

Linking Strategy to Finance and Risk-Based Capital Budgeting

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Abstract Today's strategic business decisions require a thorough picture of both the firm's risk environment and the linkage to financial performance. Thus, senior management cannot pursue a silo approach and consider the company's capital budgeting and risk management decision as separate and distinct activities. The purpose of this chapter is to highlight that all risk management activities need to be an integral part of the overall business strategy and must be ultimately aligned with the firm's financing decisions. We present Cash Flow at Risk (CFaR) as a powerful and versatile management tool enabling the firm's top executives to

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comprehensively integrate strategic, financial and risk considerations in uniform decision framework.

1 Introduction

The role of risk management within non-financial firms has significantly changed over the course of the past 20 years. In the late 1980s and throughout the 1990s, the job of a firm's risk manager was still defined as a mid-level position within the corporate treasury dealing predominately with insurance contracts, whereas the treasury department itself was dealing with the firm's interest rate and foreign exchange rate risk exposures. The vast majority of practitioners interpreted risk management as a form of crisis management and established the function out of fear of financial losses and not because a well-defined risk management process could systematically increase company value. *Value-at-Risk* (VaR) systems had been implemented without actually paying attention to the suitability of these risk tools for mapping the firm's specific business environment.¹ While VaR may be beneficial for financial trading departments in the context of pricing exotic derivatives and monitoring the daily trading risk, it provides only a limited benefit for non-financial firms managing their corporate risk exposures in illiquid markets and over long time horizons (Culp 2002a).

The risk managers of the early 1990s – oftentimes having an academic background in mathematics or physics rather than in business or economics – merely concentrated on the technical nature of risk management by defining probability distributions or estimating time-varying correlation matrices.² However, only little effort has been spend on the question of how to harmonize the firm's risk management practices with the corporate objectives such as value maximization or the stabilization of the firm's cash flows.

Over the past decade though, the scope of risk management has been widely extended – beyond the sole concentration on insurance contracts and the hedging of financial risks. Nowadays, a firm's risk management approach covers a broad selection of the potential risks a corporation faces, for instance including operational risk, regulatory risk, political risk, and most recently strategic and liquidity risk. At the same time, the risk manager's position has significantly gained in terms of prominence. Within most firms, the risk management function is nowadays executed by a senior manager with the title *Chief Risk Officer* (CRO) and is directly supervised by the board of managing directors (Nocco and Stulz 2007). Her responsibilities cover the definition of risk limits and the monitoring of the various

¹ Bessis (2010), Duffie and Pan (1997), Gregoriou (2009), Holton (2003), Jorion (2007), and Saita (2007) provide a more in-depth overview of the VaR methodology.

² A discussion about time-varying correlation matrices is provided by Engle (2009).

risk measures with the objective to manage the overall risk position in line with the company's fundamental business objectives.

This chapter will emphasize that a corporate risk management department should never be considered as a stand-alone insurance function. In fact, we want to highlight that each risk management activity needs to be an integral part of the business strategy and must be aligned with the firm's financing decisions. *Cash Flow at Risk* (CFaR) is presented as a management tool enabling the firm's top executives to integrate the various strategic, financial and risk aspects. This methodology allows non-financial firms to quantitatively assess the various threats and opportunities facing a corporation occasionally, periodically or even continuously. In addition, CFaR summarizes all relevant information into a single performance measure, which can then be used as a basis for strategic business decisions.

The structure of the chapter is as follows: Section 2 provides the background of the recent academic discussion on the integrative treatment of strategic risk management activities and the firm's financing decisions. The subsequent section concentrates on the design of the risk management process and its role within a comprehensive strategy-based risk management framework. Section 4 introduces the reader to the principles of employing the CFaR technique in a risk management context. While our focus is on CFaR's role as a coordination mechanism between risk management and financing activities, this chapter will provide a more detailed treatment of the quantitative techniques needed to compute the CFaR measure. Finally, Section 5 concludes.

2 Strategy-Based Risk Management and Risk-Based Capital Budgeting – Two Sides of the Same Coin

Capital management and corporate risk management are effectively two sides of the same coin. Nevertheless, finance theory and practice have treated these two topics largely separately in the past (Shimpi 2002). The CFO was assigned the role of managing the firm's capital requirements by minimizing the cost of capital (mainly via the creation of an optimal mix of debt and equity funding), whereas the treasury department was dealing with the firm's risk position ex post using insurance contracts and financial hedging instruments (mainly focusing on foreign exchange, interest rate and commodity price exposures).

However, managing risk exposures and capital availability separately comes at a significant cost as it ignores the causal impact of risk exposures on cash flows and cost of capital (Froot et al. 1994). In order to overcome the isolated treatment of these two issues, companies need to adopt a comprehensive decision-making framework, which integrates the risk view into the strategy selection process and the management of real investments. It requires the application of a tool set for risk modeling, which complements and extends standard capital budgeting techniques.

Business schools commonly teach the gospel of "perfect capital markets" as part of their basic finance curriculum, where shareholders are able to fully diversify their

portfolio and where corporate value only depends on systematic (non-diversifiable) rather than total risk. It implies that management should solely focus on market-related risks, while it can safely ignore diversifiable (idiosyncratic) risk (e.g. technical risk associated with R&D projects). The real-life business environment is however significantly more complex with shareholders only having an incomplete picture of a company's true economic prospects. Company crises may give rise to financial distress and are ultimately triggered by total (rather than systematic) risk (O'Brien 2006). They also tend to generate significant deadweight costs resulting either from contracting inefficiencies between the company and its stakeholders or from deficiencies in insolvency regulations. While it may be argued that currency exposures largely belong to the class of diversifiable risks, they nevertheless tend to have a significant impact on the financial situation of multinational companies, which often goes well beyond the direct influence on cash flows and earnings (Nocco and Stulz 2007).

