EDINBURGH
BUSINESS SCHOOL
HERIOT-WATT UNIVERSITY

Credit Risk Management

Ken Brown

Peter Moles

This course text is part of the learning content for this Edinburgh Business School course.

In addition to this printed course text, you should have access to the course website in this subject, which will provide you with more learning content, the Profiler software and past examination questions and answers.

The content of this course text is updated from time to time, and all changes are reflected in the version of the text that appears on the accompanying website at http://coursewebsites.ebsglobal.net.

Most updates are minor, and examination questions will avoid any new or significantly altered material for two years following publication of the relevant material on the website.

You can check the version of the course text by referring to the version release number on the front page of the text and comparing this to the version number of the latest PDF version of the text on the website.

If you are studying this course as part of a tutored programme, you should contact your centre for further information on any changes.

Full terms and conditions that apply to students on any of the Edinburgh Business School courses are available on the website www.ebsglobal.net and should have been notified to you either by Edinburgh Business School or by the centre or regional partner through which you purchased your course. If this is not the case, please contact Edinburgh Business School at the address below.

Edinburgh Business School
Heriot-Watt University
Edinburgh
EH14 4AS
United Kingdom

Tel + 44 (0) 131 451 3090
Fax + 44 (0) 131 451 3002
Email enquiries@ebs.hw.ac.uk
Website www.ebsglobal.net

The courses are updated on a regular basis to take account of errors, omissions and recent developments. If you'd like to suggest a change to this course, please contact us: comments@ebs.hw.ac.uk.

Credit Risk Management

Ken Brown MA, MSc

Ken Brown, MA Econ (Hons), MSc International Banking and Financial Studies, is a Finance lecturer in EBS, having previously worked as a Finance lecturer in the Department of Accountancy and Finance at Heriot-Watt University. His main area of interest is mergers and acquisitions and he has contributed to publications on acquisitions.

Dr. Peter Moles MA, MBA, PhD

Peter Moles is on the faculty of the University of Edinburgh Business School. He took up this post following a career in the City in the international capital markets working for a number of banks, latterly for Chase Investment Bank. His responsibilities included the consultative selling of financial products, customer-related roles in product management, origination, trading, and corporate advisory. His last major post at Chase was as eurobond syndicate manager. His main research interests are in risk management, principally financial risk management, including foreign exchange management problems and the management of financial distress. He has an interest in how management decisions are made and the issues associated with managing complex problems. Training assignments have included KPMG programme, WM Company, NatWest Markets, the Advanced Management Programme in Scotland (AMPS), and Capital Markets training for PBG Bank, Lodz, Poland.

He is the principal author of the *Handbook of International Financial Terms* and has written two textbooks: *Financial Risk Management* and *Derivatives*. He also wrote the financial evaluation modules for the *Mergers and Acquisitions* course. He is currently engaged in editing an encyclopaedia of financial engineering and risk management.

Contents

Contents

Preface

The worldwide credit crunch, which started in 2006 with sub-prime mortgages in the United States, has highlighted the fundamental importance of the credit decision. As the problems in these mortgages unfolded, it was demonstrated that unsound credit decisions had been made and lessons as to how to manage credit risk effectively had been either ignored or never learned. This shows that poor lending decisions, whether by a financial institution or a corporate, can lead to significant losses. What the incredible losses sustained by banks and others caught up in the credit crunch have underlined is the major impact of credit risk and – by implication – credit risk management on the wellbeing and profitability of businesses. Being able to manage this risk is a key requirement for any lending decision. This is well understood in theory – if not always in practice – by banks and other lending institutions that make their profit by advancing money to individual and corporate borrowers. It should also be well understood by industrial and commercial firms that, in the course of their normal business, provide trade credit.

While the credit decision is relatively straightforward in principle (a lender must decide whether to give credit or refuse credit to a potential client), in practice it involves experience, judgement and a range of analytic and evaluative techniques that are designed to determine the likelihood that money will be repaid or, equally, that the money will be lost by the credit not being able to repay.

This course covers the essential credit assessment processes that involve credit risk identification, evaluation and subsequent management. It largely adopts a process- and techniques-based approach to credit risk assessment that covers a range of judgemental or experience-based methods and more formal or analytical models that have been developed to support the ultimate decision. The course also covers how credit losses may be mitigated once they have been incurred and money recovered if a credit defaults on its obligation.

Format of the Course

The 10 modules that make up Credit Risk Management can be broken down into six parts, as given below.

Part	Topic Areas	Modules
1	Introduction to credit risk management process and techniques	1
2	Understanding and evaluating financial statements	2 and 3
3	Qualitative and quantitative methods for evaluating credit risk based on borrower information	4 and 5
4	Market-based credit evaluation methods	6 and 7
5	Managing credit risk by industrial and commercial firms	8
6	Dealing with post-lending problems	9 and 10

Part 1 sets out the key elements that cover the credit evaluation process. This takes a decision theory approach to highlight the logical way in which credit can be assessed. It introduces the techniques that are expanded upon in later modules and considers how the process may be documented.

Part 2 explores the way financial statements are constructed, some of the issues in the way they are presented and how this key information about the status of potential and actual credits can be used to help determine the standing of an entity. Accounting data is very important in assessing the credit standing of businesses and can be considered the foundation for all such evaluations.

This is then followed by two modules (Part 3) that examine how corporate and personal information can be used both in a qualitative way and in more formal, mathematical models to analyse credit risks for firms and individuals. Many techniques use templates and rules of thumb, but increasingly models that make use of large quantities of information about groups of credits are used to compare and evaluate expected credit behaviour. These are the so-called scoring models, which, like the judgemental approaches, seek to compare a new credit applicant to known credits. An attraction of formal models is the way they systemise how a credit is evaluated.

Financial markets are processors of information, including news about firms, their financial performance and the quality of their managers, and this becomes a part of the way corporate securities are valued. One aspect of this valuation reflects the market's views about the credit quality. Part 4 covers the analytic models that have been developed to make use of the way the prices of securities traded in financial markets encapsulate the market's views of the obligor's credit quality. Two types of model have been developed: those that analyse the totality of the credit standing of firms and those that are primarily aimed at establishing the default probabilities that are embedded in securities prices.

Part 5 looks at the special factors that influence and affect the way industrial and commercial firms analyse and deal with credit risk. For these firms, credit risk is part of their business since such firms will be lending money via trade credit to customers. Hence, while they can and do make use of the techniques discussed in the earlier modules, there are specific issues and techniques that such firms employ in managing their trade credit.

Part 6 deals with what happens, and how to handle the situation, when credit has been granted and it all goes wrong. While firms go bankrupt, they also get into serious financial difficulties that affect their ability to repay. Financial distress and bankruptcy pose special challenges for lenders. Those who are owed money want to ensure that as much of it as possible can be recovered. As with the original decision to extend credit, this involves judgements about the borrower and, in the case of bankruptcy, an understanding of the legal process and its implications.

Spreadsheets

Throughout the course text and self-test exercises available online, you will find links to spreadsheets available on the Downloads page of the *Credit Risk Management*

course website. The spreadsheets allow you to see how some of the more complex tables and examples have been constructed. If you are having difficulty working out some of the numbers in a particular table, the related spreadsheet will indicate how the numbers are generated: simply look at the formula in the relevant cells.

Assessment

This course is assessed by exam. Candidates are required to answer a mix of multiple choice questions and case studies. At the end of each module of this course and also available via the website are examples of multiple choice questions and case studies that are similar to those that might be set for assessment. This course also includes two practice final exams that students may wish to attempt once they have mastered the material.

The marking scheme for the course is:

Section	Number of questions	Marks obtainable per question	Total marks for the section
Multiple choice questions	30	2	60
Cases	2	50	100
			160

Introduction to Credit Risk Management Process and Techniques

Module 1 Introduction

Introduction

Contents

Learning Objectives

This module introduces the key ideas for managing **credit risk**. Managing credit risk is a complex multidimensional problem and as a result there are a number of different approaches in use, some of which are quantitative while others involve qualitative judgements. Whatever the method used, the key element is to understand the behaviour and predict the likelihood of particular credits defaulting on their obligations. When the amount that can be lost from a default by a particular set of firms is the same, a higher likelihood of loss is indicative of greater credit risk. In cases where the amount that can be lost is different, we need to factor in not just the probability of default but also the expected loss given default.

Determining which counterparty may default is the art and science of credit risk management. Different approaches use judgement, deterministic or relationship models, or make use of statistical modelling in order to classify credit quality and predict likely default. Once the credit evaluation process is complete, the amount of risk to be taken can then be determined.

After completing this module, you should:

- understand the nature of credit risk, and in particular:
  - what constitutes credit risk
  - the causes of credit risk
  - the consequences of credit risk
- understand the nature of the credit assessment problem, and that:
  - credit risk can be viewed as a decision problem
  - the major problem in assessment is in misclassifying credit risk
- understand the different techniques used to evaluate credit risk, namely:
  - judgemental techniques
  - deterministic models

– statistical models
- be able to set up and undertake the credit review process
- know the basic contents of a credit policy manual.

1.1   Introduction

> The company is fundamentally sound. The balance sheet is strong. Our financial liquidity has never been stronger… My personal belief is that Enron stock is an incredible bargain at current prices and we will look back a couple of years from now and see the great opportunity that we currently have.
>
> Enron Chairman Kenneth Lay on 26 September 2001 in an online chat with employees, as reported by Reuters. Less than three months later the company filed for bankruptcy.

As the quotation above indicates, a transaction – in this case buying a firm's stock (or shares) – exposes the buyer to unforeseen outcomes. While buying stock can be considered inherently risky, in that you are taking a chance on the firm's performance, most firms have similar problems: to gain orders, they may need to lend money to customers through granting credit terms on sales; they may ask other firms to undertake work on their behalf; or they may place surplus cash on deposit with a financial institution. Hence, as a result of transactions of various kinds, **credit risk** and **credit risk management** are key issues for most firms.

The possibility that a contractual arrangement is not adhered to means that there is a risk of non-performance. This has the capacity to hurt the objectives of a firm when what it considered will happen, in fact, does not. Money can be lost if the customer fails to pay or if the financial institution in which money is deposited goes bankrupt. Companies with whom the firm has placed orders may themselves become insolvent and fail to deliver on their promise.

Credit risk can be defined as 'the potential that a contractual party will fail to meet its obligations in accordance with the agreed terms'. Credit risk is also variously referred to as **default risk**, **performance risk** or **counterparty risk**. These all fundamentally refer to the same thing: the impact of credit effects on a firm's transactions. There are three characteristics that define credit risk:

1. Exposure (to a party that may possibly default or suffer an adverse change in its ability to perform).
2. The likelihood that this party will default on its obligations (the default probability).
3. The recovery rate (that is, how much can be retrieved if a default takes place).

Note that, the larger the first two elements, the greater the exposure. On the other hand, the higher the amount that can be recovered, the lower the risk. Formally, we can express the risk as:

$$\text{Credit risk} = \text{Exposure} \times \text{Probability of default} \times (1 - \text{Recovery rate}) \qquad (1.1)$$

Given the above, credit risk management is the process of controlling the potential consequences of credit risk. The process follows a standard risk management framework: namely identification, evaluation and management. That is, the cause of the risk has to be identified, the extent of the risk has to be evaluated and decisions have to be made as to how this risk is to be managed.[*]

1.1.1 Credit Risk

What is credit risk? Well, the easiest way to consider credit risk is to think of your own situation. Take the case where an acquaintance, someone you may have known at school or in a social situation, turns to you and asks you to lend them some money. Not a trivial amount to pay for their bus fare home but a sufficient amount so that, if they do not repay you as promised, you are left significantly out of pocket. What do you do? Do you lend the individual the money? They may not repay you. Therefore, it is better to refuse. Then again, you may lose out on a possible profitable opportunity.

The crux of the decision is whether the individual honours the promise to repay or defaults. The desirable result is that the loan is repaid (with interest). The undesirable outcome that you wish to avoid is that the individual fails to repay the loan or, in the parlance of credit, **defaults**.

Note how the example raises all sorts of issues. If you knew the individual better, you might be more inclined to go with the lending decision (that is, if you knew the person's circumstances and their ability to repay). The past experience of others who have lent money to the individual might be useful to know. You may also wish to compare the individual to others who have borrowed money in a similar situation. As a result, you may be able to obtain a statistical estimate of the likelihood that the individual will repay you (or, equivalently, will default on the loan).

Your views as to whether you would be wise to lend the money to this acquaintance might change if the individual produced a guarantee to support the loan, or some collateral (that is, something you could call upon if the individual were unable or unwilling to meet the obligation).

