

Five

Market risk

Objectives

This chapter will cover the following topics:

- ◆ market risk;
- ◆ interest-rate risk;
- ◆ foreign exchange risk.

5.1 Introduction

Market risk deals with the risks stemming from adverse movements in market prices or market rates affecting both on and off-balance-sheet activities. Market risk, in turn, can be subdivided into a series of other risks: interest rate risks, equity price risks, exchange rate risks and commodity price risks, to name just a few. Interest rate risk and foreign exchange rate risk on on-balance and off-balance-sheet assets that are not intended for trading are, however, managed differently and will thus be looked at separately in this chapter. Although market risk theoretically exists on every asset, from a risk management point of view it is only sensible to look at it for those products which have liquid and deep markets and where prices are readily available. In practice it is therefore common to calculate market risk only for those instruments that are revalued at frequent intervals, particularly for those that are revalued on a daily basis.

Unlike credit risk, market risk is not directly driven by probability of default. Instruments representing indebtedness, such as bonds, clearly contain credit risk

and their market price will reflect changes in it. But this is indirect, as changes in credit risk will change supply and demand, and therefore the price of the instrument. It is therefore appropriate to manage those instruments involving risks mainly driven by price changes separately as part of market risk management.

Market risk has risen dramatically in importance over the last 30 years and risk management techniques have become significantly more sophisticated as a result. As with risk management in general, this has been very much driven by the high level of instability in the environment within which banks operate. We have already touched upon the exchange rate instability that followed the breakdown of the Bretton Woods system of fixed exchange rates. Indeed the creation of the Euro was driven by the significant volatility of the legacy currencies over the years prior to its creation. The strains of the European exchange rate mechanism in September 1992, when both the Italian lira (temporarily) and pound sterling (permanently) were forced to exit the mechanism, was a symptom of the underlying problems. Similarly interest rate instability, caused by very high interest rates, had significant impact on asset prices.

Another development was technological change, which in turn led to the growth of debt and equity markets as access to them become global, rather than being restricted to domestic players. At the same time this has led to increased correlation between markets around the world, posing new risk management challenges to treasurers. Independently of whether this was driven by technological changes, reduced regulation or increased interconnection between financial markets worldwide, the result was that banks took on board many more risks than had previously been the case. Price volatility, whether in stock markets or commodities, only reinforced the need for improved market risk management.

It should also be noted that the 1996 'Amendment to the Capital Accord to Incorporate Market Risk', issued by the Basel Committee on Banking Supervision has given significant impetus to the management of market risk. It is sometimes also referred to as the market risk amendment. To some extent it has distilled best practice and this helped its implementation by banks that previously had not considered market risk as being that important. The amendment is, however, mostly concerned with ensuring sufficient capital is held by banks for market risk. As a result we will look at the market risk management separately from the market risk amendment.

5.2 Market risk measurement

Measuring and monitoring market risk mainly involves two techniques. 'Marking to market' refers to valuing (and revaluing) positions in marketable instruments on the basis of current market prices. 'Value at risk' methodologies take price changes to compute how much value is at risk on a normal or average trading day. Value at risk

has become an important management tool, but one that should only be used with knowledge of its limitations. Both techniques are closely linked to bank's trading books, although the techniques are beginning to be used in other areas. The term trading book is generally referred to as those assets that are managed with an intention of active trading, as opposed to holding an asset till maturity. The Basel Committee defines the trading book as a 'bank's proprietary positions in financial instruments (including positions in derivative products and off-balance-sheet instruments) which are intentionally held for short-term resale and/or which are taken on by the bank with the intention of benefiting in the short-term from actual and/or expected differences between their buying and selling process, or from other price or interest rate variations, and positions in financial instrument arising from matched principal brokering and market marking, or positions taken in order to hedge other elements of the trading book'.

Holding securities, or other assets, for trading purposes increases the need to constantly monitor price developments. This soon began to mean marking to market and it is reasonable to say that almost all assets in a trading book would now be expected to be marked to market from a risk management perspective.

5.2.1 Marking to market

Marking to market is based on the idea that the value of assets in a bank's trading book should reflect their current market value. The valuation tends to be done on a daily basis for most instruments, although for instruments whose prices are not so readily available some longer periods are used. Marking to market has a number of advantages over other valuation methods, such as historic cost accounting. To briefly recap, historic cost accounting is the method most commonly used in accounting, where assets remain on the books at the value at which they were originally purchased.

Marking to market, which can be linked to fair value accounting, provides relative objective and reliable means of valuing positions, as it is based on current prices. More importantly it facilitates accountability by making it harder for managers to hide profits and losses by applying subjective adjustments. At the same time it can be used to reveal profit and losses very quickly, which will again increase accountability of those managing portfolios. It can thus be used very effectively to give managers and dealers feedback on their investment strategies. For example, a failing strategy will make losses that highlight its failure, and this loss signal should enable managers to change strategy before their losses grow much further.

One of the consequences of marking to market is that it will increase the volatility of profit and loss reporting. This does, however, create better risk awareness and should therefore lead to improved risk management. Better risk management will not work, however, if it is not combined with certain controls to ensure the accuracy of the marking to market process. A key requirement here is that prices are checked

independently from the dealers and that dealers can have no input into the calculations. There have been several high profile instances where this simple control had not been implemented and where dealers were thus able to provide inaccurate prices with devastating effects for their organizations. This is particularly important as valuations are usually undertaken in the back-office, which in many organizational cultures means that it has less power to resist strong-arm tactics by dealers. A good example of this was again provided by Allfirst, which we have already mentioned.

5.2.2 Value at risk

Value at risk methodologies, generally referred to as VaR methodologies, attempt to measure losses due to normal market movements. It is calculated on the basis of statistical analysis at a given confidence level. Confidence levels used in practice are generally either 95% or 99%. The value at risk is thus the upper limit of price changes that would only be breached in either 5% or 1% of cases. In other words, a 95% confidence level would mean that one out of every 20 trading days would see market movements in excess of the limits suggested by VaR.

Figure 5.1: Confidence levels and variability of returns

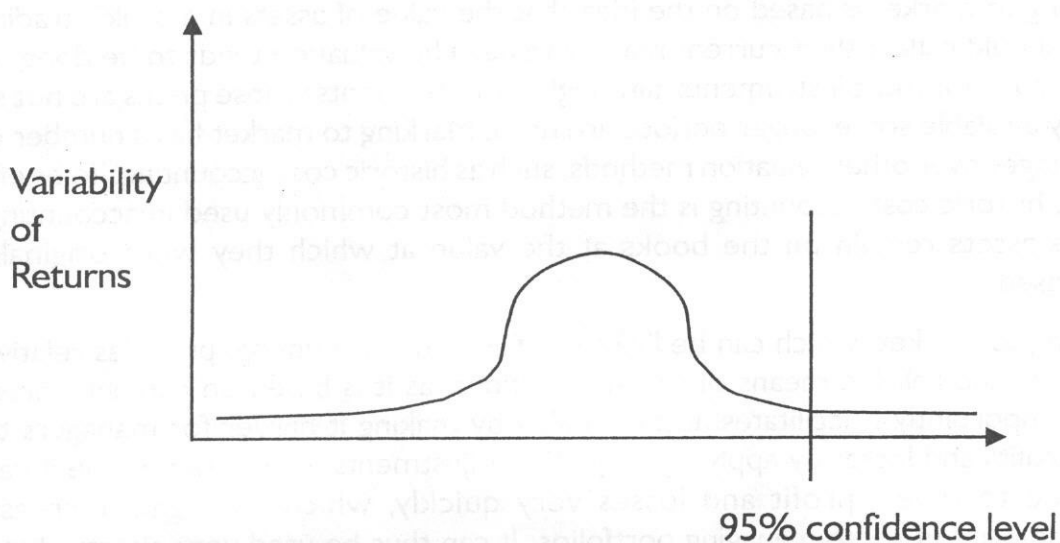


Figure 5.1 shows the concept behind VaR. The bell shaped curve shows the distribution of the value at risk, bunched around the average. The 95% confidence level means that only in 5% of cases will the variability of returns be to the right of the 95% confidence line.

Particularly since the Market Risk Amendment it has become common to use a 99% confidence level. Similarly the amendment prescribes a one year minimal data set. It also requires that VaR calculations should be based on an instantaneous shock

equivalent to a 10-day move in prices. It should be noted that these parameters are only required to be used for the calculation of regulatory capital, and banks may therefore use different requirements for their own internal purposes. Different requirements are often used to be even more prudent.

Benefits

An advantage of VaR is that it can be calculated for a variety of risks. These can then be aggregated, while still taking account of portfolio effects by incorporating correlations between different risk factors. Thus it helps to take account of portfolio risk. By providing a single number it is also suitable for reporting purposes, be it for senior management, regulatory reporting or disclosure in annual reports. As such it is simply a way to describe the magnitude of the likely losses on the portfolio, without taking extremes into account. It provides a common risk yardstick, and this yardstick makes it possible for institutions to manage their risks in a variety of new ways that were not possible before VaR was introduced.

Going into the detailed calculations aspects of VaR is beyond the scope of this text. Instead we can focus on the benefits of VaR approaches to senior management. A key benefit is that it allows senior management to quantify and therefore set their overall risk appetite or risk target. It tells them how risky, or in other words how volatile, the bank's portfolio is. At the same time such a figure can be used to manage the risk figure either up or down, depending on the strategic decision taken. This is where it can be used to set risk targets. A further advantage is that VaR can be used to determine risk targets and position limits at various intermediate levels, from a portfolio level down to the individual dealing desk.

VaR has another potential use in relation to internal capital allocation. The riskier an activity, the more capital there should be to support it. By providing a measure of riskiness, VaR models provide a yardstick to determine internal capital allocation. At another level VaR can be helpful to assess the risks of different investment opportunities before decisions are made. It can be used for that purpose because it is mathematically based and results can therefore be easily simulated. In the same vein it can be used to evaluate the performance of business units after the event.

The availability of VaR models has had a significant effect on risk management. It certainly has given senior management in banks a much better handle on risks than they could otherwise have. This has led to more informed and therefore better risk management. It enables senior management to understand the risks their organizations are facing and they can use this to set their own risk targets. It does so by providing a consistent and integrated treatment of risks across banks. This paragraph has been discussing risk management in general, as VaR methodologies can also be used to measure other risks, such as credit, liquidity and cashflow risks. This in turn can lead to a more integrated approach to the management of different kinds of risks, improved budget planning, and better strategic management.

Particularly useful from a treasurer's point of view is that VaR models provide operational decision rules to guide investment, hedging and trading decisions. These rules take full account of the risk implications of alternative choices and substantially improve the quality of decision making.

From an operational point of view VaR models have led to more robust control systems. These in return make it much harder for fraud and human error to go undetected. It generates greater risk transparency and a more consistent treatment of risks across a bank. Another operational benefit is that it can be used to provide incentives that are better aligned with risk than would otherwise be possible. By taking risk into account VaR models can be used for remuneration rules for traders, managers and other employees to take account of the risks they take. This discourages excessive risk-taking, unlike reward structures that are based purely on profits. Given that high returns are correlated to high risk, profit-based incentive structures generally reward high risk-taking, and are therefore unlikely to be incentives compatible with the risk appetite set by senior management.

Limitations

Despite all the benefits that VaR can provide, its limitations need to be well understood. Otherwise it could easily lead to the VaR number itself providing a comfort, while it in reality distracts from the underlying risks that may or may not be addressed. One of the main deficiencies of VaR models is that they are backward looking. The notion is that historic data can be used to forecast likely future losses, based on the assumption that any relationship that drove historic data will hold in the future. While this is a reasonable assumption given that there is no better alternative, it reinforces the need to treat VaR as one out of a list of complementary management tools. This helps to ensure that should the underlying assumption break down and the model lose its value, there are still other management tools in place. A useful tool in such an instance is stress testing, which will allow senior management to assess how a portfolio will react to events not incorporated into the model's design. Sometimes stress tests can be based on historic scenarios, such as the events after 11 September 2001, or the slow decline in share prices since the peak of 2000.

