chapter 23

Derivatives and Risk Management

Bombardier Inc., a manufacturer of snowmobiles in Montreal, has always tried to control risks. However, its snowmobile division's profits depend on a risk that is notoriously hard to control: the weather. Early signs of a cold, snowy winter lead to a brisk sellout, whereas warmer temperatures force Bombardier to cut prices to shed excess inventory.

Bombardier can't change the weather, but it does its best to manage its weather-related risks. For example, one winter the company offered to pay a $1,000 rebate to snowmobile buyers in 16 Midwestern cities if the area snowfall that winter turned out to be less than one-half the average snowfall over the previous 3 years. Not surprisingly, the rebate led to higher sales. Bombardier then took an important step to limit its risks—it bought "snowfall options." For each snowmobile sold, Bombardier paid an option writer between $45 and $400, depending on the city in which the snowmobile was purchased. In return, the option writer fully reimbursed Bombardier each time it had to pay a customer the $1,000 rebate.

These snowfall options are just one example of "weather derivatives," a small but rapidly growing market. The Chicago Mercantile Exchange (CME) now trades a large number of weather-based futures and options contracts. Some of these contracts are based on the average monthly temperature, some on snowfall, and some on the number of frost days. Contracts are available for the weather in a variety of U.S. and international cities, from Des Moines to Berlin to Tokyo. Not surprisingly, many participants are electric and gas utilities whose earnings depend on weather.

Weather derivatives represent just one of many approaches companies can use to control risk. As you read this chapter, try to answer these questions: Why should a company try to manage its risks? What financial techniques can be used to manage risk? Can programs designed to limit risks actually increase them, and if so, what safeguards should companies put in place to prevent this unintended consequence?

Sources: Mark Golden and Ed Silliere, "Weather Derivatives Are Becoming a Popular Hedge," *The Wall Street Journal,* February 2, 1999, B9A; and the Chicago Mercantile Exchange, **http://www.cme.com.**

In this chapter, we discuss risk management, a topic of increasing importance to financial managers. The term *risk management* can mean many things, but in business it involves identifying events that could have adverse financial consequences and then taking actions to prevent and/or minimize the damage caused by these events. Years ago, corporate risk managers dealt primarily with insurance—they made sure the firm was adequately insured against fire, theft, and other casualties, and that it had adequate liability coverage. More recently, the scope of risk management has been broadened to include such things as controlling the costs of key inputs like petroleum by purchasing oil futures, or protecting against changes in interest rates or exchange rates through transactions in the interest rate or foreign exchange markets. In addition, risk managers try to ensure that actions intended to hedge against risk are not actually increasing risks.

Also, since the September 11, 2001, attacks on the World Trade Center and Pentagon, insurance against terrorist attacks has become a major issue. Unless possible terrorist targets—including large malls, office buildings, oil refineries, airlines, and ships—can be insured against attacks, lenders may refuse to provide mortgage financing, and that would crimp the economy. Private insurance companies are reluctant to insure these projects, at least without charging prohibitive premiums, so the federal government has been asked to step in and provide terrorist insurance. Normally, it is best to have private projects insured by private insurance, because then risk-reducing actions will be taken to hold down insurance costs.[1] However, losses due to terrorist attacks are potentially so large that they could bankrupt even strong insurance companies. How this new risk should be dealt with is currently being debated in Washington and around the world.

e-resource

The textbook's Web site contains an *Excel* file that will guide you through the chapter's calculations. The file for this chapter is ***FM12 Ch 23 Tool Kit.xls***, and we encourage you to open the file and follow along as you read the chapter.

23.1 Reasons to Manage Risk

We know that investors dislike risk. We also know that most investors hold well-diversified portfolios, so at least in theory the only "relevant risk" is systematic risk. Therefore, if you asked corporate executives what type of risk worries them most, you might expect their answer to be "beta." However, this is almost certainly not the answer you would get. The most likely answer, if you asked a CEO to define risk, would be similar to this: "Risk is the possibility that our future earnings and free cash flows will be significantly lower than we expect." For example, consider Plastics Inc., which manufactures dashboards, interior door panels, and other plastic components used by auto companies. Petroleum is the key feedstock for plastic and thus makes up a large percentage of its costs. Plastics has a 3-year contract with an auto company to deliver 500,000 door panels each year, at a price of $20 each. When the company recently signed this contract, oil sold for $50 per barrel, and oil was expected to stay at that level for the next 3 years. If oil prices fell during this time, Plastics would have higher than expected profits and free cash flows, but if oil prices rose, profits would fall. Since Plastics' value depends on its profits and free cash flows, a change in the price of oil would cause stockholders to earn either more or less than they anticipated.

[1]Most insurance policies exclude claims that result from acts of war. Now claims based on terrorist attacks are also being excluded from new policies.

Corporate Valuation and Risk Management

Risk management can reduce firm risk, leading to a lower cost of capital. In some instances, derivatives such as swaps can actually reduce the effective interest rate paid by a corporation, again reducing its cost of capital.

$$\text{Value} = \frac{\text{FCF}_1}{(1 + \text{WACC})^1} + \frac{\text{FCF}_2}{(1 + \text{WACC})^2} + \frac{\text{FCF}_3}{(1 + \text{WACC})^3} + \cdots + \frac{\text{FCF}_\infty}{(1 + \text{WACC})^\infty}$$

Now suppose that shortly after signing the contract with its door panel supplier, Plastics announces that it plans to lock in a 3-year supply of oil at a guaranteed price of $50 per barrel, and the cost of getting the guarantee is zero. Would that cause its stock price to rise? At first glance, it seems that the answer should be yes, but maybe that's not correct. Recall that the value of a stock depends on the present value of its expected future free cash flows, discounted at the weighted average cost of capital (WACC). Locking in the cost of oil will cause an increase in Plastics' stock price if and only if (1) it causes the expected future free cash flows to increase or (2) it causes the WACC to decline.

Consider first the free cash flows. Before the announcement of guaranteed oil costs, investors had formed an estimate of the expected future free cash flows, based on an expected oil price of $50 per barrel. Therefore, while locking in the cost of oil at $50 per barrel will lower the riskiness of the expected future free cash flows, it might not change the expected *size* of these cash flows, because investors already expected a price of $50 per barrel. Note, though, that declining cash flows can disrupt a firm's operation, and that disruption can in turn adversely affect cash flows.

Now what about the WACC? It will change only if locking in the cost of oil causes a change in the cost of debt or equity, or the target capital structure. Assuming the foreseeable increases in the price of oil were not enough to raise the threat of bankruptcy, Plastics' cost of debt should not change, and neither should its target capital structure. Regarding the cost of equity, recall from Chapter 6 that most investors hold well-diversified portfolios, which means that the cost of equity should depend only on systematic risk. Moreover, even though an increase in oil prices would have a negative effect on Plastics' stock price, it would not have a negative effect on all stocks. Indeed, oil producers should have higher than expected returns and stock prices. Assuming that Plastics' investors hold well-diversified portfolios, including stocks of oil-producing companies, there would not appear to be much reason to expect its cost of equity to decrease. The bottom line is this: If Plastics' expected future cash flows and WACC will not change significantly due to an elimination of the risk of oil price increases, then neither should the value of its stock.

We discuss futures contracts and hedging in detail in the next section, but for now let's assume that Plastics has *not* locked in oil prices. Therefore, if oil prices increase, its stock price will fall. However, if its stockholders know this, they can build portfolios that contain oil futures whose values will rise or fall with oil prices and thus offset changes in the price of Plastics' stock. By choosing the correct amount of futures contracts, investors can thus "hedge" their portfolios and

completely eliminate the risk due to changes in oil prices. There will be a cost to hedging, but that cost to large, sophisticated investors should be about the same as the cost to Plastics. Since stockholders can hedge away oil price risk themselves, why should they pay a higher price for Plastics' stock just because the company itself hedged away the risk?

The points raised above notwithstanding, companies clearly believe that active risk management is important. A 1998 survey reported that 83% of firms with market values greater than $1.2 billion engage in risk management, and that percentage is surely much higher today.[2] Here are several reasons companies manage risks:

1. *Debt capacity*. Risk management can reduce the volatility of cash flows, which decreases the probability of bankruptcy. As we discussed in Chapter 16, firms with lower operating risks can use more debt, and this can lead to higher stock prices due to the interest tax savings.
2. *Maintaining the optimal capital budget over time*. Recall from Chapter 16 that firms are reluctant to raise external equity due to high flotation costs and market pressure. This means that the capital budget must generally be financed with debt plus internally generated funds, mainly retained earnings and depreciation. In bad years, internal cash flows may be too low to support the optimal capital budget, causing firms to either slow investment below the optimal rate or else incur the high costs associated with external equity. By smoothing out the cash flows, risk management can alleviate this problem. This issue is most relevant for firms with large growth opportunities. A recent study by Professors Gerald Gay and Jouahn Nam found that such firms do in fact use derivatives more than low-growth firms.[3] Thus, maintaining an optimal capital budget is an important determinant of firms' risk management practices.
3. *Financial distress*. The stages of financial distress can range from stockholder concern, to higher interest rates on debt, to customer defections, to bankruptcy. Any serious level of financial distress causes a firm to have lower cash flows than expected. Risk management can reduce the likelihood of low cash flows, hence of financial distress.
4. *Comparative advantages in hedging*. Most investors cannot hedge as efficiently as a company. First, firms generally have lower transactions costs due to a larger volume of hedging activities. Second, there is the problem of asymmetric information—managers know more about the firm's risk exposure than outside investors; hence managers can create more effective hedges. And third, effective risk management requires specialized skills and knowledge that firms are more likely to have.
5. *Borrowing costs*. As discussed later in the chapter, firms can sometimes reduce input costs, especially the interest rate on debt, through the use of derivative instruments called "swaps." Any such cost reduction adds value to the firm.
6. *Tax effects*. The present value of taxes paid by companies with volatile earnings is higher than the present value of taxes paid by stable companies due to the treatment of tax credits and the rules governing corporate loss carryforwards and carrybacks. Moreover, if volatile earnings cause a company to declare

[2]See Gordon M. Bodnar, Gregory S. Hayt, and Richard C. Marston, "1998 Wharton Survey of Financial Risk Management by U.S. Non-Financial Firms," *Financial Management*, Winter 1998, pp. 70–91.
[3]See Gerald D. Gay and Jouahn Nam, "The Underinvestment Problem and Corporate Derivatives Use," *Financial Management*, Winter 1998, pp. 53–69.

bankruptcy, then the company usually completely loses its tax loss carryforwards. Therefore, using risk management to stabilize earnings can reduce the present value of a company's tax burden.[4]

7. *Compensation systems*. Many compensation systems establish "floors" and "ceilings" on bonuses, and also reward managers for meeting targets. To illustrate, suppose a firm's compensation system calls for a manager to receive no bonus if net income is below $1 million, a bonus of $10,000 if income is between $1 million and $2 million, and one of $20,000 if income is $2 million or more. Moreover, the manager will receive an additional $10,000 if actual income is at least 90% of the forecasted level, which is $1 million. Now consider the following two situations. First, if income is stable at $2 million each year, the manager gets a $30,000 bonus each year, for a 2-year total of $60,000. However, if income is zero the first year and $4 million the second, the manager gets no bonus the first year and $30,000 the second, for a 2-year total of $30,000. So, even though the company has the same total income ($4 million) over the 2 years, the manager's bonus is higher if earnings are stable. Therefore, even if hedging does not add much value for stockholders, it may still benefit managers.