Whatever your thoughts, the decision requires you to make a judgement on the uncertain future outcome. This might take the form of a gut feeling (or what professionals would term **expert judgement**), or you might be able to rely on a formal assessment model.

In commerce, every time an individual or a firm borrows and hence makes a promise to pay, a financial asset is created. This promise can be informal and take the form of a verbal agreement or can be based on a formal written contract. The promise can involve the purchase of an asset, product or a service from the provider. The promise can also be, as in the above example, to repay a loan. Regardless of the purpose of the transaction, the value of the promise will depend on the ability and willingness of the person or firm to make good on the promise.

---

[*] The elective courses on *Financial Risk Management* and *Strategic Risk Management* examine the process of risk management in detail.

Some financial assets are backed only by the general credit and good faith of the borrower to repay. Others are backed by legal obligations that would force payment or the forfeiture of a specific asset. Such collateralised promises include liens, mortgages, leases and auto loans. Other contractual arrangements provide for a third-party guarantee and hence, because the guarantor is also pledging their credit, require analysis of both the initial party and the quality of the guarantee.

Box 1.1: What are Credit Events?

The market that has developed in credit risk transfer, known as **credit derivatives**, has led to the formalisation of what constitutes credit events. The following list gives the principal types as usually defined in the documentation for these instruments.

Bankruptcy or insolvency under corporate law: in this case the legal entity is dissolved, having been declared bankrupt or insolvent by a commercial court.

Credit upon a merger: assets are transferred (with a negative impact on the ability to pay) or the legal entity is consolidated into another company.

Cross-acceleration: other obligations of the legal entity become due prior to maturity owing to a breach of contract. (In debt contracts, covenants – which are legally binding requirements on the borrower – are breached, which leads to repayment being mandated.)

Cross-default: obligations of the legal entity have been declared in default. Under debt contracts, failure of one set of obligations to perform leads to the automatic declaration of other obligations to be in default, even if these obligations have not experienced any breach of contract (covenant).

Currency convertibility: foreign exchange controls in a particular country or countries prevent repayments in the affected currency or currencies. Note that currency convertibility is usually linked with currency risk. Country risk is the risk associated with lending to a particular country, whereas default risk is usually company specific.

Downgrade: the situation where an obligor has a downward, hence adverse, change made in the independently and publicly available credit opinion (known as a credit rating) on the obligor. This can include the cancellation of the available rating. A downgrade may lead to holders having to sell the obligor's debt securities.

Restructuring: the legal entity defers or reschedules outstanding debt(s): reduces the interest payable, postpones payments, changes the obligation's seniority or extends its maturity.

Failure to pay: the legal entity is not able to or does not make the contractual payment.

Government action: any action(s) by a government or an agency of government that results in outstanding claims becoming unenforceable against

---

the legal entity.

Market disruption: the situation where the tradable securities of the obligor cease trading.

Moratorium on debts: the legal entity declares a standstill on its existing debts and interest payments.

Obligation acceleration: a contractual obligation becomes payable before its due maturity owing to default by the legal entity. This is similar to, but not identical to, cross-default, since it refers to a direct obligation with an affected party (whereas cross-default refers to a third party).

Obligation default: an event of default has occurred in the legal entity's obligations.

Repudiation: the legal entity disaffirms or disclaims its debts.

1.1.2 Assessing Credit Risk

Assessing credit risk requires us to model the probability of a **counterparty** defaulting in full, or in part, on its obligation. We can picture the credit decision in terms of the basic risk management model. This involves a decision either (A) to extend credit, which provides a reward but entails a risk, or (B) to refuse credit. The situation facing the credit manager is shown as a decision problem in Figure 1.1. The requirement is to balance the gain from taking the credit risk by extending credit against the potential loss. In the decision problem the alternative is to refuse credit and not obtain any reward.
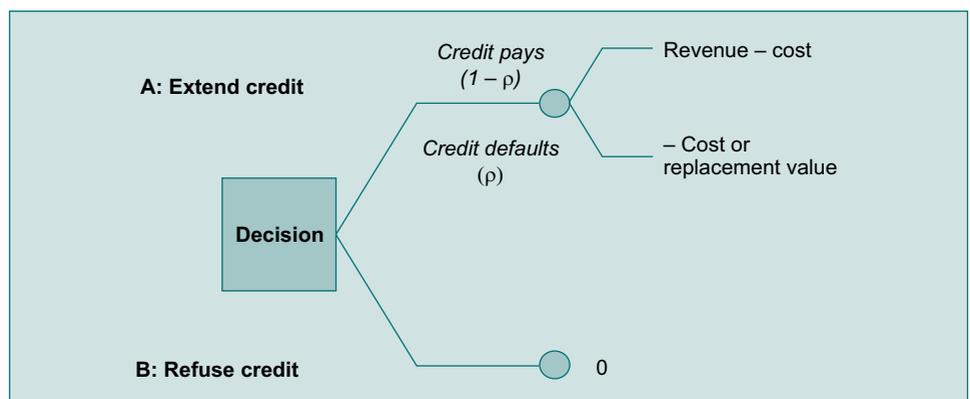
Figure 1.1   The credit decision as a decision problem

Note: In this model, boxes designate decisions and circles designate outcomes

The credit risk decision facing a firm relates to (1) the gain if no default happens against (2) the potential loss from extending credit based on the likelihood that default takes place and the amount that is lost if default occurs. The probability that the credit defaults is given as (ρ). There are only two possible outcomes: the credit performs according to expectations or the credit defaults. If the credit defaults, the

cost to the credit manager will be the cost or the replacement value for what has not been provided.*

For instance, in deciding whether to provide trade credit, a firm faces a decision as to which applications to proceed with; what limit to set on the amount of credit extended and whether this needs to be modified over time; what action should be taken if there is a delay in repayment; and which counterparties should be actively solicited for business.

Although the nature of the credit analysis decision can be readily described, the steps required to effectively manage the process are more complicated. In essence, the problem relates to the risk that counterparties will not honour their obligations when the moment comes for them to perform under their contract.

Determining which counterparty may default is the art of credit risk management. Different approaches use judgement, deterministic or relationship models, or make use of statistical modelling, in order to classify credit quality and predict likely default frequency. Once the credit evaluation process is complete, the amount of risk to be taken can then be determined.

In applying the decision model, the effect of credit exposure is measured by the cost of replacing the cash flows if the other party defaults. But losses do not arise only from failure to pay. Losses also result from credit risk when credit rating agencies downgrade firms or businesses. Where these obligations are traded securities, there is often a decrease in their market value. In addition, where the transaction is cross-border, **country risk** needs to be included in the risk assessment.

1.1.3　Additional Factors in Analysing Credit Quality

Credit risk has a number of sub-issues including **concentration risk** and **settlement risk**. Concentration risk arises when there are a large number of exposures to parties that share similar characteristics. Settlement risk arises when a clearing agent or third party processes transactions for other parties. Indeed, financial institutions have recognised the importance of measuring credit concentration risk in addition to the credit risk of individual loans. That is, they examine not only individual risks but also the total credit risk characteristics at the portfolio level.

Settlement risk is particularly important for financial institutions that process a large number of high-value transactions. Prior to 1974, settlement risk was not considered a major issue by banks until a small German bank, Bankhaus Herstatt, defaulted on interbank payment transactions after receiving payment from counterparties. Herstatt's failure prompted the establishment in 1974 of the Basel Committee on Banking Supervision (BCBS).†

---

*　Obviously, as per Equation 1.1, there is the potential for some recovery, so the cost is simply the amount times $(1 \times \text{Recovery rate})$. Higher recovery rates mitigate the credit risk.

†　This is the Group of Ten (G10) countries' coordination effort to set joint bank capital adequacy standards. The BCBS is situated at the Bank for International Settlements (BIS) in Basel, Switzerland. The BIS is colloquially known as the central banker's bank, since it acts as a clearing house for the major central banks in the world. See www.bis.org for further details.

As a business grows, a greater number of exposures are acquired, increasing credit risk. As the scale increases, it is necessary for the firm to consider how concentrated its portfolio of credit customers is. In particular, two sub-types of credit risk – **country risk** and **industry risk** – affect multinational enterprises. Country risk arises from having exposure to individuals and institutions in countries that have legal systems, business codes and standards that differ from those of the lender. There are four factors relevant to this. The first is **political risk**, which arises when a country's government is challenged externally or from within national borders. Political risk is more problematic in long-term lending agreements than for short-term transactions. An example of this problem is lending to countries of the former Soviet Union. Some of these countries are highly unstable politically, and a change of regime might mean that the new government repudiates or seeks to renegotiate contracts already entered into.

The second factor in country risk is **economic risk**, namely the depressed or declining economic stability in a country. In this situation it is sensible to question the quality of loans or credit to such a country and also to implement a limit to any such agreement. In 1997, for example, the South East Asian Crisis meant that both corporations and banks had to revise their policy towards counterparties in the affected countries.

The third factor is **currency risk**, which always arises with cross-border lending. If a British company extended credit to, say, an Australian company in Australian dollars and the value of the Australian dollar declined, the value of the debt, in British pounds, would decline if the loan had not previously been hedged to remove the currency effect.[*]

Finally, the fourth factor is the **enforcement risk** from the legal system in the debtor country. Because a creditor has to go through a foreign legal system, it has been known for debtors to use their domestic legal process to stall or attempt to avoid paying, claiming that rules from their home country apply.

Another important credit risk is **industry risk**, which is a form of concentration risk. This applies particularly when the domestic or international economy is in recession and the poor economic conditions particularly affect certain industries. Industry structure may have credit consequences because of the supply chain within which most firms operate. For instance, a steel producer is involved with car manufacturers. This has two important consequences. If car sales decline, this affects manufacturers of motor vehicle components, together with the car manufacturers. Consequently, a producer with all its output destined for one industry finds it impossible to avoid industry risk exposure to that industry.

---

[*] Hedging is the process of removing a risk through the use of financial markets transactions. A loan in Australian dollars could be hedged by using forward foreign exchange contracts to convert the future cash flows from the loan back into British pounds. Therefore, regardless of the future behaviour of the Australian dollar, the British company would be guaranteed a fixed amount of British pounds. These kinds of transaction are a common feature of the international capital markets. For a fuller discussion, see the elective course *Derivatives*.

1.1.4   Evaluating the Credit Decision

The decision model given in Section 1.1.2 provides a theoretical framework for assessing the risk. One approach to evaluating the risk is to work out the payoffs from the choices facing the firm (or individual). The *ex ante* payoff of the two situations is:

Extend credit: $\text{PV}(\text{Revenue} - \text{Costs}) \times (1 - \rho) - \text{PV}(\text{Cost}) \times \rho$ $\hspace{2em}$ (1.2)

Refuse credit: 0

The reward is the revenue earned less the costs; the risk is the full or partial loss if a default takes place. In evaluating the desirability of taking on credit risk, different situations will have different levels of risk based on (a) the probability of default (ρ) and (b) the amount of loss that is expected or actually incurred. Thus lending, for instance, has a higher exposure (the amount at risk) for the same sized contract than does entering into an off-balance-sheet derivative agreement such as a swap. If a firm goes into liquidation, the loan might be an almost total write-off, but the risk on the swap relates to the difference between the original value and its replacement cost. Part of the evaluation process therefore needs to calculate the exposure that will arise if default takes place, and this exposure needs to be controlled by setting overall **credit limits** per individual counterparty and by industry type and country, if applicable.

Firms gain a reward by accepting the risk that the credit may default. Alternatively, nothing is hazarded if credit is refused. Since most organisations have to take risks to earn a return, the decision is slightly more complex than this simple model would suggest. In their day-to-day activities, firms seek to trade off credit risk against the potential gains and losses. These arise not just from accepting bad credits but also in rejecting good ones.

At this point it should be noted that modern finance theory suggests that rejecting credit is not necessarily the appropriate response to poor credit quality. The tenets of modern theory about risk postulate that the required return should be adjusted for the risk taken. If the risk has been correctly estimated, then, for large organisations over the medium term and where portfolio diversification effects apply, losses will be compensated by gains elsewhere. Finance theory would, in addition, suggest that only the systematic risk component need be priced. One aim of the credit modelling process should be to provide estimates of the likely risk. The decision can then be made as to whether to provide a credit line at an appropriate risk-adjusted price to compensate for the risk or to find ways to reduce the degree of exposure but still enter into the transaction.[*] This is a more sophisticated approach than is used in most organisations, which tend to adopt a 'yes' or 'no' view to extending credit and also seek to control their exposure via limits on the amounts at risk.