Like all models, VaR calculations are based on assumptions, particularly when aggregating risks to analyse portfolios. Risk managers and senior management need to remain aware of these assumptions and how they affect the model. It is therefore important that any existing model is compared with other models to ensure it is up to date. Back testing should also be a key tool for validating a system on a continuous basis. Back testing is the term used for running historic data through the model. Risk managers can then compare the actual outcome with the outcomes predicted by the model.

Finally it needs to be remembered that no system is foolproof and, as we have already said, VaR models are only one tool among many others. Nevertheless there

are certain things management can do to ensure that the value of the model is maximized. It is essential to employ staff that have the appropriate skills to oversee and maintain a VaR model. They need to understand the implications of what is done with the model and still remain aware of the overall aim of risk management. This requires specialized skills that do not come cheaply, and senior management needs to accept this as part of running the business. There are other simple controls that can be put in place to enhance the value of a VaR model. Access controls to the model, procedures on how to validate the model and changes to it, separation between front-office and risk management, defining the role of internal audit in reviewing process are all controls that can help protect the integrity of the model.

Statistical issues

Although we said earlier that technical details of such models were beyond the scope of this textbook, readers may nevertheless find a quick introduction to the key statistical issues of use, even if this will not be tested. In particular it may be helpful to describe the two generic approaches that VaR models can take and which form part of the key assumptions on which models will be built.

One type of VaR methodology is based on historical simulation. This approach uses the historical distributions of returns to the assets in the portfolio to simulate the portfolio's VaR. It is thus based on the hypothetical assumption that a bank held the constituent items of the historical data set and held it for the same period of time as covered by the historical data set. This makes it conceptually simple and easy to report, as the model does not depend on assumptions about distribution of returns or their interdependencies. However, this dependency on a particular historical data set, may in itself distort the results. This is particularly the case if the estimation period was unusual, for example too quiet or too volatile. It could also be that the period included unusual events that are unlikely to re-occur. This methodology is also not appropriate if there have been permanent changes in risk factors that did not yet exist at the time of the data set. This also means that the methodology cannot be used to forecast future events as plausible as they may be. An example of this would be currency devaluations, which could not be factored in unless they were already incorporated into the initial data set.

The second methodology is to estimate VaR on the basis of simulation results derived from statistical or mathematical models. The idea is to simulate repeatedly the random processes governing the prices of financial instruments that the model is designed to capture. Based on statistical theory, the more simulations the more likely the distribution of the portfolio is to equal the portfolio's true, or real, distribution. The advantage of this model is that it can cope with unusual returns. At the same time it also significantly increases model risk. Model risk is the risk that the model itself provides the wrong results. Model risk is often checked for via back testing. As we saw earlier back testing checks how a model would have compared with the real outcome of historic occurrence.

5.3 Other market risk management tools

In addition to VaR models, a number of other controls that provide useful input into risk management exist. Indeed those banks that do not use VaR models will have to rely entirely on these risk management tools. All dealing operations for example will put in place dealing limits as a risk management tool. These limits help control the trading environment, but more importantly, if they are set on a holistic basis they will increase the transparency of risk-taking. The setting of limits itself therefore provides a key tool to determine the risk appetite that a bank is willing to take on to its books.

Limits can be based on absolute exposure, VaR numbers, profit and loss limits or other risk-adjusted limits. Limits can be applied, for example, to individual dealers, to dealing desks, to portfolios, to divisions or even a bank as a whole. The aim is to provide management with some confidence that its risk parameters are not exceeded or, if they are, that they are made aware of them so as to enable them to take appropriate corrective actions. Should limits be exceeded this generally means that positions need to be closed, which either means selling them off or taking positions onto the books that countervail the existing one.

Historically limits began with absolute limits. Thus a dealing desk would have a limit in terms of the number or size of open positions. Limits would also exist in order to restrict dealers from dealing in products they were not yet sufficiently experienced in. It would also protect dealers from dealing in instruments that the back-office could not settle. Foreign exchange dealers for example would be given a set type of instruments they would be allowed to undertake, such as only G-10 currencies in terms of forwards. Other dealers would be allowed to trade foreign currencies via options or future contracts. Swaps may also have limits attached to them. Many of these instruments will also have limits imposed to control other risks, such as credit or settlement risk that is inherent in many products dealt in by treasury functions.

Stop-loss limits are another common type of limit that can be applied to most instruments. Rather than looking at the absolute or risk-adjusted level, stop-loss limits work on the profit and loss account. Instead of incurring the risk of further losses it will make sense from a risk management point of view to crystallize losses at a specified level. The rationale behind this type of limit is to protect the resources of an organization, so that ultimately they can be used for another activity with hopefully better results. Stop-loss limits can exist in a variety of forms. They can be dynamic or fixed. Dynamic limits are those that keep being adjusted to take account of developments. An example are stop-loss limits that are reduced as a financial year progresses. This will ensure that profits already achieved are not put at risk and do not undermine the financial performance of the bank. By their very nature limits expressed in VaR numbers are dynamic, as they take account of market developments. Although not strictly speaking stop-loss limits they can have similar results. This is because after a breach of a VaR limit the only way to return to a

position within the agreed trading limits may be to cut the losses and start again. In contrast fixed stop-loss limits would be those that remain unchanged until a general review is undertaken of the limit structure.

In relation to VaR models stress testing and scenario analysis are key management tools. They are in effect procedures to gauge the vulnerability of portfolio to hypothetical or real scenarios, such as 11 September 2001. Although they say nothing about how likely scenarios are, the results of stress tests help identify hidden assumptions or the results of large market movements. The difficulty for risk managers will be to determine what are appropriate scenarios. They can also be used to run simulations on potential investment opportunities or what the effects of hedging versus open positions might be. They are thus a necessary complement to VaR models. Regular back testing is of similar importance, in as much as it can be necessary to validate the model and therefore its appropriateness as a risk management tool.

An important risk management issue for treasury functions is whether to hedge or not. Whether to hedge will often be determined by corporate policies. Some banks have clear guidelines, for example that all interest rate risk or foreign exchange rate risk is hedged, while openly taking on other risks such as credit risk. The danger of hedging all transactions are that this can easily lead to overhedging, particularly if there are correlations between various instruments. This is the case because many risks are offset by other risks; thus aggregation is an inappropriate treatment. It may also be the case that natural hedges already exist and anything additional would therefore lead to overhedging as well. This arises because hedging on an individual basis would be based on gross exposures, rather than net exposures. This has financial implications, as hedging is generally an expensive activity. Banks may therefore not wish to hedge where they feel that they have a skills advantage compared to competitors. VaR models are therefore again an important risk management tool, as they make it possible to factor in net positions and correlation effects between types of risk.

Risk management also needs to incorporate the general principles of risk management. Issues like independence of the risk management function, robust procedures and separation between front and back-offices have already been mentioned. Detailed procedures on how activities are due to be undertaken are key, and adherence to these procedures is essential. In addition to procedures it is common for banks to have a Trading Book Policy statement which will outline the high level principles governing trading and risk management activities.

Readers wishing to take the topic of controls in trading rooms further are recommended to read the 'Report to the Boards of Directors of Allied Irish Banks, Plc., Allfirst Financial Inc. and Allfirst Bank Concerning Currency Trading Losses' published in March 2002. This report, also known as the Ludwig Report, provides practical details of how controls over trading can break down and what impact this has on risk management.

...in the event of a crisis, it may be to cut the "red" lines...
...that remain in place...
...the risk...

...models stress testing and scenario analysis...
...effect procedures to reduce the...
...typical...
...about how likely...
...results of large market movements...
...management...
...effects of...
...necessary...
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Six

Interest rate risk

Objectives

This chapter will cover the following topics:

- ◆ sources of interest rate risk;
- ◆ interest rate risk management.

6.1 Introduction

Interest rate risk is, simply put, the exposure a bank has to adverse movement in interest rates. For the trading book interest rate risk is incorporated into market risk, which we discussed previously. But interest rate risk also applies more widely to those parts of a bank that fall in the banking book, as opposed to the trading book. Given that banking is the activity of borrowing and lending money based on interest rates, interest rate risk is one of the main risks that banks face. We have already seen that the last 30 years have seen considerable volatility in interest rates, which has ensured that bankers remain very well aware of this risk. This is because changes in interest rates will affect the underlying value of bank's assets and liabilities, both on- and off-balance-sheet. It will also affect cashflows.

From an earning perspective changes in interest rates will change the income figures. In the case of an adverse change, it may lead to a bank incurring losses rather than remaining profitable. This in turn could ultimately threaten the financial stability of the bank. From a risk management point of view changes in interest rates will not only affect the bank via the interest it earns on loans. It also needs to consider fee

income, which in many instances is directly affected by changes in interest rates. For example, administration fees based on the value of the interest earning funds can fall significantly as rates increase, given that the value of existing bonds will fall as a result.

Interest-rates not only affect future cashflows, they also affect the net worth of organizations. This is because the value of individual assets in the portfolio is in reality the value of the present value of the future income streams. In economic terms the present value is calculated by discounting the value of the future income streams by the current market rate. An increase in interest rates will thus reduce the value of existing assets, while interest rate falls will increase their value. Aggregated over a whole bank's portfolio the net effect will be of considerable concern to shareholders and management.

6.2 Sources of interest rate risk

Those banks that manage their portfolio with specific regard to interest rate risk will be able to use this to enhance their profitability, by taking on risk they deem appropriate. At the same time they will minimize excessive risk exposure, for example via hedging.

Misjudging interest development can lead to large losses as the cost of funding loans may exceed the income obtained from such loans. This can happen if income is fixed, or can only be adjusted slowly, as may be the case for fixed or capped loans. If the funding of such loans is on variable rates with a shorter term, losses can arise quite quickly. The role of the treasury function will be to understand the interest rate exposure and to develop adequate contingency plans. Part of this will be to ensure an appropriate mix of funding with different maturities to provide diversity of funding.

There are several sources of interest rate risk, which a treasury function needs to be aware of to ensure it can manage its exposures. The most common one follows from the maturity transformation role of banks. We already saw the effect a maturity mismatch had on liquidity, but it will also have an effect on interest rates. For floating-rate exposures this is also known as repricing risk, as each time the rate is changed it in effect reprices the loan. The effect on a bank will be significant, as it may affect both future income, as well as the underlying value of its assets, liabilities and off-balance-sheet positions. This will happen because, in economic terms, the value of assets will be the discounted value of the future income streams.

Table 6.1: Risk associated with providing loans

	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Loan	<hr/>											
Borrowing	<hr/>											
Interest-rate risk	<hr/>											

The diagrammatic representation above illustrates, in simple terms, the risk associated with providing loans at fixed rates and funding those loans out of step. Here the bank faces an interest rate risk from July onwards, when it needs to fund the remaining six months of the one year loan.

A different source of interest rate risk is yield curve risk. As we have already seen the yield curve is the relationship between the rate of interest and time till maturity. The yield curve is upward sloping and positive if longer-term lending rates are higher than for short-term lending. Although a positive yield curve is considered the norm, in reality the slope can be downward or negative. Short-term interest rates may be increased, for example on the basis of government intervention designed to control variables in the economy, particularly inflation. This was the case in the UK in 1989-90. With inflation of about 10%, the Chancellor of the Exchequer felt it necessary to raise short-term rates to 15%, while at the same time ten-year government bonds were yielding only just 11%.

Yield curve risk comes in two forms. There can be a parallel shift of the curve, which would mean that all interest rates change by the same magnitude. At other times only the shape of the curve will change, leaving certain maturities changed by less than others. Treasurers will have to be prepared for both types of yield curve risk.

Basis risk is another source of interest rate risk. It refers to changes in the pattern of interest rates and the relationship between two different costs of money – ie the basis on which the money is borrowed and the way it is lent, such that at roll-over time the relationship between the levels of the respective interest rates can change. For example, suppose that LIBOR deposit rates fall by $\frac{1}{2}\%$ and interest payable on the loan falls by only $\frac{1}{8}\%$ – this creates a mismatch of interest rates due to the different rates of change in the individual benchmark rates (LIBOR, New York Prime Lending Rate, etc). This differential in the rates following a general interest rate movement creates an exposure, which in turn involves a risk to margins. Equally the differential can work in the bank's favour.

