Volume Title: Risk and Capital Adequacy in Commercial Banks

Volume Author/Editor: Sherman J. Maisel, editor

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-50281-3 (cloth); 0-226-50282-1 (paper)

Volume URL: http://www.nber.org/books/mais81-1

Conference Date:

Publication Date: 1981

Chapter Title: Estimates of Typical Risks

Chapter Author(s): Sherman J. Maisel

Chapter URL: http://www.nber.org/chapters/c13522

Chapter pages in book: (p. 75 - 102)

4 Estimates of Typical Risks

4.1 Introduction

In this chapter we examine a variety of estimates of risks in banks. We discuss three major types of risk: interest rates, shifts in operating earnings, and loan losses. The next chapter takes up problems in valuing net worth and shows how the figures of this chapter can be combined with net worth calculations to measure capital adequacy. As noted previously, our studies did not include estimates for risks of maldiversification or fraud. Therefore, the prototype risk computations exclude these risks. While the history of bank bankruptcies over the past thirty-five years reveals these factors to be a main cause of failures in small banks, the losses to liability holders of these institutions from such forces have been extremely small.

The studies show the degree to which risks vary among banks even under our existing system of regulation. Dissimilarities in risks assumed by institutions are found to be economically significant: the risks from possible interest rate movements and maldiversification appear far more likely to lead to bankruptcy than do those from loan or operating losses.

These prototype models are only illustrative. The estimates of the probability distributions are preliminary; they require more detailed information. However, the case example of the First Pennsylvania Corporation, which contains more specific data, appears to confirm the analysis. Individual banks may vary more in their choice of activities than the examples selected. The past relationships reflect a particular set of conditions that have been changing. They may change even more, particularly if the regulations and anticompetitive policies that shaped the past are removed. Just as relaxation of regulations will shift past relationships, so will differing inflation rates and changed techniques of monetary

policy. Estimates must take into account any such expected shifts in the environment.

At this time, a complete estimate of the covariance matrix is far too complex for existing knowledge, and it probably is not necessary. The analytical model allows one to pick out a limited number of significant risk relationships. The empirical data, moreover, seem to indicate that an adequate system of probability functions can be built with far less than complete information. With good theory and models, it is possible that less information would be required to insure or regulate banks than is now developed in the examination process.

For example, examiners now spend a good deal of time evaluating individual loans. In small banks with inadequate managers, directors, and records, such examinations may be helpful, but they are not obviously necessary. Risk may be controlled instead through simpler and more general classifications, taken together with measures of adequate diversification and with data on nonperforming loans. Probability distributions can be applied to broad groups and to the total bank. Only if diversification is inadequate because too many loans are being made to similar industries, localities, countries, or regions may more complete data on individual loans be necessary.

Similarly, the model and the analysis of chapters 8 and 14 show that in theory a simple concept of duration may not be adequate for measuring interest rate risk because the changes in discount factors from year to year, while fairly high, are not completely correlated. In contrast, the empirical data seem to show that, in practice, duration without information for individual flows may be an adequate measure. The risks caused by uneven annual returns from assets with similar durations may be minor compared with differences in the average duration of banks' assets and liabilities.

4.2 Interest Rate Risks

The general discussion of the previous chapter showed that interest rate risks depend on a mismatch of the maturity structure of an institution's assets and liabilities. When interest rates move, banks are affected in at least four ways:

1. Their cash flows alter as the rate at which commitments are taken down changes, assets are paid off more or less rapidly, and deposit liabilities are transferred.
2. The interest rates paid and received on liabilities and assets tied to market rates move with those rates.
3. The term structure of interest rates shifts. If the term structure moves up, the value of future promises to pay becomes less.

4. The discounts for risk may widen. These changes will have the same effect as movements in the risk-free rate.

4.2.1 Approach to the Estimates

Most of the papers in part 2 are concerned with the theory and estimates of such interest rate risks. The papers by Morrison and Pyle, Nadauld, and Lane and Golen (chaps. 13, 14, and 15) consider both the theory of how movements in spot interest rates affect the term structure and how such changes influence capital values of specific activities. Nadauld also discusses the effect of interest rate movements on cash flows. However, his analysis is restricted to the mortgage market.

The paper by Maisel and Jacobson estimates the year-by-year effect of interest rate movements on the total returns to a bank that distributes its assets and liabilities in accordance with the average balance sheet for banks as a whole.

In this paper, as in much of the other analysis in this volume, lack of data leads to the assumption that rates on different classes of assets and liabilities move together with changes in the risk-free rate. Table 9.2 shows this to be a fairly good assumption. However, costs of borrowed money have a somewhat greater amplitude of rise and fall than does the risk-free rate. Offsetting such added dangers from rate changes, certificates of deposit have a fixed maturity and fixed rates. A lag occurs in their adjustment.

There is debate about whether implicit (actual) rates on demand and time deposits adjust to the market. If their rates remained constant as market rates rose, such an obvious case of noncorrelation would reduce interest rate risk. The study in chapter 9 indicates that implicit rates do move with the market. Intangible capital is created by banks, which can attract consumer and demand deposits, through the capitalization of excess earnings on deposits with regulated rates. However, the amount of such returns varies with the total amount of deposits rather than with shifting interest rates. The probability of losses from disintermediation or gains from added demand and savings deposits must be considered, but it can be part of capital analysis.

