Financial Risk Management for Management Accountants

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Financial Risk Management for Management Accountants

Executive Summary

This Management Accounting Guideline (MAG) summarizes the basic principles of financial risk management. The MAG first briefly outlines (a) the different types of financial risk that firms may face, (b) the basic elements of a risk management framework, and (c) the benefits of managing financial risks. The MAG’s core sections then focus on the interlinked issues of risk assessment (or quantification) and possible control tools. Risk assessment and control tools are suggested for each type of financial risk, and real-world examples are used to illustrate the discussion. A case study of the financial risks and the financial risk management choices available to Pietrolunga, a fictitious specialist Italian lumber merchant, shows how the suggested methods may be applied in practice. A glossary of key terms provides a quick source of reference.

Underlying all of the material in this MAG is the premise that the key aim of financial risk management is to assist management in controlling risks that may affect the achievement of organizational objectives. There is no single ideal risk management package, but risks will be managed most effectively if sound judgment and common sense are combined with the use of a judicious mix of qualitative and quantitative controls.

Financial risk management has ranked very high on the corporate agenda since the early 1990s, but the large losses experienced in the last couple of years indicate that many firms are still a long way from managing their financial risks effectively.

Introduction

While some of the tools and practices described in this MAG have been developed by risk managers for use in and by financial institutions, the primary target audience for this MAG is the financial manager in non-financial organizations that face an array of financial risks and challenges inherent in doing business in today’s global economy.

Risk management is concerned with understanding and managing the risks that an organization faces in its attempt to achieve its objectives. These risks will often represent threats to the organization – such as the risk of heavy losses or even bankruptcy. Risk management has traditionally associated itself with managing the risks of events that would damage the organization.

Organizations face many different types of risk. These include risks associated with (a) the business environment, (b) laws and regulations, (c) operational efficiency, (d) the organization’s reputation, and (e) financial risks. These financial risks relate to the financial operation of a business – in essence, the risk of financial loss (and in some cases, financial gain) – and take many different forms. These include currency risks, interest rate risks, credit risks, liquidity risks, cash flow risk, and financing risks. The importance of these risks will vary from one organization to another. A firm that operates internationally will be more exposed to currency risks than a firm that operates only domestically; a bank will typically be more exposed to credit risks than most other firms, and so forth.

It is frequently suggested that the key driver of change has been a series of economically significant and large-scale financial disasters. To give just a few examples: in 1993, Germany’s Metallgesellschaft AG lost $1.3 billion in oil futures trading, and in the following year the US municipality, Orange County, was forced to file for Chapter 9 bankruptcy following massive losses from speculating on derivatives. In 1995, Barings Bank in the UK failed due to unauthorized derivatives trading by an offshore subsidiary. And in 1998 the hedge fund Long Term Capital Management (LTCM) collapsed – demonstrating that having two Nobel Prize-winning finance experts on its board of directors offered only limited protection from financial risks. Then there was the fall of Enron in 2001 and the accompanying collapse of Arthur Andersen, the major accounting firm that acted as Enron’s external auditors. The last couple of years have witnessed a considerable number of huge losses involving many of the world’s leading financial institutions. Indeed, recent events suggest that many firms – including many financial institutions that should really have known better – still have a lot to learn about effective financial risk management.

The financial risk management disasters of the last fifteen years or so have (a) made it clear that risk management is fundamental to good corporate governance, and (b) prompted a number of responses relating to governance and internal control. Among these, the Combined Code in the UK and the King Report in South Africa. All see risk management as part of the internal control process for which the board of directors is responsible. Similarly, in the USA the Sarbanes Oxley Act (SOX) of 2002 requires companies to establish and maintain an adequate internal control structure for financial reporting.

Over this same period, company managers have also increasingly recognized the potential for effective risk management to add value to an organization, and the language of risk management has started to permeate the day-to-day language of business. As a result, it is now commonplace to consider the risk implications of many business decision-making problems, such as (a) making budgetary choices, (b) choosing between alternative...
operating plans, and (c) considering investment proposals. Risk reporting and risk disclosure are also becoming increasingly important as stakeholders wish to know more about the risks that their organizations are taking.

Naturally, there is huge variation in the level of resources that are devoted to risk management across organizations of differing sizes. At one end of the scale, the risk management function may be performed by a single risk champion or a part-time risk manager. At the other end of the scale may be found a dedicated risk management department headed by a chief risk officer with a seat on the board. But no matter how small or large the organization’s dedicated risk management function might be, the current view of risk management is that everyone in an organization carries some responsibility for managing and controlling the risks to which it is exposed. The board of directors holds the ultimate responsibility; it chooses the organization’s risk management strategy and is responsible for putting into place the organization’s risk management framework. Other managers directly support risk management by (a) identifying risks in their area of expertise, (b) taking ownership and responsibility for those risks, (c) promoting compliance with the organization’s control systems, and (d) engendering a culture of risk awareness.

Although risk management is primarily concerned with managing downside risk – the risk of bad events – it is important to appreciate that risk also has an upside. This upside involves the exploitation of opportunities that arise in an uncertain world, such as opportunities to profit from new markets or new product lines. Risk management is therefore concerned both with conformance – that is, controlling the downside risks that may threaten achievement of strategic objectives – and with performance – such as opportunities to increase a business’s overall return. In this way, risk management is linked closely with achieving the organization’s objectives, and involves the management of upside as well as downside risks.

This MAG offers introductory advice on (a) the nature of financial risks, (b) the key components of a financial risk management system, and (c) the tools that can be used to make decisions under uncertain conditions. The advice will need to be fine-tuned to fit differing organizational contexts, but the underlying message and risk management framework universally provide a basis for discussion among senior management on the drafting of their own organization’s financial risk management strategies.

After briefly discussing the different types of financial risk that firms may face and the benefits of managing them, we outline the basic elements of a risk management framework. The core sections of the MAG focus on (a) the interlinked issues of risk assessment (or quantification) and possible tools of control, and (b) how these may be applied to each of the main types of financial risk – namely, market, credit, financing, and liquidity risks. Risk assessment and control tools are suggested for each financial risk type, and real-world examples are used to illustrate the discussion. A case study of the financial risks and the financial risk management choices available to Pietrolunga, a fictitious specialist Italian lumber merchant, shows how the suggested methods may be applied in practice, and a glossary of key terms provides a quick source of reference.

**Different Types of Financial Risk**

Financial risks create the possibility of losses arising from the failure to achieve a financial objective. The risk reflects uncertainty about foreign exchange rates, interest rates, commodity prices, equity prices, credit quality, liquidity, and an organization’s access to financing. These financial risks are not necessarily independent of each other. For instance, exchange rates and interest rates are often strongly linked, and this interdependence should be recognized when managers are designing risk management systems.

Financial risks can be subdivided into distinct categories; a convenient classification is indicated in Figure 1 below.
Market risks: These are the financial risks that arise because of possible losses due to changes in future market prices or rates. The price changes will often relate to interest or foreign exchange rate movements, but also include the price of basic commodities that are vital to the business.

**EXAMPLE 1: CADBURY’S SCHWEPPES’ EXPOSURE TO FOREIGN EXCHANGE RATE RISK**

The confectionery giant, Cadbury Schweppes, recognized in its 2007 annual report that it has an exposure to market risks arising from changes in foreign exchange rates, particularly the US dollar. More than 80% of the group’s revenue is generated in currencies other than the reporting one of sterling. This risk is managed by the use of asset and liability matching (revenue and borrowings), together with currency forwards and swaps.

Credit risks: Financial risks associated with the possibility of default by a counter-party. Credit risks typically arise because customers fail to pay for goods supplied on credit. Credit risk exposure increases substantially when a firm depends heavily upon a small number of large customers who have been granted access to a significant amount of credit. The significance of credit risk varies between sectors, and is high in the area of financial services, where short- and long-term lending are fundamental to the business.

A firm can also be exposed to the credit risks of other firms with which it is heavily connected. For example, a firm may suffer losses if a key supplier or partner in a joint venture has difficulty accessing credit to continue trading.

**EXAMPLE 2: AMAZON’S CREDIT RISKS**

Amazon, the global online retailer, accepts payment for goods in a number of different ways, including credit and debit cards, gift certificates, bank checks, and payment on delivery. As the range of payment methods increases, so also does the company’s exposure to credit risk. Amazon’s exposure is relatively small, however, because it primarily requires payment before delivery, and so the allowance for doubtful accounts amounted to just $40 million in 2006, against net sales of $10,711 million.

**EXAMPLE 3: CREDIT RISK MANAGEMENT IN THE BANK OF AMERICA**

In its 2007 annual report (p.69), Bank of America states that it manages credit risk “based on the risk profile of the borrower or counterparty, repayment sources, the nature of underlying collateral, and other support given current events, conditions and expectations.” Additionally, the bank splits its loan portfolios into consumer or commercial categories, and by geographic and business groupings, to minimize the risk of excessive concentration of exposure in any single area of business.

Financing, liquidity and cash flow risks: Financing risks affect an organization’s ability to obtain ongoing financing. An obvious example is the dependence of a firm on its access to credit from its bank. Liquidity risk refers to uncertainty regarding the ability of a firm to unwind a position at little or no cost, and also relates to the availability of sufficient funds to meet financial commitments when they fall due. Cashflow risks relate to the volatility of the firm’s day-to-day operating cash flow.

**EXAMPLE 4: A CREDIT TRIGGER**

Banks often impose covenants within their lending agreements (e.g., a commitment to maintain a credit rating), and access to credit depends on compliance with these covenants. Failure to comply creates the risk of denial of access to credit, and/or the need to take action (and costs involved) to restore that rating.

