

# Chapter 11

# Banking risks management



**Learning objectives**

- To define risk measurement and risk management
- To understand the importance of risk management
- To identify the main risk management techniques

## 11.1 Introduction

This chapter focuses on risk management as a central management tool to ensure banks' soundness and profitability. Risk management is a complex and comprehensive process, which includes creating an appropriate environment, maintaining an efficient **risk measurement** structure, monitoring and mitigating risk-taking activities and establishing an adequate framework of internal controls. As we have noted in previous chapters, the management of banking risks is becoming increasingly important in the light of the new Basle Accord (Basle II), that introduced a link between minimum regulatory capital and risk. In particular, banks will be required to adopt more formal and quantitative risk measurement and risk management procedures and processes. It is not only regulators that have placed an increased emphasis on **risk management** in an attempt to foster financial stability and economic development; it is also all the more important for bankers to manage their capital more efficiently in order to maximise risk-adjusted returns from their business activities.

There are several aspects of risk management in banking and this chapter does not aim to explore them all in detail, but rather to highlight the main issues. While Section 11.2 introduces the general issues of risk management; Sections 11.3, 11.4 and 11.5 outline the main techniques used by banks to manage risks including: credit risk, interest rate risk and liquidity risk. Sections 11.6 and 11.7 illustrate the techniques that are used to manage market and operational risk, following the new Basle Accord. Finally, the management of country risk is discussed in Section 11.8.

## 11.2 General risk management

This section focuses on how the risk management function is handled within the banking organisation and highlights the importance given to this function by managers and the institutional environment influencing its effectiveness and efficiency. Here we aim to provide an overview of systems and practices that cut across the major types of risks faced by banks. These systems and processes include such items as the allocation of resources to risk management activities, governance issues, record-keeping, communications within the organisation and internal audit. As pointed out by Cumming and Hirtle (2001) the difference between risk measurement and risk management is that while risk measurement deals with the quantification of risk exposures, risk management deals with the overall process that a financial institution follows to define a business strategy, to identify the risks to which it is exposed, to quantify those risks and to understand and control the nature of risks. In Chapter 10 we reviewed the main risks faced by financial institutions; for each class of risk banks need to estimate the expected losses and the probability of unexpected losses, so that an appropriate amount of capital may be held.

It is important to recall that the main objective of bank risk managers is that of shareholders' wealth maximisation and in pursuit of such an objective they have to manage carefully the trade-off between risk and returns. In order to increase shareholder wealth a company has to generate returns greater than its opportunity

cost of capital. The opportunity cost of capital is the perceived cost to the bank of raising equity and keeping shareholders happy (see also Section 8.4.3). For example, if a bank makes an acquisition that generates a return-on-equity of 8 per cent, but the cost of obtaining the capital funds needed to undertake the acquisition is 10 per cent then this destroys shareholder wealth. Alternatively if returns exceed 8 per cent then the acquisition creates value for shareholders. Typically, higher returns (ROE) are reflected in higher market valuations of a company's shares – or to put it another way – investors rank profitable firms more highly and this is reflected in greater equity prices. The aim of bank managers therefore is to maximise ROE relative to its cost of capital and this will maximise shareholder wealth. Note that banks can do these sorts of calculations for all parts of their business in order to identify how capital is being used within the bank and what parts are generating the best or worst returns.

Investors, on the other hand, can expect a higher rate of return only by increasing the risk they are prepared to bear. Risk measures are therefore related to profitability measures, as banks must take risks to earn adequate returns. As Sinkey (1998) points out that 'the essence of modern banking is the measuring, managing, and accepting of risk and the heart of bank financial management is risk management. The task then becomes: how to set appropriate targets for a bank's returns and the corresponding risks undertaken? Hempel and Simonson (1999), while cautioning that there is no exact answer, suggest three steps:

- assess how other similar individual banks and groups of banks have made their risk/return decisions;
- compare the bank's performance measure to those of similar banks;
- set reasonable objectives against the backdrop of a bank's historic performance, the performance of its peers and its external environment.

These steps, in turn, are essentially based on the following analysis:

- stock market expectations (if the bank is quoted);
- trend analysis of past performance;
- trend and comparative analysis of peers' performance allowing for factors such as business mix, available production technology and external environment (macroeconomic and regulatory).

One of the underlying issues in most banking systems is the fact that deregulation, globalisation and internationalisation have increased the (real or perceived) degree of competition in banking markets, requiring banks to take on more risk to achieve satisfactory returns.

Given their special role in any economy, banks should be run in a safe and sound manner. In particular, as we saw above, they should manage risks in a context of trade-off between profitability and liquidity. Regulatory authorities monitor banks' behaviour and try to ensure that they achieve a good **CAMELS** rating. Banks are rated 1 (essentially sound) to 5 (basically insolvent). Banks with ratings of 1 or 2 are considered to present few, if any, supervisory concerns, while banks with ratings of 3, 4, or 5 present moderate to extreme degrees of supervisory concern.

CAMELS summarises the following elements:

- adequate capital (C);
- good asset quality (A);
- competent management (M);
- good earnings (E);

- sufficient liquidity (L); and
- sensitivity to market risk (S)

A bank's CAMELS rating is highly confidential; it is evaluated by the bank's senior management and disclosed only to the appropriate supervisory staff. However, the public may infer such information based on subsequent bank actions or specific disclosures.

The main elements of modern risk management processes and strategies include identifying, measuring and monitoring risk exposures. The overall risk management process should be a comprehensive one, which creates risk management cultures in all departments of the financial institution. The specific Asset–Liability Management (ALM) function (its coverage and functions) varies from bank to bank. However, as detailed in Chapter 9, the ALM function takes an overall risk management view of the bank. Specifically, ALM is concerned with explicit managerial and risk functions such as: liquidity, capital management, funding and cost of funds, and managing the bank's security portfolio.

Interest rate risk management and lending and credit risk management, are key components of a bank's overall risk management function, and are also part of the ALM function, but they are usually managed specifically by separate units or divisions within a bank. For this reason, and because of the relative importance of such risks for financial institutions, we will analyse in detail their management processes. Before we move on to specific risk management techniques, let us outline the basic concepts of the risk management process.

Following the publication of the comprehensive set of *'Core Principles'* for effective banking supervision in 1997 (see BCBS, 1997a), and as part of an on-going effort to enhance sound practices in banking organisations, the Basle Committee on Banking Supervision (BCBS) has issued a number of papers to highlight the principles that should underpin the risk management process:

- 'Framework for Internal Control Systems in Banking Organisations' (September, 1998);
- 'Enhancing Corporate Governance for Banking Organisations' (September, 1999);
- 'Customer Due Diligence for Banks' (October, 2001c);
- 'Internal Audit in Banks and the Supervisor's Relationship with Auditors: A Survey' (August, 2002);
- 'Sound Practices for the Management and Supervision of Operational Risk' (February, 2003a);
- 'Risk Management Principles for Electronic Banking' (July, 2003b)
- 'International Convergence of Capital Measurement and Capital Standards – A Revised Framework' (June, 2004a);
- 'Principles for the Management and Supervision of Interest Rate Risk' (July, 2004b)
- 'Consolidated KYC (know-your-customer) Risk Management' (October, 2004c).
- 'Compliance and the Compliance Function of Banks' (April, 2005)

Basle Committee publications relating to credit risk and operational risk are also very numerous and now form part of the wider Basle II framework. The most recent publications include recommendations on:

- 'Principles for the Management of Credit Risk' (September, 2000)
- 'Sound Practices for the Management and Supervision of Operational Risk' (February, 2003a)

All of the above reports can be found at the Bank for International Settlements website at http://www.bis.org.

As mentioned in Chapter 10, the total risk a financial institution faces can be assigned to different sources. Given the general guidelines of risk management discussed above, in the next sections we detail the management process of specific risks.

## 11.3 Credit risk management

Credit risk, defined as the potential that a bank borrower or counterparty will fail to meet its obligations in accordance with agreed terms, is the most familiar of banking risks (and it still remains the most difficult to quantify).

According to the BCBS, the goal of credit risk management is 'to maximise a bank's risk-adjusted rate of return by maintaining credit risk exposure within acceptable parameters'. Banks need to manage the credit risk arising both from individual creditors and individual transactions and the risk inherent in their entire portfolio. Furthermore, banks need to consider the relationships between credit risk and other risks. The effective management of credit risk is a critical component of a comprehensive approach to risk management and essential to the long-term success of any banking organisation.

While financial institutions can face difficulties for a number of reasons, loans that are not repaid (referred to as non-performing loans, or bad debts, or loan-losses) are the most frequent cause of bank losses.

For most banks, loans are the largest and most obvious source of credit risk; however, other sources of credit risk exist throughout the activities of a bank, both on and off the balance sheet. Traditionally, banks have monitored credit risk through a number of standard procedures, such as ceilings placed on the amount lent to any one customer and/or customers within a single industry and/or customers in a given country. While such procedures have long been a central feature of bank lending, credit risk measurement does raise several important issues:

- The size of the loan is not sufficient to measure the risk because risk has two dimensions – the quantity of risk, or the amount that can be lost, plus the quality of the risk, which is the likelihood of default. The quality of risk is often appraised through some form of credit ratings. These ratings may be internal to a bank or external when they come from a credit rating agency. Measuring the quality of risk ultimately leads to quantifying the default probability of customers, plus the likelihood of any recovery (how much of the loan or other debt can be recovered) in the event of default. The probability of default is obviously not easy to quantify. Historical data on defaults by credit rating class or/and by industry are available, but often they cannot be easily assigned to individual customers. The extent of recoveries is also unknown. Losses may depend upon guarantees, either from third parties or from any posted **collateral**, of recovery after bankruptcy and the liquidation of assets.
- The cumulated credit risk over a portfolio of transactions, either loans or market instruments, is difficult to quantify because of diversification effects. If the defaults of all customers tend to occur at the same time, the risk is much more important than if those default events are not related (or independent). All banks, of course, protect themselves against risk through diversification, which

makes simultaneous default very unlikely. However, the quantitative measurement of the impact of diversification still remains a modelling challenge.

Banks are increasingly facing credit risk (or counterparty risk) in various financial instruments other than loans, including acceptances, interbank transactions, trade financing, foreign exchange transactions, financial futures, swaps, bonds, equities, options, in the extension of commitments and guarantees, and the settlement of transactions.

Market transactions also generate credit risk. For instance, the inability of a company to service a swap, futures or options agreement, or make dividend repayments on bonds is also regarded as a credit risk. The loss in the event of default depends on the value of these instruments and their liquidity. If the default is totally unexpected, the loss is the market value of the instruments at the time of default. If the credit standing of the counterparty falls, e.g., Standard and Poor's reduce the credit rating of a counterparty from AAA to AA, it will still be possible to sell their instruments in the market at a discount. For financial instruments with more limited marketability such as over-the-counter (OTC) transactions, for example, as swaps and options, sale is not usually feasible. The credit risk of these types of instruments changes constantly with market movements during their lifespan. Therefore, the potential values of the transactions during the period of the contracts are at risk. Clearly, there is a relationship between credit risk and market risk during this period because values depend on market movements.

