

# Chapter 1

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## Risk and Its Management

### Chapter Objectives

- Discuss different meanings of the term *risk*.
- Describe major types of business risk and personal risk.
- Explain and compare pure risk to other types of risk.
- Outline the risk management process and describe major risk management methods.
- Discuss organization of the risk management function within business.

### 1.1 Risk

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#### Different Meanings of Risk

The term *risk* has a variety of meanings in business and everyday life. At its most general level, risk is used to describe any situation where there is uncertainty about what outcome will occur. Life is obviously very risky. Even the short-term future is often highly uncertain. In probability and statistics, financial management, and investment management, risk is often used in a more specific sense to indicate possible variability in outcomes around some expected value.

We will develop the ideas of expected value and risk as reflecting variability around the expected value in Chapter 3. For now it is sufficient for you to think of the expected value as the outcome that would occur on average if a person or business were repeatedly exposed to the same type of risk. If you have not yet encountered these concepts in statistics or finance classes, the following example from the sports world might help. Allen Iverson has averaged about 30 points per game in his career in the National Basketball Association. As we write this, he shows little sign of slowing down. It is therefore reasonable to assume that the expected value of his total points in any given game is about 30 points. Risk, in the sense of variability around the expected value, is clearly present. He might score 50 points or even higher in a particular game, or he might score as few as 10 points.

In other situations, the term risk may refer to the expected losses associated with a situation. In insurance markets, for example, it is common to refer to high-risk policyholders. The meaning of risk in this context is that the expected value of losses to be paid by the insurer (the expected loss) is high. As another example, California often is described as having a high risk of earthquake. While this statement might encompass the notion of variability around the expected value, it usually simply means that California's expected loss from earthquakes is high relative to other states.

In summary, (see Figure 1.1) risk is sometimes used in a specific sense to describe variability around the expected value and other times to describe the expected losses. We employ each of these meanings in this book because it is customary to do so in certain types of risk management and in the insurance business. The particular meaning usually will be obvious from the context.

### Risk Is Costly

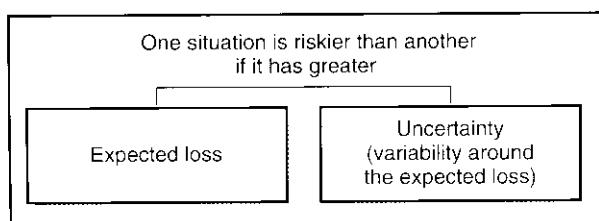
Regardless of the specific meaning of risk being used, greater risk usually implies greater cost. To illustrate the cost of risk we use a simple example: Suppose that two identical homes are in different but equally attractive locations. The structures have the same value, say \$100,000, and initially there is no risk of damage to either house. Then scientists announce that a meteor might hit the earth in the coming week and that one house is in the potential impact area. We would naturally say that one house now has greater risk than the other.

Let's assume that everyone agrees that the probability of one house being hit by the meteor is 0.1 and that the probability of the other house being hit is zero. Also assume that the house would be completely destroyed if it were hit (all \$100,000 would be lost). Then the expected property loss at one house is greater by an amount equal to 0.1 times \$100,000, or \$10,000. If the owner were to sell the house immediately following the release of news about the meteor, potential buyers would naturally pay less than \$100,000 for the house. Rational people would pay at least \$10,000 less, because that is the expected loss from the meteor. Thus, greater risk—in the sense of higher expected losses—is costly to the original homeowner. The value of the house would drop by at least the expected loss.

In addition to greater expected losses, one homeowner has greater uncertainty in the sense that potential outcomes have greater variation. At the end of the week, one house will be worth \$100,000 with certainty, but the other house could be worth zero or \$100,000. This greater uncertainty about the value of the house also is likely to impose costs on the owner. Because of the greater uncertainty, potential buyers might require a price decrease in excess of the expected loss (\$10,000). Let's say the additional price drop is \$5,000. Thus, greater risk—in the sense of greater uncertainty—is also costly to the original homeowner.

**FIGURE 1.1**

Two meanings of risk.



To summarize, this example illustrates that both meanings of risk depicted in Figure 1.1 are costly. In this example, the value of the house declined by the expected loss (the first meaning of risk) plus an additional amount due to increased uncertainty (the second meaning of risk). As you will see throughout this book, risk management is concerned with decreasing the cost of risk.

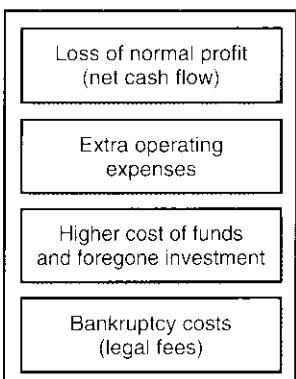
### Direct versus Indirect Expected Losses

When considering the potential losses from a risky situation, you must consider indirect losses that arise in addition to direct losses. In the previous example, if the meteor destroyed the house, the direct loss would be \$100,000. Indirect losses arise as a consequence of direct losses. If the house were destroyed, the owner would likely have additional expenses, such as hotel and restaurant costs; these additional expenses would be indirect losses. As another example, when a person's car is damaged, the time spent getting it repaired is an indirect loss.

For businesses, indirect losses are extremely important. Indeed, as we discuss in later chapters, the possibility of indirect losses is one of the main reasons that businesses try to reduce risk. Figure 1.2 summarizes the major types of indirect losses that can arise from the risks faced by businesses. For example, damage to productive assets can produce an indirect loss by reducing or eliminating the normal profit (net cash flow) that the asset would have generated if the damage had not occurred. Large direct losses also can lead to indirect losses if they threaten the viability of the business and thereby reduce the willingness of customers and suppliers to deal with the business or change the terms (prices) at which they transact.

Moreover, if sales or production are reduced in response to direct losses, certain types of normal operating expenses (known as continuing expenses) may not decline in proportion to the reduction in revenues, thus increasing indirect losses. If a long interruption in production would cause many customers to switch suppliers, or if a firm has binding contractual commitments to supply products, it also may be desirable for the firm to increase operating costs above normal levels following direct losses. For example, some businesses might find it desirable to maintain production by leasing replacement equipment at a higher cost so as to avoid loss of sales. The increased operating cost would create an indirect loss. Similarly, a business that decides to recall defective products that have produced liability claims will incur product recall expenses and perhaps increased advertising costs to reduce damage to the firm's reputation.

**FIGURE 1.2**  
Types of  
indirect losses.



Other forms of indirect losses include the possibility that the business will face a higher cost of obtaining funds from lenders or from new equity issues following large direct losses. In some cases, the higher costs of raising capital will cause the firm to forgo making otherwise profitable investments. Finally, in the case of severe direct and indirect losses, the firm might have to reorganize or be liquidated through costly legal proceedings under bankruptcy law.

## 1.2 Types of Risk Facing Businesses and Individuals

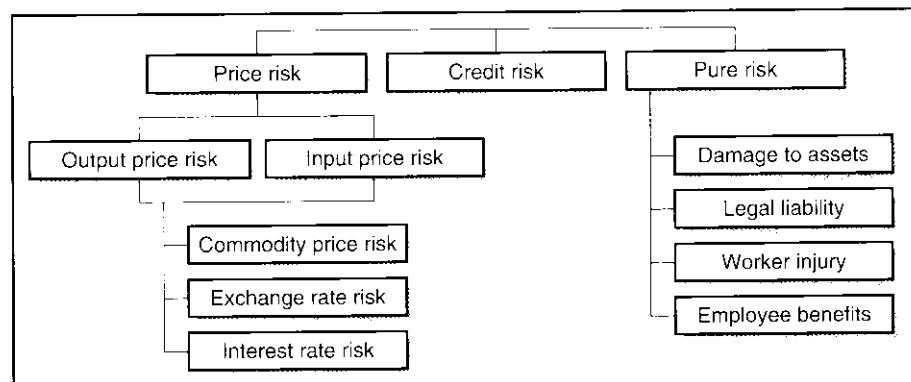
### Business Risk

Broadly defined, business risk management is concerned with possible reductions in business value from any source. Business value to shareholders, as reflected in the value of the firm's common stock, depends fundamentally on the expected size, timing, and risk (variability) associated with the firm's future net cash flows (cash inflows less cash outflows). Unexpected changes in expected future net cash flows are a major source of fluctuations in business value. In particular, unexpected reductions in cash inflows or increases in cash outflows can significantly reduce business value. The major business risks that give rise to variation in cash flows and business value are price risk, credit risk, and pure risk (see Figure 1.3).

#### Price Risk

**Price risk** refers to uncertainty over the magnitude of cash flows due to possible changes in output and input prices. Output price risk refers to the risk of changes in the prices that a firm can demand for its goods and services. Input price risk refers to the risk of changes in the prices that a firm must pay for labor, materials, and other inputs to its production process. Analysis of price risk associated with the sale and production of existing and future products and services plays a central role in strategic management.<sup>1</sup>

**FIGURE 1.3**  
Major types of business risk.



<sup>1</sup>Thus, most strategic risks and operational risks can be viewed as particular examples of price risk.