The paper by McCulloch calculates the probable variance in the risk-free interest rate applicable to assets and liabilities at maturities from three months to thirty years. He compares returns at each maturity for discount instruments, par bonds, and amortized loans. These estimates are based on the listing of actual month-to-month movements in the return on government securities between 1951 and 1977. He shows how these risk calculations apply to individual activities with different durations and how, depending on the particular portfolio of an institution, they can be combined to find the weighted total variance from interest rates.

4.2.2 Variations among Banks

Wide divergences are found in the distribution of assets and liabilities among banks and, therefore, in the interest rate risks they assume. Institutions alter their interest risk along either of two dimensions.

1. They may vary the proportion of each asset and liability in their portfolios. For example, they may choose to increase their ratio of purchased money or instead they might emphasize dependence on demand or saving deposits. Again, they may put more money into loans instead of into securities. The percentages of each category of asset and liability held by banks are widely dispersed.

2. They have a choice within each category of maturity structures. They can hold all short-term Treasury bills, or concentrate instead on twenty-year bonds. While in some cases maturities are closely related to a class of asset or liability, in many cases choices are wide. Banks appear to vary their risks either as a matter of preference—they are more or less willing to gamble—or because of ignorance—they fail to recognize that they are risking insolvency by assuming too much interest rate risk.

Table 4.1 measures some differences among liabilities and assets in banks. This table, as well as table 4.3, compares information for the top 250 banks whose average net earning assets exceeded $500 million in 1979 with the 8,400 banks with assets under $25 million and with data for all of the more than 14,000 insured commercial banks. The largest banks constituted less than 0.2 percent in number but accounted for over 60 percent of the assets of all banks. Banks with under $25 million in net earning assets made up nearly 60 percent of all banks but accounted for less than 8 percent of bank assets. The tables are weighted averages of the December 1978, June 1979, and December 1979 condition reports (with weights of ¼, ½, and ¼ respectively) and 1979 income statements for all banks.

Liabilities and Interest Expense

The first four items in table 4.1 show differences among liabilities held by banks. They also serve as rough measures of risk from the danger that interest expenses may change as a result of movements in market interest rates. When interest rates on liabilities rise, two types of danger emerge. Most types of liabilities, and therefore their average, will cost more. Equally significant, it becomes likely that one class will be substituted for another. Disintermediation may occur. More expensive liabilities may have to be substituted for cheaper ones.

Table 4.1 shows that banks vary considerably in the types of deposits they hold and in their use of borrowed money. Many small banks have large amounts of demand and savings deposits. They are net sellers of federal funds. On the other hand, some large banks have only limited net demand and savings deposits. They purchase large sums of money at

Table 4.1 **Measures of Interest Rate Risk in 1979 by Bank Size (as a Percentage of Net Earning Assets)**

Bank Size by Net Earning Assets	Banks at Specific Percentiles for Individual Item						
	1	5	25	50	75	95	99
				Net Demand Deposits			
Over $500 million	0%	5.3%	14.8%	19.6%	24.2%	31.5%	39.6%
Under $25 million	8.6	12.4	18.2	23.2	29.5	42.5	64.1
All banks	8.3	12.2	17.8	22.6	28.6	39.9	57.3
				Foreign Deposits			
Over $500 million	0	0	0	1.3	10.5	46.9	64.6
Under $25 million	0	0	0	0	0	0	0
All banks	0	0	0	0	0	0	1.6
				Purchased Money			
Over $500 million	7.3	13.2	26.1	40.6	56.8	81.7	91.7
Under $25 million	0	0	2.7	6.4	12.4	25.3	38.0
All banks	0	0.2	4.0	8.8	16.4	33.1	51.5
				Interest Expense			
Over $500 million	3.8	4.4	5.7	6.4	7.3	8.9	10.9
Under $25 million	1.0	2.8	4.0	4.5	5.1	5.9	6.5
All banks	1.6	3.1	4.2	4.8	5.3	6.1	7.1
				Mortgages			
Over $500 million	0	1.9	8.3	14.6	21.8	33.9	46.9
Under $25 million	0.1	2.5	9.7	17.7	27.8	42.1	50.8
All banks	0.4	3.3	11.6	19.9	29.3	42.1	50.5
				Gross Interest Income			
Over $500 million	8.4	8.9	9.9	10.4	11.1	12.2	14.8
Under $25 million	3.2	4.5	6.4	7.6	8.9	10.8	12.3
All banks	3.5	4.9	6.8	8.0	9.3	11.0	12.3
				Net Interest Income			
Over $500 million	1.0	2.0	3.3	4.0	4.7	6.0	6.9
Under $25 million	0	0.4	2.0	3.0	4.4	6.4	8.2
All banks	0	0.5	2.1	3.2	4.4	6.2	7.8

Source: 1978 and 1979 call reports for all insured commercial banks in the United States.

current market rates. They raise by borrowing nearly 100 percent of the amounts needed to cover their loans and investments.