When financing their investments, companies face the problem of what instruments to use to cover the necessary capital expenditures. Myers and Majluf (1984) addressed this issue by developing the so-called *Pecking Order Theory*. If the firm has accumulated sufficient earnings in the past, management will initially deplete its cash reserves to fund new investments (e.g. modernization of plant and equipment). If the cost of the investment however exceeds the firm's existing internal cash reserves, then the firm has to choose between different forms of external financing. It can turn towards debt markets and cover the capital expenditure gap with an intermediated bank loan or the issuance of fixed-income instruments (e.g. corporate bond). If the company fails to obtain the required funding on the debt side, it can alternatively tap into equity markets and issue new stock (or other forms of equity claims). Corporations most commonly prefer the first option.³ However, Myers and Majluf (1984) argue that the sources of debt finance are limited. The firm's level of credit borrowing today has a time-delayed influence on the availability of debt in the future. Credit lenders could simply conclude that a company with a large debt burden will rather pay off its existing outstanding debt position than investing it in value creating projects. Secondly, very high debt levels are able to trigger financial distress, and can ultimately lead to bankruptcy. Hence, the authors conclude that internal funds are used first, and once they are depleted, debt is issued, and when the firm's debt capacity is exhausted, new equity is being raised.⁴

³ Hovakimian et al. (2001) provide evidence that "profitable firms are more likely to issue debt rather than equity and are more likely to repurchase equity rather than retire debt". López-Gracia and Sogorb-Mira (2008) empirically confirm the pecking order theory showing that internal resources represent the main source of financing for small and medium enterprises.

⁴ In case a corporation issues new equity, this activity could potentially signal to the market that the stock is overvalued from the firm's perspective. Hovakimian et al. (2004) empirically strengthen this argument showing that during periods of high stock returns the probability of equity issuance increases.

Thus, for the vast majority of firms the main objective of managing corporate risks – without distinguishing between diversifiable and non-diversifiable – consists of the reduction of potential cuts in earnings or cash flows ultimately leading to a significant underinvestment problem. An integrative management of the firm's risk exposures and their financial implications potentially limits the probability of heavy cash shortfalls.

In other words, a viable corporate risk management strategy should include a comprehensive treatment of the firm's risk environment and its implications on financial resources, thereby increasing the firm's ability to achieve its strategic objectives (Nocco and Stulz 2007). Corporate strategy and corporate risk management are therefore indeed two sides of the same coin. A company's corporate risk position needs to be analyzed in the context of a valuation framework and can be quantified using the CFaR approach. Strategy selection represents the ultimate source of corporate risk exposures and, hence, strategic decision-making must not only take into account the expected value creation, but also its implications on the variability of performance.

3 Strategy-Based Risk Management – A Process View

The previous decade has seen the development of first-best risk management practices and the significant refinement of risk measurement tools – especially when considering non-financial firms (Culp 2002a; Shimpi 2002). Applying these more advanced methods however requires them being embedded in a well-designed risk management process, especially when looking at the problem from a governance perspective. Hence, this section explains the key generic steps of such a process. In line with the argument developed in the previous section, the reach of the risk management function must explicitly cover the full range of corporate decision-making from strategy selection to the narrow management of actual risk exposures.

Traditional designs of the corporate risk management function focus on contracted exposures and emphasize a factor-based silo approach to risk management – thereby largely ignoring the statistical interdependence between different risk factors. In contrast, modern strategic risk management concepts adopt a more holistic view of the firm's essential risks, its corresponding exposures and the resulting enterprise-wide risk profile. As a consequence, the firm's executives are encouraged to utilize all available information relevant for understanding performance variability ranging from the “easily quantifiable” to the “fuzzy and vague” sources of risk.

Anderson (2005) presents a strategic risk management framework for internationally active non-financial firms, which is based on the principle that senior management should conduct an extensive risk review for all business units on an ongoing basis. Corporate executives need to concentrate on the conditions that permeate the firm's external environment as well as the internal organizational

traits including productive assets, operational infrastructure, processes and human resources. By specifying all relevant risks, a firm's internal risk awareness is being developed to observe changes in company's business environment which may possibly have an impact on the achievement of strategic objectives and the firm's cash-flow performance. Moreover, an ongoing monitoring of the various risk factors ensures the creation of feasible response actions before adverse events are affecting operations. Immediate action will not always be required, but constant monitoring will develop a strategy-based risk management framework as the backbone of corporate decision-making.

3.1 Overview

Current literature offers an overwhelming variety of ways how to structure a corporate risk management process. Following Culp (2002c), four steps are essential and are always included in one form or another (e.g. Chapman 2006) for a more detailed exposition:

- (a) Identify risk factors and determine overall risk tolerances
- (b) Measure risk exposures
- (c) Implement risk mitigation measures
- (d) Monitor and report risk

The first critical step is the identification of all risk factors with potential relevance for the firm's operations and ultimately its long-term strategic development. In addition, management has to develop an explicit view on the overall risk tolerances (which needs to be derived on the basis of the company's risk management objectives). Secondly, the company needs to determine its risk exposures, which requires management to develop a view on the statistical properties of each risk factor and the correlation structure covering the interactions between individual exposures.