Since perhaps the most important aspect of risk management involves derivative securities, the next section explains **derivatives,** which are securities whose values are determined by the market price of some other asset. Derivatives include *options*, which we discussed in Chapter 9, whose values depend on the price of some underlying asset; *interest rate and exchange rate futures and swaps*, whose values depend on interest rate and exchange rate levels; and *commodity futures*, whose values depend on commodity prices.

SELF-TEST

Explain why finance theory, combined with well-diversified investors and "homemade hedging," might suggest that risk management should not add much value to a company.

List and explain some reasons companies might actually employ risk management techniques.

23.2 Background on Derivatives

See the Chicago Board of Trade's Web site, **http://www.cbot.com,** for a wealth of information on the operation and history of the exchange.

A historical perspective is useful for studying derivatives. One of the first formal markets for derivatives was the futures market for wheat. Farmers were concerned about the price they would receive for their wheat when they sold it in the fall, and millers were concerned about the price they would have to pay. Each party soon realized that the risks they faced could be reduced if they established a price earlier in the year. Accordingly, mill agents began going out to the Wheat Belt with contracts that called for the farmers to deliver grain at a predetermined price, and both parties benefited from the transaction in the sense that their risks were reduced. The farmers could concentrate on growing their crop without worrying about the price of grain, and the millers could concentrate on their milling operations. Thus, *hedging with futures* lowered aggregate risk in the economy.

These early futures dealings were between two parties who arranged transactions between themselves. Soon, though, intermediaries came into the picture,

[4]See Clifford W. Smith and René Stulz, "The Determinants of Firms' Hedging Policies," *The Journal of Financial and Quantitative Analysis*, December 1985, pp. 395–406.

and *trading* in futures was established. The Chicago Board of Trade, founded in 1848, was an early marketplace where *futures dealers* helped make a market in futures contracts. Thus, farmers could sell futures on the exchange, and millers could buy them there. This improved the efficiency and lowered the cost of hedging operations.

A third group—*speculators*—soon entered the scene. As we see in the next section, most derivatives, including futures, are highly leveraged, meaning that a small change in the value of the underlying asset will produce a large change in the price of the derivative. This leverage appealed to speculators. At first blush, one might think that the appearance of speculators would increase risk, but this is not true. Speculators add capital and players to the market, which tends to stabilize the market. Of course, derivatives markets are inherently volatile due to the leverage involved; hence risk to the speculators themselves is high. Still, the speculators bear much of the risk, which makes the derivatives markets more stable for hedgers.

Natural hedges, defined as situations in which aggregate risk can be reduced by derivatives transactions between two parties (called *counterparties*), exist for many commodities, for foreign currencies, for interest rates on securities with different maturities, and even for common stocks where investors want to "hedge their bets." Natural hedges occur when futures are traded between cotton farmers and cotton mills, copper mines and copper fabricators, importers and foreign manufacturers for currency exchange rates, electric utilities and coal mines, and oil producers and oil users. In all such situations, hedging reduces aggregate risk and thus benefits the economy.

Hedging can also be done in situations in which no natural hedge exists. Here one party wants to reduce some type of risk, and another party agrees to write a contract that protects the first party from that specific event or situation. Insurance is an obvious example of this type of hedge. Note, though, that with nonsymmetric hedges, risks are generally *transferred* rather than *eliminated*. Even here, though, insurance companies can reduce certain types of risk through diversification.

The derivatives markets have grown more rapidly than any other major market in recent years, for a number of reasons. First, analytical techniques such as the Black-Scholes Option Pricing Model, which was discussed in Chapter 9, have been developed to help establish "fair" prices, and having a good, transparent basis for pricing hedges makes the counterparties more comfortable with deals. Second, computers and electronic communications make it much easier for counterparties to deal with one another. Third, globalization has greatly increased the importance of currency markets and the need for reducing the exchange rate risks brought on by global trade. Recent trends and developments are sure to continue if not accelerate, so the use of derivatives for risk management is bound to grow.[5]

SELF-TEST

What is a "natural hedge"? Give some examples of natural hedges.

List three reasons the derivatives markets have grown more rapidly than any other major market in recent years.

[5]For more information on the derivatives markets, see Don M. Chance, *An Introduction to Derivatives and Risk Management* (Mason, OH: Thomson/South-Western, 2004); and Alger B. "Duke" Chapman, "Future of the Derivatives Markets: Products, Technology, and Participants," *Financial Practice and Education*, Fall/Winter 1994, pp. 124–128.

23.3 Derivatives in the News

Although derivatives are very important tools for corporate risk management, they also have a potential downside. These instruments are highly leveraged, so small miscalculations can lead to huge losses. They are also complicated and misunderstood by most people. This makes mistakes more likely than with less complex instruments and, importantly, it makes it harder for a firm's top management to understand and exercise proper control over derivatives transactions. This potential for miscalculation and misuse has led to some highly publicized losses for some large and well-respected companies in the past several years. Procter & Gamble (P&G), Gibson Greetings, Metallgesellschaft, Barings Bank, Long Term Capital Management (LTCM), Enron, and Orange County, California, all experienced losses that were either attributed to or associated with inappropriate use of derivatives. In the Barings Bank case, one relatively low-level 28-year-old employee operating in the Far East entered into transactions that led to the bankruptcy of Britain's oldest bank, the institution that held the accounts of the Queen of England. We give a more detailed explanation of the LTCM case and Enron Corporation's failure below.

Long Term Capital Management (LTCM)

The August 29, 1994, cover story of *BusinessWeek* described the formation of Long Term Capital Management LP (LTCM). The LP stands for **limited partnership,** and LTCM was a **hedge fund** set up as a limited partnership. A hedge fund is a money management organization that can invest in essentially any type of asset anywhere in the world, can (and does) sell securities short, can use as much leverage as banks and other lenders will permit, and is essentially unregulated. Originally, hedge funds truly hedged—they bought what they thought were undervalued securities and sold short what they thought were overvalued securities. Now, however, hedge funds also take positions in options and other complex derivatives. Because they are largely unregulated, hedge funds are open only to "sophisticated" investors, generally defined as individuals or institutions whose net worth is in the millions and whose income is in the hundreds of thousands.

LTCM's chairman, John Meriwether, was perhaps the best-known Wall Street trader. His team, described by *BusinessWeek* as the "Dream Team," included other renowned traders, the former vice chairman of the Federal Reserve Board (David Mullins), and two Nobel Prize winners (Myron Scholes, co-inventor of the Black-Scholes Option Pricing Model, and Robert Merton of the Massachusetts Institute of Technology). LTCM quickly attracted about $3 billion of equity capital from a "Who's Who" of financial leaders and institutions, including the chairmen of Merrill Lynch and Yale University, and it arranged to borrow more than $100 *billion* to leverage its positions.

The fund then made bets on securities all around the globe, and from 1994 through 1997, it earned huge annual returns—in the vicinity of 50% per year. Then, in 1998, the roof caved in. LTCM made a number of leveraged bets that didn't work out. Most importantly, it bet that there would be a "convergence" of interest rates between risk-free and riskier bonds, that is, that risk premiums would shrink. So, it sold Treasury bonds short and bought risky bonds to the tune

of billions of dollars. It also established positions in stocks it thought were undervalued, in Russian securities, in European currencies, and so forth. But LTCM was wrong on almost all counts. Economies around the world began collapsing, leading to a "flight to quality." This meant that investors started selling risky securities and buying Treasury bonds, which widened bonds' risk premiums and led away from rather than toward the convergence LTCM was betting on.

With its 33-to-1 leverage, even a small miscalculation would have eroded LTCM's equity position, and the massive disruption in world markets led to losses of 50% *per month* during the summer of 1998. Worried bankers began to call in their loans, forcing LTCM to sell securities at a loss. Those distressed sales caused the securities' prices to fall further, which exacerbated the problem. It soon became clear that LTCM would have to default on some of its $100 billion of loans, putting the banks that made the loans at risk. At the same time, other hedge funds began to take hits, and the possibility of a worldwide financial collapse soon loomed. At that point, the Federal Reserve stepped in, twisted some bankers' arms, and induced the banks to provide $3.6 billion in new equity capital to LTCM and take control. As a result of the massive bailout, LTCM was able to liquidate its portfolio in an orderly fashion over the next 15 months, and it returned the entire $3.6 billion to the banks by the end of December 1999. However, LTCM's original investors lost about 90% of their investment.

Enron and Other Energy Traders

Most segments of the electric power industry were deregulated during the 1990s. Previously, all power users were required to buy from their local utility, but after deregulation large users, which account for about 65% of electricity usage, could buy from other suppliers. Independent power producers then built plants and began competing with the older utilities. Power users could either buy electricity on the "spot" market at prices that fluctuated depending on supply and demand, or else contract with independent producers to buy at a fixed price for delivery in the future. Thus, the electricity market was transformed from a regulated monopoly into a competitive market that was something akin to the wheat market, where farmers worked with grain merchants to deliver wheat to milling companies.

However, there is a major difference between wheat and electricity—wheat can be stored efficiently, and stored wheat mitigates the effects of supply and demand fluctuations on prices. Electricity cannot be stored, so supply and demand fluctuations result in wide price swings, which disrupt both users and producers. It did not take long for users and producers to realize that all parties would benefit by hedging with long-term supply contracts at fixed prices. Users would have an assured supply at a known price, and producers would have a guaranteed market for their power. Thus, hedging would help all parties, just as it helped wheat farmers and millers.

Enron Corporation was one of the first companies to get into the electricity trading business. Enron owned a few generating plants, but it operated primarily as a marketer, buying from merchant generators and reselling to large users. Enron would sign a multiyear contract to supply specific amounts of electricity at a fixed price to a customer such as General Motors. For example, it might agree to build a new plant, expecting to produce power at a cost of 3 cents per kilowatt-hour (kWh) and simultaneously contract to sell the plant's output at 3.1¢/kWh. The 0.1¢/kWh margin would cover administrative costs and provide

a "normal" profit. Under those conditions, the PV of the expected revenues would be about equal to the PV of the expected costs, so the NPV of the new plant would be slightly above zero.[6]

Now suppose conditions changed so that the cost of producing power fell below 3.0¢/kWh, say to 2 cents, but the price remained at 3.1 cents. In that case, the expected cash flows from the new plant would rise, causing the contract's net present value to increase. Enron would report the increase in the contract's value as profit and add it to operating income. The higher profit would then boost the stock price and trigger executive bonuses.

Such a development would be legal, but Enron cheated. Its executives wanted to report higher profits in order to trigger bonuses and more stock options, so it inflated its profits by forecasting unreasonably high sales prices, unreasonably low purchase costs, and thus unreasonably high profits. It also downplayed the risk inherent in the contracts and discounted the overstated cash flows at unreasonably low discount rates. All of this should have been caught by its auditor, Arthur Andersen, but Andersen let Enron get away with it, resulting in reported profits that were far too high.