The share of liabilities that respond rapidly to market interest rates has been growing steadily for all banks. Traditionally, banks raised funds through demand deposits and through household deposits of under $100,000. These were considered stable sources, since the rates paid on them were regulated by interest rate ceilings. Banks were able to continue to carry low-yielding assets because their interest expenses did not rise rapidly when market rates changed. Even though the alteration in

market rates caused real capital losses and lowered future net income, banks were able to avoid showing the losses on their books because of their stable interest expenses.

Three major changes have increased the risks that liability costs will rise. In the first place, the share of demand and consumer savings and time deposits among all liabilities has fallen rapidly, particularly among large banks. The table shows that many banks have virtually no net demand deposits. What demand deposits they do have are offset by cash, required reserves, and checks in the process of collection. The median bank funds less than one-quarter of its net earning assets by demand deposits. The larger the bank, the less likely are demand deposits to be a significant source of funds.

Instead, banks depend more and more on purchased money—deposits from abroad, large certificates of deposit, federal funds, repurchase agreements, and similar liabilities bought at competitive rates in the money markets. Item 2 shows the amounts borrowed abroad. Only the largest banks use Euro-dollars and other foreign deposits, but, as the table shows, some of these banks raise a high proportion of their funds in these markets. There is wide dispersion among banks in their dependence on purchased money, the third item in the table (which includes the previous foreign deposits). The majority of small banks use only small percentages of purchased funds; they raise their money in the traditional way, through demand and savings deposits. In contrast, large banks purchase most of their liabilities in the money markets. The larger the bank, the more likely it is to depend on purchased funds. However, the table does reveal a few exceptions; some large banks make only minor purchases, while some small banks are active borrowers through the money markets.

Second, among all banks, the costs of small deposits are rising. The 1980 Bank Deregulation Act requires that ceilings on time and savings deposits be phased out as soon as feasible. In the interim, rates are rising toward the market. At the same time, the share of accounts paying interest rates tied to the market increases. At the end of 1979, money market certificates, paying rates roughly equivalent to those on six-month Treasury bills, already made up more than 10 percent of total deposits at commercial banks.

Finally, as the Maisel and Jacobson paper shows, even before these regulatory changes, the actual marginal cost for deposits under interest rate ceilings appeared to move with market interest rates. Nonprice services expanded in order to hold funds that would otherwise disintermediate as market rates rose.

Since the new types of liabilities tend to have longer maturities, they increase the average duration of the liabilities and slightly decrease a portfolio's overall duration. Since the rates are fixed for six months or

more when issued, the maturity factor furnishes a slight offset to their heightened interest volatility. However, such improvements may well be more than offset by an increased need to spend money on nonprice incentives as all depositors become more aware of the availability of nonregulated rates. Such expenses are reflected in other operating costs, not in the interest expense shown in the table.

All of these factors taken together have speeded up the rate at which liability costs react to the market. The average interest expense for all banks rose by over one hundred basis points, or more than 17 percent, in both 1978 and 1979. Beyond the change in the average are dangers that arise in individual banks because of the wide dispersion of interest costs about the average. The table shows both this wide dispersion of interest expenses and the high amounts some banks paid in 1979. While the median bank paid 4.8 percent interest to obtain the money needed to fund its net earning assets, some large banks were paying over 10.9 percent. Average interest expenses are lower the larger the amount of funds raised through capital, demand deposits, and small savings deposits. Interest expenses were nearly twice as much for banks at the 95th percentile as for those at the 5th percentile. The higher the amount borrowed through purchased money, the greater the risk. As an example of how dependence on the market can cause interest expense to vary, the costs of funds for First Pennsylvania Bank averaged about 8.9 percent per dollar of earning assets in 1979. For the first quarter of 1980, they rose to a rate of over 11.5 percent per annum.

Returns from Assets

When interest rates rise, the total returns from a bank's assets are likely to fall. What happens depends on the interest rate risk it has assumed—that is, the actual duration of its assets. The capital value of all assets with fixed maturities will fall. Although new loans will be made and new securities will be bought at higher rates, disintermediation may force a contraction of assets or limit the ability to obtain the new rates. Interest rates on some existing loans—those written with variable rates—will also rise. How a particular bank is affected depends on the percentage of its assets with variable rates and on the duration, and therefore the capital losses, of the assets with fixed rates.

The fifth item in table 4.1 carries a measure of such interest rate risk. It shows differences in the share of mortgages in bank portfolios. Since mortgages almost always carry fixed interest rates and long maturities, the higher their ratio, the greater is interest rate risk. Although not shown in the table, when the security investments of banks are compared, some portfolios are found to have maturities averaging less than two years, while others have average maturities exceeding ten years. A more complete analysis of how the average duration of the assets of banks is

dispersed shows variations of well over 100 percent. Some banks as a matter of choice take far greater interest rate risks than the average.

The final two items show the distributions of gross and net interest income as a percentage of net earning assets for each bank. Again, a bank's choice of assets determines its gross rate of earnings. The net interest earned, or the bank's margin between its interest revenues and costs, varies with its choices of both assets and liabilities. Neither the gross nor the net data in the table take into account differences in loan losses or expenses, even though our studies show that both are related to the level of gross interest rates. Nevertheless, the table illustrates the wide dispersion of risks reflected by the range of interest rates among banks.