---

[*] Note that such **risk pricing** is common in the banking industry, which tends to be at the forefront of developments in risk management.

For instance, if the company earns a margin of 20 per cent on sales, then it will break even; that is, it will be indifferent towards extending credit or refusing credit if:

$$PV(\text{Revenue} - \text{Costs}) \times (1 - \rho) - PV(\text{Cost}) \times \rho = 0 \qquad (1.3)$$
$$PV(20) \times (1 - \rho) - PV(100) \times \rho = 0$$
$$20 - 20\rho = 100\rho$$
$$20 = 120\rho$$
$$\frac{20}{120} = \rho = 0.167$$

So, with a probability of loss of 0.167, the firm is indifferent between accepting a credit risk and refusing it. Note that if the firm is risk averse then it will need an expected positive payoff to compensate it for risk taking.

The firm can do two things to increase its sales and yet not incur unacceptable credit losses. First, it can be indifferent to a higher level of losses if its margin is higher. If the margin were 30 per cent, then it would be indifferent at a loss probability of 0.23. On the other hand, if it can reduce its loss given default, say to 80 rather than 100, then again the firm can be indifferent with a loss probability of 0.2.

1.1.5 Errors in the Credit Evaluation Process

Two types of error can arise when evaluating a credit decision. The type I error is advancing credit to a lesser-quality credit (that is, a 'bad credit' that has mistakenly been classified as a 'good credit') and thereby incurring an unanticipated loss. The type II error arises from misclassifying a good credit as a bad credit and thereby forgoing an opportunity to earn profit. The different risks can be portrayed in terms of the actual credit quality (here simply called 'good' or 'bad' credit) versus the analysed credit quality, as shown in Figure 1.2.

Figure 1.2   The credit assessment problem

Note: The analysis of credit quality is in relation to the expected level of loss from credit effects

In practice, the credit analyst will devote more time to avoiding type I errors; that is, to assessing bad credits as good ones. The financial consequences of accepting bad risks that have mistakenly been classified as good ones are greater than if some good risks are mistakenly rejected. This is because the costs of extending credit in a situation where there is a credit event are far greater than the opportunity for profit forgone by refusing credit to the good risk. This is due to the uncertainties in loss recovery rates and the opportunity costs involved. That said, a credit evaluation model that habitually rejects high-quality good credits as bad means excessive opportunity losses from forgone business. Hence the probability of default of a particular kind of credit needs to be carefully factored into any analytic framework.

Box 1.2: Credit Class Default Rates and Class Transition

Information about credit losses is collected from a number of sources and firms, such as banks and consumer credit companies, whose business directly involves credit lending. Such firms keep records of their historical performance. Most of the information collated by individual companies is not in the public domain. However, the US credit rating agency Standard & Poor's does provide the default history for the companies it has rated.

Standard & Poor's classifies companies of 'investment grade' (that is, firms where there is a reasonable level of security) with a credit rating of triple-B (BBB) or above. The best-rated credits/firms are classified as triple-A (AAA). Firms or credits below triple-B (that is, double-B (BB) or below) are defined as 'speculative grade'. These firms have a higher likelihood of default over any given period.

Table 1.1 shows the cumulative default history for rated firms over time. These ratings relate to large, publicly traded corporations and their securities and hence may not be typical of the corporate sector as a whole, given the size bias. The table shows that there is a 0.0024 probability that a triple-B rated company (that is, a company classified at the lowest level of investment grade) will default over the coming 12 months. However, the cumulative probability of such a credit defaulting over 10 years is 0.0685. That is, over a 10-year period nearly 7 per cent of such rated companies are likely to default. Table 1.1 shows that credit risk increases with time and inversely to the creditworthiness of the obligor. Note that the risk rises asymptotically: a drop in credit class more than doubles the risk of default. So a firm rated single-A has a one-year probability of default of 0.0004, whereas for a firm rated triple-B the probability of default, 0.0024, is 6 times higher.

Table 1.2 shows the propensity of firms in a given class to change credit rating. This change of creditworthiness, as measured by ratings, is known as an 'upgrade' if the credit rating is raised or as a 'downgrade' if the credit rating is lowered. What is evident in the table is that a firm of a given credit quality is most likely to remain in its existing class, but there is some propensity, reflecting changes in the underlying corporate dynamics, for the company to change credit class. Note that the default probabilities for Table 1.2 differ

somewhat from those in Table 1.1 owing to the way the two tables have been compiled.

Table 1.1   Cumulative default rates (in per cent)

				Years			
Rating	1	2	3	4	5	7	10
AAA	0.00	0.00	0.04	0.07	0.12	0.32	0.67
AA	0.01	0.04	0.10	0.18	0.29	0.62	1.39
A	0.04	0.12	0.21	0.36	0.57	1.01	2.59
BBB	0.24	0.55	0.89	1.55	2.23	3.60	6.85
BB	1.08	3.48	6.65	9.71	12.57	18.09	27.09
B	5.94	13.40	20.12	25.36	29.58	36.34	48.81
CCC	25.26	34.79	42.16	48.18	54.65	58.64	62.58

Source: Derived from historical information from Standard & Poor's.

Table 1.2   Rating transition matrix (in per cent)

Rating at start of period (%)	Rating at end of period (%)							
	AAA	AA	A	BBB	BB	B	CCC	Default
AAA	93.1	6.3	0.5	0.1	0.1	-	-	-
AA	0.6	91.0	7.6	0.6	0.1	0.1	0.0	0.0
A	0.1	2.1	91.4	5.6	0.5	0.2	0.0	0.1
BBB	0.0	0.2	4.4	89.0	4.7	1.0	0.3	0.4
BB	0.0	0.1	0.4	6.1	82.7	7.9	1.2	1.5
B	-	0.1	0.3	0.4	5.3	82.1	4.9	7.0
CCC	0.1	-	0.3	0.6	1.6	10.0	55.8	31.6
Default	-	-	-	-	-	-	-	100.0

Source: Derived from historical information from Standard & Poor's.

If the analyst can correctly identify the credit quality of the counterparty, then steps may be taken to protect the lender. For instance, in the case of a financial institution that holds a loan, asset or instrument, or credit position with the counterparty, this may be closed out, insurance purchased, or the loan sold off to another (less perceptive) institution. For a supplier extending trade credit, a (high-risk) customer can be required to pay cash or provide suitable collateral to offset the credit risk.

1.2   Credit Assessment Methods

Given the decision to be made, it is necessary to analyse the credit in order to determine its quality. In the parlance of credit risk management, we would want to determine the counterparty's **creditworthiness**. This is an obligor's ability and

willingness to honour its agreement with the party extending the credit (that is, the party 'at risk' from non-performance of the legal entity).[*]

In order to establish the status of the counterparty, credit analysts will typically use a combination of financial or accounting data and non-financial variables, as well as a number of different models, or analytical tools. Some of the methods involve a subjective approach, such as judgemental methods; others are more systematic in that they use quantitative techniques to evaluate a credit against objective benchmarks. We can distinguish a number of different approaches and their underlying methodology, which are summarised in Table 1.3.[†]

Table 1.3 **Different approaches to the credit evaluation process**

Approach	Methodology
Judgemental methods	Apply the assessor's experience and understanding of the case to the decision to extend or refuse credit
Expert systems (e.g. lending committees)	Use a panel approach to judge the case or formalise judgemental decisions via lending system and procedures
Analytic models	Use a set of analytic methods, usually on quantitative data, to derive a decision
Statistical models (e.g. credit scoring)	Use statistical inference to derive appropriate relationships for decision making
Behavioural models	Observe behaviour over time to derive appropriate relationships for reaching a decision
Market models	Rely on the informational content of financial market prices as indicators of financial solvency

---

[*] Note that, in some kinds of transactions, the credit risk goes in both directions. So, for a swap transaction (that is, an off-balance-sheet instrument involving a future exchange of contractual cash flows), the performance risk lies on both sides. That said, in most cases credit risk is carried by one of the parties to the transaction.

[†] A detailed discussion of these models is undertaken in later modules of this course.
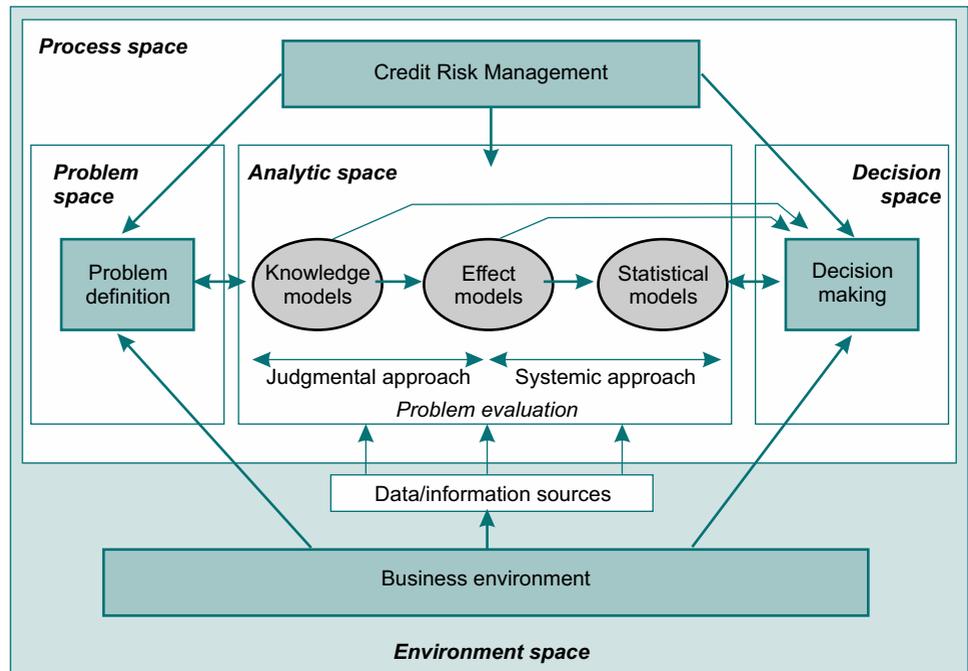
Figure 1.3   Credit evaluation process

One way to characterise the credit risk management process is shown in Figure 1.3. The schematic should be seen as a continuum from left to right, where the first step is to define the problem. In most cases this is simply a no-default/default variable. In some applications, it might be more complex, since we may want to monitor and evaluate changes in credit quality and not simply non-performance. Irrespective of how the problem is defined, the problem is then analysed. The different methods given in Table 1.3 can be mapped into the analytic space. These require data and/or information from the business environment (for instance, company reports, news reports, financial statements, market prices of the firm's securities, payment history and so on). The different analytical approaches can be loosely grouped into (1) knowledge models, which have a degree of subjectivity (for instance, the use of expert judgement by an analyst), (2) effect models, which combine some elements of subjectivity and systemic analysis (ratio analysis would fall into this category), and (3) statistical models, which can be considered more systemic in approach (credit scoring models are of this kind). The results of the analysis are used in the decision space, namely to reach a decision as to whether to grant, or not grant, credit.

A detailed analysis of the structure and characteristics of the various models is reserved for later modules of this course.

> ## Box 1.3: Wise Advice on the Credit Decision Process from Lenders
>
> Rouse (2002), in his book on bank lending, suggests that the professional credit risk manager apply the following 'lending principles' to the credit decision:
>
> - Take time to reach a decision.
> - Do not be too proud to ask for a second opinion.
> - Get full information from the customer and do not make unnecessary assumptions (i.e. do not lend to a business you do not fully understand).
> - Do not take a customer's statements and representations at face value and do ask for evidence to support the statements.
> - Distinguish between facts, estimates and opinions when forming a judgement.
> - Think again when your gut reaction suggests caution, even though the factual assessment looks satisfactory.
>
> Rouse argues that adherence to the above principles facilitates well-informed, thoroughly analysed and documentary-supported credit decisions. At the same time, in implementing the credit decision process, Rouse also considers it important to avoid unnecessary bureaucracy and delays.

The basic methodology behind classifying credit risk is to undertake financial detective work in order to determine the likelihood of default. Because analysing firms is a complex, multidimensional process, this likelihood is often not normally expressed as a probability but rather as an opinion. The process can be divided into two principal areas: **qualitative assessments** and **quantitative assessments**. These are then often combined to produce the credit assessment. Note that, although they are described as separate activities, the two are usually carried out in parallel, insights gained from one aspect of the examination leading to investigation in the other. So while the different methods used to assess credit quality are discussed separately, they are often combined in the decision-making process.