Thirdly, the company must implement a risk management program consisting of a potentially large variety of financial and operative risk mitigation actions. Finally, management must evaluate the effectiveness of risk management policies coupled with appropriate feedback loops to calibrate its overall approach. By definition, risk management is an ongoing process and involves continuous reflection on the potential impact of business and market dynamics (compare Fig. 1).

3.1.1 Identify Risk Factors and Determine Risk Tolerances

Following the specification of the relevant risk management motives (and the corresponding performance metric), the starting point of any risk management process must be the identification of significant risk factors that might cause business disruption, threaten the value of the firm's assets and liabilities, or create

Fig. 1 A formalized risk management process (based on Andersen 2005)

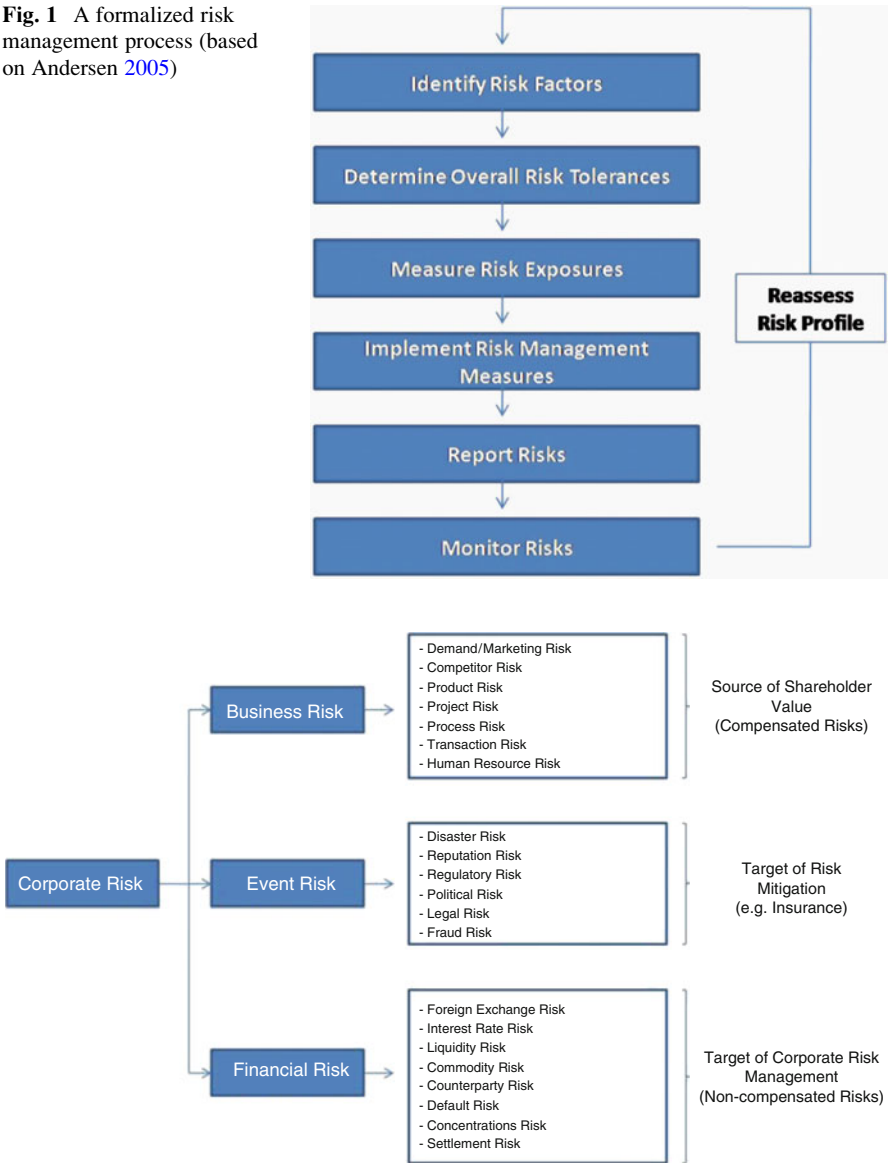


Fig. 2 Risk environment of non-financial institutions

new business opportunities. Typically, the essential risk factors influencing a non-financial firm can mainly be separated into three categories: business risks, event risks, and financial risks (see Fig. 2). The first category contains the compensated risks from a shareholder value perspective. These are typically associated with the company’s underlying business (therefore called business risks) such as

competition risk, demand risk, market risk, product risk, and human resource risk. The second category is related to adverse events. These risks are typically managed using insurance-type contracts such as regulatory risk, political risk, legal risk, or reputation risk. Finally, the last category represents financial market risks such as foreign exchange risk, interest rate risk, commodity risk, and credit risk. They typically represent non-compensated risks from the perspective of non-financial firms. Every investment can be interpreted as a portfolio of compensated and non-compensated risk exposures. While the firm would clearly prefer to eliminate all non-compensated exposures, many of those are in practice non-hedgeable or non-insurable, thereby, complicating the task of managing corporate risk exposures considerably. Risk management must further take into account to what extent risk exposures are endogenous rather than exogenous in nature.

