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Enterprise Risk Management and the Risk Management Process

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5.1 Introduction

The purpose of this chapter is to discuss the implications of enterprise risk management (ERM) for the risk management process. From my perspective, ERM does not change the major steps in the traditional risk management process; instead, ERM encourages organizations to take a broader perspective and carry out a deeper analysis in each of the steps in the risk management process. More specifically, I argue that an ERM approach (1) places more emphasis on value creation as an *objective* of risk management; (2) emphasizes the *identification* of all major risks facing an organization, regardless of how they are categorized; (3) seeks to *assess* the aggregate risk facing the organization; and (4) considers a larger and more innovative set of methods/contracts to *treat* risk.

The types of decisions being considered by risk managers often involve low probability events, which imply that it is typically difficult to obtain a large sample of outcomes from which to evaluate risk management decisions. As a consequence, risk management decisions should be evaluated based on the process and information available at the time of the decision, as opposed to the outcome of the decision. One cannot simply evaluate decisions or decision-makers by looking at results when the outcomes that concern us the most occur very rarely. Thus, utilizing a rational, objective process in risk management is important.

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There are of course multiple ways of implementing ERM and so ERM can look different in different organizations.¹ Moreover, ERM is likely to evolve over time within an organization. Some organizations have been using an ERM approach for many years and are therefore much further along the continuum of having risk evaluated at the enterprise level and having risk management integrated into all decision-making areas, including strategic decisions.

In the next section of this chapter, I will discuss how I interpret the meaning of the terms *risk*, *enterprise risk management*, and *risk management process*. In Sects. 5.3–5.7, I will discuss each of the steps in a typical risk management process: (a) determine objectives, (b) identify risk, (c) assess risk, (d) evaluate alternative treatments, and (e) monitor and adjust. I will take the perspective that an important objective for most organizations is to increase value for its stakeholders. Therefore, in the discussion of objectives, I investigate how risk affects value using a standard discounted cash flow (DCF) model from financial economics. This discussion provides the theoretical underpinnings supporting an ERM approach. In Sect. 5.8, a few examples from the literature on how ERM is implemented by various companies will be presented.

The main objective of the chapter is to explain a rational, objective risk management decision-making process. Unfortunately, human beings sometimes do not act or interpret information in objective, rational ways. Therefore, in Sect. 5.9, I discuss some common pitfalls or mistakes that are made during the risk management process. These “errors” are often due to behavioural biases that can be overcome if decision-makers are aware of the biases in themselves and their teams. Incentives of decision-makers can also impact risk management decisions. Consequently, agency problems between managers and stakeholders, as well as agency problems within organizations, are briefly discussed. In Sect. 5.10, I discuss *risk-appetite*, a term that appears frequently in ERM discussions. I discuss risk appetite using the value maximization framework presented earlier in this chapter. The chapter concludes with a short summary.

5.2 Preliminary Definitions and Concepts

5.2.1 What Is Risk?

The first step in any analysis is to clarify and define what is being analysed. In this case, we are studying risk management, and, therefore, we

need to clarify what is meant by risk. Despite the fact that the term “risk” is used frequently in everyday language, it is used to reference several different underlying concepts depending on the context and the people using it. Rather than describe the many possible definitions and the many ways that the term has been used colloquially and in the academic literature, I will describe the two non-mutually exclusive ways that I use the term “risk” in this chapter.

One commonly used notion of risk and one that we will adopt is that *risk refers to a situation in which something bad could happen*. One important aspect of this notion of risk is that we do not know for sure whether something bad will happen, but it could. In other words, there is uncertainty about the outcome. The other important aspect of this notion of risk is that at least one of the outcomes is “bad.” What does “bad” mean? One common way to define a “bad outcome” is relative to the current situation; that is, there is a loss relative to what we currently have. This is the way many people use the term risk to indicate there is a chance of a loss.

The following examples of statements about risk are consistent with this first notion of risk.

- There is more hurricane risk in Florida than in Ohio.
- A mining company has a greater risk of workplace injuries than a university.
- Joe is a riskier driver than Mary.
- Smokers have a greater risk of lung cancer than non-smokers.

For each of these statements, the riskier situation is the one that either has a higher probability of a loss or has a higher magnitude of a loss. Indeed, one way to measure this notion of risk is to calculate the expected loss, that is, sum the products of the probabilities of losses by the magnitude of losses. To illustrate, suppose that Joe and Mary have the same type of car, drive the same distance, and in the same conditions. In other words, assume that the potential magnitude of the loss for Joe and Mary is the same. To simplify even further, assume that the losses are either zero or \$10,000. However, suppose that Joe has a greater probability of being in an accident. More specifically, assume that Joe’s probability of an accident is 0.06 and that Mary’s is 0.04. Then, Joe’s expected loss is \$600 and Mary’s expected loss is \$400. Thus, Joe has a greater risk than Mary because Joe’s expected loss is greater than Mary’s expected loss.

Another commonly used notion of risk, and one that we will also adopt, is that *risk refers to the unpredictability of a situation or uncertainty associated with the outcomes*. This is the notion of risk that finance professionals typically use

when discussing investments in financial securities. The following statements illustrate this notion of risk:

- An investment in a technological company is riskier than the same investment in an electric utility company.
- The equity risk of a levered firm is greater than that of an unlevered firm, all else equal.
- The risk associated with the stock market increased during the financial crisis.

For each of these statements, the riskier situation is the one that is more difficult to predict, that is, there is greater volatility. This notion of risk is often measured by the standard deviation in the outcomes or the square of the standard deviation, that is, the variance in the outcomes (see Exhibit 5.1 for an explanation of standard deviation).

Exhibit 5.1 Standard Deviation Explained

Standard deviation measures the likely error one would experience in using the expected value as the prediction of the actual outcome. Suppose, for example, that the expected outcome is \$400. If the actual outcomes were all between \$350 and \$450, then the error in using \$400 would be small relative to a situation when the actual outcomes were between \$0 and \$800. Figure 5.1 illustrates these two scenarios.

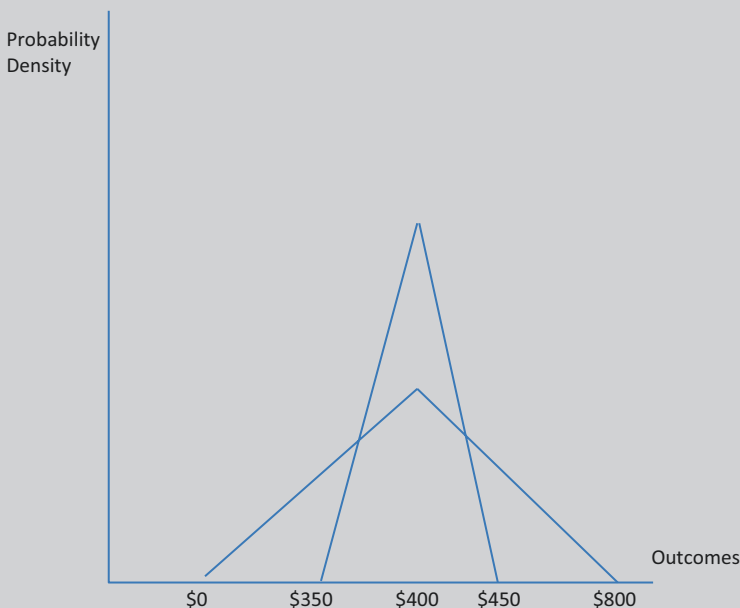


Fig. 5.1 A visual representation of differences in standard deviation

Algebraically, the variance is the probability weighted average of the squared deviations of each of the actual outcomes from the expected value. The standard deviation is the square root of the variance. To illustrate, consider the example of Mary having a 0.04 probability of incurring a \$10,000 loss. In this example, there are two possible outcomes: \$0 and \$10,000 and the expected outcome is \$400. If we used \$400 as our prediction of what would happen, then our error would be either \$400 too high or \$9600 too low. The square root of the probability weighted average of the squared deviations from the expected value is the standard deviation:

$$\text{Standard deviation} = \left[0.04(-9600)^2 + 0.96(\$400)^2 \right]^{1/2} = \$1960.$$