Missing from the table is any indication of changes in the market values of a bank's securities and of its loans that resulted from movements in market interest rates. Net interest incomes reported in call reports, from which the table is constructed, are based on book, not economic calculations. The following discussion shows that many of the banks that reported a positive net interest income actually had negative net interest margins even before operating expenses were taken into account. To obtain total economic returns, net interest income as reported must be corrected to account for interest that is charged to cover larger expected loan losses, for movements in capital values, and for expenses.

4.2.3 Movements of Market Interest Rates

Interest rate risks within an institution depend not only upon its portfolio choices, but also upon whatever random movements occur in market rates. The studies for this volume use two measures of probable fluctuations around expected rates. One is the simple variance of year-to-year movements in interest rates for United States government securities at particular maturities. The second is more detailed. McCulloch (chap. 10) fits symmetric Paretian stable distributions to adjusted monthly interest movements at each maturity point.

It is worth emphasizing again that the studies assume that the market at all times represents the economy's best judgment as to future interest rates. The expected value of rates in the future can be calculated from the spot rate and the forward rates contained in the term structure. The random distributions about expected rates are assumed to be symmetrical.

At times, the regulatory authorities and some decision-makers appear to accept the view that better estimates of future value can be found than those furnished by the market. When rates have been rising or seem high in comparison with past levels, many assume that rates are bound to fall back toward previous readings. Actions based on assumptions of this sort can be costly. As table 4.2 shows, in the post–World War II period it has

Table 4.2 **Interest Rate Movements as a Measure of Risk, 1965–80 (in Percent)**

Year	Interest Rate on 3–5 Year U.S. Government Securities[a]	Change in Capital Value for a U.S. Bond with 3-Year Duration[b]	Rate of Total Portfolio Return[c]
1965	4.82%	—	—
1966	4.84	−0.1%	−0.34%
1967	5.75	−2.55	1.04
1968	6.17	−1.19	2.17
1969	8.10	−5.45	−2.97
1970	5.96	5.66	6.30
1971	5.43	1.50	2.44
1972	6.12	−1.96	0.49
1973	6.83	−2.01	−0.12
1974	7.17	−0.95	−0.31
1975	7.37	−0.56	1.13
1976	5.98	3.88	4.76
1977	7.51	−4.33	−2.92
1978	9.48	−5.50	n.a.[e]
1979	10.55	−2.93	n.a.
1980[d]	13.68	−8.49	n.a.

Source: Federal Reserve Bulletin and chap. 9.
[a]Market average of prices in last week of year.
[b]The data in first column were used to measure change in value.
[c]From table 9.5.
[d]First quarter only
[e]n.a. = not available.

not been unusual for interest rates to continue to rise for four years or more. Between 1976 and 1980, the price of twenty-five-year government bonds fell by over 50 percent. People who assumed that prices were bound to rise soon because they were down 20 to 25 percent might have lost a fortune had they taken positions based on such views.

Financial theory teaches that if the average investor believed such corrections would take place, future rates would move to reflect such views. Anyone who takes a position contrary to the market is backing his own forecast against the majority. The Craine and Pierce paper (chap. 12) and related discussions of previous work on this problem demonstrate that markets appear to be efficient. The assumption appears to be logical that, at any time, future movements around expected rates are random.

Interest Rate Time Series

As is well known, the term structure of rates does not shift by equivalent percentages at all points. Yields on securities at separate maturities tend to shift in the same direction, but movements of short-term rates are

usually more volatile. The Morrison and Pyle paper (chap. 13) discusses such differences and some of the implications for the usefulness of duration in estimating interest rate risks. They show that the values of activities react uniquely depending upon the duration of each.

Table 4.2 contains a series of interest rate movements with their related effects on values for the period 1965 to the end of the first quarter of 1980, when rates reached a cyclical peak. The first column shows end-of-year (last week's average) rates on United States Treasury notes and bonds with maturities of three to five years. This series is selected because its duration is roughly equivalent to that of the net portfolio of an average bank's assets.

In this period, these interest rates fluctuated between 4.82 percent and 13.68 percent. Since, within some years, rates dropped lower or went above the year-end figures, the total amount of fluctuation and the spread of rates were greater than shown in the table.

The second column reports the year-to-year changes in capital values experienced by a portfolio with a duration of three years, under the assumption that the interest rate on the portfolio shifted in accordance with column 1. As the studies of part 2 show, the averaging of durations for a portfolio with assets and liabilities of different maturities for the purpose of finding the interest rate risk is more complex than this simple assumption. In addition, rates applicable at each maturity vary. However, column 2 does give a rough indication of the changes that took place in the capital values of the net asset portfolio of a typical bank.

The most critical period was from 1977 to 1980. In this three and one-quarter years, capital values of a portfolio that averaged three years in duration would have fallen more than 20 percent. The significance of such movements becomes evident when it is recognized that the book value of the average bank's capital at the start of the period was only 6 percent of its portfolio.