The use of embedded options also creates interest rate exposures. Embedded options are put or call options that are incorporated into other, more traditional instruments. Embedded options are becoming increasingly common in instruments such as bonds. Callable bonds for example allow the issuer to repay them at any

time, while those including put options allow owners to demand repayment. They tend to be more prevalent in non-trading environments, because exchange-traded and over-the-counter (OTC) markets tend to need more homogeneity among products.

6.3 Interest rate risk measurement

Interest rate risk measurement ranges from simple mismatch ladders of the current positions to the use of very complex dynamic modelling techniques. In between there are various other alternatives from static modelling to including changes in future business opportunities.

6.3.1 Interest rate mismatch ladders

An interest rate mismatch ladder shows balances by the time they are fixed or, in other words, the time remaining before repricing. The interest rate mismatch ladder is also known as a gap report. Whereas the maturity mismatch ladder shows the full length of the contract until maturity, which could be, say, one year, the interest rate mismatch ladder might show a time period of three months as the loan is rolled over and fixed on a three-month basis. Some ladders might show the rate at which the original deal was done, but for the purpose of illustration a simple example is used in Table 6.2.

Table 6.2: Mismatch ladder

<i>Interest rate period</i>	<i>Liabilities</i>	<i>Assets</i>	<i>Net mismatch</i>
Under one month	700	600	(100)
Up to three months	200	130	(70)
Three to six months	50	40	(10)
Six to nine months	20	40	20

The report informs management about the general interest rate sensitivity position of the bank that arises from a mismatch in the repricing of assets and liabilities during any specific period. The report indicates whether the bank is positioned to benefit from rising interest rates by having a positive gap position or whether it is positioned to benefit from declining interest rates by its negative gap position. In this example, there is a net mismatch of interest rates for all but the six-to-nine-months category. For under one month, up to three months and three to six months the position is 'over borrowed' – when the bank has more liabilities repricing than assets. In the six-to-nine-month category, the position is 'over lent'. If the position is

mainly over borrowed an increase in interest rates on the bank's liabilities will not be fully compensated for by the receipt of increased interest payments on the loan book, or on its other assets.

Such tables provide an overview of the situation and are useful in understanding where a bank's interest rate risk is occurring and provides insight as to how the risk position can be changed. In reality, trading positions can become quite complex, with overlapping transactions and rapidly changing positions between being over lent and over borrowed. The use of floating versus fixed rates will further increase the complexity of such tables. As a result they have limited use and the meaning behind the figures is not always obvious. In particular they fail to provide all the information necessary to measure bank's total interest rate risk exposure as it fails to measure the impact of basis risk and embedded options. Therefore it cannot measure the impact a change in interest income will have on a bank's net interest income or an effect on the market value of an institution's assets and liabilities.

The mismatch ladder approach can be further extended to take account of the effects of changing interest rates on the economic value by applying sensitivity weights to each time band. These could be derived from estimates of duration. Duration is calculated by the weighted average maturity of a bond using the relative discounted cashflows in each period as weights. What this provides is a single figure indicating the sensitivity of individual transactions or whole portfolios to changes in interest rates. It does that because changes in interest rates will change the discounts used for the calculation.

In the duration approach the difference between the duration of the asset structure and the duration of the liability structure is the bank's net duration. A positive net duration means that the duration of the assets is longer than the duration of the liabilities. A decrease in interest rates will increase the net value of the institution. Net duration analysis has the advantage that it does not rely in interest rate forecasts because it is based on parallel shifts in the yield curve. For this reason, it fails to account for basis risk. It also fails to adjust for accelerated prepayment of loans or early withdrawals of time deposits. The change in duration due to the activating of embedded options, which is often referred to as convexity, causes similar problems. However, convexity factors can be computed and duration can be adjusted accordingly to take account of the exercising of embedded options. Such adjustments improve the ability of duration analysis to more accurately measure the impact on the value of an institution's equity when interest rates change.

Another measurement methodology estimates the impact of an interest rate change by conducting a net present value analysis. This analysis determines the net present value of all the cashflows included in the model. This can be developed so as to take account of embedded options and basis risk. Such models have the advantage that they can be used to simulate a number of scenarios based on changes in the shape of the yield curve. Models can also be used to conduct dynamic simulations analysis that estimates the impact on interest rate risk on an institution's earnings. It can for

example be used to provide a worst case, a best case and a likely scenario to senior management as a help for decision making.

6.4 Management of interest rate risk

The management of interest rate risk has become simpler. There has been a proliferation of hedging instruments that have enabled risk to be more easily assessed and mitigated. Approaches to managing interest rate risk can be divided into passive approaches and active approaches. Passive approaches involve monitoring the mismatches and taking a fairly cautious approach to matching assets and liabilities, whereas an active approach involves embracing the risk and introducing instruments to hedge the risks. To what extent these more complex tools will be used will depend on the complexity of the bank's activities and the sophistication of its risk management. After all, banks with simple operations may have less need for active management. They know that interest rate risk is inherent in banking and as long as it is kept within prudent bounds there is no need for active management. Other banks, however, see active interest rate risk management as a key tool for enhancing the net worth of the organization by improving profitability and minimizing losses.

Gap reports are useful to both the active and passive risk managers, although it is likely that active risk managers will use it in combination with other tools. Gap reports help to isolate areas of the balance-sheet that constitute large portions of a bank's interest rate risk position caused by timing differences either due to positions reaching maturity or simply being repriced. The information contained in the gap report often suggests various strategies for managing interest rate risk. Thus it can provide information on where the asset/liability mix of the balance-sheet needs to be adjusted to reduce exposure.

In contrast, net duration, particularly if adjusted for convexity, results in a single figure indicating the degree to which the value of the bank can change for a given change in interest rates. Duration of individual instruments is also useful when deciding on how to hedge individual positions. Finally, full-scale models can be used for simulations and will enable the testing of the effects of specific risk management decisions on the bank's portfolio. The cost of running these models makes it likely that they will be of particular benefit to active risk managers as they will reap more benefit from the models.

There are various strategies that banks can use to manage their interest rate risk. These range from simply using the bank's investment portfolio to using derivatives to achieve the desired exposure.

Often the simplest way to manage the risk is to sell off fixed-income securities from the bank's investment portfolio and to re-invest at a different maturity. This will be reflected in the gap report and reduce or increase the risk exposure accordingly. Whether this is an option will depend on the availability of marketable securities for

resale and the effect on other risks this may have. Particularly the sale of short-term paper, while being sensible from an interest rate risk management point of view, may have significant implications for the liquidity risk the bank faces. In addition the way the funds are re-invested will result in new credit risk exposure and may also affect the net income margin of the bank.

Extensions of this tool would include securitizing certain exposures so as to get them off the bank's balance-sheet. This would free cash that can be invested in either new products or to achieve a specified desired risk exposure. To continue on the asset side it may be possible to utilize reverse repurchase agreements to change the balance sheet mix. Reverse repos represent the sale of a security with a simultaneous agreement to repurchase them at a fixed price on a specific date. This can be done at various maturities, allowing very accurate targeting of specific exposure. On the liability side banks may be able to issue certificates of deposit, known as CDs.

A longer term risk management tool may be the introduction of new products. New products may introduce new repricing periods or may include new embedded options into instruments or products. For such a strategy to work, it will need very effective communication between the risk managers and those marketing various products to the end-user. Examples are the repricing of deposit or loan rates to have the desired shift in interest rate risk. This is not a straightforward management tool and is therefore only used in conjunction with other tools.

Finally there are the more complex instruments that can be used for both hedging and interest rate risk management purposes:

- ◆ Financial futures – contracts to sell a financial instrument on or before a specified date at an agreed price. In banking as opposed to commodities this would normally be an interest-bearing contract such as a Treasury bond or perhaps a three-month Eurodollar interest rate contract.
- ◆ Forward rate agreement (FRA)– contracts where there is no commitment to make a loan or take a deposit, only an interest rate and a nominal principal amount are agreed. The amount that then becomes payable is determined by the difference between the prevailing and the actual rate in the transactions (if any). The banks are thus insuring themselves against rate movements in exchange for a risk premium.
- ◆ Interest rate swap – for the purpose of long-term interest rate management the interest-rate swap is the most popular instrument, allowing the parties involved to exchange cashflows. The underlying principal positions are unchanged, but the idea is that the two parties are able to find a better solution to their own particular funding requirement.
- ◆ Financial options – contracts that give to its holder the right but not the obligation to buy or sell an underlying security at a fixed price at or before a specific date. They are particularly useful for interest rate risk management when combined with caps and/or floors. These would be options structured so that they would limit the holder's risks up to a pre-determined level.

Banks should have an overall strategy for the management of interest rate risk. The day-to-day techniques would depend upon:

- ◆ the structure of its loans and investments;
- ◆ information on borrowing;
- ◆ information on interest-bearing investments and loans;
- ◆ total amount borrowed and invested;
- ◆ the mix in the portfolio between fixed-rate and variable or floating-rate contracts; and
- ◆ the currencies in which the transactions have taken place.

In addition there are several questions that risk managers need to ask themselves to determine which strategy to follow:

- ◆ How will it affect the gap report?
- ◆ Will it increase or decrease the bank's basis risk?
- ◆ What is the effect on the net interest margin?
- ◆ How will it affect the liquidity exposure?
- ◆ Will it expand the balance-sheet?
- ◆ How quickly can it be implemented?
- ◆ What are transaction costs?

As ever, there are a number of key controls that banks need to introduce to ensure that their interest rate risk management is appropriate and that they can rely on the reports that are produced internally. Strategies and policies should be approved at the highest level of the organization. Reporting lines should be clear and individual responsibility assigned. The larger and more complex an organization, the more important the independence of the interest rate risk management unit will become. Procedures should be clearly defined and, often forgotten, adhered to! Especially new products need to be reviewed to ensure the interest rate risk inherent in them are caught by the risk management processes.

We have seen some of the issues relevant to the monitoring and measurement of interest rate risk. Any systems should capture all material sources of interest rate risk. It is particularly important in this context that those making decisions on the interest rate structure of the books clearly understand the assumptions underpinning their systems. Limits and delegated authorities, ie what is the maximum exposure and who can (or needs to) take actions to remedy them, need to be clearly established. Adherence to them and the adequacy of the whole interest rate risk management framework should be independently assessed. Particularly the accuracy of any reporting should be verified. It is also good practice to ensure that each bank is aware of how its books will cope under stressful market conditions. Only the simplest operations should be able to do without such strict processes, and even then the reasons for that ought to be reviewed on a regular basis to ensure that the policies in place remain appropriate to the level of operations.

Seven

Foreign exchange risk

Objectives

This chapter will cover the following topics:

- ◆ translation exposure;
- ◆ transaction exposure.

7.1 Introduction

Foreign exchange risk, or FX risk, is the risk stemming from the movement of the value of one currency against the value of another. Movements in the exchange rate can result in significant increases or decreases in bank profits – a trading risk known as transaction exposure. A bank operating from its domestic market may encounter fluctuations in the effective value of its international portfolio through exchange rate movements, and for the foreign subsidiary there is the issue of how the operation will be funded and in which currency, taking into account the likely movements in exchange rates. This is known as translation exposure.

Like other risks, foreign exchange rate risk needs to be adequately controlled and managed. This is especially the case for internationally active banks that have large investments in foreign currency. The translation of currency assets into domestic currency can have a drastic effect on the performance of an institution as such book losses can have a significant impact on the published accounts. Such exposures need to be analysed in order to take the necessary steps to avoid or at least minimize the effects of adverse currency movements. At a different level FX exposures also arise

from simple banking transactions, especially if a bank is heavily involved as proprietary trader in foreign currency transactions. To minimize losses a bank will require its treasury function to implement strong controls.

