Chapter Eleven

Credit Risk: Individual Loan Risk

INTRODUCTION

As discussed in Chapter 1, financial intermediaries (FIs) are special because of their ability to efficiently transform financial claims of household savers into claims issued to corporations, individuals, and governments. An FI's ability to evaluate information and to control and monitor borrowers allows it to transform these claims at the lowest possible cost to all parties. One of the specific types of financial claim transformation discussed in Chapter 1 is credit allocation. That is, FIs transform claims of household savers (in the form of deposits) into loans issued to corporations, individuals, and governments. The FI accepts the credit risk on these loans in exchange for a fair return sufficient to cover the cost of funding (e.g., covering the costs of borrowing, or issuing deposits) to household savers and the credit risk involved in lending.

In this chapter, the first of two chapters on credit risk, we discuss various approaches to analyzing and measuring the credit or default risk on individual loans (and bonds). In the next chapter, we consider methods for evaluating the risk of loan portfolios, or loan concentration risk. Methods for hedging and managing an FI's credit risk are left to Chapters 24 to 28. Measurement of the credit risk on individual loans or bonds is crucial if an FI manager is to (1) price a loan or value a bond correctly and (2) set appropriate limits on the amount of credit extended to any one borrower or the loss exposure it accepts from any particular counterparty. The Ethical Dilemmas box highlights how the default of one major borrower can have a significant impact on the value and reputation of many FIs. Thus, managers need to manage the FI's loan portfolio to protect the overall FI from the failure of a single borrower. Management of the overall loan portfolio is equally important. In recent years Japanese FIs have suffered losses from an overconcentration of loans in real estate and in Asia. Indeed, in the early 2000s bad loans of the top eight Japanese banks exceeded $43 billion, and a majority of Japanese banks reported losses as a result of having to write off these loans. In addition, Japanese life insurers were heavily exposed through their over 14 trillion yen ($129 billion) loan exposure to Japanese banks.

We begin this chapter with a look at the types of loans (commercial and industrial [C&I], real estate, individual, consumer, and others) as well as the characteristics of those loans—made by U.S. FIs. We then look at how both interest and fees are incorporated to calculate the return on a loan. This is followed by a discussion of how the return on a loan versus the quantity of credit made available for lending is used by FIs to make decisions on wholesale (C&I) versus retail (consumer) lending. Finally,

Ethical **Dilemmas**

BANKS' WORLDCOM RISK SAID BELOW ENRON LEVELS

Fueled by memories of bad loans to the bankrupt energy trader Enron Corp., investors on Wednesday ignored analyst warnings not to flee bank stocks in response to the news of alleged accounting fraud at WorldCom Inc. Late Tuesday the Clinton, Miss.–based company, which operates MCI, the country's second biggest long-distance telephone company, said that it had improperly booked $3.9 billion of expenses. Some observers said that it may be forced to file for bankruptcy. . . .

WorldCom currently has $2.65 billion of outstanding loans, and U. S. banking companies are on the book for about a third of that. Though analysts disagree about the total U.S. bank exposure, forecasts range from $670 million to $955 million. All day Wednesday, analysts kept revising their estimates for bank exposure. They also downplayed the fraud's impact on the large commercial banking companies that extended credit to WorldCom, including Mellon Financial Corp., J. P. Morgan Chase & Co., Citigroup Inc., FleetBoston Financial Corp., Bank One Corp., Bank of America Corp., and Wells Fargo & Co.

While most of the banks, citing client confidentiality, would not comment on their exposure, Mellon said it has $100 million of exposure to WorldCom. Lori Appelbaum, an analyst at Goldman Sachs Group Inc., said it would lower Mellon's earnings per share this year by 12 cents, or 6 percent. Of the U. S. banking companies involved in the internationally shared credit, Mellon has the most exposure in proportion to its size, said Ms. Appelbaum. . . . In a report issued Wednesday, Ms. Applebaum estimated that WorldCom exposure would lower Morgan Chase's earnings per share by 5 cents, or nearly 2 percent; Fleet's by 5 cents, or nearly 2 percent; Bank One's by 3 cents, or 1 percent; Bank of America's by 5 cents, or 1 percent; Wells Fargo's by 2 cents, or 0.7 percent; and Citi's by 1 cent, or 0.3 percent. Some banks will be able to cover their charge-offs with existing reserves, she said.

Morgan Chase could have the most exposure to WorldCom, with $133 million of outstanding loans and $268 million of undrawn commitments, according to Ruchi Madan, an analyst at Citi's Salomon Smith Barney. In a report Wednesday, Ms. Madan estimated that WorldCom has $5.4 billion of credit lines outstanding. Analysts agree that banks probably will not be obligated to honor these lines. Because the company has admitted to improper accounting, it is prevented from drawing down untapped credit lines. . . .

Source: Veronica Agosta, *The American Banker,* June 27, 2002, p. 20. *www.americanbanker.com*

we examine various models used to measure credit risk, including qualitative models, credit scoring models, and newer models of credit risk measurement. Indeed, technological advances have been at least one driving force behind the advances and new models of credit risk measurement and management in recent years. Appendixes A and B examine two privately developed credit risk measurement models: CreditMetrics and Credit Risk +. Appendix C, located at the book's website (**www.mhhe.com/saunders5e**) discusses cash flow and financial ratio analysis widely used in the credit analysis process for mortgage, consumer, and commercial loans.

CREDIT QUALITY PROBLEMS

junk bond
A bond rated as speculative or less than investment grade by bond-rating agencies such as Moody's.

Over the past two decades the credit quality of many FIs' lending and investment decisions has attracted a great deal of attention. In the 1980s there were tremendous problems with bank loans to less developed countries (LDCs) as well as with thrift and bank residential and farm mortgage loans. In the early 1990s attention switched to the problems of commercial real estate loans (to which banks, thrifts, and insurance companies were all exposed) as well as **junk bonds** (rated as speculative or less

than investment grade securities by bond-rating agencies such as Moody's or Standard & Poors). In the late 1990s concerns shifted to the rapid growth in low-quality auto loans and credit cards as well as the declining quality in commercial lending standards as loan delinquencies started to increase. In the late 1990s and early 2000s, attention has focused on problems with telecommunication companies, new technology companies, and a variety of sovereign countries including at various times Argentina, Brazil, Russia, and South Korea.

www.moodys.com
www.standardandpoors.com

Nevertheless, over the last decade the credit quality of most U.S. FIs has continued to improve even in the face of a prolonged spurt in the growth of loans (see Figure 11–1). This improvement in asset quality—measured by the decline in the ratio of nonperforming loans[1] to loans from 3.9 percent in 1991 to 0.74 percent in 2000—reflects, in part, the expansion of the U.S. economy in the 1990s as well as improvements in the way FIs measure and manage credit risk (see below). However, the recession in the U.S. economy in the early 2000s led to a turnaround in this pattern as nonperforming loan rates increased to 1.5 percent. For example, J. P. Morgan Chase and Citigroup had combined loans of $1.4 billion outstanding to Enron when it declared bankruptcy in December 2001.

Internet Exercise Go to the Federal Deposit Insurance Corporation Web site and find the latest information available for nonperforming loans at commercial banks in the United States, using the following steps.

Go to the Federal Deposit Insurance Corporation Web Site a **www.fdic.gov.** Click on the "*Analysts.*" Click on "FDIC Quarterly Banking Profile." Click on "Quarterly Banking Profile." Click on the most recent date and "Commercial Bank Section." Click on "TABLE V-A. Loan Performance." This will download a file on to your computer that will contain the most recent information as "Percent of Loans Noncurrent: Total Loans and Leases."

Credit quality problems, in the worst case, can cause an FI to become insolvent or can result in such a significant drain on capital[2] and net worth that they adversely affect its growth prospects and ability to compete with other domestic and international FIs.[3]

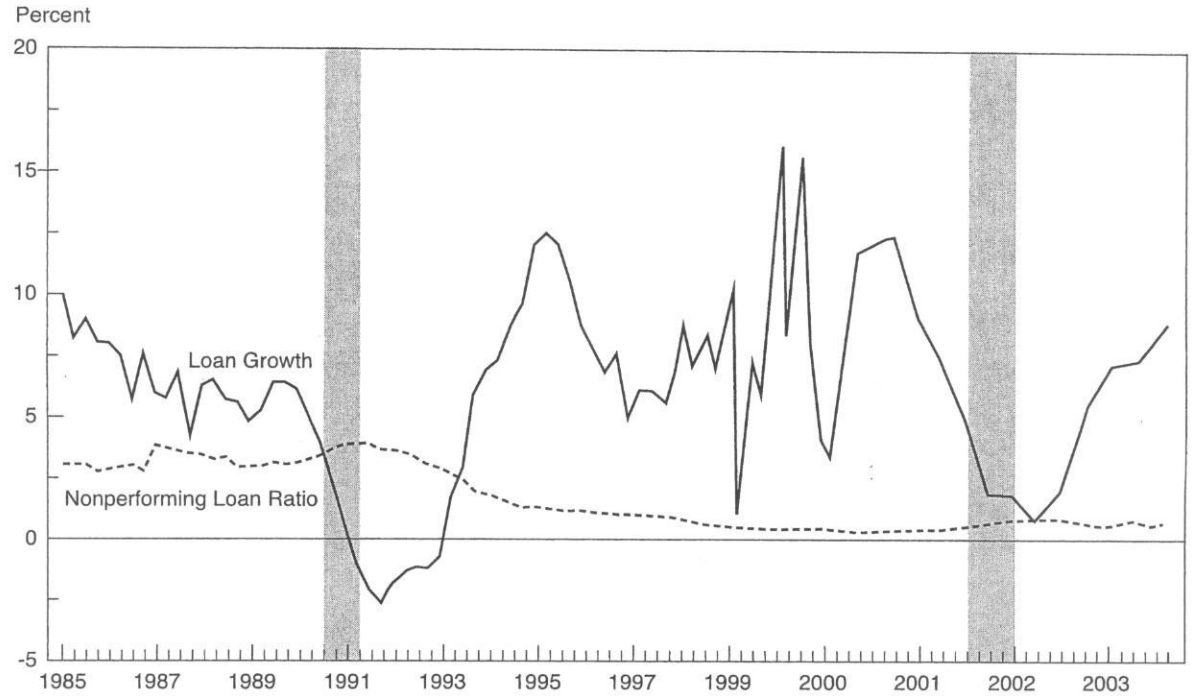
However, credit risk does not apply only to traditional areas of lending and bond investing. As banks and other FIs have expanded into credit guarantees

[1] Nonperforming loans are loans that are 90 days or more past due or are not accruing interest.