The final column in table 4.2 extends beyond the movements in capital values. It takes into account that economic returns depend upon current returns and costs as well as upon changes in capital values. This column, taken from the Maisel and Jacobson study (chap. 9), measures the total returns to an average bank. These calculations are derived from movements in total returns of the activities engaged in by a typical bank. It takes into account changes both from market values and from the bank's net operating earnings. It is therefore an approximation of the total returns in each year for the average bank.

When interest rates rise, so do current earnings from assets; but capital values fall, and payments for most liabilities go up. The random changes in value from these pressures are a measure of interest rate risk. In 1969 and 1977, net losses for a typical bank were close to 3 percent. While exact calculations are not available, at the interest rate peak in 1980,

many banks probably had a negative economic net worth. If a bank had earlier assumed that interest rates were bound to fall after a year or two of steady rises and therefore took greater than the average risk by increasing the duration of its portfolio, it would have suffered much larger losses than the average. Interest rate risks in the typical financial institution are high. They rise rapidly if a bank picks a portfolio with a duration that extends well beyond the average.

Probability Distributions

In chapter 10, McCulloch estimates interest rate risks in a more complex manner. He calculates probability distributions for unanticipated interest rate movements. He also calculates three related measures. He assumes that future interest rate movements will be similar to those of the past and that all income is paid out as it accrues. He then asks:

1. Given a specific portfolio consisting of an initial amount of capital, assets of a particular maturity, and the form of payment (amortization) for the assets, how often would random interest rate movements cause an institution's net worth to fall below zero?
2. Given assets of a particular maturity and payment form, how much capital would it take to reduce the probability of insolvency to specific levels?
3. Given specific types of portfolios, what insurance premium would be fair to cover the probability of losses to an insurer?

Table 10.3 provides answers to the first of these questions. It shows how the percentage of time that a bank would have a negative net worth varies depending upon its capital and the weighted average maturity of its portfolio. Assume that a bank has a portfolio equivalent to a bond; interest is received and paid out annually, and the principal is received at a fixed maturity. Assume also that the bank initially has 4 percent net worth and funds 96 percent of its assets by borrowing. If its portfolio was all invested so as to give on average a net three-month maturity, unanticipated fluctuations in interest rates would be expected to cause it to have a negative net worth once in 350 years. If under similar conditions the average maturity of its portfolios was 10 years, on average, it would have a negative net worth every 3.7 years.

Assume that the bank wanted to maintain a portfolio with bonds having an average maturity of 10 years, but wanted to reduce its chances of finding itself with such a negative net worth to once in 100 years. How much capital would it require? Figure 10.6 shows that it would need capital equal to 30 percent of its total assets. To reduce the probability of insolvency to once in 100 years, it must not borrow over 70 percent of the value of the portfolio. Figure 10.6 also shows the annual probability of failure that results from each capital/asset ratio and possible average portfolio maturities.

Finally, table 10.4 shows fair insurance premiums. If a bank with 4 percent capital maintained a portfolio equivalent to a ten-year bond, and it wanted to carry insurance that would pay off its creditors at 100 percent in case of insolvency, a fair premium charge would be 1.55 percent of its assets per year.

McCulloch explains how he derives these figures and describes the type of factors in his study that influence the probabilities. Included are such factors as the estimates of past and future fluctuations, the rate at which earnings are paid out, and the composition of assets and liabilities. He considers only the pure interest rate risks of unanticipated movements in risk-free rates. The probabilities of insolvency are actually larger because other interest factors are correlated with risk-free rates. On the other hand, most banks retain some of their current earnings. Retained earnings are equivalent to added capital and reduce risks.

4.3 Risks of Poor Performance

In addition to risks arising from interest rates, our studies furnish some estimates of the risks of insolvency owing to failures of banks to maintain their operating margins or to properly control their underwriting of loans. Table 4.3 brings out the wide contrasts in the record of banks in these other spheres. The risks from unanticipated movements in earnings and loan losses are estimated by constructing probability distributions of these factors.

In this chapter we examine past movements in loan losses and revenues to see what has affected them, their magnitudes, and their variances. We examine both cross-sectional and time-series data. For loan losses, the cross-sectional data come from the FDIC sample of all banks described in chapter 9. Estimates are based on the portfolios and losses of individual banks in 1975 and the changes between 1974 and 1975, which were the highs for the postwar period. For changes in revenue, the cross-sectional analysis is based on the FDIC sample for 1970, 1971, 1974, and 1975. These years include the largest year-to-year declines in the postwar period. Table 4.8 also reports loan losses and revenues for all 14,400 banks. Unfortunately, we do not have the changes for this broader universe.

The time-series data are derived from all banks and from a limited group of large banks. There are 98 banks in the large-bank sample, with individual time-series for each bank for thirteen years. Both the cross-sectional and time-series data are used in estimating probability distributions for unanticipated losses.

4.3.1 The Dispersion of Earnings

In 1979, the average insured commercial bank in the United States had net book income before taxes and security losses equal to 1.1 percent of

its assets. This income gave a pretax book return of 20.0 percent on book (not economic) net worth. The danger of insolvency depends on variations in earnings and losses resulting from fluctuations in net interest income, in operating expenses (less miscellaneous income), in loan losses, and in changes in net worth from capital gains and losses, as well as upon payment policies which add to or subtract from net worth. Table 4.3 gives an indication of the wide dispersion among banks in 1979 of the first two of these factors.