Once the relevant risk factors are identified, the firm needs to set acceptable tolerance levels. There are basically two alternatives for expressing risk tolerances, either in absolute or in relative terms. The absolute value approach allows the evaluation of all corporate-wide defined exposures in terms of a maximum loss and the frequencies of their occurrence (Culp 2002c). Value-at-Risk (VaR) represents a well-known technique in this context, primarily applied in the financial industry. The non-financial counterpart measures are Earnings-at-Risk (EaR) or Cash-Flow-at-Risk (CFaR), which will be described in Sect. 4 in more detail. Many non-financial companies feel uncomfortable or are not able to quantify and aggregate all of their risk exposures. They tend to set tolerance levels in relative terms by for instance grouping risks into high/medium/low categories according to probability of occurrence and likely impact. While the absolute approach explicitly fosters an enterprise-wide approach, using the relative approach resembles already by design the far less appropriate silo approach.

3.1.2 Measure Risk Exposures

The techniques and possibilities of measuring risks are manifold. Nominal exposure measures only consider a static view and simply indicate how much capital is at risk considering a specific risk factor. More sophisticated methods such as sensitivity or scenario analysis are able to illustrate the development of certain risk exposures in several pre-defined business environments. Probabilistic techniques based on Monte Carlo simulations represent the most advanced approach as this tool incorporates a dynamic view on the effect of a specific risk exposure over time (the concepts of VaR and CFaR fall into this category).

3.1.3 Implement Risk Mitigation Measures

By evaluating risk exposures with the performance metric chosen by the firm, a performance shortfall can be determined, which must be addressed with risk mitigation measures. While the effectiveness of risk management needs to be

evaluated using a top-down view with aggregate exposures in focus, risk mitigation must deal with specific risk exposures. The firm can typically choose from a considerable range of instruments. Currency exposures can for instance be managed with financial derivatives, financing choices, business contracting, target market selection, sourcing decisions, geographical plant allocations and other operative measures. Some of these instruments offer short-term benefits in the context of managing transaction exposures, while others are better suited to manage longer-term operative exposures. Some buffer away exposures temporarily, while others eliminate exposures completely. Some may reduce exposures outright; others are flexibility-enhancing by creating real options (Mun 2006b). Companies often develop a natural habitat approach by focusing on a limited set of instruments – an approach potentially leading to sub-optimal outcomes.

3.1.4 Monitor and Report Risk

Risk monitoring and reporting are ongoing activities to track the effectiveness of risk management policies and to re-calibrate the overall system in response to the arrival of new information. The length of the monitoring intervals will vary depending on the specific nature of the firm’s business activities and the types of risks being tracked. While financial risks should probably be managed on a daily or even intra-days basis, operative activities based on long-term delivery contracts or on large (discrete) orders lend themselves to a more lax approach (Culp 2002c). Hence, one key challenge facing senior management is to synchronize different monitoring cycles within the company.

A strategy-based risk management (SRM) approach then concatenates the four-step risk process presented with the firm’s strategic and financing activities. This procedure allows the incorporation of the numerous interactions among all decisions involved. In other words, the SRM framework aligns the on-going analytical risk management process to the strategic management process with the objective to ensure the firm’s future financial stability leading to a superior strategic position of the company (compare Fig. 3).

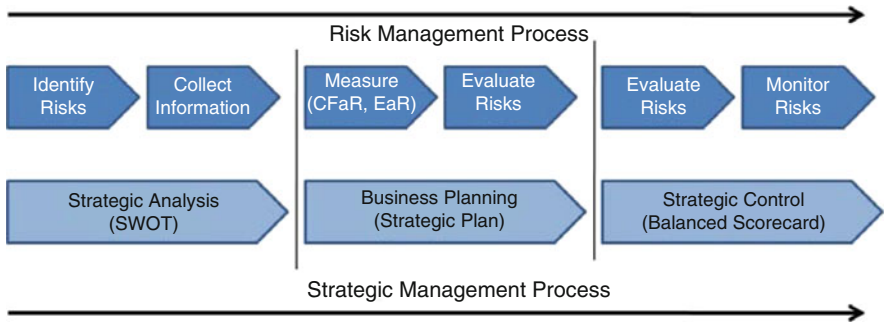


Fig. 3 A strategy-based risk management process (based on Andersen 2005)

On the one hand, the analysis of the corporate risk environment enables senior management to prepare the company for unexpected events, and allows the decision makers to generate an internal awareness for the identified risk exposures. On the other hand, the strategic management process provides a broad selection of management tools – such as the SWOT analysis or the balanced scorecard – tackling strategic and financing decisions (Simons 2000). Consequently, the implementation of the SRM framework fosters the development and initiation of activities shielding the company against potential threats.⁵

3.2 Linking Investment Performance and Risk Management Objectives

The bulk of theoretical and empirical studies in the area of corporate risk management have focused on the questions “Why does a firm hedge?” and “Does risk management increase firm value?” The literature has identified a significant range of plausible explanations that risk management is indeed able to increase firm value even after considering the costs associated with the establishment of the risk management function.