[2] Losses drain capital through the income statement item "provision for loan losses." The provision for loan losses is a noncash, tax-deductible expense representing the FI management's prediction of loans at risk of default for the current period. As credit quality problems arise, the FI recognizes its expected bad loans by recording this expense, which reduces net income and, in turn, the FI's capital. The provision for loan losses is then allocated to the allowance for loan losses listed on the balance sheet. The allowance for loan and lease losses is a cumulative estimate by the FI's management of the percentage of the gross loans (and leases) that will not be repaid to the FI. Although the maximum amount of the provision of loan losses and the reserve for loan losses is influenced by tax laws, the FI's management actually sets the level based on loan growth and recent loan loss experience. The allowance for loan losses is an accumulated reserve that is adjusted each period as management recognizes the possibility of additional bad loans and makes appropriate provisions for such losses. Actual losses are then deducted from, and recoveries are added to (referred to as net write-offs), their accumulated loans and lease loss reserve balance. See Appendix 2C, "Financial Statements and Analysis" (located at the book's Web site, **www.mhhe.com/saunders5e**) for a more detailed discussion of these items.

[3] Not only is the book value of the FI's capital affected by credit quality problems in its loan portfolio, but studies have found that returns on commercial banks' common stocks decrease significantly on the announcement of bankruptcy and default by borrowers of their bank. See S. Dahiya, A. Saunders, and A. Srinivasan, "Financial Distress and Bank Lending Relationships," *Journal of Finance,* February 2003, pp. 375–401.

FIGURE 11–1 Loan Growth and Asset Quality



Loan growth is measured as the simple change from its year-ago level.
Shaded area represents a business recession.

Source: Federal Reserve Bank of St. Louis, *Monetary Trends*, April 1998; and Federal Deposit Insurance Corporation, *Quarterly Banking Profile*, Second Quarter 2003, *www.stls.frb.org* and *www.fdic.gov*

and other off-balance-sheet activities (see Chapter 13), new types of credit risk exposure have arisen, causing concern among managers and regulators. Thus, credit risk analysis is now important for a whole variety of contractual agreements between FIs and counterparties.[4]

Concept Questions

1. What are some of the credit quality problems faced by FIs over the last two decades?
2. What are some of the newer, nontraditional activities that create credit risk for today's FIs?

TYPES OF LOANS

Although most FIs make loans, the types of loans made and the characteristics of those loans differ considerably. This section analyzes the major types of loans made by U.S. commercial banks. Remember from Chapters 2 through 6, however, that other FIs, such as thrifts, finance companies, and insurance companies, also engage heavily in lending, especially in the real estate area. We also discuss important aspects of other FIs' loan portfolios.

Table 11–1 shows a recent breakdown of the aggregate loan portfolio of U.S. commercial banks into four broad classes: commercial and industrial (C&I), real estate, individual, and all others. We look briefly at each of these loan classes in turn.

Commercial and Industrial Loans

The figures in Table 11–1 disguise a great deal of heterogeneity in the commercial and industrial loan portfolio. Indeed, commercial loans can be made for periods as

[4] This is one of the reasons for bank regulators' setting capital requirements against credit risk (see Chapter 20).

TABLE 11–1
Types of U.S. Bank Loans, October 2003 (in billions of dollars)

	Amount	Percent
Total loans*	$4,348.3	100.0%
C&I	1,106.2	25.4
Real estate	2,221.6	51.1
Individual	594.9	13.7
Other	425.6	9.8

*Excluding interbank loans.

Source: Federal Reserve Board, *Assets and Liabilities of Commercial Banks*, October 2003. *www.federalreserve.gov*

short as a few weeks to as long as eight years or more. Traditionally, short-term commercial loans (those with an original maturity of one year or less) are used to finance firms' working capital needs and other short-term funding needs, while long-term commercial loans are used to finance credit needs that extend beyond one year, such as the purchase of real assets (machinery), new venture start-up costs, and permanent increases in working capital. They can be made in quite small amounts, such as $100,000, to small businesses or in packages as large as $10 million or more to major corporations. Large C&I loans are often syndicated. A **syndicated loan** is provided by a group of FIs as opposed to a single lender. A syndicated loan is structured by the lead FI (or agent) and the borrower. Once the terms (rates, fees, and covenants) are set, pieces of the loan are sold to other FIs. In addition, C&I loans can be secured or unsecured. A **secured loan** (or asset-backed loan) is backed by specific assets of the borrower; if the borrower defaults, the lender has a first lien or claim on those assets. In the terminology of finance, secured debt is senior to an **unsecured loan** (or junior debt) that has only a general claim on the assets of the borrower if default occurs. As we explain later in this chapter, there is normally a trade-off between the security or collateral backing of a loan and the loan interest rate or risk premium charged by the lender on a loan.[5]

syndicated loan
A loan provided by a group of FIs as opposed to a single lender.

secured loan
A loan that is backed by a first claim on certain assets (collateral) of the borrower if default occurs.

unsecured loan
A loan that has only a general claim to the assets of the borrower if default occurs.

spot loan
The loan amount is withdrawn by the borrower immediately.

loan commitment
A credit facility with a maximum size and a maximum period of time over which the borrower can withdraw funds; a line of credit.

In addition, commercial loans can be made at either fixed or floating rates of interest. A fixed-rate loan has the rate of interest set at the beginning of the contract period. This rate remains in force over the loan contract period no matter what happens to market rates. Suppose, for example, IBM borrowed $10 million at 10 percent for one year, but the FI's cost of funds rose over the course of the year. Because this is a fixed-rate loan, the FI bears all the interest rate risk. This is why many loans have floating-rate contractual terms. The loan rate can be periodically adjusted according to a formula so that the interest rate risk is transferred in large part from the FI to the borrower. As might be expected, longer-term loans are more likely to be made under floating-rate contracts than are relatively short-term loans.[6]

Finally, loans can be made either spot or under commitment. A **spot loan** is made by the FI, and the borrower uses or takes down the entire loan amount immediately. With a **loan commitment,** or line of credit, by contrast, the lender makes an amount of credit available, such as $10 million; the borrower has the option to

[5] Such a trade-off has been confirmed in A. Berger and G. Udell, "Lines of Credit, Collateral and Relationship Lending in Small Firm Finance," *Journal of Business* 68 (July 1995), pp. 351–82.

[6] However, floating-rate loans are more credit risky than fixed-rate loans, holding all other contractual features the same. This is because floating-rate loans pass the risk of all interest rate changes onto borrowers. Thus, in rising interest rate environments, floating-rate borrowers may find themselves unable to pay the interest on their loans and may be forced to default. The benefit of floating-rate loans to lenders is that they better enable FIs to hedge the cost of rising interest rates on liabilities (such as deposits). This suggests that controlling interest rate risk may be at the expense of enhanced credit risk.

TABLE 11–2 Characteristics of Commercial Loan Portfolios, August 4–8, 2003

	Long-Term Loans	Short-Term Loans			
		Zero*	Daily	2 to 30 days	31 to 365 days
Amount outstanding (in billions of dollars)	$2.89	$15.48	$20.86	$9.14	$10.08
Average size of loan	$210,000	$253,000	$646,000	$644,000	$627,000
Weighted-average maturity	60 months	41 days	231 days	416 days	608 days
Percent of which made under commitment	59.2%	86.1%	72.6%	75.9%	84.0%
Percent of loans secured by collateral	66.9%	41.1%	28.0%	34.3%	45.2%

*Floating-rate loans that are subject to repricing at any time.

Source: Federal Reserve Board Web site, October 2003. *www.federalreserve.gov*

take down any amount up to the $10 million at any time over the commitment period. In a fixed-rate loan commitment, the interest rate to be paid on any takedown is established when the loan commitment contract originates. In a floating-rate commitment, the borrower pays the loan rate in force when the loan is actually taken down. For example, suppose the $10 million IBM loan was made under a one-year loan commitment. When the loan commitment was originated (say, January 2006), IBM borrows nothing. Instead, it waits until six months have passed (say, July 2006) before it takes down the entire $10 million. IBM pays the loan rate in force as of July 2006. We discuss the special features of loan commitments more fully in Chapter 13.

To determine the basic characteristics of C&I loans, the Federal Reserve surveys more than 400 banks each quarter. Table 11–2 shows the major characteristics in a recent lending survey. As you can see, more short-term (under one year) C&I loans than long-term loans were reported. Also, short-term loans are more likely to be made under commitment than long-term loans and are less likely to be backed or secured by collateral.

commercial paper Unsecured short-term debt instrument issued by corporations.