Banks are seeking ways to measure credit risk more accurately, a need which has recently been strongly driven by a variety of factors:

- the growth of the securitised loan and secondary loan trading market (see Section 9.6 and also 4.6.2);
- recent evolution of credit derivatives business;
- increased emphasis on risk-adjusted performance measurement systems (where performance for different parts of the firm/bank are assessed relative to the risk taken and capital backing) and the desire to trade credit risk;
- the desire of companies to manage the risk/return characteristics of their debt funding more effectively.

These factors have all contributed to the development of an increasingly more liquid and transparent market in tradable bank loans and other credit instruments. Such a market enables banks and large firms to trade their credit risks more effectively and therefore improve returns. It also provides banks with greater flexibility in meeting client needs as loan portfolios can be restructured in a more efficient manner, thereby releasing resources to be directed to higher-demand (and more profitable) areas. The growth in credit market instruments and the demand from banks to better assess the risks associated with their credit business has led to the development of various modelling techniques, similar in many respects to those that have previously been developed to calculate market risk[1] (such as JP Morgan's CreditMetrics™ or Credit Suisse First Boston CreditRisk+™).

The BCBS (2000) document identifies sound practices in the management of credit risk and specifically addresses the following areas:

1) establishing an appropriate credit risk environment;
2) operating under a sound credit-granting process;

[1] See Bessis (2002), ch. 33 for an overview of the main features of credit risk models.

3) maintaining an appropriate credit administration, measurement and monitoring process; and
4) ensuring adequate controls over credit risk.

Although specific credit risk management practices may differ among banks depending upon the nature and complexity of their credit activities, a comprehensive credit risk management programme will address these four areas. These practices should also be applied in conjunction with sound practices related to the assessment of asset quality, the adequacy of provisions and reserves, and the disclosure of credit risk.

## 11.4 Managing the lending function

Managing credit risk in retail banking, although based on the same broad principles, differs from wholesale banking in several ways. One first, obvious difference concerns the size of the loan commitments. Bad corporate loans can be very serious for banks because of the vast sums of money involved. Recent big corporate failures have caused more than a serious headache to banks. High-profile failures such as Enron, WorldCom and a group of other big, mainly US telecoms and energy companies have left the banks with a large amount of bad loans. The recent Argentinian financial crisis has also led to substantial write-offs. Retail lending, on the other hand, while unlikely to create serious consequences for a bank in case of individual loan defaults (although it can still create problems if a large number of retail loans default, say, as a result of a bank being overexposed to a particular sector of the economy, particularly real estate) is more difficult to assess because of the lack of information on the creditworthiness of potential borrowers.

### 11.4.1 Retail lending

An accurate credit decision, given a bank's credit standards, is the one that maximises the value of the loan for the bank and minimises the risk of default. Consequently, gathering, processing and analysing information on potential borrowers are key steps in credit risk management.

Prior to making a lending decision, banks need to assess the risk–return trade-off of a loan; this process involves both an assessment of the risk of the applicant and the applicant's business; an analysis of the external environment; the purpose of the loan and the particular loan structure requested by the applicant. One key step in this process is pricing the loan, where the 'price' (**loan rate**) should be:

$$R^L = \frac{1+r}{1-d} - 1 \tag{11.1}$$

where:
$R^L$ = profitable loan rate
$r$ = risk-free interest rate (i.e., the rate of return on a 'risk free' investment, such as government bonds)
$d$ = expected probability of default

There are some key factors that affect a loan's expected return:

1) interest rate on the loan;
2) fees relating to the loan;
3) credit risk premium on the loan;
4) collateral backing of the loan; and
5) other non-price terms (e.g., clauses and conditions on the use of the loan).

Following a general model along the lines developed by Saunders (2000), the interest rate charged on a loan is:

$$1 + k = 1 + \frac{f + (L + M)}{1 - [b(1 - R)]} \tag{11.2}$$

where:
$k$ = contractually promised gross return on the loan per £ lent
$f$ = administration fee
L = base lending rate
$M$ = market premium
$b$ = compensating balance requirement
$R$ = reserve requirement

$L$ in formula (11.2) reflects the bank's marginal cost of funds (or the so-called prime lending rate in the United States – the interest rate a bank charges its best or 'prime' customers). Compensating balances ($b$) is the portion of a loan that a borrower may be required to hold as deposit at the bank. They are commonly used in corporate lending business. Reserve ratios ($R$), are effectively a tax on deposits, and can cause the loan price to rise, as banks are not earning income for every £ of reserves. Finally, the loan price should include a market premium ($M$) and an administration fee ($f$). The administration fee should cover all the costs incurred in the origination and administration of the loan. The market premium should reflect the risk profile of the borrower: the riskier the borrower, the higher the premium.

Another factor that influences the price of the loan is the presence of any collateral (assets backing the loan that can include such things as residential property, other real estate, securities, etc.): the rate charged should be lower than in the case of no collateral. However, in times of economic trouble the price of collateral can become very volatile and banks may to have to raise either the loan price or the amount of collateral required. If collateral values fall dramatically there can be a banking sector collapse – as was the case in the Japanese banking system crises that occurred in 1997–1998 (discussed in Chapter 16). Obviously, if the value of the collateral is linked to the ability of the borrower to repay; a decrease in the value of the collateral will increase the probability of default. Box 11.1 illustrates how the fall in UK property prices in the early 1990s resulted in loan losses and negative equity.

Loans availability in retail markets may not be linked simply to the loan price, but restricted to a selected category of borrowers. This is a method for managing credit risk (**credit rationing**) that attempts to minimise the problem of adverse selection in loan markets. To reduce risk exposure, banks can limit the amount of credit available to a certain class of borrowers; for example, think of the credit limit on your credit card! Although it is illegal to discriminate against borrowers for reasons such as race, gender, religion, sexual orientation and address, there is no automatic 'right' to credit and people can be refused credit for a number of different reasons.

## Box 11.1 Mortgage market, equity withdrawal and negative equity

During the late 1980s, UK house prices soared, boosting people's confidence in the housing market and prompting them to borrow against the value of their homes. Between 1980 and 1990 average mortgage debt in the UK more than doubled relative to income. A mortgage equity withdrawal relates to home owners borrowing against the increased value of their property (capital gains), by taking out additional housing equity loans. The Bank of England's estimate of mortgage equity withdrawal (MEW) measures the part of consumer borrowing from mortgage lenders that is not invested in the housing market. Levels of mortgage equity withdrawal reached very high levels in the late 1980s; mortgage equity loans were a major factor behind the consumer boom of 1987–88. However, the collapse in the housing market in the early 1990s led to over 1.5 million homeowners being in negative equity – a situation where the market value of their property was less than the outstanding mortgage loan. The slump in the UK housing market coincided with record increases in mortgage arrears and repossessions. Between 1989 and 1993, as both interest rates and unemployment rose, the number of households in mortgage arrears increased. Arrears peaked in 1993 when more than 600,000 households owed three or more months' payments. Repossessions were highest in 1991 at 75,450, falling to 58,540 by 1993.

Falling nominal house prices reduced the amount of equity in housing and, possibly, provided incentives for borrowers to accumulate arrears and for lenders to repossess property that had been used to secure loans. However, too high a level of repossession and resale was counterproductive in an already depressed market. The housing problems of the early 1990s resulted in costly losses to banks and building societies. More than ten years later, and following a period of sharp increases in housing prices, the Council of Mortgage Lenders (CML) announced that in 2005 the number of homes being repossessed had increased for the first time in seven years. However, the CML also pointed out that repossessions were 'extremely low' by historical standards, and that the UK housing market was a long way from the early 1990s experiences, as illustrated in Table 11.1 below.

Table 11.1 **Mortgages outstanding**

| | *Mortgages outstanding* | *Mortgages 3–6 months in arrears* | | *Mortgages 6–12 month in arrears* | | *Mortgages > 12 months in arrears* | |
|---|---|---|---|---|---|---|---|
| | *Number* | *Number* | *%* | *Number* | *%* | *Number* | *%* |
| 1994 | 10,410,000 | 169,080 | 1.62 | 133,700 | 1.28 | 117,110 | 1.12 |
| 1995 | 10,521,000 | 177,910 | 1.69 | 126,670 | 1.20 | 85,200 | 0.81 |
| 1996 | 10,637,000 | 139,250 | 1.31 | 100,960 | 0.95 | 67,020 | 0.63 |
| 1997 | 10,738,000 | 117,840 | 1.10 | 73,830 | 0.69 | 45,200 | 0.42 |
| 1998 | 10,821,000 | 129,090 | 1.19 | 74,040 | 0.68 | 34,880 | 0.32 |
| 1999 | 10,932,000 | 96,690 | 0.88 | 57,120 | 0.52 | 29,520 | 0.27 |
| 2000 | 11,173,000 | 95,300 | 0.85 | 47,830 | 0.43 | 20,820 | 0.19 |
| 2001 | 11,247,000 | 81,370 | 0.72 | 43,140 | 0.38 | 19,720 | 0.18 |
| 2002 | 11,364,000 | 66,580 | 0.59 | 34,040 | 0.30 | 16,490 | 0.15 |
| 2003 | 11,452,000 | 51,910 | 0.45 | 29.200 | 0.25 | 12,680 | 0.11 |
| 2004 | 11,512,000 | 53,960 | 0.47 | 26,920 | 0.23 | 11,210 | 0.10 |

*Source*: Council of Mortgage Lenders Research (http://www.cml.org.uk/cml/statistics).

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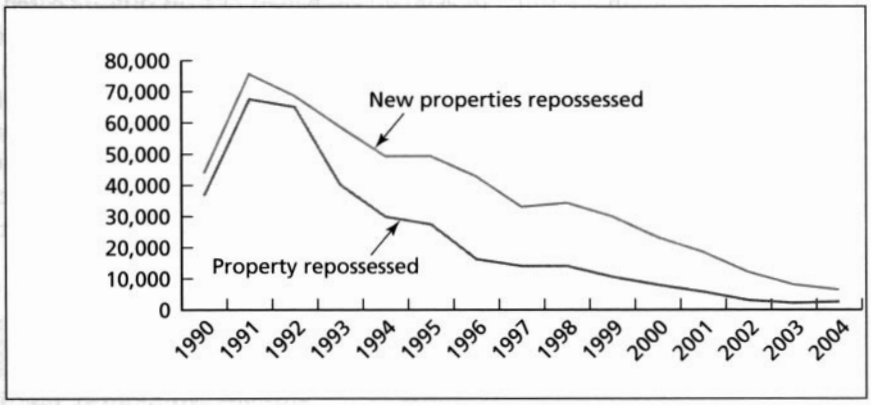
**Figure 11.1 Home repossession in the UK**




*Source*: Council of Mortgage Lenders Research.

As we have seen, a loan evaluation process focuses on evaluating the prospective risk and return on a loan. There are several techniques or models for assessing credit risk, but they can be broadly divided in qualitative models and quantitative models.

Qualitative models are normally used when there is limited available information on a borrower. Bank managers have to gather information from private sources and the amount of information needed will be proportional to the size of the loan. Quantitative models are to assess borrowers' creditworthiness based on the estimated probability of default.