Three specific types of price risk are *commodity price risk*, *exchange rate risk*, and *interest rate risk*. Commodity price risk arises from fluctuations in the prices of commodities, such as coal, copper, oil, gas, and electricity, that are inputs for some firms and outputs for others. Given the globalization of economic activity, output and input prices for many firms also are affected by fluctuations in foreign exchange rates. Output and input prices also can fluctuate due to changes in interest rates. For example, increases in interest rates may alter a firm's revenues by affecting both the terms of credit allowed and the speed with which customers pay for products purchased on credit. Changes in interest rates also affect the firm's cost of borrowing funds to finance its operations.<sup>2</sup>

### *Credit Risk*

The risk that a firm's customers and the parties to which it has lent money will delay or fail to make promised payments is known as **credit risk**. Most firms face some credit risk for account receivables. The exposure to credit risk is particularly large for financial institutions, such as commercial banks, that routinely make loans that are subject to risk of default by the borrower. When firms borrow money, they in turn expose lenders to credit risk (i.e., the risk that the firm will default on its promised payments). As a consequence, borrowing exposes the firm's owners to the risk that the firm will be unable to pay its debts and thus be forced into bankruptcy, and the firm generally will have to pay more to borrow money as credit risk increases.

### *Pure Risk*

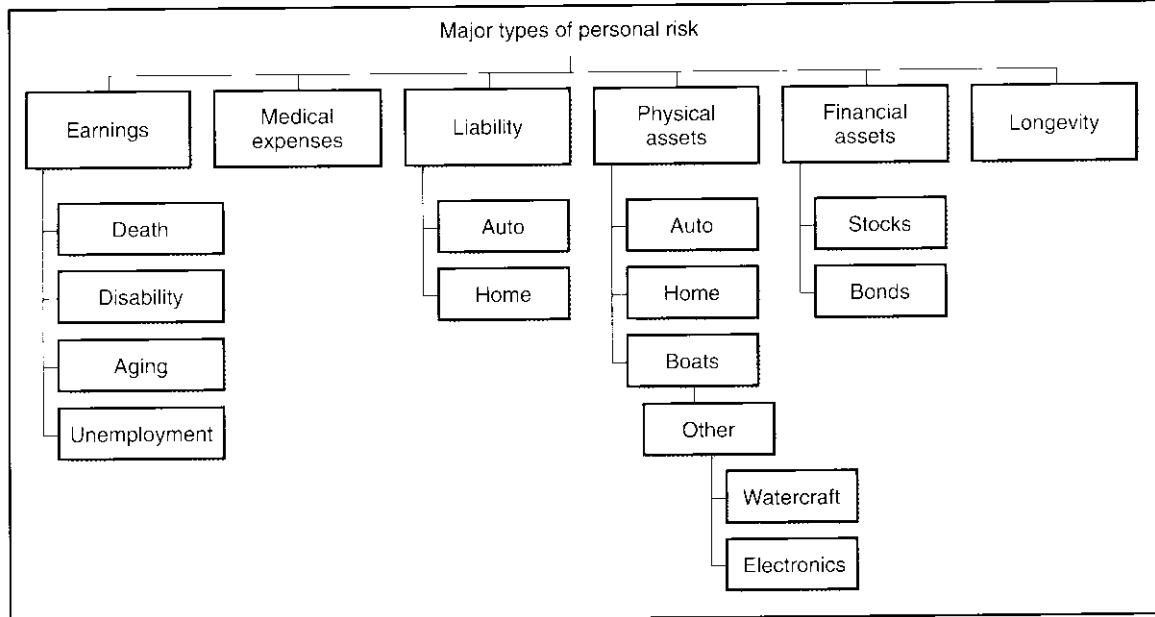
The risk management function in medium-to-large corporations (and the term *risk management*) has traditionally focused on the management of what is known as **pure risk**. As summarized in Figure 1.3, the major types of pure risk that affect businesses include:

1. The risk of reduction in value of business assets due to physical damage, theft, and expropriation (i.e., seizure of assets by foreign governments).
2. The risk of legal liability for damages for harm to customers, suppliers, shareholders, and other parties.
3. The risk associated with paying benefits to injured workers under workers' compensation laws and the risk of legal liability for injuries or other harms to employees that are not governed by workers' compensation laws.
4. The risk of death, illness, and disability to employees (and sometimes family members) for which businesses have agreed to make payments under employee benefit plans, including obligations to employees under pension and other retirement savings plans.

### **Personal Risk**

The risks faced by individuals and families can be classified in a variety of ways. In Figure 1.4, we classify personal risk into six categories: earnings risk, medical expense risk, liability risk, physical asset risk, financial asset risk, and longevity risk. Earnings risk refers to the potential fluctuation in a family's earnings, which can occur as a result of a decline in the value of an income earner's productivity due to death, disability, aging, or a change in technology. A

<sup>2</sup>More generally, changes in interest rates affect value through their effect on the present value of the firm's net cash flows, as reflected in the value of the firm's assets and liabilities.

**FIGURE 1.4** Major types of personal risk.

family's expenses also are uncertain. Health care costs and liability suits, in particular, can cause large unexpected expenses. A family also faces the risk of a loss in the value of the physical assets that it owns. Automobiles, homes, boats, and computers can be lost, stolen, or damaged. Financial assets' values also are subject to fluctuation due to changes in inflation and changes in the real values of stocks and bonds. Finally, longevity risk refers to the possibility that retired people will outlive their financial resources. Often individuals obtain advice about personal risk management from professionals, such as insurance agents, accountants, lawyers, and financial planners.

### Comparison of Pure Risk and Its Management with Other Types of Risk

Much of this book focuses on pure risk and its management, including the use of insurance as a tool to reduce risk and finance losses for businesses and individuals. The framework that we present for managing risk, however, is very general. It can be applied with little or no modification to other types of risk. In addition, our detailed discussion of insurance markets and comparison of insurance contracts to the tools used to reduce other types of business risk will help you understand the rich variety of risk reduction methods available in modern risk management.

Common (but not necessarily distinctive) features of pure risk include the following.

1. Losses from destruction of property, legal liability, and employee injuries or illness often have the potential to be very large relative to a business's resources. While business value can increase if losses from pure risk turn out to be lower than expected, the maximum

possible gain in these cases is usually relatively small. In contrast, the potential reduction in business value from losses greater than the expected value can be very large and even threaten the firm's viability.<sup>3</sup>

2. The underlying causes of losses associated with pure risk, such as the destruction of a plant by the explosion of a steam boiler or product liability suits from consumers injured by a particular product, are often largely specific to a particular firm and depend on the firm's actions. As a result, the underlying causes of these losses are often subject to a significant degree of control by businesses; that is, firms can reduce the frequency and severity of losses through actions that alter the underlying causes (e.g., by taking steps to reduce the probability of fire or lawsuit). In comparison, while firms can take a variety of steps to reduce their exposure or vulnerability to price risk, the underlying causes of some important types of price changes are largely beyond the control of individual firms (e.g., economic factors that cause changes in foreign exchange rates, marketwide changes in interest rates, or aggregate consumer demand).

3. Businesses commonly reduce uncertainty and finance losses associated with pure risk by purchasing contracts from insurance companies that specialize in evaluating and bearing pure risk. The prevalence of insurance in part reflects the firm-specific nature of losses caused by pure risk. The fact that events that cause large losses to a given firm commonly have little effect on losses experienced by other firms facilitates risk reduction by diversification, which is accomplished with insurance contracts (see Chapters 5 and 6). Insurance contracts generally are not used to reduce uncertainty and finance losses associated with price risk (and many types of credit risk). Price risks that can simultaneously produce gains for many firms and losses for many others are commonly reduced with *financial derivatives*, such as forward and futures contracts, option contracts, and swaps. With these contracts, much of the risk of loss is often shifted to parties that have an opposite exposure to the particular risk.

4. Losses from pure risk usually are not associated with offsetting gains for other parties. In contrast, losses to businesses that arise from other types of risk often are associated with gains to other parties. For example, an increase in input prices harms the purchaser of the inputs but benefits the seller. Likewise, a decline in the dollar's value against foreign currencies can harm domestic importers but benefit domestic exporters and foreign importers of U. S. goods.<sup>4</sup> One implication of this difference between pure risk and price risk is that losses from pure risk reduce the total wealth in society, whereas fluctuations in output and input prices need not reduce total wealth. In addition, and as we hinted above, the fact that price changes often produce losses for some firms and gains for others in many cases allows these firms to reduce risk by taking opposite positions in derivative contracts.

<sup>3</sup>Pure risk sometimes is defined as risk where the random outcome can only result in loss (produce a cash outflow); that is, no outcome involving a gain (cash inflow) is possible. But this is also true for other uncertain cash outflows faced by firms (e.g., the cost of raw materials). This definition also ignores the fact that businesses or individuals gain financially whenever losses from pure risk are less than expected. The gain is no different in substance from the gain that would occur if the price of raw materials dropped so that the firm could buy them more cheaply.

