurance providers and receive benefits quickly, as there is no need to wait to find out which driver is at fault. In a public insurance system, lawyers and long court proceedings are also eliminated as plan administrators determine the benefits to be received using set policies and coverage limits, resulting in much lower premiums overall. Drivers found at fault are still penalized by higher individual premiums.

**Key person insurance**. Protects a business from losses due to the death or disability of a business owner or employee who is crucial to the operation and success of the company. The proceeds can be used to hire temporary replacements or recruit and train new staff; replace lost profits; pay off lenders or loan guarantors when required by credit agreements; fund severance benefits for workers if the business is closed; and help existing partners or shareholders buy out the key person’s share of the company.

**Business interruption insurance.** Compensates businesses for lost profits and extra expenses incurred during an insured event, such as a fire or flood, and may be extended to include losses caused by a similar disruption to a customer or supplier. This type of insurance is important to companies with extensive retail or manufacturing operations.

**Export insurance.** The Government of Canada’s Export Development Corporation (EDC) offers insurance relating to export sales and foreign operations. Insurable losses can result from:

* Foreign contract cancellation or failure to honour an agreement.
* Refusal to pay or the bankruptcy of a foreign business or government.
* Foreign government limitations on the conversion of local currency to hard currencies or the transfer of funds out of the country.
* Foreign government moratoriums on debt repayment by its domestic companies.
* Cancellation of government-issued import or export permits.
* Expropriation of assets by foreign governments or damages from political unrest.

EDC also ensures performance bonds, also called surety bonds, issued by private insurance companies and financial institutions. When importers and exporters do not have an established relationship, the importer may require that the exporter purchase a performance or surety bond to protect the importer from losses due to non-fulfillment of the agreement. By ensuring these bonds, the EDC reduces exporters’ costs and limits the financial restrictions generally placed on them by private insurance companies such as collateral requirements.

* 1. **| Foreign Exchange Market**

The foreign exchange market, also known as the currency, forex, or FX market, is the largest financial market in the world, with over USD 6.6 trillion daily trading volume in April 2019. This is up from USD 5.1 trillion in April 2016, according to the Triennial Central Bank Survey of Foreign Exchange Turnover. This survey is the most comprehensive source of information on the size and structure of the global forex market and is published every three years. It is sponsored by the Bank for International Settlements (BIS), whose role is to support the world’s central banks in their pursuit of monetary and financial stability through international cooperation and to act as a bank for its 63 member countries.

Most currency trading in the forex market is in U.S. Dollars, Euros, Japanese Yen, British Pounds, or Swiss Francs. Approximately 88.3% of all trades are between the USD and other currencies, while the EUR accounts for 32.3% and the JPY for 16.8%. The USD is the world's reserve currency, meaning most international transactions are paid in dollars. Emerging market currencies, including the Chinese Renminbi, are gaining importance and account for 25% of all global turnover. All currency trades involve two currencies, such as USD or EUR, so the turnover percentages for all countries add up to 200% and not 100%.

The forex market is highly competitive, providing participants with excellent liquidity and low trading costs. There are no official currency exchanges or clearinghouses like stocks or derivatives. Instead, currencies trade electronically in the over-the-counter market through a collection of dealers and brokers located around the world. London is the largest trading center with 43.1% of the trading volume in 2019, followed by New York at 16.5%, Singapore and Hong Kong at 7.6%, and Tokyo at 4.5%. Due to differences in time zones, participants can trade currencies 24 hours a day, five and a half days a week.

The forex market is divided into a sell-side and a buy-side. The sell-side consists of reporting dealers that are generally very large multinational commercial or investment banks that buy and sell currency for their customers or speculate on currency movements in their own proprietary accounts to earn profits for the firm.

**Exhibit 3: 10 Largest Currency Traders, June 2019**

|  |  |  |  |
| --- | --- | --- | --- |
| **Rank** | **Institution** | **Country** | **Market Share** |
| 1 | JP Morgan | U.S. | 9.81% |
| 2 | Deutsche Bank | Germany | 8.41% |
| 3 | Citi | U.S. | 7.87% |
| 4 | XTX Markets | Great Britain | 7.22% |
| 5 | UBS | Switzerland | 6.63% |
| 6 | State Street Corporation | U.S. | 5.50% |
| 7 | HC Tech | U.S. | 5.28% |
| 8 | HSBC | Great Britain | 4.93% |
| 9 | Bank of America Merrill Lynch | U.S. | 4.63% |
| 10 | Goldman Sachs | U.S. | 4.50% |

Reporting dealers must be large so they can offer competitive price quotations on their different FX products. Their size provides economies of scale, justifying the considerable upfront investment in computer technology. A varied and global client base is also required to source much of the currency needed within the firm instead of trading with other dealers, further reducing costs.

The buy-side consists of the clients of the sell-side reporting dealers. These clients are divided into non-financial customers and other financial institutions.

**Non-financial customers**

**Corporate accounts.** Major corporations need foreign currency to import goods and services, make business acquisitions abroad, or establish overseas subsidiaries. Foreign currency earned by operating overseas subsidiaries needs to be repatriated. Financing raised in other countries must be converted to fund domestic operations. Large multinational corporations transact directly with reporting dealers because of high transaction volumes.

**Private individuals.** Very high-net-worth individuals trade directly with reporting dealers using their online trading platform or by placing phone-in orders.

**Governments.** Governments trade directly as they require large amounts of foreign currency to purchase goods and services such as military equipment; maintain foreign military bases, embassies, and consulates; provide foreign aid; or make contributions to international organizations like the United Nations.

**Other financial institutions**

**Non-reporting banks.** Small and medium-sized businesses and lower net-worth individuals need to buy or sell foreign currency but are too small to trade directly with reporting dealers. Individuals purchase foreign currency to travel abroad or acquire property outside the country. Many hold funds in other currencies to hedge a depreciating domestic currency, earn higher investment returns abroad, speculate in currency movements, guard against political risks at home, or “launder” the proceeds of criminal activities.

These smaller commercial and retail clients want to deal with their regular commercial or investment banks, but these institutions are often too small to operate as reporting dealers. Reporting dealers support these banks and other currency brokers by “making a market” in different currency pairs, offering bid-ask prices on an ongoing basis. The reporting dealer trades the currencies and earns the bid-ask spread on the transaction, while the bank charges a fixed commission per trade, or a variable commission based on the trade’s value.

**Institutional investors.** These “real money” investors include insurance companies, leasing companies, sales financial units, mutual funds, exchange-traded funds, pension plans, and endowments that invest internationally to diversify their portfolios and earn higher returns for their clients. Regulators limit these firms’ use of riskier investment strategies involving financial leverage and derivatives to protect their less sophisticated investors.

**Hedge funds and proprietary trading firms.** Hedge funds follow a broad range of investment strategies, including ones involving currency trading. They are not limited in their use of financial leverage or derivatives by regulators because they cater to more sophisticated high-net-worth individuals or institutions that better understand the risks and can more easily absorb any losses. Proprietary currency trading firms, proprietary trading desks at banks, and high-frequency traders speculate for their own accounts and have no outside investors, so they also require limited regulation. High-frequency traders use computer-based trading algorithms that involve frequent trades of short duration.

**Central banks.** A country may intervene in the forex market to influence the price of its currency if it feels it is either under- or overvalued. A weak currency increases exports but may cause higher inflation and a lower standard of living as imports become more expensive. A strong currency lowers exports, reducing economic activity and increasing unemployment, but may increase the standard of living as imports become more affordable. An unstable currency makes it more difficult for domestic companies to operate internationally, causing greater business uncertainty and reduced economic activity. The foreign exchange reserves of the central banks of many developing and energy-rich countries have become quite large due to current account surpluses with most developed countries. These reserves are held primarily in the USD and EUR, the forex market’s two most important currencies, so any attempt to reduce the size of these reserves will have a significant impact on exchange rates.

**Sovereign wealth funds**. Several energy-rich countries have diverted their current account surpluses into investment funds to increase their returns instead of holding foreign exchange reserves. These funds are professionally managed and are operated much like “real money” investors, although their government sponsors have greater influence over their investment and spending decisions.

**Public sector financial institutions.** International organizations such as the International Monetary Fund, World Bank, European Investment Bank, or Asian Development Bank, and domestic organizations like the Business Development Bank of Canada or the Export Development Corporation regularly buy and sell foreign currency to support development projects abroad.