## 11.4.2 Credit checking and credit scoring

Lenders want to minimise the information asymmetry problems in the retail loan market and therefore aim to ensure that potential borrowers are a good risk and do not have a history of bad debts and unpaid loans. To do this they will do two things: **Credit checking** and **Credit scoring**.

### 11.4.2.1 Credit checking

Lenders will check the applicant's entry on credit registers. **Credit reference agencies** in the United Kingdom such as Experian, Equifax and CallCredit PLC hold factual information on retail customers and this allows a lender to check individuals' names and address and past credit history, including any County Court Judgments or defaults recorded against the individual. This process will provide a person's so-called *credit reference*.

### 11.4.2.2 Credit scoring

To obtain information on a potential borrower, banks will initially adopt a qualitative approach, which involves asking the applicant a number of questions. They will then allocate points (weights) to the answers. Questions may concern the

applicant's employment history, the length of time as a customer of the bank, the number and type of accounts held, the length of time at their present address and so on. Personal judgement on behalf of loan officers based on the 'five Cs' (character, cash flow, capital, collateral and conditions)[2] is now commonly replaced by a quantitative approach based on the use of the information provided by the applicant to calculate the probability of default. Using a statistical program, creditors compare this information to the credit performance of consumers with similar profiles. A credit scoring system awards points for each factor that helps predict who is most likely to repay a debt. A total number of points – a credit score – helps predict how creditworthy the applicant is, that is, how likely it is that they will repay

## Box 11.2 Credit scoring: how to score high

- *Have you paid your bills on time?*
  Payment history typically is a significant factor. It is likely that your score will be affected negatively if you have paid bills late, had an account referred to collections, or declared bankrupt, if that history is reflected on your credit report.
- *What is your outstanding debt?*
  Many scoring models evaluate the amount of debt you have compared to your credit limit. If the amount you owe is close to your credit limit, it is likely that it will have a negative effect on your score.
- *How long is your credit history?*
  Generally, models consider the length of your credit track record. An insufficient credit history may have an effect on your score, but that can be offset by other factors, such as timely payments and low balances.
- *Have you applied for new credit recently?*
  Many scoring models consider whether you have applied for credit recently by looking at 'inquiries' on your credit report when you apply for credit. If you have applied for too many new accounts recently, it is likely that it may negatively affect your score. However, not all inquiries are counted. Inquiries by creditors who are monitoring your account or looking at credit reports to make 'pre-screened' credit offers are not counted.
- *How many and what types of credit accounts do you have?*
  Although it is generally good to have established credit accounts, too many credit card accounts may have a negative effect on your score. In addition, many models consider the type of credit accounts you have. For example, under some scoring models, loans from finance companies may negatively affect your credit score.

*Source*: Adapted from the Federal Trade Commission (www.ftc.gov).

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[2] The so-called five Cs of a credit decision can be described as follows (see for instance Sinkey, 1998): (1) *character* that refers to the willingness of the borrower to repay the loan; (2) *capacity* that refers to the borrower's cash flow and the ability of that cash flow to service the debt; (3) *capital* that refers to the strength of the borrower's balance sheet; (4) *collateral* that refers to the security backing up the loan; and finally, (5) *conditions* that refer to the borrower's sensitivity to external forces such as interest rate and business cycles and competitive pressures.

a loan and make the payments when due. Lenders will never divulge how their credit scoring works for fear of fraud and each lender will have their own system. The fact that you have been turned down by one lender will not necessarily mean that you will be declined by others.

Although such a system may seem arbitrary or impersonal, when it is properly designed it can help make decisions faster, more accurately and more impartially than individuals. In marginal cases, applicants are referred to a credit manager who decides whether the company or lender will extend credit. This may allow for discussion and negotiation between the credit manager and the consumer. Box 11.2 illustrates how a credit scoring system works in practice.

Credit scoring can be applied both to individuals and to corporations; obviously the variables used to define the scoring system will differ. Saunders (2000) and Sinkey (1998) provide detailed overviews of the main credit scoring models.

#### 11.4.2.3 Linear probability models

Loans are divided in two groups, those that defaulted ($Z_i = 1$) and those that did not ($Z_i = 0$). These observations are then regressed on a set of $j$ variables reflecting quantitative information about the $i^{th}$ borrower.

$$Z_i = \sum_{j=1}^{n} \beta_j X_{ij} + \varepsilon \tag{11.3}$$

##### Logit (and Probit) models

These constrain the cumulative probability of default on a loan between zero and one and assume the probability of default to be logistically distributed (or have a normal distribution in the Probit case).

##### Linear discriminant models

These models (which include the Altman Z-score model) divide borrowers according to their derived Z-scores into high or low default risk classes, contingent on their observed characteristics ($X_i$).

$$Z_i = \sum_{i=1}^{n} \alpha_i X_i \tag{11.4}$$

### 11.4.3 Managing the loan portfolio

Moving from individual loans to a bank's loan portfolio, the first step in credit risk management is diversification. The principle behind portfolio diversification is the same as the one behind the old saying 'don't put all your eggs in one basket'. Bank managers should diversify their lending to different sectors of the economy, different geographical locations, different types of industry, different maturities, and so on. By diversifying their loan portfolios, i.e., by owing assets whose returns are not statistically correlated, banks can reduce the impact of any failure by diversifying away the unsystematic risk. A heavy concentration of loans in one sector of the economy can cause serious trouble for banks. For example, in the United Kingdom,

building societies have historically concentrated the majority of their lending to finance residential property purchase and have therefore suffered a high number of non-performing loans when the housing market collapsed (see Box 11.1). If loans are not correlated, banks can expect to increase the expected returns on their loan portfolio by diversifying across asset classes. In other words, it is possible to apply standard portfolio theory to obtain a measure of aggregate credit risk exposure.[3]

When assessing the credit risk of the aggregate loan portfolio, bank managers need to calculate the following:[4]

- the expected loss, for each loan and for the whole portfolio, over a specific time-horizon;
- the unexpected loss for each loan and for the whole portfolio (i.e., the volatility of loss);
- the probability distribution of credit loss for the portfolio and assess the capital requirement, for a given confidence level and time-horizon (see Figure 11.2).

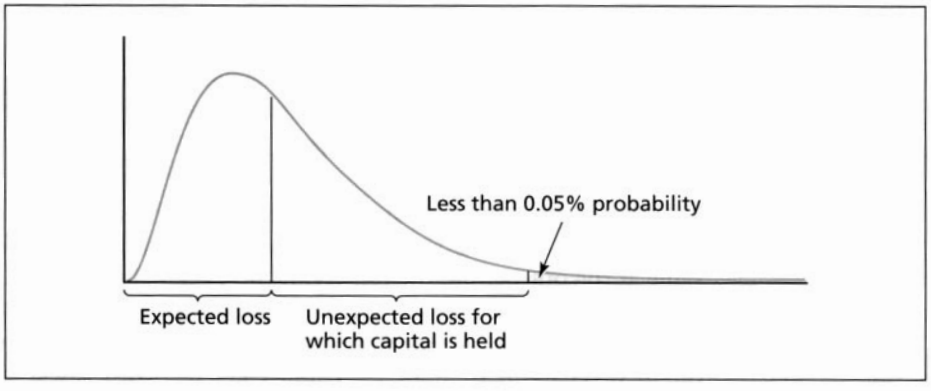
There are three factors that drive expected and unexpected losses on a credit portfolio:

- *customer default risk* – determined by the risk-grade profile of the portfolio;
- *exposure* – the amount that is likely to be outstanding at the time of default;
- *loss given default* – determined by the level of security cover, the effectiveness of the recovery process and the credit cycle.

The calculation of the expected loss is based on the current risk profile of the portfolio, possibly ignoring historical loss rates. Banks that rely on their average loss experience to derive expected loss are assuming that the risk profile, business mix and risk management processes remain constant over time. However, the existing profile might be considerably better than the one that created the losses in the past.

The main problem with applying portfolio theory to banks' loan portfolios is that, in the vast majority of cases, bank loans are non-tradable assets. As we noted earlier, there are several products in the market that attempt to deal with these issues. The best-known are Credit Suisse Financial Product's Credit Risk+™, CreditPortfolioView™ by McKinsey & Company and JP Morgan's CreditMetrics™. In addition, firms such as KMV[5] and KPMG[6] are actively participating in the debate

Figure 11.2 **Probability distribution of portfolio losses**




[3] For an introduction to Portfolio Theory, see Appendix A2.
[4] This discussion is modelled on Heffernan (2005) and Matten (2000).

and are openly sharing many of their analytical engines. KMV has several products on the market, including Credit Monitor™ and Portfolio Manager ™. KPMG's contribution is the Loan Analysis System™.[7]

## 11.5 Managing interest rate risk

Interest rate risk derives from mismatching the maturities of assets and liabilities, as part of a bank asset transformation function. Interest rate risk management is concerned with the management of the interest rate exposure of a bank. Traditionally, it is managed within the ALM function but, given the increased volatility of interest rates, together with the increased interest rate risk arising from off-balance sheet activities, it is now often managed by a dedicated department. As seen in Section 10.3, interest rate risk arises from potential variations in banks' returns that derive from unanticipated changes in interest rates. Changes in interest rates also affect a bank's underlying economic value. The value of a bank's assets, liabilities and off-balance-sheet business is affected by a change in rates because the present value of future cash flows, and in some cases the cash flows themselves, are altered. A bank interest rate risk exposure refers to market value changes in its equity position as a result of unexpected changes in market interest rates. When attempting to measure and manage interest rate risk, it is important to note that the exposure to such risk concerns *future* losses (or gains) and therefore some uncertainty will always be present. Some interest rate management techniques involve a forecast of possible interest rate scenarios and, as in every attempt to forecast the future, there is no such thing as 100 per cent accuracy. In other words, managing interest rate risk is about identifying, measuring and controlling such risk, taking uncertainty into account.

There are two broad management approaches that are used to measure interest rate risk and these are known as 'gap' and 'duration' analysis.

### 11.5.1 Gap analysis

**Gap analysis** is possibly the best-known interest rate risk management technique. The 'gap' refers to the difference between interest rate sensitive assets and interest rate sensitive liabilities over a specific time-horizon. If the interest rate sensitive liabilities are greater than the interest rate sensitive assets, then an increase in interest rates will reduce a bank's profit and vice versa. In the basic gap analysis, the focus is on the maturity of the rate-sensitive assets and liabilities.

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[5] KMV is the acronym for Kealhofer, McQuown and Vasicek, the originators of the KMV methodology. KMV was taken over by Moody's in 2002. Nowadays Moody's KMV is the world's leading provider of quantitative credit analysis tools.

[6] One of the largest professional service firms in the world.

[7] For more information on these products, see Credit Suisse First Boston (1997), Wilson (1997a and 1997b); JP Morgan (1997).

$$GAP = RSA - RSL \tag{11.5}$$

where:
RSA = rate-sensitive assets
RSL = rate-sensitive liabilities.

