Low Capital Bank, by contrast, has only $4 million of equity, so its equity multiplier is higher, equaling 25 (= $100 million/$4 million). Suppose that these banks have been equally well run so that they both have the same return on assets, 1%. The return on equity for the High Capital Bank equals 1% × 10 = 10%, while the return on equity for the Low Capital Bank equals 1% × 25 = 25%. The equity holders in the Low Capital Bank are clearly a lot happier than the equity holders in the High Capital Bank because they are earning more than twice as high a return. We now see why owners of a bank may not want it to hold too much capital. ***Given the return on assets, the lower the bank capital, the higher the return for the owners of the bank.***

Trade-off Between Safety and Returns to Equity Holders. We now see that bank capital has benefits and costs. Bank capital benefits the owners of a bank in that it makes their investment safer by reducing the likelihood of bankruptcy. But bank capital is costly because the higher it is, the lower will be the return on equity for a given return on assets. In determining the amount of bank capital, managers must decide how much of the increased safety that comes with higher capital (the benefit) they are willing to trade off against the lower return on equity that comes with higher capital (the cost).

In more uncertain times, when the possibility of large losses on loans increases, bank managers might want to hold more capital to protect the equity holders. Conversely, if they have confidence that loan losses won't occur, they might want to reduce the amount of bank capital, have a high equity multiplier, and thereby increase the return on equity.

Bank Capital Requirements. Banks also hold capital because they are required to do so by regulatory authorities. Because of the high costs of holding capital for the reasons just described, bank managers often want to hold less bank capital relative to assets than is required by the regulatory authorities. In this case, the amount of bank capital is determined by the bank capital requirements. We discuss the details of bank capital requirements and why they are such an important part of bank regulation in Chapter 11.

Application

Strategies for Managing Bank Capital

Suppose that as the manager of the First National Bank, you have to make decisions about the appropriate amount of bank capital. Looking at the balance sheet of the bank, which like the High Capital Bank has a ratio of bank capital to assets of 10% ($10 million of capital and $100 million of assets), you are concerned that the large amount of bank capital is causing the return on equity to be too low. You conclude that the bank has a capital surplus and should increase the equity multiplier to increase the return on equity. What should you do?

To lower the amount of capital relative to assets and raise the equity multiplier, you can do any of three things: (1) You can reduce the amount of bank capital by buying back some of the bank's stock. (2) You can reduce the bank's capital by paying out higher dividends to its stockholders, thereby reducing the bank's retained earnings. (3) You can keep bank capital constant but increase the bank's assets by acquiring new funds—say, by issuing CDs—and then seeking out loan business or purchasing more securities with these new funds. Because you think that it would enhance your position with the

stockholders, you decide to pursue the second alternative and raise the dividend on the First National Bank stock.

Now suppose that the First National Bank is in a similar situation to the Low Capital Bank and has a ratio of bank capital to assets of 4%. You now worry that the bank is short on capital relative to assets because it does not have a sufficient cushion to prevent bank failure. To raise the amount of capital relative to assets, you now have the following three choices: (1) You can raise capital for the bank by having it issue equity (common stock). (2) You can raise capital by reducing the bank's dividends to shareholders, thereby increasing retained earnings that it can put into its capital account. (3) You can keep capital at the same level but reduce the bank's assets by making fewer loans or by selling off securities and then using the proceeds to reduce its liabilities. Suppose that raising bank capital is not easy to do at the current time because capital markets are tight or because shareholders will protest if their dividends are cut. Then you might have to choose the third alternative and decide to shrink the size of the bank.

In past years, many banks experienced capital shortfalls and had to restrict asset growth, as you might have to do if the First National Bank were short of capital. The important consequences of this for the credit markets are discussed in the application that follows.

Application

Did the Capital Crunch Cause a Credit Crunch in the Early 1990s?

During the 1990–1991 recession and the year following, there occurred a slowdown in the growth of credit that was unprecedented in the post–World War II era. Many economists and politicians have claimed that there was a "credit crunch" during this period in which credit was hard to get, and as a result the performance of the economy in 1990–1992 was very weak. Was the slowdown in credit growth a manifestation of a credit crunch, and if so, what caused it?

Our analysis of how a bank manages bank capital suggests that a credit crunch was likely to have occurred in 1990–1992 and that it was caused at least in part by the so-called capital crunch in which shortfalls of bank capital led to slower credit growth.

The period of the late 1980s saw a boom and then a major bust in the real estate market that led to huge losses for banks on their real estate loans. As our example of how bank capital helps prevent bank failures demonstrates, the loan losses caused a substantial fall in the amount of bank capital. At the same time, regulators were raising capital requirements (a subject discussed in Chapter 11). The resulting capital shortfalls meant that banks had to either raise new capital or restrict their asset growth by cutting back on lending. Because of the weak economy at the time, raising new capital was extremely difficult for banks, so they chose the latter course. Banks did restrict their lending, and borrowers found it harder to obtain loans, leading to complaints from banks' customers. Only with the stronger recovery of the economy in 1993, helped by a low-interest-rate policy at the Federal Reserve, did these complaints subside.