<sup>4</sup>With respect to credit risk, one party's loss also is often associated with the other party's gain in the sense that the party that defaults on its obligation does not make payment.

While many of the details concerning pure risk and its management differ from other types of risk, it is nonetheless important for you to understand that pure risk and its management are conceptually similar, if not identical, to other types of risk and their management. To make this concrete, consider the case of a manufacturer that uses oil in the production of consumer products. Such a firm faces the risk of large losses from product liability lawsuits if its products harm consumers, but it also faces the risk of potentially large losses from oil price increases. The business can manage the expected cost of product liability settlements or judgments by making the product's design safer or by providing safety instructions and warnings. While the business might not be able to do anything to reduce the likelihood or size of increases in oil prices, it might be able to reduce its exposure to losses from oil price increases by adopting a flexible technology that allows low cost conversion to other sources of energy. The business might purchase product liability insurance to reduce its liability risk; it might hedge its risk of loss from oil price increases using oil futures contracts.

While the concepts and broad risk management strategies are the same for pure risk and other types of business risk, the specific characteristics of pure risk and the significant reliance on insurance contracts as a method of managing these risks generally lead to their management by personnel with specialized expertise. Major areas of expertise needed for pure risk management include risk analysis, safety management, insurance contracts, and other methods of reducing pure risk, as well as broad financial and managerial skills. The insurance business, with its principal function of reducing pure risk for businesses and individuals, employs millions of people and is one of the largest industries in the United States (and other developed countries). In addition, pure risk management and insurance have a major effect on many other sectors of the economy, such as the legal sector, medical care, real estate lending, and consumer credit.

Increases in business risk of all types and dramatic growth in the use of financial derivatives for hedging price risks in recent years have stimulated substantial growth in the scope and efforts devoted to overall business risk management. It has become increasingly important for managers that focus on pure risk to understand the management of other types of business risk. Similarly, general managers and managers of other types of risk need to understand how pure risk affects specific areas of activity and the business as a whole.

## 1.3 Risk Management

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### The Risk Management Process

Regardless of the type of risk being considered, the risk management process involves several key steps:

1. Identify all significant risks.
2. Evaluate the potential frequency and severity of losses.<sup>5</sup>
3. Develop and select methods for managing risk.

<sup>5</sup>If possible, this includes an estimation of the maximum loss that can reasonably be expected to occur in a given period with a relatively high level of confidence. This value is known in pure risk management as the *maximum probable loss* and in financial risk management as *value at risk*.

4. Implement the risk management methods chosen.
5. Monitor the performance and suitability of the risk management methods and strategies on an ongoing basis.

The same general framework applies to business and individual risk management. You will learn more about major exposures to losses from pure risk, risk evaluation, and the selection and implementation of risk management methods in subsequent chapters. Chapter 2 discusses risk management objectives for businesses and individuals. It is useful in this introductory chapter to further acquaint you with basic aspects of risk management by summarizing the major methods used to manage risk.

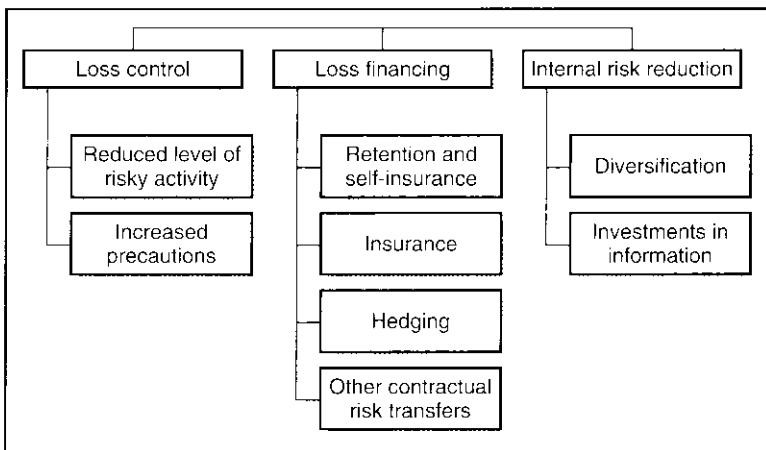
## Risk Management Methods

Figure 1.5 summarizes the major methods of managing risk. These methods, which are not mutually exclusive, can be broadly classified as (1) loss control, (2) loss financing, and (3) internal risk reduction. Loss control and internal risk reduction commonly involve decisions to invest (or forgo investing) resources to reduce expected losses. They are conceptually equivalent to other investment decisions, such as a firm's decision to buy a new plant or an individual's decision to buy a computer. Loss financing decisions refer to decisions about how to pay for losses if they do occur.

### *Loss Control*

Actions that reduce the expected cost of losses by reducing the frequency of losses and/or the severity (size) of losses that occur are known as **loss control**. Loss control also is sometimes known as risk control.<sup>6</sup> Actions that primarily affect the frequency of losses are commonly called *loss prevention* methods. Actions that primarily influence the severity of losses that do occur are often called *loss reduction* methods. An example of loss prevention

**FIGURE 1.5**  
Major risk management methods.



<sup>6</sup>Use of the term *loss control* as opposed to *risk control* helps avoid confusion between activities that reduce the expected cost of losses and activities that reduce risk (variability), such as internal risk reduction. Terminology aside, the most important thing for you to understand is how these activities work and can be used to increase business value.

would be routine inspection of aircraft for mechanical problems. These inspections help reduce the frequency of crashes; they have little impact on the magnitude of losses for crashes that occur. An example of loss reduction is the installation of heat- or smoke-activated sprinkler systems that are designed to minimize fire damage in the event of a fire.

Many types of loss control influence both the frequency and severity of losses and cannot be readily classified as either loss prevention or loss reduction. For example, thorough safety testing of consumer products will likely reduce the number of injuries, but it also could affect the severity of injuries. Similarly, equipping automobiles with airbags in most cases should reduce the severity of injuries, but airbags also might influence the frequency of injuries. Whether injuries increase or decrease depends on whether the number of injuries that are completely prevented for accidents that occur exceeds the number of injuries that might be caused by airbags inflating at the wrong time or too forcefully, as well as any increase in accidents and injuries that could occur if protection by airbags causes some drivers to drive less safely.

Viewed from another perspective, there are two general approaches to loss control: (1) reducing the level of risky activity, and (2) increasing precautions against loss for activities that are undertaken. First, exposure to loss can be reduced by reducing the level of risky activities, for example, by cutting back production of risky products or shifting attention to less risky product lines. Limiting the level of risky activity primarily affects the frequency of losses. The main cost of this strategy is that it forgoes any benefits of the risky activity that would have been achieved apart from the risk involved. In the limit, exposure to losses can be completely eliminated by reducing the level of activity to zero; that is, by not engaging in the activity at all. This strategy is called *risk avoidance*.

As a specific example of limiting the level of risky activity, consider a trucking firm that hauls toxic chemicals that might harm people or the environment in the case of an accident and thereby produce claims for damages. This firm could reduce the frequency of liability claims by cutting back on the number of shipments that it hauls. Alternatively, it could avoid the risk completely by not hauling toxic chemicals and instead hauling nontoxic substances (such as clothing or, apart from cholesterol, cheese). An example from personal risk management would be a person who flies less frequently to reduce the probability of dying in a plane crash. This risk could be completely avoided by never flying. Of course, alternative transportation methods might be much riskier (e.g., driving down Interstate 95 from New York to Miami the day before Thanksgiving—along with many long-haul trucks, including those transporting toxic chemicals).

The second major approach to loss control is to increase the amount of precautions (level of care) for a given level of risky activity. The goal here is to make the activity safer and thus reduce the frequency and/or severity of losses. Thorough testing for safety and installation of safety equipment are examples of increased precautions. The trucking firm in the example above could give its drivers extensive training in safety, limit the number of hours driven by a driver in a day, and reinforce containers to reduce the likelihood of leakage. Increased precautions usually involve direct expenditures or other costs (e.g., the increased time and attention required to drive an automobile more safely).

### Concept Checks

1. Explain how the two major approaches to loss control (reducing risky activity and increasing precautions) could be used to reduce the risk of injury to construction firm employees.

- How could these two approaches be used to reduce the risk of contracting a sexually transmitted disease?

### *Loss Financing*

Methods used to obtain funds to pay for or offset losses that occur are known as **loss financing** (sometimes called risk financing). There are four broad methods of financing losses: (1) retention, (2) insurance, (3) hedging, and (4) other contractual risk transfers. These approaches are not mutually exclusive; that is, they often are used in combination.

With **retention**, a business or individual retains the obligation to pay for part or all of the losses. For example, a trucking company might decide to retain the risk that cash flows will drop due to oil price increases. When coupled with a formal plan to fund losses for medium-to-large businesses, retention often is called *self-insurance*.