In contrast, consider a scenario where the loss outcome is either \$350 or \$450, each with probability 0.5. Then using \$400 (the expected value) as our prediction of the actual outcome would have less error on average; that is, we have less uncertainty in this case than in the previous case. This is evident in the standard deviation measure of risk for the second scenario compared to the first scenario:

$$\text{Standard deviation} = \left[0.5(-50)^2 + 0.5(50)^2 \right]^{1/2} = \$50.$$

To provide another intuitive illustration of the unpredictability notion of risk, consider the workers' compensation costs associated with two large manufacturing companies. We will assume that both companies have expected workers' compensation costs equal to \$5 million. However, Company A has more unpredictability regarding workers' compensation costs than Company B. In other words, Company A's actual costs could be much more or much less than \$5 million. In contrast, Company B's costs are much more likely to be around \$5 million. Figure 5.2 illustrates the possible outcomes for workers' compensation costs for Company A and Company B on the horizontal axis and provides an indication of the likelihood of outcomes occurring on the vertical axis. Company A's costs are more unpredictable or more uncertain than Company B's costs. Thus, using the second notion of risk, we would say that Company A has greater workers' compensation risk than Company B. Note, however, that the expected workers' compensation costs are the same for both companies. Thus, according to the first notion of risk, Company A and Company B are equally risky.

Now that we have described what we mean by "risk," risk management can be defined as the management of expected losses and the management of uncertainty. That is, it is important to manage both notions of risk outlined here. In some contexts, expected losses will be the focus and in other contexts uncertainty will be the focus.²

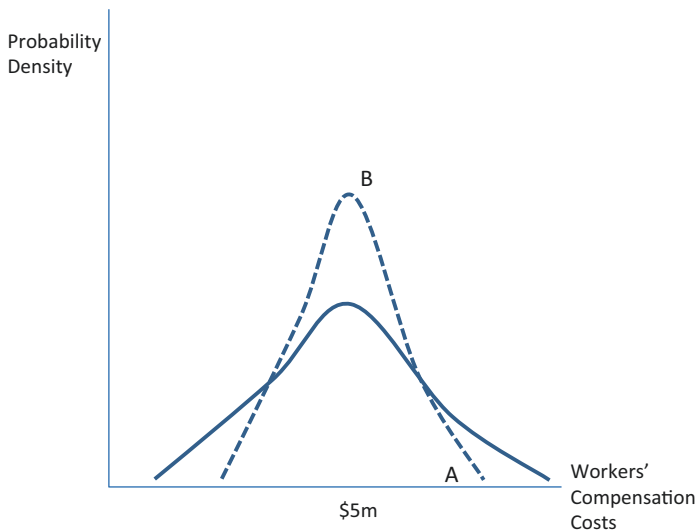


Fig. 5.2 Two possible outcomes for workers' compensation costs

5.2.2 What Is Enterprise Risk Management?

A brief historical perspective might help explain what ERM is and how it differs from traditional risk management approaches. Thirty years ago, if a business professional stated that he/she was in the risk management field it probably meant that he/she was either the person who focused on insurance purchases for a company or on safety issues related to the workplace or protecting the firm from loss of physical resources. In other words, the types of risk that were considered by the risk management professional were those that were sometimes referred to as “hazard risk,” and the primary means of dealing with hazard risk was either to purchase insurance and/or mitigate the risk by reducing the frequency and/or severity of losses.

During the late 1980s and 1990s, financial risk management became prevalent in many corporations, especially in financial institutions. Firms expanded their use of derivatives to manage commodity price risk, interest rate risk, credit risk, and currency risk. Gradually, a partial convergence between hazard risk management and financial risk management began to occur. Derivative contracts to manage hazard risk were introduced (e.g., catastrophe futures and options—see Ellenbueger 2007), and insurance contracts started to incorporate non-traditional risks. Institutionally, investment banks became involved in insurance markets and insurers/reinsurers arranged innovative risk financing deals. By the end of the century, ERM approaches were being introduced. Instead of focusing just on hazard risk

or risks that could be hedged using derivatives, firms tried to identify all of their major risks, aggregate those risks, and consider how best to manage these risks.

ERM focuses on the main sources of risk that threaten the value of the enterprise. It does not matter whether these risks have traditionally been managed or not. As will be discussed in the next section, financial economic theory implies that the types of risks that are most important are those that could potentially disrupt the firm's ability to raise capital, invest in positive net present value projects, and impair contractual arrangements with its suppliers, employees, and customers. In other words, the theory suggests that the most important risks are those that threaten the enterprise value. As a consequence, ERM tries to manage the overall risk of the enterprise. These could represent the risk of a "large" event that disrupts the firm's ability to engage in its strategic plan or the risk that multiple events could accumulate or interact in ways that disrupt the firms' strategy. As a consequence, ERM requires identifying and assessing all of the enterprise's major risks, which in turn requires communication across and up and down the organization.

The alternative to ERM would be to manage individual risks in isolation, which we will call the silo approach. The shortcomings of this approach include expenditures on risk reduction even though natural hedges exist within the firm, not managing the most important risks facing the enterprise, and less of an understanding of the risks that threaten the firm's strategy for creating value.

In addition to strong theoretical reasons for an ERM approach (see the next section of this chapter), there are also important institutional factors that have pushed firms to adopt ERM approaches. For example, stock exchanges, including the New York Stock Exchange (NYSE), require audit committees to evaluate a firm's risk. Standard and Poors included ERM assessments in their ratings starting in 2009. The US Securities and Exchange Commission (SEC) requires that proxy statements disclose the role of the board in risk oversight and the nature of communications between executives and board members regarding risk management issues, and the Dodd-Frank law requires that large banks establish risk committees that are responsible for enterprise-wide risk management practices.

5.2.3 The Risk Management Process

There are numerous articulations of the risk management process that organizations follow and/or should follow. Almost all, if not all, are reasonable and appropriate. Appendix 1 presents examples of risk management

processes that are promoted by various risk management organizations. Although the details vary, most proposed risk management processes share the following steps:

1. Determine objectives
2. Identify the risks facing the organization
3. Assess the risks
4. Evaluate alternative treatments and choose the approach that best meets your objectives
5. Implement, monitor, learn, and adjust

The subsequent sections discuss each of these steps and elaborate on how an ERM approach influences the implementation of each step.

It is important to emphasize that the steps above should be done in an objective, unbiased manner. I state this point not because subjectivity and biases typically enter the analysis on purpose, which would be unacceptable, but because human beings often do not think or act in a rational manner taking into account all information. Instead, there is a large amount of evidence indicating that humans do not always act rationally and their thinking and actions are subject to biases. Being aware of these behavioural biases can help keep biases from influencing decision-making. Some of these biases are discussed at the end of the chapter.

5.3 Objectives of Risk Management

The first step in the risk management process is to determine the objective of risk management. A commonly held view is that the objective of risk management is to reduce risk. The implicit assumption is that risk is costly and so we should reduce risk. While both notions of risk discussed can be costly, it is also important to recognize that risk often is associated with positive outcomes. These positive outcomes must be weighed against the negative outcomes when deciding whether to take on risk or reduce risk. In addition, it is important to recognize that reducing risk typically is costly. Given these points, reducing risk typically is not an appropriate objective. ERM has had an important influence on the how firms view the objective of risk management. As its name suggests, ERM is concerned about the enterprise, and, consequently, the objective of ERM should correspond to the enterprise's objectives.