**Exchange Rates**

An exchange rate is the price of one country’s currency relative to another country’s currency when it is traded on the foreign exchange market. For example:

CAD/USD 1.2486

This exchange rate quotation means 1 USD buys 1.2486 CAD. The numerator is called the quote (or price) currency, and the denominator is the base currency, which is always one currency unit. Each of the world’s approximately 180 currencies has a three-letter currency code (ex., CAD for the Canadian Dollar) assigned by the International Standards Organization (ISO). The first two letters are the country name (ex., CA for Canada) and the last letter is the name of the currency (ex., D for dollar). Currencies are assigned numerical codes to make computer processing more efficient. Exhibit 1 provides a listing of some of the most common currencies and their codes.

**Exhibit 4: Currency Codes**

|  |  |  |  |
| --- | --- | --- | --- |
| **Currency Code** | **Currency** | **Currency Code** | **Currency** |
| USD (840) | U.S. Dollar | NOK (578) | Norwegian Krone |
| EUR (978) | Euro | BRL (986) | Brazilian Real |
| JPY (392) | Japanese Yen | SGD (702) | Singapore Dollar |
| GBP (826) | British Pound | MXN (484) | Mexican Peso |
| CHF (756) | Swiss Franc | CNY (156) | Chinese Renminbi |
| CAD (124) | Canadian Dollar | HKD (344) | Hong Kong Dollar |
| AUD (036) | Australia Dollar | INR (356) | Indian Rupee |
| NZD (554) | New Zealand Dollar | KRW (410) | South Korean Won |
| ZAR (710) | South African Rand | RUB (643) | Russian Rubble |
| SEK (752) | Swedish Krona |  |  |

Exchange rate quotations are supplied by the reporting currency dealers who buy and sell currency for their customers in the foreign exchange market. Quotes from different dealers vary for identical currency pairs, but the differences are small due to the efficiency of the currency market. A currency pair refers to the two currencies being traded.

Quotes are customarily taken to four decimal places, which are 1/10000th of a currency unit. This is called a pip, or price interest point, and is the smallest price movement an exchange rate can make. In some markets, quotes are taken to five decimal places. For five decimal places, a fractional pip, or a pipette or deci-pip, is used, which equals 1/10th of a pip or 1/100000th of a currency unit. Going to five or more decimal places is helpful if more precision is required in large currency transactions or to reduce the bid-ask spread. Transactions involving the EUR are usually taken to five places. One exception to the four or five-decimal-place rule is the Japanese Yen, where the number of Yen needed to buy 1 USD is relatively high. In this case, the precision of four or five decimal places is unnecessary, so two decimal places is the norm.

News organizations, financial websites, the Bank of Canada, and other organizations distribute these exchange rate quotes to the public and often add their daily, monthly, and yearly trend data. Quotes are average dealer prices, so they do not reflect the rates at which actual currencies are traded or could be traded. Companies should refer to the bid-ask quotations supplied by each reporting dealer for exact pricing information.

**Spot Rates**

The spot rate is the price at which a pair of currencies trades today. A spot trade is an agreement between two counterparties to immediately exchange specified amounts of two currencies at the prevailing spot rate. Spot trades are settled, and the currency is delivered within two days or T+2, but this may occur faster for some currency pairs. Settlement is T+1 for the CAD/USD because of the high liquidity or size of the market.

**Exhibit 5: Spot Rate Quotations**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **CAD/USD** | **USD/EUR** | **USD/GBP** | **JPY/USD** | **MXN/USD** | **CHF/USD** | **USD/AUD** | **CNY/USD** | **USD/NZD** |
| **Today** | 1.2486 | 1.2074 | 1.38775 | 107.555 | 19.837 | 0.9147 | 0.7743 | 6.4894 | 0.7185 |
| **Week ago** | 1.2506 | 1.1985 | 1.38315 | 108.785 | 19.932 | 0.9202 | 0.7734 | 6.5296 | 0.7143 |
| **Four weeks ago** | 1.2578 | 1.1798 | 1.37890 | 108.655 | 20.594 | 0.9391 | 0.7637 | 6.5423 | 0.7003 |
| Source: Royal Bank of Canada, April 21, 2021 |

Again, the spot rate quotation of 1.2486 CAD/USD in Exhibit 5 means 1 USD would buy 1.2486 CAD today. The spot rate has fallen over the last four weeks, so the USD is depreciating against the CAD as it can be exchanged for fewer CAD. If the spot rate increased, the USD would appreciate against the CAD as it can be exchanged for more CAD.

If a Canadian company earned USD 10,000 in the U.S., it could convert this profit into CAD 12,486 (i.e., 10,000 x 1.2486). But what if a U.S. company earned CAD 10,000 in Canada and wanted to convert it to USD? The spot rate of 1.2486 is less valuable as the company needs an exchange rate that shows how much USD a company will receive for 1 CAD. The spot rate quotation can be inverted so that the USD is the numerator, and the CAD is the denominator. The quotation of 1.2486 CAD/USD would become 0.8009 USD/CAD (i.e., 1.0000 / 1.2486), which means 1 CAD could be exchanged for 0.8009 USD. If a U.S. company earns CAD 10,000 in Canada, it could convert these profits into USD 8,009 (i.e., 10,000 x 0.8009).

**Quotation Conventions**

Exchange rates are quoted in pairs of currencies, such as CAD and USD. Practices vary between markets as to which is the quote currency (numerator) and base currency (denominator).

**Direct quote.** The domestic country’s currency is the quote currency (numerator), and the foreign currency is the base currency (denominator). This ratio measures what a domestic trader would pay for one unit of a foreign currency or receive for one unit of foreign currency. The CAD/USD quote of 1.2486 from Exhibit 5 is a direct quote from the perspective of a Canadian trader. They would pay CAD 1.2486 for 1 USD or receive CAD 1.2486 for 1 USD.

**Indirect quote.** The domestic currency is the base currency (denominator), and the foreign currency is the quote currency (numerator). This ratio measures what a foreign trader would pay for one unit of domestic currency or receive for one unit of domestic currency. The USD/CAD quote of 0.8009 from Exhibit 5 is an indirect quote from the perspective of a U.S. trader. They would pay USD 0.8009 for 1 CAD or receive USD 0.08009 for 1 CAD.

**Bid-Ask Quotations**

When traders convert currency, the currency dealer quotes two prices. The bid price is the exchange rate at which they will buy the base currency, while the ask price is the exchange rate at which they will sell the base currency. The difference between these exchange rates is the bid-ask spread, which is the profit earned by the dealer or the customer’s transaction cost.

If a foreign exchange dealer has a bid price of 1.2486 CAD/USD and an ask price of 1.2491 CAD/USD, this represents a bid-ask spread of 0.0005 CAD/USD or 5 pips. If a Canadian business wants to buy USD 100,000 to purchase parts from a U.S. supplier, it will buy USD 100,000 at the ask price of 1.2491 CAD/USD or CAD 124,910. To fill this order, the dealer would have to buy USD 100,000 at the bid price of 1.2486 CAD/USD or CAD 124,860. The dealer’s profit on this transaction is CAD 50 (CAD 124,910 – CAD 124,860) or (USD 100,000 x 0.0005). Different dealers display their bid-ask quotes using variations of the table in Exhibit 6.

**Exhibit 6: Bid-Ask Quotation**

**Bid price**

**Pips**

**Ask price**

|  |
| --- |
| **CAD/USD** |
| **Sell** | **5** | **Buy** |
| 1.24**91** |  | 1.24**86** |
| **USD:** 100,000 |

This is a direct quotation where the quote currency (i.e., the numerator) is for the domestic trader and the base currency (i.e., the denominator) is for the foreign trader. The part of the exchange rate quotation that is the same is not bolded and is referred to as the “big figure” or “handle.” The remaining digits are bolded and shown as exponents. They are used to calculate the bid-ask spread of 0.0005, which is more simply shown as 5 pips. The order size is USD 100,000, which is the normal lot size for trading currency in the foreign exchange market. The spread is higher if the customer trades in “odd” lots that are lower than the normal lot size. The bid-ask spread can also be stated as a percentage of the ask price for comparison.

The size of the bid-ask spread depends on several factors.

* Bid-ask spreads average between 3 to 5 pips for major currency pairs with high trading volumes, such as the USD/EUR, but are higher for transactions involving minor currencies, also called exotic currencies, like the RUB. More trading volume means greater competition, so dealers pay higher bid prices and receive lower ask prices, reducing the spread. With higher volume or market liquidity, dealers can also trade more quickly, lowering their transaction costs and risk exposure from changing exchange rates. As discussed, most currency trades have a minimum lot size of 100,000, so trading below this amount will increase transaction costs.
* Bid-ask spreads widen as markets become more volatile in periods of heightened economic and political turmoil. A foreign exchange dealer carries an inventory of foreign currencies so they can fill buy orders from customers quickly. In volatile markets, dealers are more likely to lose money by purchasing currency at more than they eventually sell it for. Dealers manage this risk by demanding a larger bid-ask spread.
* From a North American perspective, European trading begins in the early morning hours, while Asian trading does not start till late at night. If a currency trade is not booked during the regular business hours of the exchange that trades predominantly in that currency, there is considerably less liquidity, and the bid-ask spread will be higher. For example, the EUR is primarily traded in the London foreign exchange market, so a U.S. trader would pay a higher bid-ask spread if they traded EUR late in the day in New York when the London market is not active. The spread is even higher for Hong Kong-based traders.
* Large businesses and institutional investors receive lower bid-ask spreads because of their higher transaction volume and market sophistication.