Firms can pay retained losses using either internal or external funds. Internal funds include cash flows from ongoing activities and investments in liquid assets that are dedicated to financing losses. External sources of funds include borrowing and issuing new stock, but these approaches may be very costly following large losses. Note that these approaches still involve retention even though they employ external sources of funds. For example, the firm must pay back any funds borrowed to finance losses. When new stock is issued, the firm must share future profits with new stockholders.

The second major method of financing losses is the purchase of insurance contracts. As you most likely already know, the typical insurance contract requires the insurer to provide funds to pay for specified losses (thus financing these losses) in exchange for receiving a premium from the purchaser at the inception of the contract. Insurance contracts reduce risk for the buyer by transferring some of the risk of loss to the insurer. Insurers in turn reduce risk through diversification. For example, they sell large numbers of contracts that provide coverages for a variety of different losses (see Chapter 4).

The third broad method of loss financing is **hedging**. As noted above, financial derivatives, such as forwards, futures, options, and swaps, are used extensively to manage various types of risk, most notably price risk. These contracts can be used to hedge risk; that is, they may be used to offset losses that can occur from changes in interest rates, commodity prices, foreign exchange rates, and the like. Some derivatives have begun to be used in the management of pure risk, and it is possible that their use in pure risk management will expand in the future.

Individuals and small businesses do relatively little hedging with derivatives. We discuss derivatives, their use in hedging risk, and how they compare to insurance in Chapter 24. At this point, it is useful to illustrate hedging with a very simple example (which we elaborate in Chapter 24). Firms that use oil in the production process are subject to loss from unexpected increases in oil prices; oil producers are subject to loss from unexpected decreases in oil prices. Both types of firms can hedge their risk by entering into a *forward contract* that requires the oil producer to provide the oil user with a specified amount of oil on a specified future delivery date at a predetermined price (known as the *forward price*), regardless of the market price of oil on that date. Because the forward price is agreed upon when the contract is written, the oil user and the oil producer both reduce their price risk.

The fourth major method of loss financing is to use one or more of a variety of **other contractual risk transfers** that allow businesses to transfer risk to another party. Like insurance contracts and derivatives, the use of these contracts also is pervasive in risk management.

For example, businesses that engage independent contractors to perform some task routinely enter into contracts, commonly known as *hold harmless* and *indemnity agreements*, that require the contractor to protect the business from losing money from lawsuits that might arise if persons are injured by the contractor.

#### *Internal Risk Reduction*

In addition to loss financing methods that allow businesses and individuals to reduce risk by transferring it to another entity, businesses can reduce risk internally. There are two major forms of **internal risk reduction**: (1) *diversification*, and (2) *investment in information*. Regarding the first of these, firms can reduce risk internally by diversifying their activities (i.e., not putting all of their eggs in one basket). You will learn the basics of how diversification reduces risk in Chapter 4. Individuals also routinely diversify risk by investing their savings in many different stocks. The ability of shareholders to reduce risk through portfolio diversification is an important factor affecting insurance and hedging decisions of firms (see Chapters 9 and 20).

The second major method of reducing risk internally is to invest in information to obtain superior forecasts of expected losses. Investing in information can produce more accurate estimates or forecasts of future cash flows, thus reducing variability of cash flows around the predicted value. Examples abound, including estimates of the frequency and severity of losses from pure risk, marketing research on the potential demand for different products to reduce output price risk, and forecasting future commodity prices or interest rates. One way that insurance companies reduce risk is by specializing in the analysis of data to obtain accurate forecasts of losses. Medium-to-large businesses often find it advantageous to reduce pure risk in this manner as well. Given the large demand for accurate forecasts of key variables that affect business value and determine the price of contracts that can be used to reduce risk (such as insurance and derivatives), many firms specialize in providing information and forecasts to other firms and parties.

## 1.4 Business Risk Management Organization

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Where does the risk management function fit within the overall organizational structure of businesses? In general, the views of senior management concerning the need for, scope, and importance of risk management and possible administrative efficiencies determine how the risk management function is structured and the exact responsibilities of units devoted to risk management. Most large companies have a specific department responsible for managing pure risk that is headed by the *risk manager* (or director of risk management). However, given that losses can arise from numerous sources, the overall risk management process ideally reflects a coordinated effort between all of the corporation's major departments and business units, including production, marketing, finance, and human resources.

Depending on a company's size, a typical risk management department includes various staff specializing in areas such as property-liability insurance, workers' compensation, safety and environmental hazards, claims management, and, in many cases, employee benefits. Given the complexity of modern risk management, most firms with significant exposure to price risk related to the cost of raw materials, interest rate changes, or changes in foreign exchange rates have separate departments or staff members that deal with these risks. Whether there will be more movement in the future toward combining the manage-

ment of these risks with pure risk management within a unified risk management department is uncertain.

In most firms, the risk management function is subordinate to and thus reports to the finance (treasury) department. This is because of the close relationships between protecting assets from loss, financing losses, and the finance function. However, some firms with substantial liability exposures have the risk management department report to the legal department. A smaller proportion of firms have the risk management unit report to the human resources department.

Firms also vary in the extent to which the risk management function is centralized, as opposed to having responsibility spread among the operating units. Centralization may achieve possible economies of scale in arranging loss financing. Moreover, many risk management decisions are strategic in nature, and centralization facilitates effective interaction between the risk manager and senior management.

A possible limitation of a centralized risk management function is that it can reduce concern for risk management among the managers and employees of a firm's various operating units. However, allocating the cost of risk or losses to particular units often can improve incentives for unit managers to control costs even if the overall risk management function is centralized. On the other hand, there are advantages to decentralizing certain risk management activities, such as routine safety and environmental issues. In these cases, operating managers are close to the risk and can deal effectively and directly with many issues.

## 1.5 Summary

- The term *risk* broadly refers to situations where outcomes are uncertain. Risk often refers specifically to variability in outcomes around the expected value. In other cases, it refers to the expected value (e.g., the expected value of losses). Regardless of the specific notion of risk being used, risk is costly.
- Major types of business risk that produce fluctuations in business value include price risk, credit risk, and pure risk.
- Pure risk encompasses risk of loss from (1) damage to and theft or expropriation of business assets, (2) legal liability for injuries to customers and other parties, (3) workplace injuries to employees, and (4) obligations assumed by businesses under employee benefit plans. Pure risk frequently is managed in part by the purchase of insurance to finance losses and reduce risk.
- Risk management involves (1) identification of potential direct and indirect losses, (2) evaluation of their potential frequency and severity, (3) development and selection of methods for managing risk to maximize business value, (4) implementation of these methods, and (5) ongoing monitoring.
- Major risk management methods include loss control, loss financing, and internal risk reduction.
- Loss control reduces expected losses by lowering the level of risky activity and/or increasing precautions against loss for any given level of risky activity.
- Loss financing methods include retention (self-insurance), insurance, hedging, and other contractual risk transfers.
- Many businesses achieve internal risk reduction through diversification and through investments in information to improve forecasts of expected cash flows.
- Most large corporations have a specific department, headed by the risk manager, that is devoted to the management of pure risk and, in some cases, other types of risk.

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## Key Terms

price risk 4	loss control 9	hedging 11
credit risk 5	loss financing 11	other contractual risk transfers 11
pure risk 5	retention 11	internal risk reduction 12

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## Questions and Problems

1. Describe possible direct and indirect losses to a business from: (a) an explosion that produces major damage to a manufacturing plant, and (b) lawsuits arising from the business's release of toxic chemicals that damage the environment.
2. Explain how a business could reduce the risk of loss from lawsuits by consumers injured by the business's products.
3. Describe loss control measures that you could take to reduce your risk of being injured in an automobile accident.
4. What major methods are used to finance losses? How does loss financing differ from internal risk reduction?

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## Answers to Concept Checks

1. Taking on less hazardous projects and/or reducing the total number of projects would reduce the level of risky activity. Examples of increasing precautions for a given level of risky activity include giving employees safety instruction and making them wear protective devices (such as hard hats).
2. The level of risky activity could be reduced by abstinence (complete or partial). An example of increasing precautions for a given level of risk activity (number of contacts) would be the regular use of protective devices (such as condoms).

# Chapter 2

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## Objective of Risk Management

### Chapter Objectives

- Define and explain the overall objective of risk management.
- Explain the cost of risk concept.
- Explain how minimizing the cost of risk maximizes business value.
- Discuss possible conflicts between business and societal objectives.

### 2.1 The Need for a Risk Management Objective

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In the first chapter you learned that risk refers to either variability around the expected value or, in other contexts, the expected value of losses. Holding all else equal, both types of risk—variability and expected losses—are costly (i.e., they generally reduce the value of engaging in various activities). At a broad level, risk management seeks to mitigate this reduction in value and thus increase welfare. We begin this chapter with two simple examples to illustrate how risk management can increase value: (1) the risk of product liability claims against a pharmaceutical company, and (2) the risk to individuals associated with automobile accidents.