For example, the 2005 annual report of Swisscom AG shows that the company entered into a series of cross-border tax lease arrangements with US Trusts, in which sections of its mobile networks were sold or leased for up to 30 years, and then leased back. The leasing terms included a commitment by Swisscom AG to meet minimum credit ratings. In late 2004, however, a downgrading by the rating agencies took the company’s credit rating to below the minimum specified level. As a result, Swisscom AG incurred costs of Swiss Francs 24 million to restore that rating.

**EXAMPLE 5: HOW NOT TO MANAGE FINANCING RISK: NORTHERN ROCK**

The UK bank Northern Rock provides a classic example of a company that succumbed to financing risk. Its business model depended upon access to large levels of wholesale borrowing. But in late 2007, this funding dried up during the “credit crunch” that arose out of the US subprime mortgage crisis. Without access to loans from other commercial banks, Northern Rock was unable to continue trading without emergency loans from the Bank of England to bridge its liquidity gap. However, even massive emergency loans were unable to restore investor confidence in the bank, and the British Government eventually felt compelled to nationalize it.
Why Manage Financial Risks?

Firms can benefit from financial risk management in many different ways, but perhaps the most important benefit is to protect the firm’s ability to attend to its core business and achieve its strategic objectives. By making stakeholders more secure, a good risk management policy helps encourage equity investors, creditors, managers, workers, suppliers, and customers to remain loyal to the business. In short, the firm’s goodwill is strengthened in all manner of diverse and mutually reinforcing ways. This leads to a wide variety of ancillary benefits:

- The firm’s reputation or ‘brand’ is enhanced, as the firm is seen as successful and its management is viewed as both competent and credible.
- Risk management can reduce earnings volatility, which helps to make financial statements and dividend announcements more relevant and reliable.
- Greater earnings stability also tends to reduce average tax liabilities.
- Risk management can protect a firm’s cash flows.
- Some commentators suggest that risk management may reduce the cost of capital, therefore raising the potential economic value added for a business.
- The firm is better placed to exploit opportunities (such as opportunities to invest) through an improved credit rating and more secure access to financing.

These benefits show that it is difficult to separate the effects of financial risk management from the broader activities of the business. It is therefore important to ensure that all parties within the organization recognize and understand how they might create or control financial risks. For example, staff in the marketing department might be trained on how to reduce financial risks through their approach to pricing and customer vetting. Similarly, buying policies can create financial risks by, for example, creating an exposure to exchange rate movements. Consequently, it is important to establish an integrated framework for managing all financial risks.

A Risk Management Framework

Organizations face many different types of risks, but they can all be managed using a common framework1. The framework summarized in this section therefore directly applies to financial risk management, and provides a context for subsequent sections that (a) outline the different types of financial risks, and (b) explain how financial risks may be identified and assessed before implementing appropriate strategies and control systems.

Figure 2: The Risk Management Cycle

CIMA’s risk management cycle, illustrated in Figure 2, shows that risk management forms a control loop that starts with defining risks by reference to organizational goals, then progressing through a series of stages to a reassessment of risk exposures following the implementation of controls.

At the organizational level, the stages of the risk cycle are set against the background of a clearly articulated risk policy. Drafted by senior management, the policy indicates the types of risks senior management wants the organization to take or avoid, and establishes the organization’s overall appetite for risk taking. The starting point is therefore a general understanding of (a) the range and type of risks that an organization may face in pursuing its specific strategic objectives, and (b) the scale and nature of any interdependencies between these risks. This overview can then be used as the basis for constructing a more detailed risk management strategy for each risk category – in this case, financial risks.

Based on the cycle illustrated in Figure 2, the core elements of a financial risk management system are:

- Risk identification and assessment
- Development of a risk response
- Implementation of a risk control strategy and the associated control mechanisms
- Review of risk exposures (via internal reports) and repetition of the cycle

Risk Identification and Assessment

The first stage is to identify the risks to which the organization is exposed. Risk identification needs to be methodical, and to address the organization’s main activities and their associated risks. Risk identification may be carried out via questionnaires, surveys, brainstorming sessions, or a range of other techniques such as incident investigation, auditing, root cause analysis, or interviews. The aim is to use staff expertise to identify and describe all the potential financial risks to which the organization may be exposed.

The scale of each identified risk is then estimated, using a mix of qualitative and quantitative techniques. (We will have more to say on these techniques below. For the time being, however, we focus not on the techniques themselves, but on how estimates of these risk exposures are put to use.) After this, risks are prioritized. The resulting risk ranking should relate directly back to overall corporate objectives. A commonly used approach is to map the estimated risks against a likelihood/impact matrix, such as that illustrated below. Often, both likelihood and impact would be classified into high, medium, or low. The more likely the outcome, and the bigger the impact, the more significant the risk would become. And it is especially important to identify and assess those risks that have the potential to severely jeopardize the organization’s ability to achieve its objectives, or even to threaten its very survival.

The estimated risks can then be prioritized using a likelihood/impact matrix, such as that illustrated in Figure 3.

Figure 3: A Likelihood/Impact Matrix
The numbers relate to individually identified risks, and risk impact may be expressed in either financial (quantitative) or nonfinancial (qualitative) terms. A private sector business may express impact in terms of forecast income, profit, or cash flow. On the other hand a public sector organization may measure impact in terms of its ability to provide services to a prescribed level.

Let us suppose that risk number five in the grid relates to the likelihood and risk of the impact on bad debts of a rise in interest rates. For a company retailing small-ticket consumer goods, the anticipated likelihood is shown as high – probably because of prevailing economic conditions – but the impact is relatively low. The accompanying risk register will include more specific details of the risk, such as specific interest rate forecasts, as well as the estimated monetary impact and the assumptions underlying its calculation. In the case of a mortgage provider operating under the same economic conditions, this same risk may be identified as having a much higher impact because of the size of the potential defaults and the fact that lending is its core business. In other words, the component risks and also the resulting matrix of likelihood and consequences will vary from business to business, and are subject to a degree of subjective judgment. As long as this subjectivity is recognized, the grid provides a useful tool for ranking and control.

Many firms find it useful to record their risk information in a risk register. Such a register would include information on the type of risk, its likelihood of occurrence, its likely consequence, its potential monetary impact, and its relationship (if any) with other identified risks. The risk register, which would also include information such as forecasts of key variables, the assumptions on which calculations are based, and the institution’s response to each risk, would be regularly updated.

**Figure 4: Risk Strategies and Tools**

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Risk transfer involves paying a third party to take over the downside risk, while retaining the possibility of taking advantage of the upside risk. An option, for example, creates the opportunity to exchange currency at a pre-agreed rate, known as the strike price. If the subsequent exchange rate turns out to be favorable, the holder will exercise the option, but if the subsequent exchange rate is unfavourable, the holder will let it lapse. Thus, the option protects the holder from downside risk while retaining the possible benefits of upside risk. Note, by the way, that the greater flexibility of risk transfer tools is usually accompanied by greater cost.

The pros and cons of the different responses are discussed in more depth within the context of each different type of financial risk, but it is helpful at this stage to recognize that various choices do exist.

Risk Control Implementation

Having selected a risk response, the next stage is to implement it and monitor its effectiveness in relation to the specified objectives. Implementation includes allocating responsibility for managing specific risks and, underlyng that, creating a risk-aware culture in which risk management becomes embedded within the organizational language and methods of working.

Review of Risk Exposures

The control loop is closed when the effectiveness of the risk controls is evaluated through a reporting and review process. This then leads to a new risk identification and evaluation process. This process itself has three main components:

- **Review process**: This should include a regular review of risk forecasts, a review of the management responses to significant risks, and a review of the organization’s risk strategy. It should also include the establishment of an early warning system to indicate material changes to the risks faced by the organization.

- **Internal reporting to the board or senior management group**: This might include a (a) review of the organization’s overall risk management strategy, and (b) reviews of the processes used to identify and respond to risks, and of the methods used to manage them. It should also include an assessment of the costs and benefits of the organization’s risk responses, and an assessment of the impact of the organization's risk management strategy on the risks it faces.

- **External reporting**: External stakeholders should be informed of the organization’s risk management strategy, and be given some indication of how well it is performing.

This basic framework for risk management can now be applied to each of the different categories of financial risk, namely: market, credit, financing, liquidity, and cash flow risks.

Quantifying Financial Risks

Figure 3 shows that an organization must decide how to respond to a financial risk, and choose between accepting and managing the risk as part of its normal business operations by “mitigating it, avoiding it, or transferring it. From the CIMA risk cycle, we know that the choice will reflect both

- The priority attached to the risk, for example as shown on the likelihood and consequences matrix; and
- The organization’s risk appetite.

In other words, managers need to know the scale of the risk they face before they can decide upon the response.

Three commonly used approaches to quantifying financial risks are regression analysis, Value-at-Risk analysis, and scenario analysis. It is helpful to look at each method in more depth to understand their respective strengths and weaknesses.

Regression Analysis

Regression analysis involves trying to understand how one variable — such as cash flow — is affected by changes in a number of other factors (or variables) that are believed to influence it. For example, the cash flow for a UK-based engineering business may be affected by changes in interest rates (INT), the euro/sterling exchange rate (EXCH), and the price of gas (GAS). The relationship between the variables can be expressed as follows:

\[
\text{Change in cash flow} = \theta + \beta_1 \text{INT} + \beta_2 \text{EXCH} + \beta_3 \text{GAS} + \epsilon
\]

where INT represents the change in interest rates, EXCH represents changes in the euro/sterling exchange rate, GAS represents changes in the commodity price, and \( \epsilon \) represents the random error in the equation. The random error reflects the extent to which cash flows may change as a result of factors not included in the equation.

The coefficients \( \beta_1, \beta_2, \text{ and } \beta_3 \) reflect the sensitivity of the firm’s cash flows to each of the three factors. The equation is easily estimated using standard packages (including Excel), and the estimated coefficients can be used to determine the firm’s hedging strategy.