An asset or a liability is defined as rate sensitive if the cash flow from the asset or liability changes in the same direction as changes in interest rates. The gap ratio in equation (11.5) is also called the *interest-sensitivity ratio*. If this ratio is equal to one, then the rate sensitivity of assets and liabilities are perfectly matched. However, most bank have a positive gap (RSA>RSL) since they borrow short and lend long, and therefore have assets which will mature later than liabilities. The main aim of gap analysis is to evaluate the impact of a change in interest rates on the bank net interest income and net interest margin. Ideally, the gap should be managed in such a way as to expand when interest rates are rising and contract when interest rates are declining. However, it is difficult for bank managers to know what phase of the interest rate cycle they are facing. Furthermore, bank customers may be seeking opposite interest rate positions compared to the bank.

Up to now, we have defined the gap as being related to (or a function of) a specified time-horizon (for example, 90 days). However, this is rather arbitrary as it does not clearly indicate what time period is appropriate for determining the interest rate sensitivity of assets and liabilities. For instance, focusing on a short-term gap may ignore reinvestment risk (the risk that loans are repaid early). One extension of the basic gap model is the *maturity bucket* approach. Each of the bank assets and liabilities is classified according to its maturity and placed into 'maturity buckets', for example overnight, 3 months, 3–6 months, and so on. Analysts compute both incremental and cumulative gap results. An incremental gap is defined as RSA – RSL in each time bucket; the cumulative gap is the cumulative subtotal of the incremental gaps.

As illustrated in Table 11.2, as total assets equal total liabilities by definition, the incremental gaps must total to zero and therefore the last cumulative gap must be zero. The maturity bucket approach allows bank managers to concentrate on the cumulative gaps for the different time buckets.

One extension is the maturity gap (M Gap).

$$M\ Gap = W_A RSA - W_A RSL \tag{11.6}$$

where:
$W_A RSA$ = weighted average rate-sensitive assets
$W_A RSL$ = weighted average rate-sensitive liabilities

Table 11.2 **Maturity bucket gap**

| | *Assets* | *Liabilities* | *Gap* | *Cumulative gap* |
|---|---|---|---|---|
| One day | 40 | 30 | +10 | +10 |
| More than 1 day less than 3 months | 50 | 60 | –10 | 0 |
| More than 3 months less than 6 months | 90 | 110 | –20 | –20 |
| More than 6 months less than 12 months | 110 | 120 | –10 | –30 |
| More than one year less than 5 years | 80 | 70 | +10 | –20 |
| Over 5 years | 30 | 10 | +20 | 0 |
| | 400 | 400 | | |

This model better reflects the economic reality or the true value of assets and liabilities if the bank portfolio was liquidated at today's prices. If the maturity of a bank's assets is greater than the maturity of its liabilities, an increase in interest rates will cause the value of the assets to fall more than the value of the liabilities because the assets mature later. The bigger the maturity gap, the more a bank's net worth will suffer by an increase in interest rates.

Another extension is the so-called 'dynamic gap analysis' approach, that involves forecasting interest rate changes and expected changes in the bank's balance sheet for several periods in the future. Software models provide bank managers with simulation tools to inform them of the way in which gaps are expected to be structured at certain times in the future.

Gap analysis was one of the first methods developed to measure a bank's interest rate risk exposure, and continues to be widely used by banks. Despite the extensions, the gap model has been defined as 'naïve' and has been subject to a number of criticisms as the approach:

- fails to take into account the market value effect (i.e., the new value of the asset given changes in interest rates);
- suffers from over aggregation, that is, it fails to consider for intra-bucket effects;
- fails to deal with run-offs, which is the periodic cash flow of interest and principal amortisation payments on long-term assets;
- ignores banks' exposure to pre-payment risk (the risk that loans will be repaid early);
- ignores differences in spreads between interest rates that could arise as the level of market interest rates changes (basis risk);
- does not take into account any changes in the timing of payments that might occur as a result of changes in the interest rate environment;
- generally oversimplifies the complexity of a bank's ALM.

For these reasons, gap analysis provides only a rough approximation of the actual impact of changes in interest rates.

## 11.5.2 Duration analysis

Duration is a measure of the average life of an asset's (or liability's) cash flow. **Duration analysis** takes into account the average life of an asset (or liability) rather than its maturity. It is a technique borrowed from bond portfolio management, where duration is defined as a weighted average of the maturities of the individual coupon payments. In this context, duration may be different from maturity if, for example, an asset repayment schedule includes interest and principal. A 3-year car loan that is repaid with monthly instalments will have duration different from its maturity. Maturity and duration are only ever equal in the case of single payment assets and zero coupon bonds. Higher duration implies that a given change in the level of interest rates will have a larger impact on economic value. The duration of a coupon bond is expressed by the formula (known as Macauley duration):

$$D_1 = 1^* \frac{C_1/(1+Y)^1}{V} + 2^* \frac{C^2/(1+Y)^2}{V} + \ldots + n^* \frac{C_n + P_n/(1+Y)^n}{V} \qquad (11.7)$$

where:

$Y$ = the bond's internal yield or yield-to-maturity (YTM)
$C_1$ = annual coupon payment in year 1
$P_n$ = principal payment
$n$ = number of years to maturity
$V$ = current market value of the bond

## Box 11.3 Example of Macauley duration

Consider a bond with the following characteristics:

- £100 annual coupon
- 2 years to maturity
- YTM = 10%
- Market value £1,000

The Macaulay duration for this bond is 1.909 years.

$$1.909 = 1^* \frac{£100/(1.1)}{£1000} + 2^* \frac{£1100/(1.1)^2}{£1000}$$

The formula provides the weighted average payment stream, where the maturity of each payment is weighted by the fraction of the total value of the bond accounted for by the payment. As can be seen from the example, the emphasis in duration analysis is on the market value rather than on the book value, as was the case in gap analysis.

Using formula (11.7) it is possible to compute the duration of the entire asset and liability portfolios of a bank. By matching the duration of assets and liabilities, movements in interest rates should have roughly the same effect on both sides of the balance sheet. Duration gap (DG) measures the mismatch between the duration of a bank's assets and its liabilities.

$$DG = \left(D_A - \frac{L}{A} D_L\right) \tag{11.8}$$

where:

$A$ = market value of assets
L = market value of liabilities
$D_A$ = duration of assets
$D_L$ = duration of liabilities
L/A = leverage or gearing ratio

The impact of a change in interest rates on the value of a bank's equity can be calculated from equation (11.9) as follows:

$$\Delta E = - DG \left(\frac{\Delta r}{(1 + r)}\right) A \tag{11.9}$$

where:
$\Delta E$ = change in the value of bank equity
$DG$ = duration gap
$\Delta r$ = change in interest rate
$A$ = market value of assets

**Box 11.4 Example of duration gap**

Consider a bank with the following characteristics:

- £500 millions of assets
- £400 million of liabilities
- £100 million of own equity
- the duration of assets is five years
- the duration of liabilities is three years

Let's suppose that bank management expect an interest rate increase of 0.25 per cent to 4.5 per cent following the next meeting of the Bank of England's Monetary Policy Committee (MPC).

$$DG = [5 - (400/500)3] = 2.6$$

$$\Delta E = -2.6\ [00.25/(1 + 0.0425)]\ 500 = -3.12 \text{ million}$$

In this case, an increase in interest rates from 4.25 to 4.5 per cent will decrease the equity value by £3.12 million.

Estimates derived from a standard duration approach may provide an acceptable approximation of a bank's exposure to changes in economic value for relatively non-complex banks. However, there are a number of problems arising from the use of the duration measure:

- Convexity – the duration formula implies a linear relationship between changes in interest rate and changes in equity; in reality the relationship is convex. Duration is a good approximation for small changes but it becomes less accurate for larger changes.
- Data requirements – the calculation of the duration gap can be data demanding.
- Duration generally focuses on just one form of interest rate risk exposure – re-pricing risk – and ignores interest rate risk arising from changes in the relationship among interest rates within a time-band (basis risk).
- The simplifying assumptions that underlie the calculation of standard duration mean that the risk from off-balance sheet activities may be underestimated.

### 11.5.3 Simulation approaches

Many large banks employ more sophisticated interest rate risk measurement systems than those based on simple maturity/re-pricing schedules. These simulation techniques typically involve detailed assessments of the potential effects of

changes in interest rates on earnings and economic value by simulating the future path of interest rates and their impact on cash flows. Simulation approaches typically involve a more detailed breakdown of various categories of on- and off-balance sheet positions, so that specific assumptions about the interest and principal payments and non-interest income and expense arising from each type of position can be incorporated. In addition, simulation techniques can incorporate more varied and refined changes in the interest rate environment, ranging from changes in the slope and shape of the yield curve to interest rate scenarios derived from (relatively complex) statistical approaches such as Monte Carlo simulations[1].

We can distinguish between

- *static simulations*, where only the cash flows arising from the bank's current on- and off-balance sheet positions are assessed, and
- *dynamic simulations*, where the model builds in more detailed assumptions about the future course of interest rates and the expected changes in a bank's business activity over that time.

The usefulness of simulation-based interest rate risk measurement techniques depends on the validity of the underlying assumptions and the accuracy of the basic methodology. In its document 'Principles for the Management of Interest Rate Risk' (1997b), the BCBS warns that the output of sophisticated simulations must be assessed in the light of the validity of the simulation's assumptions about future interest rates and the behaviour of the bank and its customers. One of the primary concerns of BCBS is that such simulations could become *'black boxes'* that lead to false confidence in the precision of the estimates.

## 11.6 Managing liquidity risk

As defined in Section 10.4, a bank faces liquidity risk when, because of lack of confidence or unexpected need for cash, withdrawals are higher than normal and the bank is unable to meet its liabilities. Sound liquidity management can reduce the probability of serious problems. The importance of liquidity goes beyond the individual bank, since a liquidity shortfall at a single institution can have system-wide repercussions. Systemic risk and the problems of contagion and bank runs have been discussed already in Chapter 7 and elsewhere in this text.

If a bank experiences a temporary liquidity problem, and it is either unable or unwilling to borrow on the interbank market, the central bank can provide funds, in the form of loans and advances. However, central bank borrowing is costly not only in terms of the interest rates charged but also in terms of the bank's reputation.

Liquidity pressures can arise from both sides of the balance sheet. On the liability side, unexpectedly high cash withdrawals can cause solvent banks to have liquidity problems. On the asset side, liquidity problems can be caused by unexpectedly high loan defaults and by customers unexpectedly drawing down lines of credit. Liquidity pressures can arise from off-balance sheet activities as well as from

[1] A Monte Carlo simulation is a computerised technique which is the basis for probalistic risk analysis, and which replicates real-life occurrences by mathematically modeling a projected event.

problems in the payment system. Contingent liabilities, such as letters of credit and financial guarantees, represent a potentially significant drain of funds for a bank, but are usually not dependent on a bank's liquidity position. Other potential sources of cash outflows include payments relating to transactions involving swaps, over-the-counter (OTC) options, other interest rate and forward foreign exchange rate contracts, margin calls and early termination agreements.

Liquidity management is an integral part of the ALM function. Liquidity risk management aims at protecting a bank against liquidity risk, that is, to avoid a situation of negative net liquid assets.