1.2.1   Classifying Risk and Predicting Default

For operational purposes, it is often the case that the credit assessment is used to classify a particular firm into a given credit class. These are called **credit ratings** or **credit opinions**. Different commercial credit assessors and firms using their own credit assessments use different rating systems. The rating system used by rating agencies such as Standard & Poor's has four categories of investment credit quality and three categories of speculative credit quality. The intention is to group cases in a consistent way such that, for decision-making purposes, all firms in a particular group will be treated as equivalent.

Since all firms within a particular group can be considered as having the same degree of creditworthiness, the group experience can be applied to any new credit being analysed. The process is shown schematically in Figure 1.4.
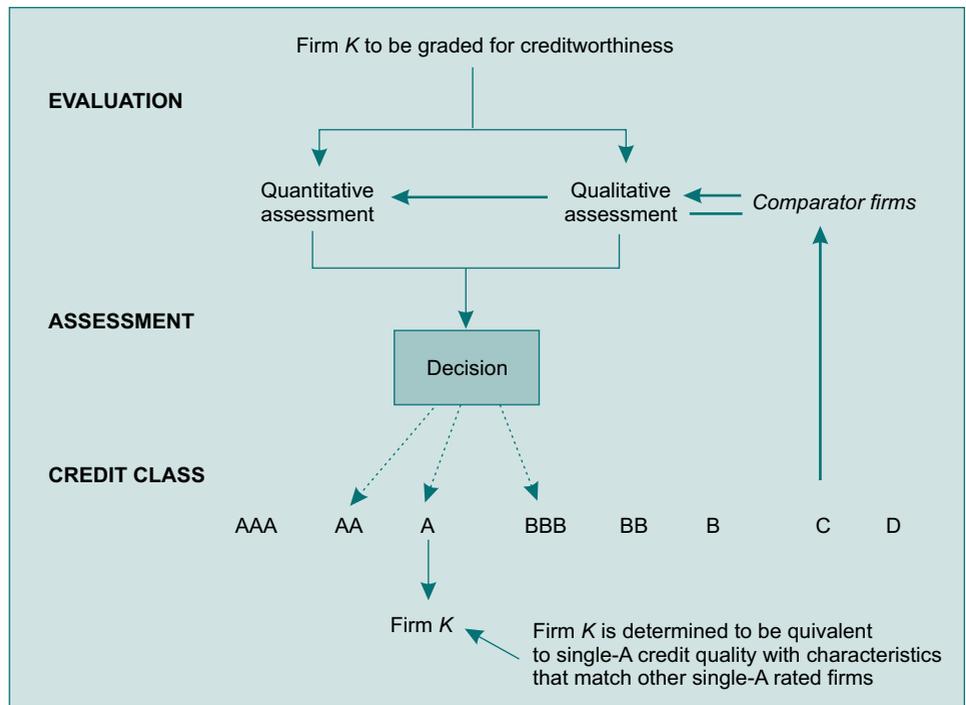
Figure 1.4   **Classifying credit quality**

The procedure in Figure 1.4 is for a particular firm (*K*) to be analysed – in this case using both a formal quantitative approach and a more judgemental qualitative approach in order to determine its credit category. In doing so, it is compared to similar firms whose credit quality has already been determined, and hence the firm is deemed to be like a particular type of credit for default prediction purposes. In Figure 1.4, firm *K* is categorised as having a single-A creditworthiness and hence (referring back to Table 1.1) would have a one-year default probability of 0.0004.

Given different default rates and types of firms, the number of classes of credit quality can be greater or fewer depending on the granularity of the model. For instance, many banks use a scale of 10 credit classes, with the highest credit quality being that of the state of the country of incorporation and the lowest being default.

1.2.2   Qualitative and Quantitative Credit Assessment Methods

As the previous section indicates, there are a number of approaches to the evaluation of credit. We can categorise the list in Table 1.3 into four categories, which are, to some extent, overlapping. We can consider these to be (1) expert systems, (2) rating systems, (3) credit scoring models, and (4) market-based models. In practice, credit analysts use a combination of methods to evaluate firms and to predict their future creditworthiness

The first method is **expert systems**. These range from the simple judgement of the credit analyst to more formal models. Some of these involve templates or processes. Expert systems or qualitative models are based on judgements as to what

constitutes good and bad credit quality, a typical model of this type being the commonly used **6 Cs of credit**.* Such models have been built up over time based on individuals' and organisations' collective experience of the credit process and are reflected in a set of operating procedures. Although not rigorous, such models can be useful in complex situations and as checklists when carrying out an assessment.

One important area for the use of expert systems is in financial analysis. This is the process of examining the financial statements of a firm with a view to understanding the nature, activity and risks that are inherent in the business. When formalised, the use of expert systems tends to be combined with the second approach, **rating systems**, where the credit quality of a firm or an individual is categorised into a pool of cases that are considered to have the same degree of creditworthiness.

For instance, Dun & Bradstreet, the credit reporting agency specialising in analysing small and medium enterprises, publishes a composite credit appraisal based on firm size (defined as net worth) as a proxy for financial capacity and dividing firms within a given net worth band into 'high', 'good', 'fair' and 'limited' quality. These composite rankings are determined from a range of factors that have a bearing on credit quality, including elements such as number of employees, the firm's payment history and so on.

The **analytic model** approach is based on using financial information and makes use of accounting relationships that, when taken together, provide a picture of the credit quality of the entity. The best-known model of this type is the **DuPont system**, named after the company that developed the approach.

At a more systemic and formal level, rating systems develop into the third category of credit assessment method, known as **credit scoring models**. These scoring models provide a rating system that is formalised into a mathematical or statistical model, and all credits are assessed using the same data and methodology. As such, they are more rigorous and transparent in their approach than rating systems that still depend on judgement, although they are designed to provide the same level of decision support.

The statistical model assessment model is based on multivariate statistical inference techniques. In such models a large sample of good and bad credits are analysed in order to establish a differential equation. The best-known of these models is the **Z-score** method used for predicting the probability of corporate failure based on discriminant analysis techniques. Statistical models are also used in a more general process known as **credit scoring**.

The final category of credit evaluation models is **market-based models**. These are formal models, as with credit scoring models, but the information used to determine credit quality is derived from financial market prices. These models make use of the information processing that takes place in financial markets to model the probability of default. For example, if investors have reservations about the future creditworthiness of a particular listed company, they tend to sell the shares. This will

---

* These are discussed in Module 4 and refer to character, capacity, capital, collateral, conditions and compliance.

have the effect of reducing the share price as these concerns get translated into the market price. A credit assessment model that can capture this effect is using the combined understanding and information processing of all investors in the market. Thus this last type of model uses a wider information set than the first three.

Box 1.4: Analytic Templates for Credit Assessment

The process of credit assessment is discussed in depth in later modules. This section seeks to illustrate the judgemental method, which is inherently qualitative in its approach. It also demonstrates the many facets of credit risk. In order to facilitate analysis, to ensure that all key areas are addressed and to provide a consistent template for reporting, the practice is to group a credit's attributes into categories. These are often in the form of mnemonics. A popular judgemental template used in the banking industry is *CAMPARI and ICE*. This is, in essence, a summary of banks' good lending practices.

CAMPARI, which relates to the performance risk in lending, stands for:

C	character	(of firm and its managers)
A	ability	(of managers/directors)
M	means	(of repayment based on financial resources of credit)
P	purpose	(of credit)
A	amount	(in absolute and relative terms)
R	repayment	(how, when, likelihood)
I	insurance	(what will ensure repayment – if anything)

Character refers to the integrity of the business and its management. Honest borrowers of good character are more likely to meet their obligations.

Ability refers to the legality of the contract between the bank and customer. A company's directors must act within the legal authority granted to them in their Articles of Incorporation.

Means refers to the borrower's financial, technical and managerial means.

Purpose refers to the reason for granting credit, which must be unambiguous and acceptable to the lender. For example, an acceptable purpose would be borrowing to fund faster growth of a company.

Amount refers to the quantity of the loan, which should be sufficient to cover the purpose of the borrowing.

Repayment relates to the ability of the borrower to repay the loan, by considering the source of repayment. This repayment ability is obviously of critical importance in lending and should be demonstrated not through projected future accounting profits but from projected cash generation. In deciding the form of lending, a credit provider would also need to consider the repayment structure being considered, e.g. bullet (a one-off lump sum repayment of the principal) or amortising (that is, principal repayment

through instalments).

Insurance refers to a safety net that the bank can rely on if the loan is not repaid. This might be collateral or the security provided in the loan, the conditions under which the loan is granted or third-party credit enhancement.

ICE is the lender's rewards for assuming the performance risk and stands for:

  I   interest   (paid on borrowing)
  C   commissions   (paid to the lender)
  E   extras   (cost of granting credit)

Interest refers to a key factor, namely the overall interest cost to the customer. This will comprise two elements: firstly, the underlying cost of funds (which could be fixed at the outset or variable) and, secondly, the margin. It is usually the case that, the higher the risk of a transaction, the greater the interest cost. Note that in bank terms this is simply an application of risk pricing.

Commissions refers to all other fees, such as commitment fees, payable to the bank for agreeing to provide a facility for a particular time period.

Extras relate to additional hidden costs, such as legal fees, associated with the provision of a loan.

Note that the total return to the bank will be the interest margin earned between what it can borrow at and the rate it lends less the extras associated with granting the loan. The decision the bank then has to make is the same as that in Figure 1.1.

To summarise, for lending purposes the main reason for carrying out a credit assessment such as that in the template above is always to ascertain the solvency and creditworthiness of the borrower. This necessitates a multidimensional study of the industry the business is involved in, its management, financial situation and market position.

1.2.3   Credit Evaluation Process

When a new credit application arrives, it is analysed using one of the methods described in the previous section (such as the CAMPARI template). Any credit decision will be focused on the business, financial and structural risks, if applicable, and will keep the following key credit considerations in mind:

- The firm's **competitive environment** (positioning amongst peer group, innovation, brand image, relative cost position and other factors that impact on the firm's competitive advantage).
- **Industry risks**, namely technology, regulatory requirements, barriers to entry for competitors and possible substitutes.

- **Capital structure**, which would include, depending on the purposes of the credit analysis, the level of capital expenditure requirement, any off-balance-sheet liabilities, accounting and tax issues, debt leverage, repayment structure of debt, debt service capacity and the interest basis (that is, whether the interest payment is fixed or is priced on a periodically resettable basis).
- **Financial flexibility**, which includes elements such as financial needs, plans and alternatives, ability to tap capital markets, and debt covenants. Financial flexibility can include issues such as bank relationships, committed lines of credit, current and future debt capacity and other issues.

The analysis of the competitive environment and industry risks, coupled with the analysis of the bargaining power of suppliers and buyers, will give a clear picture of the forces shaping industry competition. This is often based on Porter's (1985) five forces analysis.[*] A firm's external opportunities and threats can be accounted for, recognising the firm's and the industry's product life cycle and future prospects.[†] An analysis of political, economic, social and technological aspects (known as a PEST analysis) can be undertaken to give a full picture of industry developments.

It is also very important to analyse the strategy a potential credit is planning to follow (for example, whether the firm intends to be a low-cost producer or use a differentiated or focused business strategy) and to examine the quality of its management team (perhaps one of the most important aspects of creditworthiness), its brand, and other intangible factors that can determine the difference between success and failure of a business. Non-financial information used by credit analysts includes:

- a lender's own reports on reputation and experience of customers received from local market resources;
- reports prepared by credit appraisal agencies (if available), financial analysts, information providers or credit rating agencies and bureaus;
- environmental risks reports; and
- call memos and reports prepared from on-site reports and relationship managers.

For more sophisticated analysis, it may be possible to investigate the likelihood of credit migration (that is, the risk of a credit downgrade over some given time frame) and the risk of default (which can be considered the uncertainty surrounding a credit's ability to service its debt and obligations).

Measures of **expected default frequency** (EDF) provide benefits in the evaluation process. They:

- offer a greater degree of accuracy in the evaluation of the credit risk;
- quantify risk for appropriate pricing and hence improve profitability (that is, having an estimate of the expected default frequency facilitates the use of risk pricing);

---

[*]   The five forces are industry rivalry, power of suppliers, power of customers, threat of substitutes and threat of new entrants.

[†]   High-technology industries are prone to major market shifts that can destabilise firms and lead to large write-downs in the economic value of assets that may have been used as collateral.

- focus credit analysis resources into those areas where they can add the most value; and
- provide early-warning indicators of serious credit deterioration.

