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THE PROMISE AND CHALLENGE OF INTEGRATED RISK MANAGEMENT

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INTRODUCTION

In the past, risk management was rarely undertaken in a systematic and integrated fashion across the firm. Integrated risk management has only recently become a practical possibility, because of the enormous improvements in computer and other communications technologies, and because of the wide-ranging set of financial instruments and markets that have evolved over the past decade. A sophisticated and globally tested legal and accounting infrastructure is now in place to support the use of such contractual agreements on a large scale and at low cost. Equal in importance to this evolution in capital markets is the cumulative experience and success in applying modern finance theory to the practice of risk management. Today, managers can analyze and control various risks as part of a unified, or integrated, risk management policy.

Integrated risk management is the identification and assessment of the collective risks that affect firm value, and the implementation of a firm-wide strategy to manage those risks. Integrated risk management, then, looks well beyond the set of traditionally insurable risks, seeking to address *all* of a firm's risks within an organized and coherent framework. At the foundation of risk management is the integration of the three ways that a firm can alter its risk profile. These fundamental ways that a firm can implement risk management objectives, by *modifying the firm's operations*, by *adjusting its capital structure*, and by *employing targeted financial instruments*, interact to form the firm's risk management strategy. Managers must weigh the advantages and disadvantages of any particular approach in order to find an optimal mix of the three. Traditional insurance, then, a type of targeted financial instrument, is but one tool available to the firm.

This article presents a managerial overview of integrated risk management, investigating the range of management decisions that it can influence and the benefits for the firm from its implementation. To illustrate these concepts, the article places a special focus on one firm, Honeywell Inc., and its first steps toward integrating traditionally insured risks with other treasury-based risks.

WHAT IS RISK MANAGEMENT?

Traditionally, risk managers focused on insurable risks and loss control. To those outside the insurance industry, however, risk management tends to evoke thoughts of

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derivatives and strategies that magnify, not reduce, risk. While today's risk management may use derivatives, derivatives, as a risk management tool, are only a small part of the integrated risk management process. Moreover, a proper risk management strategy does not involve speculation, or betting on the future price of oil, corn, currencies, or interest rates, and indeed is antithetical to such speculation. Instead, the goal of integrated risk management is to maximize value by shaping the firm's risk profile, shedding some risks while retaining others.

By applying integrated risk management, managers will benefit from new insights about the interplay among different types of risk and traditional financial decision areas, connections easily missed without a comprehensive framework. Because the three ways to manage risk are functionally equivalent in their effect on risk, their use connects seemingly unrelated managerial decisions. For instance, because capital structure is one component of a firm's risk management strategy, effective capital structure decisions cannot be made in isolation from the firm's other risk management decisions. Consequently, a firm's capital structure choice is inextricably linked to its capital expenditure plans, along with many other operational decisions. This article's discussion of the integrated risk management framework emphasizes the connection among the ternary mechanisms to alter the firm's risk profile and offers guidance on their practical application.

BENEFITS OF INTEGRATED RISK MANAGEMENT

A cascade of basic decisions about objectives faces the manager who seeks to implement a risk management program. Is the goal of the program to reduce earnings fluctuations or to reduce fluctuations in firm value? Should the firm fully hedge its risk exposures or only partially hedge them? Should it hedge only the downside risk while retaining the upside (as with an option or more traditional insurance contract)? Or should it hedge both the downside and the upside (as a forward contract would permit)? None of these questions can be answered in the abstract, because the answers will vary from firm to firm. Still, the fundamental goal of risk management is unambiguous: As with the other facets of firm management, the goal of risk management is to maximize the value of the firm's shares. Having the capability to reduce risks does not automatically imply that the firm *should* reduce its risk.

Because the benefits (and costs) of risk management vary by firm, a risk management strategy must be tailored to the individual company. For some firms, targeting a particular level of earnings fluctuations will increase the value of the firm. For other firms, the value-maximizing strategy is to target a particular level of fluctuations in market value of the firm or shareholder equity.¹ To determine the optimal risk management policy, the manager must begin by understanding how uncertainty surrounding expected future earnings and how uncertainty surrounding expected future firm value affect the market value of the firm. That is, to assess whether and to what extent the firm should target its risk, the manager must first understand the channels through which risk management can potentially affect firm value. This understanding forms the critical underpinnings of any risk management strategy; without it, attempts to evaluate the costs and benefits of risk management within the context of a particular firm will prove fruitless.