Finally, as we noted in Chapter 2, commercial loans are declining in importance in bank loan portfolios. The major reason for this has been the rise in nonbank loan substitutes, especially commercial paper. **Commercial paper** is an unsecured short-term debt instrument issued by corporations either directly or via an underwriter to purchasers in the financial markets, such as money market mutual funds. By using commercial paper, a corporation can sidestep banks and the loan market to raise funds often at rates below those banks charge. As of October 2003, the total commercial paper outstanding in the United States was $1,324.7 billion compared with C&I loans of $1,287.8 billion.[7] Moreover, since only the largest corporations can tap the commercial paper market, banks are often left with a pool of increasingly smaller and riskier borrowers in the C&I loan market. For example, as the U.S. economy slowed in the early 2000s, noncurrent (loans that are 90 days or more past due or are not accruing interest) C&I loans increased from $14 billion (in the fourth quarter of 1999) to almost $24 billion (in the second quarter of 2003).

[7] With the advent of Section 20 subsidiaries in 1987, large banks have enjoyed much greater powers to underwrite commercial paper (and other securities) directly without legal challenges by the securities industry that underwriting by banks was contrary to the Glass–Steagall Act. With the passage of the Financial Services Modernization Act of 1999 (see Chapter 21) and the abolition of the Glass–Steagall Act, the need to issue bank loans as an imperfect substitute for commercial paper underwriting has now become much less important.

TABLE 11–3
Distribution of U.S. Commercial Bank Real Estate Mortgage Debt, Second Quarter 2003

	Percent
One- to four-family residences	76.8%
Multifamily residences	5.7
Commercial	16.1
Farm	1.4
	100.0%

Source: Federal Reserve Board Web site, September 2003. *www.federalreserve.gov*

However, in late 2001 and early 2002, the slowdown in the U.S. economy also resulted in ratings downgrades for some of the largest commercial paper issuers. For example, the downgrade of General Motors and Ford from a tier-one (the best) to a tier-two (second-best) commercial paper issuer had a huge impact on the commercial paper markets. Tyco International, another major commercial paper issuer, fell from a tier-one to a tier-three (third-best) issuer, a level for which there is virtually no demand.[8] The result is that these commercial paper issuers have been forced to give up the cost advantage of commercial paper and to move to the bank loan market or the long-term debt markets to ensure they have access to cash. Thus, while commercial paper is still the largest money market instrument outstanding, the decrease in the number of eligible commercial paper issuers in 2001–2003 resulted in a decrease in the size of the commercial paper market for the first time in 40 years.

Real Estate Loans

Real estate loans are primarily mortgage loans and some revolving home equity loans (approximately 12 percent of the real estate loan portfolio in October 2003).[9] We show the distribution of mortgage debt for U.S. banks for the second quarter of 2003 in Table 11–3. For banks (as well as thrifts), residential mortgages are still the largest component of the real estate loan portfolio; until recently, however, commercial real estate mortgages were the fastest-growing component of real estate loans. Moreover, commercial real estate loans make up more than 80 percent of life insurance companies' real estate portfolios. These loans caused banks, thrifts, and insurance companies significant default and credit risk problems in the early 1990s.

As with C&I loans, the characteristics of residential mortgage loans differ widely. These characteristics include the size of the loan, the ratio of the loan to the property's price (the loan price or loan value ratio), and the maturity of the mortgage. Other important characteristics are the mortgage interest (or commitment) rate and fees and charges on the loan, such as commissions, discounts, and points paid by the borrower or the seller to obtain the loan.[10] In addition, the mortgage rate differs according to whether the mortgage has a fixed rate or a floating rate, also called an adjustable rate. **Adjustable rate mortgages (ARMs)** have their contractual rates periodically adjusted to some underlying index, such as the one-year T-bond rate. The proportion of fixed-rate mortgages to ARMs in FI portfolios varies with the

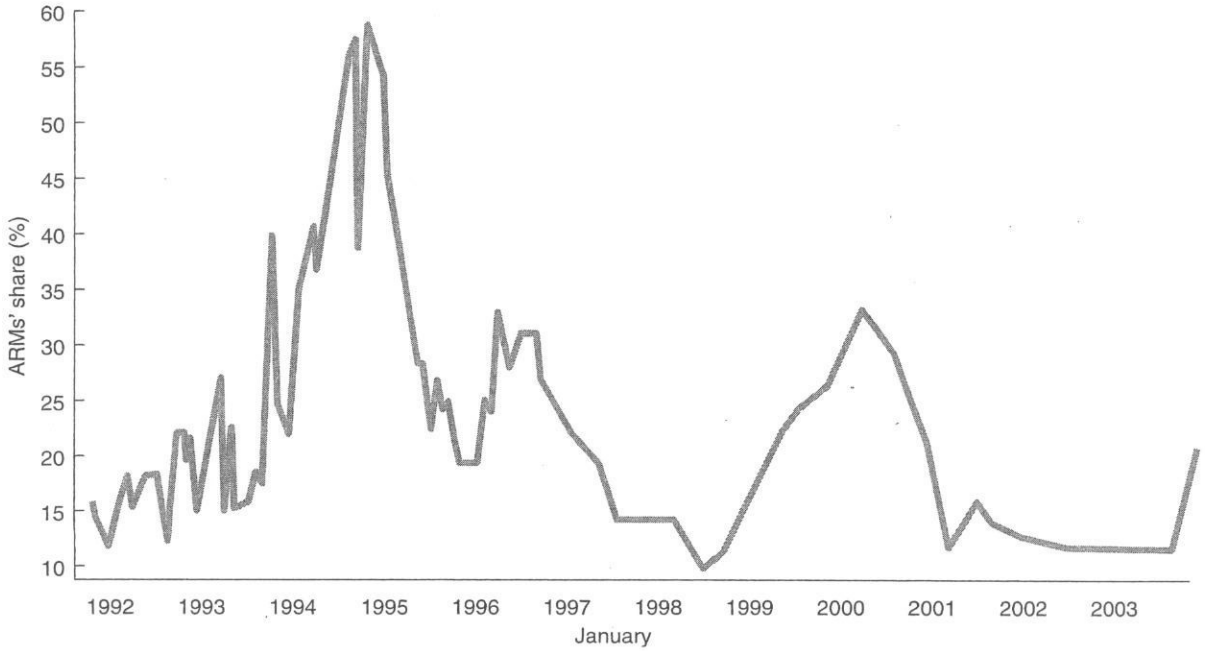
adjustable rate mortgage (ARM) A mortgage whose interest rate adjusts with movements in an underlying market index interest rate.

[8] The market and investors view this type of commercial paper as the short-term equivalent of junk bonds.

[9] Under home equity loans, borrowers use their homes as collateral backing for loans.

[10] Points are a certain percentage of the face value of the loan paid up front, as a fee, by the borrower to the lender.

FIGURE 11–2 ARMs' Share of Total Loans Closed, 1992–2003



Source: Federal Housing Finance Board Web site, October 2003. *www.fhfb.gov*

TABLE 11–4 Contractual Terms on Conventional New Home Mortgages, June 2003

Purchase price (in thousands of dollars)	$283.3
Amount of loan (in thousands of dollars)	$213.7
Loan-to-value ratio (percent)	78.0%
Maturity (years)	28.8
Fees and charges (percent of loan amount)	0.64%
Contract rate (percent)	5.42%

Source: *Federal Reserve Bulletin*, September 2003, Table 1.53. *www.federalreserve.gov*

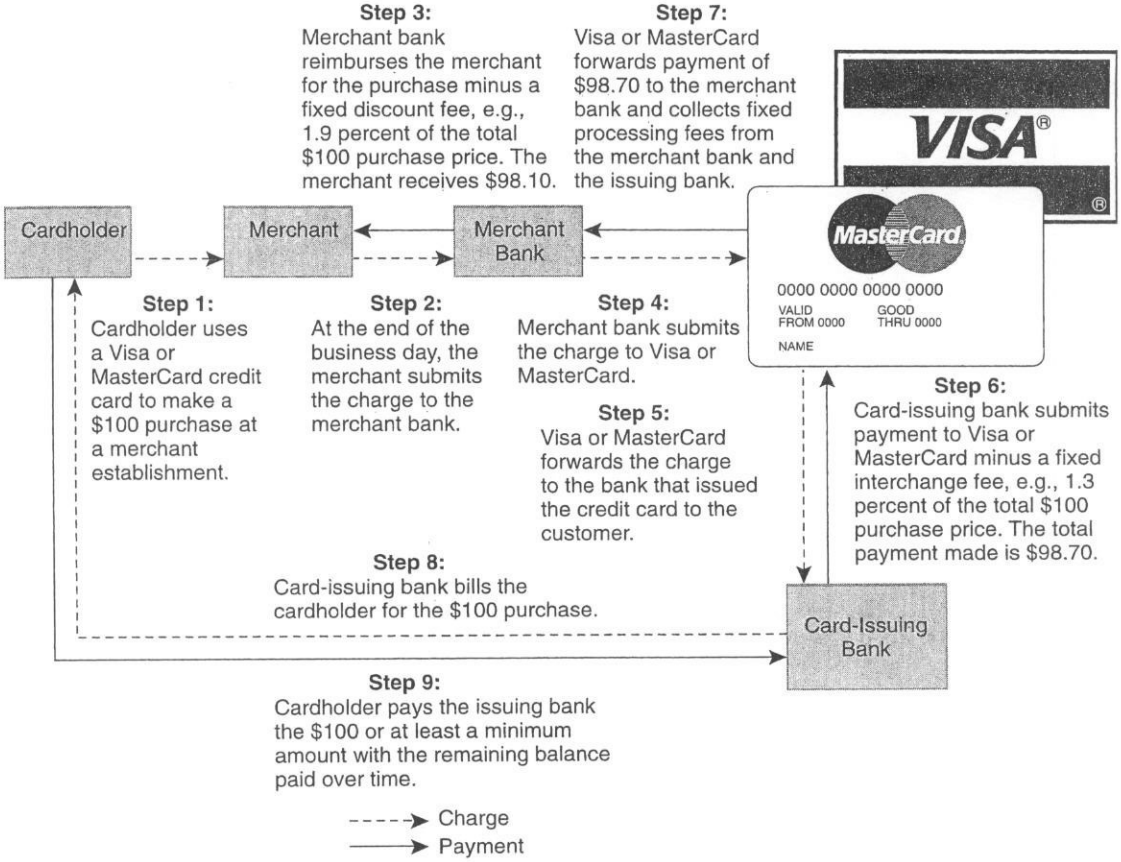
interest rate cycle. In low–interest rate periods, borrowers prefer fixed-rate to adjustable rate mortgages. As a result, the proportion of ARMs to fixed-rate mortgages can vary considerably over the rate cycle. In Figure 11–2, note the behavior of ARMs over one recent interest rate cycle—1992 to 2002—when interest rates rose, then fell, and then rose and fell again. Table 11–4 presents a summary of the major contractual terms on conventional fixed-rate mortgages as of June 2003.