To avoid liquidity problems, a bank can hold liquid assets. However, increased liquidity comes at a cost. There is a trade-off between liquidity and profitability, as the more liquid the asset, the lower the rate of return. Instead of holding liquid funds, a bank could make more profitable loans. Despite the costs, however, the holding of liquid assets is necessary as it:

- reassures creditors that the bank is safe and able to meet its liabilities;
- signals to the market that the bank is prudent and well managed;
- ensures that all lending commitments can be met;
- avoids forced sale of the bank's assets;
- avoids having to pay excessive borrowing costs in the interbank markets; and
- avoids central bank borrowing.

Banks can minimise withdrawal risk by diversifying funding sources (liability management). Prudent banks will also seek to minimise their *volatility ratio*:

$$VR = (VL–LA)/(TA–LA) \tag{11.10}$$

where:
VL = volatile liabilities
LA = liquid assets
TA = total assets

Prudent banks will have a volatility ratio lower than zero.

In measuring and managing a bank's liquidity exposure, the following techniques may be used:

- cash flow projections of daily liquidity positions
- cash flow projections of daily liquidity sources
- scenario analysis and simulation models
- liquidity gap analysis

## 11.6.1 Liquidity gap analysis and financing gap

Liquidity gap analysis is the most widely used technique for managing a bank's liquidity position. As we have already discussed, liquidity risk is generated in the balance sheet by a mismatch between the size and maturity of assets and liabilities. It is the risk that the bank is holding insufficient liquid assets on its balance sheet to meet requirements. The liquidity gap is defined as the difference between net liquid assets and unpredictable (or volatile) liabilities. If a bank's net liquid assets are less than liabilities then the bank needs to purchase funds in the market to fill the shortfall in liquid assets. Banks typically will examine the maturity profile of their assets and liabilities to identify mismatches in liquidity that require funding.

$$\text{L Gap} = \text{NLA} - \text{VL} \tag{11.11}$$

where:
NLA = net liquid assets
VL = volatile liabilities

The liquidity gap analysis is similar to the *maturity bucket approach* we have discussed for interest rate risk management. In this case, balance sheet items are placed in a bucket according to the expected timing of cash flows. Net mismatched positions are accumulated over time to produce a cumulative net mismatch position. In this way, the bank can monitor the amount of cash which becomes available over time.

Another useful measure of bank liquidity is the financing gap (F Gap):

$$\text{F Gap} = \text{Average loans} - \text{Average deposits} \tag{11.12}$$

If the F Gap is positive, the bank needs cash and will have either to sell some assets or borrow on the interbank market. The bigger the F Gap, the more a bank needs to borrow and the greater its exposure to liquidity risk. However, recent technological and financial innovations have provided banks with new ways of funding their activities and managing their liquidity. A declining ability to rely on core deposits, together with increased reliance on wholesale funds has changed the way banks view liquidity.

## 11.7 Managing market risk

Market risk is the risk resulting from adverse movements in the level or volatility of market prices of interest rate instruments, equities, commodities and currencies (see Section 10.6). Market risk is usually measured as the potential gain/loss in a position/portfolio that is associated with a price movement of a given probability over a specified time-horizon.

Financial institutions have always faced market risk; however, the sharp increase in asset trading since the 1980s has increased the need to ensure that these institutions have the appropriate management systems to control (and the capital to absorb) the risks posed by market-related exposures. As a risk, market risk gained a high profile when the Basle Committee on Banking Supervision published 'The Supervisory Treatment of Market Risks' in 1993, in which for the first time it was proposed that market risk, in addition to credit risk, needed to be taken into account for the calculation of bank capital requirements (this updated the 1988 Basle Capital Adequacy Accord).

The 1993 BCBS consultative document put forward a standardised measurement framework to calculate market risk for interest rates, equities and currencies which differentiates capital requirements for specific risk from those for general market risk. The 1996 BCSC document 'Amendment to the Capital Accord to Incorporate Market Risks' provides the framework for capital charges relative to market risk. It sets forth two approaches for calculating the capital charge to cover market risks: *the standardised approach* and *the internal models approach*. The methodology for banks using the standardised approach is based on a 'building blocks' approach, in which the specific risk and the general market risk arising from securities positions are measured separately. On the other hand, the focus of many internal models is on the bank's general

market risk exposure, leaving specific risk (i.e., exposures to specific issuers) to be measured largely through separate credit risk measurement systems.

The central components of market risk management are the **Risk-Adjusted-Return on Capital (RAROC)** and the **Value-at-Risk (VaR)** approaches. Although VaR was originally developed to manage market risk, it has now been extended to incorporate credit risk. Other techniques used to manage market risk include scenario analysis and stress testing.

### 11.7.1 Risk-Adjusted-Return on Capital (RAROC)

The concept of Risk-Adjusted-Return on Capital (RAROC) was first introduced by Bankers Trust in the late 1970s as a planning and performance management tool, in the context of Risk Adjusted Performance Measurement (RAPM). Several approaches, defined as *'asset-volatility-based approaches'* as opposed to the traditional risk-based and ROE-based approaches were developed in response to the need to target shareholders' value and to allocate banks' internal resources more efficiently. The RAROC measures the risk inherent in each banking activity, and the risk factor is computed taking into account the asset price volatility, calculated on historical data. An interesting feature of RAROC is that it can be employed to estimate the relative capital allocation of all types of banking risks.

$$\text{RAROC} = \frac{\text{Revenues} - \text{Cost} - \text{Expected losses}}{\text{Total Equity Capital}} \tag{11.13}$$

In the context of the new Basle Capital Accord (or Basle II as was explained in Section 7.8), which encourages the use of internal risk models to set banks capital requirements, the RAROC measure can help bank managers to assess in what areas they should allocate more capital.

### 11.7.2 Value-at-Risk (VaR)

VaR is the principal portfolio measure of market risk; it provides an estimate of the potential loss on the current portfolio from adverse market movements. It builds on modern portfolio theory and was originally developed by JP Morgan in the context of their RiskMetrics product. VaR is a statistical measure of potential trading revenue volatility, and a change in the general level of VaR would normally be expected to lead to a corresponding change in the volatility of daily trading revenues. The distinguishing feature of VaR is that it uses the volatility of assets.

The basic formula of VaR is as follows:[8]

$$\text{VaR}_x = V_x \, (dV/dP) \, \Delta P_t \tag{11.14}$$

where:

$V_x$ = the market value of portfolio x
$dV/dP$ = the sensitivity to market prices movements per £ of market value
$\Delta P_t$ = the adverse price movement over a specific time horizon t (under the Basle Agreement t = 10 days)

[8] A general introduction to VaR can be found in Jorion (1997).

It expresses the 'maximum' amount a bank might lose, to a certain level of confidence ($q$), as a result of changes in risk factors (i.e., changes in interest rates, exchange rates, equity and commodity prices). The basic time period $t$ and the confidence level $q$ are the two major parameters that should be chosen in an appropriate way. The time-horizon can differ from a few hours for an active trading desk to a year for a pension fund. In simple terms, the VaR approach aims to answer the following question: 'How much can I lose with x% probability over a pre-set horizon?'

Suppose that a bank portfolio manager has a daily VaR equal to £1 million at a 99 per cent confidence interval. This means that there is only one chance in 100 that a daily loss bigger than £1 million occurs under normal market conditions.

The calculation of VaR specified in equation (11.14) involves several assumptions:

- prices of financial instruments are assumed to be normally distributed;
- price changes are assumed to be statistically uncorrelated;
- the volatility (standard deviation) of the price or rate changes is stable over time;
- the interrelationship between two different price movements follows a joint normal distribution.

## Box 11.5 Example of VaR

Suppose a portfolio manager manages a portfolio which consists of a single asset. The return of the asset is normally distributed with annual mean return of 15% and annual standard deviation of 25%. The value of the portfolio today is £100 million. We want to answer various simple questions about the end-of-year distribution of the portfolio's value:

1) What is the probability of a loss of more than £20 million by year end (i.e., what is the probability that the end-of-year value is less than £95 million (£115 million minus £20 million))?
2) With 1% probability what is the maximum loss at the end of the year? This is the VaR at 1%.

To answer these questions keeping in mind the assumptions made above, we need to employ a statistical package (for example, Microsoft Excel):

1) In Excel, you need to employ the formula giving standard normal cumulative distribution. In this example:

NORMDIST (95, 115, 25, TRUE) = 0.211855

The probability of a loss of more than £20 million is 21%.

2) In Excel, you need to employ the formula giving the inverse of the normal cumulative distribution. In this example:

NORMINV (0.01, 115, 25) = 56.841325

There is 1% probability that the end of the year value will be less than £56.84 million, which means that the maximum loss is equal to

£115 million – £56.84 million = £58.16 million.

Most VaR calculations, however, are not concerned with annual value-at-risk. The main regulatory and management concern is with the loss of portfolio value over a much shorter period (typically several days). After the introduction of market risk measurement in the 1996 Amendment to the Basle I Capital Adequacy Accord, regulators have encouraged the use of VaR. The required VaR measure is for every 10 days with a confidence interval of 99 per cent. However, the 10-day VaR measure takes no account of the mitigating action that can be taken in the event of adverse market moves, nor does it express the worst result that could occur as a result of extreme, unusual or unprecedented market conditions. The absolute level of VaR should not, therefore, be interpreted as the likely range of daily trading revenues.

As there is no general consensus as to the 'best way' to carry out a VaR analysis, the approach allows various options for the choice of the underlying frequency distributions:

- parametric methods;
- non-parametric methods;
- simulation approaches (such as using Monte Carlo techniques).

Because of the different approaches that might be followed, i.e., financial institutions may use different confidence levels or holding periods, may have different sources of historical data or use longer or shorter time-series and may use approximate changes in individual risk factors following different distribution, direct comparisons between VaR numbers produced by different institutions can be misleading.

In order to determine the overall or net position, a portfolio can be divided according to its sensitivity to certain risk (the so-called Greeks):

a) Delta risk (absolute price risk): is the risk that the price of the underlying asset will change.
b) Gamma risk (convexity risk): allows for the existence of a non-linear relationship between the change in the price of the underlying asset and the change in the value of the portfolio.
c) Vega risk (volatility risk): is the risk arising from a change in the expected volatility in the price of the underlying instrument.
d) Theta risk (time-decay risk): is the risk of a change in the value of the portfolio simply connected with the passing of time.
e) Rho risk (discount risk): is the risk associated with a change in the risk-free rate.

To arrive at a VaR, the portfolio components are disaggregated according to the above risk factors, netted out and then re-aggregated.

To illustrate how VaR is reported by banks, Table 11.3 reports the figures from UBS (2004).

Some authors (Danielsonn, 2000, 2002: Taleb, 1997) have expressed the following concerns over the use of VaR:

- VaR does not give the precise amount that will be lost.
- The assumption that financial returns are normally distributed and uncorrelated may not hold.
- VaR measures are seemingly easy to manipulate.
- It does not provide an indication of the probability of a bank failure.
- If all traders are using the same approach to minimise market risk, this can result in increased liquidity risk.