The first item repeats the data on net interest income from table 4.1. The second item shows the large variations in expenses among banks. Given the wide dispersion of incomes and expenses, one is not surprised to see how greatly net operating income (before loan losses and taxes) varies among banks. Items 3 and 4 show the dispersion of such income as

Table 4.3 **Types of Income and Expenses in 1979 by Bank Size (as a Percentage of Net Earning Assets)**

Bank Size by Net Earning Assets	Banks at Specific Percentiles for Individual Items						
	1	5	25	50	75	95	99
				Net Interest Income			
Over $500 million	1.0%	2.0%	3.3%	4.0%	4.7%	6.0%	6.9%
Under $25 million	0	0.4	2.0	3.0	4.4	6.4	8.2
All banks	0	0.5	2.1	3.2	4.4	6.2	7.8
				Operating Expenses (Other Than Interest and Loan Losses)			
Over $500 million	0.7	1.7	2.8	3.6	4.2	5.4	6.9
Under $25 million	1.6	2.0	2.6	3.3	4.4	6.6	9.2
All banks	1.6	2.0	2.6	3.3	4.2	6.1	8.4
				Net Operating Income before Loan Losses and Taxes			
Over $500 million	0.3	0.7	1.2	1.6	1.9	2.7	3.6
Under $25 million	−0.6	0.8	1.6	2.0	2.6	3.6	4.5
All banks	−0.1	0.9	1.5	2.0	2.5	3.4	4.3
				Net Operating Income (before Loan Losses and Taxes) as Percentage of Equity			
Over $500 million	6.1	11.2	17.7	22.2	26.8	35.7	48.2
Under $25 million	−3.5	7.3	16.4	21.1	26.2	34.9	44.3
All banks	−1.0	9.1	16.8	21.3	26.2	35.4	46.2
				Loan Losses as Percentage of Net Earning Assets			
Over $500 million	0	0.01	0.11	0.18	0.30	0.58	1.40
Under $25 million	0	0	0.01	0.09	0.26	0.89	2.04
All banks	0	0	0.02	0.11	0.26	0.78	1.83
				Loan Losses as Percentage of Equity			
Over $500 million	0	0.2	1.5	2.7	4.3	8.9	18.7
Under $25 million	0	0	0.1	0.9	2.7	9.2	22.2
All banks	0	0	0.2	1.2	2.9	8.5	19.8

Source: 1978 and 1979 call reports for all insured commercial banks in the United States.

a percentage of net earning assets and of equity. The median bank netted 2.0 percent of its earning assets before providing for loan losses. Slightly more than 1 percent had negative returns. At the other extreme, 1 percent earned over 4.3 percent. The spread among large banks was considerably smaller. Only one large bank reported negative operating earnings before providing for loan losses. Out of the more than 14,000 banks, only 59 reported that operating losses ran as high as 1 percent of earning assets. Of these, 27 banks had losses exceeding 2 percent.

The risk from such losses depends on their size in relation to equity. The table shows that only 1 percent of banks lost as much as 1 percent of their equity as a result of operating losses. The total number who lost 10 percent of their equity or more was 53, of which one was a large bank.

The year 1979 was fairly typical in terms of bank operating earnings. In 1975, at the first percentile of all banks, the loss from operations was 1.5 percent, compared with 0.9 percent in 1979. Table 4.8 shows more detailed information about those with large losses in 1975. In that year, the number of banks with operating losses above 1 percent of earning assets or 10 percent of equity was more than twice as large as in 1979; but still, only 1.2 percent of all banks lost as much as 1 percent of their earning assets.

Loan Losses

In addition to high interest and other expenses causing poor operating results, banks can lose money because of poor underwriting leading to bad loans, failure to receive repayments, and a need to charge off the bad loans against capital. The final two items in table 4.3 show the ratio of net loan losses to all earning assets (not loans alone) and to equity. Again, the dispersion is wide. The median bank in 1979 lost only 0.11 percent of its earning assets from loan write-offs. The mean was somewhat higher at 0.21 percent. Since, typically, loans made up 65 percent of net earning assets, losses against loans alone averaged 0.33 percent. About 10 percent of operating earnings was required by an average bank to cover loan losses; 90 percent was available for profits and taxes.

The dispersion was great in this category also. Nearly one-quarter of the banks sustained no net loan losses. On the other hand, 1 percent of all banks had to charge off amounts equivalent to 1.83 percent or more of assets and over 20 percent of their equity.

The table does not show those banks—probably 20 or fewer—that were not operating at the end of the year because they had closed or merged as a result of poor operations. Of those banks with records available for the entire year, 5 had loan losses equal to 100 percent of their equity. They were able to cover such losses from other operating income, loan loss reserves, or tax credits.

The table also shows that, on average, large banks have somewhat riskier loans. Their average loan losses as a percentage of both assets and

equity are greater. On the other hand, the law of large numbers works in their favor. Because they tend to have more diversified loan portfolios, they are less likely to have an extremely high loss ratio. Their losses become serious primarily when they concentrate too many of their loans in a specific activity.