Managing Credit Risk

As seen in the earlier discussion of general principles of asset management, banks and also other financial institutions must make successful loans that are paid back in full (and so subject the institution to little credit risk) in order to earn high profits. The economic concepts of adverse selection and moral hazard (introduced in Chapters 2 and 8) provide a framework for understanding the principles that financial institutions have to follow to reduce credit risk and make successful loans.[3]

Adverse selection in loan markets occurs because bad credit risks (those most likely to default on their loans) are the ones who usually line up for loans; in other words, those who are most likely to produce an *adverse* outcome are the most likely to be *selected*. Borrowers with very risky investment projects have much to gain if their projects are successful, and so they are the most eager to obtain loans. Clearly, however, they are the least desirable borrowers because of the greater possibility that they will be unable to pay back their loans.

Moral hazard exists in loan markets because borrowers may have incentives to engage in activities that are undesirable from the lender's point of view. In such situations, it is more likely that the lender will be subjected to the *hazard* of default. Once borrowers have obtained a loan, they are more likely to invest in high-risk investment projects—projects that pay high returns to the borrowers if successful. The high risk, however, makes it less likely that they will be able to pay the loan back.

To be profitable, financial institutions must overcome the adverse selection and moral hazard problems that make loan defaults more likely. The attempts of financial institutions to solve these problems help explain a number of principles for managing credit risk: screening and monitoring, establishment of long-term customer relationships, loan commitments, collateral and compensating balance requirements, and credit rationing.

Screening and Monitoring

Asymmetric information is present in loan markets because lenders have less information about the investment opportunities and activities of borrowers than borrowers do. This situation leads to two information-producing activities by banks and other financial institutions—screening and monitoring. Indeed, Walter Wriston, a former head of Citicorp, the largest bank corporation in the United States, was often quoted as stating that the business of banking is the production of information.

Screening. Adverse selection in loan markets requires that lenders screen out the bad credit risks from the good ones so that loans are profitable to them. To accomplish effective screening, lenders must collect reliable information from prospective borrowers. Effective screening and information collection together form an important principle of credit risk management.

When you apply for a consumer loan (such as a car loan or a mortgage to purchase a house), the first thing you are asked to do is fill out forms that elicit a great deal of information about your personal finances. You are asked about your salary, your bank accounts and other assets (such as cars, insurance policies, and furnishings), and your outstanding loans; your record of loan, credit card, and charge

[3]Other financial intermediaries, such as insurance companies, pension funds, and finance companies, also make private loans, and the credit risk management principles we outline here apply to them as well.

account repayments; the number of years you've worked and who your employers have been. You also are asked personal questions such as your age, marital status, and number of children. The lender uses this information to evaluate how good a credit risk you are by calculating your "credit score," a statistical measure derived from your answers that predicts whether you are likely to have trouble making your loan payments. Deciding on how good a risk you are cannot be entirely scientific, so the lender must also use judgment. The loan officer, whose job is to decide whether you should be given the loan, might call your employer or talk to some of the personal references you supplied. The officer might even make a judgment based on your demeanor or your appearance. (This is why most people dress neatly and conservatively when they go to a bank to apply for a loan.)

The process of screening and collecting information is similar when a financial institution makes a business loan. It collects information about the company's profits and losses (income) and about its assets and liabilities. The lender also has to evaluate the likely future success of the business. So in addition to obtaining information on such items as sales figures, a loan officer might ask questions about the company's future plans, how the loan will be used, and the competition in the industry. The officer may even visit the company to obtain a firsthand look at its operations. The bottom line is that, whether for personal or business loans, bankers and other financial institutions need to be nosy.

Specialization in Lending. One puzzling feature of bank lending is that a bank often specializes in lending to local firms or to firms in particular industries, such as energy. In one sense, this behavior seems surprising, because it means that the bank is not diversifying its portfolio of loans and thus is exposing itself to more risk. But from another perspective, such specialization makes perfect sense. The adverse selection problem requires that the bank screen out bad credit risks. It is easier for the bank to collect information about local firms and determine their creditworthiness than to collect comparable information on firms that are far away. Similarly, by concentrating its lending on firms in specific industries, the bank becomes more knowledgeable about these industries and is therefore better able to predict which firms will be able to make timely payments on their debt.