¹ Stulz (1996) offers yet another way to manage risk: eliminate costly "lower-tail" outcomes. See also, Smith and Stulz (1985) and Stulz (in press).

Integrated risk management can increase shareholder wealth by reducing the costs associated with financial distress, moderating the risk faced by important nondiversified investors, decreasing taxes, reducing monitoring costs, and lowering the firm's funding costs.² More specifically, by reducing the firm's total risk, risk management makes financial distress less likely. Even successful businesses are vulnerable to the tentacular reach of financial distress, Microsoft Corporation being a case in point. Microsoft competes in a rapidly changing and volatile industry. If a bad turn of events were to create uncertainty about Microsoft's continuing viability and ability to set industry standards, customers, suppliers, or employees might alter their behavior, worsening the impact of the initial negative shock. If this shock is big enough, customers may defect, questioning Microsoft's ability to provide future service and upgrades. Other software developers may be less likely to tailor their products to Microsoft's operating platform. Key employees may leave for a more stable environment. In short, financial distress, by introducing uncertainty about Microsoft's continuing existence and dominance, has the ability to destroy substantial value.

The potential destructiveness of financial distress is not limited to technology firms. Retailers, for example, rely heavily upon their suppliers for financing. These suppliers, in turn, regulate their own risk exposures through their selection of customers and tend to respond rapidly to changes in customer creditworthiness. One has to look only to Kmart's recent difficulties for an example. As Kmart's financial condition deteriorated, anxious suppliers cut back on credit, intensifying Kmart's cash crunch. Potential Kmart customers were greeted by nearly empty stores, leading to rapid deterioration of the firm's condition as customers left to shop elsewhere. Risk management offers the potential to reduce the probability of such financial distress.

Risk management also creates value by reducing a firm's tax burden. A progressive tax structure gives firms an incentive to smooth earnings to minimize taxes, and risk management enables such smoothing. Risk management can also decrease the firm's taxes by increasing its debt capacity. In particular, a firm that increases its optimal debt level could increase its after-tax expected cash flows by the amount of the marginal tax shield of debt. By decreasing firm volatility, risk management makes just such a debt increase possible. New risk management techniques and instruments might present an opportunity for an established, profitable firm to reconfigure its capital structure. A target debt ratio that was appropriate in the past may no longer be optimal; the ability to manage risk may mean that managers can safely increase that target.³

RISK MANAGEMENT TODAY

Managers have, of course, always practiced some form of risk management, whether implicit or explicit. But, going forward, corporate risk management is likely to differ substantially from historical practice. The typical firm's current institutional organization tends to isolate risks, rather than aggregate them. Today's treasurer's office manages exchange-rate exposures and perhaps credit risk. Commodity traders, sometimes located within the purchasing area, focus on commodity price risk. Production and operations management considers risks associated with the production process. The insurance risk manager for the firm concentrates on property and casualty risks. Human resources may

² See also, Stulz (1996), Sandefer et al (2001), Froot, Scharfstein, and Stein (1994), and Shapiro and Titman (1985).

³ See Tufano (1996a).

address employee risks. As a practical matter, then, managers of traditionally separate institutional units must coordinate their risk management activities to implement an integrated risk management strategy.⁴

And, coordination of risk management across separate areas is only the first step. Managers must expand the oftentimes narrow focus of their current risk management practices, moving from a *tactical* to a *strategic* approach. Tactical risk management has limited objectives, usually the hedging of specific contracts or of other explicit future commitments of the firm; strategic risk management addresses the broader question of how risk affects the value of the *entire* firm.