A study conducted by Meulbroek (2002) provides a discussion of these arguments of how risk management can actually assist firms to stabilize or even increase their expected cash flows or earnings (Culp 2002a; Hommel 2005, 2009):

- (a) Smooth corporate earnings over time leading to a reduction of the firm’s tax expenses when facing a concave tax curve
- (b) Mitigate financial distress cost caused by a sudden breakdown of cash-flows or earnings, or by an abrupt shortfall in the value of assets below the firm liabilities
- (c) Decrease agency costs resulting from potential conflicts between the management, shareholders and corporate creditors
- (d) Optimize the level of managerial risk aversion – usually leading to conservative project decisions protecting the firm’s income with the objective to secure the existing job position – via incentives
- (e) Reduce the corporate underinvestment problem commonly arising from unanticipated depletions of the cash reserves when the firm is confronted with external financing costs that are high enough to outweigh the benefits of new investment projects

In a nutshell, a well-developed corporate risk management program goes beyond softening the firm’s fluctuations of reported earnings or minimizing the variance of the corporate cash flows. As for instance pointed out by Froot et al. (1993), the main

⁵ However, the application of a strategy-based risk management approach is still not common practice in today’s business world (see Deloitte (2007); Andersen (2005) for further reference).

contribution of corporate risk management consists in enabling firms to carry out key investments even in times of adverse market movements.

Hence, risk management grants decision-makers important degrees of freedom on the “asset” side of the balance sheet by building in financial slack on the “liability” side. This view is consistent with the observation that competitive strength is nowadays just as much defined by the availability of funds as it is by putting the right assets in place. Maintaining a minimum level of cash flow will enable firms to maintain their operations with effectively less equity – hence, risk management may serve as cost-effective substitute. By implication, even well capitalized companies will benefit from risk management as they may just as easily suffer from rationing by financial markets. As will be discussed subsequently, the Cash-Flow-at-Risk approach represents the natural choice of technique to ensure that companies will generate a sufficient number of funds through their operations with a certain level of statistical significance.

3.3 A Comment on the Time Horizon for Corporate Risk Management

So far we have just concentrated on the procedural view of risk management and its linkage to corporate financing decisions. We now attempt to shed some light on the relationship between risk exposures and time. As companies start to deal with exposures of longer maturities, they face the problem of rising spreads.

In this context, senior management needs to carefully evaluate the potential impact of the various risk factors on future cash flows with respect to different time horizons. Typically, any risks arising from price fluctuations in the financial market are being analyzed with a short-term focus assessing their potential effects on the firm’s transaction exposures. The handling of these short-term financial risks is typically straightforward, e.g. by employing financial derivatives.

Figure 4 illustrates the effect of an increasing hedging horizon on risk spreads using the example of a EUR/USD exchange rate simulation over the time span of 12 months. The upper and lower boundaries combined indicate the widening ranges for a 90% two-sided confidence interval. This phenomenon is commonly referred to as the “cone of uncertainty”. It explains why companies have a tendency of adopting a short-term focus when managing financial risks. They can be more easily mapped to performance-related exposures and can also be managed with more precision and lower costs. In this context, it is therefore not very surprising that many firms limit their (explicit) risk management activities to a 1-year horizon (Stulz 2008).

As the hedging horizon is extended, companies need to switch to operative hedging instruments (which, by definition, are more resource intensive). In practice companies show typically great reluctance to commit today’s resources to manage a longer-term risk issue given that changes in the underlying market conditions may

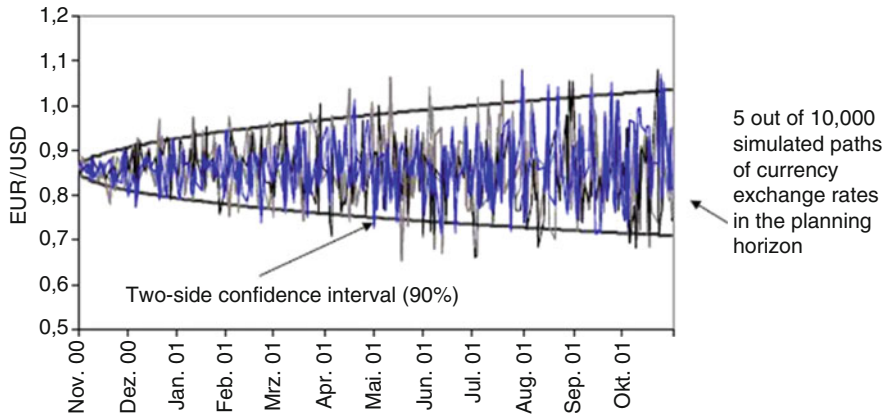


Fig. 4 Two sided confidence interval. Five out of 10,000 simulated paths are visualized to show the change of the currency exchange rate for a 12-months hedging horizon from Nov. 2000–Nov. 2001. (Wiedemann and Hager 2003)

put into question whether the exposures will ever materialize.⁶ They may also simply struggle with the fact that derivative-based hedges (as for instance in the context of managing EUR/USD swings) are ultimately expiring while the level-changes in financial prices may still persist.

More precisely, the use of financial instruments to hedge and manage price and market exposures is most suitable for specific settings in the near future. They are less effective as a universal hedging tool for all time horizons.⁷ Andersen (2005) for instance argues that it is not sensible to trade short-term interest rate futures and medium-term interest rate swaps in an effort to modify the duration gap of the firm's equity position, which reflects the value effects on long-term assets and liabilities. It is actually more appropriate to alter the maturity structure of balance sheet positions directly. Mid-and long-term risk exposures are usually far more challenging issues for risk management, as the magnitude of these exposures is generally difficult to quantify with adequate precision. In order to devote sufficient attention to these exposures, the firm needs to establish effective responsive actions reflective of its corporate resources and the operational business environment it operates in (Andersen 2005).