In the following discussion, changes in operating income before loan losses and net loan charge-offs are analyzed separately, because valuable information may be gained from considering the two individually. On the other hand, because some correlation exists between them, for some purposes the net income after loan losses is a more suitable figure.

4.4 Estimates of Operating Risks

While only a small number of banks show operating losses before loan charge-offs, the risk that operating earnings will change significantly exceeds the risk from poor loan underwriting. Tables 4.4 and 4.5 contain estimates of operating risks.

Risk is a function of unanticipated decreases in expected earnings. The discussion of risk theory pointed out that problems arise primarily if a loss is unexpected. Expected losses can be offset by capital contributions, or the bank can be closed. In some cases, however, banks will be allowed to operate even though they are expected to have a negative net worth at the end of a period. Agreements on whether to force increases of capital, mergers, or bankruptcy are regulatory decisions.

As chapter 3 noted, the best estimate of a bank's expected operating earnings or losses is simply their level in the previous period. Table 4.4 shows the levels of operating earnings in each year for all banks, for the weighted average of the 98 large bank holding companies whose annual operating results have been reported in a consistent manner on the COMPUSTAT tape, and for the company whose reported variance of earnings before loan losses was the largest during this period.[1]

The table shows that, with the major exception of the sharp drop in earnings between 1970 and 1971, shifts in income before loan losses have been relatively minor. (The differences in percentages reported for 1976 and later are due to a change in the form of reporting. Prior years were based only on domestic activities and income. In 1976 the call reports were shifted to consolidate foreign and domestic operations. Because earnings on foreign assets are lower than on domestic ones, average consolidated earnings as a percentage of net earning assets are reduced.) Except that they are slightly smaller, on the whole, the levels and movements for the large banks do not differ much from those for all banks.

1. The programming and calculations from the COMPUSTAT tapes were ably performed by Etian Gurel.

Table 4.4 **Income before Loan Losses and Income Taxes as a Percentage of Net Earning Assets at Year End**

	All Banks		98 Large Banks		Bank with Large Variance	
Year	Actual %	Change	Actual %	Change	Actual %	Change
1967	1.433	−0.079	1.512	—	1.53	—
1968	1.507	0.074	1.573	0.051	1.60	.07
1969	1.719	0.212	1.634	0.061	1.80	.20
1970	1.697	−0.022	1.713	0.079	1.91	.11
1971	1.466	−0.231	1.575	−0.138	1.75	−.16
1972	1.375	−0.091	1.444	−0.131	1.47	−.28
1973	1.461	0.086	1.412	−0.032	1.23	−.24
1974	1.561	0.100	1.464	0.052	1.16	−.07
1975	1.640	0.079	1.704	0.240	0.00	−1.16
1976[a]	1.378	n.a.	1.563	−0.141	1.36	1.36
1977[a]	1.352	−0.026	1.461	−0.102	1.09	−0.27
1978[a]	1.528	0.176	1.623	0.162	1.22	0.13
1979[a]	1.586e[b]	0.058	1.633	0.010	1.17	−0.05

Source: Cols. 1 and 2 from FDIC annual reports; cols. 3–6 COMPUSTAT tapes.
[a]Fully consolidated.
[b]e = estimated.

Their reports are on a holding company consolidated basis for the entire sixteen years.

While the data for all banks are an indication of what shifts are likely to occur in the income of an average bank as a result of economic events, they do not take into account added risks assumed by individual banks as a result of nontypical portfolio choices, management, or location. To better estimate individual bank risks, we use two other sources that do contain data on individual banks.

We have examined the record for each of 98 banks from the COMPUSTAT tape. The bank with the largest variance in these earnings is shown in table 4.4. It should be noted, however, that the tape no longer includes some large banks that disappeared because of merger or insolvency. In the cases of insolvency, failure probably resulted more from fraud or maldiversification than from accepting unusual operating risks.

The Cross-sectional Data

Table 4.5 shows the distribution of banks by changes in income before loan losses that occurred between 1970 and 1971, the year of maximum fall for this item. It shows only those whose income fell, although the distribution statistics in the table are based on all banks. On average, large banks show larger movements than small ones. Over 5 percent of

large banks saw their earnings drop by 1 percent or more of their earning assets. On the other hand, the dispersion of loss increases among small banks is far larger; more of them tend to be at the extremes.

The estimated risks from operating changes are somewhat higher than are those from loan losses found in table 4.7. There are two basic reasons for this greater apparent risk. One arises from the fact that a large number of factors influence earnings. If all of these turn negative, the unanticipated fall in income is likely to be greater than for loan losses. The drop in average income from 1970 to 1971 was 23 basis points per dollar of earning assets, compared with an average increase in loan losses of 15.7 basis points between 1974 and 1975, its maximum.

The second reason appears to be the much greater difficulty small banks have in controlling their expense/revenue ratios. While all sizes of banks except for the $50 to $500 million class show higher variances of income than of loan losses, the increase in the variance for the smallest bank is over 300 percent.