Note too that California environmentalists had for years prevented the construction of new plants. The growing demand for power caught up with a fixed supply in 2000, and a shortage resulted. This led to huge price spikes and enormous profits for generators and traders such as Enron. California then relaxed its restrictions on construction, and Enron's wonderful reported profits attracted other companies into considering construction of new plants and getting into the energy trading business. Some made careful forecasts and concluded that something was fishy because their forecasts did not produce results anywhere close to those reported by Enron. These companies wisely avoided the new market. However, others decided that if Enron could do it, so could they, and they charged ahead with new plant construction, financed primarily with debt.

When all the new capacity came online, it greatly exceeded demand. This led to huge price declines, and the builders of new plants found themselves in trouble. A new plant might have cost $100 million and shown an NPV of $10 million based on output prices when construction began. However, when the new plant came online the new low prices might have led to an actual NPV of *minus* $50 million. Similarly, a trading company that had contracted to buy power for a long period, at say 4¢/kWh, expecting to sell it in the spot market for 5 cents, might have found that it could only sell the power for 3 cents, and that too would have resulted in a *negative* NPV for the contract. Those results had to be reflected in the financial statements, so there were massive reported losses and huge write-downs, which lowered stockholder equity on the balance sheets. This, in turn, raised the companies' debt ratios, lowered their coverage ratios, and generally reduced their financial strength.

No one wants to sign a long-term contract with a party that might default if things go badly, so energy traders must have letters of credit that assure counterparties that they can make good on their contracts. They are required to maintain their financial ratios at specified levels, and if the covenants are violated, they must put up additional collateral. Many could not do so, and that led to bankruptcies.

Some old-line utilities built merchant plants and thus got into trouble. Examples include Duke Power and TECO Energy, both of which saw their stock

[6]Similarly, Enron might sign a long-term contract to buy electricity at 3¢/kWh, expecting to sell it on the spot market at 3.1 cents. The initial NPV of the contract would be close to zero. However, if demand for power rose sharply, then the spot price would rise above 3.1 cents, the expected cash flows would rise, and the contract's NPV would also rise.

prices decline by 50% or more in 2002. Southern Company, like several other utilities, put its merchant plants and trading business into a separate subsidiary (Mirant Corporation) and then spun it off to Southern's stockholders. That spin-off insulated Southern from the debacle, so its stock price dropped by only 12% during 2002, about the same as the general market. However, Mirant itself experienced a huge drop after the Enron troubles hit, falling from $47.20 to $1.90. If Southern had retained Mirant, it probably would have experienced a decline similar to that of TECO and Duke.

In spite of these problems, the U.S. electric market is not likely to return to a regulated monopoly status. Competition will continue and even increase, and that will lead power users and producers to hedge with forward contracts and other derivatives. Still, the recent problems have taught all participants that while hedging can lower risks, it can also increase risk, so it must be done with care. Also, the Enron problem demonstrates once more that if something looks too good to be true, it probably is. Our conclusion is that energy derivatives are useful and are here to stay, but future participants should be more careful than those in the recent past.[7]

Affairs such as those at LTCM and Enron make the headlines, causing some people to argue that derivatives should be regulated out of existence to "protect the public." However, derivatives are used far more often to hedge risks than in harmful speculation, and these beneficial transactions never make the headlines. So, while the horror stories point out the need for top managers to exercise control over the personnel who deal with derivatives, they certainly do not justify the elimination of derivatives.

In the balance of this chapter, we discuss how firms can manage risks and how derivatives are used in risk management.

23.4 Other Types of Derivatives

We discussed put and call options in Chapter 9. They represent an important class of derivative securities, but there are many other types of derivatives, including forward contracts, futures, swaps, structured notes, inverse floaters, and a host of other "exotic" contracts.

Forward Contracts versus Futures Contracts

Forward contracts are agreements in which one party agrees to buy a commodity at a specific price on a specific future date and the other party agrees to sell the product. *Goods are actually delivered under forward contracts*. Unless both parties are morally and financially strong, there is a danger that one party will default on the contract, especially if the price of the commodity changes markedly after the agreement is reached.

A **futures contract** is similar to a forward contract, but with three key differences: (1) Futures contracts are marked-to-market on a daily basis, meaning that

[7]The telecommunications industry experienced even worse problems. Companies such as WorldCom, Qwest, and Global Crossing reported tremendous growth and wonderful profits, and that prodded old-line companies such as AT&T to revise their business plans and move aggressively into apparently terrific new markets such as wireless and broadband communications. Most of the expansion was financed with debt, and the end result was massive overcapacity—according to reports, in early 2003 only about 20% of fiber-optic cable lines were being used. As a result, there have been huge price cuts, much fraud, and some major bankruptcies.

gains and losses are noted and money must be put up to cover losses. This greatly reduces the risk of default that exists with forward contracts. (2) With futures, physical delivery of the underlying asset is virtually never taken—the two parties simply settle up with cash for the difference between the contracted price and the actual price on the expiration date. (3) Futures contracts are generally standardized instruments that are traded on exchanges, whereas forward contracts are generally tailor-made, are negotiated between two parties, and are not traded after they have been signed.

Futures and forward contracts were originally used for commodities such as wheat, where farmers would sell forward contracts to millers, enabling both parties to lock in prices and thus reduce their risk exposure. Commodities contracts are still important, but today more trading is done in foreign exchange and interest rate futures. To illustrate how foreign exchange contracts are used, suppose GE arranges to buy electric motors from a European manufacturer on terms that call for GE to pay 1 million euros in 180 days. GE would not want to give up the free trade credit, but if the euro appreciated against the dollar during the next 6 months, the dollar cost of the million euros would rise. GE could hedge the transaction by buying a forward contract under which it agreed to buy the million euros in 180 days at a fixed dollar price, which would lock in the dollar cost of the motors. This transaction would probably be conducted through a money center bank, which would try to find a European company (a "counterparty") that needed dollars in six months. Alternatively, GE could buy a futures contract on an exchange.

Interest rate futures represent another huge and growing market. For example, suppose Simonset Corporation decides to build a new plant at a cost of $20 million. It plans to finance the project with 20-year bonds that would carry an 8% interest rate if they were issued today. However, the company will not need the money for about 6 months. Simonset could go ahead and sell 20-year bonds now, locking in the 8% rate, but it would have the money before it was needed, so it would have to invest in short-term securities that would yield less than 8%. However, if Simonset waits 6 months to sell the bond issue, interest rates might be higher than they are today, in which case the value of the plant would be reduced, perhaps to the point of making it unprofitable.

One solution to Simonset's dilemma involves *interest rate futures*, which are based on a hypothetical 20-year Treasury bond with a 6% semiannual coupon. If interest rates in the economy go up, the value of the hypothetical T-bond will go down, and vice versa. In our example, Simonset is worried about an increase in interest rates. Should rates rise, the hypothetical Treasury bond's value would decline. Therefore, Simonset could sell T-bond futures for delivery in 6 months to hedge its position. If interest rates rise, Simonset will have to pay a higher interest rate when it issues its own bonds. However, it will make a profit on its futures position because it will have presold the bonds at a higher price than it will have to pay to cover (repurchase) them. Of course, if interest rates decline, Simonset will lose on its futures position, but this will be offset by the fact that it will get to pay a lower interest rate when it issues its bonds.

Our examples show that forward contracts and futures can be used to hedge, or reduce, risks. It has been estimated that more than 95% of all such transactions are indeed designed as hedges, with banks and futures dealers serving as middlemen between hedging counterparties. Interest rate and exchange rate futures can, of course, be used for speculative as well as hedging purposes. One can buy a T-bond contract on $100,000 of bonds with only $900 down, in which case a small change in interest rates will result in a very large gain or loss. Still, the primary motivation behind the vast majority of these transactions is to hedge risks, not to create them.

Swaps

A **swap** is just what the name implies—two parties agree to swap something, generally obligations to make specified payment streams. Most swaps today involve either interest payments or currencies, but just about anything can be swapped, including equity swaps, credit spread swaps, and commodity swaps.[8] To illustrate an interest rate swap, suppose Company S has a 20-year, $100 million floating-rate bond outstanding, while Company F has a $100 million, 20-year, fixed-rate issue outstanding. Thus, each company has an obligation to make a stream of interest payments, but one payment stream is fixed while the other will vary as interest rates change in the future. This situation is shown in the top part of Figure 23-1.

Now suppose Company S has stable cash flows, and it wants to lock in its cost of debt. Company F has cash flows that fluctuate with the economy, rising when the economy is strong and falling when it is weak. Recognizing that interest rates also move up and down with the economy, Company F has concluded that it would be better off with variable-rate debt. If the companies swapped their payment obligations, an *interest rate swap* would occur. The bottom half of Figure 23-1 shows that the net cash flows for Company S are at a fixed rate, and those for Company F are based on a floating rate. Company S would now have to make fixed payments, which are consistent with its stable cash inflows, and Company F would have a floating obligation, which for it is less risky.

Our example illustrates how swaps can reduce risks by allowing each company to match the variability of its interest payments with that of its cash flows. However, there are also situations where swaps can reduce both the riskiness and the effective cost of debt. For example, Antron Corporation, which has a high credit rating, can issue either floating-rate debt at LIBOR + 1% or fixed-rate debt at 10%.[9] Bosworth Industries is less creditworthy, so its cost for floating-rate debt is LIBOR + 1.5%, and its fixed-rate cost is 10.4%. Due to the nature of its operations, Antron's CFO has decided that it will be better off with fixed-rate debt, while Bosworth's CFO prefers floating-rate debt. Paradoxically, both firms can benefit by issuing the type of debt they do not want, and then swapping their payment obligations.

First, each company will issue an identical amount of debt, which is called the **notional principal.** Even though Antron wants fixed-rate debt, it issues floating-rate debt at LIBOR + 1%, and Bosworth issues fixed-rate debt at 10.4%. Next, the two companies enter into an interest rate swap.[10] Assume that the debt maturities are 5 years; hence the length of this swap will also be 5 years. By convention, the floating-rate payments of most swaps are based on LIBOR, with the fixed rate adjusted upward or downward to reflect credit risk and the term structure. The riskier the company that will receive the floating-rate payments, the higher the fixed-rate payment it must make. In our example, Antron will be receiving floating-rate payments from Bosworth, and those payments will be set at LIBOR times the notional principal. Then, payments will be adjusted every 6 months to reflect changes in the LIBOR rate.