Table 11.3 **Value-at-Risk at UBS**

| *As at 31 Dec 2004* | | *Year ended 31 Dec 04* | | | | *Year ended 31 Dec 03* | | | |
|---|---|---|---|---|---|---|---|---|---|
| *(CHF million)** | *Limits* | *Min* | *Max* | *Avg* | *31 Dec* | *Min* | *Max* | *Avg* | *31 Dec* |
| Business Groups | | | | | | | | | |
| Investment Bank | 600 | 274 | 457 | 358 | 332 | 236 | 470 | 317 | 295 |
| Wealth Management USA | 50 | 12 | 27 | 17 | 16 | 8 | 21 | 14 | 17 |
| Global Asset Management | 30 | 5 | 16 | 11 | 7 | 7 | 16 | 11 | 8 |
| Wealth Management & Business Banking | 5 | 1 | 1 | 1 | 1 | 1 | 5 | 2 | 1 |
| Corporate Centre | 150 | 35 | 69 | 47 | 38 | 40 | 83 | 58 | 49 |
| Reserve | 170 | | | | | | | | |
| Diversification effect | | | | (69) | (62) | | | (95) | (76) |
| **Total** | **750** | **274** | **453** | **365** | **332** | **223** | **460** | **307** | **294** |

*CHF= Swiss Franc.

*Source*: http://www.ubs.com.

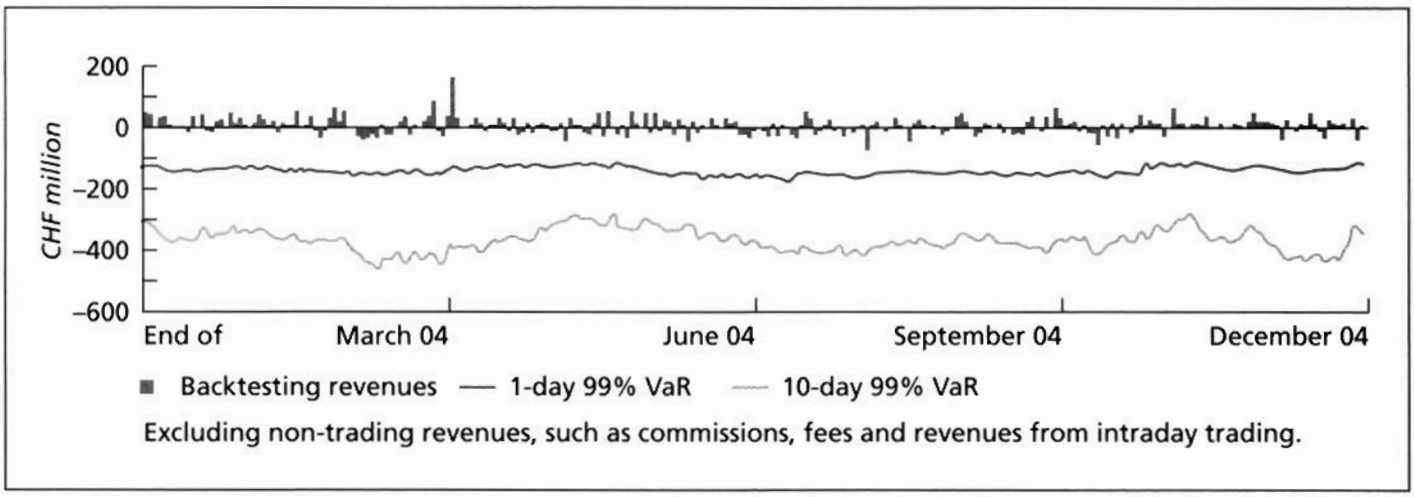
For these reasons, **back testing** (that is, an ex-post comparison of the risk measure generated by the model against actual daily changes in portfolio value) is advocated by the BCBS. Given the limitations of VaR highlighted above, most banks also employ scenario analysis and stress testing.

In simple terms, back testing compares actual revenues arising from closing positions (i.e., excluding intra-day revenues, fees and commissions) with the VaR calculated on these positions, and is used to monitor the quality of the VaR model.

Figure 11.3 shows these daily revenues and the corresponding 1-day VaR over the last 12 months for UBS. (The 10-day VaR, which is the basis of the limits and exposures in the tables above, is also reported for information.)

As illustrated in the figure, the revenue volatility over 2004 was within the range predicted by the VaR model. If we focus on the outliers, there was an increase in revenues at the beginning of the second quarter in April 2004. These have been

Figure 11.3 **Back testing VaR (UBS) 2 January 2004–31 December 2004**




*Source*: http://www.ubs.com.

attributed to various international factors, including the price decline in T-bonds that caused yields to rise.

Scenario analysis and stress testing are based on simulated forecasts of plausible unfavourable scenarios to compute how much a bank would lose in the event of a 'worst-case scenario' and tests the bank's ability to withstand possible shocks.

## Box 11.6 Risk management: keeping pace with effective results

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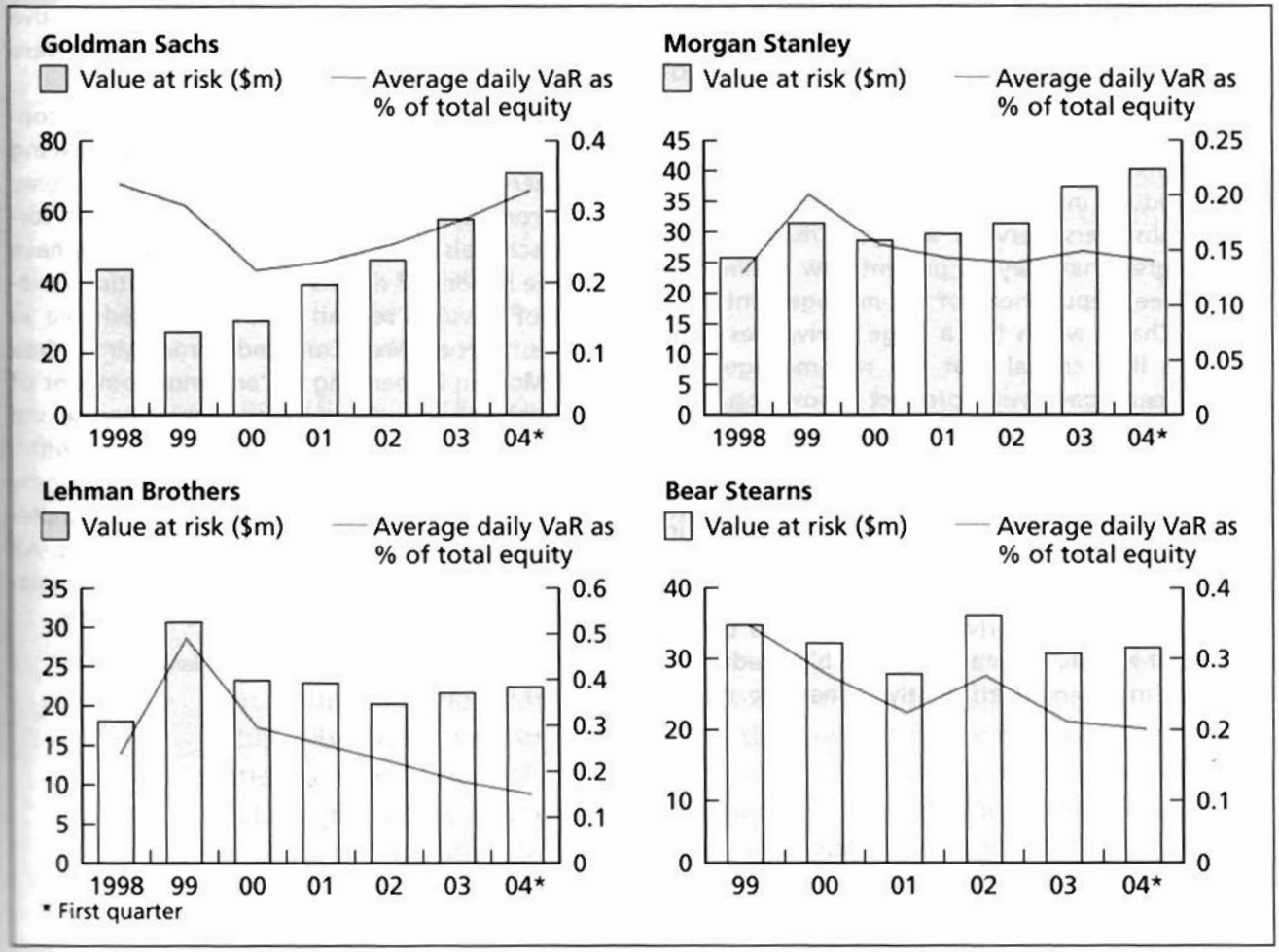
If you are looking for the hot new jobs in investment banking, forget fixed-income, eliminate equities and do not bother with derivatives. Risk management . . . that's where the growth is. Banks have been ramping up their risk management operations in recent years, increasing headcount, technology investment and status.

According to the 2004 Global Risk Management Survey by Deloitte & Touche, 81 per cent of global financial services companies now have a chief risk officer. Two years ago, it was only 65 per cent. Most industry insiders believe this has resulted in a big improvement in the effectiveness of banks' risk management – in spite of the perceived increase in risk the banks are taking on, the growth of hedge funds and the ever increasing complexity of financial products. However, some regulators question whether risk management has improved quite as much as the banks like to believe. It could be they have just been lucky.

Figure 11.4 **Investment banks' risk taking**




Source: Merrill Lynch (2004).

Edward Hida, head of banking risk management at Deloitte & Touche, says that, while it is difficult to prove that risk management has improved, all the evidence points that way. 'The fact that there have been fewer disasters in many of the larger markets suggests that risk management has improved.' He says there have been advances in all the main areas of risk management – credit risk, market risk and operational risk – and, in particular, in the way these all interact to create financial risk for the firm. Guy Moszkowski, investment banking analyst at Merrill Lynch in New York, agrees that the lack of 'massive blowouts' is persuasive. His analysis of the top Wall Street banks shows that the 'efficiency' of risk taking has improved, measured by the ratio of trading revenue to 'value at risk' (VAR). Value at risk is a measure of the potential loss in value of trading positions due to adverse market movements over a defined period. Mr Moszkowski disputes the widespread belief that banks have been taking on proportionately more risk. The amount of risk measured by VAR taken on by the top Wall Street investment banks as a group has not increased in relation to their growing capital in recent years, he says.

Among the European banks, Deutsche is widely seen as having been aggressive on risk recently and it recorded a sharp rise in VAR in the third quarter of last year. However, bankers say this was inflated by a statistical blip and that its risk-taking is not out of line with its US peers. The ever growing complexity of the products investment banks trade makes some outside observers nervous and risk management experts agree that they do present new challenges. Don McCree, deputy head of risk management at JP Morgan Chase, which has a huge derivatives business, says it is critical that the risk management process keeps pace with product innovation. 'We routinely move people from the business into the risk management function to ensure that we remain in step with developments', he says. However, Mr McCree says it is important to remember that, in many ways, the growth of derivatives has made risk management easier, not more difficult. In particular, the growth in credit derivatives has allowed banks, such as JPMorgan, to manage their big credit risk exposures much more efficiently. 'When we weigh credit derivatives as a risk or a benefit, we come down significantly into the benefit category.'