For most enterprises, this objective will involve a focus on value creation for the organization's stakeholders. For example, the Casualty Actuary Society

(2003) states that the purpose of enterprise risk management is that “of increasing the organization’s short- and long-term value to its stakeholders.” Protivi (2006) states, “ERM broadens the focus of risk management to all significant sources of enterprise value.” The last statement in a case study on risk management at Royal Dutch Shell Plc. (2011) states that “Shell was using the integrated risk management approach, now a requirement prescribed by stock exchanges, rating agencies, and regulatory bodies. By following such an approach, the earning volatility decreases, resulting in the creation of greater shareholder value.”

Most publicly traded corporations will focus on creating value for the equity holders, and this is the objective on which we will focus. This does not imply that the well-being of other stakeholders is irrelevant. To the contrary, as will become clearer as we proceed, a focus on value creation requires that managers are concerned about all of the stakeholders of the organization. Indeed, the impact of risk on other stakeholders is one of the primary motivations for engaging in risk management.

5.3.1 How Does Risk Affect Value?

If value creation is the objective (or at least one of the objectives), then we need to understand how risk affects value. To answer this question, we turn to a valuation model from the financial economics literature which is widely used in practice—the DCF or discounted cash flow model. According to this model, value is determined by the discounted expected cash flows of the firm, where the discount rate is the cost of capital. The issue we will address is how does risk, using each of the two notions of risk outlined previously, affect value.

5.3.1.1 The Valuation Model

The first step in the DCF model is to forecast the expected future cash flows of a firm. It is important to note that the cash flow for a given time period equals the cash coming into the organization minus the cash going out of the organization. Note, however, that cash flows are not accounting earnings! For example, when calculating accounting earnings, firms correctly subtract depreciation expense, but depreciation expense is not a cash outflow.³

Let CF_t equal the cash flow during time period t , where t is some year in the future. Of course, nobody knows for sure what CF_t will be; that is, there

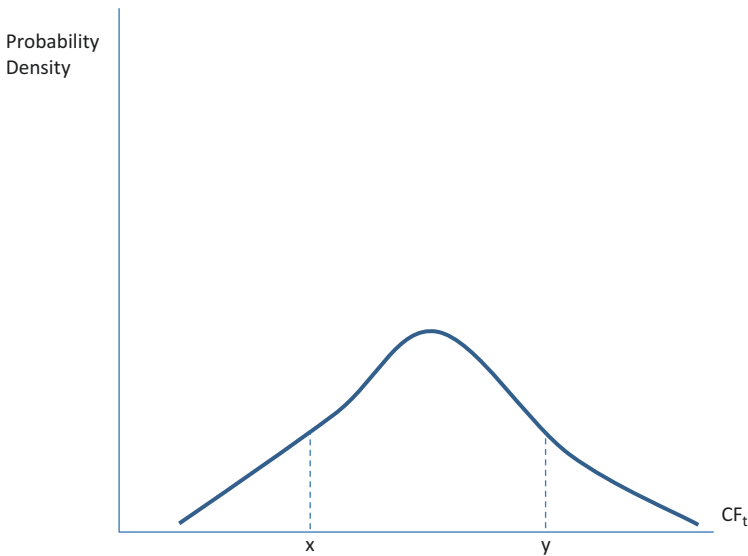


Fig. 5.3 An illustration of assumptions

is uncertainty regarding the value CF_t will have. We can think of CF_t as taking on one of many different possible values. Let $E(CF_t)$ be the expected value of CF_t , that is, the probability weighted average of all of the possible values for CF_t . Think of $E(CF_t)$ as the best guess of what CF_t will actually be.

Figure 5.3 provides an illustration of the assumptions we have just made. The possible values for CF_t are given on the horizontal axis, and the vertical axis provides an indication of the likelihood that CF_t will fall within intervals on the horizontal axis. More specifically, the area under the curve between two values on the horizontal axis gives the probability that cash flows at time t will fall between the two values on the horizontal axis. For example, the probability that cash flows during period t (CF_t) turn out to be between x and y is 0.67. Since CF_t must fall somewhere on the horizontal axis, the area under the entire curve must equal 1.

According to the DCF model, an analyst trying to value a firm will calculate the expected value of cash flows for all future time periods. Typically, cash flows are forecasted over annual periods. Thus, think of time period 1 as one year in the future and time period 2 as two years in the future. So an analyst would forecast $E(CF_1)$, $E(CF_2)$, $E(CF_3)$, and so on. In practice, analysts do not continue into perpetuity, but instead forecast for five to ten years and then calculate a terminal value of the firm. Since we are interested in the conceptual framework as opposed to the practical implementation, we will not go into these details.

Armed with data on expected cash flows for all future time periods, the analyst would add the discounted value of all of the expected cash flows to estimate the value of the firm:

$$\text{Firm value} = \frac{E(CF_1)}{(1+r)^1} + \frac{E(CF_2)}{(1+r)^2} + \frac{E(CF_3)}{(1+r)^3} + \dots$$

The discount rate, r , is the cost of capital or required rate of return. The cost of capital is equal to the expected return that investors can expect to earn on comparable risky investments. Since the cash flows are risky (uncertain), investors would expect to earn more than what they can earn on US government bonds. Thus, the cost of capital is equal to the risk-free rate of return plus a risk premium to reflect the risk of the cash flows:

$$r = \text{risk free return} + \text{risk premium}.$$

A fundamental issue in financial economics is modelling the appropriate risk premium, and we will have more to say about the risk premium shortly, as it is of central importance to risk management.

5.3.1.2 How Does the First Notion of Risk (Expected Losses) Affect the Valuation Model?

Let us examine the valuation formula above and how it can be affected by risk. Recall that we highlighted two notions of risk. The expected loss or notion of risk refers to either the frequency or severity of losses. This notion of risk can potentially impact the numerators in each of the terms in the valuation formula. For example, if a firm can reduce its expected workers' compensation losses by \$5 million if it spends \$2 million on safety equipment in a given year, then the expected cash flows for that year will increase by \$3 million, which in turn will increase value, all else equal.

This example illustrates a more general point: decisions regarding loss prevention or loss control (i.e., decisions about expected losses) primarily influence the numerators of the terms in the valuation formula. As a consequence, the value impact of these decisions is primarily determined by whether the reduction in expected losses is greater than the cost of the mitigation (appropriately discounted to take into account the time value of money).

This example also illustrates that cost-effective loss prevention and loss control measures generate expected cash flows, just as the introduction of profitable new products or expansion into new markets can increase expected cash flows. Indeed, cost-effective loss prevention and loss control should be presented in this way. Good risk management generates additional expected cash flows.

5.3.1.3 How Does the Second Notion of Risk (Variability) Affect the Valuation Model?

The variability notion of risk refers to the uncertainty in the firm's cash flows. Intuitively, if the cash flows are more uncertain (less predictable), then their value would be lower. This relationship is captured by the risk premium in the discount rate. That is, greater uncertainty in cash flows implies a higher risk premium, which implies a higher discount rate and, hence, a lower value. While this intuition is correct, the conclusion that greater uncertainty will always decrease value must be modified to take into account a basic finance principle: investors can diversify some risk from their portfolios by holding a variety of securities in their portfolio. In other words, most investors do not simply hold one stock; instead, they hold a number of different stocks. Since the values of these different stocks are affected by different firm-specific events, bad outcomes for some firms are offset by good outcomes for other firms, which reduces uncertainty in the returns on the portfolio.