For example, consider a U.S. dollar-based firm that buys steel from a Japanese firm for delivery in three months. The U.S. firm may decide to "tactically" hedge the dollar price of its steel purchase. By using forward currency contracts, the firm locks in the dollar cost of its steel purchase, offsetting the effect of dollar-yen exchange-rate movements that may occur before delivery and payment. The treasurer's office of the firm typically executes such tactical currency hedging, which is generally undertaken in a nonintegrated fashion without consideration of other hedging or insuring activities carried out in the firm, even when the risks across units are significantly correlated.⁵ In contrast, strategic currency hedging addresses the broader question of how exchange-rate fluctuations affect the value of the *entire* firm. It takes into account how those fluctuations affect the firm's competitive environment, including the pricing of its products, the quantity sold, the costs of its inputs, and the response of other firms in the same industry.⁶

THE FIRST STEPS TOWARD INTEGRATED RISK MANAGEMENT: HONEYWELL'S MULTIRISK INSURANCE POLICY⁷

In 1997, Honeywell's risk management approach was similar to that of many firms today. Different units at Honeywell managed its various risks, and the different ways of managing risk were not viewed as substitutes. Honeywell's risk management activities were dispersed throughout the firm. Active hedging or insuring of risks occurred only for currency risk, interest rate risk, liquidity risk, credit risk, pension fund risk, and traditionally insured risks. Competitive risks, operational risks, and customer and vendor risks were handled by various operating units, and the specialized areas had responsibility for legal, technological, market, regulatory, and environmental risks.

Honeywell's treasury group encompassed a financial risk management unit, a capital markets unit, an insurance management unit, and a cash management unit. The financial risk management unit managed currency risk, interest rate risk, and credit risk. The capital markets unit managed risks associated with the firm's capital structure, including liquidity risk. The insurance risk management unit's activities involved risks traditionally covered by insurance. Each unit's risks had different loss characteristics and were managed by the separate departments within the treasury unit using their own risk management methods and instruments. The insurance unit was responsible for general liability, property liability, product liability, automobile liability, employer liability, ocean marine transit liability, and workers' compensation risk. Honeywell's

⁴ See Froot, Scharfstein, and Stein (1993).

⁵ Lewent and Kearney (1990) and Mello, Parsons, and Triantis (1995).

⁶ See also Meulbroek (2000) for information about Honeywell's risk management program.

⁷ See Mello (1999) and Mello, Parsons, and Triantis (1995).

insurance risk management program used separate, annually renewable insurance policies for each type of insurable risk. Each policy had a specified deductible (or, in insurance terms, a "retention") in an amount that ranged between zero and \$6 million. The currency unit was responsible for managing financial risks, including tactical (but not strategic) transaction and translation risk. To hedge its exchange-rate exposures, the currency unit used at-the-money options.

Honeywell's managers began their evaluation of the firm's current program design by focusing on its current practice of managing each traditionally insurable risk separately, with an individual insurance policy. The Honeywell team discussed the possibility of a new insurance contract that would combine traditional hazard risk with foreign-exchange translation risk within a unified multiyear policy. The organizational barriers involved in developing such a program were daunting. The traditional insurance-based risk management area historically had little to do with the derivatives-based currency risk management team. On the surface, the objectives of their risk management programs seemed quite different, and the tools they used to manage risk did not seem at all related.

Honeywell's treasurer formed a multispecialty team from both insurance and currency risk management to assess whether the two different types of risk could be combined, and whether its approach to traditionally insured risks could be made consistent with its currency risk management program.

HONEYWELL'S MODEL OF THE INTEGRATED PROGRAM

A significant challenge for the Honeywell team members designing the new integrated program was understanding how to find the optimal risk management structure, in terms of the appropriate retention and insurance coverage levels, and adapting the insurance program to incorporate foreign-currency translation risk (usually managed with derivatives). The team adapted the standard insurance approach, explicitly modeling the interactions between the different types of risk.⁸

Standard industry practice to determine insurance structure (i.e., retention and coverage limits) is to use the firm's historical loss record to estimate the future one-year expected loss for each insurable risk by assuming that total losses followed a specific probability distribution function. Although the true underlying distribution is unknown, a typical assumption for property-liability losses, for example, might be that the losses fit a lognormal distribution.⁹ Sometimes, the analyst constructs the total loss distribution function by explicitly modeling a separate distribution for the frequency and the severity of each type of loss.¹⁰ Having identified the loss distribution function, the analyst must estimate the parameters of that distribution. For instance, the relevant parameters for a normal distribution are the mean and standard deviation. Monte Carlo analysis can be used to simulate both the firm's expected losses and its losses net of insurance payments received and premiums paid under different insurance contract designs. The analyst uses this information to find the appropriate retention levels and insurance coverage for each

⁸ See also, Harrington and Niehaus (1998).