**Cross Rates**

As discussed, if a company wants to convert USD to CAD, the USD should be the base currency and the CAD should be the quote currency (i.e., CAD/USD). If it wants to convert CAD to USD, the opposite is true (i.e., USD/CAD). To help companies, financial information providers publish tables containing cross rates. The table in Exhibit 7 shows the base currency across the top of the table and the quote currency down the side. The exchange rates of 1.2486 CAD/USD and 0.8009 USD/CAD previously discussed can be found in this exhibit.

**Exhibit 7: Cross Rates**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **USD** | **CAD** | **EUR** | **MXN** | **JPY** | **GBP** | **CHF** | **AUD** |
| **USD** | 1.0000 | 0.8009 | 1.2074 | 0.0504 | 0.0093 | 1.3878 | 1.0933 | 0.7743 |
| **CAD** | 1.2486 | 1.0000 | 1.5076 | 0.0629 | 0.0116 | 1.7327 | 1.3650 | .9668 |
| **EUR** | 0.8282 | 0.6633 | 1.0000 | 0.0418 | 0.0077 | 1.1494 | 0.9055 | 0.6413 |
| **MXN** | 19.8370 | 15.8874 | 23.9512 | 1.0000 | 0.1844 | 27.5288 | 21.6869 | 15.3598 |
| **JPY** | 107.5600 | 86.1400 | 129.8600 | 5.4200 | 1.0000 | 149.2600 | 117.5900 | 83.2800 |
| **GBP** | 0.7206 | 0.5771 | 0.8700 | 0.0363 | 0.0067 | 1.0000 | 0.7878 | 0.5580 |
| **CHF** | 0.9147 | 0.7326 | 1.1044 | 0.0461 | 0.0085 | 1.2694 | 1.0000 | 0.7083 |
| **AUD** | 1.2915 | 1.0343 | 1.5593 | 0.0651 | 0.0120 | 1.7923 | 1.4119 | 1.0000 |
| Source: Royal Bank of Canada, April 21, 2021 |

What if a Canadian trader knows the CAD/USD and USD/EUR exchange rates, but does not know the CAD/EUR? As mentioned, foreign exchange markets are very efficient, so this rate can be calculated using the exchange rates in Exhibit 8 using a process called triangulation. Notice that the USD values cancel out, leaving CAD/EUR.

$$\frac{CAD}{USD} x \frac{USD}{EUR}= \frac{CAD}{EUR}$$

$$1.2486 x 1.2074=1.5076$$

* 1. **| Hedging Exchange Rate Risk**

Traders have three motives for engaging in foreign currency transactions. First is the transaction motive, where currency is traded to import goods and services, purchase fixed assets from a foreign supplier, repatriate sales or profits, invest abroad in business operations or financial instruments, or raise needed financing overseas at a lower rate with potentially less stringent regulations. The second motive is to hedge a company’s operations or an investor’s portfolio to control the transaction risks associated with currency fluctuations. The third motive is for investors to profit by speculating on currency movements. Speculators absorb the risks that hedgers are trying to eliminate. The remainder of this module focuses on the transaction and hedging motives.

**Transaction Risk**

With the abandonment of the gold standard in 1973, the values of major currencies have been allowed to float. A fixed exchange rate system was replaced by a flexible exchange rate system in most developed countries so exchange rates could rise or fall in response to local economic conditions or external shocks like hyperinflation, oil price increases, or global financial crises. The new floating rate system has responded well to these adverse conditions, but companies must now devote more time to managing exchange rate risk.

When companies export products, they are usually paid in their own currencies and pay for imports in the corresponding foreign currencies. Anytime companies agree to receive or make payments in a foreign currency in the future, they are at risk because the exchange rate may change between the initial date of the transaction and the settlement date, resulting in a foreign exchange gain or loss – this is called transaction risk. Companies can hedge exchange rate risk using forward, futures, swaps, and options, but some businesses may decide not to hedge, thinking that any gains or losses will eventually cancel out or that the firm can profit by speculating on exchange rate movements.

Under International Financial Reporting Standards (IFRS), unhedged exchange rate gains and losses are recognized. Unrealized gains or losses are recognized at the end of each accounting period, and an adjustment is made when the transaction is settled in subsequent accounting periods. For example, a Canadian company purchased merchandise for USD 100,000 from a U.S. supplier on September 1 with payment on December 1. The current exchange rate is CAD/USD 1.2486, but it was CAD/USD 1.2493 on December 1. The CAD has depreciated relative to the USD so that the Canadian company will experience a foreign exchange loss. The journal entries would be:

|  |  |  |  |
| --- | --- | --- | --- |
| September 1 | Purchases | CAD 124,860 |  |
|  |  1Accounts payable |  | CAD 124,860 |
|  | 1(100,000) (1.2486) |  |  |
|  |  |  |  |
| December 1 | Accounts payable | CAD 124,860 |  |
|  | 1Foreign exchange loss | CAD 70 |  |
|  |  2Cash |  | CAD 124,930 |
|  | 1(100,000) (1.2486 – 1.2493)2(100,000) (1.2493) |  |  |

What if the transaction was not settled until February 1, when the exchange was CAD/USD 1.2489? The exchange rate at year-end on December 31 was CAD/USD 1.2498.

|  |  |  |  |
| --- | --- | --- | --- |
| September 1 | Purchases | CAD 124,860 |  |
|  |  1Accounts payable |  | CAD 124,860 |
|  | 1(100,000) (1.2486) |  |  |
|  |  |  |  |
| December 31 | 1Foreign exchange loss | CAD 120 |  |
|  |  Accounts payable |  | CAD 120 |
|  | 1(100,000) (1.2486 – 1.2498) |  |  |
|  |  |  |  |
| February 1 | Accounts payable | CAD 124,980 |  |
|  |  1Foreign exchange gain |  | CAD 90 |
|  |  2Cash |  | CAD 124,890 |
|  | 1(100,000) (1.2498 – 1.2489) |  |  |
|  | 2(100,000) (1.2489) |  |  |

All foreign exchange gains or losses are included in the income statement and not in other comprehensive income, so they increase the volatility of net income and earnings per share. Companies have the choice of disclosing these gains or losses as either operating or non-operating expenses, which distorts the operating profit margin ratio. The preferred treatment is to classify these transactions as operating expenses since they regularly occur and are part of everyday business activities.

**Hedging Using Forward Contracts**

Transaction risk can be hedged using forward contracts.

**Forward rates.** A forward rate is the price that a pair of currencies is expected to trade at on some future date. A company can lock in at this rate today by buying a forward contract to eliminate the exchange rate risk so that it can focus on operations. Currency dealers typically quote forward rates for major currency pairs in one-, three-, six-, nine-, or twelve-month maturities, but quotations may be available for up to five or even ten years. Forward rate maturities for minor currencies are shorter because of lower trading volume.

For example, a Canadian company was able to negotiate a USD 10 million mortgage loan with a U.S. bank at a more competitive rate to finance a new factory in Canada. Construction will be completed, and the loan will be received in one year. The loan proceeds will be converted into CAD to pay off a bridge loan from a Canadian bank that is being used to finance the factory during construction. The CFO is concerned about fluctuating exchange rates and wants to protect the company, so she locks in the forward rate in one year instead of accepting the spot rate at that time. According to Exhibit 8, a forward rate of 1.2483 CAD/USD could be negotiated so the USD 10 million mortgage would be converted into CAD 12.4830 million (i.e., 10 million x 1.2483), which approximates the value of the bridge loan. If the spot rate in one year was CAD/USD 1.2479, the opportunity cost of the hedge is positive CAD 4,000 (i.e. (1.2483 – 1.2479) (10 million)). This means the company received more by locking in the forward rate, but it could have received less if the spot rate in one year was above CAD/USD 1.2483. By locking in the forward rate, the company is hedging the transaction by transferring the risk of loss to another party called the speculator.