Portfolio diversification implies that some of the uncertainty associated with investing in securities can be eliminated. In the same way that insurance companies are able to improve their prediction of (i.e., reduce their uncertainty about) the average claim payment by writing a large number of policies versus a small number of policies, investors can reduce their uncertainty about the return that they will receive by investing in a large number of securities versus a small number of securities. The key requirement for this diversification of risk (reduction in uncertainty) to occur is that the returns on the different securities in the portfolio are not perfectly correlated with one another.

Note that when investors diversify risk (reduce uncertainty) by holding a portfolio of securities, the risk that has been diversified is eliminated from the economic system. The risk is not being transferred to someone else. This is the beauty of diversification and explains why every reasonable financial advisor recommends portfolio diversification.

Not all risk can be diversified away of course. The major reason diversification is limited is that the returns on different securities are not independent of

one another. Instead, returns on most securities are affected by some common factors, which cause the returns on the different securities in the portfolio to be positively correlated. The positive correlation in outcomes reduces the extent to which risk can be diversified away (uncertainty can be reduced). Thus, in a well-diversified portfolio, some risk will be eliminated and some will remain. The risk (uncertainty) that will be eliminated is the risk (uncertainty) due to idiosyncratic factors affecting the returns on the security, and the risk (uncertainty) that cannot be eliminated is the risk (uncertainty) due to common factors affecting the returns on all securities. The risk (uncertainty) due to common factors is often called systematic or market risk—it cannot be eliminated through diversification.⁴ The risk (uncertainty) due to idiosyncratic factors has different names, including unsystematic risk, firm-specific risk, and idiosyncratic risk.

The implications of portfolio diversification for valuation and, therefore, risk management are profound. If investors can eliminate firm-specific risk (uncertainty) from their portfolios at no cost simply by diversifying, then investors will not require additional returns for this type of risk. Stated differently, the risk premium in the cost of capital formula will not depend on firm-specific risk (uncertainty). This in turn implies that actions by the firm that reduce firm-specific risk are unlikely to influence the discount rate that is used in the denominator of each term in the valuation model. In other words, reductions in firm-specific risk will not decrease the risk premium in the discount rate.

One might be tempted to go a step further and conclude that reductions in firm-specific risk will not increase firm value. This conclusion, however, is not warranted. As we shall soon see, we ultimately will conclude that reducing firm-specific risk can, in some cases, increase value, but that it does so indirectly by increasing expected cash flows (the numerators of the valuation formula). Our conclusion here is about the channel by which risk reduction affects value: reductions in firm-specific risk will not increase firm value by decreasing the required rate of return of investors.

This analysis implies that the only way to reduce the cost of capital, the required rate of return of investors, is to reduce the amount of risk that is not diversifiable, that is, the market or systematic risk. If a firm does reduce its systematic risk, then its cost of capital should decrease as well, which would seem to increase firm value. However, by definition, systematic risk cannot be diversified away. Therefore, the only way to reduce systematic risk is to shift it to someone else. Presumably, someone else would not willingly accept more systematic risk unless he/she was compensated for doing so. The cost of compensating the counterparty for the systematic risk will offset the value

increase associated with reducing the cost of capital. Assuming all parties price systematic risk in the same way, the two effects will offset each other perfectly and reductions in systematic risk will not increase firm value. The conclusion of this discussion is that reductions in systematic risk are unlikely to increase firm value even though doing so will decrease the required rate of return of investors because the party that you shift the systematic risk to will require an offsetting return to accept this risk.

Summarizing, neither reductions in firm-specific risk nor reductions in market risk are likely to increase firm value by decreasing the cost of capital. Again, it must be emphasized that this statement does not imply that risk reduction cannot increase firm value; instead, it is a statement about the channel by which risk reduction increases firm value.

Another important point to emphasize regarding the analysis in this section is that it applies to enterprises with well-diversified owners. If the owners of a firm are not diversified, then risk reduction can increase the value that undiversified owners place on their claims.

5.3.1.4 Indirect Effects of Risk (Uncertainty) Reduction on Expected Cash Flows⁵

The main conclusion from the previous section is that if risk management is going to increase value, then it does so through the numerators of the terms in the valuation formula, not through the denominators. We have already discussed how reductions in the expected loss notion of risk can increase expected cash flows (the numerators). In this section, we discuss how reductions in the uncertainty notion of risk can increase expected cash flows. The title of this section references “indirect effects” because each of the arguments discussed here will follow a similar pattern: we will show that a reduction in variability of cash flows will indirectly increase expected cash flows.

First, we need to highlight that the direct effect of reducing the variability of cash flows, for example, by purchasing insurance or hedging, is usually the decrease in expected cash flows because these activities are costly. Insurance premiums almost always exceed the expected claim payment, which is the same as saying that you pay more to the insurance company than what you expect to get back. Insurers charge more than expected claim payments because they have to cover administrative costs, regulatory costs, underwriting costs, claims processing costs, capital costs, and so on. The amount by which the premium exceeds the expected claim payments is often called the premium loading. The

premium loading is the cost of the insurance; thus, the direct effect of buying insurance is that expected cash flows drop because of the premium loading. Hedging risk with derivatives also involves costs, including the cost of the experts, the data, and the systems needed to manage derivative positions and the transaction costs associated with taking and adjusting positions.⁶

Although the direct effect of reducing risk (uncertainty) via insurance and hedging is to decrease expected cash flows, there are several potential positive indirect effects of reducing the variability in cash flows. The idea is that bad cash flow outcomes cause the firm to incur other costs, which would not normally be considered when forecasting cash flows.

To illustrate, consider two scenarios. Each scenario has the same expected cash flows from operations, but Scenario L has low variability and Scenario H has high variability in cash flows. The firm must select which scenario it prefers. For example, suppose that the actual cash flows from operations and the probabilities of receiving the cash flows in each scenario are as follows:

Scenario L:

$$\text{Cash Flows} = \begin{cases} \$450 & \text{with prob } 0.5 \\ \$350 & \text{with prob } 0.5 \end{cases}$$
$$\Rightarrow \text{Expected cash flows} = \$400$$

Scenario H:

$$\text{Cash Flows} = \begin{cases} \$900 & \text{with prob } 0.5 \\ -\$100 & \text{with prob } 0.5 \end{cases}$$
$$\Rightarrow \text{Expected cash flows} = \$400$$

The expected cash flows of the two scenarios are the same, but the risk (variability) of cash flows for Scenario H is much higher than Scenario L. Assume, however, that the greater uncertainty with Scenario H is due to firm-specific events and, therefore, is diversifiable by holding a portfolio of securities. Since the additional uncertainty with Scenario H is diversifiable, investors do not require additional expected return for investing in it. In other words, the cost of capital is the same for both scenarios. Using the valuation formula to compare which scenario has greater value, we find that since the expected cash flows and the costs of capital are the same for both scenarios, each scenario would seem to have the same value.

5.3.1.5 Financial Distress Costs

Suppose, however, that if a firm has a really bad cash flow outcome, such as negative cash flows, it cannot make its debt payments, which requires the firm to renegotiate its debt, which is costly. In other words, a really bad cash flow outcome can cause the firm to go into financial distress and incur the costs associated with financial distress. If we take these indirect costs into account, then Scenario L will be preferred to Scenario H because if the bad outcome occurs with Scenario H, the firm not only has a direct loss of \$100 but also has additional indirect losses due to the financial distress costs. The indirect costs of the high variability scenario make the expected cash flows (both direct and indirect) higher with Scenario L. This example illustrates that reducing risk (uncertainty) in cash flows can indirectly increase expected cash flows and, therefore, increase value by reducing the likelihood of financial distress and the associated costs.