Consider first a pharmaceutical company that is developing a new prescription drug for the treatment of rheumatoid arthritis, a crippling disease of the joints. The risk of adverse health reactions to the drug and thus legal liability claims by injured users could be substantial. The possibility of injuries, which cause the firm (and/or its liability insurer) to defend lawsuits and pay damages, will increase the business's expected costs. Loss control, such as expenditures on product development and safety testing that reduce expected legal defense costs and expected damage payments, also will be costly.

If the firm purchases liability insurance to finance part of the potential losses, the premium paid will include a “loading” to cover the insurer’s administrative costs and provide a reasonable expected return on the insurer’s capital (see Chapter 8). The possibility of uninsured damage claims (self-insured losses or losses in excess of liability insurance coverage

limits) will create uncertainty about the amount of costs that will be incurred in any given period.

Most and perhaps all of these factors can increase the price that the firm will need to charge for the drug, thus reducing demand. For a given price, the risk of injury also might discourage some doctors from prescribing the drug. The risk of injury also might cause the firm and the medical profession to distribute the drug only to the most severe cases of the disease, or the firm might even decide not to introduce the drug. As a result, from the company's perspective, the risk of consumer injury could have a significant effect on the value of introducing the drug.

Now consider the risk that you will be involved in an auto accident, which could cause physical harm to you and your vehicle, as well as exposing you to the risk of a lawsuit for harming someone else. The possibility of being involved in an accident reduces the value of driving. Other things being equal, people obviously would prefer to have a lower likelihood of accident. But other things are not equal. Safety equipment included in vehicles usually increases their price. Attempting to reduce the likelihood of injury by driving less also can be costly. You either must stay home or take alternative transportation that may not be as attractive as driving (apart from the risk of accident). Driving more safely usually means taking more time to get places, or it requires greater concentration, which means you cannot think as much about other things while you are behind the wheel.

In addition to the component needed to pay losses, auto and health insurance premiums must again include a loading for the insurer's administrative costs and provide a reasonable expected return on the insurer's capital. Even with insurance, you face some uncertainty about the cost of losses that are less than your deductible (or for liability losses greater than policy limits). You also are exposed to uninsured indirect losses that arise from accidents, such as the time lost in getting your car repaired and submitting a claim to your insurer.

Along with the discussion in Chapter 1, you should be convinced by now that risk is costly and so is the management of risk. We therefore need some guiding principles to determine how much and what types of risk management should be pursued. That is, we need to identify the underlying objective of risk management.

The guiding principle or fundamental objective of risk management is to minimize the cost of risk. When we consider business risk management decisions, the objective is to minimize the firm's cost of risk. When we consider individual risk management, the objective is to minimize the individual's cost of risk. And, if we consider public policy risk management decisions, the objective is to minimize society's cost of risk.

After explaining the cost of risk concept in more detail in the next section, we show how minimizing a firm's cost of risk is the same as maximizing the firm's value (section 2.3). Then we introduce the concept of risk aversion and explain how individuals' cost of risk depends on their degree of risk aversion (section 2.4). Finally, we show how actions that minimize society's cost of risk may differ from actions that minimize the cost of risk for an individual or business (section 2.5).

## 2.2 Understanding the Cost of Risk

Recall from Chapter 1 that most risk management decisions must be made before losses are known. The magnitude of actual losses during a given time period can be determined after the fact (i.e., after the number and severity of accidents are known). Before losses occur, the

cost of direct and indirect losses reflects the predicted or expected value of losses during an upcoming time period. Thus, the cost of losses can be determined *ex post* (after the fact) and estimated *ex ante* (before the fact). Most risk management decisions must be based on *ex ante* estimates of the cost of losses and thus the cost of risk.

## Components of the Cost of Risk

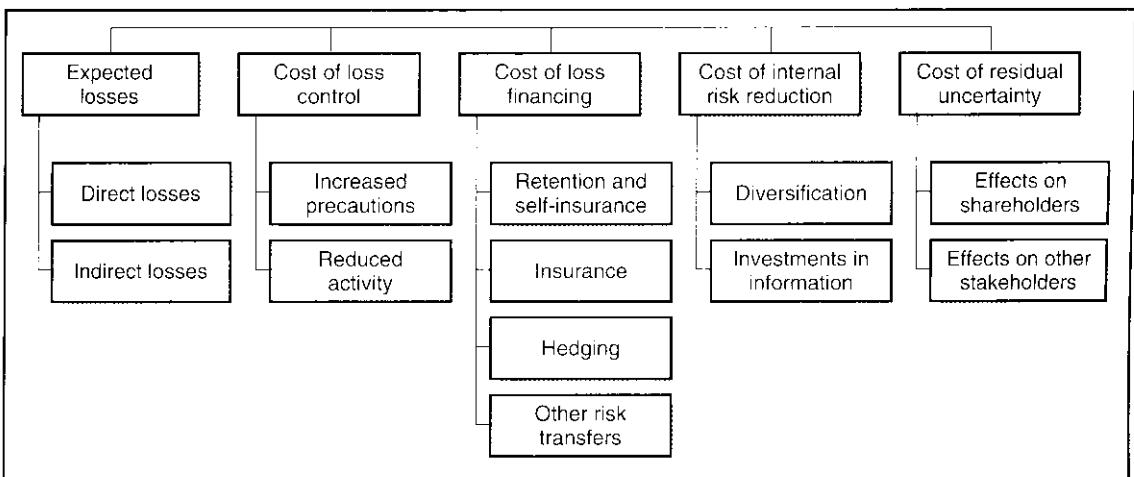
Regardless of the type of risk being considered, the **cost of risk** has five main components. For concreteness, we discuss these components from a business perspective for the case of pure risk. Using the *ex ante* perspective, the cost of pure risk includes: (1) expected losses, (2) the cost of loss control, (3) the cost of loss financing, (4) the cost of internal risk reduction, and (5) the cost of any residual uncertainty that remains after loss control, loss financing, and internal risk reduction methods have been implemented. Figure 2.1 summarizes these five components.

### *Expected Cost of Losses*

The **expected cost of losses** includes the expected cost of both direct and indirect losses. As you learned in the last chapter, major types of direct losses include the cost of repairing or replacing damaged assets, the cost of paying workers' compensation claims to injured workers, and the cost of defending against and settling liability claims. Indirect losses include reductions in net profits that occur as a consequence of direct losses, such as the loss of normal profits and continuing and extra expense when production is curtailed or stopped due to direct damage to physical assets. In the case of large losses, indirect losses can include loss of profits from forgone investment and, in the event of bankruptcy, legal expenses and other costs associated with reorganizing or liquidating a business.

In the case of the pharmaceutical company discussed earlier, the expected cost of direct losses would include the expected cost of liability settlements and defense. The expected cost of indirect losses would include items such as (1) the expected cost of lost profit if sales had to be reduced due to adverse liability experience, (2) the expected cost of product recall

**FIGURE 2.1** Components of the cost of risk.



expenses, and (3) the expected loss in profit on any investments that would not be undertaken if large liability losses were to deplete the firm's internal funds available for investment and increase the cost of borrowing or raising new equity.

#### *Cost of Loss Control*

The **cost of loss control** reflects the cost of increased precautions and limits on risky activity designed to reduce the frequency and severity of accidents. For example, the cost of loss control for the pharmaceutical company would include the cost of testing the product for safety prior to its introduction and any lost profit from limiting distribution of the product in order to reduce exposure to lawsuits.

#### *Cost of Loss Financing*

The **cost of loss financing** includes the cost of self-insurance, the loading in insurance premiums, and the transaction costs in arranging, negotiating, and enforcing hedging arrangements and other contractual risk transfers. The cost of self-insurance includes the cost of maintaining reserve funds to pay losses. This cost in turn includes taxes on income from investing these funds, as well as the possible opportunity cost that can occur if maintaining reserve funds reduces the ability of a business to undertake profitable investment opportunities.

Note that when losses are insured, the cost of loss financing through insurance only reflects the loading in the policy's premium for the insurer's administrative expenses and required expected profit. The amount of premium required for the expected value of insured losses is included in the firm's expected cost of losses.

#### *Cost of Internal Risk Reduction Methods*

Insurance, hedging, other contractual risk transfers, and certain types of loss control can reduce the uncertainty associated with losses; that is, these risk management methods can make the cost of losses more predictable. You learned in Chapter 1 that uncertainty also can be reduced through diversification and investing in information to obtain better forecasts of losses. The **cost of internal risk reduction** includes transaction costs associated with achieving diversification and the cost associated with managing a diversified set of activities. It also includes the cost of obtaining and analyzing data and other types of information to obtain more accurate cost forecasts. In some cases this may involve paying another firm for this information; for example, the pharmaceutical company may pay a risk management consultant to estimate the firm's expected liability costs.