Monitoring and Enforcement of Restrictive Covenants. Once a loan has been made, the borrower has an incentive to engage in risky activities that make it less likely that the loan will be paid off. To reduce this moral hazard, financial institutions must adhere to the principle for managing credit risk that a lender should write provisions (restrictive covenants) into loan contracts that restrict borrowers from engaging in risky activities. By monitoring borrowers' activities to see whether they are complying with the restrictive covenants and by enforcing the covenants if they are not, lenders can make sure that borrowers are not taking on risks at their expense. The need for banks and other financial institutions to engage in screening and monitoring explains why they spend so much money on auditing and information-collecting activities.

Long-Term Customer Relationships

An additional way for banks and other financial institutions to obtain information about their borrowers is through long-term customer relationships, another important principle of credit risk management.

If a prospective borrower has had a checking or savings account or other loans with a bank over a long period of time, a loan officer can look at past activity on the accounts and learn quite a bit about the borrower. The balances in the checking and

savings accounts tell the banker how liquid the potential borrower is and at what time of year the borrower has a strong need for cash. A review of the checks the borrower has written reveals the borrower's suppliers. If the borrower has borrowed previously from the bank, the bank has a record of the loan payments. Thus long-term customer relationships reduce the costs of information collection and make it easier to screen out bad credit risks.

The need for monitoring by lenders adds to the importance of long-term customer relationships. If the borrower has borrowed from the bank before, the bank has already established procedures for monitoring that customer. Therefore, the costs of monitoring long-term customers are lower than those for new customers.

Long-term relationships benefit the customers as well as the bank. A firm with a previous relationship will find it easier to obtain a loan at a low interest rate because the bank has an easier time determining if the prospective borrower is a good credit risk and incurs fewer costs in monitoring the borrower.

A long-term customer relationship has another advantage for the bank. No bank can think of every contingency when it writes a restrictive covenant into a loan contract; there will always be risky borrower activities that are not ruled out. However, what if a borrower wants to preserve a long-term relationship with a bank because it will be easier to get future loans at low interest rates? The borrower then has the incentive to avoid risky activities that would upset the bank, even if restrictions on these risky activities are not specified in the loan contract. Indeed, if a bank doesn't like what a borrower is doing even when the borrower isn't violating any restrictive covenants, it has some power to discourage the borrower from such activity: The bank can threaten not to let the borrower have new loans in the future. Long-term customer relationships therefore enable banks to deal with even unanticipated moral hazard contingencies.

Loan Commitments

Banks also create long-term relationships and gather information by issuing **loan commitments** to commercial customers. A loan commitment is a bank's commitment (for a specified future period of time) to provide a firm with loans up to a given amount at an interest rate that is tied to some market interest rate. The majority of commercial and industrial loans are made under the loan commitment arrangement. The advantage for the firm is that it has a source of credit when it needs it. The advantage for the bank is that the loan commitment promotes a long-term relationship, which in turn facilitates information collection. In addition, provisions in the loan commitment agreement require that the firm continually supply the bank with information about the firm's income, asset and liability position, business activities, and so on. A loan commitment arrangement is a powerful method for reducing the bank's costs for screening and information collection.

Collateral and Compensating Balances

Collateral requirements for loans are important credit risk management tools. Collateral, which is property promised to the lender as compensation if the borrower defaults, lessens the consequences of adverse selection because it reduces the lender's losses in the case of a loan default. If a borrower defaults on a loan, the lender can sell the collateral and use the proceeds to make up for its losses on the loan. One particular form of collateral required when a bank makes commercial loans is called **compensating balances**: A firm receiving a loan must keep a required minimum amount of funds in a checking account at the bank. For example, a business getting a $10 million loan may be required to keep compensating balances of at least $1 million in its checking account at the bank. This $1 million in compensating balances can then be taken by the bank to make up some of the losses on the loan if the borrower defaults.

A required minimum amount of funds that a firm receiving a loan must keep in a checking account at the lending bank.

Besides serving as collateral, compensating balances help increase the likelihood that a loan will be paid off. They do this by helping the bank monitor the borrower and consequently reduce moral hazard. Specifically, by requiring the borrower to use a checking account at the bank, the bank can observe the firm's check payment practices, which may yield a great deal of information about the borrower's financial condition. For example, a sustained drop in the borrower's checking account balance may signal that the borrower is having financial trouble, or account activity may suggest that the borrower is engaging in risky activities; perhaps a change in suppliers means that the borrower is pursuing new lines of business. Any significant change in the borrower's payment procedures is a signal to the bank that it should make inquiries. Compensating balances therefore make it easier for banks to monitor borrowers more effectively and are another important credit risk management tool.

Credit Rationing

Another way in which financial institutions deal with adverse selection and moral hazard is through **credit rationing**: refusing to make loans even though borrowers are willing to pay the stated interest rate or even a higher rate. Credit rationing takes two forms. The first occurs when a lender refuses to make a loan *of any amount* to a borrower, even if the borrower is willing to pay a higher interest rate. The second occurs when a lender is willing to make a loan but restricts the size of the loan to less than the borrower would like.