The costs associated with financial distress extend beyond the costs of renegotiating debt contracts. Firms in financial distress find it more difficult and costly to negotiate with suppliers, employees, and customers. Moreover, even a relatively small probability of financial distress can affect the terms at which a firm contracts with suppliers, employees, and customers. If a supplier must make specific investments for a particular customer, the supplier wants assurance that the customer will be around for many years in order to earn a return on the specific investment. As a consequence, the supplier will often require that the customer have certain types of insurance. Existing employees are more likely to accept alternative job offers if there is uncertainty about whether their existing employer will be operating in a year or two. Also, employees will require additional compensation to work for a firm for which financial distress is a concern. Finally, customers will require a discount or they will not purchase a firm's product if there is concern that the producer will not be around to service the product in the future. This is particularly relevant for durable products and financial services. Insurance is an example where the probability of distress can have a huge impact on customer demand.

The bottom line is as follows: If variability in cash flows increases the likelihood of costly financial distress, then reducing variability through risk management can increase value.

5.3.1.6 Costs of Raising External Capital

There is a large literature indicating that raising external capital is costly and that many firms therefore prefer to use internally generated funds to finance new investments. To illustrate how the costs of raising external capital can

influence risk management decisions, consider a firm that has a positive net present value project available that requires \$100 million investment. The net present value of this project is \$8 million. In other words, making the investment of \$100 million will raise firm value by \$108 million. Further assume that the investment needs to occur this year; otherwise, its value will evaporate. If capital could be raised at zero cost, then the firm would raise the capital and invest in the new project. Suppose, however, that the transaction cost of raising \$100 million of new capital is \$10 million, that is, 10 per cent of the capital raised. The cost of raising the capital in this case would cause the firm not to raise external capital and not to adopt the project.

It is possible, however, that the firm could use internally generated funds to adopt the project. Suppose the firm's internally generated free cash flows can be one of two alternatives. If the firm adopts a high risk strategy (which could correspond to not hedging), its free cash flow will be either \$140 million or \$80 million with equal probability. If the \$140 million cash flow occurs, then the firm has the funds to adopt the positive net present value project, but if the \$80 cash flow occurs, then the firm would have to forego the project. Alternatively, the firm could adopt a low risk strategy (which could correspond to hedging). Its free cash flow will then be either \$120 million or \$100 million with equal probability. Note that the expected free cash flow is \$110 million, the same as in the high risk strategy. However, with the low risk strategy the firm has the funds to adopt the positive net present value project regardless of which outcome occurs. Consequently, an indirect effect of choosing the low risk strategy is that the firm will be able to obtain the value from the investment project. In summary, the low risk strategy allows the firm to have greater certainty about internal funds, which in turn allows it to avoid the cost of raising external capital or the cost of foregoing positive net present value projects.

5.3.1.7 Taxes

There are several ways that reducing risk (uncertainty) can indirectly reduce expected tax payments and thereby increase expected cash flows and value. First, if income tax rates are progressive, then the reducing volatility in before-tax income can reduce the expected value of income taxes. I will illustrate this point using another simple example. Suppose that the firm has before-tax income that is either \$15 million or $-\$5$ million with equal probability, implying that the expected before-tax income is \$5 million. Also, assume that the tax rate is 40 per cent if before-tax income is positive and zero per cent if before-tax income is negative. In this case, the after-tax income is either

\$9 million ($\15×0.6) or $-\$5$ million ($-\$5 \times 0.4$). Given each outcome has a probability of 0.5, the expected after-tax income is \$2 million. Now suppose that the firm hedges and thereby reduces the volatility in its before-tax income, and as a result, before-tax income is either \$8 million or \$2 million. Note that the expected value of before-tax income remains at \$5 million. With the hedge, the after-tax income is either \$4.8 or \$1.2 million, yielding expected after-tax income equal to \$3 million, compared to \$2 million if it did not hedge. This example illustrates that reducing the variability in before-tax income can increase expected after-tax income if tax rates are progressive.⁷

Another way that reducing risk (uncertainty) can indirectly decrease expected tax payments is through the debt-and-equity financing choices of the firm. By reducing cash flow variability, the firm is able to increase the proportion of debt financing in its capital structure because the lower volatility in cash flows reduces the likelihood of financial distress. The additional debt financing in turn yields greater interest tax shields than equity financing.⁸

In summary, all of these examples illustrate how volatility in cash flows can impose costs on the firm. Stated differently, these examples illustrate how risk reduction can increase the value of the firm.

5.3.2 Justification for Enterprise Risk Management

Each of the arguments just put forward for why risk management can increase value provide theoretical justification for an ERM approach. The basic premise of ERM is *that risk should be managed at the enterprise level*. That is, we should think about the aggregate risk of the enterprise. This is exactly what the previous arguments imply. To reduce financial distress costs, the firm should *manage the uncertainty associated with the enterprise's cash flows and equity value*. To reduce the costs of raising capital and the costs of possibly foregoing positive net present value projects, the firm should *manage the uncertainty associated with the enterprise's cash flows and equity value*. To reduce expected income taxes, the firm should *manage the taxable income of the enterprise*. In sum, corporate finance theory implies that firms should manage the uncertainty regarding aggregate performance; this is the same directive given by the ERM approach.

5.4 Risk Identification

Risk identification is the second step in most risk management processes. Under an ERM approach, risk identification takes a broader approach than under a silo or specialized approach to risk management. It does not matter

whether risk is categorized as strategic risk, operational risk, financial risk, pure risk, and so on. If a particular risk could have major implications for the enterprise's value or cash flows, then ideally it would be identified in the risk identification step. The goal of risk identification is not to compile a long list of risks facing the firm. Rather, the goal is to identify the risks that threaten the achievement of the enterprise's objectives or threaten its strategy for creating value (PWC 2013).

One concern with the focus on identifying risks that have major implications for the enterprise is that "smaller risks" that could be profitably managed may not be identified. While the identification of the major risks is crucial, the smaller risks also need to be considered, especially those that involve the first notion of risk—expected losses. This is because expected cash flows can be increased and value is created by cost-effective reduction in expected losses. Mitigation that reduces expected losses by more than the mitigation costs is valuable for an organization, even if the mitigation has no impact on strategic objectives. Indeed, care should be taken to ensure that cost-effective risk mitigation activities for relatively "small risks" are adopted in an ERM process. These activities add value to the enterprise.

An important component of the risk identification and assessment processes under an ERM approach is communication across units within the organization and up and down the organization's hierarchy. This communication is critical because often knowledge about specific types of risk is held by individuals throughout the organization. Also, interaction and communication across units is needed to understand how risks interact with each other, which is needed to aggregate the many individual risk exposures at the enterprise level.

5.5 Risk Assessment

Risk assessment is about measuring the risks that have been identified. For a particular risk, risk assessment can be as simple as placing the risk into categories based on the likelihood of occurrence and the severity of impact. For example, the likelihood and severity categories could be low, medium, and high. At the other extreme, one might be able to estimate the probability distribution which gives all of the possible outcomes and the likelihood of them occurring.

The most important implication of ERM for risk assessment is that one is not focused on assessing the uncertainty associated with an individual risk but, instead, is focused on assessing the aggregate uncertainty of the enter-

prise's portfolio of risks. Consistent with the discussion in Sect. 5.3 of this chapter, if our objective is to increase firm value, then the focus of our risk assessment should be on the impact of aggregate uncertainty on the enterprise's cash flows and the values of its assets and liabilities, taking into account all of the indirect effects. This requires that we take into account how all of the sources of risk facing the firm interact with each other.

Since risk is not additive, a focus on the uncertainty associated with the enterprise's portfolio of risks is a much more difficult task than assessing individual uncertainty. To formally aggregate risk, a common measure of risk for all of the firm's exposures must be selected. For example, many financial institutions use standard deviation or some variant of value-at-risk as a common measure of risk for their market exposures. Also, the correlation structure of the individual risk exposures must be estimated. The formal modelling of aggregate risk portfolios can be done analytically if one is willing to assume specific probability distributions (e.g., the normal distribution) for the individual risks or alternatively by using Monte Carlo simulation. Perhaps it is needless to state, but the data, expertise, and systems required to formally model the uncertainty associated with an enterprise's aggregate portfolio of risk can be extremely costly, which explains why most organizations take a less formal, less quantitative approach to assessing the aggregate risk of the enterprise.