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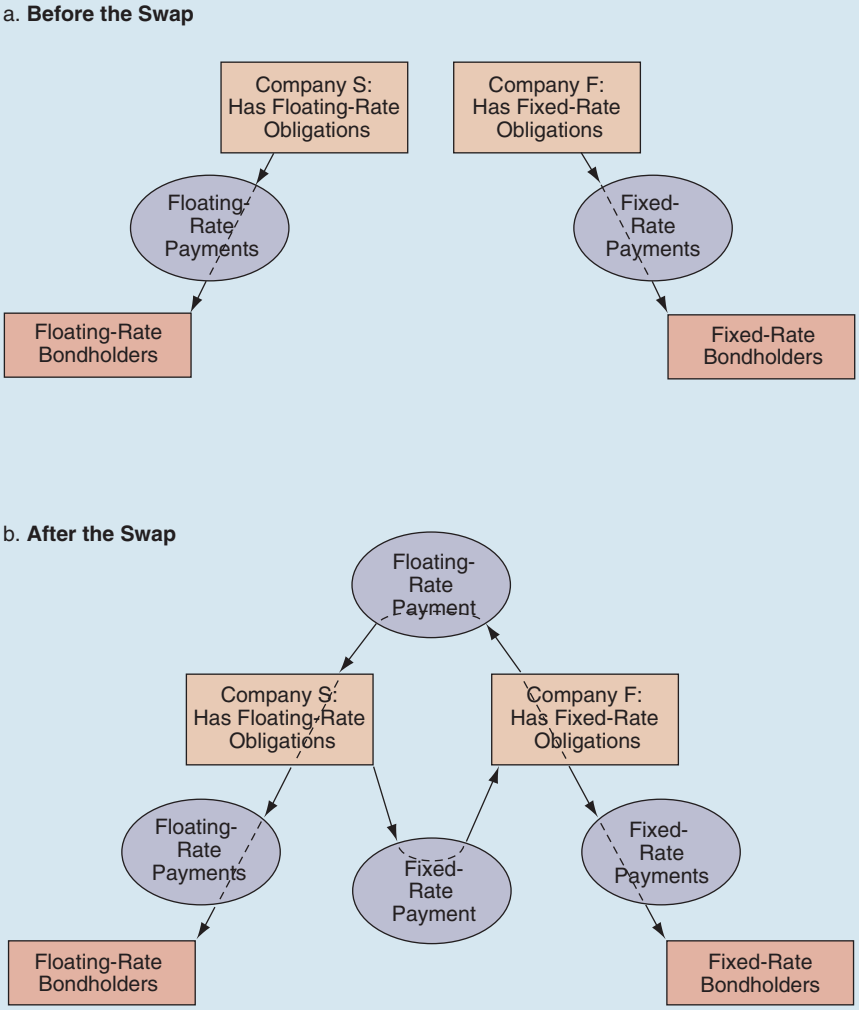
[8]In an equity swap, the cash flow based on an equity index is swapped for some other cash flow. In a commodity swap, the swapped cash flow is based on commodity prices. In a credit swap, the cash flow usually is based on the spread between a risky bond and a U.S. Treasury bond.

[9]LIBOR stands for the London Interbank Offer Rate, the rate charged on interbank dollar loans in the Eurodollar market.

[10]Actually, such transactions are generally arranged by large money center banks, and payments are made to the bank, which in turn pays the interest on the original loans. The bank assumes the credit risk and guarantees the payments should one of the parties default. For its services, the bank receives a percentage of the payments as its fee.

Figure 23-1

Cash Flows under a Swap



Note: In Panel a, Company S must make floating-rate payments out of its own internal cash flows, but in Panel b, it uses the floating payments from Company F to pay its bondholders. Company F has a reversed position. After the swap, S has de facto fixed payments, which are consistent with its stable internal flows, and F has floating payments, which are consistent with its fluctuating flows.

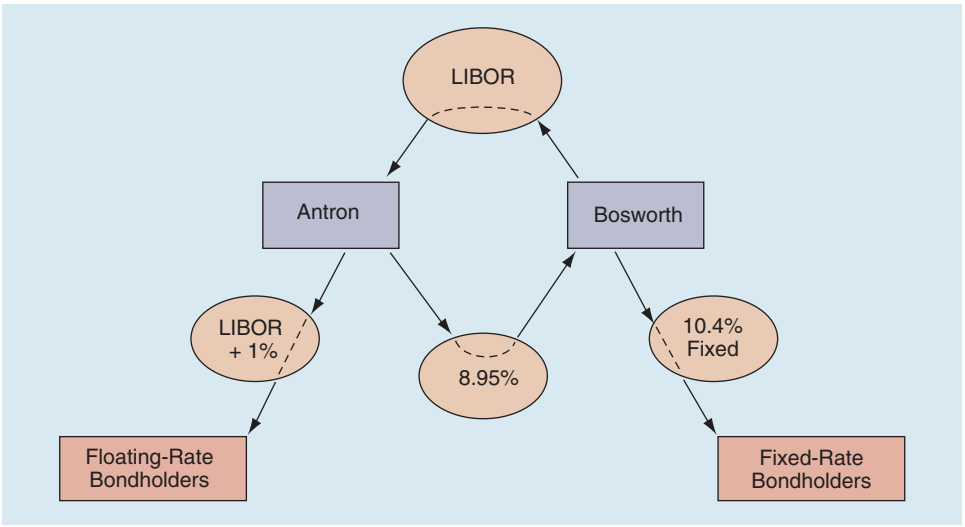
The fixed payment that Antron must make to Bosworth is set (that is, "fixed") for the duration of the swap at the time the contract is signed, and it depends primarily on two factors: (1) the level of fixed interest rates at the time of the agreement and (2) the relative creditworthiness of the two companies.

In our example, assume that interest rates and creditworthiness are such that 8.95% is the appropriate fixed swap rate for Antron, so it will make 8.95% fixed-rate payments to Bosworth. Bosworth, in turn, will pay the LIBOR rate to Antron. Table 23-1 shows the net rates paid by each participant, and Figure 23-2 graphs the flows. Note that Antron ends up making fixed payments, which it desires, but

Table 23-1 Anatomy of an Interest Rate Swap

Antron's Payments: Borrows Floating, Swaps for Fixed		Bosworth's Payments: Borrows Fixed, Swaps for Floating	
Payment to lender	−(LIBOR + 1%)	Payment to lender	−10.40% fixed
Payment from Bosworth	+(LIBOR)	Payment from Antron	+8.95% fixed
Payment to Bosworth	−8.95% fixed	Payment to Antron	−(LIBOR)
Net payment by Antron	−9.95% fixed	Net payment by Bosworth	−(LIBOR + 1.45%)

Figure 23-2 The Antron/Bosworth Swap



because of the swap, the rate paid is 9.95% versus the 10% rate it would have paid had it issued fixed-rate debt directly. At the same time, the swap leaves Bosworth with floating-rate debt, which it wants, but at a rate of LIBOR + 1.45% versus the LIBOR + 1.50% it would have paid on directly issued floating-rate debt. As the example illustrates, swaps can sometimes lower the interest rate paid by each party.

Currency swaps are similar to interest rate swaps. To illustrate, suppose Company A, an American firm, had issued $100 million of dollar-denominated bonds in the United States to fund an investment in Germany. Meanwhile, Company G, a German firm, had issued $100 million of euro-denominated bonds in Germany to make an investment in the United States. Company A would earn euros but be required to make payments in dollars, and Company G would be in a reverse situation. Thus, both companies would be exposed to exchange rate risk. However, both companies' risks would be eliminated if they swapped payment obligations.

Originally, swaps were arranged between companies by money center banks, which would match up counterparties. Such matching still occurs, but today most swaps are between companies and banks, with the banks then taking steps to

ensure that their own risks are hedged. For example, Citibank might arrange a swap with Company A. Company A would agree to make specified payments in euros to Citibank, while Citibank made dollar payments to Company A. Citibank would charge a fee for setting up the swap, and these charges would reflect the creditworthiness of Company A. To protect itself against exchange rate movements, the bank would hedge its position, either by lining up a European company that needed to make dollar payments or else by using currency futures.[11]

Structured Notes

The term **structured note** often means a debt obligation that is derived from some other debt obligation. For example, in the early 1980s, investment bankers began buying large blocks of 30-year, noncallable Treasury bonds and then *stripping* them to create a series of zero coupon bonds. The zero with the shortest maturity was backed by the first interest payment on the T-bond issue, the second shortest zero was backed by the next interest payment, and so forth, on out to a 30-year zero backed by the last interest payment plus the maturity value of the T-bond. Zeros formed by stripping T-bonds were one of the first types of structured notes.

Another important type of structured note is backed by the interest and principal payments on mortgages. In the 1970s, Wall Street firms began to buy large packages of mortgages backed by federal agencies, and they placed these packages, or "pools," with a trustee. Then bonds called *Collateralized Mortgage Obligations* (*CMOs*), backed by the mortgage pool held in trust, were sold to pension funds, individuals for their IRAs, and other investors who were willing to invest in CMOs but who would not have purchased individual mortgages. This *securitization* of mortgages made billions of dollars of new capital available to home buyers.

CMOs are more difficult to evaluate than straight bonds for several reasons. First, the underlying mortgages can be prepaid at any time, and when this occurs the prepayment proceeds are used to retire part of the CMO debt itself. Therefore, the holder of a CMO is never sure when his or her bond will be called. This situation is further complicated by the fact that when interest rates decline, bond prices normally rise. However, declining rates also lead to mortgage prepayments, which cause the CMOs to be called especially rapidly, and it is not good to have bonds called and have to reinvest funds at a lower rate. These opposing forces make it difficult to value CMOs.

It should also be noted that a variety of structured notes can be created, ranging from notes whose cash flows can be predicted with virtual certainty to other notes whose payment streams are highly uncertain. For example, investment bankers can (and do) create notes called *IOs* (for *Interest Only*), which provide cash flows from the interest component of the mortgage amortization payments, and *POs* (for *Principal Only*), which are paid from the principal repayment stream. In each case, the value of the note is found as the present value of an expected payment stream, but the length and size of the stream are uncertain. Suppose, for example, that you are offered an IO that you expect to provide payments of $100 for 10 years (you expect the mortgages to be refinanced after 10 years, at which time your payments will cease). Suppose further that you discount the expected

[11]For more information on swaps, see Keith C. Brown and Donald J. Smith, "Default Risk and Innovations in the Design of Interest Rate Swaps," *Financial Management*, Summer 1993, pp. 94–105; Robert Einzig and Bruce Lange, "Swaps at Transamerica: Applications and Analysis," *Journal of Applied Corporate Finance*, Winter 1990, pp. 48–58; John F. Marshall, Vipul K. Bansal, Anthony F. Herbst, and Alan L. Tucker, "Hedging Business Cycle Risk with Macro Swaps and Options," *Journal of Applied Corporate Finance*, Winter 1992, pp. 103–108; and Laurie S. Goodman, "The Uses of Interest Rate Swaps in Managing Corporate Liabilities," *Journal of Applied Corporate Finance*, Winter 1990, pp. 35–47.

payment stream at a rate of 10% and determine that the value is $614.46. You have $614.46 to invest, so you buy the IO, expecting to earn 10% on your money.

Now suppose interest rates decline. If rates fall, the discount rate would drop, and that would normally imply an increase in the IO's value. However, if rates decline sharply, this would lead to a rash of mortgage refinancings, in which case your payments, which come from interest only, would cease (or be greatly reduced), and the value of your IO would fall sharply. On the other hand, a sharp increase in interest rates would reduce refinancing, lengthen your expected payment stream, and probably increase the value of your IO.

Investment bankers can slice and dice a pool of mortgages into a bewildering array of structured notes, ranging from "plain vanilla" ones with highly predictable cash flows to "exotic" ones (sometimes called "toxic waste") whose risks are almost incalculable but are surely large.