Three factors in the business and capital structure of a firm contribute to a credit's **loss given default** (LGD):

- **Value of assets** in the firm. Namely, the market value of the firm's assets; that is, the discounted future cash flows of the firm generated by its assets.
- **Asset risk**: the uncertainty or risk value of the asset value; this is a measure of the firm's business and industry risks.
- **Leverage**: the extent of the firm's contractual obligations and claims on future cash flow. Higher levels of leverage increase the likelihood a firm will not be able to service its fixed obligations, such as debt and creditors. In the jargon of finance, such firms are deemed to be in **financial distress** and obligations of these firms are deemed to be **distressed debt**. Once a firm enters legal bankruptcy or insolvency proceedings, it is unequivocally in default.

The above factors affect credit risk because they affect the amount that can be recovered given default.

For consumer credit (when lending to individuals) there is not the same ready explanation of default risk. In consumer credit applications, factors such as home ownership (which may be considered a proxy for asset values) and lifestyle (married, single, children, length of time in job) may be seen as indicative of asset risk and leverage. However, while these partly explain default probability, there is no good underlying theoretical rationale. In the case of consumer credit analysis, analysts use variables that have been good indicators of credit risk in the past to predict future credit behaviour.

1.3   Expected Losses and Unexpected Losses

A key issue in understanding credit risk over time is the concept of **expected losses** and **unexpected losses**. The easiest way to understand these concepts is to illustrate them. In Figure 1.5, the loss history from credit defaults is shown over time. Using the historical time series, we have the expected losses, which is simply the average loss rate over time. That is, if we wanted to price for future losses, we would know that there was an expected loss rate (EL) to factor into our pricing. Typically, this is the average loss rate determined from past data on losses. However, there is also volatility in the loss rate. In other words, the loss experience varies over time. This variation might be due to chance and/or the underlying economic situation for the industry or for the economy as a whole, or as a result of other factors unique to the group of credits being analysed. Whatever the cause, this means that there is an element of unexpected loss if the actual loss experience differs from that predicted. This is known as **unexpected losses**. What Figure 1.5 shows is that, the wider the dispersion of unexpected losses, the greater the degree of risk from unexpected credit events. Hence it is not sufficient to know what the expected losses from credit events are; it is also necessary to know the distribution of such losses over time.
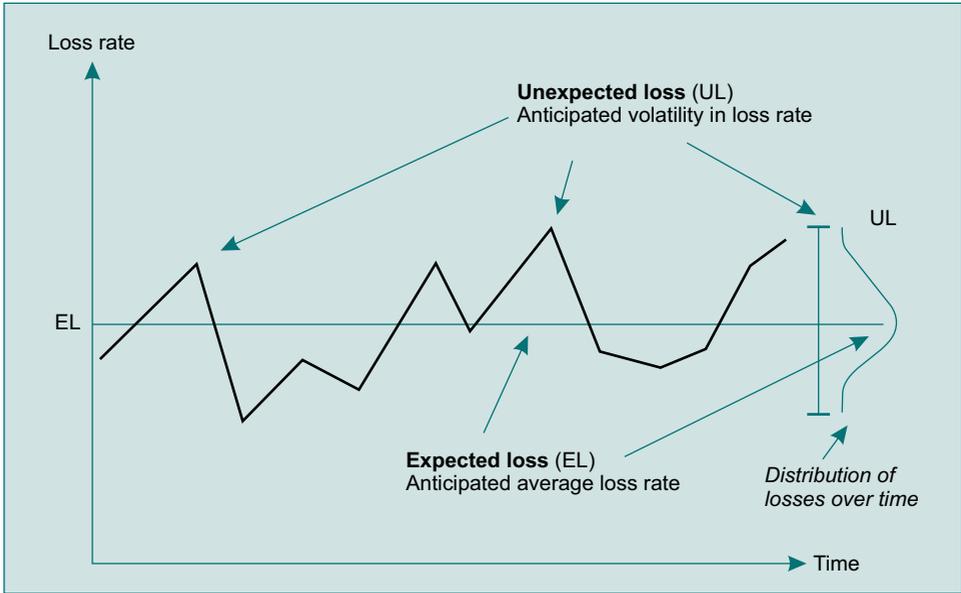
Figure 1.5　　**Expected losses and unexpected losses**

Box 1.5: Recovery Rates

If a firm suffers a loss, what recovery can be expected? At worst, there is a 100 per cent write-off of the amount due. At best, everything is recovered. Obtaining probabilities for default is difficult. Getting good estimates of recovery rates is harder still. There is no good publicly available source of such information. Some data on recovery rates can be obtained from traded securities. Historical estimates of recovery rates suggest that there is an expected loss regardless of seniority but that the median or average amount recovered increases with priority. Table 1.4 shows statistics for recovery rates on bonds and loans, as quoted by Altman *et al.* (2003).

Table 1.4   **Recovery at default of traded corporate bonds and bank loans**

Seniority	Number of issues	Median recovery (per cent)	Average recovery (per cent)	Standard deviation
Loans				
Senior secured	155	73.0	68.5	24.4
Senior unsecured	28	80.5	55.0	28.4
Bonds				
Senior secured	220	54.5	52.8	23.1
Senior unsecured	910	42.3	34.9	26.6
Senior subordinated	395	32.4	30.2	25.0
Subordinated	248	32.0	29.0	22.5
Discount	136	18.3	20.9	17.6
Total	1909	40.1	34.3	24.9

Notes to table: Data for bonds is from 1974 to 2003 and bank loans from 1989 to Q3 2003. Recovery rates are, for bonds, based on the difference in bond prices just after default and, for loans, 30 days after default.

An important issue is that, once a default occurs, although recovery can take place, there can be a considerable time delay between when the obligation was due and when a liquidator or bankruptcy court makes payment. Table 1.5 shows the ultimate recovery rates on bank loan defaults discounted for the time delay in repayments.

Table 1.5 suggests that even the best secured creditor, namely senior bank debt, is likely to suffer an average loss of 21.2 per cent. Given the high standard deviation of the data, a creditor could be confident of reclaiming only 28 per cent with 95 per cent confidence.[*]

---

[*] That said, the distribution is skewed since the series is bounded with the range between the minimum and maximum recovery being 100 per cent.

Table 1.5	Nominal and discounted recovery rates on bank loans and bond obligations			
Seniority	Number of cases	Ultimate nominal recovery (per cent)	Ultimate discounted recovery (per cent)	Standard deviation
Senior bank debt	750	87.3	78.8	29.7
Senior secured notes	222	76.0	65.1	32.4
Senior unsecured notes	419	59.3	46.4	36.3
Senior subordinated notes	350	38.4	31.6	32.6
Subordinated notes	343	34.8	29.4	34.1

Notes to table: Data is for 1988 to Q3 2003. The recoveries are discounted at each instrument's pre-default interest rate.

1.3.1   Catastrophic Losses

For solvency purposes a firm extending credit needs to know not just about expected losses and unexpected losses but also the potential for **catastrophic losses**. In Figure 1.6 we have two business activities that service different markets that, in turn, have different loss characteristics. Business 1 has a low level of expected losses but a long tail of large unexpected losses. Business 2, in contrast, has a higher level of expected losses but a lower element of unexpected losses. Modelling the loss distribution indicates that, at the 99 percentile level, Business 2 suffers less loss than Business 1.[*] Therefore, although expected losses are higher, the variability in losses for Business 2 is lower. As such, since expected losses are anticipated, whereas unexpected losses are not, Business 2 has lower credit risk than Business 1.

Note that there is also a corollary to the above, namely the existence of catastrophic losses. These are long-tail losses. For Business 1, while the expected losses are low, there is a relatively high incidence of significant long-tail losses above the 99 percentile level, due to the skewed nature of the loss distribution. These are known as **catastrophic losses** because of their potentially serious impact on the business. Business 1 has a much greater exposure to such exceptional catastrophic losses than Business 2, despite the latter's higher expected losses. When losses are expected, they can be priced into any transaction bearing credit risk. Unexpected losses, however, require a different approach. Therefore, it is necessary for credit management purposes for the analyst to understand the full distribution of credit loss in order to effectively manage the inherent credit risk.

The issue of catastrophic losses arises where there is a concentration of credit in a particular industry, to a particular country and/or to a particular type of debtor. This is because such exposure is likely to have a common underlying risk factor.

---

[*]   The 99 percentile level means that all but 1 in 100 losses will be less than this amount. The remaining 1 per cent will be higher than this.

That is, loans across the portfolio are highly correlated and will tend to behave in the same manner. For instance, firms lending to Argentina are exposed to common factors that affect less-developed countries (LDCs) and Latin America, and to internal economic and political developments in the country itself.
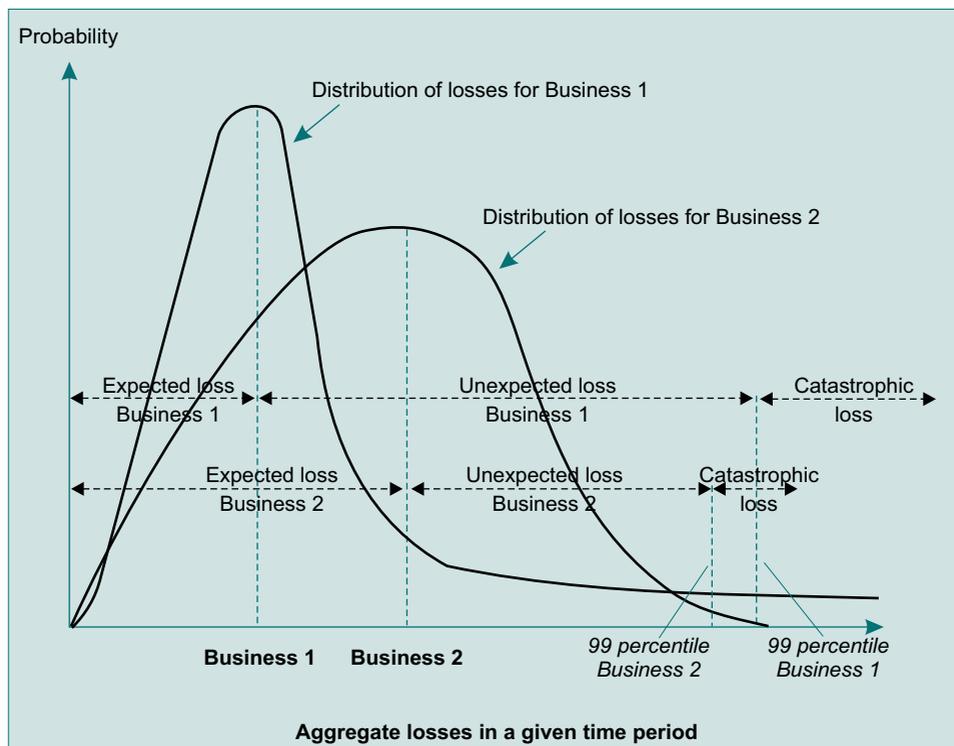
Figure 1.6   **Loss distribution showing expected losses, unexpected losses and catastrophic losses**

1.3.2   Credit Evaluation and the Business Cycle

Credit losses may be cyclical in the sense that credit events are more likely in periods of economic downturn. Hence it is important to understand what is being analysed and how the resultant decision can be affected by the business cycle. Good credit anticipates changes in economic conditions.

It may be argued that the underlying aim of credit management should be to control the level of credit risk. In this model, the credit manager's key activity is to identify high-risk elements. For many firms making decisions about credit, an important issue is how the firm decides, during periods of above-normal profitability within an economic expansion (that is, when actual loss experience is below expected losses), whether a particular counterparty would be a high credit risk if its business was in decline or under adverse economic conditions. On the other hand, if a business is still profitable in recession, the chances of its survival and continued prosperity appear good.

The above is not a trivial point; a key contention raised by the Basel Committee on Banking Supervision (2000) was that a major cause of serious banking problems is 'directly related to lax credit standards for borrowers and counterparties, poor portfolio management, or a lack of attention to changes in economic or other circumstances that can lead to a deterioration in the credit standing of a bank's counterparties'.

1.3.3 Relevance and Timeliness

In order that market participants receive up-to-date information concerning the prospects of a business or company, information must be released at regular intervals. Transforming this information into the credit assessment process is a major element of maintaining credit quality. This is particularly the case with credit exposures that arise during the normal course of business. Given that the financial status of credits can change over time, it is important to use up-to-date information and to review new information on a timely basis.