⁶ An incorrect application of financial derivatives to manage longer-term exposures may even lead to significant losses jeopardizing the firm's financial stability (Mello and Parsons 1995).

⁷ The trading of financial instruments – such as futures, options, or swaps – for instance becomes also a very costly risk management strategy if applied to mid-and long-term exposures.

3.4 The Corporate Risk Map – Distinguishing Between Compensated and Uncompensated Risks

The corporate risk map consists of risks, which are the source of corporate value (compensated risks), and risks, which threaten to destroy value (uncompensated risks). It is the task of risk management to focus, above all, on the latter category. Given that the firm's risk capacity is limited overall, applying risk mitigation to risks outside of the firm's sphere of core competencies will create scope of adding compensated risks to the investment portfolio (Hommel 2005; Nance et al. 1993; Schrand and Unal 1998; Tufano 1998). Applying this principle implies that the firm should engage in selective risk management by hedging away only certain types of exposures (e.g. financial market risks for non-financial firms).

3.5 Hedging Strategy Selection and Enterprise-Wide Risk Management

The shortcomings of managing risk exposures separately on the basis of a so-called "silo" approach have received increasing attention during the last decade. The advantages of a more holistic risk management based on an explicit effort to capture a company's aggregate risk profile are obvious. Consequently, concepts such as Integrated Risk Management (IRM) or Enterprise-Wide Risk Management (ERM) have garnered increasing support in the literature (Doherty 2000; Harrington et al. 2002; Meulbroek 2002). One can for instance argue that a firm-wide view represents a prerequisite for aligning the company's financing decisions with the shareholder value maximization objective. Laux (2005) provides an overview over the four main aspects and advantages of ERM from the firm's perspective:

- (a) The integration of various risk management factors and responsibilities within a firm leads to a shift from an isolated view on each individual risk towards an evaluation of the company's collective net risk exposure.
- (b) The holistic treatment of risk management, financing and operating decision is crucial for estimating the relevant net exposure and for developing alternative ways to pursue a potential multitude of (competing or at least related) risk management objectives.
- (c) The integration of various risk management techniques provides the opportunity for designing a more efficient way to transfer the risks to third parties.
- (d) The simultaneous handling of risk management and managerial incentive problems potentially reduces agency costs (e.g. incentive problems between headquarters and division managers or between equity holders and the senior management).

As will be discussed in the subsequent section, CFaR/EaR represent logical methodological choices for company-wide risk management. They generate a

single risk measure, which can be employed for embedding ERM into a value-based management structure (KPMG 2001).

Capturing the statistical interdependence between different risk factors is obviously essential for managing corporate risk on an enterprise-wide basis. Most risks are imperfectly correlated and therefore yield collectively a diversification effect. Accounting for such natural hedges reduces hedging needs, while ignoring them implies a waste of corporate resources. Estimating correlation structures however represents a daunting task in a corporate setting with managers being faced with the threat of applying ad-hoc reasoning and producing “garbage-in – garbage-out” outcomes (Hager 2004; Meulbroek 2002).

4 The Cash Flow at Risk Approach (CFaR)

The well-known Value at Risk (VaR) method – initially developed by JP Morgan in 1993 – still has an ongoing impact on today’s risk measurement practice within the financial industry. The majority of the banks and insurance companies nowadays manage their risk exposure applying this technique (Deloitte 2007). In addition, VaR is used by regulators to set capital adequacy requirements for financial service firms. The triumphal development of this method can mainly be attributed to the fact that it offers the possibility of aggregating the various risk exposures into a single measure, thereby raising the efficiency and effectiveness of risk monitoring and communication activities (Andrén et al. 2005). Section 4 provides an overview of the VaR equivalent – Cash-Flow-at-Risk – for non-financial firms with a focus on its relevance, its advantages and the procedural execution (Hommel 2009).

4.1 *The Relevance of Cash Flow at Risk*

The success of the VaR methodology in the financial sector created an increasing interest within the non-financial industry to develop an “at Risk” technique adapted to the corporate environment. Alternative principles have been engineered replacing “value” with financial figures such as cash flows or earnings – Cash-Flow-at-Risk (CFaR) and Earnings-at-Risk (EaR). We will focus in the remainder of this chapter on CFaR, but the arguments can be equivalently applied to corporate earnings as the relevant performance metric.⁸

CFaR provides – similar to VaR – an integrated view on all relevant risk factors facing non-financial firms and yield a single measure of the enterprise-wide (aggregate) risk exposures. To a certain degree, the analogy between a bank’s portfolio of

⁸ In general, EaR tends to be used more frequently by practitioners, whereas CFaR represents the more valuable measure from an economic perspective.

financial assets and a non-financial firm's portfolio of real investment projects holds up well (Jankensgård 2008). While financial as well as real assets generate cash flows, real investments are however more long-term, involve more sunk costs and are far less liquid than financial assets. As a consequence, the time horizon for estimating CFaR compared to VaR is remarkably different. While the VaR value is typically calculated in days or weeks, the CFaR approach commonly looks at a horizon of a quarter or a financial year. While financial service firms can base their VaR calculations on daily or even intra-day prices, non-financial firms may need to rely on monthly or even quarterly data and may struggle with the fact that historical time series may not at all be representative of the future outlook. Companies will nevertheless benefit from using CFaR in decision-making (Stein et al. 2001):

(a) Capital Structure Policy

The CFaR approach supports a more precise quantitative evaluation of the debt-equity financing choice. In addition, it enables corporate executives to reflect on capital structure policy in more detail (for example the appropriate level of cash reserves or the correct magnitude of credit lines).