At first you might be puzzled by the first type of credit rationing. After all, even if the potential borrower is a credit risk, why doesn't the lender just extend the loan but at a higher interest rate? The answer is that adverse selection prevents this solution. Individuals and firms with the riskiest investment projects are exactly those that are willing to pay the highest interest rates. If a borrower took on a high-risk investment and succeeded, the borrower would become extremely rich. But a lender wouldn't want to make such a loan precisely because the investment risk is high; the likely outcome is that the borrower will *not* succeed and the lender will not be paid back. Charging a higher interest rate just makes adverse selection worse for the lender; that is, it increases the likelihood that the lender is lending to a bad credit risk. The lender would therefore rather not make any loans at a higher interest rate; instead, it would engage in the first type of credit rationing and would turn down loans.

Financial institutions engage in the second type of credit rationing to guard against moral hazard: They grant loans to borrowers, but not loans as large as the borrowers want. Such credit rationing is necessary because the larger the loan, the greater the benefits from moral hazard. If a bank gives you a $1,000 loan, for example, you are likely to take actions that enable you to pay it back because you don't want to hurt your credit rating for the future. However, if the bank lends you $10 million, you are more likely to fly down to Rio to celebrate. The larger your loan, the greater your incentives to engage in activities that make it less likely that you will repay the loan. Since more borrowers repay their loans if the loan amounts are small, financial institutions ration credit by providing borrowers with smaller loans than they seek.

Managing Interest-Rate Risk

With the increased volatility of interest rates that occurred in the 1980s, banks and other financial institutions became more concerned about their exposure to interest-rate risk, the riskiness of earnings and returns that is associated with changes in

interest rates. To see what interest-rate risk is all about, let's again take a look at the First National Bank, which has the following balance sheet:

FIRST NATIONAL BANK

Assets		Liabilities	
Rate-sensitive assets	$20 million	Rate-sensitive liabilities	$50 million
Variable-rate and short-term loans		Variable-rate CDs	
Short-term securities		Money market deposit accounts	
Fixed-rate assets	$80 million	Fixed-rate liabilities	$50 million
Reserves		Checkable deposits	
Long-term loans		Savings deposits	
Long-term securities		Long-term CDs	
		Equity capital	

A total of $20 million of its assets are rate-sensitive, with interest rates that change frequently (at least once a year), and $80 million of its assets are fixed-rate, with interest rates that remain unchanged for a long period (over a year). On the liabilities side, the First National Bank has $50 million of rate-sensitive liabilities and $50 million of fixed-rate liabilities. Suppose that interest rates rise by 5 percentage points on average, from 10% to 15%. The income on the assets rises by $1 million (= 5% × $20 million of rate-sensitive assets), while the payments on the liabilities rise by $2.5 million (= 5% × $50 million of rate-sensitive liabilities). The First National Bank's profits now decline by $1.5 million (= $1 million − $2.5 million). Conversely, if interest rates fall by 5 percentage points, similar reasoning tells us that the First National Bank's profits rise by $1.5 million. This example illustrates the following point: ***If a bank has more rate-sensitive liabilities than assets, a rise in interest rates will reduce bank profits and a decline in interest rates will raise bank profits.***

Gap and Duration Analysis

The sensitivity of bank profits to changes in interest rates can be measured more directly using **gap analysis**, in which the amount of rate-sensitive liabilities is subtracted from the amount of rate-sensitive assets. In our example, this calculation (called the "gap") is −$30 million (= $20 million − $50 million). By multiplying the gap times the change in the interest rate, we can immediately obtain the effect on bank profits. For example, when interest rates rise by 5 percentage points, the change in profits is 5% × −$30 million, which equals −$1.5 million, as we saw.

The analysis we just conducted is known as *basic gap analysis*, and it can be refined in two ways. Clearly, not all assets and liabilities in the fixed-rate category have the same maturity. One refinement, the *maturity bucket approach*, is to measure the gap for several maturity subintervals, called *maturity buckets*, so that effects of interest-rate changes over a multiyear period can be calculated. The second refinement, called *standardized gap analysis*, accounts for the differing degrees of rate sensitivity for different rate-sensitive assets and liabilities.

An alternative method for measuring interest-rate risk, called **duration analysis**, examines the sensitivity of the market value of the bank's total assets and liabilities to changes in interest rates. Duration analysis is based on what is known as Macaulay's

concept of *duration*, which measures the average lifetime of a security's stream of payments.[4] Duration is a useful concept because it provides a good approximation of the sensitivity of a security's market value to a change in its interest rate:

$$\text{percent change in market value of security} \approx -\text{percentage-point change in interest rate} \times \text{duration in years}$$

where $\approx$ denotes "approximately equals."