⁹ In practice, actuarial professionals fit property-liability losses to a number of well-known distributions for analysis purposes.

¹⁰ The number of loss occurrences per year (frequency) is often estimated using either the Poisson or the negative binomial distributions. The dollar losses per occurrence (severity) are often estimated using either the Pareto or the lognormal distributions.

individual risk category. This decision involves trading off the lower premium cost associated with assuming higher retention levels, and the greater risk exposure associated with that higher retention level. In other words, the greater the risk retained by the firm, the lower the insurance premium and the greater the firm's exposure to volatility in earnings and firm value. Honeywell's usual practice was to set retention levels such that the probability of having a loss greater than the retention above that level was roughly 45 percent.

Honeywell's risk management team followed a process similar to the one just outlined above. But, instead of analyzing one risk at a time, the team estimated the expected loss of the combined insured and currency translation risks over the life of the policy. The team thought it reasonable to assume that currency movements had little to do with the loss pattern experienced from traditionally insured risks (e.g., property-liability and workers' compensation risk), so it estimated the correlation between the two major groups of risk to be zero. This assumption, combined with the expected loss estimate for the portfolio of risks (which equaled the weighted sum of the expected losses for each individual risk) and an idea about the probability distribution of each individual risk, yielded an estimate of the probability distribution of the aggregate portfolio of risks, along with its relevant parameters. Monte Carlo analysis was again used, with the joint probability distribution of the risks of the portfolio, to find the desired retention and coverage levels.

This analysis, along with the subsequent development of a structure consistent with the stated program objectives, and the evaluation of potential designs, took almost 12 months. The final policy was a multiyear insurance-based strategy that covered all traditional insured global risks and currency translation risk in a single master insurance policy. In contrast to Honeywell's existing plan, the proposed program had one aggregate retention (deductible) of \$30 million, rather than a separate retention for each individual risk. This aggregate retention was set to approximately equal the sum of the separate retentions under the existing program. The \$30 million also roughly equaled the firm's expected annual losses for the portfolio of covered risks. That is, Honeywell "self-insured" its first \$30 million of annual losses (the aggregate of traditionally insured and foreign-currency translation losses).

If this first integrated risk management program were successful, Honeywell anticipated that other risks (e.g., interest rate exposures, weather risk, commodity price risk, and perhaps others) could eventually be incorporated into the contract. The insurance premium cost of the new program was about 15 to 20 percent less than that of the existing program.

HOW COMBINING RISKS WITHIN A SINGLE POLICY CREATES VALUE

The distinguishing feature of the Honeywell policy was that it covered multiple risks with one insurance policy that aggregated the deductibles for each risk. This approach, which could be expanded to encompass all of the firm's risk, is a lower-cost way to manage risk because it avoids paying for "excessive" insurance. Consider a hypothetical firm that faces nonoperating risks of three types: losses from product liability, losses from fire, and losses from foreign-exchange-rate exposures. Suppose that the firm is willing to "self-insure" against these risks up to a maximum total loss of \$3 million. To meet the overall firm maximum-loss constraint using separate insurance policies, the maximum deductible on each of the three policies is \$1 million. These limits are necessary because, although unlikely, all three types could suffer losses in excess of \$1 million. However,

this collection of separate policies provides more insurance than the firm wants. For example, suppose that the firm experiences a product liability judgment of \$2.5 million and no losses from either fire or foreign exchange. Then, the separate-policy approach covers all but \$1 million of the loss even though the firm was prepared to take the entire \$2.5 million loss within its maximum-loss limit. Of course, after the fact, the firm would be happy to have the greater coverage. But, beforehand when it makes its risk management decisions, the firm will pay higher insurance premiums for that extra, unwanted coverage. If instead the firm could purchase a comprehensive policy covering all three types of risks, it could have a deductible of \$3 million and receive the coverage it actually wants. Because the three types of risks are not perfectly correlated with one another, the premium for the comprehensive policy with a \$3 million deductible will be less than the sum of the three separate policies with a \$1 million deductible on each, even when all premiums are absolutely actuarially fair.