In terms of the management of credit exposures, this necessitates a reporting process that updates exposures when new information is available and that monitors developments over time. Typically, for matters such as trade credit, this takes place every month, or even more frequently. For longer-dated exposures such as the loans banks make to customers, the review process is likely to be once a year.

1.3.4 Comparability

Comparability of credit risks between individual cases is desirable from a processing perspective and to facilitate cross-credit analysis. However, different assessors often adopt different terminology, use different criteria for ranking firms and individuals, and define non-performance in different ways. In addition, companies that are incorporated in different jurisdictions are subject to differing national accounting practices. For example, the generally accepted accounting practice in the UK (UK GAAP) requires goodwill to be written off, whereas under US GAAP goodwill can be amortised over the useful life of the asset. This means that the financial statements of firms in the two countries are not fully comparable.[*]

1.4 Controlling Credit Risk

A key issue for credit risk management is controlling risk. The traditional approach to managing credit risk, as discussed earlier, is to evaluate the risk by assessing the borrower's ability to repay. This involves examining historical financial statements of the counterparty and projecting future ability to pay. The core issue is whether the credit officer in the firm believes the counterparty can reasonably expect to meet

---

[*] The movement to a common reporting standard, known as International Financial Reporting Standards, or IFRS, should help reduce the problem, though there may continue to be some variations in the way different jurisdictions convert these to generally accepted accounting standards, in areas where the new IFRS rules provide a degree of latitude.

their repayments, in full and on time. The credit risk can be controlled in various ways, as discussed below.

As such, credit risk differs from other types of risk being managed in that, essentially, it is an event risk. An obligor will either be good or will be in default on its obligations. As mentioned earlier, there are variations on this: in some cases the credit risk management decision also includes the possibility of credit downgrades. For example, a bond fund may only be eligible to invest in investment grade securities. Any bonds that fall below this category would have to be sold and proceeds reinvested in eligible bonds. So such a fund is not just subject to default risk but is also exposed to changes in the credit standing of its investments. Any factors that can influence the value of the counterparty and affect the value of the transaction go by the generic name of **credit triggers** or **credit events**. Box 1.1 gave a list of such triggers identified by the credit derivatives market (credit derivatives are contracts used in financial markets for transferring credit risk from one party to another). The five most common are given in Box 1.6.

Box 1.6: The Five Most Common Credit Events

1. Failure to meet payment obligations when due (after any grace period and above any payment requirement specified at the contract's inception)
2. Bankruptcy (or moratorium for sovereign entities)
3. Repudiation
4. Material adverse debt restructuring
5. Obligation acceleration or obligation default

1.4.1   Managing the Loss Given Default

Managing the credit risk means managing the amount of loss if a default should take place, known as the **loss given default** (LGD). There are a number of different ways in which firms can do this. One method mentioned earlier is through the use of **collateral** and **collateralisation**. With this approach, the party taking credit provides a security against default. In the event of default, the lender has a claim on a specific asset of the borrower. The benefit (for the lender) from using collateral is that, in the event of default, the lender is spared the expense of the default process and dealing with the borrower's other creditors, assuming that the collateral pledged sufficiently covers the loan amount.

For example, it is a requirement in futures markets for all market participants to provide margin (also, interestingly enough, sometimes called a performance bond) when entering into transactions. This is a deposit that covers potential future losses and hence means that there is no performance risk to other parties in the futures markets.[*]

---

[*] This is an overstatement since there is the possibility that the margin is insufficient to cover future losses. However, to take account of this potential additional risk, a futures exchange and its clearing house (which undertakes to act as the counterparty to the futures transactions) will both be well capitalised and counter-indemnified against losses by the brokerage firms that trade the market through an insurance fund. To date, these credit-reducing institutional structures have stood the test of a number of major market crises (such as the October 1987 market crash) without failing, and hence, as

As well as collateral, a lender should be interested in the total level of a borrower's capital. The reason being that an adequate supply of capital provides a cushion against bankruptcy or insolvency, should the credit experience temporary losses. Where a particular credit is unacceptable due to its high risk of non-performance, it is possible in some cases to obtain a **credit guarantee**. This is third-party insurance that, in effect, underwrites the risk of default. Such guarantees are often requested when borrowing is being undertaken by a subsidiary of a company that is thinly capitalised (that is, the subsidiary is mostly financed via debt) and the parent company is then asked to guarantee the transaction.

Another approach, common in derivatives transactions between major banks and other financial institutions, is to reduce the exposure via **netting agreements**. In such an agreement only the net proceeds rather than gross proceeds are due to the other party. So, for instance, in a swap contract, one party is due to pay a sum to the other, conditional on receiving in return the contracted payment by the other party. With a netting agreement only the difference is paid across. Hence where there are a large number of positions between the two parties (this may be because both are active market makers) only the net sum of the long and short positions in the swap contracts with the counterparty is paid. Note that some of these contracts will have a positive value (an asset) while others will have a negative value (a liability). By using netting agreements, asset positions (which carry credit risk on the other party) can be offset against liability positions (where the position is reversed).

Since 1993, when the first **credit derivative contract** was transacted, there has been a growing market in off-balance-sheet transactions that transfer the credit risk from one party (the protection buyer) to another (the protection seller) so that all the credit risk of the particular reference asset is transferred to the protection seller.[*]

> **Box 1.7: The Seven Stages of Credit Risk**
>
> **Stage 1: We only make good loans**
> Credit approval, monitoring and pricing decisions are decentralised and judgemental. Good loans are accepted; bad ones rejected.
>
> **Stage 2: Loans should be graded**
> The relative riskiness of loans is formally recognised, with three to four grades for good loans and the same for bad. But, due to grade definitions, most good loans fall into one category.
>
> **Stage 3: Return on equity is the name of the game**
> Business unit managers receive bonuses linked to their unit's return on equity (ROE) performance. But measurement techniques lack the appropriate adjustments for credit risk and this can lead to managers originating many high-yielding (and high-risk) assets too cheaply.

---

a result, market participants consider there to be little or no credit risk from trading futures. Note that, if required, the exchange also has the right to request additional margin from market participants (for instance, during a period of unexpected market instability) in order to strengthen the degree of protection.

[*] For a full discussion of the economic function of such off-balance-sheet instruments see the elective course *Derivatives*.

Stage 4: We need to price for risk
Key risk measurement advances allow successful implementation of the ROE culture. These include expanding the loan grading scale to ten levels, each explicitly calibrated to an expected loss level, and introducing different risk adjustments into the customer, product and business line profitability measurement systems, based on unexpected losses.

Stage 5: Manage the loan book like an investment portfolio
Modern portfolio theory is applied to the management of the loan book. A portfolio manager and statisticians are appointed. But this can lead to conflict between customer-focused functions and portfolio managers, while initial results may be disappointing if model inputs are inaccurate (as they are likely to be).

Stage 6: Our shareholders demand risk/return efficiency
Advances – including better risk discrimination (say, 15–20 grades), appropriate default correlation measurement, and implementation of techniques to quantify unexpected loss contributions – allow the setting of limits on exposures and volatility, target weights for sectors and expected asset returns.

Stage 7: Diversification is paramount
Portfolio management realises that diversification is paramount to achieving risk/return efficiency. This may lead to conflict with customer-centred functions, which benefit from larger transactions and specialisation. The conflict can be resolved by a formal separation of portfolio management and origination.

1.4.2 Diversification

Diversification is a fundamental ingredient in financial risk management since it allows the credit grantor to spread its risk. Although one must accept that all commercial and consumer loans exhibit some degree of credit risk, **diversification** can significantly reduce the risk. If such risks are uncorrelated, a portfolio of just 10 separate credits of 10 000 versus one credit of 1 000 000 will have a significantly lower risk of loss. If the probability of a loss is 0.2, there is no recovery given loss (to simplify the analysis), and the correlation between loss events in the portfolio is zero, then the expected value from having just one credit exposure will be as shown in Table 1.6.

Table 1.6   Expected value with one credit exposure

Probability	Payoff	Expected value
0.2	0	0
0.8	1 000 000	800 000
		800 000

A spreadsheet version of this table is available on the EBS course website.

The standard deviation (σ) of the loss will be:

$$\sigma = [(0.2)(0 - 800\,000)^2 + (0.8)(1\,000\,000 - 800\,000)^2]^{\frac{1}{2}} = 400\,000 \qquad (1.4)$$

If we now have two credit exposures for the same amount, the expected value remains the same, as shown in Table 1.7. Now there are four possible states of the world: both credits default with probability of 0.2, but using probability arithmetic this joint probability is $0.2 \times 0.2 = 0.04$; there are two states of the world where one credit defaults and the other is good $(0.2 \times 0.8) \times 2 = 0.32$; and one state of the world where both credits are good (0.8×0.8). In this result, the expected value remains unchanged at $800\,000$, but the standard deviation of the loss will now be lower, as shown in Equation 1.4.

Table 1.7   Expected value with two credit exposures

Probability	Payoff	Expected value
0.04	0	0
0.32	500 000	160 000
0.64	1 000 000	640 000
		800 000

A spreadsheet version of this table is available on the EBS course website.

The standard deviation (σ) of the loss with two credits that are not correlated will be:

$$
\begin{aligned}
\sigma &= [(0.04)(0 - 800\,000)^2 + (0.32)(500\,000 - 800\,000)^2 \qquad (1.5)\\
&\quad + (0.64)(1\,000\,000 - 800\,000)^2]^{\frac{1}{2}}\\
&= 282\,843
\end{aligned}
$$

As we add more credits, the expected value remains unchanged, but at the same time the standard deviation of the expected value is reduced. The effect on the standard deviation from adding more credits to the portfolio is shown in Table 1.8.

Table 1.8   Effect of diversification on the distribution of losses

Number of credits in the portfolio	Standard deviation of the portfolio
1	400 000
2	282 843
3	230 940
10	126 500
100	40 000

Simply put, the greater the number of credits in such a portfolio, the closer the actual loss experience will be to the expected loss experience. Diversification reduces the loss volatility of the portfolio (i.e. it reduces the extent of unexpected losses).

In order for diversification to be effective, it should include industrial, geographical and international factors. For example, there is evidence that, in past decades, banks made inadequate attempts to ensure their portfolios were well-diversified and such loan books had excessive concentration into credits that had common underlying risk factors; hence the loss experience was more volatile than diversification would have led the credit manager to expect.[*] For instance, banks had undiversified portfolios of loans as a result of making advances to different customers dependent on the same source of income. This would be the case in a farming community where loans were made to farmers and also to farm equipment suppliers. A domino effect could be triggered if farmers experienced hard times, affecting their ability to pay their suppliers and, in turn, affecting the suppliers' ability to meet repayments to the bank.

1.4.3 Covenants and Monitoring

A **covenant** is a restriction on, or requirement imposed on, the borrower, and agreed to under the terms of a contract. An example would be where a corporation borrows using a guarantee and the guarantor, to improve the financial stability of the borrower, requires them to conform to set conditions. These conditions, or covenants, as they are known, might include a minimum level of liquid assets or working capital, limits on dividends, or conditions requiring the borrower corporation to maintain the quality of assets pledged as collateral in the facility.[†]

It is common for specific covenants of the kind indicated above to be included in loan agreements to maintain or protect the capital level of the firm. These covenants are of three types: **affirmative covenants**, which require the contracted party to undertake certain actions (such as maintaining the value of the collateral); **negative covenants**, which restrict the actions of the contracted party (for instance, limiting the payment of dividends during the contract period); and **information covenants**, which require the contracted party to provide agreed information to the party at risk in the contract.

Covenants allow the lender or party at risk from credit events to take action. Ensuring that the contracted party is performing to expectations requires monitoring. This oversight aims to identify problems as and when they occur and to trigger the appropriate recovery process. A **breach of covenant** allows the at-risk party to take action, for example by allowing for acceleration of repayment, declaration of insolvency or the liquidation of collateral.

Consequently controlling credit risk requires the credit manager to actively monitor the financial condition of counterparties and be prepared to act, if conditions deteriorate. If a credit does get into difficulties (known as **financial distress**), then such problem accounts can be managed to maximise the amount that can be

---

[*]   Note that concentration in a portfolio is also colloquially known as a **hot spot**. Reducing the credit risk in such ill-diversified portfolios is one of the rationales for the development of credit derivatives.

[†]   Note that a lot of **trade credit** has no covenant protection being granted on 'open account' credit lines. Such trade credit is based on the standard contract used in commercial law and is only secured on the general willingness of the counterparty to repay. It ranks *pari passu* with all other unsecured credit in any winding-up of the company. Secured creditors (with access to collateral) would get priority.

recovered. In some cases, selling the amount due to a third-party specialist recovery firm removes the problem, although this is likely to be at a substantial discount to its contracted value.