Residential mortgages are very long-term loans with an average maturity of almost 29 years. To the extent that house prices can fall below the amount of the loan outstanding—that is, the loan-to-value ratio rises—the residential mortgage portfolio can also be susceptible to default risk. For example, during the collapse in real estate prices in Houston, Texas, in the late 1980s, many house prices actually fell below the prices of the early 1980s. This led to a dramatic surge in the proportion of mortgages defaulted on and eventually foreclosed by banks and thrifts.

Individual (Consumer) Loans

Another major type of loan is the individual, or consumer, loan, such as personal and auto loans. Commercial banks, finance companies, retailers, savings institutions,

FIGURE 11–3 Payment Flows in a Typical Credit Card Transaction



Source: GAO (1994) (GAO/GGD-94-23), p. 57.

TABLE 11–5
Biggest Credit Card Issuers as of December 2002

Source: Card Source One Web site, November 2003. *www.cardsourceone.com*

Card Issuer	Total Outstanding Balances (in billions of dollars)	Change from Year Earlier (percent)
Citigroup	$116.6	+7%
MBNA America	92.4	+9
BankOne	74.0	+8
Capital One Financial	57.7	+27
Discover Financial Services	55.8	+13

credit unions, and oil companies also provide consumer loan financing through credit cards, such as Visa, MasterCard, and proprietary credit cards issued by, for example, Sears and AT&T. A typical credit card transaction is illustrated in Figure 11–3. The five largest credit card issuers and their outstanding balances in 2003 are shown in Table 11–5.

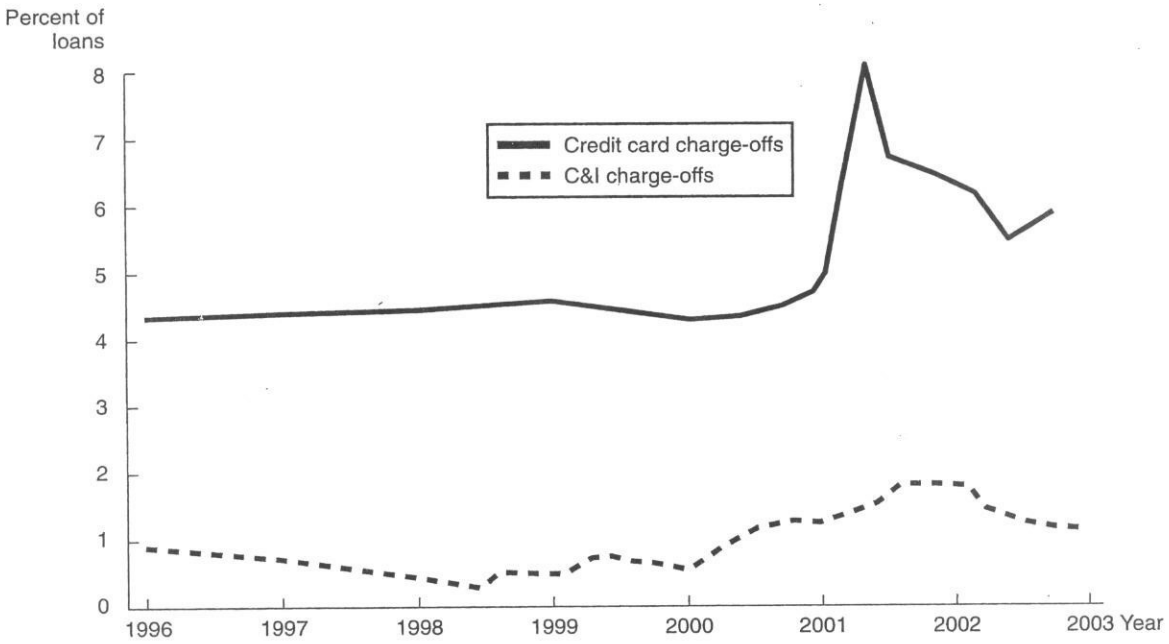
In Table 11–6 are the two major classes of consumer loans at U.S. banks. The largest class of loans is nonrevolving consumer loans, which include new and used automobile loans, mobile home loans, and fixed-term consumer loans such

TABLE 11–6
Types of Consumer Loans at Commercial Banks, August 2003

	Percent
Revolving	37.2%
Nonrevolving	62.8
	100.0%

Source: Federal Reserve Board Web site, Consumer Credit, October 2003. *www.federalreserve.gov*

FIGURE 11–4 Annual Net Charge-Off Rates on Loans



Source: Federal Deposit Insurance Corporation, *Quarterly Banking Profile*, various issues. *www.fdic.gov*

revolving loan
A credit line on which a borrower can both draw and repay many times over the life of the loan contract.

as 24-month personal loans. The other major class of consumer loans is revolving loans, such as credit card debt. With a **revolving loan,** the borrower has a credit line on which to draw as well as to repay up to some maximum over the life of the credit contract. In recent years, banks have faced charge-off rates between 4 and 8 percent on their credit card loan outstanding. These charge-off rates are significantly higher than those on commercial loans (see Figure 11–4). Such relatively high default rates again point to the importance of risk evaluation prior to the credit decision.

In Table 11–7 we show indicative interest rates on car, personal, and credit card loans as of August 2003. These rates differ widely depending on features such as collateral backing, maturity, default rate experience, and non–interest rate fees. In addition, competitive conditions in each market as well as regulations such as state- or city-imposed **usury ceilings** (maximum rates FIs can charge on consumer and mortgage debt) all affect the rate structure for consumer loans. For example, in April 2001, Philadelphia enacted a statute, targeting nonbank lenders, prohibiting the issuance of mortgage loans with an interest rate

usury ceilings
State- or city-imposed ceilings on the maximum rate FIs can charge on consumer and mortgage debt.

TABLE 11–7
Interest Rate Terms on Consumer Loans, August 2003

	Percent
48-month car loan	6.77%
24-month personal loan	11.94
Credit card	12.94

Source: Federal Reserve Board Web site, Consumer Credit, October 2003. *www.federalreserve.gov*

more than 6.5 percent above the yield on comparable maturity Treasury securities and with total fees greater than 4 percent of the total loan amount.

Other Loans

The "other loans" category can include a wide variety of borrowers and types, including farmers, other banks, nonbank financial institutions (such as call loans to investment banks[11]), broker margin loans (loans financing a percentage of an individual investment portfolio), state and local governments, foreign banks, and sovereign governments. We discuss sovereign loans in Chapter 16.

Concept Questions

1. What are the four major types of loans made by U.S. commercial banks? What are the basic distinguishing characteristics of each type of loan?
2. Will more ARMs be originated in high- or low-interest-rate environments? Explain your answer.
3. In Table 11–7, explain why credit card loan rates are much higher than car loan rates.

CALCULATING THE RETURN ON A LOAN

An important element in the credit management process, once the decision to make a loan has been made, is its pricing. This includes adjustments for the perceived credit risk or default risk of the borrower as well as any fees and collateral backing the loan.[12] This section demonstrates one method used to calculate the return on a loan: the traditional *return on assets approach*. Although we demonstrate the return calculations using examples of commercial and industrial loans, the techniques can be used to calculate the return on other loans (such as credit card or mortgage loans) as well.

The Contractually Promised Return on a Loan

The previous description of loans makes it clear that a number of factors impact the promised return an FI achieves on any given dollar loan (asset) amount. These factors include the following:

1. The interest rate on the loan.
2. Any fees relating to the loan.

[11] A call loan is a loan contract enabling the lender (e.g., the bank) to request repayment of a loan at any time in the contract period. A noncallable loan leaves the timing of the repayment in the hands of the borrower subject to the limit of the maturity of the loan. For example, most broker loans to investment banks are callable within the day and have to be repaid immediately at the bank lender's request.

[12] FIs have recently developed relationship pricing programs, which offer discounts on interest rates for customers based on the total amount of fee-based services used and investments held at the FI. Relationship pricing is in contrast to (the more traditional) transaction pricing, in which customers pay a stated rate for a service regardless of the total amount of other (nonloan) business conducted with the FI.

3. The credit risk premium on the loan.
4. The collateral backing of the loan.
5. Other nonprice terms (especially compensating balances and reserve requirements).

First, let us consider an example of how to calculate the promised return on a C&I loan. Suppose that an FI makes a spot one-year, $1 million loan. The loan rate is set as follows:

$$\begin{aligned} \text{Base lending rate } (BR) &= 12\% \\ + \text{ Credit risk premium or margin } (m) &= \underline{\ 2\%} \\ BR + m &= 14\% \end{aligned}$$

LIBOR
The London Interbank Offered Rate, which is the rate for interbank dollar loans of a given maturity in the offshore or Eurodollar market.

prime lending rate
The base lending rate periodically set by banks.