The point is analogous to buying an individual put option on each security in a portfolio versus buying a put option on the portfolio of securities itself. As is well known, the sum of premium charges for a portfolio of individual put options on each security is larger than the premium for a put option on the overall portfolio. If all the investor cares about is protecting against losses on the overall portfolio value and not on each part separately, then the portfolio of put options provides too much coverage. Similarly, the firm buys too much insurance when it buys a separate policy, or put option, for each risk. When the firm buys a comprehensive policy that insures against all three risks, it buys a different (and lower-cost) product. Exposure of the firm's value, after all, does not depend on the *source* of the risk *per se*; instead, it depends on the *total* risk. So, the type of insurance needed by the firm is one that pays off when the effect of the aggregated risks exceeds a certain, prespecified, amount. If what the firm really wants is to insure that the risks do not lead to a drop of more than \$3 million in value, then it should insure against the joint event that the combined risks do not lead to a drop of more than \$3 million.

BEYOND HONEYWELL: CHALLENGES IN CREATING AN INTEGRATED RISK MANAGEMENT SYSTEM

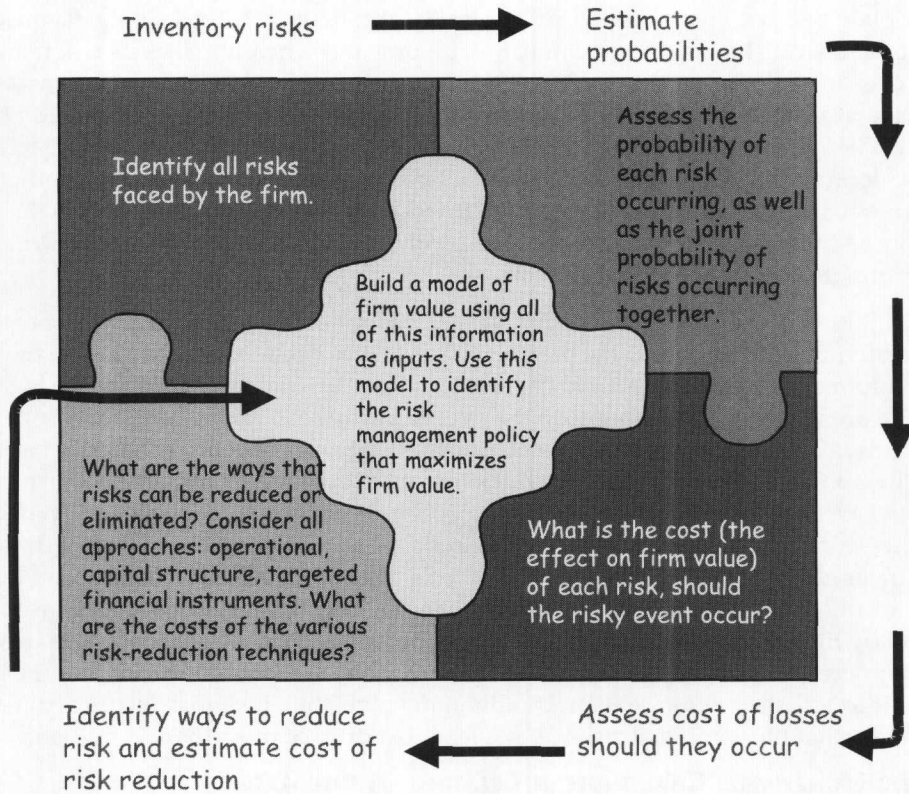
The Honeywell integrated insurance policy is a first step, but a true integrated risk management strategy must go beyond the scope of the Honeywell contract: It must incorporate more of the firm's risks, shift the analysis from tactical to strategic, and evaluate how the other ways to manage risk (operationally and via the firm's capital structure) should be used.