To continue the example, suppose \( \beta_2 \) is negative, implying that the firm’s cash flow would fall if the exchange rate went up. If the firm wished to hedge its cash flow against such an event, then it might do so by taking out a forward contract. If the exchange rate rose, the resulting drop in cash flow would be countered by an equivalent rise in the
value of the forward contract. Thus, assuming the hedge position was properly designed and implemented, the result is to insulate the firm against a change in the exchange rate.

Of course, in practice, no hedge is ever perfect, and this approach to selecting a hedge also assumes a stable regression equation. Even mildly volatile economic conditions make this assumption rather dubious, but the example does illustrate how regression-based hedge positions can help reduce a firm's exposure to a risk factor.

Regression analysis can also be used for financial reporting purposes, as a means of proving the effectiveness of a hedging transaction. In the context of IAS 39, Accounting for Financial Instruments, the rules state that any hedge ineffectiveness must be recorded in the income statement as either a loss or a profit, according to price movements. Additionally, where hedge accounting is being used, formal documentation is required at the inception of the hedge, and this must include evidence of how the hedge effectiveness will be assessed. Regression analysis (either period-to-period or cumulative) is one of the more common methods used for assessing this effectiveness, although the analysis itself is only reported internally within the business.

Value-at-Risk

Another popular approach to risk measurement is Value-at-Risk (VaR) analysis. The VaR can be defined as the maximum likely loss on a position or portfolio at a specified probability level (known as the confidence level) over a specified horizon or holding period. So, for example, a company may own an investment portfolio on which the risk manager estimates the VaR to be $14 million, at a 95% confidence level over a ten-day holding period. This means that if no investments are bought or sold over a ten-day period, then there is a 95% chance of the portfolio falling by no more than $14 million. VaR is therefore an estimate of the likely maximum loss, but actual losses may be either above or below VaR.

The VaR is an attractive approach because it is expressed in the simplest and most easily understood unit of measure, namely dollars lost, and because it gives us a sense of the likelihood of high losses. However, VaR also has a serious drawback: it tells us nothing about what to expect when we experience a loss that exceeds the VaR. If the VaR at a particular confidence level is $10m, we have no idea whether to expect a loss of $11m or $111m when losses occur that are greater than the VaR.

Although VaR was originally developed to estimate market risks, its basic principles easily extend to liquidity risks, financing risks, and different types of credit risk exposure. To give an example, a board of directors might set an earnings target of, say, 80 pence per share, but also be conscious that if the earnings per share (EPS) fell below 70 pence then there would be strong adverse reaction from the market, causing the share price to fall. The board may therefore wish to ensure that there is only, say, a 5% likelihood of earnings falling to 70 pence per share. It is possible for organizations to construct a model that measures the sensitivity of earnings to changes in the market prices of financial assets or liabilities, and use this model to estimate a VaR to assess their potential exposure if such risks are left partially or wholly unhedged.

Another example is the application of VaR methods to estimate the riskiness of pension funds. Changes in the accounting standards for post-employment benefits have led to increased management awareness of the value of company pension funds, because of the rules on disclosure of surpluses/deficits. VaR can then be a useful tool for helping manage the risk of huge variations in the potential surplus or shortfall in company contributions. Such volatility is a particular characteristic of defined benefit schemes, where managers face uncertainty over the employment, retirement, and salary profiles of scheme members.

**EXAMPLE 6: MICROSOFT’S USE OF VaR TO MANAGE ITS FINANCIAL RISKS**

Where companies have global operations that trade across a range of currencies and interest rate regimes, it is quite likely that such currency and interest rate risks interact. Historically, companies have tended to hedge risks independently as transactions occur, but VaR can treat the various risks as a portfolio of related components that can be managed together. Microsoft is one example of a company that uses VaR to manage aggregate risks in this way. Currency, interest rate, and equity/investment risks are hedged in combination to take advantage of the effects of diversification within the portfolio. The company then uses simulation analysis to estimate and report a VaR figure that shows the potential loss on the combined risk exposures, assuming a 97.5% confidence limit and a 20-day holding period. Microsoft draws attention to the fact that the VaR amount does not necessarily reflect the potential accounting losses. Nonetheless, the fact that VaR is used at all indicates active risk management, giving a positive signal to the market. The VaR can then be compared to overall reported earnings as a sensitivity measure.
Besides this application of VaR methods to estimate Earnings-at-Risk and Pension-Fund-at-Risk, other applications include:

- **Liquidity-at-Risk**: VaR taking account of changes in market liquidity.
- **Cashflow-at-Risk**: VaR analysis applied to a firm’s cash flows rather than P&L.
- **Credit-at-Risk**: VaR analysis applied to a firm’s credit exposure.
- **Default-Value-at-Risk**: VaR analysis applied to estimate a firm’s losses in the event of default.

Thus, VaR-type analysis is very flexible and can be applied to any type of quantifiable risk.

**Scenario Analyses**

Another useful approach to quantifying risk involves scenario analyses (sometimes also referred to stress tests, sensitivity tests, or ‘what if?’ analyses). These involve a financial model of the firm and a set of specified scenarios. We ask ‘what if’ one or more scenarios should occur, and we use the model to determine the impact of these scenarios on the firm’s financial position. The scenarios chosen include any we believe might be relevant to our organization. For example, we might ask:

- “What if the stock market crashed by 20%?”
- “What if interest rates were to rise by 300 basis points?”
- “What if the exchange rate were to fall 10%?”
- “What if a firm were to lose a key client or key market?”
- And so forth.

If we wish to, we can then convert the results of the scenario analyses into a risk measure by assuming the risk exposure to be equal to the largest of the forecast scenario analysis losses.

Firms have used scenario analyses in some form or other for many years. Early scenario analyses were often little more than ‘back of the envelope’ exercises, but the methodology has improved considerably over the years, thanks in large part to improvements in spreadsheet technology and computing power. Modern scenario analyses can be highly sophisticated exercises.

Scenario analyses are particularly helpful for quantifying what we might lose in crisis situations where ‘normal’ market relationships break down. Scenario analyses can identify our vulnerability to a number of different crisis-phenomena:

- **Changes in the cost and availability of credit**: Scenario analyses are ideal for evaluating our exposure to an (a) increase in the cost, and (b) decrease in the availability, of credit.
- **Sudden decreases in liquidity**: Markets can suddenly lose liquidity in crisis situation, and risk management strategies can easily become unhinged, leading to much bigger losses than anticipated.
- **Concentration risks**: Scenario analyses can sometimes reveal that we might have a much larger exposure to a single counterparty or risk factor than we had realized, taking into account the unusual conditions of a crisis. Probability-based measures such as VaR can overlook such concentration, because they tend not to pay much attention to crisis conditions.
- **Macroeconomic risks**: Scenario analyses are well suited for gauging a firm’s exposure to macroeconomic factors such as the state of the business cycle, sudden exchange rate changes, and the economic condition of a particular country.

**EXAMPLE 7: NORTHERN ROCK’S LIQUIDITY PROBLEMS**

The importance of liquidity-related scenario analyses was highlighted by the fate of the British bank Northern Rock in 2007; they had failed to carry out such analyses even though their business model made the bank very dependent on financing from the capital markets. The failure to anticipate a possible drying up of market liquidity was a key factor in the bank’s subsequent demise.

Although the principles behind scenario analyses are straightforward, the categories of stress test may vary according to the type of event, the type of risk involved, the risk factors, the country or region, the stress test methodology, the model assumptions, the instruments used, the level of the test (e.g., business unit level vs. corporate level), data requirements, and the complexity of our portfolio. Scenario analysis is thus simple in principle but complex in practice.

Scenario analyses can also be very useful for highlighting weaknesses in a firm’s risk management setup. The process of actually going through a scenario analysis should force managers to think through the ramifications of bad scenarios, as well as help them to pinpoint weaknesses or hidden assumptions they might have overlooked. If it is done well, it should not only give some indication of where the institution is vulnerable, but also highlight flaws in contingency planning. Indeed, what risk managers learn about these hidden weaknesses is often more valuable for risk management purposes than the loss figures that such exercises actually produce.

It is also worth emphasizing – as the examples in the above discussion demonstrate – that the methodology of scenario analysis is, like VaR methodology, very flexible and can apply to a great variety of different types of risk exposure. Indeed, one very common uses of scenario analyses are to assess credit risk exposures. It is good
practice, for example, for firms to carry out scenario analyses to determine their potential losses if a major counterparty to which they have extended credit should default. It is also becoming increasingly common for firms to stress-test their exposures to financing and liquidity risks; the benefits of such exercises are amply borne out by the difficulties faced in the credit crunch of 2007-8.

**EXAMPLE 8: CADBURY SCHWEPPES’S INTEREST-RATE AND FOREIGN-EXCHANGE RATE RISK EXPOSURE**

The results of scenario analyses can be reported to shareholders as a way of providing some information about the anticipated effects of hypothetical events. To give an example, in its 2007 Annual Report and Accounts, Cadbury Schweppes, the world’s largest confectionery company, includes on p. 46 of its Financial Review a table showing the expected impact on the income statement of both a 1% decrease in interest rates and a 10% reduction in the value of sterling against other currencies. This table gives the reader some idea of its exposure to interest rate and foreign exchange risk.

**EXAMPLE 9: SCENARIO ANALYSIS OF PENSION RISK**

A company operating a defined benefit pension scheme will be concerned about how much the present value of its future pension liabilities may change in response to shifts in a number of key factors. For example, the faster that employee salaries are expected to grow, the higher the potential liabilities. The present value of the liabilities will also be affected by the rate that is used to discount the future payments. Consequently, the present value of the pension liabilities depends on (among other things) the combined estimates for both salary forecasts and the discount rate.

Scenario analysis can be used to evaluate the effect of changes in both of these factors, and the table below illustrates how a pension liability might change under different assumptions.