Securitizing mortgages through CMOs serves a useful economic function—it provides an investment outlet for pension funds and others with money to invest, and it makes more money available to homeowners at a reasonable cost. Also, some investors want relatively safe investments, while others are willing to buy more speculative securities for the higher expected returns they provide. Structured notes permit a partitioning of risks to give investors what they want. There are dangers, though. In some cases the "toxic waste" is bought by naive officials managing money for local governments like Orange County, California, when they really ought to be holding only safe securities.

Inverse Floaters

A floating-rate note has an interest rate that rises and falls with some interest rate index. For example, if the prime rate were currently 8.5%, then the interest rate on a $100,000 note at prime plus 1% would be 9.5% and the note's rate would move up and down with the prime rate. Because both the cash flows associated with the note and the discount rate used to value it would rise and fall together, the market value of the note would be relatively stable.

With an **inverse floater,** the rate paid on the note moves counter to market rates. Thus, if interest rates in the economy rise, the interest rate paid on an inverse floater will fall, lowering its cash interest payments. At the same time, the discount rate used to value the inverse floater's cash flows will rise along with other rates. The combined effect of lower cash flows and a higher discount rate leads to a very large decline in the value of the inverse floater. Thus, inverse floaters are exceptionally vulnerable to increases in interest rates. Of course, if interest rates fall, the value of an inverse floater will soar.

Could an inverse floater be used for hedging purposes? The answer is "yes, perhaps quite effectively." These securities have a magnified effect, so not many are required to hedge a given position. However, because they are so volatile, they could make what is supposed to be a hedged position actually quite risky.

We have discussed the most important types of derivative securities, but certainly not all types. This discussion should, though, give you a good idea of how and why derivatives are created, and how they can be used and misused.

SELF-TEST

Briefly describe the following types of derivative securities: (1) futures and forward contracts; (2) swaps; (3) structured notes and CMOs; and (4) inverse floaters.

Messman Corporation issues fixed-rate debt at a rate of 9.00%. Messman agrees to an interest rate swap in which it pays LIBOR to Moore Inc. and Moore pays 8.75% to Messman. What is Messman's resulting net payment? (LIBOR + 0.25%)

23.5 Corporate Risk Management

As businesses become increasingly complex, it is becoming more and more difficult for CEOs and directors to know what problems might lie in wait. Therefore, companies need to have someone systematically look for potential problems and design safeguards to minimize potential damage. With this in mind, most large firms have a designated "risk manager" who reports to the chief financial officer, while the CFOs of smaller firms personally assume risk management responsibilities. In any event, **risk management** is becoming increasingly important, and it is something finance students should understand. Therefore, in the remainder of this chapter we discuss the basics of risk management, with particular emphasis on how derivatives can be used to hedge financial risks.[12]

Types of Risk

It is useful to begin our discussion of risk management by defining some commonly used terms that describe different risks. Some of these risks can be mitigated, or managed, and that is what risk management is all about.

1. *Pure risks* are risks that offer only the prospect of a loss. Examples include the risk that a plant will be destroyed by fire or that a product liability suit will result in a large judgment against the firm.
2. *Speculative risks* are situations that offer the chance of a gain but might result in a loss. Investments in new projects and marketable securities involve speculative risks.
3. *Demand risks* are associated with the demand for a firm's products or services. Because sales are essential to all businesses, demand risk is one of the most significant risks that firms face.
4. *Input risks* are risks associated with input costs, including both labor and materials. Thus, a company that uses copper as a raw material in its manufacturing process faces the risk that the cost of copper will increase and that it will not be able to pass this increase on to its customers.
5. *Financial risks* are risks that result from financial transactions. As we have seen, if a firm plans to issue new bonds, it faces the risk that interest rates will rise before the bonds can be brought to market. Similarly, if the firm enters into contracts with foreign customers or suppliers, it faces the risk that fluctuations in exchange rates will result in unanticipated losses.
6. *Property risks* are associated with destruction of productive assets. Thus, the threats of fire, floods, and riots impose property risks on a firm.
7. *Personnel risks* are risks that result from employees' actions. Examples include the risks associated with employee fraud or embezzlement, or suits based on charges of age or sex discrimination.
8. *Environmental risks* include risks associated with polluting the environment. Public awareness in recent years, coupled with the huge costs of environmental cleanup, has increased the importance of this risk.

[12]For an excellent overview of risk management, see Kenneth A. Froot, David S. Scharfstein, and Jeremy Stein, "A Framework for Risk Management," *Journal of Applied Corporate Finance*, 1994, pp. 22–32; Walter Dolde, "The Trajectory of Corporate Financial Risk Management," *Journal of Applied Corporate Finance*, Fall 1993, pp. 33–41; and Marshall Blake and Nelda Mahady, "How Mid-Sized Companies Manage Risk," *Journal of Applied Corporate Finance*, Spring 1991, pp. 59–65.

9. *Liability risks* are associated with product, service, or employee actions. Examples include the very large judgments assessed against asbestos manufacturers and some health care providers, as well as costs incurred as a result of improper actions of employees, such as driving corporate vehicles in a reckless manner.
10. *Insurable risks* are risks that can be covered by insurance. In general, property, personnel, environmental, and liability risks can be transferred to insurance companies. Note, though, that the *ability* to insure a risk does not necessarily mean that the risk *should be* insured. Indeed, a major function of risk management involves evaluating all alternatives for managing a particular risk, including self-insurance, and then choosing the optimal alternative. For a more detailed discussion of corporate insurance programs, see ***Web Extension 23A*** at the textbook's Web site.

Note that the risk classifications we used are somewhat arbitrary, and different classifications are commonly used in different industries. However, the list does give an idea of the wide variety of risks to which a firm can be exposed.

An Approach to Risk Management

Firms often use the following process for managing risks:

1. *Identify the risks faced by the firm*. Here the risk manager identifies the potential risks faced by his or her firm. (See the box entitled, "Microsoft's Goal: Manage Every Risk!")
2. *Measure the potential effect of each risk*. Some risks are so small as to be immaterial, whereas others have the potential for dooming the company. It is useful to segregate risks by potential effect and then to focus on the most serious threats.
3. *Decide how each relevant risk should be handled*. In most situations, risk exposure can be reduced through one of the following techniques:
    a. *Transfer the risk to an insurance company*. Often, it is advantageous to insure against, hence transfer, a risk. However, insurability does not necessarily mean that a risk should be covered by insurance. In many instances, it might be better for the company to *self-insure*, which means bearing the risk directly rather than paying another party to bear it.
    b. *Transfer the function that produces the risk to a third party*. For example, suppose a furniture manufacturer is concerned about potential liabilities arising from its ownership of a fleet of trucks used to transfer products from its manufacturing plant to various points across the country. One way to eliminate this risk would be to contract with a trucking company to do the shipping, thus passing the risks to a third party.
    c. *Purchase derivative contracts to reduce risk*. As we indicated earlier, firms use derivatives to hedge risks. Commodity derivatives can be used to reduce input risks. For example, a cereal company may use corn or wheat futures to hedge against increases in grain prices. Similarly, financial derivatives can be used to reduce risks that arise from changes in interest rates and exchange rates.
    d. *Reduce the probability of occurrence of an adverse event*. The expected loss arising from any risk is a function of both the probability of occurrence and

Microsoft's Goal: Manage Every Risk!

Twenty years ago, risk management meant buying insurance against fire, theft, and liability losses. Today, though, due to globalization, volatile markets, and a host of lawyers looking for someone to sue, a multitude of risks can adversely affect companies. Microsoft addressed these risks by creating a virtual in-house consulting practice to help manage the risks faced by its sales, operations, and product groups, including these 12 major sources of risk:

1. *Business partners* (interdependency, confidentiality, cultural conflict, contractual risks).
2. *Competition* (market share, price wars, industrial espionage, antitrust allegations, etc.).
3. *Customers* (product liability, credit risk, poor market timing, inadequate customer support).
4. *Distribution systems* (transportation, service availability, cost, dependence on distributors).
5. *Financial* (foreign exchange, portfolio, cash, interest rate, stock market).
6. *Operations* (facilities, contractual risks, natural hazards, internal processes and control).
7. *People* (employees, independent contractors, training, staffing inadequacy).
8. *Political* (civil unrest, war, terrorism, enforcement of intellectual property rights, change in leadership, revised economic policies).
9. *Regulatory and legislative* (antitrust, export licensing, jurisdiction, reporting and compliance, environmental).
10. *Reputations* (corporate image, brands, reputations of key employees).
11. *Strategic* (mergers and acquisitions, joint ventures and alliances, resource allocation and planning, organizational agility).
12. *Technological* (complexity, obsolescence, the year 2000 problem, virus attacks, workforce skill-sets).

In many ways risk management mirrors the quality movement of the 1980s and 1990s. The goal of the quality movement was to take the responsibility for quality out of a separate Quality Control Department and to make all managers and employees responsible for quality. Microsoft has a similar goal—to have risk management permeate the thinking of all Microsoft managers and employees.

Source: Edward Teach, "Microsoft's Universe of Risk," *CFO*, March 1997, pp. 69–72.

the dollar loss if the adverse event occurs. In some instances, it is possible to reduce the probability that an adverse event will occur. For example, the probability that a fire will occur can be reduced by instituting a fire prevention program, by replacing old electrical wiring, and by using fire-resistant materials in areas with the greatest fire potential.

e. *Reduce the magnitude of the loss associated with an adverse event*. Continuing with the fire risk example, the dollar cost associated with a fire can be reduced by such actions as installing sprinkler systems, designing facilities with self-contained fire zones, and locating facilities close to a fire station.

f. *Totally avoid the activity that gives rise to the risk*. For example, a company might discontinue a product or service line because the risks outweigh the rewards, as with the decision by Dow-Corning to discontinue its manufacture of silicon breast implants.

Note that risk management decisions, like all corporate decisions, should be based on a cost/benefit analysis for each feasible alternative. For example, suppose it would cost $50,000 per year to conduct a comprehensive fire safety training program for all personnel in a high-risk plant. Presumably, this program would reduce the expected value of future fire losses. An alternative to the training program would be to place $50,000 annually in a reserve fund set aside to cover future fire

losses. Both alternatives involve expected cash flows, and from an economic standpoint the choice should be made on the basis of the lowest present value of future costs. Thus, the same financial management techniques applied to other corporate decisions can also be applied to risk management decisions. Note, though, that if a fire occurs and a life is lost, the trade-off between fire prevention and expected losses may not sit well with a jury. The same thing holds true for product liability, as Firestone, Ford, GM, and others have learned.

SELF-TEST

Define the following terms: (1) pure risks, (2) speculative risks, (3) demand risks, (4) input risks, (5) financial risks, (6) property risks, (7) personnel risks, (8) environmental risks, (9) liability risks, (10) insurable risks, and (11) self-insurance.

Should a firm insure itself against all of the insurable risks it faces? Explain.

23.6 Using Derivatives to Reduce Risks

Firms are subject to numerous risks related to interest rate, stock price, and exchange rate fluctuations in the financial markets. For an investor, one of the most obvious ways to reduce financial risks is to hold a broadly diversified portfolio of stocks and debt securities, including international securities and debt of varying maturities. However, derivatives can also be used to reduce the risks associated with financial and commodity markets.[13]

For information about futures markets, including prices, see the CBOT's Web site, **http://www.cbot.com,** and the Web site of Ira Epstein & Company, **http://www.iepstein.com.**

Hedging with Futures

One of the most useful tools for reducing interest rate, exchange rate, and commodity risk is to hedge in the futures markets. Most financial and real asset transactions occur in what is known as the *spot*, or *cash, market*, where the asset is delivered immediately (or within a few days). *Futures*, or *futures contracts*, on the other hand, call for the purchase or sale of an asset at some future date, but at a price that is fixed today.