The whole issue of exchange rate exposure has increased in importance, as exchange rates have become more volatile, increasing the need for effective controls. Foreign exchange risk relates to structural balance-sheet exposures, which come from decisions made on currency mix in both international currency dealings and from operating subsidiaries in other countries. Here we are not concerned solely with foreign exchange (FOREX or FX) dealing but with all the lending, investment and borrowing that takes place as a natural part of the wholesale money markets. These activities will try to take advantage of exchange rate volatility and mitigate negative risk outcome but will not trade solely on the movements in exchange rates as is the case in the FX markets.

The world economy now exists within a world of mainly floating exchange rates. We have already seen that this developed subsequent to the collapse of the Bretton Woods agreement which had set up a framework of exchange stability. The floating exchange rate system has become even more prevalent since the introduction of the Euro, which reduced the number of currencies trading within agreed bands. Although intervention by central banks has become less important as a result of the Euro, intervention still exists as central banks strive to maintain a stable regime of interest rates, exchange rates and inflation. Indeed, as more countries join the Euro, these countries are likely to increase interventions to bring about the convergence of their currency to the Euro, as required by the Euro entry criteria.

7.2 Translation exposures

Translation exposure relates to the foreign-currency financial statements being translated into the reporting currency of the parent company. As the exchange rate changes the parent currency value of the exposed asset or liability changes. The assets and liabilities would be translated for a number of reasons:

- ◆ consolidation of accounts;
- ◆ performance evaluation;
- ◆ creditworthiness reviews;
- ◆ assessment of taxation liabilities.

The effects of changes in exchange rates on the translated accounts do not affect the cashflow of the trading subsidiary because the figures are only being translated rather than converted into the currency of the parent book. Nevertheless the effects matter because of their impact on the accounts and thus the perception the company has in the market place.

Take the example of a UK bank with a subsidiary in Spain. The UK bank has an asset whose value is dependent on movements in the Euro. However, if the UK bank decides to fund the Spanish subsidiary in sterling there is a different risk again. The assets are valued in Euros and the liabilities are denominated in sterling. If sterling then strengthens against the Euro, there will be a shortfall in the subsidiary in sterling terms. This would then require the parent bank to write off the shortfall from reserves. But this approach may have been taken for good reason, in the anticipation that the Euro was to strengthen against sterling.

7.3 Transaction exposures

A bank's transaction risk relates to its foreign exchange exposures in its trading and banking positions. The receivable or the payable change in value as the exchange rate changes. For example, take a British bank faced with repaying funding it procured from an American bank on a three-month basis and that will reach maturity on a date in the future. If sterling weakens against the dollar, then repayment of the maturity value would cost more.

If an investment was made in the US by a British bank, the real return on that investment has to take account of movements in the exchange rate – from the point at which investment was initiated to the point at which it is realized. Equally, if a deposit is made with a US bank, the value of that deposit can go down in line with the exchange or, alternatively, go up, generating a greater than expected profit.

International banks in fact thrive on this risk by marketing forward and options instruments on behalf of trading companies. These instruments, to be covered in depth later in this text, are designed so that import-export risks for commercial companies are shared in return for a margin. The risk is taken from the trading company and the bank profits or losses based on the actual exchange of goods and money that takes place in, say, three months' time. For example, a French pharmaceutical company agrees to sell an assignment of drugs to an American company in three months' time. In order to fix the interest rate so that profit margins can be assessed and fixed, the American company gets a quote from the bank for a forward exchange rate which largely respects the margin negotiated on the imported goods. If the bank's calculations are correct, it too will receive a profit from the transaction. But there is an inherent risk of losing on the deal and this will be reflected in the spread the bank will use to quote for payment in three months' time. However, the larger the bank's book is, the more the bank will be diversified. It will thus have a natural hedge against the risk contained in each individual trade and it will therefore be able to live off the margins that it is making on individual deals.

Taking the example back into the financial sector, let us look at an American bank with USD50m on deposit with another bank in the USA, earning 3%. Seeing UK interest rates move to 5%, the bank moves its USD50m deposit to a UK bank for

nine months. The transaction risk to the US depositor bank is that sterling could then fall by, say, 10% in relation to the US dollar, thus reducing the value of the investment to USD45m. The net effect would have been to cancel out the gain from moving the funds to attract the higher rate of interest.

7.4 Managing foreign exchange risk

7.4.1 Managing translation risk

The attitude a bank takes to translation exposure – the risk from designating the fund currency for subsidiaries – will vary from bank to bank. Rather than see it as a loss in real terms, some banks will see it merely as an accounting imbalance that reaches an equilibrium over a period of time. Under this interpretation the bank might automatically elect to fund in the parent company's domestic currency. But, in spite of the fact that the bank may not have chosen to employ the hedging tactic, it may choose to ensure that it has a diversified currency portfolio in order to control the level of risk exposure.

7.4.2 Managing transaction exposure

The management of transaction exposure is likely to be treated as a separate issue to managing translation exposure. The transaction exposure will result in an actual cashflow, whereas the translation exposure would normally involve a reporting currency exposure. It will be the general strategy of the bank which will determine to what extent transaction exposure ought to be hedged.

7.4.3 Foreign exchange exposure policy

The management at all levels has to decide which risks are important and then establish reporting and policy-making structures to establish at what level exposure-related decisions will be made. Policy decisions will need to be made on such issues as under what circumstances hedging would take place and how exposures on translation risks are considered – in other words, how they should be managed or indeed whether they should be managed.

The issue of whether or not to hedge is a subject of some debate. Hedging can be very costly. Therefore, if one considers translation risk to net itself out over the long run there appears to be limited justification for the practice. If, on the other hand, the desire is not to distort asset values and earnings per share, then hedging provides a means of showing a less volatile picture. Other strategies, which would

be less concerned with hedging all foreign exchange risk, would use hedging only when it was necessary to keep risk exposures within predetermined bands.

In determining the liability structure, the bank would normally consider the bank's natural business to determine its funding approach. Depending upon the type of trading it is engaged in, it might have no hesitation in dealing in the subsidiary country's domestic currency, which may or may not involve an element of hedging of the exposure. If the subsidiary is heavily involved with further currencies, other than that of the subsidiary and its parent, then Head Office would have to consider the risks involved in dealings in that third currency.

7.4.4 Forecasting foreign exchange rate movements

Economists are often maligned for their inability to forecast accurately. The complexity of macroeconomics makes the proposition of successfully forecasting movements in economic variables difficult. But, with varying degrees of success, bank treasury economists use a combination of gut feeling and sophisticated forecasting and scenario planning techniques in an attempt to forecast the direction, magnitude, and timing of exchange rate changes with varying degrees of success. This will then be used, in combination with dealers' gut feeling to decide on the future positions that should be taken.

7.4.5 Measurement and reporting

A first step for bank management will be to define its foreign exchange exposures. Only then will it be able to manage them. It needs to be able to forecast its degree of exposure for each major currency in which it operates. This involves forecasting worst-case and probable exposure scenarios, not attempting to forecast exchange rate movements themselves, which is a more speculative endeavour.

Once a bank has decided how it wishes to measure foreign exchange exposure, it then needs to establish a reporting system which calls on the centralized control functions and the local personnel in the subsidiaries or branches. The foreign input is required in order to utilize the most relevant and best quality information, given that those located in the foreign country will have a better 'feel' for the local economy.

The centralized reporting and control is necessary to take account of the overall exposure within the parent corporation. By setting out uniform reporting requirements for branches, affiliates and subsidiaries it can then get a complete picture, and employ its strategy for dealing with the exposures. There are usually different levels of review. First of all reviews would take place at a local level, then it is likely that the reported exposure would be reported at a regional level – eg Europe, Asia – or that determined by the organizational structure. The region might

consolidate its data by account and by currency for each time period, with final reporting at corporate level where broad-based strategies are developed.

To some extent the more transactions a bank undertakes the lower its effective exposures. This is because the more transactions are on its book, the more the various individual exposures are likely to net out. The result is that the bank, despite increased risk taking, will increase its profitability from the margins it earns on each single trade, as a diversified portfolio will provide it with a natural hedge.

7.4.4 Forecasting foreign exchange rate movements

Forecasting foreign exchange rates is often made difficult for their inability to forecast accurately. The concept of market efficiency makes the proposition of successfully forecasting movements in exchange rates difficult. But with varying degrees of success banks can try to forecast for a number of years ahead. The best way to forecast exchange rates is to use a number of different forecasting techniques and compare them. This will give a better idea of the accuracy of the forecasts. The best way to forecast exchange rates is to use a number of different forecasting techniques and compare them. This will give a better idea of the accuracy of the forecasts.

7.4.5 Measurement and reporting

A first step in bank management will be to define its foreign exchange exposure. Only then will it be able to manage them. It needs to be able to identify its degree of exposure for each major currency in which it operates. This involves forecasting movements in exchange rates and adjusting for the risk exposure. The best way to forecast exchange rates is to use a number of different forecasting techniques and compare them. This will give a better idea of the accuracy of the forecasts.

Eight

Credit risk

Objectives

This chapter will cover the following topics:

- ◆ definition of credit risk;
- ◆ rating systems, rating agencies and rating methodologies;
- ◆ credit risk management;
- ◆ country risk;
- ◆ settlement risk.

8.1 Introduction

The previous chapters looked at the key risks with which treasury units are generally associated. Although credit risk is not foremost associated with treasury functions, it remains an underlying risk that drives both treasury operations directly and indirectly via its impact on the business units that a treasury function supports.

Although banks often try to organize their activities around different risks, such as market risk in dealing rooms, one should always remain aware that many risks are interrelated and that it would be self-defeating to manage them in isolation. Credit risk, for example, is prevalent in the corporate lending areas, but it will also exist in a trading environment. Country risk, as a particular type of credit risk, is similar. It will underlie all exposures to foreign counterparties, but it is unlikely to be foremost in the mind of traders, who will be looking at their internal limits to ensure that they do not threaten the risk management approach of their institutions. The same can

be said for settlement risk, which is the risk that the counterparty does not deliver on their part of the deal as a result of problems with settlement.

Credit risk is defined as the risk of loss arising from the failure of a counterparty to make a contractual payment. Given that traditional banking is about lending of money, credit risk is one of the more pervasive banking risks. Credit risk not only arises from loans but also in the wider banking book, be it guarantees and other on- and off-balance-sheet activities. It also exists in the trading book, where bonds for example can default. Credit risk, which is often referred to as counterparty risk, is all pervasive: it exists within acceptances, interbank transactions, trade financing, foreign exchange transactions, financial futures, swaps, bonds, equities, options, commitments and guarantees. Settlement risk is also a type of credit risk. It will thus be discussed separately at the end of this chapter.

In the UK the small banks crisis was a good example of credit risk affecting a banking sector. In the early 1990s, the small and medium-sized banks consisted of over one hundred institutions, many of which specialized in lending to particular geographical regions, industrial sectors or ethnic/religious groups. Many of these small (and medium-size) banks were heavily exposed to property lending and, to a lesser extent, to instalment credit and hire purchase lending. On the liabilities side, most of the banks were heavily reliant on wholesale funding. Many of the small banks that subsequently went on to fail enjoyed particularly rapid loan growth in the second half of the 1980s. With the benefit of hindsight, this marked increase in lending was an indicator of excessive credit risk taking. During the economic downturn of the early 1990s, many of these small banks experienced pressure on both sides of their balance-sheets. The impact of the recession was particularly severe on the property market and this resulted in a marked decline in banks' asset quality and collateral values. At the end three small banks – Chancery, Edington and Authority – were allowed to fail in early 1991. As the Bank of England did not consider such failures a threat to the financial system, no emergency support was provided.

Credit risk continues to plague banking systems. Poor credit risk management led to the problems in two German banks in 2001, Delbrück & Co. and Schmidt Bank. Both banks had been unable to make sufficient profit margins to compensate for the level of default inherent in their portfolio, which consisted mainly of loans to small and medium-sized enterprises. In short they did not manage their credit risk appropriately.