Duration analysis involves using the average (weighted) duration of a financial institution's assets and of its liabilities to see how its net worth responds to a change in interest rates. Going back to our example of the First National Bank, suppose that the average duration of its assets is three years (that is, the average lifetime of the stream of payments is three years), while the average duration of its liabilities is two years. In addition, the First National Bank has $100 million of assets and $90 million of liabilities, so its bank capital is 10% of assets. With a 5-percentage-point increase in interest rates, the market value of the bank's assets falls by 15% ($= -5\% \times 3$ years), a decline of $15 million on the $100 million of assets. However, the market value of the liabilities falls by 10% ($= -5\% \times 2$ years), a decline of $9 million on the $90 million of liabilities. The net result is that the net worth (the market value of the assets minus the liabilities) has declined by $6 million, or 6% of the total original asset value. Similarly, a 5-percentage-point decline in interest rates increases the net worth of the First National Bank by 6% of the total asset value.

As our example makes clear, both duration analysis and gap analysis indicate that the First National Bank will suffer if interest rates rise but will gain if they fall. Duration analysis and gap analysis are thus useful tools for telling a manager of a financial institution its degree of exposure to interest-rate risk.

Application

Strategies for Managing Interest-Rate Risk

Suppose that as the manager of the First National Bank, you have done a duration and gap analysis for the bank as discussed in the text. Now you need to decide what alternative strategies you should pursue to manage the interest-rate risk.

If you firmly believe that interest rates will fall in the future, you may be willing to take no action because you know that the bank has more rate-sensitive liabilities than rate-sensitive assets and so will benefit from the

[4] Algebraically, Macaulay's duration, D, is defined as:

$$D = \sum_{\tau=1}^{N} \tau \frac{CP_\tau}{(1+i)^\tau} \Big/ \sum_{\tau=1}^{N} \frac{CP_\tau}{(1+i)^\tau}$$

where τ = time until cash payment is made
CP_τ = cash payment (interest plus principal) at time τ
i = interest rate
N = time to maturity of the security

For a more detailed discussion of duration gap analysis using the concept of Macaulay's duration, you can look at an appendix to this chapter that is on this book's web site at www.aw.com/mishkin.

expected interest-rate decline. However, you also realize that the First National Bank is subject to substantial interest-rate risk because there is always a possibility that interest rates will rise rather than fall. What should you do to eliminate this interest-rate risk? One thing you could do is to shorten the duration of the bank's assets to increase their rate sensitivity. Alternatively, you could lengthen the duration of the liabilities. By this adjustment of the bank's assets and liabilities, the bank's income will be less affected by interest-rate swings.

One problem with eliminating the First National Bank's interest-rate risk by altering the balance sheet is that doing so might be very costly in the short run. The bank may be locked in to assets and liabilities of particular durations because of where its expertise lies. Fortunately, recently developed financial instruments known as financial derivatives—financial forwards and futures, options, and swaps—can help the bank reduce its interest-rate risk exposure but do not require that the bank rearrange its balance sheet. We discuss these instruments and how banks and other financial institutions can use them to manage interest-rate risk in Chapter 13.

Off-Balance-Sheet Activities

Although asset and liability management has traditionally been the major concern of banks, in the more competitive environment of recent years banks have been aggressively seeking out profits by engaging in off-balance-sheet activities.[5] **Off-balance-sheet activities** involve trading financial instruments and generating income from fees and loan sales, activities that affect bank profits but do not appear on bank balance sheets. Indeed, off-balance-sheet activities have been growing in importance for banks: The income from these activities as a percentage of assets has nearly doubled since 1980.

Loan Sales

One type of off-balance-sheet activity that has grown in importance in recent years involves income generated by loan sales. A **loan sale**, also called a *secondary loan participation*, involves a contract that sells all or part of the cash stream from a specific loan and thereby removes the loan from the bank's balance sheet. Banks earn profits by selling loans for an amount slightly greater than the amount of the original loan. Because the high interest rate on these loans makes them attractive, institutions are willing to buy them, even though the higher price means that they earn a slightly lower interest rate than the original interest rate on the loan, usually on the order of 0.15 percentage point.