The base lending rate (BR) could reflect the FI's weighted-average cost of capital or its marginal cost of funds, such as the commercial paper rate, the federal funds rate, or **LIBOR**—the London Interbank Offered Rate, which is the rate for interbank dollar loans of a given maturity in the Eurodollar market. The center of the Eurodollar market is London. Alternatively, it could reflect the **prime lending rate.** The prime rate is most commonly used in pricing longer-term loans, while the fed funds rate and LIBOR rate are most commonly used in pricing short-term loans. Traditionally, the prime rate has been the rate charged to the FI's lowest-risk customers. Now, it is more of a base rate to which positive or negative risk premiums can be added. In other words, the best and largest borrowers now commonly pay below prime rate to be competitive with the commercial paper market.[13]

Direct and indirect fees and charges relating to a loan generally fall into three categories:

1. A loan origination fee (of) charged to the borrower for processing the application.
2. A compensating balance requirement (b) to be held as non-interest-bearing demand deposits. **Compensating balances** are a percentage of a loan that a borrower cannot actively use for expenditures. Instead, these balances must be kept on deposit at the FI. For example, a borrower facing a 10 percent compensating balance requirement on a $100 loan would have to place $10 on deposit (traditionally on demand deposit) with the FI and could use only $90 of the $100 borrowed. This requirement raises the effective cost of loans for the borrower since less than the full loan amount ($90 in this case) can actually be used by the borrower and the deposit rate earned on compensating balances is less than the borrowing rate. Thus, compensating balance requirements act as an additional source of return on lending for an FI.[14]
3. A reserve requirement (RR) imposed by the Federal Reserve on the FI's (specifically depository institution's) demand deposits, including any compensating balances.

compensating balance
A percentage of a loan that a borrower is required to hold on deposit at the lending institution.

While credit risk may be the most important factor ultimately affecting the return on a loan, these other factors should not be ignored by FI managers in evaluating loan profitability and risk. Indeed, FIs can compensate for high credit risk in a number of ways other than charging a higher explicit interest rate or risk premium on a loan or restricting the amount of credit available. In particular, higher

[13] For more information on the prime rate, see P. Nabar, S. Park, and A. Saunders, "Prime Rate Changes: Is There an Advantage in Being First?" *Journal of Business* 66 (1993), pp. 69–92; and L. Mester and A. Saunders, "When Does the Prime Rate Change?" *Journal of Banking and Finance* 19 (1995), pp. 743–64.

[14] They also create a more stable supply of deposits and thus mitigate liquidity problems.

fees, high compensating balances, and increased collateral backing all offer implicit and indirect methods of compensating an FI for lending risk.

The contractually promised gross return on the loan, k, per dollar lent—or ROA per dollar lent—equals:[15]

$$1 + k = 1 + \frac{of + (BR + m)}{1 - [b(1 - RR)]}$$

This formula may need some explanation. The numerator is the promised gross cash inflow to the FI per dollar, reflecting direct fees (of) plus the loan interest rate ($BR + m$). In the denominator, for every \$1 in loans the FI lends, it retains b as non-interest-bearing compensating balances. Thus, $1 - b$ is the net proceeds of each \$1 of loans received by the borrower from the FI, ignoring reserve requirements. However, since b (compensating balances) are held by the borrower at the FI as demand deposits, the Federal Reserve requires depository institutions to hold non-interest-bearing reserves at the rate RR against these compensating balances. Thus, the FI's net benefit from requiring compensating balances must consider the cost of holding additional non-interest-bearing reserve requirements. The net outflow by the FI per \$1 of loans is $1 - [b(1 - RR)]$ or, 1 minus the reserve adjusted compensating balance requirement.

EXAMPLE 11–1 *Calculation of ROA on a Loan*

Suppose a bank does the following:

1. Sets the loan rate on a prospective loan at 14 percent (where $BR = 12\%$ and $m = 2\%$).
2. Charges a 1/8 percent (or 0.125 percent) loan origination fee to the borrower.
3. Imposes a 10 percent compensating balance requirement to be held as non-interest-bearing demand deposits.
4. Sets aside reserves, at a rate of 10 percent of deposits, held at the Federal Reserve (i.e., the Fed's cash-to-deposit reserve ratio is 10 percent).

Plugging the numbers from our example into the return formula, we have:[16]

$$1 + k = 1 + \frac{.00125 + (.12 + .02)}{1 - [(.10)(.9)]}$$

$$1 + k = 1 + \frac{.14125}{.91}$$

$$1 + k = 1.1552 \text{ or } k = 15.52\%$$

This is, of course, greater than the simple promised interest return on the loan, $BR + m = 14\%$.

In the special case where fees (of) are zero and the compensating balance (b) is zero:

$$of = 0$$

$$b = 0$$

[15] This formula ignores present value aspects that could easily be incorporated. For example, fees are earned in up-front undiscounted dollars while interest payments and risk premiums are normally paid on loan maturity and thus should be discounted by the FI's cost of funds.

[16] If we take into account the present value effects on the fees and the interest payments and assume that the bank's discount rate (d) was $12\frac{1}{2}$ percent, then the $BR + m$ term needs to be discounted by $1 + d = 1.125$ while fees (as up-front payments) are undiscounted. In this case, k is 13.81 percent.

the contractually promised return formula reduces to:

$$1 + k = 1 + (BR + m)$$

That is, the credit risk premium or margin (m) is the fundamental factor driving the promised return on a loan once the base rate on the loan is set.

Note that as commercial lending markets have become more competitive, both origination fees (of) and compensating balances (b) are becoming less important. For example, where compensating balances are still charged, the bank may now allow them to be held as time deposits, and they earn interest. As a result, borrowers' opportunity losses from compensating balances have been reduced to the difference between the loan rate and the compensating balance time-deposit rate. Further, compensating balance requirements are very rare on international loans such as Eurodollar loans.[17] Finally, note that for a given promised gross return on a loan, k, FI managers can use the pricing formula to find various combinations of fees, compensating balances, and risk premiums they may offer their customers that generate the same returns.

The Expected Return on a Loan

default risk
The risk that the borrower is unable or unwilling to fulfill the terms promised under the loan contract.

The promised return on the loan ($1 + k$) that the borrower and lender contractually agree on includes both the loan interest rate and non-interest rate features such as fees. The promised return on the loan, however, may well differ from the expected and, indeed, actual return on a loan because of default risk. **Default risk** is the risk that the borrower is unable or unwilling to fulfill the terms promised under the loan contract. Default risk is usually present to some degree in all loans. Thus, at the time the loan is made, the expected return [$E(r)$] per dollar lent is related to the promised return as follows:

$$E(r) = p(1 + k) - 1$$

where p is the probability of repayment of the loan. To the extent that p is less than 1, default risk is present. This means the FI manager must (1) set the risk premium (m) sufficiently high to compensate for this risk and (2) recognize that setting high risk premiums as well as high fees and base rates may actually reduce the probability of repayment (p). That is, k and p are not independent. Indeed, over some range, as fees and loan rates increase, the probability that the borrower pays the promised return may decrease (i.e., k and p may be negatively related). As a result, FIs usually have to control for credit risk along two dimensions: the price or promised return dimension ($1 + k$) and the quantity or credit availability dimension. Further, even after adjusting the loan rate (by increasing the risk premium on the loan) for the default risk of the borrower, there is no guarantee that the FI will actually receive the promised payments. The measurement and pricing approaches discussed in the chapter consider credit risk based on probabilities of receiving promised payments on the loan. The actual payment or default on a loan once it is issued may vary from the probability expected.

[17] For a number of interesting examples using similar formulas, see J. R. Brick, *Commercial Banking: Text and Readings* (Haslett, Mich.: Systems Publications Inc., 1984), chap. 4. If compensating balances held as deposits paid interest at 8 percent ($r_d = 8\%$), then the numerator (cash flow) of the bank in the example would be reduced by $b \times r_d$, where $r_d = .08$ and $b = .1$. In this case, the $k = 14.64$ percent. This assumes that the reserve requirement on compensating balances held as time deposits (RR) is 10 percent. However, while currently reserve requirements on demand deposits are 10 percent, the reserve requirement on time deposits is 0 percent (zero). Recalculating but assuming $RR = 0$ and interest of 8 percent on compensating balances, we find $k = 14.81$ percent.

In general, compared with wholesale (e.g., C&I) loans, the quantity dimension controls credit risk differences on retail (e.g., consumer) loans more than the price dimension does. We discuss the reasons for this in the next section. That is followed by a section that evaluates various ways FI managers can assess the appropriate size of m, the risk premium on a loan. This is the key to pricing wholesale loan and debt risk exposures correctly.

Concept Questions

1. Calculate the promised return (k) on a loan if the base rate is 13 percent, the risk premium is 2 percent, the compensating balance requirement is 5 percent, fees are $^1/_2$ percent, and reserve requirements are 10 percent. (16.23%)
2. What is the expected return on this loan if the probability of default is 5 percent. (10.42%)

RETAIL VERSUS WHOLESALE CREDIT DECISIONS

Retail

Because of the small dollar size of the loans in the context of an FI's overall investment portfolio and the higher costs of collecting information on household borrowers (consumer loans), most loan decisions made at the retail level tend to be accept or reject decisions. Borrowers who are accepted are often charged the same rate of interest and by implication the same credit risk premium. For example, a wealthy individual borrowing from a credit union to finance the purchase of a Rolls-Royce is likely to be charged the same auto loan rate as a less wealthy individual borrowing from that credit union to finance the purchase of a Honda. In the terminology of finance, retail customers (consumer loans) are more likely to be sorted or rationed by loan quantity restrictions than by price or interest rate differences.[18] That is, at the retail level an FI controls its credit risks by **credit rationing** rather than by using a range of interest rates or prices. Thus, the FI may offer the wealthy individual a loan of up to $60,000, while the same FI may offer the less wealthy individual a loan of up to $10,000, both at the same interest rate. Residential mortgage loans provide another good example. While two borrowers may be accepted for mortgage loans, an FI discriminates between them according to the loan-to-value ratio—the amount the FI is willing to lend relative to the market value of the house being acquired—rather than by setting different mortgage rates.[19]

credit rationing Restricting the quantity of loans made available to individual borrowers.