Improving credit risk management is one of the main goals of the new Basel Capital Accord. One of the difficulties of credit risk management is its cyclical nature. Banks tend to lend when the economic outlook is positive and corporates expect significant profits to cover their financing cost. This is often driven by what has become known as the herd instinct, where banks begin to lend because their competitors do, rather than because the deals make economic sense. At the same time every

economic downturn leads to an increase in default rates of corporates and retail customers, which tends to significantly affect the profitability of banks.

Credit risk is of both direct and indirect importance to treasurers. It is directly relevant because funds placed by treasury departments will incur a credit risk. This needs to be controlled and taken into account when pricing any transactions. Similarly the bank itself will be a credit risk to other institutions and the treasurer will need to know what this is in order to maximize returns. Dealing activities undertaken by the treasury function will also incur settlement risk for which controls need to be in place. Credit risk will also affect the treasury function indirectly as a result of its impact on other business units. Defaults of counterparties of other business units may have a significant impact on cashflows and the treasurer needs to be able to adapt to these in order to maintain the liquidity of the institution.

8.2 Measurement of credit risk and rating agencies

The aim of credit risk measurement is to find some methodology that will enable banks to categorize their exposures in terms of bands of riskiness. Conceptually this should be aimed at assigning a probability of default to each counterparty or issue, but in practice many banks use a less complex framework. For the sake of simplicity most banks, even those that work off probability of defaults, transpose their assessments into rating categories. The complexity of banks' credit risks will determine what type of methodology is sufficient for management. The main issue is that the system can be used to assess the probability of a particular issue not being repaid in full when it falls due for redemption, or give an indication of the likelihood of future problems at a counterparty.

The simplest rating methodology would only use four categories:

- ◆ low risk;
- ◆ medium risk;
- ◆ high risk; and
- ◆ in default.

A more common approach is to reflect the rating system introduced by Standard's & Poors or Moody's, the largest rating agencies. Their long-term ratings follow the following structure:

- ◆ Business franchise, ie the scope of business activities and its value – it would also include group issues, customer base, competitive differentiation, external drivers, staff issues, etc.
- ◆ Internal controls, such as effectiveness of internal audit and compliance functions.
- ◆ Organization, ie its ownership structure and other organizational issues, such as any government ownership, or large single shareholders. Country of origin would also be relevant.
- ◆ Management quality, ie culture, experience, board composition, non-executive directors, approach to planning and strategy.

Other aspects that would be included are any hidden strength and reserves, or hidden weaknesses and overvalued assets. A company's underlying country risk would also have to be factored in when the counterparty in question comes from overseas. How economic conditions are taken into account will depend on the methodology used. Some banks use a through-the-cycle approach, meaning that the final rating should already have factored in any changes due to economic conditions. Other banks use a point in time methodology, which will only hold under the economic conditions at the time the rating was given.

In practice banks often use both their internal ratings as well as the ratings given by credit rating agencies to help in their decision making process. Credit ratings from independent bodies have advantages in terms of being already available and being widely recognized. Thus where speed is essential, such as in a dealing environment, they can provide a useful input. Furthermore they provide a useful reference against which to compare internal ratings. Nevertheless many banks feel they have additional knowledge and expertise that is not available to rating agencies and that they can get a competitive advantage by utilizing their own ratings. Some banks have invested significant amounts to come up with automated rating systems. Although credit scoring is more common for retail transactions, variations of it may also be used for some parts of the corporate lending portfolio. Credit scoring is based on assigning values to various factors that are likely to determine probability of default. To qualify for a positive lending decision the credit scoring has to pass a given hurdle. At the other extreme are credit assessments that are only based on expert judgement without a qualitative framework underpinning it. In reality most methodologies used by banks are some form of hybrid between the extremes of expert judgement or pure credit scoring approaches. Like other credit risk management tools internal ratings need to be effectively controlled. This is particularly important since internal ratings methodologies are likely to become increasingly important as part of the future capital adequacy rules.

Credit risk cannot be managed without a clear definition of what is defined as 'default'. A default is generally considered to have occurred with regard to a particular obligor when a bank considers that the obligor is unlikely to pay its credit obligations to the banking group in full. For the assessment of default, the possibility of realizing a collateral to obtain payment would be discounted. Definition of default is, however,

very subjective. Thus many institutions have come up with some additional, objective measures. Certainly if an obligor is past due more than, say, 90 days on any material credit obligation then it ought to be treated as being in default. The period is, however, variable with some banks waiting until up to 180 days, or more depending on product, before treating an obligor as being in default. For other areas, such as overdrafts, a simple limit breach may be treated as being an event of default.

Symptoms of default may include:

- ◆ The bank makes a charge-off or account-specific provision to take account of the significant perceived decline in credit quality subsequent to the bank taking on the exposure.
- ◆ The bank sells the credit obligation at a material credit-related economic loss.
- ◆ The bank consents to a distressed restructuring of the credit obligation where this is likely to result in a diminished financial obligation caused by the material forgiveness, or postponement, of principal, interest or (where relevant) fees.
- ◆ The bank has filed for the obligor's bankruptcy or a similar order in respect of the obligor's credit obligation or indeed the obligor itself may have sought or been placed in bankruptcy or similar protection. This in turn is likely to avoid or delay repayment of the credit obligation to the bank.

Moody's, the rating agency, describes its own definition of default for long-term debt securities as: 'Default usually involves missed or delayed payments of interest or principal or bankruptcy and is therefore clearly identifiable. However, Moody's definition of default also includes a category called "distressed exchange" which, while less prevalent, is more difficult to define and apply.'

8.3 Credit risk management

Credit risk management processes will differ from bank to bank, but over time sound practices have developed. These were codified by the Basel Committee on Banking Supervision in September 2000 in its 'Principles for the Management of Credit Risk' paper.

8.3.1 Establish appropriate credit risk environment

The credit risk environment should be driven by the highest authority of an institution. Thus the board of directors or its counterpart should approve and review credit risk strategy on a regular basis. The strategy needs to reflect the bank's tolerance for risk and the level of profitability the bank expects to achieve from its credit risk exposures. The strategy should be consistent with other processes within the bank, for example remuneration, and, in particular, bonuses, should reflect risk taking instead of only rewarding volumes. Senior management should be accountable for

implementing the credit risk strategy. This will involve the development of policies and procedures for identifying, measuring, monitoring and controlling credit risk, at both individual credit and portfolio levels. Particular care should be taken to identify and manage credit risk inherent in all products and activities, especially with new products, instead of only managing the obvious credit exposures from, for example, the retail and corporate loan book.

8.3.2 Operating under a sound credit-granting process

It is essential that banks operate with sound, well-defined credit-granting criteria. These criteria must be communicated and understood throughout the organization. To ensure adherence internal procedures should give a clear indication of the bank's target markets. Credits should only be granted following a thorough understanding of the borrower or counterparty. This should be combined with an understanding of the purpose and structure of the credit and source of repayment. In practice this is the role of credit officers to assess and credit committees to approve. It certainly should not be delegated to outsiders, such as lead underwriters or credit rating agencies.

It is common practice to get credit proposals over certain limits (or exceeding delegated authorities) to be approved by a credit committee. For the largest transactions the credit committee may be the board itself. It is generally the credit committee which fulfils the requirement to have a clearly-established process in place for approving new credits as well as the amendment, renewal and re-financing of existing credits. Moreover extensions of credit to connected parties, such as subsidiaries or other group companies, must be made on an arm's length basis. The more obvious the potential conflict of interest for providing the loan, the more important it becomes to adhere to the arm's length principle.

A sound credit-granting process will also include overall credit limits at the level of individual borrowers and counterparties. To be effective these limits will include exposures to other parts of a group, should the transaction be with a group company. Furthermore it is essential to consider all existing credit exposures, including those in the trading book, banking book and on- and off-balance-sheet items. Only that way can a bank ensure that it does not unwittingly open itself to large exposures that it could not cope with if a default was to occur. This is where treasury functions will need to be integrated into the overall credit risk strategy of the bank.

8.3.3 Maintain an appropriate credit administration, measurement and monitoring process

It may sound facetious, but lending money is the easy part. The real banking skill lies in ensuring that borrowers repay their loans as they are due. This can only be achieved

consistently if a bank has in place a system for the ongoing administration of its various credit risk-bearing portfolios. This should include a system for monitoring the condition of each individual loan, including determining the adequacy of provisions and reserves. Information systems and analytical techniques should enable management to measure the credit risk inherent in all on- and off-balance-sheet activities. Reporting credit exposures is also fundamental to enable pro-active credit risk management. This in turn requires appropriate management information systems to provide adequate information on the composition of the whole bank's credit portfolio, including identification of any concentrations of risk. It should enable ongoing monitoring of the overall composition and quality of the credit portfolio. Furthermore banks should consider potential future changes in economic conditions when assessing individual credit and portfolio, particularly under stressful conditions. The processes also need to be clearly linked to the definition of default and the actions that a bank needs to take once it becomes aware of a default.

8.3.4 Ensure adequate controls over credit risks

The importance of controls over credit risk management cannot be overestimated. It will be the responsibility of senior management to ensure that the credit-granting function is being properly managed and that credit exposures are within levels consistent with prudential standards, such as large exposure requirements, and internal limits. Internal limits should reflect the overall credit risk strategy of the bank, including concentration levels and large exposures. Furthermore banks should establish and enforce internal controls and practices to ensure that exceptions to policies, procedures and limits are reported in a timely manner to the appropriate level of management for action. Early remedial action needs to be taken on deteriorating credits, problem credits need to be managed and particularly default situations need to be actively pursued. Additionally a system of independent, ongoing assessment of the bank's credit risk management process must be in place. The results of such reviews should be communicated directly to the board. In practice such reviews can be undertaken by internal audit functions, be outsourced or be undertaken by specialized risk management units.

8.4 Credit risk management in practice

As ever in risk management it is important that the strategy is agreed at the highest level of the organization, such as a board of directors. It is the board's role to establish an appropriate credit risk environment by, for instance, deciding on the target market of the institution. The level of desired riskiness is both an input into the decision and also an outcome of the same strategic decision. Similarly the level of concentration of the credit risk will be part of that decision. The decision will in turn impact on how procedures are implemented, responsibility assigned and limits set.

High concentration of exposures to specific industries will also affect the credit risk faced by an institution. The small banks crisis in the early 1990s was an example where concentration in the real-estate sector was so high that a number of institutions were not able to survive. Although concentration risk is one of the inputs into risk management it should not be seen as an absolute requirement, as diversification for its own sake can create new risks. There is a particular risk that management that diversifies for the sake of it does not have the knowledge required to undertake the new activity successfully. In turn such diversification could create more operational risk, which may ultimately be of a bigger risk to the institution than the concentration risk ever was. This is another example showing that risk management is about finding the right trade-offs between risks, rather than eliminating risks altogether.

In most banks, credit committees form the mainstay of credit risk management, as it is the credit committee that will provide a sound credit-granting process. In practice the board of directors will delegate a certain level of authority to the credit committee, which will approve loans and limits that fall within its delegated authority. For large exposures the board itself may act as the credit committee, while for smaller loans individual bank officers may have sufficient delegated authority to lend without additional input. Treasury functions operate in such a fast moving environment that it will be impractical to have every deal approved by a committee; and given the size of deals, which are generally in the millions rather than lower, it is also not possible to leave the delegated authority with one individual. It is thus common practice to work on the basis of limits for individual counterparties. These will have to be approved by the credit committee and once established give dealers the parameters within which they can create credit risk exposures. The challenge will be to integrate such limits with those exposures created in other parts of the business. Only that way can it be ensured that credit risk is managed on a global basis across the organization, taking into account large exposures and portfolio effects.