**Exhibit 8: Forward Exchange Rates**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Spot** | **1 Month** | **3 Months** | **6 Months** | **1 Year** | **2 Years** | **3 Years** | **4 Years** | **5 Years** |
| **Per USD** |  |  |  |  |  |  |  |  |  |
|  **CAD** | 1.2486 | 1.2486 | 1.2484 | 1.2484 | 1.2483 | 1.2517 | 1.2587 | 1.2652 | 1.2695 |
|  **EUR** | 1.2074 | 1.2082 | 1.2098 | 1.2122 | 1.2175 | 1.2291 | 1.2453 | 1.2663 | 1.2907 |
|  **JPY** | 107.5550 | 107.5225 | 107.4572 | 107.3530 | 107.0451 | 106.2998 | 105.0061 | 103.1930 | 101.0000 |
|  **GBP** | 1.3878 | 1.3879 | 1.3882 | 1.3885 | 1.3896 | 1.3907 | 1.3940 | 1.4021 | 1.4139 |
| **Per CAD** |  |  |  |  |  |  |  |  |  |
|  **USD** | 0.8009 | 0.8009 | 0.8010 | 0.8010 | 0.8011 | 0.7989 | 0.7945 | 0.7904 | 0.7877 |
|  **EUR** | 1.5076 | 1.5085 | 1.5103 | 1.5132 | 1.5198 | 1.5385 | 1.5675 | 1.6021 | 1.6386 |
|  **JPY** | 86.1405 | 86.1100 | 86.0700 | 85.9900 | 85.7500 | 84.9300 | 83.4200 | 81.5600 | 79.5600 |
|  **GBP** | 1.7327 | 1.7329 | 1.7330 | 1.7334 | 1.7346 | 1.7407 | 1.7546 | 1.7740 | 1.7949 |
| Source: Royal Bank of Canada, April 21, 2021 |

The forward rate for a specific period may be higher (premium) or lower (discount) than the current spot rate, depending on the market’s exchange rate expectations. A forward discount for CAD/USD rate means the CAD is expected to appreciate against the USD so that the USD will buy fewer CAD. A forward premium means the CAD is depreciating against the USD, so that the USD will buy more CAD. The expected appreciation or depreciation can be expressed as a percentage of the current spot rate to measure the rate of change. For example, if the 1-year forward rate is 1.2483 CAD/USD and the current spot rate is 1.2486 CAD/USD, the USD is trading at a forward discount of -0.0240%.

$\frac{1.2483-1.2486}{1.2486}$ =-.000240 or -0.0240%

Expressed on an annual basis, the forward premium or discount is:

Forward premium (discount) = $\frac{Forward rate-Spot rate}{Spot rate}$ x $\frac{12}{Length of contract}$

When dealers provide bid-ask quotations for forward rates, they provide the adjustments that must be made to the current spot rate to get the forward rate at different maturities. The adjustment is given in forward points, which are the same as pips, as shown in Exhibit 5.

**Exhibit 9: Forward Bid-Ask Quotations (USD/EUR)**

|  |  |
| --- | --- |
| **Maturity** | **Spot Rate or** **Forward Points** |
| Spot rate (Bid/Ask) | 1.3549/1.3651 |
| 1 month | -5.6/-5.1 |
| 3 months | -15.9/-15.3 |
| 6 months | -37.0/-36.3 |
| 12 months | -94.3/-91.8 |

The bid and ask prices for the 3-month forward rate are:

Bid price 1.3549 + ($\frac{-15.9}{10,000}$) = 1.35331 Ask price 1.3651 + ($\frac{-15.3}{10,000}$) = 1.36357

**Forward contracts.** This is an agreement between two counterparties to exchange specified amounts of two currencies on a settlement date in the future at a forward rate agreed on today. Forward trades are usually settled in 1 month, 3 months, 6 months, 9 months, or 12 months, but this period can be for just a few days or up to 10 years in the case of the four major currency pairs. These pairs include the USD and EUR, USD and JPY, USD and GBP, and USD and CHF.

Forward contracts are sold primarily by banks and do not typically require an upfront payment, but if a client’s creditworthiness is questioned, a cash deposit or other collateral may be required. The forward contract sets out the currency pair, notional principal (i.e., the amount of currency being traded), settlement date, and delivery rate (i.e., forward rate). Forward contracts do not have standardized terms, so they trade in the over-the-counter market and not on organized exchanges. The counterparties to these contracts are interested in either hedging a [foreign exchange](https://www.investopedia.com/terms/f/foreign-exchange.asp) position or speculating on currency movements. The hedger locks in a specific forward rate, and the speculator attempts to profit from differences in the delivery rate and spot rate when the contract is settled.

Forward contracts can be settled by 1) having the counterparties deliver the currency to each other or 2) exchanging the difference between the delivery rate and the spot rate in cash when the contract is settled. For example, a Canadian exporter expects to receive USD 10 million in three months. The company plans to convert USD into CAD at that time, so the exporter is exposed to exchange rate risk, and they decide to hedge. The exporter enters a cash-settled currency forward contract to exchange 10 million USD for CAD after three months at a delivery rate of 1.2484 CAD/USD. This means it will receive CAD 12.484 million (USD 10 million x 1.2484) after three months. What if the spot rate falls to 1.1837 CAD/USD after three months? If there were no forward contracts, the exporter would receive CAD 11.837 million (USD 10 million x 1.1837) by exchanging USD 10 million at the current spot rate. Since there is a forward contract, the exporter or hedger would receive CAD 12.484 million from the other counterparty or speculator. The other counterparty or speculator would receive CAD 11.837 from the exporter or hedger, losing CAD 0.647 (CAD 11.837 – CAD 12.484) on the transaction.

What if the futures contract specifies that the other counterparty must compensate the exporter by making a cash payment equivalent to the difference between the delivery rate and the spot rate? The exporter will receive CAD 0.647 million (CAD 12.484 million – CAD 11.837 million) from the counterparty as a cash settlement. When the exporter converts the USD 10 million into CAD at the spot rate of 1.1837 CAD/USD, they will receive CAD 11.837 million instead of CAD 12.484 million, but the CAD 0.647 million received from the counterparty will increase their net proceeds to CAD 12.484 million. This is the same amount that they would have received if they had taken delivery of the currency. If the USD instead strengthened to 1.2534 CAD/USD, then the exporter would have to make a payment of CAD 0.050 million (USD 10 million x 1.2534 – USD 10 million x 1.2484) to the counterparty. When the exporter converts USD 10 million into CAD at the spot rate of 1.2534 CAD/USD, it will receive CAD 12.534 million, but the CAD 0.050 million paid to the counterparty would reduce its net proceeds to CAD 12.484 million. Regardless of the changes in the exchange rate, the exporter receives CAD 12.484 successfully hedging the transaction.

**Hedging Using Swap Contracts**

Translation risk can be hedged using either foreign exchange swaps or currency swaps.

**Foreign exchange swaps.** This is an agreement between two counterparties to borrow one currency and lend another on an initial date, and then return them at maturity. In the first leg of the transaction, the equivalent amount of currency in their respective currencies is swapped at the spot rate. In the second leg, these amounts are returned at the agreed-upon forward rate.The amounts swapped serve as collateral for the lending agreement.

For example, a Canadian company is planning to expand its operations in Europe and needs EUR. A European company needs CAD to expand its operations in Canada. The counterparties agree to swap 1,000,000 EUR. The agreement has a maturity of six months with a spot rate of 1.5076 CAD/EUR and a forward rate of 1.4830 CAD/EUR. The forward rate is lower as the CAD is expected to appreciate compared to the EUR over the next six months. Initially, the Canadian company receives EUR 1,000,000 and pays CAD 1,507,600 (1 million x 1.5076). At the maturity of the agreement in six months, the Canadian company pays EUR 1,000,000 and receives CAD 1,483,000 (1 million x 1.4830).

Foreign exchange swaps vary in length from one day to several months. Like forward contracts, they allow companies to lock in the forward rate to hedge foreign exchange risk. They will also enable them to secure short-term loans in a foreign currency at a more favourable rate or with less regulation than if they borrowed in the foreign market themselves. The counterparties can first raise capital in their own countries at a lower rate and then swap the funds.

**Currency swaps.**  Like foreign exchange swaps, the two counterparties agree to exchange principal amounts in different currencies for a period and then repay them at an agreed-upon forward rate at maturity. With currency swaps, the counterparties also agree to exchange interest payments in different currencies for the same period. Both counterparties could pay either a fixed or floating rate, or one may pay a fixed rate while the other pays a floating rate. The counterparties use these agreements to hedge foreign exchange risk on both the principal and interest.

Like forward contracts, swap contracts trade over the counter instead of through organized exchanges, as the contracts are not sufficiently standardized. A company wanting to enter a swap agreement approaches a dealer who takes the other side of the agreement. The swap dealer then tries to arrange an offsetting transaction with another company or dealer and records it in their swap book. Each dealer attempts to keep a balanced or “matched” book to minimize their risk exposure. Banks are the primary swap dealers in North America.