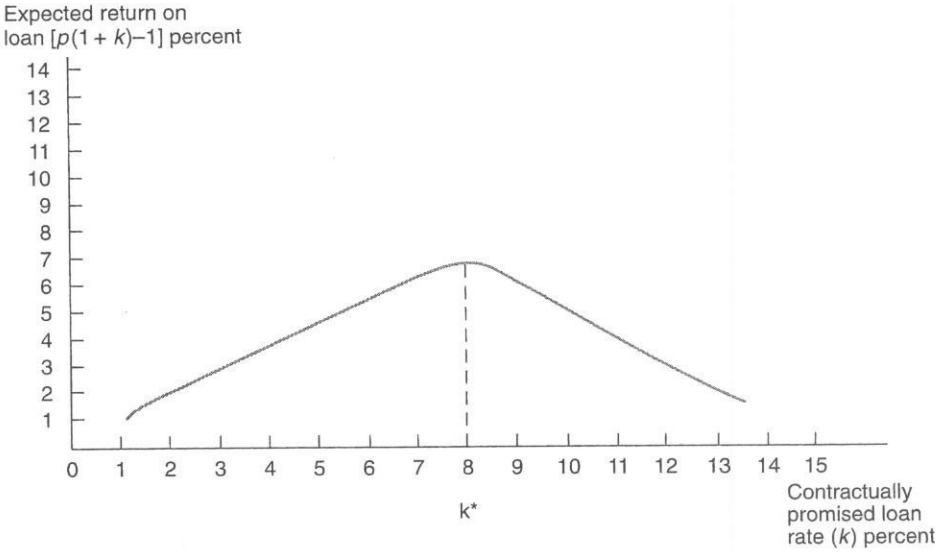
Wholesale

In contrast to the retail level, at the wholesale (C&I) level FIs use both interest rates and credit quantity to control credit risk. Thus, when FIs quote a prime lending rate (BR) to C&I borrowers, lower-risk borrowers may be charged a lending rate below the prime lending rate. Higher-risk borrowers are charged a markup on the prime rate, or a credit (default) risk premium (m), to compensate the FI for the additional credit risk involved.

[18] This does not mean that rates cannot vary across FIs. For example, finance companies associated with car manufacturers (e.g., GMAC) offered 0.0 percent financing on car loans for much of the early 2000s. Unrecognized by many car buyers, the lenders' costs of funds were incorporated into an increased price for the car. Depository institutions, not able to recover their costs of funds in this manner, offered varying rates in an attempt to compete with finance companies. However, for a given FI, the rate offered on car loans would be the same for all borrowers.

[19] However, as the cost of information falls and comprehensive databases on individual households' creditworthiness are developed, the size of a loan for which a single interest rate becomes optimal will shrink.

FIGURE 11–5
Relationship between the Promised Loan Rate and the Expected Return on the Loan



As long as they are compensated with sufficiently high interest rates (or credit risk premiums), over some range of credit demand, FIs may be willing to lend funds to high-risk wholesale borrowers. However, as discussed earlier, increasing loan interest rates (k) may decrease the probability (p) that a borrower will pay the promised return. For example, a borrower who is charged 15 percent for a loan—a prime rate of 10 percent plus a credit risk premium of 5 percent—may be able to make the promised payments on the loan only by using the funds to invest in high-risk investments with some small chance of a big payoff. However, by definition, high-risk projects have relatively high probabilities that they will *fail* to realize the big payoff. If the big payoff does not materialize, the borrower may have to default on the loan. In an extreme case, the FI receives neither the promised interest and fees on the loan nor the original principal lent. This suggests that very high contractual interest rate charges on loans may actually reduce an FI's expected return on loans because high interest rates induce the borrower to invest in risky projects.[20] Alternatively, only borrowers that intend to use the borrowed funds to invest in high-risk projects (high-risk borrowers) may be interested in borrowing from FIs at high interest rates. Low-risk borrowers drop out of the potential borrowing pool at high-rate levels. This lowers the average quality of the pool of potential borrowers. We show these effects in Figure 11–5.[21]

At very low contractually promised interest rates (k), borrowers do not need to take high risks in their use of funds and those with relatively safe investment projects use FI financing. As interest rates increase, borrowers with fairly low-risk, low-return projects no longer think it is profitable to borrow from FIs and drop out of the pool of potential borrowers. Alternatively, borrowers may switch their use of the borrowed funds to high-risk investment projects to have a (small) chance of being able to pay off the loan. In terms of Figure 11–5, when interest rates rise

[20] In the context of the previous section, a high k on the loan reflecting a high base rate (BR) and risk premium (m) can lead to a lower probability of repayment (p) and thus a lower $E(r)$ on the loan, where $E(r) = p(1 + k) - 1$. Indeed, for very high k, the expected return on the loan can become negative.

[21] See also J. Stiglitz and A. Weiss, "Credit Rationing in Markets with Imperfect Information," *American Economic Review* 71 (1981), pp. 393–410.

above k^* (8 percent), the additional expected return earned by the FI through higher contractually promised interest rates (k) is increasingly offset by a lower probability of repayment on the loan (p). In other words, because of the potential increase in the probability of default when contractually promised loan rates are high, an FI charging wholesale borrowers loan rates in the 9 to 14 percent region can earn a *lower* expected return than will an FI charging 8 percent.

This relationship between contractually promised interest rates and the expected returns on loans suggests that beyond some interest rate level, it may be best for the FI to *credit ration* its wholesale loans, that is, to not make loans or to make fewer loans. Rather than seeking to ration by price (by charging higher and higher risk premiums to borrowers), the FI can establish an upper ceiling on the amounts it is willing to lend to maximize its expected returns on lending.[22] In the context of Figure 11–5, borrowers may be charged interest rates up to 8 percent, with the most risky borrowers also facing more restrictive limits or ceilings on the amounts they can borrow at any given interest rate.

Concept Questions

1. Can an FI's return on its loan portfolio increase if it cuts its loan rates?
2. What might happen to the expected return on a wholesale loan if an FI eliminates its fees and compensating balances in a low–interest rate environment?

MEASUREMENT OF CREDIT RISK

To calibrate the default risk exposure of credit and investment decisions as well as to assess the credit risk exposure in off-balance-sheet contractual arrangements such as loan commitments, an FI manager needs to measure the probability of borrower default. The ability to do this depends largely on the amount of information the FI has about the borrower. At the retail level, much of the information needs to be collected internally or purchased from external credit agencies. At the wholesale level, these information sources are bolstered by publicly available information, such as certified accounting statements, stock and bond prices, and analysts' reports. Thus, for a publicly traded company, more information is produced and is available to an FI than is available for a small, single-proprietor corner store. The availability of more information, along with the lower average cost of collecting such information, allows FIs to use more sophisticated and usually more quantitative methods in assessing default probabilities for large borrowers compared with small borrowers. However, advances in technology and information collection are making quantitative assessments of even smaller borrowers increasingly feasible and less costly.[23] The simpler details (such as cash flow and ratio analysis) associated with the measurement of credit risk at the retail and the wholesale levels are discussed in Appendix 11C to the chapter, located at the book's Web site (**www.mhhe.com/saunders5e**).

[22] Indeed, it has been found that the availability of bank credit depends not just on interest rates, but on the borrower's credit quality as well. Specifically, banks sometimes tighten their credit standards (forgoing riskier loans even when higher interest rates can be charged) to maximize their expected return on lending. See C. S. Lown, D. P. Morgan, and S. Rohatgin, "Listening to Loan Officers: The Impact of Commercial Credit Standards on Lending and Output," *FRBNY Economic Policy Review*, July 2000, pp. 1–16. In addition, the degree of competition in the wholesale loan market, and hence the price elasticity of demand for loans, will affect the availability of bank credit. That is, as competition for loans increases, the point (interest rate) at which banks switch from risk-based pricing to credit rationing may increase as well, and vice versa.

[23] These advances include database services and software for automating credit assessment provided by companies such as Dun & Bradstreet.

covenants
Restrictions written into bond and loan contracts either limiting or encouraging the borrower's actions that affect the probability of repayment.

In principle, FIs can use very similar methods and models to assess the probabilities of default on both bonds and loans. Even though loans tend to involve fewer lenders to any single borrower as opposed to multiple bondholders, in essence, both loans and bonds are contracts that promise fixed (or indexed) payments at regular intervals in the future. Loans and bonds stand ahead of the borrowing firm's equity holders in terms of the priority of their claims if things go wrong. Also, bonds, like loans, include **covenants** restricting or encouraging various actions to enhance the probability of repayment. Covenants can include limits on the type and amount of new debt, investments, and asset sales the borrower may undertake while the loan or bonds are outstanding. Financial covenants are also often imposed restricting changes in the borrower's financial ratios such as its leverage ratio or current ratio. For example, a common restrictive covenant included in many bond and loan contracts limits the amount of dividends a firm can pay to its equity holders. Clearly, for any given cash flow, a high dividend payout to stockholders means that less is available for repayments to bondholders and lenders. Moreover, bond yields, like wholesale loan rates, usually reflect risk premiums that vary with the perceived credit quality of the borrower and the collateral or security backing of the debt. Given this, FIs can use many of the following models that analyze default risk probabilities either in making lending decisions or when considering investing in corporate bonds offered either publicly or privately.[24]

Concept Questions

1. Is it more costly for an FI manager to assess the default risk exposure of a publicly traded company or a small, single-proprietor firm? Explain your answer.
2. How do loan covenants help protect an FI against default risk?