Today, futures contracts are available on hundreds of real and financial assets traded on dozens of U.S. and international exchanges, the largest of which are the Chicago Board of Trade (CBOT) and the Chicago Mercantile Exchange (CME). Futures contracts are divided into two classes, **commodity futures** and **financial futures.** Commodity futures, which cover oil, various grains, oilseeds, livestock, meats, fibers, metals, and wood, were first traded in the United States in the mid-1800s. Financial futures, which were first traded in 1975, include Treasury bills, notes, bonds, certificates of deposit, Eurodollar deposits, foreign currencies, and stock indexes.

To illustrate how futures contracts work, consider the CBOT's contract on Treasury bonds. The basic contract is for $100,000 of a hypothetical 6% coupon, semiannual payment Treasury bond with 20 years to maturity.[14] Table 23-2 shows Treasury bond futures data from the Chicago Board of Trade.

[13]In Chapter 26, we discuss both the risks involved with holding foreign currencies and procedures for reducing such risks.

[14]The coupon rate on the hypothetical bond was changed to 6% from 8% in March 2000. The CBOT contract doesn't actually specify a 20-year bond, but instead allows delivery of any noncallable bond with a remaining maturity greater than 15 years (or callable bond that is not callable for at least 15 years). Rather than simply deliver a bond, which might have an interest rate different than 6%, the actual bond price is adjusted by a conversion feature to make it equivalent to a 6% bond that is trading at par. Because the average maturity of bonds that are eligible for delivery is about 20 years, we use a 20-year maturity for the hypothetical bond in the futures contract.

Table 23-2

Futures Prices (Treasury Bonds: $100,000; Pts. 32nds of 100%)

Delivery Month (1)	Last (2)	Change (3)	Open (4)	High (5)	Low (6)	Estimated Volume (7)	Open Interest (8)
September 2006	109-08	+0-18	108-20	109-15	108-18	21,612	778,970
December 2006	109-17	+0-18	108-28	109-18	108-28	1,345	22,128
March 2007	109-11	+0-18	109-11	109-11	109-11	0	8
June 2007	109-09	+0-18	109-09	109-09	109-09	0	15

Source: The Wall Street Journal Online; **http://www.wsj.com,** August 5, 2006.

The first column of the table gives the delivery month, and the next two columns give the last price of the day and the change in price from the previous day. For example, the last price for the March 2007 contract, 109-11, means 109 plus $\frac{11}{32}$, or 109.34375% of par. This is often called the settlement price. The change was +0-18, which means the March 2007 contract's last price of the day was $\frac{18}{32}$ higher than the previous day's last trade, which must have been at 108-25. The next three columns show the opening, high, and low prices for that contract on that day. Column 7 shows the day's estimated trading volume. Notice that most of the trading occurs in the contract with the nearest delivery date. Finally, Column 8 shows the "open interest," which is the number of contracts outstanding.

To illustrate, we focus on the Treasury bonds for March delivery. The settlement price was 109.34375% of the $100,000 contract value. Thus, the price at which one could buy $100,000 face value of 6%, 20-year Treasury bonds to be delivered in March was 109.34375% of par, or (109.34375%)($100,000) = $109,343.75. The contract price increased by $\frac{18}{32}$ of 1% of $100,000 from the previous day, so if you had bought the contract yesterday, you would have made $562.50 = ($\frac{18}{32}$)($100,000). There were 8 contracts outstanding, representing a total value of about 8($109,343.75) = $874,750.

e-resource

See ***FM12 Ch 23 Tool Kit.xls*** at the textbook's Web site for all calculations.

Note that the contract increased by $\frac{18}{32}$ of a percent on this particular day. Why would the value of the bond futures contract increase? Bond prices increase when interest rates fall, so interest rates must have fallen on that day. Moreover, we can calculate the implied rates inherent in the futures contracts. Recall that the contract relates to a hypothetical 20-year, semiannual payment, 6% coupon bond. The settlement price was 109.34375% of par. We can solve for r_d by using the following equation:

$$\sum_{t=1}^{40} \frac{\$30}{(1 + r_d/2)^t} + \frac{\$1{,}000}{(1 + r_d/2)^{40}} = \$1{,}093.4375.$$

Using a financial calculator, input N = 40, PV = −1,093.4375, PMT = 30, FV = 1,000 and solve for I/YR = 2.6202. This is the semiannual rate, which is equivalent to a nominal annual rate of 5.2404%, or approximately 5.24%. The previous day's last (settlement) price was 108 and $\frac{25}{32}$. Setting N = 40, PV = −1,087.8125,

PMT = 30, FV = 1,000 and solving for I/YR = 2.6418 implies an annual yield of 5.2836%, or approximately 5.28%. Therefore, interest rates fell by about four basis points from the previous day, but that was enough to increase the value of the contract by $562.50.

In August 2006, when the data in Table 23-2 were gathered, the yield on a 20-year T-bond was about 5.13%. But as we just calculated, the implied yield on the March 2007 futures contract was about 5.24%. The March yield reflects investors' beliefs as to what the interest rate level will be in March: The marginal trader in the futures market was predicting an 11-basis-point increase in yields between August and March. That prediction could, of course, turn out to be incorrect.

Now suppose that 3 months later, in November, implied yields in the futures market had fallen from the earlier levels, say, from 5.24% to 4.74%. Inputting N = 40, I/YR = 4.74/2 = 2.37, PMT = 30, FV = 1,000, and solving for PV = −1,161.6668 shows that the March contract would be worth about $116,166.68 in November if interest rates fell to 4.74%. Thus, the contract's value would have increased by $116,166.68 − $109,343.75 ≈ $6,823.

When futures contracts are purchased, the purchaser does not have to put up the full amount of the purchase price; rather, the purchaser is required to post an initial *margin*, which for CBOT Treasury bond contracts is $900 per $100,000 contract.[15] However, investors are required to maintain a certain value in the margin account, called a *maintenance margin*. If the value of the contract declines, then the owner may be required to add additional funds to the margin account, and the more the contract value falls, the more money must be added. The value of the contract is checked at the end of every working day, and margin account adjustments are made at that time. This is called "marking to market." If an investor purchased our illustrative contract and then sold it later for $116,166.68, he or she would have made a profit of $6,823 on a $900 investment, or a return of 658% in only 3 months. It is clear, therefore, that futures contracts offer a considerable amount of leverage. Of course, if interest rates had risen, then the value of the contract would have fallen, and the investor could easily have lost his or her $900, or more. Futures contracts are rarely settled by delivery of the securities involved. Rather, the transaction is completed by reversing the trade, which amounts to selling the contract back to the original seller.[16] The actual gains and losses on the contract are realized when the futures contract is closed.

For current margin requirements on hedging investments, see **http://www.cbot.com/cbot/pub/page /0,3181,2143,00.html.**

Futures contracts and options are similar to one another—so similar that people often confuse the two. Therefore, it is useful to compare the two instruments. A *futures contract* is a definite agreement on the part of one party to buy something on a specific date and at a specific price, and the other party agrees to sell on the same terms. No matter how low or how high the price goes, the two parties must settle the contract at the agreed-upon price. An *option*, on the other hand, gives someone the right to buy (call) or sell (put) an asset, but the holder of the option does not have to complete the transaction. Note also that options exist both for individual stocks and for "bundles" of stocks such as those in the S&P and *Value Line* indexes, but generally not for commodities. Futures, on the other hand, are

[15]This is the margin requirement for hedgers. Speculators have a different margin requirement.

[16]The buyers and sellers of most financial futures contracts do not actually trade with one another—each trader's contractual obligation is with a futures exchange. This feature helps to guarantee the fiscal integrity of the trade. Incidentally, commodities futures traded on the exchanges are settled in the same way as financial futures, but in the case of commodities much of the contracting is done off the exchange, between farmers and processors, as *forward contracts*, in which case actual deliveries occur.

Risk Management in the Cyber Economy

In the old bricks-and-mortar economy, most of a company's value was due to its tangible assets. Not so in the cyber economy, where value is due to intellectual property and networks that manage knowledge bases. Insurance companies are rapidly developing new types of insurance policies to protect these valuable cyber assets.

Intellectual property (IP) insurance now covers "all intellectual property—patents, trademarks, trade secrets, copyright—and includes defense, as well as enforcement, of intellectual property rights," according to Judith Pearson, director of Aon Corp.'s financial services group. These policies can cover losses in excess of $200 million, with premiums ranging from 1% to 5% of the coverage.

Insurers also provide coverage for breaches in network security. For example, companies can buy insurance to cover cases of cyberextortion, such as the recent demand for $100,000 by the hacker "Maxus" in exchange for not publicly releasing 300,000 credit card numbers stolen from CD Universe. Other policies cover content defamation, copyright and trademark infringement, denial-of-service attacks, viruses, theft of information, and destruction or alteration of data. Costs of insurance have fallen to between 1% and 3% of the policy's coverage, but most insurers subject applicants to a thorough review of their current security measures before granting coverage.

One thing is certain: As the cyber economy matures, look for even more sophisticated risk management techniques.

Sources: John P. Mello, Jr., "Blanketing Intellectual Risk," *CFO*, May 2000, p. 16; and Russ Banham, "Hacking It," *CFO*, August 2000, pp. 115–118.

used for commodities, debt securities, and stock indexes. These two types of instruments can be used for the same purposes. One is not necessarily better or worse than the other—they are simply different.[17]

Security Price Exposure

All investors are exposed to losses due to changes in security prices when securities are held in investment portfolios, and firms are also exposed during times when securities are being issued. In addition, firms are exposed to risk if they use floating-rate debt to finance an investment that produces a fixed income stream. Risks such as these can often be mitigated by using derivatives. As we discussed earlier, derivatives are securities whose value stems, or is derived, from the values of other assets. Thus, options and futures contracts are derivatives, because their values depend on the prices of some underlying asset. Now we will explore further the use of two types of derivatives, futures and swaps, to help manage certain types of risk.

Futures Futures are used for both speculation and hedging. **Speculation** involves betting on future price movements, and futures are used because of the leverage inherent in the contract. **Hedging,** on the other hand, is done by a firm or individual to protect against a price change that would otherwise negatively affect profits. For example, rising interest rates and commodity (raw material) prices can hurt profits, as can adverse currency fluctuations. If two parties have mirror-image risks, then they can enter into a transaction that eliminates, as opposed to transfers, risks. This is a "natural hedge." Of course, one party to a

[17]For additional insights into the use of financial futures for hedging, see Stanley B. Block and Timothy J. Gallagher, "The Use of Interest Rate Futures and Options by Corporate Managers," *Financial Management*, Autumn 1986, pp. 73–78; and Mark G. Castelino, Jack C. Francis, and Avner Wolf, "Cross-Hedging: Basis Risk and Choice of the Optimal Hedging Vehicle," *Financial Review*, May 1991, pp. 179–210.

futures contract could be a speculator, the other a hedger. Thus, to the extent that speculators broaden the market and make hedging possible, they help decrease risk to those who seek to avoid it.