5.6 Evaluate Alternative Risk Management Treatments

Once the risks have been identified and assessed, the next step is to evaluate alternative treatments, including no treatment, gathering additional information, mitigation (reducing the likelihood or severity of loss), reducing volatility by purchasing insurance or hedging, or engaging in some other contractual transfer of risk. The main impact of ERM on this step has been on the criteria used to evaluate alternative risk management treatments. As stated earlier, ERM implies that risk management decisions should be made to achieve the enterprise's goals. This broader perspective has led to the treatment of some risk that would not have been treated under a silo approach and has led to the retention of some risk that would have been treated under a silo approach. Examples of each of these will be illustrated in what follows when we summarize ERM processes adopted by specific companies.

Traditional discussions of the methods of treating hazard or pure risk focused on the choice between insurance, mitigation, and retention (no treat-

ment). Note that retention is implicitly using equity financing to absorb the risk. More contemporary ERM discussions consider the cost of retention, as opposed to insurance (or hedging), to be the cost of the equity capital needed to absorb the risk. In other words, the trade-off considered is between say the cost of insurance and the cost of capital associated with the additional capital needed if insurance is not purchased. This perspective naturally leads one to consider alternative financial market instruments to treat risk, including debt securities (e.g., catastrophe bonds) and derivative securities (e.g., weather derivatives). Thus, the ERM approach has broadened the set of tools that are considered for treating risk and has helped to promote a convergence between risk management and finance.

5.7 Monitor and Adjust

Monitoring and adjusting the risk management practices of an organization is part of continuous improvement. As time passes and the environment changes, goals can change, the underlying risks facing an organization can change, and the benefits and costs of certain risk management treatments can change. Thus, the risk management process does not end. The frequency with which one re-examines prior decisions depends on the degree of change in the environment and the costs of going through the decision-making process again.

5.8 Examples of ERM Processes

5.8.1 United Grain Growers⁹

One of the first non-financial institutions to implement an ERM programme was United Grain Growers (UGG). The company provided inputs and services to farmers in western Canada. The inputs and services included almost everything that a farmer would need to produce crops and livestock, including seed, fertilizer, and feed. The firm's largest source of revenue was from grain handling, that is, shipping and storing grain produced by farmers. It adopted an ERM approach in the late 1990s. Prior to their adoption of an ERM approach, UGG had developed plans for a major capital investment programme that would replace old grain storage facilities with safer, more efficient structures. In addition, the firm had taken on more debt in its capital structure.

UGG employed the Willis Group to help them implement an ERM process. Willis met with groups of employees to identify the firm's main risks. Not surprisingly, a large number of risks were identified and preliminarily assessed. The list was narrowed to six. The actuaries and statisticians at Willis then worked on assessing these risks in terms of their potential impact on the firm's cash flows and value. They found that the most important risk facing UGG was weather. More specifically, temperature and precipitation in the summer months had a large impact on crop yields, which in turn had a large impact on the volume of grain shipments, which in turn had a large impact on UGG's cash flows. This was a risk that was not previously considered nor managed by UGG.

The next step was to determine what to do about the weather risk. This is where the innovative thinking and the convergence of finance, insurance, and risk management is most evident. They considered using weather derivatives, which at the time were just beginning to be traded in the over-the-counter market. The market was relatively thin and involved considerable basis risk in their case. Basis risk refers to the less-than-perfect correlation between the payoff on the instrument used to hedge (the weather derivative) and the underlying risk exposure (the cash flows from shipping grain). They also pursued innovative insurance coverages with various carriers and decided to purchase an insurance policy from Swiss Re that bundled some of UGG's existing coverages with coverage if grain shipments were unusually low.

The problem with insuring UGG's grain shipments is that it could cause a potentially severe moral hazard problem; that is, UGG would have reduced incentives to provide high-quality service to its customers if UGG was insured for low grain volume. Fortunately, UGG's grain shipments were highly correlated with industry grain shipments and UGG only had a 15 per cent market share of grain shipments. Consequently, Swiss Re based grain volume coverage on whether industry shipments were abnormally low.

As a result of the ERM process, UGG identified a major risk to its cash flows that previously was not managed. Cash flow volatility was especially important to UGG at the time because of their capital investment programme and increased financial leverage in their capital structure. A major drop in cash flows could curtail the capital investment and possibly even push the firm into financial distress. They were able to obtain insurance to cover losses from grain volume risk and bundle this coverage with their other property and liability coverages. The bundling enabled UGG to reduce some property and liability coverage and thereby keep the overall cost of insurance roughly the same. Thus, they obtained coverage for the risks that threatened their strategic goals.

5.8.2 Hydro One

A traditional aid in identifying the risks facing a firm is an existing list of common risks or a list of risk categories. These lists can be used to elicit from employees the risks facing the firm. Often firms will hire a consultant to hold risk identification workshops with groups of employees. Regardless of whether a workshop is led by internal employee or an outsider, it is important that the goals and strategies of the firm are explained to the workshop participants. Otherwise, they cannot identify the main risks that threaten the firm's objectives.

Hydro One is a Canadian electric utility that adopted an ERM process with an extensive identification stage. The firm's chief risk officer believed that ERM required the managers to have a common understanding of the firm's strategic objectives and the risks that threatened achieving those objectives. To achieve this, Hydro One grouped managers into teams based on their business line or main project. It then polled each group asking them to identify the risks facing their business or project. This led to a large list of risks, which was narrowed by emailing the managers and asking them to choose the most important risks. These responses led to a short list of about 10 or so risks. The managers then met for a half-a-day to discuss these risks and come to a consensus ranking of the relative significance of the risks to each of the firms' strategic objectives. The discussion among the managers was viewed as critical to the proper identification and assessment of the risks.

At this stage, the risk management process proceeded along two paths. We will call one path the "local path" and the other the "enterprise path." The local path was within the set of managers (and their teams) participating in each risk workshop. Notice that each managerial team not only identified the main risks that they faced but also assessed the risk in terms of its significance. Based on these assessments, the managerial team discussed action plans to deal with the main risks and assigned a person to "own" each of the main risks. The risk owner's responsibility was to further develop mitigation plans and make "local" decisions regarding the risk.

Hydro One held many of these risk workshops with different teams of managers. The results of the individual risk workshops were then used as input for the enterprise path. Specifically, the individual team assessments from the risk workshops were combined by the chief risk officer and his team in a report to the executive management team twice a year. In essence, the chief risk officer used the risk workshops to obtain a bottoms-up risk identification and assessment from the experts closest to the risk. The twice-a-year reports on the main

risks facing Hydro One were then used to decide how to allocate financial resources to mitigate the firm's most important risks.

Notice that the Hydro One ERM process utilized the chief risk officer and his team to communicate vertically within the organization. In addition, the chief risk officer's team also served as the accumulator of risk information from across the organization. Also, the process used by Hydro One is an example of a qualitative assessment approach, as there was no attempt to develop precise risk metrics. Instead, risks were classified into bins based on the magnitude of the impact on the firm's objectives. Financial institutions often take a much more quantitative approach (see, e.g., the Nationwide example discussed later).