**Hedging Using Options Contracts**

Call or put options give the buyer the right, but not the obligation, to buy or sell another currency at a specific exchange rate or strike price on or before the specified expiry date. Currency options are used by companies to hedge exchange rate risk or speculate on currency movements.

For example, a Canadian company agreed to buy two million shares of a British company for GBP 110 million with settlement in one month. The spot price is CAD/GBP 1.7327, but the company is concerned that the CAD will depreciate against the GBP over the next month, and it would have to pay more in CAD, so it hedged the transaction. The CFO bought a call option to purchase GBP 110 million at a strike price of CAD/GBP 1.7327 that expires in one month. If the CAD did depreciate and the spot rate was CAD/GBP 1.7844 in one month, the Canadian company would pay CAD 196.284 million (110 million x 1.7844) to buy the shares but would also exercise the call option and receive a payout of CAD 5.687 million (110 million x (1.7844 – 1.7327)). The net cost of buying the shares would be CAD 190.597 million (CAD 196.284 million – CAD 5.687 million), which equals the CAD 190.597 million (110 million x 1.7327) they would have been paid initially if settlement had not been deferred. What if the CAD appreciated against the GBP and the spot rate was CAD/GBP 1.7100 in one month? The Canadian company would pay CAD 188.1 million (110 million x 1.7100) to buy the shares, but would not exercise the options contract as it would not be profitable. The net cost of buying the shares would only be CAD 188.1 million, which is lower than CAD 190.597 million.

The protection provided by call or put options is different from forward contracts. In the example, the buyer of the call option is protected from a depreciating currency but still benefits if it appreciates. Options must only be exercised if they are “in the money,” which means the buyer of the options makes a profit. If the options are “out of the money,” the buyer will not exercise them. Why would the other counterparty agree to write an option if they had to compensate the buyer if the exchange rate moved against them, but did not receive anything if the exchange rate moved in their favour? The answer is options are not free. Buyers must pay option writers a premium to fairly compensate them for having to pay out on some contracts. Options writers make money when the premiums received exceed the payouts.

Consider an example of a put option. A Canadian company sold an asset to a British company for GBP 10 million, and the transaction will be settled in one month. The spot price is CAD/GBP 1.7570, but the company is concerned that the GBP will depreciate over the next month, and it will receive less when it converts the proceeds into CAD. The CFO bought a put option to sell GBP 10 million at a strike price of CAD/GBP 1.7570 that expires in one month. If the GBP did depreciate and the spot rate was CAD/GBP 1.7350 in one month, the Canadian company would convert the GBP into CAD 17.350 million (10 million x 1.7350) but would also exercise the put option and receive a payout of CAD 0.22 million (10 million x (1.7570 – 1.7350). The net proceeds would be CAD 17.570 million (CAD 17.350 million + CAD 0.220 million), which equals the CAD 17.570 million (10 million x 1.7570) they would have received initially if payment was not deferred.

**Natural Hedges**

Managing a hedging program using derivative securities like forward contracts is expensive, and the instruments are often not available for longer periods. Some companies instead employ operational hedging strategies, or natural hedges, where they adjust their operations to manage the risk. For example, if a Canadian company has significant U.S. sales, it will experience a foreign exchange loss if the USD depreciates against the CAD. Instead of buying a forward contract to hedge this risk, the Canadian company could adjust its operations to borrow an equal amount in USD instead of CAD. A foreign exchange gain would be realized since it would take fewer CAD to pay back the USD loan. The foreign exchange gain and loss cancel out, and the company would save any hedging costs. This strategy is called cash flow matching and involves matching all cash inflows in another currency with an equal amount of cash outflows in the same currency.

Parties to a contract can also enter a currency risk-sharing contract where they agree to share exchange rate risk if rates fall outside a specific range. Remember, currency trading is a zero-sum game, so the winner pays the loser and neither party is better or worse off.

* 1. **| Hedging Interest Rate Risk**

**Interest Rate Swaps**

An interest rate swap is an agreement between two counterparties to exchange interest payments on different loans to hedge against or speculate on interest rate movements. Interest rate swaps can be:

**Fixed-for-floating.** One counterparty agrees to pay interest on a loan at a fixed interest rate in exchange for receiving interest on the same loan at a floating rate. This swap converts an existing floating-rate loan into a fixed-rate loan to lock in a fixed rate if the counterparty feels that interest rates in the economy are going to rise. This counterparty is hedging interest rate movements.

**Floating-for-fixed.** One counterparty agrees to pay interest on a loan at a floating interest rate in exchange for receiving interest on the same loan at a fixed interest rate. This swap converts an existing fixed-rate loan into a floating-rate loan if the counterparty feels that interest rates are going to fall. This counterparty is speculating on interest rate movements.

The counterparty paying the fixed rate, or fixed leg, is called the payer. The counterparty paying the floating rate, or float leg, is called the receiver. The loan’s principal is called the notional value, as it is only used to calculate the interest payments since there are no principal payments made in a swap. The length of a swap agreement is called the swap term. Interest payments are made on specified settlement dates, and the time between payments is the settlement period, which can be daily, weekly, monthly, quarterly, annually, or any other agreed-upon period. The interest payments made are netted for each period, so only the difference between the payments, or the net swap payment, is paid by one counterparty to the other. Each counterparty continues to make the interest and principal payments on their existing commercial loan, but when the net swap payments are included, the counterparty’s loans are converted to either the fixed-rate or floating-rate loans they wanted. The net interest payment is the interest paid to the commercial lender plus any net swap payments made, or less any net swap payments received. A fixed-for-floating swap, also called a “plain vanilla” swap, is the most common type of swap, as they are initiated by companies wanting to hedge interest rate movements by converting a floating-rate loan into a fixed-rate loan.

**Exhibit 10: Structure of a Fixed-for-Floating Swap**

Receives fixed leg

Receiver

Pays float leg

Swap rate



Notional value

Banker’s acceptance rate + Adjustment



Pays fixed leg

Payer

Receives float leg

Like with a currency swap, a company that wants to negotiate an interest rate swap approaches a dealer, usually a bank, who arranges an offsetting transaction with another party. These swaps trade over the counter, so they can be customized to meet the requirements of the counterparties. A fixed rate or swap rate is quoted by the dealer when the swap is first negotiated, which does not change over the life of the agreement. This rate is determined by the shape of the current yield curve. If short-term rates are expected to rise, the swap rate is higher as the receiver will pay higher floating rates, but if short-term rates are expected to fall, the swap rate will be lower as the receiver will pay less interest. The floating rate is also quoted by the dealer initially, but it varies over the life of the swap as market conditions change. In Canada, the benchmark for the floating rate is the banker’s acceptance rate plus an adjustment. The adjustment ensures the swap rate and floating rate are initially equal, as the counterparties will only swap interest payments if they are worth the same at the beginning of the agreement.

PV of interest on the floating-rate loan = PV of interest on the fixed-rate loan

Consider an example of a fixed-for-floating swap. Firm A has a 5-year, CAD 500,000 floating-rate commercial loan at the banker’s acceptance rate plus 100 bps. The company believes interest rates will rise, so it contacts a swap dealer to exchange its floating-rate loan for a fixed-rate loan with Firm B, which is paying 6.11% on a fixed-rate loan. The dealer quotes a swap rate of 6.11% and a floating rate equal to the current banker’s acceptance plus 100 bps. The swap term is five years with an annual settlement period. The banker’s acceptance rate was 4.90% and 5.55% at the end of the first and second years of the agreement.

Exhibit 11 shows the net swap and net interest payments for the first two years of the loan. Firm A (i.e., the payer) and Firm B (i.e., the receiver) have successfully swapped interest payments and converted their lending agreements into fixed-rate and floating-rate loans. In this example, the swap rate and the fixed rate on Firm B’s loan were the same, and so were the swap’s floating rate and the floating rate on Firm A’s loan. As a result, the swap worked out perfectly, with the payer’s net interest payment equaling the fixed leg they paid and the receiver’s net interest payment equaling the float leg they paid. In practice, there will be slight differences between these amounts so the hedge will not be perfect but still effective.