<table>
<thead>
<tr>
<th>Discount Rate</th>
<th>Salary Growth 4%</th>
<th>5%</th>
<th>6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>3%</td>
<td>$100,449</td>
<td>$90,000</td>
<td>$81,229</td>
</tr>
<tr>
<td>4%</td>
<td>$113,004</td>
<td>$100,559</td>
<td>$90,184</td>
</tr>
<tr>
<td>5%</td>
<td>$127,901</td>
<td>$113,004</td>
<td>$100,667</td>
</tr>
</tbody>
</table>

The table shows that the liability increases by approximately 12% for each one percentage increase in salary growth; this information can be useful not just for financial planning, but also in staff planning and budgeting.

**Table 1: Comparison of Approaches to the Quantification of Risk**

<table>
<thead>
<tr>
<th>Method</th>
<th>Ease of Use</th>
<th>Uses</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression analysis</td>
<td>Simple</td>
<td>Reducing exposure to specific risk factors e.g., exchange rate movements Determining hedging strategies</td>
<td>Excel-based Easy to understand</td>
<td>Regression equation may not be stable over time, making the results unreliable</td>
</tr>
<tr>
<td>VaR</td>
<td>Potentially complex, requiring good statistical understanding</td>
<td>Enhances understanding of a wide range of risks covering liquidity, cash flows, portfolio values, credit, etc. Can be used as a risk control tool</td>
<td>Easy to understand Gives a sense of the likelihood of a given scale of losses</td>
<td>No idea of the potential scale of losses in excess of VaR. May give a false sense of security because it does not capture extreme scenarios</td>
</tr>
<tr>
<td>Scenario Analysis</td>
<td>Simple</td>
<td>“What if” analyses Crisis planning</td>
<td>Highly flexible Easy to understand</td>
<td>Likelihood of alternative scenarios may not be easily assessed. Specification of scenarios is subjective</td>
</tr>
</tbody>
</table>
The table also shows how rising salary costs can be ‘compensated for’ by an increase in the discount rate, so that liabilities remain close to stable. This information is useful for understanding the financial reporting implications of pensions risks, because the stock market now views pension liabilities as a form of corporate debt. As a result, high liabilities can serve to reduce the market value of the firm.

In this section, we have suggested three alternative methods for measuring risk, and it is helpful to end by summarizing the respective uses, advantages, and disadvantages of each approach.

**Tools and Techniques to Mitigate Risk**

Knowing the potential scale and likelihood of any given financial risk, management needs to decide how to deal with it. This means deciding whether it wishes to accept, partially mitigate, or fully avoid the risk. Different tools exist for each of these choices and for each risk type. Table 2 summarizes the choices, using the risk management framework developed earlier in this MAG.

Choosing the most appropriate tool depends upon the risk appetite, level of expertise in the business, and the cost effectiveness of the particular tool. The board of directors sets the organization’s risk appetite, so it is important for board members to understand the methods being used to manage risk in their company. If the methods are not well understood, then it is advisable not to use them.

The rest of this section explains, according to risk type, each of the control tools listed in table 2.

**Market Risk Tools**

*Internal Strategies*

**Natural hedging** is internal to a business and takes advantage of the fact that different risk exposures may offset each other.

**Uses:** primarily used in managing foreign exchange and interest rate risks.

**Table 2: Risk Management Tools for Different Categories of Financial Risk**

<table>
<thead>
<tr>
<th>Internal Strategies</th>
<th>Financial Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Hedging</td>
<td>Credit Risks</td>
</tr>
<tr>
<td>Internal Netting</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk Sharing Strategies</th>
<th>Credit Risks</th>
<th>Financing/Liquidity Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vetting</td>
<td>Customer Risks</td>
<td>Financing</td>
</tr>
<tr>
<td>Position Limits</td>
<td>Supplier Risks</td>
<td>Market Liquidity</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Partner Risks</td>
<td>Cashflows</td>
</tr>
<tr>
<td>Netting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Credit Enhancement</td>
<td></td>
<td>Lines of Credit</td>
</tr>
<tr>
<td>Lines of Credit</td>
<td></td>
<td>Working Capital Management</td>
</tr>
<tr>
<td>Debt/Equity Mix Management</td>
<td></td>
<td>Liquidty Insurance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk Transfer Strategies</th>
<th>Market Risks</th>
<th>Financings/Liquidity Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Options</td>
<td>Equity Risks</td>
<td>Financing</td>
</tr>
<tr>
<td>Insurance</td>
<td>Interest Rates</td>
<td>Market Liquidity</td>
</tr>
<tr>
<td>Securitization</td>
<td>Exchange Rates</td>
<td>Cashflows</td>
</tr>
<tr>
<td></td>
<td>Commodity Prices</td>
<td></td>
</tr>
</tbody>
</table>

|                      | Credit Derivatives |                           |
|                      | – Credit Default Swaps |                          |
|                      | – Total Return Swaps |                           |
|                      | – Credit-Linked Notes |                           |

|                      | Credit Insurance |                           |
|                      | Securitization   |                           |

|                      | Liquidity Insurance |                     |
|                      |                     |                         |
EXAMPLE 10: USING NATURAL HEDGING TO MITIGATE EXCHANGE RATE RISK

A Canadian company is sourcing supplies of household textiles in India, and is therefore exposed to the risk of movements in the exchange rate between the Canadian dollar and the Indian rupee. At the same time, the business is developing a new retail business in India. Natural hedging means that it could use the rupee-denominated retail income to fund the payments to its local textile suppliers. In this way, the currency risk on an asset is matched by an opposite (and potentially exactly equal) currency risk on a liability. Consequently the overall exposure is eliminated or, at the very least, reduced. In such cases, there may be little need to hedge the individual asset or liability exposures because the firm’s aggregate exposure is fairly limited.

EXAMPLE 11: USING NATURAL HEDGING TO MITIGATE INTEREST-RATE RISK

A US aircraft manufacturer is uncertain about whether interest rates will rise or fall in the medium term, and is concerned because the bulk of its borrowing is through variable rate loans. The company has long-term contractual commitments from customers, which require the granting of medium-term credit lines. The risk of an increase in interest rates can be internally hedged by ensuring that the credit lines granted to customers are linked to interest rates. In this way, if the manufacturer’s own liabilities increase because of a rise in interest rates, the value of accounts receivable will also increase. The match will not be perfect but will reduce costs.

Internal netting: This is a form of natural hedging.

Uses: to manage multiple internal exposures across a range of currencies.

EXAMPLE 12: INTERNAL NETTING AS A NATURAL HEDGE

Some divisions of huge global businesses, such as those in the car manufacturing business, end up in net debt, while others carry net assets in a range of currencies. If Treasury operations are centralized, the assets and liabilities in each currency can offset one another, so that the global organization faces only the net exposure. A decision can then be taken whether or not to use other tools to further hedge this exposure.

EXAMPLE 13: USING FORWARDS TO HEDGE COMMODITY PRICE RISK

In the five years to 2007-8, the cost of aviation fuel has trebled. Such cost increases create risks that require decisions to be made in relation to hedging. In its 2007-8 Annual Report, British Airways reports that it uses around 6 million tonnes of fuel per year, and that changes in the related costs can significantly affect the company’s operating results. In response, the company hedges part, but not all, of its risk through purchasing forward contracts for oil and petroleum. The hedges are imperfect, however, because changes in aviation fuel prices do not fully mirror the movements in underlying oil prices.

EXAMPLE 14: USING FORWARDS TO HEDGE FOREIGN EXCHANGE RISK

Air Canada uses foreign exchange forward contracts as one of a range of tools to manage the risks associated with foreign currency exchange rates. In its annual report for 2007, Air Canada states that for contracts relating to 2008 and 2009 they chose not to designate the transactions as hedges for accounting purposes. Consequently, the losses resulting from the fall in the market value of the derivatives contracts at the balance sheet date were recorded as an unrealized foreign exchange loss in the accounts.
**Futures:** Futures contracts are a form of standardized forward contract that are traded exclusively on organized exchanges.

**Uses:** In principle, futures may be used to protect against changes in any asset or commodity price, interest rate, exchange rate, or any measurable random variable such as temperature, rainfall, etc.

Contract sizes for futures are standardized, meaning that they lack the flexibility of forward contracts. Additionally, it is not possible to use straightforward futures contracts to protect against price changes for all commodities. For example, jet fuel is not traded on an organized futures exchange, so airline companies have to find alternative tools, such as the commodity swap market, to manage their exposure to the risk of rising fuel costs.

Nonetheless, the protection that futures (and also forwards) provide can be vital for all commodities that are significant components of production.

**EXAMPLE 15: CADBURY SCHWEPPES AND COMMODITY FUTURES**

Cadbury Schweppes uses commodity futures contracts to hedge against adverse cash flow or profit and loss movements arising from changes in the prices of sugar, cocoa, aluminium, and other commodities. It is easy to understand why Cadbury Schweppes use commodity futures, because between the end of 2000 and June 2002, for example, the price per metric tonne of cocoa increased from $800 to $2200. Such a huge increase within a relatively short time implies that a failure to hedge such an exposure would potentially have dramatically affected their profits. Similarly, the oil price rises of 2008 have seriously affected the profits of small haulage firms that chose to accept the price risk rather than to hedge their exposure.

**Joint ventures** imply that an organization is willing to accept a given level of risk, but it may wish to share that risk with another party.

**Uses:** expansion into new markets where shared knowledge, as well as shared costs, helps to reduce risks.

**EXAMPLE 16: JOINT VENTURES TO SHARE RISKS**

The CW television network in the USA, which was launched in the September 2006 season, is a joint venture owned in equal parts by CBS Corporation and Warner Brothers. The network is specifically targeted at a narrowly defined market group – 18-34 year old females. Launch risks are reduced by sharing the investment costs, but this also reduces the upside gains from risk-taking because the resulting profits are also shared.