5.8.3 American Electric Power¹⁰

For their ERM programme, American Electric Power (AEP) implemented a communications and governance structure to ensure that the main risks in the organization were identified and managed. The structure can be visualized as a pyramid (see Fig. 5.4) with functional unit personnel at the base with the responsibility of identifying risk and providing information regarding the identified risks to the functional managers. The functional managers were responsible for managing the risks, as well as reporting to the Enterprise Risk Oversight Unit, which was responsible for understanding and overseeing the risk management at the functional units. In addition, the Enterprise Risk Oversight Unit prepared summary reports for the Risk Executive Committee, which provided a strategic perspective. The strategic perspective also implied that the Risk Executive Committee was responsible for thinking about potential emerging risks that could jeopardize the firm's strategy. Thus, the Enterprise Risk Oversight Unit received information about risks "from



Fig. 5.4 A visualization of a firm's ERM programme

below”—the functional unit managers and from above—the Risk Executive Committee. Finally, the Risk Executive Committee reported to the Audit Committee of the Board, which had the oversight responsibility for all of the risks.

5.8.4 Nationwide¹¹

Consistent with most financial institutions, Nationwide takes a more quantitative approach to ERM than the examples of non-financial institutions summarized previously. Nevertheless, Nationwide’s ERM process reinforces some of the same points that were made when discussing the previous cases. For example, regarding risk identification, Nationwide uses both a top-down and a bottom-up approach. The top managers are responsible for identifying the major risks that could threaten the financial strength of the company. The functional units are responsible for identification, assessment, and mitigation of risks at the unit level. In this way, Nationwide attempts to identify, measure, and then aggregate all of the major risks in the organization.

5.9 Decision-Making Mistakes

The chapter has focused on a rational, objective decision-making process for risk management with the objective of increasing value. However, casual observation, as well as empirical evidence, indicates that often humans are subject to biases in interpreting information and make decisions that are not always the best given the information available. A useful framework for thinking about decision-making mistakes is presented by Daniel Kahneman in his book *Thinking, Fast and Slow*. He presents the case that people are more likely to interpret information in an unbiased way and make better decisions when they take their time, analyse, apply logic, and use complex reasoning, that is, think slowly. In contrast, when people react to information, make decisions quickly, apply intuition, and use simple associations, that is, think fast, they are more likely to make mistakes.

The literature surveyed by Kahneman provides numerous examples of common biases and decision-making errors. Being aware of these biases and errors can help us avoid them in our decisions and can help identify when others are making errors. Thus, the remainder of this section will discuss mistakes that are commonly made. In addition to the book by Kahneman, the section

will draw on the book by Russo and Schoemaker (2002) and the articles by Stulz (2009), Taleb et al. (2009), which discuss common risk management mistakes.

5.9.1 Behavioural Biases

5.9.1.1 Saliency Bias

When making decisions with uncertain outcomes, people often give too much weight to outcomes that are related to salient events. As an example, a person might assess a higher likelihood that a flood will damage his property in the next year if a neighbouring town recently experienced damage from flooding. This could lead to purchasing additional flood insurance for a year or two. Once the neighbouring town's flood experience is no longer salient, the person's assessment of the flood risk would likely return to its original level.¹²

5.9.1.2 Availability Bias

Not only do people give undue weight to salient events, they give undue weight to information that is readily available. For example, an anecdote from a friend about bad service at a restaurant might cause someone to avoid the restaurant even though the vast majority of customers may have viewed the service as good. It is worth highlighting, however, that it may be perfectly rational to use information obtained easily (i.e., at low cost) rather than incurring the cost associated with gathering additional information because the expected value of the better information is low. In the example given previously, the information from the anecdote was obtained at no cost, but the costs of obtaining the information about the views of a large number of customers may have been greater than the expected benefit received from the better information (perhaps because there were numerous other good restaurants nearby).

5.9.1.3 Anchoring Bias

Assessment of risk can also be influenced by the tendency of people to anchor on particular numbers or reference points that they have recently seen. For example, if people are "primed with" (given) a random number (say \$1000),

and then asked to assess the magnitude of something (say, the average loss from a worker's compensation claim), the answers tend to be close to the number that they were given. Possible anchors/reference points that could influence risk assessment include the most recent value of losses or the most recent frequency of claims.

5.9.1.4 Confirmation Bias

When examining evidence on an issue, people often give greater weight to evidence that confirms their prior beliefs. For example, if a manager intuitively believes that a new investment project is a good project, he/she might give greater weight to evidence that the project is indeed good and less weight to evidence that highlights the possibility of losses. Thus, risk decisions can be distorted.

5.9.1.5 Optimistic Bias

Evidence also indicates that people tend to be overly optimistic and confident. In other words, people tend to underestimate the likelihood and the magnitude of bad outcomes and/or overestimate the likelihood and magnitude of good outcomes. Thus, the optimistic bias can result in the underestimation of risk and too little risk management. Moreover, the evidence indicates that the optimistic bias is even more prevalent when people have had previous success.

5.9.1.6 Failure to Ignore Sunk Cost

People are often inclined to continue to invest in an activity for which the additional costs are greater than the additional benefits because they have previously made investments and these past investments would be considered wasted if they did not continue. Rational thinking, however, implies that the past investments are sunk and are irrelevant to a decision about continuing to invest in the activity.

5.9.1.7 Other Risk Management Mistakes

Nassim Taleb, in several books and articles,¹³ has argued that the most important events impacting organizations (and societies as well) are almost impos-

sible to predict. He refers to these high-impact, almost-impossible-to-predict events as black swans, and this terminology has now become common place. Taleb criticizes risk management that tries to estimate the probability of rare events because it is difficult, if not impossible, to estimate the probability of rare events with precision. Instead, organizations should focus on how to respond to unexpected events.

Risk management requires thinking about what could happen in the future. Nevertheless, we often look at historical data to get a sense of what could happen in the future. There is nothing wrong with this, unless we blindly assume that what happened in the past mirrors what could happen in the future. If the underlying economic structure has changed, then past data are less likely to help predict what could happen in the future.¹⁴

A number of writers have criticized risk management practices by financial institutions prior to the financial crisis for using models with assumptions that turned out not to be valid during the market disruption. For example, correlations between the returns on securities increased during the crisis, causing risk to be higher than the models implied. Another criticism is that managers did not understand fully the underlying assumptions of the models and as a consequence tended to put too much confidence in the risk models. This led managers to take more risk than they otherwise would have.

Of course, we cannot do away with models; they are necessary and valuable tools for assessing risk. We must remember, however, that models are not reality. Models include assumptions that may turn out to be incorrect. Also, models often use historical data to estimate parameters and the historical data may not be representative of what will happen in the future. While models are necessary, they are not sufficient. Judgement and an understanding of the potential shortcomings of the models are also important.

5.9.1.8 Agency Problems

Finally, it is worth noting that agency problems between an organization's stakeholders can influence risk management decisions. In an effort to motivate managers to increase firm value, management compensation packages often provide bonuses and/or stock options. The asymmetric treatment of performance (good performance implies higher compensation, but bad performance does not lower compensation) can provide managers an incentive to take excessive risk. On the other hand, harsh treatment of mistakes or bad decisions can lead to managers to take too

little risk. In addition, it can lead employees to not report bad news. Thus, well-designed incentive structures are an important component of a good risk management process.

5.10 Risk Appetite

Often risk management processes, including those embracing an ERM approach, emphasize that the organization needs to define its risk appetite, which is usually defined as the amount of risk that an organization is willing to accept. One interpretation of this definition is that the organization has an absolute amount of risk defined by some metric, beyond which the organization is not willing to go. Conceptually, we can think of a measure of risk along scale and the organization's risk appetite is the maximum point on the scale that the firm is willing to accept. Figure 5.5 provides an illustration.