**Exhibit 11: Net Swap and Net Interest Payments**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Payer** | **Fixed Leg****Paid** | **Float Leg****Received** | **Net Swap Payment** | **Interest Payment** | **Net Interest Payment** |
| Year 1 | (30,550) | 29,500 | (1,050) | (29,500) | (30,550) |
| Year 2 | (30,550) | 32,750 | 2,200 | (32,750) | (30,550) |
| 500,000 x 0.0611 = 30,550500,000 x (0.0490 + 0.0100) = 29,500500,000 x (0.0555 + 0.0100) = 32,750 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Receiver** | **Float Leg Paid** | **Fixed Leg Received** | **Net Swap Payment** | **Interest Payment** | **Net Interest Payment** |
| Year 1 | (29,500) | 30,550 | 1,050 | (30,550) | (29,500) |
| Year 2 | (32,750) | 30,550 | (2,200) | (30,550) | (32,750) |

**Caps, Floors, and Collars**

Besides interest rate swaps, banks and other financial institutions provide clients with interest rate caps, floors, and collars to hedge fluctuating interest rates. A cap is an insurance policy on floating-rate debt. The notional principal is the loan amount being hedged, the term is the length of the cap agreement, and the cap or strike rate is the interest rate after which coverage begins. A cap pays out when a benchmark short-term variable rate, such as the Secured Overnight Financing Rate (SOFR) rises above the cap rate. The proceeds reduce the cost of borrowing on a floating-rate loan, so the company never pays more than the cap rate times the notional principal.

The size of the premium paid for cap insurance reflects several factors. The premium generally rises linearly with notional value, but very small caps have proportionately higher premiums because of fixed upfront administration costs, and large caps have proportionately higher premiums because of greater risk for the cap provider. Cap premiums also go up as the cap rate falls, interest volatility rises, the yield curve becomes steeper, meaning higher forward interest rates, and the term of the agreement increases – there is a higher probability that the cap provider will have to pay out on the agreement. Commercial lenders often require a borrower to purchase a cap on a floating-rate loan and assign it to them as added collateral.

Interest rate floors operate like caps, except investors are buying insurance against falling investment returns. A floor pays out when a benchmark short-term variable rate falls below the floor rate. An interest rate collar combines a cap and a floor, creating a band within which interests can fluctuate before any insurance coverage is paid. But why would a company buy a collar to hedge a variable-rate loan? They are protected from rising rates with the cap, but they would not benefit from falling rates with the floor. Insurance providers that sell collars construct them using a special type of option called an interest rate option. They buy interest rate call options that pay out when short-term rates rise above the call rate and write put options that they must pay out on when short-term rates fall below the floor rate. The premium paid for buying the interest rate call option is reduced by the premium earned from writing the interest rate put option, so the collar is sold at a lower premium than a cap alone. The purchaser of a collar on a floating-rate loan is giving away some of the benefits from falling rates to get more affordable coverage against rising rates.

* 1. **| Hedging Commodity Price Risk**

**Futures Market**

A futures contract is an agreement between two counterparties to buy or sell an underlying asset on a specified future date at a price agreed on today. The buyer is obligated to buy and take delivery of the asset, and the seller is obligated to sell and deliver the asset when the contract expires. The party that agrees to buy the commodity is said to be “long” and will benefit from rising prices. The party that agrees to sell the commodity is said to be “short” and will benefit from falling prices. A futures contract is like a forward contract, but there are several significant differences.

**Exhibit 12: Futures Versus Forwards**

|  |  |
| --- | --- |
| **Futures** | **Forwards** |
| Standardized contracts designed by an exchange | Customized contracts are negotiated between two parties through a financial institution |
| Trade publicly on an organized exchange | Not actively traded after the contract is originated |
| Daily price data available | No price data available |
| Exchange acts as a clearinghouse | No clearinghouse |
| Initial and maintenance margins required | No margin requirements |
| Daily settlement  | Settled at maturity |
| Physical delivery is rarely taken | Physical delivery is more common |

Futures contracts have standard terms and trade on organized futures exchanges where positions can be opened or closed at any time at the current market price. The exchange defines the contracts being traded, establishing the asset to be delivered, its grade, the size and notional amount of the contract, and the date, time, method, and location of delivery. These terms are the same for all market participants, so the contracts can be easily traded in public markets, providing greater market liquidity and pricing efficiency.

The futures exchange serves as a central clearinghouse, guaranteeing all transactions. When a futures contract is bought or sold, the exchange becomes the buyer to the seller and the seller to the buyer. This reduces the default or counterparty risk associated with the chance of a buyer or seller reneging on their obligations. Trading is also done anonymously, so the activities of hedgers and investors are hidden.

To further reduce default risk, the buyer and seller are each required to make an upfront deposit called an initial margin consisting of cash or other collateral when they open a position to cover any potential losses on the futures contract. The initial margin is determined by the futures exchange using simulation software that incorporates the maximum estimated daily change in the contract’s value - the riskier the underlying asset, the higher the margin required. The margin typically varies from 2.0% to 12.0% of the contract’s settlement value. Brokers who trade futures for clients on an exchange may charge a higher initial margin for newer or smaller accounts, but are not allowed to charge less.

As the value of the futures contract rises and falls each day, any gains or losses are added to or subtracted from a trader’s margin account. Each trader is required to maintain their margin requirement over the life of the contract and to make additional payments or margin calls if the account is deficient. The maintenance margin is the minimum amount that must be maintained at any given time and is less than the initial margin, usually 50% to 75%. The maintenance margin is below the initial margin, so a margin call will not be required immediately after the initial transaction if the price of the contract moves against a party. When the value of the margin account falls below the maintenance margin, the party must contribute additional collateral to bring the balance back to the initial margin. This process is called market-to-market or daily settlement and is done more often if the market for the underlying asset becomes highly volatile. Margin calls must be paid for on the same day. If they are not, the exchange reduces or closes out the position and demands immediate payment for what is owed.

For example, a company went long and agreed to buy 40,000 tonnes of canola by entering two future contracts for 20,000 tonnes each at a final settlement price of CAD 800 per metric ton. The initial margin is 5.0% of the settlement value of the contract, which is CAD 1,600,000 (i.e., 40,000 x CAD 800), and the maintenance margin is 75.0% of the initial margin or CAD 1,200,000. The spot or cash prices of canola over the first four days were CAD 801, CAD 802, CAD 785, and CAD 786. Exhibit 10 contains the daily settlements and margin calls.

**Exhibit 13: Market to Market (CAD)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Day** | **Spot Price** | **Daily Gain or Loss** | **Margin Account Balance** |
| 0 | 800 | 40,000 x 800 x 0.05 = 1,600,000 | 1,600,000 |
| 1 | 801 | 40,000 x (801 - 800) = 40,000 | 1,640,000 |
| 2 | 802 | 40,000 x (802 – 801) = 40,000 | 1,680,000 |
| 3 | 785 | 40,000 x (785 – 801) = -640,000 | 1,040,000 |
| Maintenance margin 1,600,000 x 0.75 = 1,200,000Margin call 1,600,000 – 1,040,000 = 560,000 | 1,600,000 |
| 4 | 786 | 40,000 x (786 – 785) = 40,000 | 1,640,000 |

Once a futures contract expires, the buyer or seller can either physically receive or deliver the amount of the underlying asset or make a cash settlement. In practice, physical delivery rarely occurs except for some commodities, and many exchanges do not allow it; instead, the counterparties close out their positions by making an offsetting transaction just before the final trading day. The remaining balance of the margin account is refunded or applied to another trade. For some futures contracts like stock index futures, the underlying asset cannot be physically delivered, so only cash settlement is possible. Traders can also close out a futures position at any time before final settlement by making an offsetting transaction.

Future exchanges will write contracts for nearly any underlying asset if there is sufficient interest from hedgers and speculators due to price volatility. New contracts are constantly being added while others are dropped. Futures contracts are traditionally divided into commodity futures and financial futures. Commodity futures have been traded since the mid-1800s and are available on a variety of agricultural, metal, and energy products. Financial futures first traded in the early 1970s with currency, then interest rate and stock-based contracts. The volume of the financial futures market now greatly exceeds the commodity futures market.

**Exhibit 14: Types of Future Contracts**

|  |  |
| --- | --- |
| Agricultural futures | Wheat, oats, soybeans, corn, rice, canola, frozen orange juice, milk, lean hogs, live cattle, feeder cattle, coffee, cocoa, sugar, ethanol, palm oil, fertilizer, cotton, wool, rubber |
| Energy futures | Crude oil, heating oil, natural gas, propane, gasoline, electricity |
| Metal futures | Gold, steel, copper, lead, zinc, tin, nickel, cobalt, molybdenum, aluminum, palladium, platinum, lumber, wood pulp |
| Financial futures | Individual currencies, currency indexes, individual stocks, stock market indexes, short-term and long-term interest rates |

There are over 90 future exchanges worldwide offering competing products. They operate either as for-profit companies or non-profit, member-owned organizations using mainly electronic trading platforms, although some exchanges still use floor trading with open outcry. Since 2000, many of the future exchanges have merged with or been acquired by larger financial services conglomerates that also provide stock and option trading and other financial services. CME Group, based in Chicago, is now the world’s largest futures exchange and operates the historic Chicago Board of Trade (founded in 1848), Chicago Mercantile Exchange (founded in 1898), and New York Mercantile Exchange (founded in 1882). Canada’s Montreal Exchange trades futures and [options](https://en.wikipedia.org/wiki/Option_%28finance%29) on equities, indices, currencies, ETFs, energy and interest rates and is owned by the TSX. The Canadian Derivatives Clearing Corporation (CDCC) is a subsidiary of the Montreal Exchange. The Winnipeg Commodities Exchange was acquired by U.S.-based Intercontinental Exchange (ICE) in 2007, which continues to trade Canadian contracts for milling [wheat](https://en.wikipedia.org/wiki/Wheat), [durum](https://en.wikipedia.org/wiki/Durum) wheat, western [barley](https://en.wikipedia.org/wiki/Barley), and [canola](https://en.wikipedia.org/wiki/Canola).