The counterparty to any futures contract is the exchange itself. This means that firms taking futures positions face negligible default risk. The exchange protects itself against default risk by obliging firms involved to maintain margin accounts. Every day, the value of the position is marked against market, and gains or losses are settled immediately. So, for example, if a firm has a purchased a futures position (i.e., one that increases in value if the futures price should rise), and if the futures price does in fact rise, then the firm can take its profit. But if the futures price should fall, the firm will realize a loss and may face margin calls. Futures contracts are more liquid than forward contracts, but the firm also has to take account of the possibility of margin calls that may strain liquidity.

**Swaps:** A swap is a contract to exchange the difference between two cash flows at one or more agreed future dates.

**Uses:** management of interest rate and exchange rate risks. More recently, markets in commodity and credit risk swaps have developed. Swaps can be used to (a) reduce funding costs, arbitrage tax, or funding differentials, (b) gain access to new financial markets, and (c) circumvent regulatory restrictions.

**EXAMPLE 17: AN INTEREST-RATE SWAP**

A fixed-for-floating interest rate swap enables a firm to arrange with a swap dealer to swap the difference between a fixed and a floating rate of interest. Such an arrangement effectively allows an organization to convert a position in a floating rate loan into a position in a fixed rate one, and vice versa.

LXN’s Treasurer has negotiated a fixed rate of 6% or Euro Libor +1.5% variable rate for a loan of €1.8 million. The counterparty is a swap dealer, MGV, who has agreed to convert the fixed rate debt into synthetic floating rate debt via a swap arrangement in which the two companies will share the quality spread differential (QSD) equally.

The counterparty can borrow at 7.2% fixed or Euro Libor + 2.5% variable. Euro Libor is currently 5%.

Comparing the cost of fixed rate borrowing between LXN and MGV, we see that LXN has a comparative advantage equal to 1.2% (7.2% - 6.0%). In the floating rate market, LXN also has a comparative advantage of 1% ( Libor +2.5% - LIBOR + 1.5%). The gap between the relative benefit in the fixed versus floating markets is termed the QSD, and in most swaps this is shared equally between the two parties. In this case the QSD equals 0.2%.

The result is a net saving to both parties of 0.1% interest on the terms that they could otherwise have obtained, i.e., LXN pays 6.4% instead of 6.5% variable, and MGV pays 7.1% fixed instead of 7.2%. This saving has to be offset against the additional risk arising from the swap because of the counterparty risk. LXN faces the risk that
Many swaps also involve exchanges of cashflows across currencies. An example of such a cross-currency interest rate swap is where a firm might convert floating-rate payments in the Canadian dollars into fixed-rate payments in the US dollars. Another example is a so-called diff swap in which the counterparties swap, say, Canadian dollar payments at the Canadian interest rate into Canadian dollar payments at the US interest rate. Other common swaps are commodity swaps, where one or more swap legs are tied to a commodity price such as the price of oil or an agricultural price.

Swaps are highly flexible instruments that are traded OTC, and can be arranged at low cost compared to most other alternatives, but they also have disadvantages. Most importantly, as with forwards, the parties to swap arrangements expose themselves to mutual default risks, although many ‘credit enhancement’ techniques have evolved to deal with these exposures.

**Risk Transfer Strategies**

**Options:** An option is a contract that gives the holder the right (but, unlike forward or futures contracts, not the obligation) to buy or sell an underlying asset at an agreed price at one or more specified future dates. The agreed price is known as the strike or exercise price. An option that involves the right to buy is known as a call option and one that involves the right to sell is a put option. Options come in a great variety of forms, and can be exchange-traded as well as traded OTC.

Options can also be classed as European, American, or Bermudan, depending upon when the option may be exercised. A European option gives the holder the right to exercise the option at a fixed future date; an American option gives the holder the right to exercise at any time until the date the option expires; and a Bermudan option gives the holder the right to exercise over some part of the period until the option expires.

There are many different types of options. Some of the more common include: caps and floors, in which a price or rate is capped or floored; Asian options, in which the underlying is an average rather than a spot price; and barrier options, of which the most important are knock-out options that automatically become worthless if the underlying hits or exceeds a stipulated barrier.

**Uses:**
- Firms might use caps on interest rates to hedge their interest rate exposure, or caps and floors on exchange rates to hedge their foreign exchange rate risk.
- Asian options on fuel prices may be used to hedge fuel bills (e.g., by airlines), where the main concern is the average price of fuel over an extended period.
- A firm might purchase an option with a knock-out barrier on an exchange or interest rate (a) because it is cheaper than a ‘regular’ option, (b) because it does not expect the underlying to hit the barrier anyway, or (c) if the firm is otherwise ‘covered’ should the barrier be breached.

Options give the holder downside protection so that the maximum possible loss is limited to the premium (or price) of the option. But they can still get the upside profits if the underlying goes the ‘right’ way. This attractive feature makes options expensive relative to most other derivatives.

Options are similar in nature to insurance, but although their functions are similar, an option does not satisfy the legal definition of insurance. For example, to legally purchase insurance, the purchaser must have an insurable interest in the property being insured, but there is no such requirement when purchasing an option.

**EXAMPLE 18: FOREIGN EXCHANGE OPTIONS TO HEDGE EXCHANGE RATE RISK**

A firm could buy put options to protect the value of overseas receivables. Similarly, it could protect against the increase in cost of imports (overseas payables) by buying call options. Therefore, suppose that an US company has a net cash outflow of €300,000 in payment for clothing to be imported from Germany. The payment date is not known exactly, but should occur in late March. On January 15, a ceiling purchase price for euros is locked in by buying 10 calls on the euro, with a strike price of $1.58/€ and an expiration date in April. The option premium on that date plus brokerage commissions is $0.0250, or a unit cost of $1.6050/€. The company will not pay more than $1.6050/€. If euros are cheaper than dollars on the March payment date, the company will not exercise the call option but simply pay the lower market rate of, say, $1.52/€. Additionally, the firm will sell the 10 call options for whatever market value they have remaining.

**Insurance:** Many risks, such as risk of loss of or damage to buildings or contents by fire, are best managed by traditional insurance. The payment of a premium secures the purchaser against losses on the insured asset.
The purchase of insurance is often obligatory, either for legal reasons or as precondition for credit – as is the case with mortgages.

**Self-insurance:** The firm may decide to bear certain types of risk itself, and possibly set up its own insurance company (known as a captive insurance company) to provide the cover. The global accountancy firms of PricewaterhouseCoopers, Deloitte Touche Tohmatsu, Ernst and Young, and KPMG are good examples of businesses that own captive insurance companies that provide the firms with professional liability protection for their audit staff. Self-insurance is also often used to cover employee benefits such as health benefits, in addition to covering certain types of litigation risks, and may be combined with purchased insurance. Captive insurance companies may retain all of the insured risk or choose to reinsure a portion of it in the open market.

**Securitization:** The conversion of financial assets (such as credit cards, bank loans, and mortgages) or physical assets into financial instruments that can be traded, often through the use of special-purpose vehicles.

**Uses:** creating the potential to increase the scale of business operations through converting relatively illiquid assets into liquid ones.

Examples of businesses that have been securitized include airports, motorway service stations, office accommodation, and utilities. More recently, firms have begun to securitize the risks associated with their pension funds.

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**EXAMPLE 19: SECURITIZATION OF PENSION LIABILITIES**

Companies can now opt to onward sell the liabilities and the associated risks relating to their final salary/defined benefit pension schemes to the UK insurance company Paternoster via an OTC deal that represents a specialized form of securitization. Paternoster purchases the liabilities. In so doing, it assumes the responsibility for paying future pensions. This type of securitization protects firms against the risk of uncertain escalation of their pension liabilities, thereby allowing them to focus on their core business.

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**EXAMPLE 20: SECURITIZATION OF PHYSICAL ASSETS**

The Canary Wharf Group plc has been securitizing some of its major office block developments since 1997. Developments that are leased to blue chip clients offer predictable, low risk cashflows, and the securitization of such high-quality assets gives the group access to borrowings at prime rates, thus lowering the overall cost of capital as well as increasing its potential overall debt capacity.

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**Credit Risk Tools**

### Internal Strategies

The majority of tools for controlling credit risk fall into this category. They include:

- **Vetting:** prospective counterparties to assess their credit risk. This is the oldest and most basic means of managing credit risk exposure.

### EXAMPLE 21: EXTERNAL CREDIT VETTING

Internal vetting may be supplemented by the purchase of credit quality information from external providers. For small and medium sized firms this may take the form of purchase of facilities such as Creditwatch™ which, in return for a fee, allows the nomination of specific businesses on which it provides an alert service to notify creditors of critical events such as the filing of new accounts, court judgements, director resignations etc. Credit information on large companies or organizations commonly takes the form of a formal credit rating assigned by one of the agencies such as Standard and Poor’s or Fitch. Such ratings are based on detailed analysis of the company’s financial position and performance, in addition to more general information about economic and market conditions.

- **Position limits:** imposing limits on the credit to be granted to any individual counterparty. These position limits can be both ‘soft’ and ‘hard’; the former would be similar to targets that might occasionally be breached; the latter would be hard and fast limits that should not be exceeded under any circumstances.

- **Monitoring:** Firms should always monitor their ongoing credit risk exposures, especially to counterparties to whom they are heavily exposed. Monitoring systems should send warning signals as a counterparty approaches or breaches a position limit.

- **Netting arrangements:** to ensure that if one party defaults, the amounts owed are the net rather than gross amounts.