DEFAULT RISK MODELS

Economists, analysts, and FI managers have employed many different models to assess the default risk on loans and bonds. These vary from relatively qualitative to the highly quantitative models. Further, these models are not mutually exclusive; an FI manager may use more than one model to reach a credit pricing or loan quantity rationing decision. As will be discussed below in more detail, a great deal of time and effort has recently been expended by FIs in building highly technical credit risk evaluation models. Many of these models use ideas and techniques similar to the market risk models discussed in Chapter 10. We analyze a number of models in three broad groups: qualitative models, credit scoring models, and newer models.

Qualitative Models

In the absence of publicly available information on the quality of borrowers, the FI manager has to assemble information from private sources—such as credit and deposit files—and/or purchase such information from external sources—such as credit rating agencies. This information helps a manager make an informed judgment on the probability of default of the borrower and price the loan or debt correctly.

In general, the amount of information assembled varies with the size of the potential debt exposure and the costs of collection. However, a number of key factors

[24] For more discussion of the similarities between bank loans and privately placed debt, see M. Berlin and L. Mester, "Debt Covenants and Renegotiation," *Journal of Financial Intermediation* 2 (1992), pp. 95–133; M. Carey et al., "The Economics of Private Placement: A New Look," *Financial Markets, Institutions and Instruments* 2, no. 3 (1993); and M. Carey et al., "Does Corporate Lending by Banks and Finance Companies Differ? Evidence on Specialization in Private Debt Contracting," *Journal of Finance* 53 (June 1998), pp. 845–78.

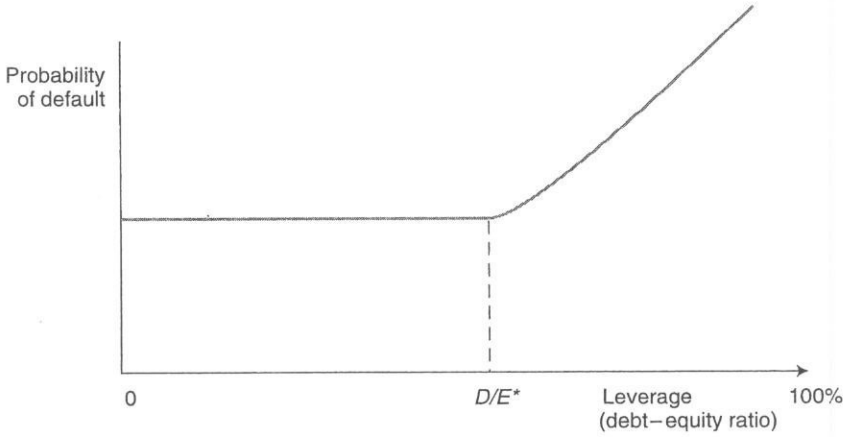


FIGURE 11–6
Relationship between the Cost of Debt, the Probability of Default, and Leverage

enter into the credit decision. These include (1) *borrower-specific* factors which are idiosyncratic to the individual borrower, and (2) *market-specific* factors, which have an impact on all borrowers at the time of the credit decision. The FI manager then weights these factors subjectively to come to an overall credit decision. Because of their reliance on the subjective judgment of the FI manager, these models are often called expert systems. Commonly used borrower-specific and market-specific factors are discussed next.

Borrower-Specific Factors

Reputation The borrower's reputation involves the borrowing–lending history of the credit applicant. If, over time, the borrower has established a reputation for prompt and timely repayment, this enhances the applicant's attractiveness to the FI. A long-term customer relationship between a borrower and lender forms an **implicit contract** regarding borrowing and repayment that extends beyond the formal explicit legal contract on which borrower–lender relationships are based. The importance of reputation, which can be established only over time through repayment and observed behavior, works to the disadvantage of small, newer borrowers. This is one of the reasons initial public offerings of debt securities by small firms often require higher yields than do offerings of older, more seasoned firms.[25]

implicit contract
Long-term customer relationship between a borrower and lender based on reputation.

Leverage A borrower's **leverage** or capital structure—the ratio of debt to equity—affects the probability of its default because large amounts of debt, such as bonds and loans, increase the borrower's interest charges and pose a significant claim on its cash flows. As shown in Figure 11–6, relatively low debt–equity ratios may not significantly impact the probability of debt repayment. Yet beyond some point, the risk of bankruptcy increases, as does the probability of some loss of interest or principal for the lender. Thus, highly leveraged firms, such as firms recently engaged in leveraged buyouts (LBOs) financed in part by FIs' provision of junk bonds or below-investment-grade debt, may find it necessary to pay higher risk premiums on their borrowings if they are not rationed in the first place.[26]

leverage
The ratio of a borrower's debt to equity.

[25] For the link between bank finance and the cost of initial public offerings of securities, see C. James and P. Weir, "Borrowing Relationships, Intermediation, and the Costs of Issuing Public Securities," *Journal of Financial Economics* 28 (1992), pp. 149–71.

[26] However, S. J. Grossman and O. D. Hart argue that high debt (leverage) may be a signal of managerial efficiency and may in fact lower bankruptcy risk. Similar arguments have been made about the efficiency incentives for managers in junk bond–financed LBOs. That is, firms with a lot of debt have to be "lean and mean" to meet their repayment commitments. See "Corporate Financial Structure and Managerial Incentives," in *The Economics of Information and Uncertainty*, ed. J. McCall (Chicago: Chicago University Press, 1982).

Volatility of Earnings As with leverage, a highly volatile earnings stream increases the probability that the borrower cannot meet fixed interest and principal charges for any given capital structure. Consequently, newer firms or firms in high-tech industries with a high earnings variance over time are less attractive credit risks than are those with long and more stable earnings histories.

Collateral As discussed earlier, a key feature in any lending and loan-pricing decision is the degree of collateral, or assets backing the security of the loan. Many loans and bonds are backed by specific assets should a borrower default on repayment obligations. Mortgage bonds give the bondholder first claim to some specific piece of property of the borrower, normally machinery or buildings; debentures give a bondholder a more general and more risky claim to the borrower's assets. Subordinated debentures are even riskier because their claims to the assets of a defaulting borrower are junior to those of both mortgage bondholders and debenture bondholders. Similarly, loans can be either secured (collateralized) or unsecured (uncollateralized).[27]

Market-Specific Factors

The Business Cycle The position of the economy in the business cycle phase is enormously important to an FI in assessing the probability of borrower default. For example, during recessions, firms in the consumer durable goods sector that produce autos, refrigerators, or houses do badly compared with those in the nondurable goods sector producing tobacco and foods. People cut back on luxuries during a recession but are less likely to cut back on necessities such as food. Thus, corporate borrowers in the consumer durable goods sector of the economy are especially prone to default risk. Because of cyclical concerns, FIs are more likely to increase the relative degree of credit rationing in recessionary phases. This has especially adverse consequences for smaller borrowers with limited or no access to alternative credit markets such as the commercial paper market.[28]

www.federalreserve.gov

The Level of Interest Rates High interest rates indicate restrictive monetary policy actions by the Federal Reserve. FIs not only find funds to finance their lending decisions scarcer and more expensive but also must recognize that high interest rates are correlated with higher credit risk in general. As discussed earlier, high interest rate levels may encourage borrowers to take excessive risks and/or encourage only the most risky customers to borrow.

So far, we have delineated just a few of the qualitative borrower- and economy-specific factors an FI manager may take into account in deciding on the probability of default on any loan or bond.[29] Rather than letting such factors enter into the decision process in a purely subjective fashion, the FI manager may weight these

[27] However, collateralized loans are still subject to some default risk unless these loans are significantly overcollateralized; that is, assets are pledged with market values exceeding the face value of the debt instrument. There is also some controversy as to whether posting collateral signifies a high- or low-risk borrower. Arguably, the best borrowers do not need to post collateral since they are good credit risks, whereas only more risky borrowers need to post collateral. That is, posting collateral may be a signal of more rather than less credit risk. See, for example, A. Berger and G. Udell, "Lines of Credit, Collateral and Relationship Lending in Small Firm Finance," *Journal of Business,* 1995, pp. 351–381.

[28] For a good discussion of the sensitivity of different U.S. industries' default rates to the business cycle, see J. D. Taylor, "Cross-Industry Differences in Business Failure Rates: Implications for Portfolio Management," *Commercial Lending Review,* 1998, pp. 36–46.

[29] More generally, J. F. Sinkey identifies five Cs of credit that should be included in any subjective (qualitative) credit analysis: character (willingness to pay), capacity (cash flow), capital (wealth), collateral (security), and conditions (economic conditions). See *Commercial Bank Financial Management—In the Financial Services Industry,* 5th ed. (New York: Macmillan, 1998).

www.rmahq.org

factors in a more objective or quantitative manner. We discuss quantitative credit scoring models used to measure credit risk next. One frequently used source of much of this information is Robert Morris Associates (RMA). RMA has become a standard reference for thousands of commercial lenders by providing average balance sheet and income data for more than 400 industries, common ratios computed for each size group and industry, five-year trend data, and financial statement data for more than 100,000 commercial borrowers.

Concept Questions

1. Make a list of 10 key borrower characteristics you would assess before making a mortgage loan.
2. How should the risk premium on a loan be affected if there is a reduction in a borrower's leverage?

Credit Scoring Models

credit scoring models Mathematical models that use observed loan applicant's characteristics either to calculate a score representing the applicant's probability of default or to sort borrowers into different default risk classes.

Credit scoring models are quantitative models that use observed borrower characteristics either to calculate a score representing the applicant's probability of default or to sort borrowers into different default risk classes. By selecting and combining different economic and financial borrower characteristics, an FI manager may be able to:

1. Numerically establish which factors are important in explaining default risk.
2. Evaluate the relative degree or importance of these factors.
3. Improve the pricing of default risk.
4. Be better able to screen out bad loan applicants.
5. Be in a better position to calculate any reserves needed to meet expected future loan losses.