**Price Quotations**

Futures are standardized contracts that trade publicly on organized exchanges. Each exchange designs its own contracts, oversees its trading, and provides the public with a description along with real-time pricing and volume data. Exhibit 14 defines some key terminology.

**Exhibit 15: Futures Contract Terminology**

|  |  |
| --- | --- |
| Name of contract | Description of the underlying asset being bought and sold |
| Contract code | Two-character code for the contract |
| Exchange | Exchange where the contract trades |
| Contract size | Standard size of the contract |
| Contract value | Size of the contract times the current market price |
| Minimum tick | Minimum fluctuation in the price of one futures contract unit |
| Tick value | Minimum fluctuation in the value of one futures contract |
| Initial/maintenance margins | Collateral required |
| Final settlement price | Price at which the contract will be settled at expiration |
| Delivery or expiration date | Date of final settlement when the underlying asset is delivered or cash settlement is made |
| Delivery method | Physical delivery or cash settlement |
| Open | Price of the first transaction of the current trading session |
| High | High price of the current trading session |
| Low | Low price of the current trading session |
| Close or settlement price | Closing price of the current trading session |
| Last | Most recent transaction of the current trading session |
| Change | Change in the closing price of the current and previous trading sessions given as an absolute amount or as a percentage. If trading is live, it is the change between the last price of the current trading session and the closing price of the previous trading session. |
| 52-Week High/Low | Highest and lowest prices in the last year |
| Volume  | Number of contracts traded during the current trading session |
| Open Interest | Number of outstanding contracts |

Futures contracts have a standard size, such as 1,000 barrels, but smaller micro and mini versions of the same contract are sometimes available for smaller investors. Each contract has a minimum price fluctuation called a minimum tick. Ticks are set by the exchanges and vary depending on the type and size of the contract and the requirements of the market. The smaller the tick, the greater the potential for profit or loss on a trade, and the tighter the bid-ask spread, which lowers transaction costs. For example, if a futures contract denoted in CAD has a tick of .0025, that means the price of one contract unit can rise or fall by one-quarter of one cent. If the contract size is 10,000 units, the value of the futures contract can fluctuate by a minimum of CAD 25 (10,000 x .0025). This is called the tick value.

New York Mercantile Exchange (NYMEX) is a major commodity futures exchange also owned by the CME Group. It offers the NYMEX West Texas Intermediate (WTI) Crude Oil futures, the world’s most traded crude oil contract. Exhibit 15 contains a description of the contract that might be provided by NYMEX or a broker that places orders for clients on the exchange.

**Exhibit 16: NYMEX WTI Crude Oil**

|  |  |
| --- | --- |
| Contract | WTI Crude Oil |
| Exchange | NYMEX |
| Exchange symbol | CL |
| Contract size | 1,000 barrels |
| Price quotation | U.S. dollar and cents per barrel |
| Tick size/value | 1 cent per barrel or USD 10.00 per contract |
| Trading hours | Sunday 5:00 p.m. to Friday 4:00 p.m. with a 60-minute break at 4:00 p.m. each day |
| Initial/maintenance margins | USD 6,380 / USD 5,800 |
| Listed contracts | Monthly contracts for the next 10 years and two additional monthly contracts |
| Last trading day | Trading terminates at the close of business on the third business day before the 25th calendar day of the month preceding the delivery month |
| Settlement method | Delivery |
| Grade and quality | Light sweet crude |
| Delivery procedures | Delivery at a pipeline or storage facility in Cushing, OK, or by an alternative arrangement acceptable to the buyer |
| Delivery period | Available in Cushing, OK, on the first calendar day of the month of delivery for delivery anytime during the month and the title is transferred when payment is received. |

Exchanges may use a special notation to quickly describe what a contract is for and when it expires. For example, the WTI Crude Oil contract’s notation CLZ24 means:

|  |  |  |
| --- | --- | --- |
| **Contract Code** | **Expiration Month** | **Expiration Year** |
| CL | Z | 24 |

Instead of numbering the months, these letters are used:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **JAN** | **FEB** | **MAR** | **APR** | **MAY** | **JUN** | **JUL** | **AUG** | **SEP** | **OCT** | **NOV** | **DEC** |
| F | G | H | J | K | M | N | Q | U | V | X | Z |

Exhibit 16 provides select price and volume quotations for the WTI Crude Oil (CL) contracts expiring in September, October, November, and December of 2023. As noted in Exhibit 15 under Listed Contracts, contracts are offered that expire each month over the next ten years so that companies can hedge the price of WTI crude oil for up to 10 years. For other commodities, contracts may only be available for certain months depending on the needs of investors. For example, the canola contracts offered by Intercontinental Exchange (ICE) expire each January, March, May, July, and November.

**Exhibit 17: Price and Volume Quotations**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Contract** | **Last** | **Change** | **Open** | **High** | **Low** | **Previous** | **Volume** | **Open Interest** |
| CLU23 |  82.73 | +1.18 | 81.73 | 83.24 | 81.51 | 81.55 | 262,366 | 331,246 |
| CLV23 | 82.16 | +1.08 | 81.22 | 82.66 | 81.04 | 81.08 | 82,776 | 227,918 |
| CLX23 | 81.63 | +1.02 | 80.79 | 82.11 | 80.56 | 80.61 | 42,985 | 135,476 |
| CLZ23 | 81.09 | +0.97 | 80.18 | 81.53 | 80.05 | 80.12 | 72,109 | 234,824 |
| August 4, 2023, at 13:18 CT |

**Hedging Using Futures Contracts**

Hedging involves buying or selling futures contracts to protect against the risk of changing prices. There are two types of hedges:

**Short hedge.** This hedge is used when a business plans to sell assets in the future but wants to protect itself from the risk that prices may fall in the interim. The company could be growing wheat that will not be ready to harvest for several months or have bundles of finished lumber at its sawmills waiting to be sent to home improvement stores in anticipation of high seasonal demand. To hedge these transactions, a business goes “short” and agrees to sell the assets in the future at a specified price. When the company “shorts” the asset, it profits from falling prices, which compensates for the lower prices received when the assets are eventually sold. The business was able to lock in the future price, eliminating a potential decline in revenues.

For example, a mining company has 100,000 pounds of copper inventory that it plans to sell in three months, but it is concerned that the spot price will fall. It purchased four 25,000-pound copper futures contracts with delivery in three months at a final settlement price of USD 3.8365. If the spot price were USD 2.2104 on the final settlement date, the company would gain USD 162,610 ((3.8365 – 2.2104) x 25,000 x 4) on the futures contract when the position is closed out which would cover its losses of USD 162,610 ((2.2104 – 3.8365) x 25,000 x 4) from holding the copper and later selling it at a lower spot price in the cash market. The spot or cash price is the price at which the underlying assets can be bought or sold today. When the underlying asset is bought or sold for cash or other consideration, the trader is said to be operating in the cash market.

**Long hedge.**  This hedge is used when a business plans to buy assets like raw materials in the future but wants to protect itself from the risk that prices may rise in the interim. To hedge these transactions, a business goes “long” in the futures market and agrees to buy the assets in the future at a specified price. When the business goes “long,” it profits from rising prices, which compensate for the higher prices paid when the assets are eventually purchased. The company was able to lock in the future price, thus eliminating a potential increase in costs.

For example, a flour mill needs 100,000 bushels of milling wheat in three months, but it is concerned that the spot price may rise. It purchased twenty 5,000-bushel milling wheat futures contracts with delivery in three months at a final settlement price of USD 8.8903. If the spot price were USD 11.5293 on the final settlement date, the company would gain USD 263,900 ((11.5293 – 8.8903) x 5,000 x 20) on the futures contracts when the position is closed out which would cover its losses of USD 263,900 ((11.5293 – 8.8903) x 5,000 x 20) from having to pay more when it buys the milling wheat at a higher spot price in the cash market.