- **Credit enhancement:** techniques include periodic settlement of outstanding debts; imposing margin and collateral requirements, and arranging to make or receive further collateral payments if one party suffers a credit downgrade; purchasing credit guarantees from third parties; and credit triggers (arrangements to terminate contracts if one party’s credit rating hits a critical level).
**Risk Sharing Strategies**

**Purchase of a credit guarantee:** the purchase from a third party, usually a bank, of a guarantee of payment. One example is an export credit guarantee, which is often issued by governments as a way of encouraging a growth in exports to developing markets in which credit risks may be relatively high.

**Credit derivatives:** these mitigate downside risk by transfer to an external party. Examples of credit derivatives include:

- **Credit default swap:** A swap in which one payment leg is contingent on a specified credit event such as a default or downgrading.

**EXAMPLE 22: LINKING LOAN COSTS TO CREDIT DEFAULT SWAP PRICES**

In the tightened credit markets of 2008, both US and European companies found that if they wished to renew short-term credit facilities they had to accept terms that linked interest payments to their creditworthiness. The traditional system of "relationship pricing" of credit facilities – in which banks offered cheap loans to their best clients – was replaced by one in which facilities are based upon measures of credit risk. Major companies such as Halliburton, Nokia and Wal-Mart, all of which renewed their revolving credit facilities in 2008, found the terms had changed. For example, when Caterpillar renewed its 364 day credit facility (which it has never used) the renewal terms were priced so that if the facilities were drawn down, the company would pay LIBOR (London inter-bank offer rates) plus the current credit default swap spread for their business.


- **Total return swap:** A swap in which one leg is the total return on a credit-related reference asset. Total return is defined as the coupon rate plus capital gain or loss.
- **Credit-linked note:** A security which includes an embedded credit default swap. The issuer offers a higher rate of return to the purchaser, but retains the right not to pay back the par value on maturity if a specified credit default occurs.

However, credit derivatives come with a large health warning: they entail their own credit risk because the counter-party may default, and they can also entail substantial basis risk.

**Risk Transfer Strategies**

**Credit insurance:** Credit insurance works in exactly the same way as any other form of insurance, whereby premiums are paid for the purchase of a policy that then pays out in the event of a specified credit default. Such insurance is, however, likely to be expensive.

**EXAMPLE 23: DIFFERENT LEVELS OF CREDIT INSURANCE**

The global credit insurance market is dominated by three main groups – Euler Hermes, Coface and Atradius, and the premiums charged for such insurance directly reflects the perceived risk levels. Insurance may be taken out to provide protection on a single transaction – such as an export order – or in relation to either one segment or even the whole turnover of the business. Costs can be reduced by selecting a self-underwritten policy, although this clearly implies that not all of the risk is transferred across.

In extreme circumstances, companies can lose the confidence of credit insurers, which means that suppliers can no longer purchase coverage against payment. For example, in late 2008 all three of the major credit insurers refused to provide new coverage for both Ford and General Motors. Suppliers may respond by refusing to provide further goods, and in such cases the loss of confidence can become a death warrant, as it prevents companies accessing the goods required to continue trading.

**Tools to Manage Financing, Liquidity, and Cash Flow Risks**

In times of economic downturn, these types of risk may rise to the fore, as access to credit tightens or the cost begins to escalate. Standard and Poor’s estimates that a total of $2,100 billion of European company debt will mature between the end of 2008 and the end of 2011, and companies need to make sure that they have controls in place to ensure access to the finance and liquidity necessary to sustain trading.

**Internal Strategies**

The starting point for managing liquidity and financing is the use of internal controls to monitor both liquidity and access to funding. Among the tools available for this purpose are:

**Lines of credit:** Arranged in advance with banks and suppliers, these lines are essential to maintaining the ability to trade by ensuring that neither liquidity nor access to core inputs is placed at risk. Some credit lines will include covenants that must be adhered to for credit to remain available e.g., maintenance of a maximum debt/equity ratio.
EXAMPLE 24: THOMAS COOK CREDIT LINE
In May 2008 the European based travel company Thomas Cook announced that it had replaced its existing credit lines with a new €1.8 billion facility intended for use to fund both acquisitions and a share buy-back programme. Up to €320 million of the facility will, however, be dependent upon the successful sale of the company’s German airline Condor, to Air Berlin.

Working capital management: Too much capital tied up in inventory or accounts receivable puts liquidity pressures on a company, making it more difficult to take advantage of opportunistic investments. Additionally, debtors and inventory offer no return on capital. On the other hand, cash invested elsewhere in a business could be used to increase earnings. The use of Key Performance Indicators for core working capital ratios, and investment in MRP systems and other software can also help to maintain maximum access to short-term finance.

EXAMPLE 25: EXTENDED PAYMENT TERMS
For smaller companies supplying to large businesses, there is sometimes limited control over the payment terms, and this can put severe pressure on working capital requirements. For example, in October 2008 the global retailer Tesco wrote to all of its non-food suppliers saying that it had changed its payment terms from 30 to 60 days effective December 1st, 2008. The policy change generates millions of pounds in additional working capital for Tesco, but simultaneously deprives its suppliers of access to that funding. Suppliers therefore needed to respond by tightening their own working capital controls.

Keeping liquid assets: Firms can also protect their ability to trade by keeping reserves of easily liquidated assets, such as 90-day notes, that can be liquidated easily and at low cost if the firm needs additional financing in a hurry.

EXAMPLE 26: ILLIQUIDITY IN THE BANKING SECTOR
The credit boom was characterized by many banks choosing to replace low earning traditional liquid assets with high earning structured credit products. In the 1960s holdings of cash or near-cash instruments such as government bonds stood at around 30% of total assets but this proportion fell close to zero near the beginning of the millennium. As access to inter bank credit began to dry up in response to the sub-prime crisis, a number of banks paid the price for their lack of liquidity. Unable to borrow, even big names on both sides of the Atlantic, such as Lehman Brothers, Bear Stearns, Bradford and Bingley and HBOS were forced into liquidation or an agreed take-over. Even the grandest of names are not immune from liquidity problems.

Debt/Equity mix: Finance theory suggests that when levels of long-term debt exceed certain levels, the cost of capital for a business will increase. So, maintaining an optimal debt/equity mix is vital to maximizing shareholder wealth. Excessively high ratios also create risks because it may lead to breaches of borrowing covenants, which result in additional costs. This risk must, however, be weighed against the benefit that such debt has a lower cost than equity.

EXAMPLE 27: YELL
In 2008 there were many examples of companies whose share price were negatively affected because they were too highly leveraged. One such example is Yell, which publishes print and on-line directories in the UK, US and Spain. By July 2008 its share price had fallen to less than one tenth of its February 2007 value of 645 pence. The fall reflected not just the general credit crisis, but specific concerns about levels of debt within Yell. Analysts noted that with levels of debt ran at 4.9 times the value of equity, the stock was too highly leveraged for its sector, and there was also some concern the company would soon be in breach of covenants as a result. In order to avoid such risks, debt/equity ratios should be selected bearing in mind the need for a degree of sensitivity to a collapse in share prices.

Risk Sharing Strategies
There are no derivatives-based tools available to manage financing and liquidity risks.

Risk Transfer Strategies
Liquidity insurance: insurance against a sudden loss of liquidity which, if not resolved, would endanger a company’s ability to continue trading.

EXAMPLE 28: LIQUIDITY INSURANCE
The importance of liquidity insurance is illustrated by the experience of Countrywide, a US mortgage provider. In August 2007, Countrywide faced a run, but claimed on its liquidity insurance to draw down credit lines of $11.5 billion, which enabled the bank to continue trading. Interestingly, the UK bank Northern Rock appeared to hold no such insurance policies.

Tools and Techniques to Control Risk: Summary
The tools and techniques outlined above for managing financial risks are varied and require different levels of expertise in their application. There is no single ideal answer to the question of “How do we manage this...
Managers need to take into account (a) the organizational risk appetite, (b) the likelihood that a risk will materialize and the scale of the resulting impact, and (c) the cost of alternative hedging strategies. More generally, governance regulations place risk management responsibility firmly in the hands of boards of directors. In so doing, they signal a need for caution in the use of complex financial instruments. This issue is discussed in more depth below.

The Need for Clear Hedging Policies and Understanding of Derivatives Trading

Many of the tools discussed in the previous section are derivatives, or financial instruments whose payoffs depend on the realized values of one or more underlying random variables. It is therefore appropriate to offer some further advice on how derivatives should (and should not) be used.

Design of hedging strategies

A firm needs to design hedging strategies carefully. Three important issues that arise especially with derivatives hedging strategies are (a) basis risk, (b) leverage, and (c) the financing risk implied by any hedging strategy:

- We have noted already that basis risk is the 'residual' risk that remains once a position has supposedly been hedged. Basis risk is almost always a problem, but it is especially pronounced in cases such as credit and catastrophe ('cat') derivatives, where hedging is hampered by the difficulties of specifying trigger events that closely match the actual events that firms are trying to hedge against. For instance, if the catastrophic event in a cat derivative is not carefully chosen, a firm might experience a real catastrophe, but not the one specified as calling for a derivative payout. The hedge instrument must therefore be carefully chosen to avoid excessive basis risk. A hedge with a lot of basis risk is of little practical use, and can leave the firm very exposed without the firm’s management being aware of it. As the saying goes, the only perfect hedge is in a Japanese garden.

- Leverage is the gain or loss on a position relative to the movement of an underlying risk factor. Many derivatives such as futures and options offer the prospect of high leverage. This can be useful because it enables a 'large' position to be hedged by a 'small' one. However, a highly leveraged position magnifies losses as well as gains: what goes up can also go down.

- A firm needs to manage any liquidity implications of its risk management strategies. For example, a firm that hedges a forward position with a futures hedge can experience significant liquidity repercussions if the firm faces margin calls on its futures position. In addition, a firm’s credit risk strategies can also have significant liquidity implications. An example would be where a firm gets hit with the need to make new collateral payments or otherwise renegotiate a credit enhancement arrangement after it suffers a credit downgrade. Credit enhancement can be good for managing credit risks, but can leave the firm exposed to liquidity problems at exactly those moments when financing becomes more expensive and harder to obtain.