The other development that makes some outside observers jumpy is the growth in hedge funds. This nervousness is understandable given that the collapse of Long-Term Capital Management is still a recent memory. When the hedge fund imploded in 1998, prompting the Federal Reserve to organise a $3.6bn bail-out, its bankers had an estimated exposure of $125bn. Tim Geithner, president of the New York Federal Reserve, one of the US bank regulators, said in a recent speech that the quality of risk management of counterparties of hedge funds had 'improved substantially since 1998', but that progress had been 'uneven across the major dealers'. He also drew attention to 'signs of some erosion in standards in response to competitive pressures' as banks fought to attract increasingly lucrative hedge fund fees. Mr Geithner said that improving the overall discipline of the stress testing regime was critical. Because potential future exposure measures are based on VAR calculations, they can produce misleadingly low overall measures of counterparty credit risk, he said. This is because VAR calculations reflect recent market conditions and correlations, so do not necessarily provide an effective measure of vulnerability to loss under more severe conditions of market stress and illiquidity.

Thanks partly to the relatively benign market conditions in recent years, the biggest risks to leading investment banks, particularly in the US, have come from a completely different quarter: the wave of corporate scandals. Citigroup and JPMorgan alone have set aside billions of dollars to cover potential settlements of lawsuits related to their alleged role in scandals, such as WorldCom and Enron. Mr McCree says JPMorgan is spending an 'enormous amount of time' analysing new risks such as 'reputation risk and litigation risk created by parties we do business with'.

At the same time, banks are also facing new demands on risk management as part of their implementation of the Basle II capital adequacy rules. All of which suggests those risk management departments will keep growing for some time to come.

*Source*: *Financial Times* (2005 'Investment Banking Survey', 27 January, by David Wighton.

## 11.8 Managing operational risk

The Risk Management Group of the Basle Committee on Banking Supervision (2001b) broadly defines operational risk as 'the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events'. In general terms, this is the risk associated with the possible failure of a bank's systems, controls or other management failure (including human error). This definition focuses on the causes of operational risk, and it is aimed at facilitating operational risk measurement and management.

Despite the increased importance of operational risk in the management of financial institutions, reflected in the fact that Basle II incorporates a new capital charge for operational risk, there is no clearly established, single way to measure operational risk on a firm-wide basis. Furthermore, the management of operational risk is still at very early stages of development.

One of the reasons behind the difficulties in quantifying operational risk lies in the fact that most risk factors usually identified by banks are typically measures of internal performance, such as internal audit ratings, volume, turnover, error rates and income volatility, rather than external factors such as market price movements or a change in a borrower's condition. As a consequence, there is uncertainty about which factors are important for measuring operational risk and the importance of different factors may vary among financial institutions. Furthermore, also unlike the cases of credit and market risk, there is a lack of a direct relationship between the risk factors usually identified and the size and frequency of losses.

In line with the management of other banking risks, a capital provision should be set aside to cover for unexpected losses due to operational risk. However, explicit pricing of the losses relating to operational risk is uncommon.

The Basle II framework proposes three methods for calculating operating risk capital charges, which present increasing sophistication and risk sensitivity:[9]

1 the *basic approach,*
2 the *standardised approach,*
3 the *internal measurement approach.*

The *basic approach* allocates capital using a single indicator (Gross Income) as a proxy for a banks' overall operational risk exposure.

In the *standardised approach,* a bank's activities are divided into a number of standardised business units and business lines. Within each business line, regulators have specified a proxy to reflect the volume of a bank's activity in this area as illustrated in Table 11.4. This proxy is then used as an indicator for the operational risk within each business line.

Within each business line, the capital charge is calculated by multiplying a bank's broad financial indicator by a 'beta' factor (which is a rough proxy for the relationship between the industry's operational risk loss experience for a given business line and the broad financial indicator for the bank's activity in that business line). The total capital charge is the sum of the capital charges in each business line.

The *internal measurement approach* allows individual banks to use internal loss data. However, the methods for calculating the capital charge would be determined by the regulators.

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[9] BCBS (2001b) 'Consultative Document. Operational Risk'.

Table 11.4 **The standardised approach to operational risk management**

| *Business units* | *Business lines* | *Indicator* |
|---|---|---|
| Investment banking | • Corporate finance<br>• Trading and sales | Gross income |
| Banking | • Retail banking<br>• Commercial banking<br>• Payment and settlement | • Annual average assets<br>• Annual average assets<br>• Annual settlement throughput |
| Others | • Retail brokerage<br>• Asset management | • Gross income<br>• Total funds under management |

*Source*: Adapted from BCBS (2001b).

The Basle Committee is also encouraging banks to better manage operational risk, in order to reduce the exposure, frequency and severity of losses. One mitigation technique which is growing in importance is the use of insurance to cover specific operational risk exposures.

## Box 11.7 Structure of the internal measurement approach

In the internal measurement approach, a bank's activities are categorised into a number of business lines, and a broad set of operational loss types are defined and applied across business lines. Within each business line/loss type combination, the supervisor specifies an exposure indicator (EI) which is a proxy for the size (or amount of risk) of each business line's operational risk exposure.

For each business line/loss type combination, banks measure, based on their internal loss data, a parameter representing the probability of loss event (PE) as well as a parameter representing the loss given that event (LGE). The product of EI*PE*LGE is used to calculate the expected loss (EL) for each business line/loss type combination.

The supervisor supplies a factor (the 'gamma term', $\gamma$) for each business line/loss type combination, which translates the expected loss (EL) into a capital charge. The overall capital charge for a particular bank is the simple sum of all the resulting products. This can be expressed in the following formula:

$$\text{Required capital} = \Sigma i\, \Sigma j\, [\gamma\,(i,j) * EI(i,j) * PE(i,j) * LGE(I,j) \qquad (11.15)$$

where:
i = the business line, and
j = the risk type

To facilitate the process of supervisory validation, banks supply their supervisors with the individual components of the expected loss calculation (i.e., EI, PE, LGE) instead of just the product EL. Based on this information supervisors calculate EL and then adjust for unexpected loss through the gamma term to achieve the desired soundness standard.

*Source*: Adapted from BCBS (2001), p. 8.

## 11.9 International risk assessment

Banks engaged in international activities face a plethora of risks, in addition to the ones already discussed, including amongst others foreign currency risk, regulatory risk, strategic and reputation risk. These risks are not mutually exclusive and any product or service provided either domestically or internationally may expose the bank to multiple risks. For banks either contemplating an international investment or those already with substantial overseas operations the risks associated with operating in a foreign country need to be evaluated. Put simply, firms that operate internationally have to evaluate the country risk associated with their investments and/or overseas operations.

Country risk is the risk that economic, social and political conditions and events in a foreign country will adversely affect a firm's commercial/financial interests. In addition to the adverse effect that deteriorating macroeconomic conditions and political and social instability may have on the returns generated from an overseas investment, country risk also includes the possibility of nationalisation or expropriation of assets, governments revoking licences, imposition of exchange controls, and the likelihood of currency depreciation or devaluation.

Country risk can have a critical effect on a firm's international activities and therefore needs to be explicitly taken into account in the risk assessment of all overseas investments/activities. Even the risk associated with what are perceived to be the most stable (or safe) investments will increase if, for instance, the political or macroeconomic conditions change and cause the exchange rate to depreciate resulting in lower cash flows (and therefore profits) from overseas investments. Country risk is also not necessarily limited to a firm's exposure to overseas operations. A firm may have commercial relationships in its home country with a foreign firm that may be subject to such risks. For instance, country risk factors should also be taken into account, when assessing the creditworthiness of domestic trade creditors. One should also be aware that country risk factors are critically important for all types of international firms, non-financial and financial. Borrowers in higher risk countries pay higher premiums for their debt compared with those located in lower risk countries.

In banking, country risk is regarded as the exposure to a loss in cross-border lending, caused by events in a particular country that are (at least to some extent) under the control of the government but are not under the control of a private enterprise or individual. This contrasts with what is known as sovereign risk which relates to the risk associated with a government default on bond or loan repayments. A broader definition of country risk relates to any loss associated with international activity due to adverse changes in the overseas operating environment beyond the control of the firm. Transfer risk is another form of risk that is believed to be one of the most important drivers of country risk. This is simply the risk associated with the restriction of foreign payments from overseas to the home company or bank. Transfer risk refers to restrictions on payments between private agents whereas sovereign risk is associated with a government default on payments. In reality, sovereign and transfer risks are closely related as a government default on payments may lead private parties to renege on their payment obligations – especially if the government default leads to a major depreciation or crisis scenario.

## 11.9.1 Managing country risk

In order to effectively control the level of risk associated with their international operations, firms must have in place a procedure that systematically evaluates the country risk features of its business. This includes having in place a country risk evaluation process that has:

- effective oversight by senior managers;
- appropriate risk management policies and procedures;
- an accurate system for reporting change in country risk and potential exposures;
- an effective process for analysing country risk;
- a country risk rating system;
- regular monitoring of country conditions.

While the details and complexity of country risk assessment will vary from bank to bank, senior management must be suitably qualified to evaluate the bank's international activities.

### 11.9.1.1 Effective oversight by senior managers

If country risk is to be managed effectively then senior bank managers, up to board level, must oversee the process. It is likely that a team of senior project appraisers will review the bank's international operations in order to ensure that they are consistent with the company's major strategic objectives. Decisions to extend international operations and exposure to different countries' risk will ultimately be a decision for the company board, as they should have a view of the sorts of country exposure required and it is up to the board to make sure that country risk (as well as other risks) is effectively managed.

### 11.9.1.2 Appropriate risk management policies and procedures

It is the responsibility of senior bank management to implement policies and procedures for managing country risk. This involves:

- identifying investments and other activities exposed to country risk;
- identifying desirable and undesirable opportunities that can be used to complement or be substituted for current operations resulting in a reduction of country risk;
- establishing country risk limits if necessary;
- identifying clear lines of responsibility and accountability for country risk management decisions.

Senior management are ultimately responsible for country risk management policies, standards and practices and also need to make sure that these are communicated effectively to relevant parts of the organisation.

### 11.9.1.3 Systems for reporting country risk and potential exposures

In order to effectively manage country risk, banks need to have reliable systems for capturing and categorising the volume and nature of their foreign activities. Such a reporting system should cover all aspects of the company's international operations. Banks, for example, have to have country exposure reporting systems to support regulatory reporting of foreign exposures requirements.

### 11.9.1.4 An effective process for analysing country risk

The level of resources dedicated to the country risk analysis process will vary from bank to bank depending on the size and sophistication of the company's international activities. In order to construct an effective country risk evaluation process senior managers need to ask the following questions:

- Is there a quantitative and qualitative assessment of the risk associated with each country in which the firm is conducting or planning to undertake activities?
- Is any formal country risk analysis undertaken on a regular basis and are changes in country risk monitored in any way?
- Is the country risk analysis adequately documented, with the findings communicated to the relevant parties?
- Are adequate resources devoted to country risk evaluation procedures?
- Do the company's country risk assessments concur with the risk ratings of third-party assessors, such as rating agencies?

If the answers to these questions are in the affirmative then the bank is well placed to use the results of its country risk analysis effectively in strategic and operational decision making. In order to arrive at a conclusion about the level of country risk faced by a bank, managers need to evaluate the current (and possible future) economic, political and social characteristics of a country. For this they are likely to use some form of country risk rating system.