These two examples of short and long hedges perfectly compensated the hedger because a futures contract was available for the exact commodity in the appropriate grade. What if the right contract was not available? For example, jet fuel is the second biggest cost for an airline after the cost of buying or leasing planes. If the airline wanted to hedge jet fuel prices, it could not do so perfectly, as no jet fuel contract exists. An alternative would be to use cross-hedging, where a futures contract for a similar commodity, like heating oil, is substituted. Jet fuel and heating oil prices are highly correlated but not perfectly correlated, so the hedge is not perfect. The airline would continue to be exposed to some risk from fluctuating prices called basis risk.

The hedge ratio (h) compares the value of a position being hedged to the value of the entire position.

h = $\frac{Hedge value}{Total position value}$

A hedge ratio of 1.0 means the position is fully hedged against the risk of changing prices. This is only true if the asset being hedged is the same as the underlying asset in the futures contract, which means there is no basis risk. If a contract for the exact commodity cannot be found and cross-hedging is used, the optimal hedge ratio (h\*) is:

h\* =$ρ ( \frac{σ\_{s}}{σ\_{f}} ) $

$ρ$ - Correlation coefficient of changes in the future and spot price

$σ\_{s}$ - Standard deviation of the changes in spot price (s)

$σ\_{f}- $Standard deviation of the changes in futures price (f)

The optimal hedge ratio, also known as the minimum-variance hedge ratio, determines when the variability of the value of the hedged position is minimized. Referring to the formula, this ratio increases as the price of the asset being hedged becomes more variable ($σ\_{s})$ to the underlying asset ($σ\_{f}) $and the correlation coefficient between the two assets ($ρ$) increases. This means price changes are more likely to occur at the same time and less likely to cancel each other out. The optimal number of contacts (n) that should be purchased to hedge a position is:

n = h\* ($\frac{Size of position being hedged}{Size of contract}$)

As the size of the optimal hedge ratio increases, so does the number of contracts needed to hedge the position.

**Hedging Using Options Contracts**

Options give the holder the right, but not the obligation, to buy or sell an asset at an agreed-upon exercise price or strike price on or before the expiry date. If a company plans to buy a commodity in the future and is concerned about rising prices, it can hedge its position by purchasing a call option that allows it to buy the commodity in the future at a strike price agreed on today. If a company plans to sell a commodity in the future and is concerned about falling prices, it can hedge its position by purchasing a put option that allows it to sell the commodity in the future at a strike price agreed on today. An American option can be exercised at any time before the expiration date, while a European option can only be exercised on the expiration date.

Futures and options are alternative ways to hedge against unfavourable price changes.

**Exhibit 18: Futures Versus Options**

|  |  |  |
| --- | --- | --- |
|  | **Futures** | **Options** |
| Buying the commodityExpect a price increase | Long futures contract | Purchase a call option |
| Selling the commodityExpect a price decrease | Short futures contract | Purchase a put option |

The difference between futures and options is that there is no cost to enter into a futures contract, but there is for an options contract. If a company plans to buy a commodity and expects prices to rise, it could hedge its position by going “long” in the futures market and agreeing to buy the commodity at the final settlement price. When a company goes “long,” it profits on the futures contract if the spot price rises above the final settlement price, which compensates for the higher spot price it must pay when the commodity is later purchased on the cash market. But what if the price unexpectedly falls below the final settlement price? The company would experience a loss on the futures contract, but this is compensated for by the lower spot price it pays when the commodity is later purchased on the cash market. When going “long” in the futures market, the hedger is protected from price increases but pays for that protection by giving up any potential gains from price decreases. This is why there is no cost to enter into a futures contract.

The protection provided by a call or put option is different from a futures contract. The holder of a call option is protected from rising commodity prices but still benefits if prices fall. An option will only be exercised if the spot price rises above the strike price and the option is “in the money,” which means the holder of the option makes a profit when the contract is exercised. If the option is “out of the money,” the holder will not exercise it but will benefit from lower spot prices when the commodity is eventually purchased in the cash market. Why would the other counterparty agree to write an option if they had to compensate the holder if the price moved against the writer, but did not receive anything if the price moved in the writer’s favour? The answer is that the option is not free. Option holders must pay option writers a premium to compensate the writer for having to pay out on some contracts. Options writers make money when the premiums received exceed the payouts made to option holders. Companies may decide to use call options instead of futures to hedge commodity risk if they think the premiums will be less than what they will gain if spot prices fall. The logic is similar for put options.

**Call options.** A flour mill needs 100,000 bushels of milling wheat in three months, but it is concerned that the spot price may rise. It purchased twenty 5,000-bushel milling wheat call options contracts with a premium of USD 0.4439 per bushel. Delivery is in three months at a strike price of USD 8.8903 per bushel. If the spot price were USD 11.5293 per bushel on the expiry date, the options contracts would be “in the money” and the company would gain USD 219,510 ((11.5293 – 8.8903 – 0.4439) x 5,000 x 20) when the position is closed. This approximately covers its losses of USD 263,900 ((11.5293 – 8.8903) x 5,000 x 20) from having to pay more when it buys the milling wheat at a higher spot price on the cash market. The difference is due to the premium costs of USD 44,390 (0.4439 x 5,000 x 20). What if the price fell to a spot price of 7.1300? The options contracts would be “out of the money,” so they would not be exercised, and the company would gain USD 123,640 ((8.8903 - 7.1300 – 0.4439) x 5,000 x 20) when it buys the milling wheat at a lower spot price on the cash market. This includes the premium costs.

**Put options.** A mining company has 100,000 pounds of copper inventory that it plans to sell in three months, but it is concerned that the spot price will fall. It purchased four 25,000-pound copper put option contracts with a premium of USD 0.1918 per pound. Delivery is in three months at a strike price of USD 3.8365 per pound. If the spot price were USD 2.2104 per pound on the expiry date, the options contracts would be “in the money” and the company would gain USD 143,430 ((3.8365 – 2.2104 – 0.1918) x 25,000 x 4) when the position is closed. This approximately covers its losses of USD 162,610 ((2.2104 – 3.8365) x 25,000 x 4) from holding the copper and later selling it at a lower spot price in the cash market. The difference is due to the premium costs of USD 19,180 (0.1918 x 25,000 x 4). What if the price rose to a spot price of USD 4.9256 per pound? The options contracts would be “out of the money,” so they would not be exercised, and the company would gain USD 89,730 ((4.9256 – 3.8365 – 0.1918) x 25,000 x 4) when it sells the copper at a higher spot price on the cash market. This includes the premium costs.

Options contracts are traded over the counter or through organized exchanges, like forwards and futures. Over-the-counter options or dealer options trade between two private parties, so they can be customized to suit their specific needs. There is no market-to-market for over-the-counter options, but the parties are often required to deposit collateral to reduce default risk. Exchange-traded options trade alongside futures on combined futures-options exchanges. These options contracts are standardized, and real-time price data is available. The exchange designs the contracts and assumes both sides of any transactions through its central clearinghouse to ensure fulfillment. The contract holder only pays the premium upfront, but option writers need to pledge collateral that varies with the riskiness of their trading strategies.

**Hedging Using Backward Integration, Storage, and Long-term Contracts**

Backward integration is when a parent company buys one or more of its suppliers. The supplier profits if commodity prices rise, but this is offset by higher costs at the parent company, eliminating any commodity price risk. An example of an integrated business is an oil company that engages in exploration and development but also refines its own crude and then distributes it to customers through a chain of gasoline stations and convenience stores. Previously, tire producers also owned rubber plantations, and auto manufacturers produced all of their own parts. This hedging strategy sounds simple, but there are hidden costs. The parent company typically pays a substantial premium when acquiring the supplier and is generally not experienced in operating the business, leading to inefficiencies. Today, companies are focusing on their core business and becoming more flexible by adopting strategies like just-in-time inventory and contracting out. Many integrated oil companies have divided themselves into separate production and retail units, tire companies no longer own rubber plantations, and auto companies only produce key components like engines and transmissions and sub-contract the rest.

If a manufacturer’s material costs are expected to rise, it could purchase inventory today at a lower price and store it until it is needed instead of going long and buying a futures contract. Again, this strategy seems simple, but inventory financing and storage costs are high and likely to consume any savings.

A better alternative to either backward integration or storage is to negotiate long-term supply contracts. These contracts offer several advantages to both parties. In addition to stable prices, they lower ordering costs by improving communications and reducing the number of suppliers. They also minimize supply chain disruptions by guaranteeing a secure source of supply. Commodity futures and options offer similar benefits as long-term supply contracts, assuming an appropriate contract can be found. The use of commodity swaps is growing in importance.