(b) Risk Management Policy

CFaR analysis enables companies to coordinate their investment and financial strategies and to determine the proper amount of internally generated cash flows for financing (Froot et al. 1993); (Stulz 1996).

(c) Managing Investors' Expectations with respect to Earnings Volatility

In general, capital market participants such as investors or analysts are usually very concerned about fluctuations in quarterly reported cash flows and earnings. Disappointing the financial markets is likely to put tremendous pressure on the firm and its management. Managing investor relations and analyst expectations by communicating on the basis of CFaR/EaR may reinvigorate trust when under-delivering on market expectations.

In sum, CFaR can represent a very powerful technique in a strategy-based risk management process. Moreover, the application of this method allows non-financial firms to link risk measures with more traditional indicators of operating and financial performance (McVay and Turner 1995).

4.2 Relevant Risks, Distributional Properties and Their Aggregation

CFaR or EaR can be calculated by either using a bottom-up or a top-down approach. The bottom-up approach (initially developed by RiskMetrics) focuses on the simulation of certain cash flow components and their exposure to market risks, which are then subsequently aggregated to derive the firms overall cash flow distribution. The CFaR measure can be inferred directly from the firm-wide cash flow distribution. It requires the analyst to include all relevant risk factors facing the firm and to also explicitly account for any causal and statistical linkages between different risk

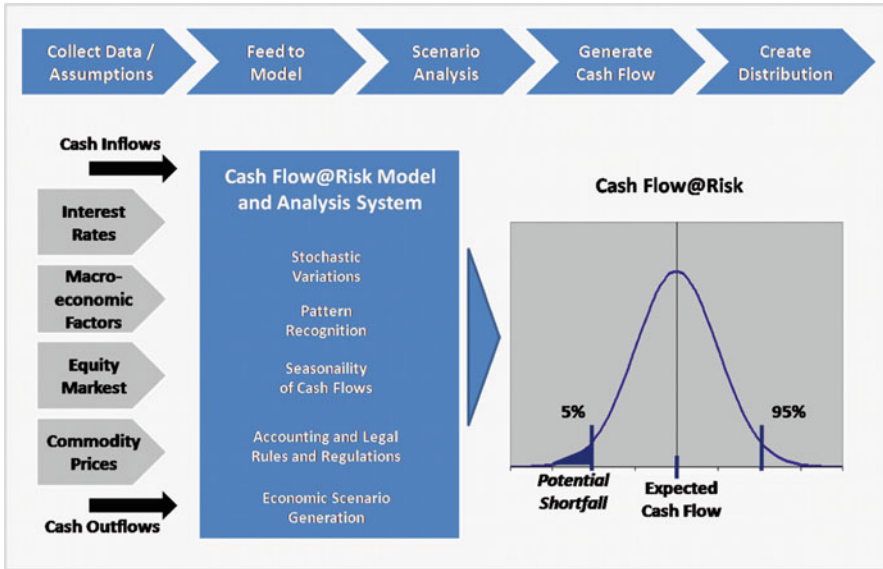


Fig. 5 An example for a *bottom-up* CFaR approach (Bansal and Jacobs 2009)

factors and cash flow streams (see Fig. 5).⁹ Kim et al. (1999) for instance concentrate on production volumes and their exposure to exchange rates as the two main pillars for computing a CFaR distribution. They simulate production prices and exchange rates on the basis of a variance-covariance matrix consistent with historical data in order to calculate the conditional values of the firm's cash flows.

Bottom-up CFaR measures are typically calculated using Monte-Carlo simulations (Condamine et al. 2006; Damodaran 2008; Mun 2004, 2006a; Rees 2008; Vose 2008). Each risk factor is characterized by a probability distribution based on historical data. While it is comparatively straightforward to derive probability distributions for financial market risks, modeling business risks is generally a much more challenging task due to the lack of historical data. Properly defining the variance-covariance matrix often tends to be exceedingly difficult and, hence, practitioners often choose to ignore statistical interdependencies (which is however equivalent to assuming a correlation of zero!). Capturing non-linearities often proves to be equally challenging and quickly moves practitioners beyond spreadsheet-based modeling (Hoitsch and Winter 2004).

A widely accepted approach in literature represents the so called *Business Risk Model*, where the identified risk factors are being connected to the firm's financial objectives – commonly operationalized by corporate cash flows, earnings or the

⁹ The CFaR measure can be calculated as the maximum shortfall of net cash generated, relative to a specified target that could be experienced due to the impact of market risk on a specified set of exposures, for a specified reporting period and confidence level.

annual net income (McVay and Turner 1995). Nevertheless, Andrén et al. (2005) argue that even this bottom-up type methodology contains a number of shortcomings. In particular, the last two decades of academic research have shown that the firm's exposure to macroeconomic and market risks is so complex and multifaceted that it is basically impossible to capture the cross-dependencies within an analytical model.

The top-down methodology has been developed to avoid the aforementioned shortcomings. Instead of using the firm's own historical data, cash flow data for a large number of comparable companies is collected in order to estimate a *pooled* cash flow distribution. Clearly, the net benefit of switching to a top-down approach hinges on the quality of the peer group selection process. Stein et al. (2001) employ the top-down method and identify mainly four elements which have a high explanatory power for unexpected fluctuations in cash flows (measured by EBITDA): firm size, riskiness of industry cash flow, share price volatility, and profitability. Therefore, they suggest relying on these four characteristics when selecting the set of comparable companies.