Pricing considerations will also have to be taken into account as part of the credit granting process. It is important to ensure that loans get repaid, but interest charged must also include sufficient margin to cover the costs incurred by the bank in providing and administering the loan. From a portfolio management point of view the margin also needs to cover the likely probability of default. Every banker will know that there will be instances when debtors will default on their obligations. This likelihood of default will be determined by the obligor's creditworthiness, which is generally expressed in ratings. Thus every rating will have an explicit or implicit probability of default attached to it. Taking this probability into account a bank should ensure that the interest rate the obligor has to pay covers the risk associated with the loan. Although every banker and particularly treasurer will know of the need to price according to this risk return relationship, it can easily be forgotten. In particular market share considerations, and reputational effects can force banks into accepting returns on loans that are inadequate given the risks undertaken. Syndicated loans are an example, where it has sometimes been the case that participation in a loan

was important to remain a player in the market, even if in reality margins were inadequate to cover the risk taken onto the books.

The credit granting process is only the starting point of the whole credit risk management process. In particular within a treasury function, where controls are via limits, it will be important to monitor trading. Segregation will also need to be in place. Dealers should, for example, not be able to initiate payment, as this should be the remit of a separate back-office function. Similarly there need to be controls over who can change limits on the computer system. Other controls need to be in place over settlement procedures. Deal slips should be pro-actively reconciled with the information provided by the counterparty. Finally such back-office procedures need to be as tightly controlled as front-offices to ensure adherence to procedures. Segregation between front-offices and back-offices is a pre-requisite for this. These are the same controls as for the management of market risk.

Not only will it be important to ensure that limits are not breached, the appropriateness of limits needs to be reviewed, especially in light of new financial information that may impact on the creditworthiness of the counterparty. Many loans will also include covenants, breach of which may enable a bank to ask for early repayment. It is thus essential to monitor counterparties to ensure the bank's position is protected. This information will need to be assessed and, in particular, reviewed in order to assess if pro-active management is required. Examples of active management would be the calling for early repayment in case of a breach of contract, such as a breach of a covenant. Another would be the use of credit risk mitigation techniques or, for example, a straight sale of the exposure. When active management is required, for example for resale of a loan to reduce exposure, or taking a decision on whether to call any embedded options, it will be essential to have the original documentation at hand. Good record keeping is thus in each bank's self interest. Collateral and guarantees need to be monitored to ensure they still provide the protection that was originally intended. There also need to be procedures in place to ensure that adequate provisioning for downgrades of creditworthiness is correctly taken into account. The above shows that the process of credit risk management is far from over once a credit has been agreed, indeed active risk management only starts at that point. The appropriateness of procedures is thus important and adherence to them should be monitored continuously. This is generally done via the combination of a risk management unit and internal audit.

8.4.1 Credit risk modelling

The most advanced banks will use credit risk modelling to manage their credit risk. The approach is based on a more rigorous analysis of the bank's credit risk exposure than is common in less sophisticated banks.

Credit risk has three main components:

- ◆ Probability of default is the probability that the counterparty will fail to make a contractual payment.
- ◆ Loss given default is the proportion of claims that cannot be recovered if the counterparty or an exposure defaults.
- ◆ Exposure at default is the credit exposure relating to the amount that the bank will stand to lose in default. This is usually interpreted as the replacement value of the contract in the event of default or, in the case of commitment, the level of usage.

As already indicated there is a strong correlation between credit ratings and default rates. Credit ratings can thus be used to predict default rates. Predictions of default rates can also be improved by referring to other observable factors. Some financial variables can thus be used to discriminate between those firms likely to fail and those that are not. Indeed some banks use these financial variables to directly derive a probability of default for each individual counterparty or issue. Depending on the probability of default they will then assign a rating.

Similarly loss-given default rates can also be modelled. Intuitively there is a link between a rating and the recovery rates. It will vary depending on the seniority ranking of the creditor. Secured debt for example tends to have a recovery rate of up to 90%, while subordinated debt tends to have recovery rates of between 10% and 15%. There are also other differences. Probability of default very much depends on the obligor. In contrast loss given default only becomes an issue once a facility has been put in default. Even then the loss given default will be different for each exposure, even if to the same obligor. Thus a loan secured on a property is likely to have a much lower loss given default, than for example high-yield debt instruments that are treated as subordinated debt.

Any such credit models will have to be validated internally to ensure that results from it are robust. This can be undertaken either by backtesting the model against historic data, or for example by using scenario testing. Here the same issues arise that arise for VaR models. This is particularly the case since credit risk models by definition incorporate diversification effects.

Modelling has certain advantages in terms of risk management. From a business point of view it allows an improved assessment of the underlying capital that is needed for the various lending activities. This ought to help resource allocation within the institution, which in turn should ultimately lead to increased profits. The methodology is also useful from a reporting point of view. It is possible to estimate the maximum credit exposure at some level of confidence. Using a 95% confidence level, the credit at risk figure would show the maximum credit exposure that could be expected for a given holding period. Such a figure is useful to provide a feel for the overall credit risk that the bank is running. As is the case for VaR models, which are used for market risk, such a figure should not be confused with the maximum credit exposure possible. A further advantage of credit risk modelling is that it allows portfolio effects to be taken into account. This means that benefits of having

exposures that are not correlated to each other, and therefore reduce the riskiness of the portfolio, could be more clearly identified. It should be noted that the Basel Committee, when proposing a new Capital Accord, has explicitly avoided allowing full scale credit risk modelling for regulatory capital adequacy purposes on the basis that these are as yet insufficiently developed. Some practitioners disagree, and view the half-way step of allowing only internal rating models as insufficient.

8.4.2 Credit risk mitigation techniques

As we have seen, there are three elements of credit risk: default probability, loss given default and exposure at default. Credit risk management can therefore be regarded as a set of techniques for reducing default probability and exposure at default while at the same time increasing recovery rate. There are numerous techniques available to achieve this, some of which will be discussed below.

Netting arrangements

Netting arrangements stipulate that each party should be liable for the net amount, rather than the gross amount they owe to the other party. Netting arrangements protect the non-defaulting party from a situation where its counterparty defaults on one contract and yet simultaneously insists on the payment due on the other. In general, the reduction in credit exposure created by netting will be greater, the greater the number of deals outstanding with a counterparty and the more nearly aligned the individual contracts are in terms of maturities, contract size, etc. Periodic settlement has similar characteristics to netting, although it may be less effective in reducing exposure. Periodic settlement is based on the idea that outstanding obligations are settled at periodic intervals in the value of a contract, rather than aggregating them at the end of the contract. Although periodic settlement can reduce exposure, it can also increase problems under adverse market conditions.

Margin and collateral requirements

Institutions can also reduce their exposure by means of margin or collateral requirements. This means that a counterparty makes available some particular asset that it would forfeit to a creditor in the event of default. Collateral is usually demanded upfront, and it is common for margin requirements to be demanded by organized exchanges and by many derivative brokers. This margin is usually set to cover a specified large adverse move in the value of the underlying instruments.

Credit guarantees

Credit risk can also be reduced by seeking guarantees from third parties. Such guarantees mean that full loss of the principal can only occur if both the counterparty

and its guarantor default before payment can be made. This can sometimes lead to a major reduction in credit risk, as the likelihood of both counterparty and guarantor defaulting at the same time ought to be lower than the probability of default of just the counterparty.

Credit triggers

Credit triggers are clauses that allow a contract to be terminated on pre-agreed terms if the credit rating of a counterparty falls to some trigger level. These clauses are similar to the covenants often used in commercial lending that specify that the debtor must maintain minimum net worth or credit rating. These triggers may in theory reduce credit risk by setting a floor to the loss that will be taken. Whether this works as well in practice remains debatable, as significant use of credit triggers creates additional volatility which may not be in anyone's interest.

Credit derivatives

Firms can also manage their credit risks by using credit derivatives. These are derivatives contracts with payments conditional on credit events of one sort or another. Some of the more common credit derivatives are: credit default swaps, credit spread swaps and total return swaps. With credit default swaps one party makes periodic payments to another party in return for a promise of payment in the event of a default by some other party. With credit spread swaps periodic payments are made in return for the promise of a spread-contingent payment. Finally in total-return swaps parties swap bond payments, where at least one of the bonds involved is credit-risky. Firms that sell their credit risk can benefit by freeing up credit lines to good customers, while at the same time reducing their exposure to key or weak customers, so reducing their vulnerability. At the same time, other firms might benefit from acquiring particular credit risks, either from a diversification point of view or to increase yields.

Securitizations

Securitization has similar benefits to credit derivatives, the main difference being that once obligations have been securitized exposures are deemed to have moved completely off the books, rather than being only hedged, as is the case under the credit derivatives approach. Generally securitization refers to the repackaging of obligations into a special purpose company, which then sells its own instruments into the markets. Sometimes securitizations are also thought to include simple sales of individual loans. Either way there remains a question mark about the extent to which such a resale is permanent. The scale of the problem will depend on the exact nature of the securitization.

8.4.3 Impact on treasury activities

There are a number of ways that credit risk will be of importance to treasury functions. Clearly a treasury function will itself create credit risk by lending or placing money into the markets. This needs to be controlled like any other credit risk within a bank, although procedures are likely to be somewhat different to take account of the specific nature of dealing rooms.

Another element for consideration will be the credit risk the bank itself poses to other banks. This will drive the price at which funds can be obtained from the market and will therefore impact on the cost of funding in general. It will also matter with regard to the products that a bank can offer. A good example is in interest-rate swaps. As we will see in a later chapter, depending on the credit risk the bank itself poses, it may be able to enhance the borrowing capacity of some of its clients.

Finally credit risk, as a source of key risk, can lead to crisis. For example, during the Russian crisis in 1998 the market risk faced by some institutions rose significantly, creating pressure on liquidity. In such situations it is up to treasury management to manage the crisis by calling in commitments and creating liquidity by selling assets, sometimes at prices well below the normal market price. It is in such instances that treasury functions will prove their mettle by having clear procedures, and being able to implement these, to avoid a crisis undermining the institution as a whole.

8.5 Country risk

Country risk is the uncertainty created when funds are to cross international frontiers. It is the risk that a foreign borrower will not satisfactorily service its foreign currency debt obligations for economic or political reasons. Sovereign risk is a variation thereof. It arises when the borrower in question is part of the public sector of another country. Borrowers from the private sector would face an additional transfer risk, ie the risk that they are not allowed to transfer funds.

Country risk became more of an issue during the 1970s and 1980s. The assumption on which lending had been based was that debt could be serviced relatively easily given that export growth was higher in percentage terms than the rate of interest on the debt. This turned out to be a wrong assumption during the early 1980s, particularly when interest rates rose significantly as developing countries increased their domestic interest rates to overcome inflation. In 1982 the six-month Eurodollar interest rate for example rose to over 17%. At the same time, between 1980 and 1983, the debt of developing countries rose by almost USD 200bn but export earnings rose by only 10% of that amount. Debt servicing problems ensued and within a year some 15 countries with liabilities to international banks of over USD 200bn were renegotiated. Since 1979 there have been almost 200 rescheduling agreements between over 40 countries and their creditor banks. Although country

risk was less of an issue during the 1990s, the recent economic downturn and falls in asset prices have shown that country risk remains a type of credit risk that should not be ignored.

All cross border lending is subject to country risk, but there has always been some lack of clarity regarding what drives it and how to measure it. Starting from points of principle the assessment of country risk should concentrate on the ability of a country to generate or conserve the foreign exchange earnings which will allow residents of that country to service their foreign currency debt. Where the borrower is a state-owned entity the assessment of the country risk alone represents the credit assessment that a lender undertakes when considering any lending proposition.

As for other credit risk assessment, country risk assessment is based on both quantitative and qualitative factors. Typical quantitative factors are:

- ◆ Balance of payments and its structure, as a measure of foreign exchange in- and outflows.
- ◆ Size of external debt, particularly as a percentage of GNP or GDP.
- ◆ GNP growth, as a measure of a country's entrepreneurial dynamic.
- ◆ Inflation, on the basis that high inflation will undermine a country's economic performance and governments will have to take drastic actions, which generally increase country risk.
- ◆ Debt servicing burden, including debt servicing ratios and debt maturity.
- ◆ Structure of exports, a diversified set of exports being a positive characteristic.
- ◆ Foreign currency reserves held by the respective central bank.