#### *Cost of Residual Uncertainty*

Uncertainty about the magnitude of losses seldom will be completely eliminated through loss control, insurance, hedging, other contractual risk transfers, and internal risk reduction. The cost of uncertainty that remains (that is "left over") once the firm has selected and implemented loss control, loss financing, and internal risk reduction is called the **cost of residual uncertainty**. This cost arises because uncertainty generally is costly to risk-averse individuals and investors. For example, residual uncertainty can affect the amount of compensation that investors require to hold a firm's stock.

Residual uncertainty also can reduce value through its effects on expected net cash flows. For example, residual uncertainty might reduce the price that customers are willing to pay for the firm's products or cause managers or employees to require higher wages

(e.g., the top managers of the pharmaceutical company could require higher pay to compensate them for uncertainty associated with product liability claims).<sup>1</sup> We provide detailed discussion of how residual uncertainty affects individuals and shareholders of large corporations in Chapters 9 and 20.

## Cost Tradeoffs

A number of tradeoffs exist among the components of the cost of risk. The three most important cost tradeoffs are those between: (1) the expected cost of direct/indirect losses and loss control costs, (2) the cost of loss financing/internal risk reduction and the expected cost of indirect losses, and (3) the cost of loss financing/internal risk reduction and the cost of residual uncertainty.

First, recall from Chapter 1 that a tradeoff normally exists between expected losses (both direct and indirect) and loss control costs. Increasing loss control costs should reduce expected losses. In the case of the pharmaceutical company, for example, expenditures on developing a safer drug will reduce the expected cost of liability suits. Ignoring for simplicity the possible effects of loss control on other components of the cost of risk (such as the cost of residual uncertainty), minimizing the cost of risk requires the firm to invest in loss control until the marginal benefit—in the form of lower expected costs resulting from direct and indirect losses—equals the marginal cost of loss control (see Chapter 11).

The amount of loss control that minimizes the cost of risk generally will not involve eliminating the risk of loss.<sup>2</sup> (We touched on this point in Chapter 1.) It will not produce a world in which buildings never burn, workers are never hurt, and products never harm customers because *reducing the probability of loss to zero would be too costly*. Beyond some point, the cost of additional loss control exceeds the reduction in the expected cost of losses (that is, the marginal cost exceeds the marginal benefit) so that additional loss control will increase the cost of risk. Eliminating the risk of loss will not minimize the cost of risk for either businesses or society.

Even if it were technologically feasible to eliminate the risk of harm, people would not want to live in such a world. It simply would be too expensive. To use an absurd example to prove this point, injuries from automobile accidents might be virtually eliminated if automobiles were simply tanks without weapons. But very few people could afford to drive a tank, and those who could would rather risk injury and get to their destination more quickly with a pickup or luxury sports sedan. Because loss control is costly, a point is reached where people prefer some risk of harm to paying more for goods and services or incurring other costs to reduce risk.

The second major tradeoff among the components of the cost of risk is the tradeoff between the costs of loss financing/internal risk reduction and the expected cost of indirect

<sup>1</sup>Note that these managers also may require higher pay because of the expected cost of indirect losses to them from, for example, lost pay and the costs of seeking new employment if large losses cause them to lose their jobs. The cost of residual uncertainty in this case reflects the increase in pay above the amount needed to compensate managers for the expected cost of these indirect losses. That is, the cost of residual uncertainty arises because of the uncertainty about whether these costs will be incurred.

<sup>2</sup>For a couple of days following 9/11/01, the entire U.S. airline industry was shut down to reduce the probability of a crash to zero. After a few days of no air travel, however, the cost of eliminating the risk of loss was deemed to be too high and commercial flights resumed.

losses. As more money is spent on loss financing/internal risk reduction, variability in the firm's cash flows declines. Lower variability reduces the probability of costly bankruptcy and the probability that the firm will forgo profitable investments as a result of large uninsured losses. As a result, the expected cost of these indirect losses declines. This tradeoff between the costs of loss financing/internal risk reduction and the expected cost of indirect losses is of central importance in understanding when firms with diversified shareholders will purchase insurance or hedge (see Chapters 7 and 9).

The third major tradeoff is that which often occurs between the costs of loss financing/internal risk reduction and the cost of residual uncertainty. For example, if the firm incurs higher loss financing costs by purchasing insurance, residual uncertainty declines. Greater and more costly internal risk reduction also reduces residual uncertainty.

### **Concept Checks**

1. For an airline, describe the most important components of the cost of risk that arise from the risk of plane crashes.
2. How might the risk of crashes be eliminated by the airline, if at all?
3. Assume that you want to fly across the country and that for a price of \$400 the probability of a fatal crash is one in a million trips. To reduce this probability to one in 1.5 million trips, the price of a ticket would increase to \$800. Would you be willing to pay the extra \$400?

### **Cost of Other Types of Risk**

We illustrated the cost of risk concept using a business perspective and analyzing pure risk. However, the cost of risk is a general concept. With some modification, our discussion of the cost of pure risk is applicable to other types of risk. To illustrate, we will briefly discuss the risk of input price changes, using the specific example of a manufacturer that uses oil in its production process. In this case, the prices charged for the firm's products generally will not immediately adjust to reflect changes in the price of oil so that the firm's profits will be affected by oil price changes. Oil price increases will cause the firm's profits (or net cash flows) to decline in the short run, and oil price decreases will lead to a short-run increase in profits.

From an ex ante perspective, the expected cost of oil is analogous to the expected cost of direct losses from pure risk, such as those associated with product liability claims against the pharmaceutical company. Ex post, the actual cost of oil price changes can differ from what was expected, just as the actual costs from product liability claims can differ from those expected. If costs are greater than expected, then profits will be lower than expected in both cases. However, because oil is an integral input to the production process for which ongoing expenditures are routinely expected, the expected cost of oil normally would not be considered as part of the cost of risk. (Similarly, while wages paid to employees can differ from what is expected, the expected cost of wages normally would not be considered as part of the cost of risk.)

Large increases in the price of oil could cause indirect costs if, for example, production is reduced, alternative sources of energy need to be arranged, or profitable investment is curtailed. The possibility of indirect costs increases the expected cost of using oil in the production process. Expenditures on loss control, such as redesigning the production process

to allow for the substitution of other sources of energy, would decrease the expected cost of oil use and indirect losses.

With regard to loss financing, the manufacturer might choose to reduce its exposure to the risk of oil price changes with futures contracts. As we explain in Chapter 24, the appropriate use of futures will produce a profit if oil prices increase, thus offsetting all or part of the loss to the firm. (If oil prices drop, all or part of the gain that the firm otherwise would experience will be offset by a loss on its futures contracts.) However, the use of futures contracts involves transaction costs that are analogous to the loading in insurance premiums. The firm also might engage in internal risk reduction by diversifying its activities to reduce the sensitivity of its profits to oil price changes or by investing in information to obtain better forecasts of oil prices.

You can see from this simple example that the cost of risk concept illustrated in Figure 2.1 is quite general. This concept provides a useful way of thinking about and evaluating all types of risk management decisions.

## 2.3 Firm Value Maximization and the Cost of Risk

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### Determinants of Value

As we noted in Chapter 1, a business's value to shareholders depends fundamentally on the expected magnitude, timing, and risk (variability) associated with future net cash flows (cash inflows minus cash outflows) that will be available to provide shareholders with a return on their investment.

Business value and the effects of risk on value reflect an *ex ante* perspective: Value depends on expected future net cash flows and risk associated with these cash flows. Cash inflows primarily result from sales of goods and services. Cash outflows primarily arise from the production of goods and services (e.g., wages and salaries, the cost of raw materials, interest on borrowed funds, and liability losses). Increases in the expected size of net cash flows increase business value; decreases in expected net cash flows reduce value. The timing of cash flows affects value because a dollar received today is worth more than a dollar received in the future.

Because most investors are risk averse, the risk of cash flows reduces the price that they are willing to pay for the firm's stock and thus its value (provided that this risk cannot be eliminated by investors holding a diversified portfolio of investments, which we discuss in more detail in Chapter 9). For a given level of expected net cash flows, this reduction in the firm's stock price due to risk increases the expected return from buying the stock. In other words, the variation in net cash flows causes investors to pay less for the rights to future cash flows, which increases the expected return on the amount that they invest. Thus, a fundamental principle of business valuation is that risk reduces value and increases the expected return required by investors. The actual return to investors in any given period will depend on realizations of net cash flows during the period and new information about the expected future net cash flows and risk.

### Maximizing Value by Minimizing the Cost of Risk

Unexpected increases in losses that are not offset by cash inflows from insurance contracts, hedging arrangements, or other contractual risk transfers (see Chapter 1) increase

cash outflows and often reduce cash inflows, thus reducing the value of a firm's stock. The effects of risk and risk management on firm value before losses are known reflect their influence on (1) the expected value of net cash flows and (2) the compensation required by shareholders to bear risk. Much of basic financial theory deals with the kind of risk for which investors demand compensation and the amount of compensation required. We will have more to say about how risk affects expected cash flows, risk, and required compensation in later chapters. For now, it is sufficient for you to understand that making risk management decisions to maximize business value requires an understanding of how risk and risk management methods affect (1) expected net cash flows and (2) the compensation for risk that is required by shareholders.