Andrén et al. (2005) propose the *exposure-based* CFaR as an alternative approach, which actually represents a mixture of the top-down and bottom-up approach. They simulate a firm-wide CFaR measure (based on the top-down approach), which is then related to macroeconomic risk factors (quantified using the bottom-up approach). This method addresses the need of management to understand the underlying risk drivers and their impact on corporate cash flows. The application of a multivariate regression framework (Oxelheim and Wihlborg 1997) allows the estimation of a set of exposure coefficients offering information on how market and macroeconomic risk factors actually influence corporate performance. Consequently, the exposure-based CFaR framework combines the favorable characteristics of both the bottom-up and the top-down methodology providing a more comprehensive picture of the firm's overall cash flow variability.¹⁰

4.3 Managing the Internal Financing Gap

Once quantified, companies can adopt various strategies for managing the internal financing gap with financial operative means. The most obvious approach is to reconfigure real investments so that earnings or cash flow targets are actually reached. CFOs can adopt a variety of complementary financial strategies to support these efforts. A few examples of recently invented products are:

¹⁰ There exist a few contributions applying the CFaR technique to certain companies and industries. LaGattuta et al. (2000) present a top-down approach evaluating the changing risk environment for the U.S. electricity industry. Jankensgård (2008) uses the bottom-up approach to derive a CFaR measure for Norsk Hydro ASA, an integrated aluminum company headquartered in Oslo, Norway.

- *Total Return Swaps (TRS)* allow firms to move the risk together with the return of a certain asset in exchange for a predefined fixed commission calculated on the basis of expected revenues from that asset. Thus, a TRS can be seen as a financing transaction equivalent to the disposal of an asset (Culp 2002b).
- *Equitized derivative products* allow firms to contract conditional equity by securing an equity infusion in specific market environments, while avoiding the typical transaction costs of a new equity issue.¹¹
- *Integrated Risk Management (IRM) products* represent multi-line risk transfer solutions supporting corporations to manage their enterprise-wide risk management strategy. They offer the opportunity to cover a certain bundle of risks with the same aggregate limits and deductibles. Due to the fact that losses due to single risk factors are commonly not perfectly correlated to each other (i.e. production, exchange rate and fire risks), the total costs of acquiring such a bundled risk management solution should in principle be less than the sum of insurance fees when purchasing individual coverage for different risks (Meulbroek 2002).
- *Contingent Capital Solutions* can be seen as insurance products enabling a corporation to concatenate strategic risk management and financing decisions. They exhibit similar features as *Knock-in Put Options* on equity or debt, where the firm as the owner is able to exercise the option in cases where a specific loss due to a predefined risk exposure has materialized. As a consequence, contingent capital enables a corporation to raise additional capital during difficult times.¹²

5 Summary

The quality of the firm's risk management policy critically depends on whether the senior executives in charge – primarily CRO or CFO – are able to foster a risk management culture deeply ingrained in the corporate organization. Its scope must extend to all core management functions and must reach from headquarters to near-market operational units. Strategy-based risk management should ultimately act as an enabler for the availability of funds to invest in value-increasing projects (in particular those critical for the firm's competitive positioning and those potentially representing game-changing investment opportunities).

In this context, the CFaR methodology provides a quantitative framework to detect potential financing gaps and to assess the effectiveness of risk mitigation actions. CFaR fosters an enterprise-wide approach to risk management and, hence,

¹¹ “Equity risk transfer products effectively provide what amount to options on paid-in capital – that is, the firm receives the funds only in specific circumstances, such as the decline of the LIBOR below the fixed rate in a pay floating/receive fixed swap” (Culp 2002a).

¹² Culp (2002a) provides an illustrative example of a *Contingent Capital* contract offered by Swiss Re to the French tire manufacturer Michelin.

moves the company away from the compartmentalization of the risk management function when analyzing risk exposures or assigning responsibilities across functional areas or different hierarchical levels within the corporate organization. Ultimately, the responsibility for corporate risk management must lie with senior management (Meulbroek 2002).

While a non-quantitative approach to dealing with risk in general or with certain risk exposures in particular implies that they are actually not measured at all (see also Kross in this volume), senior managers must be equally aware of the inherent limitations of quantitative risk management. These range from the danger of ad-hoc reasoning in cases where management's understanding of the risk is fuzzy and vague to more fundamental (almost philosophical) issues. First, as financial market participants increasingly rely on a common (state-of-the-art) set of hedging techniques, they will have an increasing tendency of moving as a herd implying that the likelihood of not finding a counterparty is going up (Roubini and Nihm 2010); (Triana 2009). Second, Knight and Keynes have already explained the difference between risk and uncertainty with the latter implying that future states of nature cannot be fully characterized. Taleb's (2007) theory of the "black swan" has most recently explained the impact of the "highly improbable" on economic behavior. Lastly, Ayache (2010) moves even beyond Taleb's distinction between predictable and non-predictable events and questions the predictability in more fundamental terms (the so-called "blank swan").

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Creating Value in a Dynamic Market Environment

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(Eds.)

2012, XVI, 316 p., Hardcover

ISBN: 978-3-642-04348-2