Qualitative factors will include:

- ◆ A country's likelihood of facing internal unrest (ranging from industrial strife to civil war). The higher the likelihood the higher the country risk.
- ◆ The possibility of external conflict, which will take away resources from debt repayment, will also increase country risk.
- ◆ Similarly the existence of economic sanctions (or the possibility of them being introduced) is likely to undermine a country's debt servicing capacity.
- ◆ Previous rescheduling by the same country is also likely to be viewed as increasing country risk.

8.5.1 Rescheduling of sovereign debt

Given the legal aspects of sovereign debt and the amounts involved in sovereign debt, rescheduling negotiations have often been difficult. Sovereign debtors have tended to have large outstanding debt, which has to be placed widely in order for the financial markets to meet the demand. In a restructuring or rescheduling situation, the number of players does, however, increase the complexity of negotiations, particularly given the strong negotiating positions that a large sovereign borrower

has against a collection of lenders, particularly since the threat of ostracizing a country from future loans does not work.

Key parties to rescheduling have almost always been the International Monetary Fund (IMF) and the Paris Club. While the World Bank (IBRD) has large sovereign assets it has not had the same influence in renegotiations as the IMF. The Paris Club is an informal forum in which governments of debtor and creditor countries have renegotiated the terms of intra-government debt since 1956. It generally works in combination with the IMF. Organizationally it has been supported by French Treasury officials, thus the term Paris Club.

To some extent it has almost become a precondition for a rescheduling to have an agreement with the IMF. According to the IMF's charter, its main purposes include assisting countries with balance of payments problems and working for an orderly international monetary system. This includes the promotion of policies aimed at avoiding debt problems. This tends to be done via regular consultations with its members, including an exchange of views on a country's financial position and its policies. It often advises on how imbalances and existing or potential problems could be addressed. An IMF agreement would normally make available new IMF funding. Because of its international set-up, the IMF is almost the sole international entity that can force policy changes, often of a structural nature, as a quid pro quo for providing new funding. As a result countries will try to meet IMF payments, even if they have already defaulted on other loans, particularly since failure to meet IMF targets is invariably classified as an event of default under commercial loan agreements.

Rescheduling of commercial bank debt has tried to imitate the structure of the Paris Club. Commercial debt restructuring is sometimes known as the London Club, although in practice is even more ad hoc than the Paris Club. Each London Club is formed at the initiative of the debtor country and is dissolved when a restructuring agreement is signed. London Club 'Advisory Committees' are chaired by a leading financial firm and include representatives from a cross-section of other exposed firms. Recently, Advisory Committees have included representatives from non-bank creditors (notably fund managers holding sovereign bonds). London Club meetings are not restricted to London and may be held in either London, New York, Paris, or other financial centres.

For commercial banks it is almost more important to have an IMF agreement in place prior to renegotiating the debt. This is because they tend to have even less influence over sovereign countries than the large G10 countries, which are generally at the table for the Paris Club meetings. A key negotiation issue is normally to agree what will be covered by the negotiations and what will not. For example, trade debt, such as documentary credits, tends to be excluded as countries know of the difficult economic situations they would face if such a key area of finance for their economies was undermined by inclusion in a debt rescheduling.

Recently the IMF has proposed the setting up of collective action clauses (CACs) for sovereign debt. The idea is that this would lead to a speedier resolution of sovereign debt crises, which would be positive for market confidence. The IMF holds the view that 'the current process for the restructuring of sovereign debt is more prolonged, more damaging to a debtor and its creditors, and more unpredictable than is desirable'. The IMF proposes that the CAC includes a provision enabling a qualified majority to bind all bondholders within the same issue to the financial terms of a restructuring. The intention is to limit the ability of a minority of bondholders to disrupt the restructuring process by enforcing claims after a default and prior to a restructuring agreement. Additionally there would be a universal statutory framework (the sovereign debt restructuring mechanism, SDRM) which could create 'a legal framework of collective decision making by debtors and a supermajority of creditors'. However, doubts about the proposals within the international financial community remain, and progress is likely to remain slow.

8.6 Settlement and delivery risk

Settlement and delivery risk is also known as Herstatt risk. It is named after Bankhaus Herstatt in Germany, which went bankrupt having received German marks but not having delivered US dollars. After the failure in 1974 it took several weeks to untangle the web of transactions that had been undertaken and caused significant liquidity problems in the markets as well – all because the principle of 'valeur compensée', ie that the deal should be completed on the same day, was not honoured.

Technically settlement risk is a credit risk, but it is of such a special nature that it needs to be reviewed separately. Foreign exchange (FX) settlement risk is of particular concern and this section will focus on this type of settlement risk. Basically FX settlement risk is the risk of loss when a bank in a foreign exchange transaction pays the currency it sold but does not receive the currency it bought. FX settlement failures can arise from counterparty default, operational problems, market liquidity constraints and other factors. Settlement risk exists for any traded product but the size of the foreign exchange market makes FX transactions the greatest source of settlement risk for many market participants, involving daily exposures of tens of billions of dollars for the largest banks. Most significantly, for banks of any size, the amount at risk to even a single counterparty could in some cases exceed their capital. FX settlement risk is a form of counterparty risk involving both credit risk and liquidity risk. As with other forms of risk, banks need to ensure that they have a clear understanding of how settlement risk and particularly FX settlement risk arises.

The whole issue of settlement risk is taken very seriously by central banks and supervisory authorities. For example, the UK's Financial Services Authority discusses with banks what actions are being taken to ensure that this category of risk is being minimized. The crash of October 1987 clearly focused the minds of many banking

communities, prompting The Group of Thirty to produce a report called 'Clearance and Settlement Systems in the World's Securities Markets', a report which warned against the dangers of treating settlement risk lightly. A breakdown in the principles and practices that underpin the world's financial dealings may have grave consequences for the global money market, the banks that operate in them, and the world economies. Understanding and recognition of FX settlement risk has increased significantly, not least because of the work of the Committee on Payment and Settlement Systems (CPSS) of the Bank for International Settlements and the various reports and recommendations it has published. All banks are now expected to have a good understanding of FX settlement risk and to have formulated clear and firm plans for how to manage it.

8.6.1 Risk reduction

The risk is not just a daytime one, but extends from the moment a trade is struck to the time receipt of funds has been verified, which, with weekends, can easily extend over five days. It is thus important that all stakeholders actively work at reducing settlement risk.

Individual banks can reduce settlement risk by:

- ◆ Improving their awareness of FX settlement risk, its measurement and risk control.
- ◆ Ensuring careful release of payment instructions. Achieving this has been made more difficult by the introduction of straight through processing.
- ◆ Using electronic confirmation systems such as Crossmar® Matching Service, which is used by over 350 banks and 450 fund managers.
- ◆ Requiring better services from correspondents in turn-round time for payments to be confirmed using Crossmar® Matching Service or equivalent services.
- ◆ Requiring better services from correspondents in turn-round time for payments and in monitoring and reporting receipts.
- ◆ Signing bilateral netting agreements using agreements such as IFEMA, or joining FXNET or the SWIFT Accord.
- ◆ Using CLS Bank.

IFEMA is the International Foreign Exchange Master Agreement. The agreement includes procedures for foreign exchange dealing, close-out provisions, novation netting and settlement netting. Banks sign bilateral agreements but select which provisions from IFEMA will apply. IFEMA has mostly been used for close-out netting to establish obligations in the event of default by one of the parties. The aim of this is to prevent a liquidator 'cherry-picking' contracts, that is, honouring payments in his favour and ignoring the others. IFEMA has not generally been used for novation netting (to replace and net all current transactions) or settlement (payment) netting, although novation is covered in the agreement.

FXNET Limited, a limited partnership set up in the UK and owned by 12 major banks is a limited partnership of the world's leading foreign exchange market-making banks. The first and largest netting system available to banks today, the FXNET System is firmly established in 33 institutions serving 78 trading floors in 13 cities. It is an automated service for handling the netting of spot and forward contract on a bilateral basis. The process of novation is used. This cancels the initial deals and adds them to the running balances on each value date as part of a single netting agreement. Members are free to choose with which members they wish to net settlement amounts.

Using the SWIFT Accord, counterparties who have entered into binding legal agreements with each other may calculate their bilateral positions for payment netting. SWIFT writes that the 'bilateral netting service allows you to confirm, match, net and settle deals using a single supplier that takes financial liability for all subsequent stages of the value chain. By virtue of its real-time reporting mechanism, SWIFTNet Accord is ideally suited for netting by novation.'

8.6.2 Minimizing settlement and delivery risks

If there is a large need for overnight or short-term balances to cover short-term settlement difficulties, the banks will engage their contingency plan using available lines of credit. An example of an extreme case was when the Bank of New York needed USD 24 billion dollars overnight due to a technical problem.

Settlement risk requires particular emphasis and control in back-office operations. Based on this understanding, policies for managing the risk should be developed at the highest levels within the bank and implemented through a formal and independent process with adequate senior management oversight. As part of this process, a bank has to have measurement systems that provide appropriate and realistic estimates of settlement exposures on a timely basis. The development of counterparty settlement limits and the monitoring of the exposures against these limits are a critical control function. The bank also needs to have procedures for reacting in a prompt and balanced manner to failed transactions or other settlement problems.

Industry groups can help by:

- ◆ Introducing well-founded netting systems. Netting systems reduce the number and size of payment that are necessary when deals are settled on a trade-by-trade basis.
- ◆ Support continuous linked settlement systems, such as offered by CLS Bank. CLS Bank goes a step further than the multilateral netting systems provided by its predecessor ECHO.

ECHO, based in London, was a clearing house owned by a group of major international banks to provide multilateral netting of spot and forward contracts

between participants on a global basis, as is Multinet, based in North America. ECHO, established in August 1995, provided a multilateral netting facility for FX spot (two days) and forward contracts (up to two years), by becoming the central counterparty to trades between its users. It netted 11 currencies and had 24 users (banks). ECHO was owned by CLS Services Ltd, which also developed CLS Bank. ECHO ceased its service in 1999.

Central banks can help by:

- ◆ Improving national payment systems including Real Time Gross Settlement (RTGS). It should be noted that all European central banks already run RTGS systems.
- ◆ Encouraging banks in their country to recognize the risks and helping them to take action to reduce these risks.

More recently, since September 2002, FX settlement risk can be further reduced by the use of CLS Bank. CLS Bank is a private sector bank based in New York. Its sole purpose is to provide continuous linked settlement. CLS Bank eliminates settlement risk in cross-border payment instruction settlement, substantially reducing risk in the FX markets. The simultaneous exchange of value between settling parties (so-called Payment versus Payment – PVP) introduces a far higher degree of certainty in the settlement process which will benefit the market as a whole. The main benefits are that it eliminates the risk in cross currency payment instructions as settlement occurs on the same day and it enables its members to manage their liquidity better as the system enables them to see which transactions are settling in real time.

None of these initiatives will provide a completely risk-free payment system but together they go a long way to reducing risk.

Nine

Operational risk

Objectives

This chapter will cover the following topics:

- ◆ definition of operational risk;
- ◆ measurement and management;
- ◆ legal, reputational and strategic risk.

9.1 Introduction

Operational risk is, like credit risk, one of those banking risks that is almost all pervasive. Indeed one has to be careful to define operational risk in such a way that not every risk becomes an operational risk. Operational risk is self-evidently not particular to treasury functions. Nevertheless, given the nature of dealing activities, the consequences of poor operational risk management in treasury functions can be drastic. The examples of Bankhaus Herstatt, Barings and Allfirst have already been mentioned, and they are by no means the largest failures of operational risk management.