There are two basic types of hedges: (1) **long hedges,** in which futures contracts are *bought* in anticipation of (or to guard against) price increases, and (2) **short hedges,** where a firm or individual *sells* futures contracts to guard against price declines. Recall that rising interest rates lower bond prices and thus decrease the value of bond futures contracts. Therefore, if a firm or individual needs to guard against an *increase* in interest rates, a futures contract that makes money if rates rise should be used. That means selling, or going short, on a futures contract. To illustrate, assume that in August Carson Foods is considering a plan to issue $10,000,000 of 20-year bonds in March to finance a capital expenditure program. The interest rate would be 9% paid semiannually if the bonds were issued today, and at that rate the project would have a positive NPV. However, interest rates may rise, and when the issue is actually sold, the interest rate might be substantially above 9%, which would make the project a bad investment. Carson can protect itself against a rise in rates by hedging in the futures market.

In this situation, Carson would be hurt by an increase in interest rates, so it would use a short hedge. It would choose a futures contract on the security most similar to the one it plans to issue, long-term bonds, and so would probably hedge with March Treasury bond futures. We can see from Table 23-2 that each March contract has a value of 109-11, so the total value of one contract is $109,343.75. Because it plans to issue $10,000,000 of bonds, and because each contract is worth $109,343.75, Carson will sell $10,000,000/$109,343.75 = 91.45 ≈ 91 contracts for delivery in March. It will have to put up 91($900) = $81,900 in margin money and also pay brokerage commissions. The total value of the 91 contracts is 91($109,343.75) = $9,950,281, which is very close to the value of the bonds Carson wants to issue.

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See ***FM12 Ch 23 Tool Kit.xls*** at the textbook's Web site for all calculations.

Now suppose that in March when Carson issues its bonds renewed fears of inflation push interest rates up by 100 basis points. What would the bond proceeds be if Carson still tried to issue 9% coupon bonds when the market requires a 10% rate of return? We can find the total value of the offering with a financial calculator, inputting N = 40, I/YR = 5, PMT = −$450,000, FV = −10,000,000, and solving for PV = 9,142,046. Therefore, bonds with a 9% coupon, based upon its original plans, would bring proceeds of only $9,142,046, because investors now require a 10% return. Because Carson would have to issue $10 million worth of bonds at a 10% rate, Carson's cost would go up by $857,954 = $10,000,000 − $9,142,046 as a result of delaying the financing.

However, the increase in interest rates would also bring about a change in the value of Carson's short position in the futures market. Since interest rates have increased, the value of the futures contract would fall. If the interest rate on the futures contract also increased by the same full percentage point, from 5.24 to 6.24%, the new contract value can be found by inputting N = 40, I/YR = 6.24/2 = 3.12, PMT = −3,000, FV = −100,000 and solving for PV = $97,279.26 per contract. With 91 contracts, the total value of the position is $8,852,413 = 91($97,279.26). Carson would then close its position in the futures market by repurchasing for $8,852,413 the contracts that it earlier sold short for $9,950,281, giving it a profit of $1,097,868, less commissions.

Thus, Carson would, if we ignore commissions and the opportunity cost of the margin money, offset the loss on the bond issue. In fact, in our example Carson more than offsets the loss, pocketing an additional $239,914 = $1,097,868 − $857,954. Of course, if interest rates had fallen, Carson would have lost on its

futures position, but this loss would have been offset by the fact that Carson could now sell its bonds with a lower coupon.

If futures contracts existed on Carson's own debt, and interest rates moved identically in the spot and futures markets, then the firm could construct a **perfect hedge,** in which gains on the futures contract would exactly offset losses on the bonds. In reality, it is virtually impossible to construct perfect hedges, because in most cases the underlying asset is not identical to the futures asset, and even when they are, prices (and interest rates) may not move exactly together in the spot and futures markets.[18]

Note too that if Carson had been planning an equity offering, and if its stock tended to move fairly closely with one of the stock indexes, the company could have hedged against falling stock prices by selling short the index future. Even better, if options on Carson's stock were traded in the options market, then it could use options rather than futures to hedge against falling stock prices.

The futures and options markets permit flexibility in the timing of financial transactions, because the firm can be protected, at least partially, against changes that occur between the time a decision is reached and the time when the transaction will be completed. However, this protection has a cost—the firm must pay commissions. Whether or not the protection is worth the cost is a matter of judgment. The decision to hedge also depends on management's risk aversion as well as the company's strength and ability to assume the risk in question. In theory, the reduction in risk resulting from a hedge transaction should have a value exactly equal to the cost of the hedge. Thus, a firm should be indifferent to hedging. However, many firms believe that hedging is worthwhile. Trammell Crow, a large Texas real estate developer, recently used T-bill futures to lock in interest costs on floating-rate construction loans, while Dart & Kraft used Eurodollar futures to protect its marketable securities portfolio. Merrill Lynch, Salomon Smith Barney, and the other investment banking houses hedge in the futures and options markets to protect themselves when they are engaged in major underwritings.

Swaps A *swap* is another method for reducing financial risks. As we noted earlier, a swap is an exchange of cash payment obligations in which each party prefers the payment type or pattern of the other party.[19] Generally, one party has a fixed-rate obligation and the other a floating-rate obligation, or one has an obligation denominated in one currency and the other in another currency.

Major changes have occurred over time in the swaps market. First, standardized contracts have been developed for the most common types of swaps, which has had two effects: (1) Standardized contracts lower the time and effort involved in arranging swaps, and this lowers transactions costs. (2) The development of standardized contracts has led to a secondary market for swaps, which has increased the liquidity and efficiency of the swaps market. A number of international banks now make markets in swaps and offer quotes on several standard

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[18]In this example, Carson hedged a 20-year bond with a T-bond futures contract. Rather than simply matching on maturity, it would be more accurate to match on duration (see ***Web Extension 5C*** at the textbook's Web site for a discussion of duration). A matching duration in the futures contracts could be accomplished by taking positions in the T-bond futures contract and in another financial futures contract, such as the 10-Year Treasury Note contract. Because Carson's bond had a 20-year maturity, matching on maturity instead of duration provided a good hedge. If Carson's bond had a different maturity, then it would be essential to match on duration.

[19]For more information on swaps, see Clifford W. Smith, Jr., Charles W. Smithson, and Lee Macdonald Wakeman, "The Evolving Market for Swaps," *Midland Corporate Finance Journal*, Winter 1986, pp. 20–32; and Mary E. Ruth and Steve R. Vinson, "Managing Interest Rate Uncertainty Amidst Change," *Public Utilities Fortnightly*, December 22, 1988, pp. 28–31.

types. Also, as noted above, the banks now take counterparty positions in swaps, so it is not necessary to find another firm with mirror-image needs before a swap transaction can be completed. The bank would generally find a final counterparty for the swap at a later date, so its positioning helps make the swap market more operationally efficient.[20]

To further illustrate a swap transaction, consider the following situation. An electric utility recently issued a 5-year floating-rate note tied to the prime rate. The prime rate could rise significantly over the period, so the note carries a high degree of interest rate risk. The utility could, however, enter into a swap with a counterparty, say, Citibank, wherein the utility would pay Citibank a fixed series of interest payments over the 5-year period, and Citibank would make the company's required floating-rate payments. As a result, the utility would have converted a floating-rate loan to a fixed-rate loan, and the risk of rising interest rates would have been passed from the utility to Citibank. Such a transaction can lower both parties' risks—because banks' revenues rise as interest rates rise, Citibank's risk would actually be lower if it had floating-rate obligations.

Longer-term swaps can also be made. Recently, Citibank entered into a 17-year swap in an electricity cogeneration project financing deal. The project's sponsors were unable to obtain fixed-rate financing on reasonable terms, and they were afraid that interest rates would increase and make the project unprofitable. The project's sponsors were, however, able to borrow from local banks on a floating-rate basis and then arrange a simultaneous swap with Citibank for a fixed-rate obligation.

Commodity Price Exposure

As we noted earlier, futures markets were established for many commodities long before they began to be used as financial instruments. We can use Porter Electronics, which uses large quantities of copper as well as several precious metals, to illustrate inventory hedging. Suppose that in May 2007, Porter foresaw a need for 100,000 pounds of copper in March 2008 for use in fulfilling a fixed price contract to supply solar power cells to the U.S. government. Porter's managers are concerned that a strike by Chilean copper miners will occur, which could raise the price of copper in world markets and possibly turn the expected profit into a loss.

Porter could, of course, go ahead and buy the copper that it will need to fulfill the contract, but if it does it will incur substantial carrying costs. As an alternative, the company could hedge against increasing copper prices in the futures market. The New York Commodity Exchange trades standard copper futures contracts of 25,000 pounds each. Thus, Porter could buy four contracts (go long) for delivery in March 2008. Assume that these contracts were trading in May for about $1.00 per pound and that the spot price at that date was about $1.02 per pound. If copper prices do rise appreciably over the next 10 months, the value of Porter's long position in copper futures would increase, thus offsetting some of

[20]The role of banks in the global swap market is worrisome to the Federal Reserve and other central banks. When banks take positions in swaps, they are themselves exposed to various risks, and if the counterparties cannot meet their obligations, a bank could suddenly become liable for making two sets of payments. Further, swaps are off–balance sheet transactions, so it is currently impossible to tell just how large the swap market is or who has what obligation. The fear is that if one large multinational bank gets into trouble, the entire worldwide swap market could collapse like a house of cards. See "Swap Fever: Big Money, Big Risks," *Fortune*, June 1, 1992.

the price increase in the commodity itself. Of course, if copper prices fall, Porter would lose money on its futures contracts, but the company would be buying the copper on the spot market at a cheaper price, so it would make a higher than anticipated profit on its sale of solar cells. Thus, hedging in the copper futures market locks in the cost of raw materials and removes some risk to which the firm would otherwise be exposed.

Many other companies, such as Alcoa with aluminum and Archer Daniels Midland with grains, routinely use the futures markets to reduce the risks associated with price volatility.

The Use and Misuse of Derivatives

Most of the news stories about derivatives are related to financial disasters. Much less is heard about the benefits of derivatives. However, because of these benefits, more than 83% of large U.S. companies use derivatives on a regular basis. In today's market, sophisticated investors and analysts are demanding that firms use derivatives to hedge certain risks. For example, Compaq Computer was sued by a shareholder group for failing to properly hedge its foreign exchange exposure. The shareholders lost the suit, but Compaq got the message and now uses currency futures to hedge its international operations. In another example, Prudential Securities reduced its earnings estimate for Cone Mills, a North Carolina textile company, because Cone did not sufficiently hedge its exposure to changing cotton prices. These examples lead to one conclusion: If a company can safely and inexpensively hedge its risks, it should do so.

There can, however, be a downside to the use of derivatives. Hedging is invariably cited by authorities as a "good" use of derivatives, whereas speculating with derivatives is often cited as a "bad" use. Some people and organizations can afford to bear the risks involved in speculating with derivatives, but others are either not sufficiently knowledgeable about the risks or else should not be taking those risks in the first place. Most would agree that the typical corporation should use derivatives only to hedge risks, not to speculate in an effort to increase profits. Hedging allows a manager to concentrate on running his or her core business without having to worry about interest rate, currency, and commodity price variability. However, big problems can arise if hedges are improperly constructed or if a corporate treasurer, eager to report relatively high returns, uses derivatives for speculative purposes.