If the firm's cost of risk is defined to include all risk-related costs from the perspective of shareholders, *a business can maximize its value to shareholders by minimizing the cost of risk*. To see this more clearly, we define:

$$\text{Cost of risk} = \text{Value without risk} - \text{Value with risk} \quad (2.1)$$

Writing this expression in terms of the firm's value to shareholders in the presence of risk gives:

$$\text{Value with risk} = \text{Value without risk} - \text{Cost of risk} \quad (2.2)$$

The value of the firm without risk is a hypothetical and abstract concept that is nonetheless very useful. It equals the hypothetical value of the business in a world in which uncertainty associated with net cash flows could be eliminated at zero cost. This hypothetical value reflects the magnitude and timing of future net cash flows that would occur without risk and risk-related costs. We emphasize that this value is entirely hypothetical because risk is inherent in real-world business activities.

To illustrate the cost of risk, consider the product liability example introduced earlier. For the pharmaceutical company, the value of the firm without risk is the hypothetical value that would arise if (1) it were impossible for the drug to hurt consumers and thus produce lawsuits and (2) the firm did not have to incur any cost to achieve this state of riskless bliss. The reality of injury risk and the costs of loss control give rise to risk-related costs, thus reducing the value of the business.

Equation 2.2 implies that if the firm seeks to maximize value, it can do so by minimizing the cost of risk. It accomplishes this by making the reduction in value due to risk as small as possible. Thus, *as long as costs are defined to include all the effects on value of risk and risk management*, minimizing the cost of risk is the same thing as maximizing value.

Why bother introducing the cost of risk instead of just talking about **value maximization**? First, the cost of risk concept helps focus attention on and facilitates categorization of the major ways that risk reduces value. Second, the concept is used extensively in practice (although its breadth is sometimes narrower, as is noted below).

## Measuring the Cost of Risk

In order to maximize business value by minimizing the cost of risk, businesses ideally will estimate the size of the various components of the cost of risk and consider how these costs will be affected by the firm's operating and risk management decisions. However, in practice, the necessary analysis is costly. Moreover, some of the components are particularly

difficult to measure. Examples include the estimated cost of forgone activity (e.g., profits that would have been achieved but for risk and the reduction in activity), the impact of decisions on customers or suppliers, and the cost of residual uncertainty.

As a result of these practical limitations, businesses often will not attempt to quantify all of their costs precisely. Small businesses especially are unlikely to measure costs with much precision because the cost of analysis is usually large compared to the potential benefit in the form of improved decisions. However, even when quantifying the various components of the cost of risk is not cost-effective, managers need to understand these components and the general ways in which their magnitude will be affected by risk management. This understanding is necessary for making informed decisions using intuitive and subjective assessments of the effects of decisions on costs.<sup>3</sup>

## Subsidiary Goals

While the overall objective of risk management is to maximize business value to shareholders by minimizing the cost of risk, a variety of subsidiary goals is used to guide day-to-day decision making. Examples of these subsidiary goals include making insurance decisions to keep the realized cost of uninsured losses below a specified percent of revenues, purchasing insurance against any loss that could be large enough to seriously disrupt operations, making decisions to comply with stipulations in loan contracts on the types and amounts of insurance that must be purchased, and spending money on loss control when the savings on insurance premiums are sufficient to outweigh the costs. These types of rules generally can be viewed as a means to an end (i.e., as practical guides to increasing business value). However, in each case, there should be a reasonably clear link between the particular goal and the increase in value.

## Objectives for Nonprofit Firms

How does the overall objective of risk management differ for nonprofit or government entities that do not have shareholders? Nonprofit firms can be viewed as attempting to maximize the value of products or services provided to various customers and constituents (e.g., taxpayers or persons that donate money to finance the firm's operations), where value depends on the preferences of these parties. If the cost of risk is defined as the reduction in value of the nonprofit firm's activities due to risk, the appropriate goal of risk management remains minimization of the cost of risk to those constituents.

Minimizing the cost of risk for a nonprofit firm may involve giving greater weight to certain factors than would be true for a for-profit firm. A nonprofit hospital, for example, might place greater emphasis on the adverse effects of large losses on its customers than would a for-profit firm.

<sup>3</sup> Some survey evidence exists on the magnitude of the cost of pure risk for large corporations (see *Cost of Risk Survey*, Risk and Insurance Management Society, New York, NY). Corporate respondents provide estimates of amounts spent on property-liability insurance, uninsured losses, and loss control and loss financing programs. While still valuable to managers, these estimates of the total cost of risk will underestimate the true cost (perhaps substantially in many cases) because information on the cost of loss control that arises from reducing the level of risky activity and many indirect costs of losses are not included, presumably due to the difficulty of estimating these costs.

However, while the details may differ, the overall objective of risk management and the key decisions that must be made by nonprofit firms are similar to those for for-profit firms. Nonprofit firms need to identify how risk reduces the net value of services provided and make decisions with the goal of minimizing the cost of risk. They have to consider the same basic components of the cost of risk as for-profit firms. It is not clear whether the absence of shareholders and the possibly fewer penalties for failing to minimize costs make agency costs (see Box 2.1) greater for nonprofit firms than for for-profit firms, or, if so, whether this affects risk management.

## Will Managers Maximize?

Owner-managers (e.g., sole proprietors, managing partners, and owner-managers of corporations without publicly traded common stock) have a clear incentive to operate their businesses to achieve their own interests. This generally will involve value maximization provided that value is appropriately defined to reflect the owners' attitude toward risk and their ability to diversify their risk of ownership.

One of the longest and most thoroughly debated subjects in business economics and finance is whether managers of large corporations with widely held common stock (i.e., with large numbers of shareholders that are not involved in management) will diligently strive to maximize value to shareholders. The ownership and management functions are separated in businesses with widely held common stock. Managers can be viewed as agents of shareholders. Managers may have incentives to take actions that benefit themselves at a cost to shareholders, thus failing to maximize shareholder wealth. The costs associated with these actions, including the costs incurred by shareholders in monitoring managerial behavior, are broadly referred to as *agency costs*.

Agency costs reduce business value. In the context of risk management, agency costs might be manifested by managers being excessively cautious. Because managers could be seriously harmed by financial distress of the firm, they might spend more money than is needed on insurance, loss control, or other methods of reducing the likelihood of financial distress.

From a normative perspective (i.e., from the perspective of how people or businesses *should* behave), managers are agents of shareholders and therefore should seek to maximize value. As a practical matter, a number of factors give managers strong incentives not

to deviate too much from value maximization, thus reducing agency costs:

1. Managers often are compensated in part with bonuses linked to the firm's profitability (and thus indirectly to its stock price), or with stock or stock options that directly increase managers' personal wealth when the firm's stock price increases. These performance-based compensation systems provide a direct incentive for value maximization. Poor performance by managers also can reduce their prospects for achieving employment with other firms (it can reduce their value in the managerial labor market).
2. Failing to maximize the value of the firm's stock makes it more likely that the firm will be acquired by another firm or parties that can then replace current top management with managers that will take actions to increase firm value.
3. If failure by managers to control costs, including the cost of risk, increases the price or reduces the quality of the firm's products, the firm will lose sales to firms with managers who are more inclined to control costs and increase value. This outcome makes it more likely that managers will be replaced and/or that the managers' salaries will be lower than if they maximized value.
4. Many firms have stockholders with large stakes and other stakeholders (such as lenders) that routinely monitor managerial performance.
5. State laws and the legal liability system impose fiduciary duties on managers. Failing to act in the interest of shareholders can give rise to lawsuits against managers and potential legal liability.

## 2.4 Individual Risk Management and the Cost of Risk

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The cost of risk concept also applies to individual risk management decisions. For example, when choosing how to manage the risk of automobile accidents, an individual would consider the expected losses (both direct and indirect) from accidents, possible loss control activities (such as driving less at night) and the cost of these activities, loss financing alternatives (amount of insurance coverage) and the cost of these alternatives, and the cost and benefits of gathering information (e.g., about the weather and road conditions). In addition, an individual would consider the cost of any residual uncertainty, which depends on that person's attitude toward risk (uncertainty).<sup>4</sup>

The amount of risk management undertaken by individuals depends in part on their degree of risk aversion. A person is **risk averse** if when having to decide between two risky alternatives that have the same expected outcome, the person chooses the alternative whose outcomes have less variability. This example illustrates the concept of risk aversion: Suppose that you must choose between the following alternatives. With alternative A, you have a 50 percent chance of winning \$100 and a 50 percent chance of losing \$100. With alternative B, you have a 50 percent chance of winning \$10,000 and a 50 percent chance of losing \$10,000. Both gambles have an expected value equal to zero, but alternative A's outcomes have less variability (i.e., they are closer to the expected outcome).<sup>5</sup> Stated more simply, most would agree that alternative B is riskier than A. Thus, if you choose alternative A, you are risk averse. If you choose alternative B, you would be called risk loving; and if you are indifferent between the two, you are risk neutral.