The problem with this interpretation is that it suggests that the risk appetite is fixed and independent of the potential returns from the activity being considered. For example, suppose there is a potential activity that involves risk beyond what the firm's risk appetite allows. Even if this activity has tremendous expected returns, it would be rejected. Figure 5.5 illustrates this possibility. Risk is measured on the horizontal axis and expected return is on the vertical axis. The risk appetite is given by the dashed vertical line—the firm is not willing to accept risk beyond this level. Consider an activity that has risk greater than the risk appetite, but a very high expected return, as denoted by point G on the figure. There is another activity with risk just

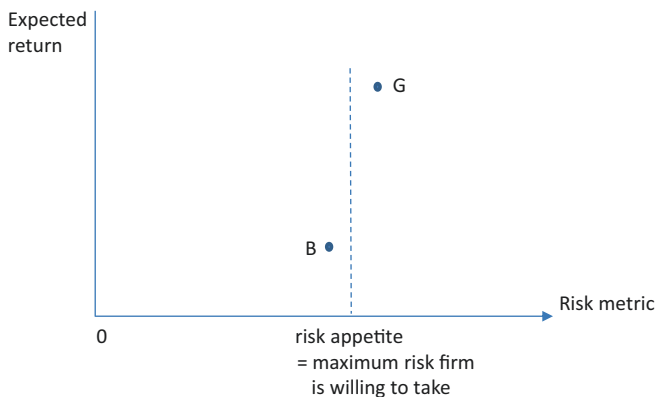


Fig. 5.5 An illustration of the concept of risk appetite

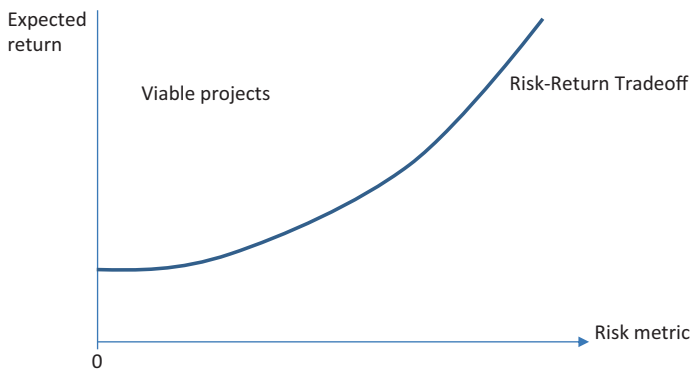


Fig. 5.6 A trade-off between risk and expected return

below the risk appetite, but that has much lower expected return; it is given by point B on the figure. If risk appetite is defined by an absolute amount of risk that the firm is not willing to go beyond, then point G would be rejected and point B would be considered to be viable, even though for a small amount of additional risk, and activity G would yield a much higher expected return.

This discussion suggests that risk appetite should instead be defined by a trade-off between risk and expected return. Figure 5.6 illustrates such a trade-off. The curve in the figure represents the minimum amount of expected return needed for taking on a given level of risk. Thus, any activity represented by a point to the left of the curve would be acceptable because the expected return is sufficient for the given amount of risk associated with it. The way that the curve is drawn indicates that the firm requires incrementally more expected return for each additional unit of risk accepted. This is not necessarily the case; the trade-off could be linear, that is, each additional unit of risk requires the same additional expected return regardless of the initial amount of risk. The main conceptual point is that the risk appetite is not an absolute limit on the amount of risk; it should be a description of the trade-off that the firm is willing to accept between risk and expected return.¹⁵

What affects the trade-off that a firm should require? The trade-off certainly depends on many factors. In practice, the preferences of the managers leading the organization and the past experience of the top managers probably play a role in determining the risk–return trade-off of a particular company. The compensation package of managers can also affect

a manager's willingness to take more risk. As discussed earlier, managers with stock options or bonus plans that provide large pay-outs if the firm performs well but limited downside risk provide an incentive for managers to take more risk.

A firm's current financial situation and the markets in which it operates likely influence the risk–return trade-off (risk appetite). The earlier discussion on how risk affects value is instructive regarding how a firm's current situation can affect its risk appetite. For example, all else equal, firms should be willing to take more risk if

- They are financially strong and, therefore, have little chance of financial distress.
- They have generated and expect to continue to generate large cash flows and, therefore, can finance investment from internal funds (as opposed to costly external funds).
- They have cash flows that are positively correlated with capital investment opportunities (e.g., oil producers) and, therefore, are likely to have internal funds when investment opportunities are good.
- They are larger in size and, therefore, tend to have lower costs of raising external capital.
- They have diversified owners.

5.11 Summary

A good risk management process is essential for the proper management of uncertain situations. This is because rare events provide limited data on which to judge most decisions ex post. Also, humans often are subject to biases when making decisions under uncertainty. A process can force people to systematically and objectively identify risk, assess risk, and evaluate the costs and benefits of alternative treatments.

This chapter has argued that if a firm's objective includes increasing value to its stakeholders, then an ERM approach to risk management, as opposed to a silo approach, is appropriate. An ERM approach does not change the basic steps in the risk management process, but an ERM approach encourages a broader perspective when identifying risk, a deeper assessment of risk in part because one must assess how various risks within the organization interact and aggregate, and a consideration of a broader set of potential tools when deciding how to treat risk.

Notes

1. Some implementation differences will be discussed later in the chapter. For a broad range of cases on ERM, see Fraser et al. (2015).
2. Note that uncertainty can exist without the possibility of a loss relative to the current situation. For example, suppose that you are given the following gamble: if a coin flip is heads, you win \$10 and if it is tails, you win \$0. There is no chance that you could lose money relative to what you start with. Does this situation involve risk? Given there is uncertainty about the outcome, I would say yes—this is a risky situation. If this terminology bothers you, then consider redefining a loss as an outcome that is less than the expected outcome, as opposed to the current situation. With this definition of a loss, the \$0 outcome is a loss.
3. Note that it is important to take depreciation expense into account because it affects income taxes, which is a cash outflow.
4. Systematic risk is often measured in practice using the beta of the firm.
5. This section draws heavily from Froot et al. (1994), Graham and Smith (1999), Mayers and Smith (1982), and Smith and Stulz (1985). Harrington and Niehaus (2004) provide a summary of these analyses.
6. In addition, the expected payoff on a hedging position is often negative.
7. In practice, firms can reduce the progressivity in tax rates by carrying losses forward or backward.
8. There are also tax benefits that are specific to reducing risk using insurance contracts. One benefit arises from the tax treatment of insured depreciated property. Another benefit arises from insurers being able to deduct incurred losses versus non-insurance companies being able to deduct paid losses. See Harrington and Niehaus (2004).
9. See Harrington et al. (2002) for a fuller description of the case.
10. See Buck et al. (2012) for a more detailed discussion of AEP and its risk management practices.
11. See Nocco and Stulz (2006) for more details on ERM at Nationwide as well as conceptual arguments supporting an ERM approach.
12. The saliency bias in this example could actually improve decision-making if the person originally underestimated the likelihood of flood damage.
13. See, for example, Taleb et al. (2009).
14. See Stulz (2009).
15. If capital markets are perfect in the sense that there are no transaction costs, everyone has the same information, and no taxes, then finance theory implies that the risk–return trade-off would be given by market’s valuation of risk. Under a commonly used model, the capital asset pricing model (CAPM), risk would be measured by beta and the risk–return trade-off would be a straight line. Projects above the line would be accepted and projects below the line would be rejected.

Appendix 1: Risk Management Processes Proposed by Various Risk Management Organizations

Casualty Actuary Society

The risk management process involves[3]:

1. Establishing context
2. Identifying risks
3. Analysing/quantifying risks
4. Integrating risks
5. Assessing/prioritizing risks: treating/exploiting risks
6. Monitoring and reviewing

The Committee of Sponsoring Organizations of the Treadway Commission (COSO)

1. Objective setting
2. Event identification
3. Risk assessment
4. Risk response
5. Control activities
6. Information and communication
7. Monitoring

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