The need for a clear derivatives policy

Underlying the above issues, the complexity and potential dangers involved in the use of derivatives instruments make it important for every firm to have a clear derivatives policy – even if that policy is not to touch them. The need for such a policy is reinforced by the introduction of regulations on accounting for financial instruments within FAS133 (USA) and IAS 39 (International Accounting Standards Board), which require the firm to document the rationale for the use of any derivative and to disclose the costs associated with derivatives hedging. A detailed description of the financial accounting regulations is far beyond the scope of this MAG, but it is perhaps helpful to note that the rules distinguish between derivatives held for speculative or trading purposes and those held for hedging. The distinction requires a clear declaration of the management intent behind holding a financial instrument as a hedge.

An organization’s derivatives policy should clearly specify why the firm uses derivatives in the first place – assuming it does at all. The most obvious reason would be to hedge its risks, but organizations might also use derivatives for arbitrage purposes (e.g., tax arbitrage) or speculative purposes. This said, firms should be careful about using derivatives positions to speculate or achieve lower funding costs, because they may be taking on greater risks than their managers realize. There is after all no such thing as a free lunch. A firm’s derivatives policy should also specify which types of derivatives the firm would consider using, and which types it will never use. A good rule is never to engage in derivatives transactions that are not understood by someone in senior management.

EXAMPLE 29: PROCTER AND GAMBLE

A salutary lesson is provided by the experience of Procter and Gamble in the early 1990s. They entered into a leveraged interest rate swap with Bankers Trust to reduce their funding costs. However, this arrangement entailed a large exposure to US interest rates of which Procter & Gamble’s management was unaware, and the firm got hit badly when US interest rates subsequently rose. For its part, Bankers Trust was subsequently fined for sharp practice.
Conclusions

All organizations face financial risks, and their ability to achieve their objectives (and in some cases even their survival) depends on how well they manage those risks. It is therefore critical to establish a framework that (a) facilitates the identification and quantification of the main types of risk to which a firm is exposed, and (b) sets out the main tools and techniques that the firm will use to manage those exposures. The importance of financial risk management is reinforced by the very large losses reported by many institutions since August 2007, which highlight the fact that they still have a long way to go before they can be said to be managing their financial risks adequately. Financial risk management does not come cheap, but it is less expensive than the alternative.

Case Study

Pietrolunga is a small stock market-listed Italian timber merchant involved in forestry management, timber production, and the export of specialist woods used in the production of fine musical instruments – so-called “singing wood.” The company, based in the mountains of Trentino in the North Italy, has a reputation as the world’s finest producer of woods for the production of concert-grade grand pianos. Pietrolunga has a thirty-year contract to supply all of the piano wood requirements for a leading manufacturer based in Japan, in addition to numerous small scale contracts with master luthiers around the world who specialize in producing high-quality hand-made classical stringed instruments from violins to double bass.

The trees used in piano production take around sixty years to reach the required level of maturity, but the maple used for the backs of the stringed instruments takes much longer, and these trees are more susceptible to disease. This long lead time requires careful planning by the staff at Pietrolunga, who face huge uncertainties about the long-term demand for such items. In addition, significant amounts of working capital are tied up in the forestry stocks because even once felled, the slow air-drying processes mean that wood cannot be sold for several years.

There is also a high level of uncertainty within the company’s current business environment. The primary geographic market for products is South East Asia, in the countries of Japan, Singapore, and China, but both the European and North American markets are in decline, except for cheap student-grade instruments that are now being produced in huge numbers under factory conditions in China. Chinese producers have also gained a foothold in the professional grade of instrument making, by sending staff over to train in the leading instrument-making schools of Europe, and then using these masters to train local staff back in China. The Chinese instruments are made using local, tropical woods rather than the spruce and maple commonly used in Europe, but the resulting instruments are highly rated by many professional players, and are priced at less than half of their traditional equivalent.

In contrast to the market for classical instruments, that for hand-made guitars is growing. In recognition of this, Pietrolunga entered into a joint venture arrangement in 2006 with a US-based company that supplies wood to North American luthiers. Under the terms of the joint venture agreement, in which costs, income, and profit are shared 50:50 between the two parties, Pietrolunga takes responsibility for forestry management and felling, while the US party then stores, dries, prepares, and manages the sale and distribution of the wood. Due to different climatic conditions, the trees grown in the US are not the same as those in Italy, although maturity cycles are similar. The resulting tonewood is, however, very well suited to the US guitar market.

Analysis of the accounts of Pietrolunga for the last two years reveals the key statistics as shown in chart on page 23.

All revenue from trade sales and transactions within mainland Europe are priced in euros, but sales to all other geographic areas are priced in local currencies. Contract prices are fixed on felling the selected trees an average of 24 months before delivery. It is common practice for luthiers to use their own experts to select trees while still growing, as the sound of the tree when knocked with a mallet indicates the quality of the core wood.

Using just the limited information given above, it is possible to draft a basic profile of Pietrolunga’s exposure to financial risk, which can then be used as the basis for developing risk management policies:

- The company is very heavily dependent upon sales to one single customer and this dependence is growing, albeit slowly. Under normal circumstances, this risk would need to be managed downwards, but the thirty-year contract term reduces this risk. A critical question for a risk manager is how many years are remaining on the current contract.
- 70% of sales in 2006 and 63% of sales in 2007 were denominated in foreign currencies, therefore exposing the business to a risk of exchange rate movements.
- The bad debts to sales ratio are high at 6% in 2006, and rose even further in 2007. Credit risk is clearly a problem.
- Although the total level of debt is not particularly high relative to the market capitalization of the company, close to one-third of the debt is short term in nature and also at variable rates. This poses both a liquidity and an interest rate risk to Pietrolunga.
- At the 2007 level for short-term debt, even just a one per cent increase in the interest rate would reduce net profits by 2%. In a business where margins are already being squeezed, this poses a high risk.
### Analysis of the accounts of Pietrolunga for the last two years

<table>
<thead>
<tr>
<th></th>
<th>2007 Euros (m)</th>
<th>2006 Euros (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total sales revenue</td>
<td>24,243</td>
<td>23,759</td>
</tr>
<tr>
<td>Sales to Japan (1 client)</td>
<td>10,255</td>
<td>9,788</td>
</tr>
<tr>
<td>Mainland Europe sales</td>
<td>6,580</td>
<td>7,150</td>
</tr>
<tr>
<td>UK sales</td>
<td>2,920</td>
<td>2,150</td>
</tr>
<tr>
<td>North America sales</td>
<td>4,488</td>
<td>4,671</td>
</tr>
<tr>
<td>Market Capitalization</td>
<td>27,153</td>
<td>33,264</td>
</tr>
<tr>
<td>Long-term fixed rate debt</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td>Short-term variable rate debt (Average cost Euro Libor + 2.5% )</td>
<td>800</td>
<td>750</td>
</tr>
<tr>
<td>Net profit from continuing operations</td>
<td>3879</td>
<td>4158</td>
</tr>
<tr>
<td>Ratio of bad debts/sales</td>
<td>8:100</td>
<td>6:100</td>
</tr>
<tr>
<td>Debtor days</td>
<td>95</td>
<td>82</td>
</tr>
<tr>
<td>Working capital per Euro of sales</td>
<td>16 cents</td>
<td>16 cents</td>
</tr>
<tr>
<td>Credit rating</td>
<td>65/100</td>
<td>65/100</td>
</tr>
</tbody>
</table>

- The profit margin has declined from 17.5% in 2006 to 16% in 2007. This suggests a risk of further falls, and the causes of the drop need to be identified. Is it due to pricing pressures in response to foreign competition, or is it a result of increases in production costs, and could any of these risks be hedged?
- The joint venture in the USA commenced in 2006, but it is unclear how long it will be before it generates any profits, and how significant these will be relative to profits elsewhere within the business.
- The company is investing in long-term assets to serve a market that is relatively static in global terms, and also subject to increasing competition from China. There is a huge risk that the stock of trees currently maturing and being newly planted today will not be required in the same marketplace in 50 years time. Some form of contingency planning is therefore needed.
- Future sales and profits depend on physical assets that have long maturity cycles, and are potentially vulnerable to natural damage from disease, storms, fires, etc.

This list is purely indicative of the types of risks that may be faced by a company such as Pietrolunga, but can be used to draft a table of risk exposures and possible tools for their control, as shown below. This table can then be used to rank risks using the likelihood of consequences matrix explained earlier in the Guideline. In this way, efforts can be concentrated on those risks that are the greatest threat to the business, both short- and long-term.