Incorporating more of the firm's risks means that an integrated risk management system must consider all risks that affect firm value. Operational risk, product market risk, input risk, tax risk, regulatory risk, legal risk, and financial risk compose the broad classes of risks faced by most firms, risks that in aggregate form the overall risk exposure of the firm. Every firm faces these risks, but the damage induced by those risks, and the costs to reduce, insure, or otherwise manage them can differ significantly from firm to firm.¹¹

The key steps in the development of a risk management strategy are summarized in Figure 1. After taking the inventory of all the risks faced by the firm and assessing the probability of the risks occurring (both as separate events and concurrently), the next

¹¹ See also, Crouhy, Mark, and Galai (2000), and Doherty (2000).

FIGURE 1
Building a Risk Management System



step is to estimate the effect of a particular risk on firm value. This step is critical to the shift from tactical risk management to strategic risk management.

Managers must not only estimate the effect of each risk on firm value, in an integrated risk management approach, but they must also understand how each risk contributes to total firm risk and determine the cost of reducing each risk. This approach differs from the current industry standard as applied by Honeywell (as described above). Recall that Honeywell's usual practice was to set retention levels such that the probability of having a loss greater than the retention level was roughly 45 percent. But why 45 percent? An integrated risk management approach calls for evaluating the losses that the firm is willing to sustain across the firm, which in turn determine an appropriate retention level. This *optimal retention level* may or may not use 45 percent as the critical probability level. In order to set the optimal level, managers must consider how a loss (of any level) will affect firm value, asking questions such as, If the firm sustains a loss of \$100 million, how likely are our suppliers to stop delivering products without advance payment? Can we still sell our product with a loss of \$100 million? Will customers stop buying if they think that the company is unlikely to be around to service our product in the future?

INTEGRATING WAYS TO MANAGE RISK

Next, managers must consider the various ways of managing the risks they have inventoried.¹² To better understand how the three ways to manage risk interact, consider Microsoft's operational strategy of relying upon a large number of temporary workers. This strategy reduces Microsoft's operating leverage (here the fixed costs of a more permanent workforce), giving it more flexibility to respond to unexpected shocks in demand, technology, or regulation, thereby improving the firm's chances of survival and mitigating the potential for even more severe collateral effects. This operational flexibility is particularly important for Microsoft, as it competes in a rapidly changing, volatile industry, whose future shape is uncertain.

Alternatively, Microsoft could choose to manage risk through its capital structure. Lower debt means that the firm has fewer fixed expenses, which translates into greater flexibility in responding to any type of volatility that affects firm value. Lower debt also reduces the chance that the firm becomes financially distressed. In contrast, a firm with high leverage is more likely to default on its debt when faced with unexpected variations in demand for its product or with increases in its input costs. The leverage induced by debt magnifies the effect of nearly all types of risk. The primary advantage of managing risk by using a larger proportion of equity in the capital structure is that equity provides an all-purpose risk cushion against loss, thus protecting against those other risks that cannot be readily anticipated or measured or for which no specific targeted financial instrument exists. The larger the amount of risk that cannot be accurately measured or shed, the larger the firm's equity cushion should be.

Microsoft's financial risk management policies complement its operational risk management decisions. Microsoft has no outstanding debt, and indeed, it currently holds approximately \$38 billion in cash. Its no-leverage (or negative-leverage) policy gives Microsoft flexibility that is particularly valuable when the costs associated with financial distress are high. The low-debt policy may also reflect an attempt to reduce the risk borne by some of its senior executives, who together own a substantial fraction of the outstanding shares. Microsoft's operational policy of using temporary employees and its financial policy of low leverage both serve to reduce its overall level of fixed-cost operating leverage, increase its flexibility, and thereby reduce the firm's total risk. Both types of policies, although quite different in their applications, are functionally equivalent. To that extent, they may be considered substitutes for one another. Even if similar in function, each policy, of course, has its particular costs as well as benefits. Thus, temporary workers, for example, may not be as motivated as permanent employees. Without debt, Microsoft loses out on the tax advantage of the interest deductibility of debt.