As mentioned earlier, most people are averse to risk. Risk-averse people generally are willing to pay to reduce risk, or must be compensated for taking on risk. For example, risk-averse people buy insurance to reduce risk. Also, risk-averse people require higher expected returns to invest in riskier securities. The degree of risk aversion can vary across people. If Mary is more risk averse than David, then Mary would likely purchase more insurance than David, all else being equal.

## 2.5 Risk Management and Societal Welfare

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From a societal perspective, the key question is how risky activities and risk management by individuals and businesses can best be arranged to minimize the total cost of risk for society. This cost is the aggregate—for all members of society—of the costs of losses, loss control, loss financing, internal risk reduction, and residual uncertainty. Minimizing the total cost of risk in society would maximize the value of societal resources.

Minimizing the total cost of risk for society produces an **efficient level of risk**. Efficiency requires individuals and businesses to pursue activities until the marginal benefit equals the marginal cost, including risk-related costs. Expressed in terms of the cost of pure risk, *efficiency requires that loss control, loss financing, and internal risk reduction be pursued until the marginal reduction in the expected cost of losses and residual uncertainty equals the marginal cost of these risk management methods.* As was discussed

<sup>4</sup>For some types of risk (e.g. automobile liability), regulations constrain choices.

<sup>5</sup>These ideas will be presented with more precision in later chapters.

earlier, however, achieving the efficiency goal does not eliminate losses because it is simply too costly to do so.

While the efficiency concept is abstract and the benefits and costs of risk management are often difficult to measure, the efficiency goal is nonetheless viewed as appropriate by many people (especially economists). The main reason for this is that maximizing the value of resources by minimizing the cost of risk makes the total size of the economic "pie" as large as possible. Other things being equal, this permits the greatest number of economic needs to be met.

Greater total wealth allows greater opportunity for governments to transfer income from parties that are able to pay taxes to parties that need assistance. A fundamental problem that affects these transfers, however, is that the size of the economic pie is not invariant to how it is sliced (i.e., divided among the population). High marginal tax rates, for example, discourage work effort beyond some point, thus tending to reduce the size of the economic pie. Thus, attempts to produce a more equal distribution of income generally involve some reduction in economic value. The goal is to achieve the right balance between the amount of total wealth and how it is distributed.

Similar issues arise within the context of risk. An important example (discussed in Chapter 8) is the effect of government regulations that cause insurance premium rates for some buyers to differ from the expected costs of providing them coverage. By changing how the total cost of risk is divided (or how the total cost pie is sliced), these regulations can alter incentives in ways that increase the total cost of risk (e.g., by encouraging too much risky activity by individuals whose insurance premiums are subsidized). While many persons might argue that these regulations produce a fairer distribution of costs, they nonetheless involve some increase in cost.

It is reasonable to assume that individuals, acting privately, will make risk management decisions that minimize their own cost of risk. Similarly, businesses that seek to maximize value to shareholders will make risk management decisions to minimize the cost of risk to the business. The question arises: Will minimizing the cost of risk to the business or individual minimize the cost of risk to society?

Note first that maximizing business value by minimizing the cost of risk generally will involve some consideration of the effects of risk management decisions on other major stakeholders in the firm. As suggested above and explained in detail in later chapters, the firm's value to shareholders and the reduction in value due to the cost of risk will depend in part on how risk and risk management affect employees, customers, suppliers, and lenders. The basic reason is that risk and its management affect the terms at which these parties are willing to contract with the business. For example, other things being equal, businesses that expose employees to obvious safety hazards will have to pay higher wages to attract employees. This provides some incentive for the firm to improve safety conditions in order to save on wages (apart from any legal requirement for the firm to pay for injuries).

Unfortunately, because we do not live in a perfect world, the goal of making money for shareholders can lead to risk management decisions that may not necessarily minimize the total cost of risk to society. In order for business value maximization to minimize the total cost of risk to society, the business must consider all societal costs in its decisions. In other words, all social costs should be internalized by the business so that its private costs equal social costs. If the **private cost of risk** (the cost to the business) differs from the **social cost**

**of risk** (the total cost to society), business value maximization generally will not minimize the total cost of risk to society.

A few simple examples should help to illustrate the increase in the social cost of risk that can arise when the private cost is less than the social cost. To illustrate the point simply, assume that there is no government regulation of safety, no workers' compensation law, and no legal liability system that allows persons to recover damages from businesses that cause them harm. Under this assumption, businesses that seek to maximize value to shareholders may not consider possible harm to persons from risky activity. It would be very likely that many businesses would make decisions without fully reflecting upon their possible harm to "strangers" (persons with no connection to the business).

In addition, businesses would tend to produce products that are too risky and expose workers to an excessive risk of workplace injury given the social cost if consumers and workers underestimate the risk of injury. Note in contrast that if consumers and workers can accurately assess the risk of injury, they can influence the business to consider the risk of harm by reducing the price they are willing to pay for products and increasing the wages demanded in view of the risk of injury.

You will learn more about these issues in chapters that address the legal liability system and workers' compensation law. For now, it is sufficient to note that a major function of liability and workplace injury law is to get businesses to reflect more upon the risk of harm to consumers, workers, and other parties in making their decisions. If legal rules are designed so that private costs are approximately equal to social costs, then value maximizing decisions by businesses will help to minimize the total cost of risk in society. Efficient legal rules are those that achieve this goal.<sup>6</sup>

## 2.6 Summary

- The overall objective of risk management is to minimize the cost of risk.
- Components of the cost of risk include: (1) the expected cost of losses, (2) the cost of loss control, (3) the cost of loss financing, (4) the cost of internal risk reduction, and (5) the cost of any residual uncertainty that remains after loss control, loss financing, and internal risk reduction methods have been implemented.
- In the context of business risk management, maximizing firm value is equivalent to minimizing the cost of risk.
- Loss control reduces the expected cost of losses. Beyond some point, the cost of additional loss control will exceed the reduction in the expected cost of losses. As a result, minimizing the cost of risk will not eliminate completely the risk of loss. If it were feasible, eliminating the risk of loss would be excessively costly to businesses and consumers alike.
- Loss financing and internal risk reduction reduce risk and therefore can reduce both the expected cost of indirect losses and the cost of residual uncertainty.

<sup>6</sup>In concluding this chapter, we note that some of this material might seem fairly abstract to you at this point. If so, these ideas will become clearer to you as you progress further along in the course. It also might be helpful for you to reread parts of this chapter after covering the related material that comes later.

- The overall objective of risk management for nonprofit firms also should be to minimize the cost of risk, provided that the special objectives and circumstances of these firms are incorporated into the cost of risk.
- The overall objective of risk management for individuals can be viewed as minimizing the cost of risk and thus maximizing the welfare of individuals.
- If businesses do not bear the full costs of their risky activities (that is, if the private cost of risk is less than the social cost), the total cost of risk in society will not be minimized when businesses maximize value. A major function of business liability and workplace injury law is to align private costs with social costs so that business value maximization will minimize the social cost of risk.

## Key Terms

cost of risk 17	cost of internal risk reduction 18	efficient level of risk 25
expected cost of losses 17	cost of residual uncertainty 18	private cost of risk 26
cost of loss control 18	value maximization 22	social cost of risk 26
cost of loss financing 18	risk averse 25	

## Questions and Problems

- Some people argue that *any* risk of injury from toxic chemicals and environmental pollutants is too high. Explain why this “zero risk” goal would not lead to an efficient level of risk in society.
- Describe specific factors included in the cost of risk for: (a) the risk that workers in a manufacturing plant will be injured by machines and equipment, (b) the risk that an international business will suffer loss from the expropriation of its investments by a foreign government, and (c) the risk that the price that a beer manufacturer can charge will decline due to a change in consumer preferences toward wine and soda.
- Ignoring incentives from the legal system, what incentives do businesses have to: (a) make safe products, (b) reduce worker injury risk, and (c) avoid polluting the environment?
- Mr. Fatcat manages a large corporation. Given his preferences, he would like to take expensive and frivolous trips in the company jet, receive a large salary, decorate his office with ancient artifacts, and throw corporate money at projects with borderline prospects for making any significant returns. What motivating influences can help Mr. Fatcat resist these temptations and maximize firm value?
- We-Dump-It is in the business of disposing of toxic chemicals. Explain why a legal system might be necessary to increase the private cost of risk for We-Dump-It in order to better align its goal of maximizing firm value with the goal of achieving an efficient level of risk in society.
- Describe how the risk of injury to consumers and “bystanders” could affect the design, production, distribution, and pricing of jet skis if the manufacturer seeks to maximize firm value (assuming no safety regulations and that the producer cannot be held liable for harm to consumers or bystanders). Will value maximization cause the manufacturer to consider the effects of noise on the tranquillity of beaches and inland waterways?
- Air travel can be made safer by increasing the security efforts. Identify the trade-offs