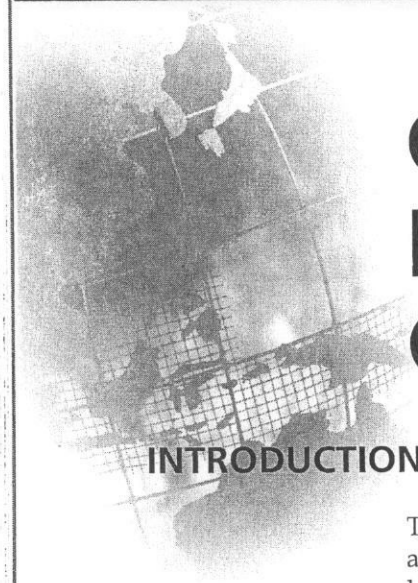
The primary benefit from credit scoring is that credit lenders can more accurately predict a borrower's performance without having to use more resources. With commercial loan credit scoring models taking into account all necessary regulatory parameters and posting an 85 percent accuracy rate on average, according to credit scoring experts,[30] using these models means fewer defaults and write-offs for commercial loan lenders. Indeed, many commercial credit grantors are implementing credit scoring models as a way to come in accordance with the Sarbanes–Oxley Act of 2002, which sets guidelines for corporate governance in several areas, including risk management and control assessment.

To use credit scoring models, the manager must identify objective economic and financial measures of risk for any particular class of borrower. For consumer debt, the objective characteristics in a credit scoring model might include income, assets, age, occupation, and location. For commercial debt, cash flow information and financial ratios such as the debt–equity ratio are usually key factors.[31] After data are identified, a statistical technique quantifies, or scores, the default risk probability or default risk classification.

[30] See "Credit Scoring Heats Up," *Collections and Credit Risk,* September 2003, p. 34.

[31] A. N. Berger, W. S. Frame, and N. H. Miller, in "Credit Scoring and the Availability, Price, and Risk of Small Business Credit," 2002, Working Paper, Federal Reserve Board, find that small business credit scoring is associated with expanded credit supply, higher average interest rates, and greater risk levels for small business loans. Their findings are consistent with a net increase in lending to small businesses that would otherwise not receive credit without the use of credit scoring.

Chapter Twelve



Credit Risk: Loan Portfolio and Concentration Risk

INTRODUCTION

The models discussed in the previous chapter describe alternative ways by which an FI manager can measure the default risks on *individual* debt instruments such as loans and bonds. Rather than looking at credit risk one loan at a time, this chapter concentrates on the ability of an FI manager to measure credit risk in a loan (asset) *portfolio context* and the benefit from loan (asset) portfolio diversification. We discuss and illustrate several models that are used by FI managers to assess the risk of the overall loan portfolio. The risk-return characteristics of each loan in the portfolio are a concern for the FI, but the risk-return of the overall loan portfolio, with some of the risk of the individual loans diversified, affects an FI's overall credit risk exposure. Additionally, we look at the potential use of loan portfolio models in setting maximum concentration (borrowing) limits for certain business or borrowing sectors (e.g., sectors identified by their Standard Industrial Classification [SIC] codes).

This chapter also discusses regulatory methods for measuring default risk of a portfolio. In particular, the FDIC Improvement Act of 1991 required bank regulators to incorporate credit concentration risk into their evaluation of bank insolvency risk. Moreover, a debate currently is being conducted among bankers and regulators about how this could be done. One possibility is that banks will be allowed to use their own internal models, such as CreditMetrics and Credit Risk+ (discussed in the Chapter 11 Appendixes) and KMV's Portfolio Manager (discussed later in this chapter), to calculate their capital requirements against insolvency risk from excessive loan concentrations. Further, the National Association of Insurance Commissioners (NAIC) has developed limits for different types of assets and borrowers in insurers' portfolios—a so-called pigeonhole approach.

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SIMPLE MODELS OF LOAN CONCENTRATION RISK

FIs widely employ two simple models to measure credit risk concentration in the loan portfolio beyond the purely subjective model of "we have already lent too

TABLE 12–1
A Hypothetical Rating Migration, or Transition, Matrix

		Risk Rating at End of Year			
		1	2	3	*D**
Risk rating at beginning of year	1	.85	.10	.04	.01
	2	.12	.83	.03	.02
	3	.03	.13	.80	.04

*D = default.

much to this borrower."[1] The first is **migration analysis,** where lending officers track S&P, Moody's, or their own internal credit ratings of certain pools of loans or certain sectors—for example, machine tools. If the credit ratings of a number of firms in a sector or rating class decline faster than has been historically experienced, FIs curtail lending to that sector or class.

migration analysis
A method to measure loan concentration risk by tracking credit ratings of firms in particular sectors or ratings class for unusual declines.

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www.moodys.com

A **loan migration matrix** (or transition matrix) seeks to reflect the historic experience of a pool of loans in terms of their credit rating migration over time. As such, it can be used as a benchmark against which the credit migration patterns of any new pool of loans can be compared. Table 12–1 shows a hypothetical credit migration matrix, or table, in which loans are assigned to one of three rating classes (most FIs use 10 to 13 rating classes).[2] The rows in Table 12–1 list the rating at which the portfolio of loans began the year, and the columns list the rating at which the portfolio ended the year. The numbers in the table are called transition probabilities, reflecting the average experience (proportions) of loans that began the year, say, as rating 2 remaining rating 2 at the end of the year, being upgraded to a 1, being downgraded to a 3, or defaulting (*D*).

loan migration matrix
A measure of the probability of a loan being upgraded, downgraded, or defaulting over some period.

For example, for loans that began the year at rating 2, historically (on average) 12 percent have been upgraded to 1; 83 percent have remained at 2; 3 percent have been downgraded to 3; and 2 percent have defaulted by the end of the year. Suppose that the FI is evaluating the credit risk of its current portfolio of loans of borrowers rated 2 and that over the last few years, a much higher percentage (say, 5 percent) of loans has been downgraded to 3 and a higher percentage (say, 3 percent) has defaulted than is implied by the historic transition matrix. The FI may then seek to restrict its supply of lower-quality loans (e.g., those rated 2 and 3), concentrating more of its portfolio on grade 1 loans.[3] At the very least, the FI should seek higher credit risk premiums on lower-quality (rated) loans. Not only is migration analysis used to evaluate commercial loan portfolios, it is widely used to analyze credit card portfolios and consumer loans as well.[4]

[1] See Board of Governors of the Federal Reserve, "Revisions to Risk-Based Capital Standards to Account for Concentration of Credit Risk and Risks of Non-Traditional Activities," Section 305, FDICIA, Washington, DC, March 26, 1993.

[2] A recent survey of credit portfolio management by FIs found the range of credit rating classes to be 5 to 22. See "2002 Survey of Credit Portfolio Management Practices," International Association of Credit Portfolio Managers, International Swaps and Derivatives Association, and Risk Management Association, October 2002.

[3] The theory underlying the use of the average one-year transition matrix (based on historic data) as a benchmark is that actual transactions will fluctuate randomly around these average transitions. In the terminology of statistics, actual transitions follow a stable Markov (chain) process.

[4] See, for example, J. Kallberg and A. Saunders, "Markov Chain Approaches to the Analysis of Payment Behavior of Retail Credit Customers," *Financial Management,* 1983, pp. 5–14.

concentration limits
External limits set on the maximum loan size that can be made to an individual borrower.

The second simple model requires management to set some firm external limit on the maximum amount of loans that will be made to an individual borrower or sector. The FI determines **concentration limits** on the proportion of the loan portfolio that can go to any single customer by assessing the borrower's current portfolio, its operating unit's business plans, its economists' economic projections, and its strategic plans. Typically, FIs set concentration limits to reduce exposures to certain industries and increase exposures to others. When two industry groups' performances are highly correlated, an FI may set an aggregate limit of less than the sum of the two individual industry limits. FIs also typically set geographic limits. They may set aggregate portfolio limits or combinations of industry and geographic limits.

EXAMPLE 12–1 *Calculating Concentration Limits for a Loan Portfolio*

Suppose management is unwilling to permit losses exceeding 10 percent of an FI's capital to a particular sector. If management estimates that the amount lost per dollar of defaulted loans in this sector is 40 cents, the maximum loans to a single sector as a percent of capital, defined as the concentration limit, is:

$$\text{Concentration limit} = \text{Maximum loss as a percent of capital} \times \frac{1}{\text{Loss rate}}$$
$$= 10\% \times [1/.4]$$
$$= 25\%$$

Bank regulators in recent years have limited loan concentrations to *individual borrowers* to a maximum of 10 percent of a bank's capital.[5]

Concept Questions

1. What would the concentration limit be if the loss rate on bad loans is 25 cents on the dollar?
2. What would the concentration limit be if the maximum loss (as a percent of capital) is 15 percent instead of 10 percent?

Next we look at the use of more sophisticated portfolio theory–based models to set concentration limits. While these models have a great deal of potential, data availability and other implementation problems have, until recently, hindered their use. The basic idea is to select the portfolio of loans that maximizes the return on the loan portfolio for any given level of risk (or that minimizes the degree of portfolio risk for any given level of returns).

LOAN PORTFOLIO DIVERSIFICATION AND MODERN PORTFOLIO THEORY (MPT)

To the extent that an FI manager holds widely traded loans and bonds as assets or, alternatively, can calculate loan or bond returns, portfolio diversification models can be used to measure and control the FI's aggregate credit risk exposure. Suppose the manager can estimate the expected returns of each loan or bond ($\overline{R}_i$) in the FI's portfolio.

[5] In some countries, such as Chile, limits are mandated by sector or industry.