The following table gives examples of some of the larger operational risk events in recent years:

Table 9.1: Large losses from operational risk 1992 – 2002

Amount (USDm)	Bank	Year (of discovery)	Description
1,330	Barings PLC	1995	Due to unauthorized trading
1,110	Daiwa Bank Ltd.	1995	Due to unauthorized trading
900	JP Morgan Chase	2002	Enron-related litigation and regulatory matters
770	First National Bank of Keystone	2001	Loan fraud by senior managers
691	Allied Irish Bank	2002	Due to unauthorized trading
636	Morgan Grenfell (Deutsche Bank)	1997	Due to trades contravening fund management mandate
611	Republic New York Corp	2001	Restitution and fines for its role as custodian of securities
490	Bank of America	2002	Settlement of US class action lawsuit
440	Standard Chartered Bank PLC	1992	Breach of Indian banking laws
440	Superior Bank FSB	2001	Improper accounting

Increasingly the definition of operational risk is seen as the one given by the Basel Committee: 'The risk of loss resulting from inadequate or failed internal processes, people and system or from external events. The definition includes legal risk but excludes strategic and reputational risk'. Although many banks now work with this definition, some exclude legal risks, while others include reputational risk in their definition of operational risk.

This definition of operational risk is very extensive, but unlike other definitions it does leave room for the other risks. The Basel Committee has given the following examples of what the definition would include:

- ◆ Internal fraud. For example, intentional misreporting of positions, employee theft, and insider trading on an employee's own account.
- ◆ External fraud. For example, robbery, forgery, cheque kiting, and damage from computer hacking.
- ◆ Employment practices and workplace safety. For example, workers' compensation claims, violation of employee health and safety rules, organized labour activities, discrimination claims, and general liability.
- ◆ Clients, products and business practices. For example, fiduciary breaches, misuse of confidential customer information, improper trading activities on the bank's account, money laundering, and sale of unauthorized products.

- ◆ Damage to physical assets. For example, terrorism, vandalism, earthquake fires and floods.
- ◆ Business disruption and system failures. For example, hardware and software failures, telecommunication problems, and utility outages.
- ◆ Execution, delivery and process management. For example, data entry error collateral management failures, incomplete legal documentation, unapproved access given to client accounts, non-client counterparty misperformance and vendor disputes.

9.2 Background

Although credit and market risk remain the best known banking risks, operational risk is moving up the risk management agenda. The large losses incurred by banking institutions from failures in their systems and controls processes are only the symptoms of an increasingly complex environment in which banks operate. Increasing use of technology is an example, which has created new risks that are not easily managed. This not only relates to model risk, but wider uses of technology, such as straight through processing which reduces human input. Another example is e-Commerce and its associated distribution channels. Corporate activities, such as acquisitions and mergers (or de-mergers) bring their own demands on the skills of management teams, which may not always be able to fully meet the challenges that integration of new business units may bring. Outsourcing itself brings new risks that need to be adequately controlled and managed. Finally the complexity of instruments itself has brought about new risks. For example, when a bank misprices its option book, and thus incurs large losses, this is not caught by credit or market risk. Operational risk is a handy term to talk about a variety of risks that can be managed in a uniform manner.

The management of specific operational risks is not new. Indeed, we have looked at a number of these practices in the previous chapters. Examples are the prevention of fraud, independence of risk management units, segregation of duties and reducing manual input. Operational risk is about codifying these and integrating them into a more general operational risk management approach that can be run alongside market and credit risk management. This is particularly the case since the historic focus on internal control mechanisms within business lines, even if supplemented by the audit function, has not been successful in managing operational risk exposures.

Nevertheless operational risk management is still in its infancy and no best practice has yet emerged. There are even some fundamental questions on which banks cannot yet agree. For example, does operational risk arise purely out of business activities and thus is a consequence of business strategy or is operational risk taken on in its own right? The latter view implies that it can be pro-actively managed in its own right. The debate appears to be shifting to the latter view as specific structures and processes are beginning to emerge that are aimed at a distinct class of risk and

are emulating approaches that have worked for the treatment of credit and market risk.

This new approach to operational risk is partly driven by the perceived failings of previous methodologies in stemming the number of operational risk events, as shown in Table 9.1. Examples of such methodologies that were not as successful as had been hoped were self-assessments and devolving operational risk management to local business managers. Self-assessments was a methodology where banking units made regular self-assessments of the operational risks they faced and these were then fed into a central pool for action by either risk management units or internal audit. In contrast the devolution to local business managers often did not include any centralized reporting structure.

9.3 Sound practices for operational risk management

The 'Sound Practices for the Management and Supervision of Operational Risk' paper issued by the Basel Committee in February 2003 is a useful summary of the current approach to operational risk management. The paper acknowledges that operational risk management is currently in the process of being developed and that banks still need to evolve to best find how to implement these sound practices.

9.3.1 Developing an appropriate risk management environment

Like other risks, operational risk management requires the operational risk appetite to be clearly defined by senior management. Each bank should provide a firm-wide definition of operational risk and lay down the principles of how operational risk is to be identified, assessed, monitored, and controlled. This should include having staff with the appropriate skills and regular reviews by audit functions. Organizationally this would also require that a unified approach be developed to reporting operational risk exposures to senior management.

9.3.2 Risk management: identification, assessment, monitoring, and mitigation/control

Each bank should review its operations, and identify and assess the operational risk inherent in all material products, activities, processes and systems. This needs to be reviewed on a regular basis, and particularly when new products, activities, processes and systems are introduced. Once established, processes need to be in place to

monitor the risk profile and report this to the relevant internal committees. Only that way can banks ensure that their risk limitation and control strategy is appropriate to their overall risk appetite. A key risk mitigation that all banks should have is effective business continuity planning to be put into motion should there be a severe disruption of business.

Recent developments have focused on identifying and measuring operational risks. Tools that banks are trying out to identify operational risks include:

- ◆ Scorecards are used by some banks to translate qualitative assessments undertaken by staff into numbers to allow a ranking of different types of operational risk exposures. If appropriate the scorecard approach can be used across business lines. They can also be used to rank controls and other risk mitigation tools. Other self- or risk-assessment methodologies may have similar benefits to the scorecard approach.
- ◆ Risk mapping allows the categorization of activities into various operational risk types. The information can then be used to reveal areas of weakness and help prioritize subsequent management action.
- ◆ Monitoring risk indicators can also provide insight into a bank's risk position. These indicators may point to underlying problems. Examples are the number of failed trades, staff turnover rates and the frequency and/or severity of errors and omissions. Clearly such risk indicators will only be useful if they are monitored on a regular basis and used to identify issues for pro-active management.
- ◆ Other banks have taken an even more statistical approach by collecting historical loss data as a means to obtain meaningful information for assessing the bank's exposure to operational risk and developing a policy to mitigate/control the risk. This may be particularly useful if it is used to systematically track and record the frequency, severity and other relevant information on individual loss events. It can then be used to model operational risk, which in turn will enable scenario analysis and simulations to be run. This is likely to be of particular value if combined with risk indicators and other control factors that could give prior indications.

Particularly the modelling of operational risk could be used to differentiate between expected and unexpected losses. Expected losses could then be more systematically incorporated into pricing decisions. Unexpected losses could also be quantified statistically, which in turn may help a decision on whether the purchase of insurance contracts may be a useful risk mitigant.

In practice, many banks will have to continue to use the more traditional operational risk management tools. This will be based on ensuring compliance with internal processes, which for that purpose need to be well documented. It will require credible audit functions and risk management functions, which can ensure that appropriate risk controls and, where appropriate, limits are in place. As ever staff will need the appropriate skills and particularly senior management will need to understand the business they are in. Particularly when an enterprise-wide approach

is implemented, senior management should ensure that incentives provided to staff do not run counter to the risk management processes they are trying to implement. An example of this is that bonuses should not reward pure income, as this could lead to risky operations. Instead reward systems that take into account the riskiness of underlying activities are more likely to achieve the desired outcome of aligning the risk appetite chosen by senior management with the one to which the bank is actually exposed.

9.4 Legal risk

Whether legal risk should be included in the definition of operational risk, as suggested by the Basel Committee, remains an area of debate. It is quite often lawyers who believe that legal risk is sufficiently different to be treated separately. Indeed legal risk can be seen as an environmental risk, which is outside of the control sphere of management. This may be the case when there are legal changes that create a challenge to the business model and business practices of a bank. But even then it should be possible for senior management to find ways of controlling and mitigating legal risk, as it does for other operational risks.

Examples of legal risk that have crystallized because of firms' own actions are the misselling of personal pensions in the UK, or the investigations into the role of analysts in the US. Both of these created large costs, not only in legal fees, but also in regulatory fines. Legal risk thus exists from the activities of banks being challenged by regulators and customers. Retail customers may be able to involve the Financial Ombudsman Service for redress, while other clients could go straight to the courts.

A particular challenge of legal risk management is that the size of losses can be large and uncertain. However, in that it is no different from other operational risks. Indeed the effective management of legal risk can be used to mitigate much of the risk. This can be done by ensuring that documentation is retained to justify a bank's action. Prior to that it is a bank's culture which will drive how serious the legal aspects of documentation is taken. Adherence to legal requirements in general, in addition to supervisory requirements, can go a long way in mitigating legal risk. As ever employing staff with the appropriate skills is an important risk management principle. Having the procedures in place that will allow the identification and reporting of legal risk is no different for legal risk than for other operational risks.

9.5 Reputational risk

Even more so than legal risk, reputational risk often crystallizes rapidly. The danger is that once reputation is lost, a bank's brandname loses its value and the whole business model may become threatened. Reputation is even more difficult to measure

than other operational risks. This is particularly the case as it does not create losses (or monetary outflows) in itself. Rather, it stops customers doing business, and thus threatens the income generating capacity of an institution.

Nevertheless there is much that banks can do to control and mitigate their reputational risk. A starting point would be to manage how reputational risk arises in the first place. It may arise as a result of legal risk or regulatory action. In this case it is something that senior management can take action on prior to the event by implementing an appropriate culture that is aware of the potential of reputational risks and has reporting lines available that will ensure senior management is aware of the risks being taken by the business.

Managing reputational risk may be more difficult if the reputation is threatened by differences between internal business culture and the evolving public view of what is ethically acceptable. Discussions about senior management remuneration are an example. Nevertheless if managed correctly institutions may be able to mitigate the risk by better countering any inaccurate information that can sometimes drive public debates. A good example outside of the financial sector was Shell's Brent Spar debacle in 1995. Only after the reputation of Shell had been severely tarnished did Greenpeace acknowledge that the initial proposals by Shell were not as environmentally damaging as its own proposals had been.

Reputational risk management has a significant role to play even after a reputational risk event has occurred. Recent history has shown that companies that acknowledge problems early and are open to the public have a better chance of overcoming their reputational problems. This should almost be part of contingency planning, with clear guidelines on who in the organization will talk to the press and the public. The aim will be to show the public that the organization is in control of the situation and is doing the most it can. This will require clear assignation of responsibility and adherence to it by all staff.

9.6 Strategic risk

Strategic risk deals with the possibility that senior management takes strategic decisions that, with hindsight, prove to be bad decisions. The risk is again similar to reputational risk, in as much as it does not create a monetary loss. Instead it can produce significant loss of income, or threaten the institution's own survival. Examples abound where banks have decided to 're-focus on their core activities'. This generally happens after a decision has been taken to change the business mix, and that decision has not proved as successful as hoped.

In terms of risk management, the approach to strategic risk management does not differ significantly from managing other risks. Senior management should have a clear policy on how much risk it is willing to take. This will depend on its existing

line of business. It will then have to ensure that this agreed risk appetite is complied with throughout the organization.

Management should think strategically and review its strategy on a regular basis. This will enable it to anticipate major new developments, either to take advantage of them or at least to be prepared. From a control point of view, processes need to be in place to ensure that certain decisions are only taken at the most senior levels. Particular decisions would be major exposures, major investments and joint ventures. Clearly a change in business strategy should also be authorized at the highest level. This will only work if reporting lines and channels of communication are in place to ensure strategic policies are implemented throughout the organization and that potential issues are being reported up to senior management without being censored by middle management. Thus a board which looks at reports on business opportunities and leads, and the underlying economic value of projects, is more likely to be aware of issues than a board that only looks at financial reports.

Clearly strategic management will benefit shareholders significantly. It will facilitate optimal investment decisions. This in turn will protect cashflows and mediate between the different interests of shareholders and bondholders. If nothing else it ought to increase a company's net worth by ensuring that resources are utilized where they are most needed. This in turn should make earnings less volatile and reduce expected losses generally.