### 11.9.1.5 Country risk rating

Country risk ratings simply summarise the main findings of the country risk analysis process. While large firms and banks are likely to have teams evaluating country risk, smaller firms are more likely to rely heavily on the country risk assessments done by specialist third-party firms. Because there is a wide range of factors that can affect country risk, it is often difficult for smaller firms to dedicate the relevant resources to assess somewhat complex issues. Macroeconomic and political environments can change rapidly and it is often difficult to keep abreast of these developments, especially if one is considering or monitoring projects in a number of countries. Box 11.8 provides a broad indication of the various factors that affect country risk.

#### Box 11.8 Factors affecting country risk

Macroeconomic factors

- Size and structure of the country's external debt in relation to its economy
- Level of international reserves
- Potential for extreme adverse exchange rate movements and the effect on the relative price of the country's imports and exports
- GDP growth and inflation levels, current and forecast
- Role of foreign sources of capital in meeting the country's financing needs
- Country's access to international financial markets and the potential effects of a loss of market liquidity
- Country's relationships with private sector creditors
- The country's current standing with multilateral and official creditors such as the IMF

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- Trends in foreign investments and the country's ability to obtain foreign investment in the future
- Privatisation of government-owned entities
- The extent to which the economy of the country may be adversely affected through the contagion of problems in other countries
- The size and condition of the country's banking and financial system
- The extent to which state-directed lending or other government intervention may have adversely affected the soundness of the country's financial system and economy.

Socio-political factors

- The country's natural and human resource potential
- The willingness and ability of the government to recognise economic or budgetary problems and implement appropriate remedial action
- Extent to which political or regional factionalism or armed conflicts are adversely affecting government of the country
- Any trends toward government-imposed price, interest rate, or exchange controls
- Extent to which the legal system of the country can be relied upon to fairly protect the interests of foreign creditors and investors
- Accounting standards and the reliability and transparency of financial information
- The level of adherence to international legal and business practice standards
- Level of corruption
- Level of corporate social responsibility.

Institution-specific factors

- The bank's business strategy and its plans for investment in the country
- Types of investments, FDI or portfolio investments, joint ventures, licensing agreements, and so on
- Economic outlook for any specifically targeted business opened within the country
- Extent to which political or economic developments are likely to affect the bank's chosen lines of business
- The degree to which political or economic developments are likely to affect the credit risk of individual counterparties in the country. For instance, foreign firms with strong export markets in developed countries may have significantly less exposure to the local country's economic disruptions than do other firms operating in the country.
- The institution's ability to effectively manage its country risk through in-country or regional representation, or by some other arrangement that ensures the timely reporting of, and response to, any problems

One can see from Box 11.8 that there is a whole host of factors that affect a country's risk rating including various economic, financial and socio-political risks, as well as those risks that may be relevant to the specific bank or firm in question. In quantifying the broad economic/financial and socio-political risks companies can do their own risk evaluation but can also cross-check these with a variety of ratings calculated by third-party firms.

There are many firms that provide services that measure country risk. The main providers include:

- Control Risks Information Services (CRIS)
- Economist Intelligence Unit (EIU)
- Euromoney
- Institutional Investor
- Moody's Investor Services
- OECD
- Political risk services: International Country Risk Guide (ICRG)
- Political risk services: Coplin-O'Leary Rating System
- Standard and Poor's Rating Group

Apart from the OECD, all act as 'rating agencies' and sell their country risk ratings via the web or through other media. Each of these firms produce risk ratings using a variety of qualitative and quantitative information so as to construct a single index or country risk rating schedule. For example, Institutional Investor's credit ratings are based on a survey of leading international bankers who are asked to rate each country on a scale from zero to 100 (where 100 represents maximum creditworthiness). Institutional Investor averages these ratings, providing greater weights to respondents with greater world-wide exposure and more sophisticated country analysis systems. International Country Risk Guide (ICRG) compiles monthly data on a variety of political, financial and economic risk factors to calculate risk indices in each of these categories as well as a composite risk index. Five financial, thirteen political and six economic factors are used. Each factor is assigned a numerical rating within a specified range. In the case of ICRG country risk weightings political risk assessment scores are based on subjective staff analysis of available information. Economic risk assessment scores are based upon objective analysis of quantitative data, and financial risk assessment scores are based upon analysis of a mix of quantitative and qualitative information.

Of the non-commercial country risk ratings, those provided on a regular basis by the OECD are widely used and often these will be cross-checked against a firm's own internal risk assessment and those of a private third-party provider. How the OECD calculates its country risk ratings is outlined in Box 11.9 and Table 11.5 reports its country risk ratings from June 2004.

## Box 11.9 OECD country risk-weighting calculations

The OECD produces a regular country credit risk assessment that classifies countries into eight risk categories (0 to 7) with 7 being the most risky.

The Country Risk Classification Method measures the country credit risk, i.e., the likelihood that a country will service its external debt.

The classification of countries is achieved through the application of a methodology comprised of two basic components: (1) the Country Risk Assessment Model (CRAM), which produces a quantitative assessment of country credit risk, based on three groups of risk indicators (the payment experience of the participants, the financial situation and the economic situation) and (2) the qualitative assessment of the model results, considered country-by-country to integrate political risk and/or other risk factors not taken (fully) into account by the model. The details of the CRAM are confidential and not published.

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The final classification, based only on valid country risk elements, is a consensus decision of the sub-group of country risk experts that involves the country risk experts of the participating export credit agencies.

The sub-group of country risk experts meets several times a year. These meetings are organised in such a way as to guarantee that every country is reviewed whenever a fundamental change is observed and at least once a year. While the meetings are confidential and no official reports of the deliberations are made, the list of country risk classifications is published after each meeting.

*Source*: http://www.oecd.org.

**Table 11.5 Example of OECD country risk classification of the participants to the arrangement on officially supported export credits (as of June 2005)**

| *Country code* | *Country name* | *01 Jan 2005*<br>*28 Jan 2005* | *20 Jun 2005*<br>*28 Oct 2005* |
|---|---|---|---|
| ALB | Albania | 6 | 6 |
| DZA | Algeria | 4 | 3 |
| AGO | Angola | 7 | 7 |
| ATG | Antigua and Barbuda | 7 | 7 |
| ARG | Argentina | 7 | 7 |
| ARM | Armenia | 7 | 7 |
| ABW | Aruba | 4 | 4 |
| AUS | Australia | 0 | 0 |
| AUT | Austria | 0 | 0 |
| AZE | Azerbaijan | 6 | 6 |
| BHS | Bahamas | 3 | 3 |
| BHR | Bahrain | 3 | 3 |
| BGD | Bangladesh | 6 | 6 |
| BLR | Belarus | 7 | 7 |
| BEL | Belgium | 0 | 0 |
| BLZ | Belize | 6 | 7 |
| BEN | Benin | 7 | 7 |
| BOL | Bolivia | 7 | 7 |
| BIH | Bosnia and Herzegovina | 7 | 7 |
| BWA | Botswana | 2 | 2 |
| BRA | Brazil | 6 | 5 |
| BRN | Brunei | 2 | 2 |
| BGR | Bulgaria | 4 | 4 |
| BFA | Burkina Faso | 7 | 7 |
| CMR | Cameroon | 7 | 7 |
| CAN | Canada | 0 | 0 |
| CPV | Cape Verde | 7 | 7 |

*Source*: Adapted from http://www.oecd.org/dataoecd/47/29/3782900.pdf.

#### 11.9.1.6 Regular monitoring of country conditions

While banks have a wide range of resources at their disposal to evaluate country risk they also have to ensure that this risk is monitored on an on-going basis as country circumstances can change rapidly. International banks therefore should have a system in place to monitor current conditions in each of the countries where they have significant operations and also reconcile their risk assessments with those provided by other parties (such as the rating scores provided by the firms listed in the previous section). The quantity of resources devoted to monitoring conditions within a country should, of course, be proportionate to the firm's level of overseas activity and the perceived level of risk. Information provided by senior managers in the foreign country are a valuable resource for monitoring country conditions as are regular reports by regional or country managers. There also needs to be regular contact between parent senior management and those responsible for the operations in the foreign market. All banks conducting international business should not rely solely on informal and ad hoc lines of communication, and established procedures should be in place for dealing with operations that are faced with troubled overseas environments. Also, various contingency plans should be put in place for dealing with problems associated with increases in country risk; if necessary this should include various exit strategies.

It should also be stressed that international banks also must have adequate internal controls in place so that there is a reporting mechanism ensuring the integrity of the information used by senior management to monitor country risk positions and to comply with any pre-determined country risk exposure limits.

## 11.10 Conclusions

This chapter reviewed various aspect of bank risk management. The basic principles of bank management, including Asset and Liability Management, were reviewed in Chapter 9, whereas Chapter 10 analysed the main banking risks. This present chapter introduced the general concepts of bank risk management in Section 11.2. It then considered the management of specific banking risks, focusing particularly on the banking risk included in the calculation of regulatory capital in the new Basle Accord (credit risk, market risk and operational risk) and the management of the 'traditional' ALM function (interest rate risk and liquidity risk). Finally, given the growing importance of international banking activities, Section 11.9.1 outlined the main features relating to the management of country risk. Risk management is a complex and comprehensive process, which includes creating an appropriate environment, maintaining an efficient risk measurement structure, monitoring and mitigating risk-taking activities and establishing an adequate framework of internal controls. Banks will increasingly need to adopt more formal and quantitative risk measurement and risk management procedures and processes.

## Key terms

**Risk measurement**
**Risk management**
**CAMELS**
**Collateral**
**Loan rate**
**Mortgage equity withdrawal**
**Negative equity**
**Credit rationing**
**Credit checking**
**Credit scoring**
**Credit reference agencies**
**Gap analysis**
**Duration analysis**
**VaR**
**Back testing**
**Risk-Adjusted Return on Capital (RAROC)**

## Key reading

Basle Committee on Banking Supervision (1997a), 'Core Principles for Effective Banking Supervision', September, http://www.bis.org/publ/bcbs30a.pdf.

Basle Committee on Banking Supervision (2001a) 'Overview on the New Basle Capital Accord', *Consultative Document*, http://www.bis.org/publ/bcbsca02.pdf.

Basle Committee on Banking Supervision (2003b) 'Risk Management Principles for Electronic Banking', July, http://www.bis.org/publ/bcbs98.pdf.

Basle Committee on Banking Supervision (2004a) 'International Convergence of Capital Measurement and Capital Standards – A Revised Framework', June, http://www.bis.org/publ/bcbs107.pdf.

## Revision questions and problems

1 What is described as 'sound practice' in the management of credit risk?
2 Explain the process of credit scoring and describe its main applications.
3 What are the main limitations of the GAP approach?
4 Why should prudent banks seek to minimise their volatility ratio?
5 What are the main techniques used to manage a bank's liquidity exposure?
6 What is VaR? Explain the importance of VaR in the context of the new Basle Capital Adequacy Accord (Basle II).
7 What are the difficulties inherent in the measurement and management of operational risk?
8 What are the main factors affecting country risk?