Generation of Fee Income

Another type of off-balance-sheet activity involves the generation of income from fees that banks receive for providing specialized services to their customers, such as making foreign exchange trades on a customer's behalf, servicing a mortgage-backed security by collecting interest and principal payments and then paying them out, guaranteeing debt securities such as banker's acceptances (by which the bank promises

[5]Managers of financial institutions also need to know how well their banks are doing at any point in time. A second appendix to this chapter discusses how bank performance is measured; it can be found on the book's web site at www.aw.com/mishkin.

to make interest and principal payments if the party issuing the security cannot), and providing backup lines of credit. There are several types of backup lines of credit. We have already mentioned the most important, the loan commitment, under which for a fee the bank agrees to provide a loan at the customer's request, up to a given dollar amount, over a specified period of time. Credit lines are also now available to bank depositors with "overdraft privileges"—these bank customers can write checks in excess of their deposit balances and, in effect, write themselves a loan. Other lines of credit for which banks get fees include standby letters of credit to back up issues of commercial paper and other securities and credit lines (called *note issuance facilities*, NIFs, and *revolving underwriting facilities*, RUFs) for underwriting Euronotes, which are medium-term Eurobonds.

Off-balance-sheet activities involving guarantees of securities and backup credit lines increase the risk a bank faces. Even though a guaranteed security does not appear on a bank balance sheet, it still exposes the bank to default risk: If the issuer of the security defaults, the bank is left holding the bag and must pay off the security's owner. Backup credit lines also expose the bank to risk because the bank may be forced to provide loans when it does not have sufficient liquidity or when the borrower is a very poor credit risk.

Trading Activities and Risk Management Techniques

We have already mentioned that banks' attempts to manage interest-rate risk led them to trading in financial futures, options for debt instruments, and interest-rate swaps. Banks engaged in international banking also conduct transactions in the foreign exchange market. All transactions in these markets are off-balance-sheet activities because they do not have a direct effect on the bank's balance sheet. Although bank trading in these markets is often directed toward reducing risk or facilitating other bank business, banks also try to outguess the markets and engage in speculation. This speculation can be a very risky business and indeed has led to bank insolvencies, the most dramatic being the failure of Barings, a British bank, in 1995.

www.federalreserve.gov/boarddocs/SupManual/default.htm#trading

The Federal Reserve Bank Trading and Capital Market Activities Manual offers an in-depth discussion of a wide range of risk management issues encountered in trading operations.

Trading activities, although often highly profitable, are dangerous because they make it easy for financial institutions and their employees to make huge bets quickly. A particular problem for management of trading activities is that the principal-agent problem, discussed in Chapter 8, is especially severe. Given the ability to place large bets, a trader (the agent), whether she trades in bond markets, in foreign exchange markets or in financial derivatives, has an incentive to take on excessive risks: If her trading strategy leads to large profits, she is likely to receive a high salary and bonuses, but if she takes large losses, the financial institution (the principal) will have to cover them. As the Barings Bank failure in 1995 so forcefully demonstrated, a trader subject to the principal–agent problem can take an institution that is quite healthy and drive it into insolvency very fast (see Box 1).

To reduce the principal–agent problem, managers of financial institutions must set up internal controls to prevent debacles like the one at Barings. Such controls include the complete separation of the people in charge of trading activities from those in charge of the bookkeeping for trades. In addition, managers must set limits on the total amount of traders' transactions and on the institution's risk exposure. Managers must also scrutinize risk assessment procedures using the latest computer technology. One such method involves the so-called value-at-risk approach. In this approach, the institution develops a statistical model with which it can calculate the

Box 1: Global

Barings, Daiwa, Sumitomo, and Allied Irish

Rogue Traders and the Principal–Agent Problem. The demise of Barings, a venerable British bank over a century old, is a sad morality tale of how the principal–agent problem operating through a rogue trader can take a financial institution that has a healthy balance sheet one month and turn it into an insolvent tragedy the next.

In July 1992, Nick Leeson, Barings's new head clerk at its Singapore branch, began to speculate on the Nikkei, the Japanese version of the Dow Jones stock index. By late 1992, Leeson had suffered losses of $3 million, which he hid from his superiors by stashing the losses in a secret account. He even fooled his superiors into thinking he was generating large profits, thanks to a failure of internal controls at his firm, which allowed him to execute trades on the Singapore exchange *and* oversee the bookkeeping of those trades. (As anyone who runs a cash business, such as a bar, knows, there is always a lower likelihood of fraud if more than one person handles the cash. Similarly for trading operations, you never mix management of the back room with management of the front room; this principle was grossly violated by Barings management.)

Things didn't get better for Leeson, who by late 1994 had losses exceeding $250 million. In January and February 1995, he bet the bank. On January 17, 1995, the day of the Kobe earthquake, he lost $75 million, and by the end of the week had lost more than $150 million. When the stock market declined on February 23, leaving him with a further loss of $250 million, he called it quits and fled Singapore. Three days later, he turned himself in at the Frankfurt airport. By the end of his wild ride, Leeson's losses, $1.3 billion in all, ate up Barings's capital and caused the bank to fail. Leeson was subsequently convicted and sent to jail in Singapore for his activities. He was released in 1999 and apologized for his actions.