By properly monitoring exposures, problems can be detected at an earlier, less critical stage, when there are still options open to solve the problem without incurring substantial losses. Good credit control uses a range of signals to try to identify such credits prior to the critical stage. Although firms differ in the exact way they would handle such a credit problem, all firms should have clearly laid-out plans for dealing with this kind of situation.

1.4.4 Risk Pricing

As mentioned earlier, correctly pricing the credit risk to take into account expected losses is important. The type of analysis discussed in Section 1.1.4 needs to be applied to situations involving credit risk.

For instance, banks must ensure that the loan rate (also known as the price of the loan) exceeds a risk-adjusted rate to compensate for expected losses and is inclusive of administration fees, establishment costs, the bank's desired profit and other costs of being in business. Therefore, under this model the loan rate would comprise the market rate of interest for the currency being borrowed, administrative costs, plus a risk premium to compensate for expected default. The less creditworthy a potential borrower is considered to be, the higher the risk premium.[*]

1.4.5 Loan Loss Provisioning

A common practice among financial institutions engaged in lending is to provision against expected losses. The provision of loan losses reserves is a mechanism used by such lenders to recognise in a timely fashion impending losses on troubled loans. The fact that a certain proportion of credits will default is acknowledged and accepted by financial institutions. In the same way, an industrial and commercial corporation would have a reserve for expected bad debts. Further, on occasions where changes in the business cycle or local factors have an adverse effect on the loan book or default experience, such reserves or provisions can be used to mitigate the consequences on the lender. For example, a downturn in a local economy may lead to defaults in real estate loans. These tend to occur in clusters due to the concentration effect of such loans. As a result, it may cause the lender financial distress to write off a considerable loss within one reporting period; hence the reason for the loan loss provisions. These protect the lender's earnings stream and smooth over the losses.[†]

---

[*] Note that, for a variety of reasons, in practice there is likely to be a loan rate above which a bank will not lend and hence a minimum credit quality that is acceptable. Acceptable credit quality borrowers are known as **prime**. Credit quality below acceptable lending quality is called **sub-prime**.

[†] It is a distinctive feature of financial reporting that firms can create provisions and set these against earnings and then release these provisions at a later date to be included in the reported earnings for that period.

Box 1.8: BIS Survey on How Bank Rating Systems Differ

Mixture of risk factors

Banks appear to consider similar types of risk factors when assigning a credit rating, but their relative importance and the mix of quantitative and qualitative considerations differ between banks, and even between different borrower types within the same bank.

Judgement versus modelling

Banks use different approaches to assign internal ratings. At one extreme are systems focused on the judgement of expert personnel, and at the other those based solely on statistical models. Each will probably require a different approach to supervisory review and validation.

Borrower versus transaction type

The vast majority of banks surveyed assign ratings based on an assessment of the borrower. Approximately half also consider the risk contributed by the specific characteristics of the transaction.

Use of information

The information gleaned from ratings is used in broadly similar processes at the banks surveyed, including management reporting, pricing and limit setting.

Quantifying loss

Data sources and techniques for quantifying loss characteristics per grade (default probability, loss given default, etc.) differ between banks. In addition, in those banks surveyed, they appear to have greater difficulty in attributing loss given default estimates to their exposures than in assessing default probability.

Differing definitions

Data providers and banks use differing definitions of 'default' and 'loss' in assigning ratings and quantifying loss characteristics, which represent a source of inconsistency and/or measurement error that will need to be considered in the credit risk management process.

Data availability

Data availability remains a challenge to banks' efforts to quantify risk, although some banks are making progress in collecting and analysing internal data for certain market segments covering the past few years.

Source: Basel Committee on Banking Supervision (2000). *Range of Practice in Banks' Internal Rating Systems*. Bank for International Settlements: Basel.

1.5   The Credit Policy Manual

Turning a credit evaluation process into a functional activity requires a detailed set of guidelines, procedures and processes. This goes by the generic name of a **credit policy manual**. Every firm that has a credit department or a credit manager needs to have a credit policy manual to formalise its decision processes regarding the day-to-day management of credit decisions and the resultant collection challenges when accounts are slow to pay, or fail to pay amounts when due. The thinking behind creating a manual, which is really a formalisation of credit risk management procedures, is to be able to recognise and detail policy on important credit risk management issues, and to ensure consistent thinking and action on these issues by people engaged in credit risk management.

As a document that formalises the management of credit risk, a credit policy manual should provide decision rules and guidelines on important aspects of the credit-granting process being performed within the credit department and as discussed in earlier sections of this module.

It is important to remember that, by formalising the credit risk management process in a set of procedures, this will affect other elements of a firm's operations, such as marketing and sales, the buying department and corporate treasury. Consequently, it will be a combined document based on agreed policies from the firm's senior management, sales and the other affected departments.

For the most part, credit policies will not change very often. However, as a matter of good practice, firms should review the manual annually, including in the review the views from senior management and affected departments, as mentioned above, to ensure that the procedures it details are up to date and reflect current thinking and practice.

No two companies will have the same set of credit risk management policies; however, the following list of components represents a typical set of policies that most firms would adopt to manage their credit exposures.

1.5.1   Credit Management Mission Statement

The **mission statement** will provide a summary of the overall objectives of the credit risk management process detailed within the manual. For example: 'The credit function's mission is to help sell the firm's products and services to customers using best practice credit risk assessment and collection procedures and services.'

The mission statement might include a statement about credit philosophy. For instance:

> The firm develops, markets and sells products and services within the home entertainment field. These products are generally high-margin and short shelf-life items. Because of the product and the nature of the industry, company management has maintained a credit philosophy of being liberal on sales and conservative on collections. This means that the company is willing to accept a larger degree of risk in order to make our product available to a wider audience.

1.5.2   Goals of Credit Management

In establishing the mission statement, the credit policy manual will set out the goals of the credit management process. This can be done by either listing specific goals or by making the goals more general in nature. These goals will be based upon many factors, including the company's credit philosophy (that is, its attitude to assuming credit risk by offering credit sales to customers). It will also be a factor in relation to sales targets and financial performance. Other factors, over which the firm may not have control, include competition in its markets and business conditions.

As part of the goals, there may be specific, observable objectives, such as setting a maximum number of days outstanding for credit items, collection systems, and the frequency of bad and doubtful debts. Note that such objectives will dictate the type and extent of credit risk being taken by the firm. For instance, if the company is seeking a low level of bad debts, it will most likely have to confine its credit to high-quality firms with low-default probability. This will impact on its ability to offer credit and hence grow sales with lesser creditworthy customers. Attitudes to credit risk will also dictate the frequency and scope of credit reviews of existing and prospective customers.

1.5.3   Responsibilities

As part of developing a sound process of credit granting, the various responsibilities and limitations on discretion of staff involved in credit risk management and credit granting have to be clearly laid out. As with many other types of operation, there is a potential conflict of interest between those individuals who are rewarded by creating new business and those who act to control risks. Hence proper lines of responsibility and awareness of these issues should lead to the separation of the credit evaluation and credit-granting functions.

Also, who finally signs off on a credit decision and who has the authority to override the normal criteria for acceptance and rejection needs to be thought through. Since refusing a credit application has important repercussions on customers and staff alike, it is important that all parties within the firm understand clearly who has responsibility and power to authorise. This is even more important in the case where an existing customer has to have their credit line withdrawn.

1.5.4   Credit Management Policies

The credit policy manual will provide a variety of policies and processes that govern the credit function, including credit terms, the processes required for opening new accounts, processing applications, methods and techniques for credit investigation, the creation and dissemination of credit reports, setting lines of credit, and other factors that are involved in the credit management process.

It should also include monitoring of accounts to ensure that they are compliant with credit terms and include issues such as collection policy and procedures and, for financial institutions, dealing with events of default. As with granting credit, the processes and approach that will be adopted in cases of delinquency need to be mapped out. For instance, in many banks, once an account becomes delinquent it is transferred from the relationship manager to a specialised unit whose function is to

maximise the amount that can be recovered from the credit. It should also be clear who within the organisation has the authority to initiate enforcement actions.

There will be criteria for transferring accounts between categories, namely good accounts, accounts that may be doubtful and defaulted accounts. The process for provisioning and writing off debts should also be detailed. For instance, the policy might be that non-paying accounts can be written off to bad debt only after the customer has filed for bankruptcy, gone out of business or been placed with a collection agency or collection attorney and no payments have been received for a period of six months.[*]

1.5.5   Additional Policies

Additional policies can be identified for issues such as compliance, regulation and the law regarding lending and credit. There should be criteria laid down for the exchange of credit information in order to obtain bank and trade experience, record keeping, credit organisations, customer visitation, travel, interaction with other departments, international credit, security and other costs of administering the credit department.

Box 1.9: Credit Implications of the Enron Collapse

The opening quotation of this module highlighted the fact that, even though Enron appeared sound and a good credit, it went bankrupt. Enron was a high-profile credit default partly due to its rapid change from being an acceptable counterparty to being in default, and partly due to the reasons that lay behind the firm's collapse. What impact did its demise have on its trading partners? Because of the huge amount of publicity surrounding the event, a lot of firms went public with their exposures and potential losses (before any recoveries) from the default. The default's impact on energy trading (that is, trading in oil, gas, coal and electricity, in which Enron was a major participant) could have seriously affected the market.

The International Swaps and Derivatives Association (ISDA), the off-balance-sheet derivatives trade association that establishes the legal relationships between counterparties in financial derivatives, and of which Enron was a board member, indicated that it considered itself to be confident that the effectiveness of its documentation, combined with the fact that energy markets were deep and liquid, would be sufficient for the market to continue post Enron.

US energy-trading firms at the time of Enron's default participated in a global market that was estimated to have a value of US$60 trillion. To facilitate trading and to minimise post-contractual disputes, the majority of transac-

---

[*]   Note that for many financial institutions, such as banks, that are subject to regulation there may be externally imposed criteria as to how to categorise bad and doubtful debts. For instance, the banking industry has a 90-day rule on overdue interest for determining whether a loan should be considered impaired and hence falls into the doubtful or bad debt category.

tions in the market derived their contractual documentation from Master Agreements, drawn up by the ISDA.

As one industry participant put it, commenting on Enron's condition and the likely impact on other parties, 'The benefits of netting are once again being appreciated.'

Of the energy companies that traded with Enron prior to its financial unravelling, the following firms reported on their counterparty exposures.

El Paso Corporation indicated its maximum natural gas and power net trading exposure to Enron was approximately US$50 million. The company further added that it did not expect any adverse earnings impact from Enron's difficulties.

Mirant announced that its current pre-tax exposure to Enron was approximately US$50 million to US$60 million. It also indicated that it had begun limiting its exposure risk early on in the Enron crisis.

Exelon Power Team's direct net exposure to Enron, based on the current book of business and existing market prices, was less than US$10 million and the direct gross exposure (i.e. for current energy sales from Exelon to Enron) was less than US$20 million.

St. Mary Land & Exploration had oil and gas production hedges coming due the current financial year to the magnitude of US$420 000. On a mark-to-market basis (that is, on a replacement cost basis), its 2002 undiscounted hedges on which Enron was liable to pay amounted to US$3.1 million and to US$650 000 in 2003.

Tractebel SA, the energy arm of Suez SA of France and Electrabel, Tractebel's European subsidiary, reported that they had anticipated Enron's situation and substantially reduced their exposure early on, resulting in a negligible Electrabel exposure and maximally covered positions for Tractebel, which operates mainly in the US.

RWE AG, Europe's fourth-biggest electricity company, said its open trading positions with Enron Corp. amounted to €8.9 million but had been much higher in the past.

What is evident is that trading firms in the energy market, when concerned about the creditworthiness of Enron as counterparty, reduced their exposures. In addition, because of netting agreements in place, such firms were only exposed to the net cash flows across all their transactions with the company. Such limited exposures by these firms indicated that they had considered the key issues in credit risk management and had adopted these in their trading procedures. As a result, these firms were able to escape the worst consequences that resulted from Enron's failure.

Learning Summary

This module has introduced the key concepts for managing credit risk. Credit risk arises from changes in the financial solvency of firms and individuals. An event of default occurs when the obligor fails to perform under the terms of the contract. In this case, the lender or party with the credit is exposed to a potential or actual loss. The degree of loss will depend on how much can be recovered given the credit event or default.