One interesting example of a derivatives debacle involved Kashima Oil, a Japanese firm that imports oil. It pays with U.S. dollars but then sells oil in the Japanese market for yen. Kashima began by using currency futures to hedge, but it later started to speculate on dollar-yen price movements, hoping to increase profits. When the currency markets moved against Kashima's speculative position, lax accounting rules permitted it to avoid reporting the losses by simply rolling over the contract. By the time Kashima bit the bullet and closed its position, it had lost $1.5 billion. Other companies have experienced similar problems.

Our position is that derivatives can and should be used to hedge against certain risks, but that the leverage inherent in derivatives contracts makes them potentially dangerous. Also, CFOs, CEOs, and board members should be reasonably knowledgeable about the derivatives their firms use, should establish policies regarding when they can and cannot be used, and should establish audit procedures to ensure that the policies are carried out. Moreover, a firm's derivatives

position should be reported to stockholders, because stockholders have a right to know when situations such as that involving Kashima might arise.

SELF-TEST

What is a futures contract?
Explain how a company can use the futures market to hedge against rising interest rates.
What is a swap? Describe the mechanics of a fixed-rate to floating-rate swap.
Explain how a company can use the futures market to hedge against rising raw materials prices.
How should derivatives be used in risk management? What problems can occur?
A Treasury bond futures contract is selling for 94-16. What is the implied annual yield? (6.5%)

Summary

Companies every day face a variety of risks, for it is hard to operate a successful business without taking some chances. Back in Chapter 6, we discussed the trade-off between risk and return. If some action can lower risk without lowering returns too much, then the action can enhance value. With this in mind, we described in this chapter the various types of risks that companies face, and we discussed the basic principles of corporate risk management. One important tool for managing risk is the derivatives market. Consequently, this chapter has also provided an introduction to derivative securities. The key concepts covered are listed below:

- There are several reasons **risk management** might increase the value of a firm. Risk management allows corporations (1) to increase their **use of debt,** (2) to maintain their **capital budget** over time, (3) to avoid costs associated with **financial distress,** (4) to utilize their **comparative advantages in hedging** relative to the hedging ability of individual investors, (5) to reduce both the risks and costs of borrowing by using **swaps,** and (6) to reduce the **higher taxes** that result from fluctuating earnings. Managers may also want to stabilize earnings in order to boost their own compensation.
- A **derivative** is a security whose value is determined by the market price or interest rate of some other security.
- A **hedge** is a transaction that lowers risk. A **natural hedge** is a transaction between two **counterparties** where the parties' risks are mirror images.
- A **futures contract** is a standardized contract that is traded on an exchange and is marked-to-market daily, but where physical delivery of the underlying asset usually does not occur.
- Under a **forward contract,** one party agrees to buy a commodity at a specific price and a specific future date and the other party agrees to make the sale. Delivery does occur.
- A **structured note** is a debt obligation derived from another debt obligation.
- A **swap** is an exchange of cash payment obligations. Swaps occur because the parties involved prefer the other's payment stream.
- In general, **risk management** involves the management of unpredictable events that have adverse consequences for the firm.

- The three key steps in risk management are as follows: (1) **identify** the risks faced by the company, (2) **measure** the potential impacts of these risks, and (3) **decide** how each relevant risk should be dealt with.
- In most situations, risk exposure can be dealt with by one or more of the following techniques: (1) **transfer the risk** to an insurance company, (2) **transfer the function** that produces the risk to a third party, (3) **purchase a derivative contract,** (4) **reduce the probability** of occurrence of an adverse event, (5) **reduce the magnitude** of the loss associated with an adverse event, and (6) totally **avoid** the activity that gives rise to the risk.
- **Financial futures** permit firms to create hedge positions to protect themselves against fluctuating interest rates, stock prices, and exchange rates.
- **Commodity futures** can be used to hedge against input price increases.
- **Long hedges** involve buying futures contracts to guard against price increases.
- **Short hedges** involve selling futures contracts to guard against price declines.
- A **perfect hedge** occurs when the gain or loss on the hedged transaction exactly offsets the loss or gain on the unhedged position.

Questions

(23-1) Define each of the following terms:
a. Derivative
b. Corporate risk management
c. Financial futures; forward contract
d. Hedging; natural hedge; long hedge; short hedge; perfect hedge
e. Swap; structured note
f. Commodity futures

(23-2) Give two reasons stockholders might be indifferent between owning the stock of a firm with volatile cash flows and that of a firm with stable cash flows.

(23-3) List six reasons risk management might increase the value of a firm.

(23-4) Discuss some of the techniques available to reduce risk exposures.

(23-5) Explain how the futures markets can be used to reduce interest rate and input price risk.

(23-6) How can swaps be used to reduce the risks associated with debt contracts?

Self-Test Problem Solution Appears in Appendix A

(ST-1) Hedging
It is now March, and the current cost of debt for Wansley Construction is 12%. Wansley plans to issue $5 million in 20-year bonds (with coupons paid

semiannually) in September, but is afraid that rates will climb even higher before then. The following data are available:

Futures Prices: Treasury Bonds—$100,000; Pts. 32nds of 100%

Delivery Month (1)	Open (2)	High (3)	Low (4)	Settle (5)	Change (6)
Mar	96-28	97-13	97-22	98-05	+7
June	98-03	98-03	97-13	97-25	+8
Sept	97-03	97-17	97-03	97-13	+8

a. What is the implied interest rate on the September contract?
b. Construct a hedge for Wansley.
c. Assume all interest rates rise by 1 percentage point. What is the dollar value of Wansley's increased cost of issuing debt? What is Wansley's gain from the futures contract?

Problems Answers Appear in Appendix B

Easy Problems 1–2

(23-1) Swaps

Zhao Automotive issues fixed-rate debt at a rate of 7.00%. Zhao agrees to an interest rate swap in which it pays LIBOR to Lee Financial, and Lee pays 6.8% to Zhao. What is Zhao's resulting net payment?

(23-2) Futures

A Treasury bond futures contract has a settlement price of 89-8. What is the implied annual yield?

Intermediate Problems 3–4

(23-3) Futures

What is the implied interest rate on a Treasury bond ($100,000) futures contract that settled at 100-16? If interest rates increased by 1%, what would be the contract's new value?

(23-4) Swaps

Carter Enterprises can issue floating-rate debt at LIBOR + 2% or fixed-rate debt at 10.00%. Brence Manufacturing can issue floating-rate debt at LIBOR + 3.1% or fixed-rate debt at 11%. Suppose Carter issues floating-rate debt and Brence issues fixed-rate debt. They are considering a swap in which Carter will make a fixed-rate payment of 7.95% to Brence, and Brence will make a payment of LIBOR to Carter. What are the net payments of Carter and Brence if they engage in the swap? Will Carter be better off to issue fixed-rate debt or to issue floating-rate debt and engage in the swap? Will Brence be better off to issue floating-rate debt or to issue fixed-rate debt and engage in the swap?

Challenging Problem 5

(23-5) Hedging

The Zinn Company plans to issue $10,000,000 of 20-year bonds in June to help finance a new research and development laboratory. The bonds will pay interest

semiannually. It is now November, and the current cost of debt to the high-risk biotech company is 11%. However, the firm's financial manager is concerned that interest rates will climb even higher in coming months. The following data are available:

Futures Prices: Treasury Bonds—$100,000; Pts. 32nds of 100%

Delivery Month (1)	Open (2)	High (3)	Low (4)	Settle (5)	Change (6)	Open Interest (7)
Dec	94-28	95-13	94-22	95-05	+7	591,944
Mar	96-03	96-03	95-13	95-25	+8	120,353
June	95-03	95-17	95-03	95-17	+8	13,597

a. Use the given data to create a hedge against rising interest rates.
b. Assume that interest rates in general increase by 200 basis points. How well did your hedge perform?
c. What is a perfect hedge? Are most real-world hedges perfect? Explain.

Spreadsheet Problem

(23-6) Build a Model: Hedging

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Start with the partial model in the file ***FM12 Ch 23 P06 Build a Model.xls*** from the textbook's Web site. Use the information and data from Problem 23-5.

a. Create a hedge with the futures contract for Zinn Company's planned June debt offering of $10 million. What is the implied yield on the bond underlying the futures contract?
b. Suppose interest rates fall by 300 basis points. What are the dollar savings from issuing the debt at the new interest rate? What is the dollar change in value of the futures position? What is the total dollar value change of the hedged position?
c. Create a graph showing the effectiveness of the hedge if the change in interest rates, in basis points, is: −300, −200, −100, 0, 100, 200, or 300. Show the dollar cost (or savings) from issuing the debt at the new interest rates, the dollar change in value of the futures position, and the total dollar value change.

Cyberproblem

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Please go to the textbook's Web site to access any Cyberproblems.

Mini Case

Assume that you have just been hired as a financial analyst by Tennessee Sunshine Inc., a midsized Tennessee company that specializes in creating exotic sauces from imported fruits and vegetables. The firm's CEO, Bill Stooksbury, recently returned from an industry corporate executive conference in San Francisco, and one of the sessions he attended was on the pressing need for smaller companies to institute corporate risk management programs. Since no one at Tennessee Sunshine is familiar with the basics of derivatives and corporate risk management, Stooksbury has asked you to prepare a brief report that the firm's executives could use to gain at least a cursory understanding of the topics.

To begin, you gathered some outside materials on derivatives and corporate risk management and used these materials to draft a list of pertinent questions that need to be answered. In fact, one possible approach to the paper is to use a question-and-answer format. Now that the questions have been drafted, you have to develop the answers.

a. Why might stockholders be indifferent whether or not a firm reduces the volatility of its cash flows?
b. What are six reasons risk management might increase the value of a corporation?
c. What is corporate risk management? Why is it important to all firms?
d. Risks that firms face can be categorized in many ways. Define the following types of risk:
   (1) Speculative risks
   (2) Pure risks
   (3) Demand risks
   (4) Input risks
   (5) Financial risks
   (6) Property risks
   (7) Personnel risks
   (8) Environmental risks
   (9) Liability risks
   (10) Insurable risks
e. What are the three steps of corporate risk management?
f. What are some actions that companies can take to minimize or reduce risk exposures?
g. What is financial risk exposure? Describe the following concepts and techniques that can be used to reduce financial risks:
   (1) Derivatives
   (2) Futures markets
   (3) Hedging
   (4) Swaps
h. Describe how commodity futures markets can be used to reduce input price risk.
i. It is January and Tennessee Sunshine is considering issuing $5 million in bonds in June to raise capital for an expansion. Currently, TS can issue

20-year bonds with a 7% coupon (with interest paid semiannually), but interest rates are on the rise and Stooksbury is concerned that long-term interest rates might rise by as much as 1% before June. You looked online and found that June T-bond futures are trading at 111-25. What are the risks of not hedging and how might TS hedge this exposure? In your analysis, consider what would happen if interest rates all increased by 1%.