Our asymmetric information analysis of the principal–agent problem explains Leeson's behavior and the danger of Barings's management lapse. By letting Leeson control both his own trades and the back room, it increased asymmetric information, because it reduced the principal's (Barings's) knowledge about Leeson's trading activities. This lapse increased the moral hazard incentive for him to take risks at the bank's expense, as he was now less likely to be caught. Furthermore, once he had experienced large losses, he had even greater incentives to take on even higher risk because if his bets worked out, he could reverse his losses and keep in good standing with the company, whereas if his bets soured, he had little to lose since he was out of a job anyway. Indeed, the bigger his losses, the more he had to gain by bigger bets, which explains the escalation of the amount of his trades as his losses mounted. If Barings's managers had understood the principal–agent problem, they would have been more vigilant at finding out what Leeson was up to, and the bank might still be here today.

Unfortunately, Nick Leeson is no longer a rarity in the rogue traders' billionaire club, those who have lost more than $1 billion. Over 11 years, Toshihide Iguchi, an officer in the New York branch of Daiwa Bank, also had control of both the bond trading operation and the back room, and he racked up $1.1 billion in losses over the period. In July 1995, Iguchi disclosed his losses to his superiors, but the management of the bank did not disclose them to its regulators. The result was that Daiwa was slapped with a $340 million fine and the bank was thrown out of the country by U.S. bank regulators. Yasuo Hamanaka is another member of the billionaire club. In July 1996, he topped Leeson's and Iguchi's record, losing $2.6 billion for his employer, the Sumitomo Corporation, one of Japan's top trading companies. John Rusnak lost *only* $691 million for his bank, Allied Irish Banks, over the period from 1997 until he was caught in February 2002. The moral of these stories is that management of firms engaged in trading activities must reduce the principal–agent problem by closely monitoring their traders' activities, or the rogues' gallery will continue to grow.

maximum loss that its portfolio is likely to sustain over a given time interval, dubbed the value at risk, or VAR. For example, a bank might estimate that the maximum loss it would be likely to sustain over one day with a probability of 1 in 100 is $1 million; the $1 million figure is the bank's calculated value at risk. Another approach is called "stress testing." In this approach, a manager asks models what would happen if a doomsday scenario occurs; that is, she looks at the losses the institution would sustain if an unusual combination of bad events occurred. With the value-at-risk approach and stress testing, a financial institution can assess its risk exposure and take steps to reduce it.

Because of the increased risk that banks are facing from their off-balance-sheet activities, U.S. bank regulators have become concerned about increased risk from banks' off-balance-sheet activities and, as we will see in Chapter 11, are encouraging banks to pay increased attention to risk management. In addition, the Bank for International Settlements is developing additional bank capital requirements based on value-at-risk calculations for a bank's trading activities.

Summary

1. The balance sheet of commercial banks can be thought of as a list of the sources and uses of bank funds. The bank's liabilities are its sources of funds, which include checkable deposits, time deposits, discount loans from the Fed, borrowings from other banks and corporations, and bank capital. The bank's assets are its uses of funds, which include reserves, cash items in process of collection, deposits at other banks, securities, loans, and other assets (mostly physical capital).
2. Banks make profits through the process of asset transformation: They borrow short (accept deposits) and lend long (make loans). When a bank takes in additional deposits, it gains an equal amount of reserves; when it pays out deposits, it loses an equal amount of reserves.
3. Although more-liquid assets tend to earn lower returns, banks still desire to hold them. Specifically, banks hold excess and secondary reserves because they provide insurance against the costs of a deposit outflow. Banks manage their assets to maximize profits by seeking the highest returns possible on loans and securities while at the same time trying to lower risk and making adequate provisions for liquidity. Although liability management was once a staid affair, large (money center) banks now actively seek out sources of funds by issuing liabilities such as negotiable CDs or by actively borrowing from other banks and corporations. Banks manage the amount of capital they hold to prevent bank failure and to meet bank capital requirements set by the regulatory authorities. However, they do not want to hold too much capital because by so doing they will lower the returns to equity holders.
4. The concepts of adverse selection and moral hazard explain many credit risk management principles involving loan activities: screening and monitoring, establishment of long-term customer relationships and loan commitments, collateral and compensating balances, and credit rationing.
5. With the increased volatility of interest rates that occurred in the 1980s, financial institutions became more concerned about their exposure to interest-rate risk. Gap and duration analyses tell a financial institution if it has more rate-sensitive liabilities than assets (in which case a rise in interest rates will reduce profits and a fall in interest rates will raise profits). Financial institutions manage their interest-rate risk by modifying their balance sheets but can also use strategies (outlined in Chapter 13) involving financial derivatives.
6. Off-balance-sheet activities consist of trading financial instruments and generating income from fees and loan sales, all of which affect bank profits but are not visible on bank balance sheets. Because these off-balance-sheet activities expose banks to increased risk, bank management must pay particular attention to risk assessment procedures and internal controls to restrict employees from taking on too much risk.