This simple case study shows the scope for identifying risk from even the most basic of information. Managers who understand their business well will be extremely adept at such an exercise, but they still need a risk management framework to guide their thinking and help them use their knowledge to protect the business. This is especially important for a company such as Pietrolunga, which faces serious long-term risks which the management must take account of.
<table>
<thead>
<tr>
<th>Nature of Risk</th>
<th>Potential Impact on Financial Statements</th>
<th>Tools for Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependence upon single customer</td>
<td>Massive drop in revenues if contract lost&lt;br&gt;Potentially crippling debt if payment problems emerge</td>
<td>1) Diversification of customer base, or renegotiation of contract terms to guarantee annual extension subject to preset mutually agreed criteria.&lt;br&gt;2) Regular updating of credit checks&lt;br&gt;3) Credit insurance</td>
</tr>
<tr>
<td>Significant proportion of sales denominated in foreign currencies</td>
<td>Foreign exchange transaction losses/gains</td>
<td>1) Natural hedging via diversification of currencies receivable (already being done) or invoicing in euros rather than the customer’s currency&lt;br&gt;2) Purchase of forward or option contracts. Futures are not applicable here because of relatively small contract sizes.</td>
</tr>
<tr>
<td>Contract prices agreed 2 years before delivery date</td>
<td>Foreign exchange losses/gains</td>
<td>1) Use of staged payment clauses in contracts to reduce the period of exposure to basis risk e.g., 10% on felling; additional 20% after 12 months, and balance upon delivery.&lt;br&gt;2) Insertion of price adjustment clauses to revise prices according to the movement in a defined price index over the period between felling and delivery.</td>
</tr>
<tr>
<td>US-based joint venture</td>
<td>Foreign exchange losses/gains</td>
<td>Currently, the venture may require net investment until the first trees reach maturity. The purchase of dollar-denominated assets could be funded through reinvestment of existing dollar revenues, or via a dollar-denominated loan that can be repaid with future proceeds from the venture.</td>
</tr>
<tr>
<td>Interest rate risk</td>
<td>Earnings volatility</td>
<td>1) Renegotiation of the loan to include a cap/collar, or both.&lt;br&gt;2) Conversion to fixed rate medium-term debt.&lt;br&gt;3) Negotiation of an interest rate swap.</td>
</tr>
<tr>
<td>High level of bad debts</td>
<td>Reduction in current assets&lt;br&gt;Cash flow problems&lt;br&gt;Reduced profits</td>
<td>1) Customer profiling, based upon data analysis of the characteristics of bad debtors in terms of geographic location, size of business, length of trading period, etc. This could be done in-house via the purchase of basic profiling software, or could be outsourced to a credit agency.&lt;br&gt;2) Credit insurance&lt;br&gt;3) Introduction of a credit scoring system for new customers&lt;br&gt;4) Deposit requirements for orders from specified customers or below a certain size.</td>
</tr>
<tr>
<td>Falling profit margin</td>
<td>Reduced profit&lt;br&gt;Lower EPS and dividends per share&lt;br&gt;Reduced potential to continue trading if this persists over the long term</td>
<td>1) Clarification of pricing strategies and benchmarking of prices and costs relative to key competitors.&lt;br&gt;2) Negotiation of open-book arrangements with the Japanese customer, to ensure consistency of margins on the main contract&lt;br&gt;3) Sales and leaseback of forestry to release cash and reduce capital requirements.</td>
</tr>
<tr>
<td>Vulnerability to a long-term declining market</td>
<td>Falling profits, erosion of reserves and the ultimate demise of the business</td>
<td>1) Market diversification reputation is for high-quality wood, but is there scope for lower quality faster turnaround production?&lt;br&gt;2) Joint venture with a Chinese company to supply lower grade markets but at high volumes.&lt;br&gt;3) Review of the potential non-musical instrument markets e.g., bespoke furniture</td>
</tr>
<tr>
<td>Vulnerable physical assets</td>
<td></td>
<td>1) Insurance&lt;br&gt;2) Securitization&lt;br&gt;3) Dispersal of forest assets across different regions of the world</td>
</tr>
</tbody>
</table>
**Glossary**

**Basis point (bp):** one hundredth of one percentage point. Often used to quote changes or spreads in interest rates.

**Basis risk:** the risk of loss associated with an imperfectly hedged position. Basis risk arises when a hedge and the position being hedged are imperfectly matched.

**Bid-ask spread:** difference between the buying and selling prices of a traded commodity or financial instrument. Also known as the bid-offer spread.

**Call option:** option to buy a specified underlying asset at a specified exercise price on, or before, a specified exercise date. See also Put option and Option.

**Cashflow-at-Risk (CFaR):** the lowest or most negative likely cash flow over some holding period at a given level of confidence.

**Catastrophe ('cat') derivative:** a financial derivative whose payoff is contingent on the occurrence of a specified catastrophe event.

**Collar:** a position created by buying a call (put) and selling a put (call) option, or a cap and a floor if applied to interest rate options. The premium earned from selling one option helps to reduce (or even eliminate) the cost of the position.

**Correlation:** a measure of the extent to which movements in two variables are related.

**Credit derivatives:** derivatives contracts with payoffs contingent on credit events.

**Credit exposure:** the total amount of credit granted to a counterparty.

**Credit risk:** the risk of loss arising from the failure of a counterparty to make a contractual payment.

**Credit scoring:** assessment of the creditworthiness of an individual or company by rating numerically a number of both financial and non-financial aspects of the target’s present position and previous performance.

**Default risk:** See Credit risk.

**Default-value-at-risk (Default-VaR):** the largest likely loss from counterparty default over some period and at a particular level of confidence.

**Delta:** the change in the value of a derivatives contract associated with a small change in the price of the underlying.

**Derivatives:** contracts whose values depend on the prices of one or more other variables, known as underlying variables.

**Enterprise-wide risk management (ERM):** the management of overall institutional risk across all risk categories and business units.

**Floating rate financial assets and financial liabilities:** financial assets and liabilities that attract an interest charge and have their interest rate reset at least once a year. For the purpose of financial reporting, financial assets and liabilities that have their interest rate reset less frequently than once a year are to be treated as fixed rate.

**Forward contract:** an agreement to buy or sell a particular commodity or asset at a particular future time for a price agreed now, but paid on the arranged future date.

**Futures contract:** a standardized, exchange-traded forward contract. Futures contracts are also subject to margin requirements and marked to market daily.

**Hedge:** a position designed to reduce or eliminate a particular risk exposure.

**Hedge effectiveness:** the degree to which changes in the fair value or cash flows of the hedged item that are attributable to a hedged risk are offset by changes in the fair value or cash flows of a designated hedged item (IAS 39).

**Hedging:** a transaction to reduce or eliminate and exposure to risk.

**Historical simulation approach to VaR:** an approach that estimates VaR from a profit and loss distribution that is simulated using historical returns data.

**Leverage:** the gain or loss on a position relative to the gain or loss on the underlying risk factor.

**Liquidity:** the ability to unwind a position at little or no cost. The availability of sufficient funds to meet financial commitments when they fall due.

**Liquidity risk:** the risks arising from the potential cost or inconvenience of unwinding a position. Liquidity risk can apply to market liquidity (the risk that a market may become less liquid) and funding risk (which is the risk that an individual firm will not be able to meet an obligation when it comes due).

**Margin requirements:** deposits required against the taking of risky positions.

**Market (price) risks:** the risks of loss arising from adverse movements in market prices.

**Marking to market:** the process of valuing and periodically revaluing positions in marketable securities to reflect their current market prices.

**Maximum loss optimization:** a form of stress testing in which risk factors are pushed in the most disadvantageous directions, and then the combined effect of all such changes on the portfolio are assessed.

**Monte Carlo simulation approaches to VaR:** approaches that estimate VaR from a distribution of future portfolio values that is simulated using ‘random number’ techniques.
Netting arrangements: arrangements by which the parties in multiple bilateral contracts agree to owe each other the net rather than gross amounts involved.

Normal approach to VaR: approaches that estimate VaR on the assumption that the portfolio is a linear function of normally distributed risk variables.

Normal distribution: the Gaussian or bell-curve probability distribution.

Operational risks: risks arising from the failure of internal systems or the people who operate in them.

Option: a contract that gives the holder the right but not the obligation, depending on the type of option, to buy or sell a particular commodity or asset on pre-agreed terms. European options give the holder the right to exercise the option at a particular future date, while American options give the holder the right to exercise at any time over a particular period. Options can be traded on organized exchanges (exchange-traded) or traded over-the-counter (OTC).

Performance evaluation: ex post risk adjustment (i.e., risk adjustment after the risks have been taken).

Position limits: management-imposed limits on the sizes of the positions that traders or asset managers are allowed to take.

Put option: option to sell a specified underlying asset at a specified exercise price on or before a specified exercise date. See also Call option and Option.

Recovery rate: the proportion of money owing recovered from a debtor in the event of bankruptcy.

Regression analysis: a statistical procedure that seeks to estimate a relationship between one variable and one or more others.

Risk: the prospect of gain or loss. Risk is usually regarded as quantifiable, and is often compared against uncertainty, which is not quantifiable.

Risk-adjusted return on capital (RAROC): the ratio of return to VaR.

Risk adjustment: in general, the process of adjusting returns for the risks involved. However, the term is usually used to refer more specifically to ex ante risk adjustment (i.e., to adjustments before the risks are actually taken).

Risk appetite: the amount of risk an organization is willing to accept in pursuit of its objectives.

RiskMetrics: the analytical framework developed by JP Morgan to estimate VaR.

Scenario analysis: a form of stress testing that focuses on the impact of one or more specified scenarios or particular states of the world.

Scenario simulation: a procedure that uses the distribution of principal factors to simulate the distribution of the future portfolio value.

Speculation: the process of increasing risks.

Speculative position: a position that increases risks.

Stress testing: the process of assessing the vulnerability of a position or portfolio against hypothetical events.

Swaps: agreements to swap future cash flows.

Underlying: the variable on which the payoff to a derivatives contract depends.

Value-at-Risk (VaR): the maximum likely loss over some particular holding period at a particular level of confidence.

Variance-co-variance approaches to VaR: approaches to estimating VaR that make use of the variance-co-variance matrix of the asset returns. These are a form of parametric VaR method that takes account of the returns to the individual asset that make up a portfolio.

Volatility: the variability of a price, usually interpreted as its standard deviation.

Worst-case scenario analysis: a form of stress testing that estimates the worst of a number of events expected to occur over some particular period.

Endnotes

1 Detailed discussion of such a framework lies outside the scope of this MAG, but general guidance on how to establish a risk management system is contained in Risk Management: A Guide to Good Practice (CIMA, 2002).

2 We also gloss over the issue of how to determine the size of the hedge position, but this is covered in all standard textbooks on the subject.
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