Some risks cannot be managed effectively through the operations of the firm, either because no feasible operational approach exists, or because an operational solution is simply too expensive to implement or it is too disruptive of the firm's strategic goals. Targeted financial instruments such as derivatives (futures, swaps, or options) or insurance can be an alternative to using operations directly to reduce risk. Such instruments are available for many commodities, currencies, stock indices, and interest rates, and the menu is continually expanding to reflect a variety of other risks, including even the

¹² See also, Crane et al. (1995).

weather. If a loss does occur, targeted financial instruments can attenuate or eliminate its effect on firm value.

Targeted financial instruments are especially suited for firms with large exposures to commodity prices, currencies, interest rates, or the overall stock market. These exposures derive not only from the firm's inputs, outputs, or production processes but also from risks passed along from its suppliers, employees, customers, or competitors. A candy producer, for instance, may have a substantial risk exposure to sugar prices and can hedge this risk using sugar futures. Likewise, an oil producer can sell its production forward to reduce its exposure to oil price risk. A manufacturer of recreational vehicles typically has substantial exposure to oil and gasoline price risk; it can hedge these risks contractually through oil or gasoline futures or forwards.

The benefit of risk management via targeted financial instruments is that firms are able to focus on a specific risk at a low cost without disrupting the firm's operations. Ironically, this ability to precisely target risk is the source of its primary shortcoming: Namely, risk management using targeted financial instruments is effective only against the specific risk at which it is explicitly targeted. Therefore, a currency hedge will protect only against earnings losses from exchange-rate changes. Their targeted nature limits their effective use to offsetting risks that managers are able to foresee in both type and magnitude. The range of currently available contracts of course limits the feasibility of this application tool.¹³

Just as different categories of risks can affect firm value in a similar fashion, so too can different ways of managing risks be combined to achieve collectively a common objective. Thus, Microsoft can reduce its risk via the operational policy of using temporary workers; it can also reduce its risk by carrying a low level of debt. The integrated risk management approach recognizes that a firm has many ways to manage its risk, and that both the optimal amount of risk retained and the tools used to achieve that level of risk will differ from firm to firm. In weighing the advantages and disadvantages of any particular approach, managers must consider factors such as the type of information required to effectively implement a strategy and the cost to do so, as well as the availability of proper risk management instruments in the market. The model of firm value discussed below incorporates this information and is a key tool in mapping the firm's risk management strategy.

MODELING FIRM VALUE AS PART OF THE INTEGRATED RISK MANAGEMENT PROCESS

With knowledge of the firm's aggregate risks and the costs associated with the various ways to manage those risks, managers can formally calculate the value-maximizing risk management strategy. To do so, they must build a model of firm value that encompasses their knowledge about the economics underlying the firm and its competitive environment, as well as management's beliefs about the ways in which risk potentially affects firm value. By varying the inputs to the model, managers can observe how firm value changes when various risks are hedged or not. In this fashion, managers will be able to determine the optimal level of total risk for the firm, the configuration of risks constituting this level of risk (i.e., the risks to be divested and the risks to be retained), and the

¹³ See also, Meulbroek (2001), Petersen and Thiagarajan (2000), Stulz (in press), and Tufano (1996b).

best way to achieve the desired risk profile. Of course, creating such a valuation model requires extensive knowledge about consumer demand and the nature of competition in the industry. Building such a model is a process of constant refinement. Some of the information needed to construct such a model will already reside in the firm. Other information will need to be amassed over time, as managers become more aware of what information is necessary and begin to collect the required data.

Because an integrated approach to risk management departs from the rigid compartmentalization of risks and requires a thorough understanding of the firm's operations, as well as its financial policies, risk management is the clear responsibility of senior managers. It cannot be delegated to derivatives experts, nor can management of each individual risk be delegated to separate business units. Although management will no doubt seek counsel from managers of business units or projects, it must ultimately decide which risks are essential to the profitability of the firm, taking into account cross-risk and cross-business effects, and develop a strategy to manage those risks. The rapidly expanding universe of tools available for risk measurement and management offers managers significant opportunities for value creation, but this growth also creates new responsibilities. Managers must understand how to use these tools and actively decide on their selective application.

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