Key Terms

asset management, p. 208
balance sheet, p. 201
capital adequacy management, p. 208
compensating balance, p. 219
credit rationing, p. 220
credit risk, p. 208
deposit outflows, p. 208
discount loans, p. 203
discount rate, p. 210
duration analysis, p. 221
equity multiplier (EM), p. 214
excess reserves, p. 204
gap analysis, p. 221
interest-rate risk, p. 208
liability management, p. 208
liquidity management, p. 208
loan commitment, p. 219
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money center banks, p. 212
off-balance-sheet activities, p. 223
required reserve ratio, p. 204
required reserves, p. 204
reserve requirements, p. 204
reserves, p. 204
return on assets (ROA), p. 214
return on equity (ROE), p. 214
secondary reserves, p. 204
T-account, p. 205
vault cash, p. 204

Questions and Problems

Questions marked with an asterisk are answered at the end of the book in an appendix, "Answers to Selected Questions and Problems."

1. Why might a bank be willing to borrow funds from other banks at a higher rate than it can borrow from the Fed?

*2. Rank the following bank assets from most to least liquid:
   a. Commercial loans
   b. Securities
   c. Reserves
   d. Physical capital

3. Using the T-accounts of the First National Bank and the Second National Bank, describe what happens when Jane Brown writes a $50 check on her account at the First National Bank to pay her friend Joe Green, who in turn deposits the check in his account at the Second National Bank.

*4. What happens to reserves at the First National Bank if one person withdraws $1,000 of cash and another person deposits $500 of cash? Use T-accounts to explain your answer.

5. The bank you own has the following balance sheet:

Assets		Liabilities	
Reserves	$ 75 million	Deposits	$500 million
Loans	$525 million	Bank capital	$100 million

If the bank suffers a deposit outflow of $50 million with a required reserve ratio on deposits of 10%, what actions must you take to keep your bank from failing?

*6. If a deposit outflow of $50 million occurs, which balance sheet would a bank rather have initially, the balance sheet in Problem 5 or the following balance sheet? Why?

Assets		Liabilities	
Reserves	$100 million	Deposits	$500 million
Loans	$500 million	Bank capital	$100 million

7. Why has the development of overnight loan markets made it more likely that banks will hold fewer excess reserves?

*8. If the bank you own has no excess reserves and a sound customer comes in asking for a loan, should you automatically turn the customer down, explaining that you don't have any excess reserves to lend out? Why or why not? What options are available for you to provide the funds your customer needs?

9. If a bank finds that its ROE is too low because it has too much bank capital, what can it do to raise its ROE?

*10. If a bank is falling short of meeting its capital requirements by $1 million, what three things can it do to rectify the situation?

11. Why is being nosy a desirable trait for a banker?

*12. A bank almost always insists that the firms it lends to keep compensating balances at the bank. Why?

13. "Because diversification is a desirable strategy for avoiding risk, it never makes sense for a bank to specialize in making specific types of loans." Is this statement true, false, or uncertain? Explain your answer.

*14. Suppose that you are the manager of a bank whose $100 billion of assets have an average duration of four years and whose $90 billion of liabilities have an average duration of six years. Conduct a duration analysis for the bank, and show what will happen to the net worth of the bank if interest rates rise by 2 percentage points. What actions could you take to reduce the bank's interest-rate risk?

15. Suppose that you are the manager of a bank that has $15 million of fixed-rate assets, $30 million of rate-sensitive assets, $25 million of fixed-rate liabilities, and $20 million of rate-sensitive liabilities. Conduct a gap analysis for the bank, and show what will happen to bank profits if interest rates rise by 5 percentage points. What actions could you take to reduce the bank's interest-rate risk?

Web Exercises

1. Table 1 reports the balance sheet of all commercial banks based on aggregate data found in the Federal Reserve *Bulletin*. Compare this table to the balance sheet reported by Wachovia found at www.wachovia.com/investor/annualfinancials.asp. Does Wachovia have more or less of its portfolio in loans than the average bank? What type of loan is most common?

2. It is relatively easy to find up-to-date information on banks because of their extensive reporting requirements. Go to www2.fdic.gov/qbp/. This site is sponsored by the Federal Deposit Insurance Corporation. You will find summary data on financial institutions. Go to the most recent Quarterly Banking Profile. Scroll to the bottom and open Table 1-A.
   a. Have banks' return on assets been increasing or decreasing over the last few years?
   b. Has the core capital been increasing and how does it compare to the capital ratio reported in Table 1 in the text?
   c. How many institutions are currently reporting to the FDIC?