Many factors affect the potential exposure to credit events and hence credit-related losses. The key element in determining the acceptability of risk taking in regard to credit exposures is in assessing the probability of default. This involves analysing and assessing counterparties based on a variety of techniques. Even so, there is the potential for exposure to unexpected and – at times – catastrophic losses from credit events. For this reason, firms need to control these credit risks through setting out policies on evaluation, management and having the correct procedures in place.

Introduction

- Credit risk is the risk of loss from exposure to firms that undergo credit events. This might be that the obligor defaults, but in some cases it is that adverse changes in credit quality can lead to losses. There are a great many events that can have a credit impact, which complicates the definition, analysis and management of the process.
- Credit risk can be seen as an informational problem. The credit giver does not know enough about the quality of the credit taker and how the obligor will perform in the future.
- As a task, credit risk management involves identifying the source of risk, selecting the appropriate evaluation method or methods and managing the process. This will mean setting an appropriate cut-off point that balances the conflicting demands of the organisation with regard to credit exposure.
- Credit risk management can be seen as a decision problem. The assessment involves determining the benefit of risk taking versus the potential loss.
- Decisions about extending credit are complex and subject to change, but at the same time are critical elements of risk control within most organisations.
- While it is easy to outline the credit analysis decision, implementing an effective approach is more complicated. At its simplest, it requires an assessment of the likelihood that a particular counterparty will default on a contract and of the loss given default (LGD).
- As a process, credit decisions usually involve some classification of creditworthiness into categories or classes as a precaution against credit exposure to high-risk counterparties. This allows new credits to be analysed by comparison to pre-classified credits whose default history is known.

Credit Assessment Methods

- Credit appraisal can involve a number of techniques that can be used individually but are more often combined as part of the assessment process. These techniques can be categorised as either qualitative or quantitative in approach.
- There are basically three separate methodologies: judgement, deterministic models based on past experience or knowledge of the risks, and statistical models that may be either static or dynamic, or involve monitoring behaviour over time.
- Two basic methods exist for analysing credit quality: traditional quantitative–qualitative credit analysis and decision models based on deterministic or statistical processes. Each offers a different insight into the credit risk problem.

Expected Losses and Unexpected Losses

- In many cases, as with financial institutions, the amount of credit given by an organisation is substantial and requires steps to control the exposure in order to prevent unanticipated losses emerging.
- Unanticipated losses arise due to the variability of loss rates experienced over time, for instance as a result of changes in business conditions. If the loss experience in practice is above that expected, organisations will experience unexpected losses over and above those anticipated. This will happen as a result of variability in the actual loss rate against the expected loss rate.
- In some cases losses may be catastrophic, in that they far exceed any reasonable degree of variation that historical loss experience would indicate. Such losses can have a disproportionate effect on the organisations subject to such a risk.

Controlling Credit Risk

- The credit analyst or manager is required to understand the ways in which bad debts or credit losses arise and to devise methods for identifying these. This then requires that due consideration is given to how these are effectively managed.
- A key issue is credit control, which involves constantly managing the credit-granting process. This can be seen as a policy that includes procedures, guidelines and processes for managing the credit process.
- Diversification can play an important role in reducing exposure to unexpected and catastrophic losses. However, spreading risks will be effective only if the principles of efficient portfolio construction are followed. There is a danger that the portfolio is ill-diversified, leading to unexpected losses.
- As with all risk management processes, the exposure to credit risks has to be kept under constant review and action taken as required. Credit risk management is a dynamic process that responds to new information.
- Finding the links between a firm's financial condition, behaviour and default is the key skill required in the management of credit or counterparty risk.

The Credit Policy Manual

- This process of credit risk management is formalised in most organisations in a set of procedures generally called a credit policy manual.

Review Questions

Multiple Choice Questions

1.1   Which of the following is correct? Credit quality is:
   A.   the thoroughness of the assessment made on a particular counterparty.
   B.   the financial standing and solidity of a particular counterparty.
   C.   the reputation of a credit assessment firm such as Moody's Investors Service or Standard & Poor's.
   D.   the amount of cash on a firm's balance sheet.

1.2   The risk from default is made up of:
   I.   the probability that the firm will default.
   II.   the amount or value that is involved.
   III. the amount or value that can be recovered.
   IV.   the nature of the contract entered into.
   Which of the following is correct?
   A.   I and II.
   B.   I and III.
   C.   I, III and IV.
   D.   All of them.

1.3   Which of the following is correct? When analysing credit quality, the major danger from the assessor's perspective is:
   A.   analysing poor-quality firms as being good quality.
   B.   analysing good-quality firms as being poor quality.
   C.   analysing poor-quality firms as being poor quality.
   D.   None of the above.

1.4   Which of the following is correct? When a credit assessor refers to the credit's character, this means:
   A.   the reputation of the credit.
   B.   the credit's willingness to honour the obligation.
   C.   the credit's past activities that demonstrate good qualities.
   D.   All of A, B and C.

1.5 Which of the following is correct? Collateral is that element of a credit assessment that deals with:

   A. the security available when credit is extended.
   B. the knock-on effects that credit problems have for the lender.
   C. the increased rate applied to a loan to reflect credit quality.
   D. None of the above.

1.6 What is meant by 'concentration risk' in the context of credit risk management?

   A. The risk that a large number of counterparties default at the same time.
   B. The risk that a large number of counterparties share common risk characteristics.
   C. There is a strong positive correlation in the historical behaviour of credit-sensitive assets in a portfolio.
   D. All of A, B and C.

1.7 A company has a mark-up of 12 per cent, and a unit costs 80 to produce. At which of the following probabilities of default will the company be indifferent between accepting and rejecting a sale on credit grounds?

   A. 0.10
   B. 0.13
   C. 0.15
   D. The question cannot be answered from the information provided.

1.8 What is meant by 'settlement risk' in the context of credit risk management?

   A. It is the uncertainty about the amount recovered in any settlement of a bad debt by a lender.
   B. It is the risk that transactions processed through third parties fail to be completed on time.
   C. It is the uncertainty surrounding what is the true expected loss for a particular type or class of exposure.
   D. It is the tendency of a firm in a particular credit class to change class over time.

1.9 What factors in Enron's bankruptcy led energy-trading firms, which traded with the company, to avoid major losses?

   A. Their use of a credit policy manual.
   B. The existence of netting agreements on two-way transactions with Enron minimised their exposure.
   C. Inside knowledge of developments at Enron prior to its filing for bankruptcy.
   D. All of A, B and C.

1.10 If one accepts a _____ as a _____, the result will be _____ than expected _____.
   Which of the following is correct?

A. poor credit	good credit	higher	losses
B. poor credit	poor credit	higher	profits
C. good credit	good credit	lower	profits
D. poor credit	poor credit	higher	losses

1.11 What is meant by 'investment grade' in the context of Standard & Poor's credit rating classification system?
   A. It refers to all obligors given an A rating or above.
   B. It refers to all obligors given a BBB rating or above.
   C. It refers to all obligors given a B rating or above.
   D. It is a meaningless term within Standard & Poor's credit rating classification system.

1.12 In Table 1.1, a double-B credit has a one-year default probability of 1.08 per cent and a two-year cumulative probability of default of 3.48 per cent. What is the year 2 marginal probability of default (that is, the default probability for one year in year 2)?
   A. 1.08 per cent
   B. 2.40 per cent
   C. 3.48 per cent
   D. 3.52 per cent

1.13 Why does one observe that the likelihood of credit migration of an obligor in a given credit class, such as that given by Standard & Poor's, diminishes as the credit rating falls?
   A. This is false; there are no differences across ratings.
   B. It is simply a spurious characteristic of the sampling method.
   C. This is true; it is due to the fact that lower credit grades have a higher probability of default.
   D. It is simply a result of having a fixed scale where top-quality credits can only deteriorate in quality.

1.14 What is the difference between statistical models and market-based models?
   A. There is no difference between the two types of model.
   B. Statistical models use information on a particular credit for assessment, whereas market models use market-wide information.
   C. Statistical models use private firm- or individual-specific information, whereas market models use only publicly available information.
   D. Both models use firm-specific information, but market models use traded financial prices as inputs to the model.

1.15 Which of the following is correct? Firms within a particular credit class will:
   A. have similar expected default probabilities.
   B. have common financial conditions and size.
   C. be in the same or similar industries.
   D. All of A, B and C will lead firms to be in a particular credit class.

1.16 If average losses over the last six years have been $0.95 million per year and current-year losses are $1.12 million, which of the following is true?
   A. The distribution of losses has a dispersion of $0.78–$1.12 million.
   B. Losses from the current year are below expected losses.
   C. Losses from the current year are above expected losses.
   D. We cannot make any statements about losses from the information provided.

1.17 Which of the following is the most common credit loss event?
  A. Bankruptcy of the obligor.
  B. The failure to make payment when due.
  C. A material adverse debt restructuring.
  D. A debt repudiation.

1.18 What is a credit guarantee?
  A. It is an understanding by a counterparty to provide additional information for credit evaluation purposes.
  B. It is a third-party undertaking to make good any losses if the counterparty defaults on an obligation.
  C. It is a surety deposit placed with a third party, such as a bank.
  D. It is a form of credit insurance better known as 'credit factoring'.

1.19 Which of the following is correct? A netting agreement is:
  A. a way of encouraging debtors to pay early by offering a discount for prompt payment.
  B. an offset agreement where sums due and sums payable are set against each other.
  C. a special type of contract that allows party A with a liability to party B to net this against a payment due from party C.
  D. a concession in the corporate tax laws of most countries that allows for credit losses to be netted against corporation tax due.

1.20 In managing credit risk, what is meant by 'hot spots'?
  A. They are a collection of credit exposures that share common features and therefore reduce the benefits of risk diversification.
  B. They are the exposure to poor-quality credit obligors in a firm's credit portfolio.
  C. They refer to those industries that are in recession and hence suffer from above-average credit losses.
  D. It is a credit assessment mnemonic template that means 'healthy-or-troubled, security, provisioning, tracking and settlement'.

1.21 A portfolio has three credits worth 10 000 each. The probability of default of these accounts is 0.10, and if default takes place there is no recovery. The credits' performances are uncorrelated. What is the expected value of the portfolio?
  A. 21 000
  B. 27 000
  C. 28 770
  D. 29 000

1.22 In the previous question, what is the standard deviation of the portfolio?
  A. 1230
  B. 5196
  C. 24 345
  D. 28 770

1.23 What is a loan loss provision?
   A. It is an accounting entry for future expected losses.
   B. It is a charge against profits for recently reported losses.
   C. It is a discount made to future cash flows to reflect expected bad debts.
   D. It is a charge against profit before calculating liability for corporate taxes.

1.24 In the context of credit risk management, what is meant by risk pricing?
   A. It is an increase in the price to reflect expected credit losses.
   B. It is an increase in the interest rate charged by banks to their customers to cover expected credit losses.
   C. It is an evaluation of the price to charge a customer taking trade credit to reflect the probability of default.
   D. All of A, B and C.

1.25 What is meant by 'collateralisation'?
   A. It is the provision of security to support a transaction.
   B. It is when creditors to a defaulted company work together to minimise losses.
   C. It is a contract that bundles a credit-sensitive security with a credit derivative to remove the credit risk.
   D. It is a form of legal redress available to creditors when a firm goes bankrupt and fraud is suspected.

Case Study 1.1: Determining the Credit Risk of a Portfolio

A firm has four receivables outstanding and expects to maintain this number over time by replacing each transaction as it is paid.

The probability of default for each counterparty company is the same, at 0.15, and if default takes place then the firm expects to recover 40 per cent of the amount outstanding. The contract size for each credit is 100 000. The firm has a selling margin mark-up of 18 per cent on these transactions.

1 What is the expected value of the contracts and what is the standard deviation of losses for its portfolio under the assumption that the losses are independent?

2 The firm wants to be 95 per cent (1.96 standard deviations) certain it will achieve a minimum of 270 000 from the transactions. What should be its quoted selling price for these transactions to the nearest thousand? (Note that you will need to use trial and error to obtain the new selling price.)

References

Altman, E., Resti, A. and Sironi, A. (2003). *Default Recovery Rates in Credit Risk Modeling: A Review of the Literature and Empirical Evidence.* December, Working Paper, Stern School of Business, New York University.

Basel Committee on Banking Supervision (2000). *Risk Management Group of the Basel Committee on Banking Supervision.* September, p.1. Bank for International Settlements: Basel.

Porter, M. (1985). *Competitive Advantage: creating and sustaining superior performance.* New York: The Free Press.

Rouse, C.N. (2002). *Bankers' Lending Techniques* (2nd ed.). Chartered Institute of Bankers: Financial World Publishing, p.26.