Time-Series Data

The risks of changes in income, as measured by the time-series data of the 98 large banks, agree with the concept that operating risks exceed those from loan losses by a great deal. The average variance in values from operating changes from 1965 to 1979 was 0.0000064 (table 5.4). At the median, the time-series data show operating risks about 100 percent higher than risks of movements in loan losses. The largest banks with lowest operating risks show a variance of about 0.000001. On the other hand, the bank with the largest variation of this income shows a risk more than thirty times higher, at 0.000031. Because we lack time-series data for individual small banks, the time-series estimates of operating risk are somewhat below those from cross-sectional data. If we had time-series data for small banks, those at the higher end would probably show a much higher probability of loss from this factor than is brought out in the table.

Table 4.5 **Change in Operating Income before Loan Losses and Taxes, 1970–71**

Size of Bank in Millions of $	Mean	σ	Percentile 1	5	10	25	Median	Var. log(1+Δ)
>500	−0.35	0.44	−2.01	−1.04	−0.73	−0.53	−0.31	.000019
50–500	−0.26	0.37	−1.51	−0.87	−0.71	−0.46	−0.23	.000014
10–49	−0.06	0.53	−1.58	−0.90	−0.57	−0.35	−0.06	.000028
<10	−0.04	0.83	−3.31	−1.33	−1.06	−0.49	−0.05	.000069

Source: FDIC tape.

Other Risk Factors

The lack of time-series data for small banks is only one factor tending to underestimate loss probabilities for this group. Another is the good chance that, as a result of fraud, insider abuse, or nondiversification, a few banks each year will have a greater probability of losses than is shown in these estimates. In each year of the 1970s a few banks experienced losses greater than 5 percent, and in some cases over 10 percent of their earning assets.

If these banks are small the losses to the economy from such failures will be minor. It may well be inefficient and costly to the economy's productivity to fight to keep such losses as low as they now are (Mayer 1975). On the other hand, it may well be that improved techniques of estimating nondiversification and insider abuse through simulations could increase our knowledge of what types of portfolios contain appreciable risks from these sources. A new system might hold down such losses at a lower cost to the economy.

4.4.1 Estimate of Risks from Loan Losses

Most discussion of banks has concentrated on default risk—the inability of borrowers to pay off their loans. In fact, in a diversified portfolio this risk may be far lower than that from interest rate changes.

Loan losses are dangerous primarily if the bank concentrates too many of its loans in a particular sphere, such as construction and development loans, real estate investment trusts, loans to individual investors, or foreign loans. Table 4.3 showed loan loss ratios for 1979. We also examined in detail similar information for 1975, the year losses rose most sharply. Net charge-offs (losses less recoveries) were actually slightly less than in 1979 for the median bank. However, the mean of loan losses in 1975 was twice as high as in 1979. More banks—and especially more large banks (whose weight is much greater in calculating the mean)—suffered a sharp increase in loan losses as a result of the recession. Their loan experience was likely to be particularly adverse if they had made large loans to real estate investment trusts and on construction projects.

In 1975 loan losses exceeded 1 percent of net earning assets for 572 banks, and in over 5 percent of the cases losses exceeded currently available revenue, thus requiring that capital be drawn down. In the period 1970–75, however, only a handful of banks had losses exceeding 5 percent of assets for either a one- or a two-year period. Under existing conditions, a bank must have an undue concentration of loans or be extremely inept to fail because of loan losses alone.

It must be remembered that these favorable results have occurred under a regime when banks are examined at regular intervals. They are not as reliable a predictor of potential losses without regulations. Theory, however, does indicate that roughly similar results should be expected if

other properly devised measures of risk and risk-taking are substituted for examinations and evaluation of individual loans.

4.4.2 Levels of Losses

Table 4.6 contains time-series data for loan losses derived in the same manner as those for operating losses in table 4.4. This table also makes clear why, on the whole, loan losses have not been a critical risk factor under our existing banking system. On average, loan losses were low in the 1960s. They took a series of jumps in the 1970s. Still they reached only slightly over 0.4 percent for all banks in 1976 and slightly over 0.5 percent for the largest banks. From 1976 to 1979, the net loss ratio was cut by over one-half.

Moreover, it is not the level of loan losses that is most critical. Losses that are anticipated will be charged for in the interest rate or in fees quoted prospective borrowers. Expected losses will merely increase the gap between gross and net revenue. Risks arise not from the total, but from unanticipated increases in losses and from the distribution of individual banks around the average change.

In any year, the level of loan losses will depend upon the type of portfolio and the operating skills and style of individual banks. Levels of losses from one year to the next, and therefore expected income, depend upon such individual bank factors. However, most changes in the level of

Table 4.6 **Net Loan Losses as a Percentage of Net Earning Assets at Year End**

	All Banks		96 Large Banks		Bank with Large Variance	
Year	Actual %	Change	Actual %	Change	Actual %	Change
1967	0.119	−0.004	0.101	—	0.058	—
1968	0.101	−0.018	0.078	−0.023	−0.063	−0.121
1969	0.116	0.015	0.087	0.009	0.285	0.348
1970	0.213	0.097	0.238	0.151	0.251	−0.034
1971	0.210	−0.003	0.266	0.028	0.293	0.042
1972	0.148	−0.062	0.162	−0.104	0.458	0.165
1973	0.170	0.022	0.191	0.029	0.615	0.157
1974	0.265	0.095	0.285	0.094	1.990	1.375
1975	0.422	0.157	0.532	0.247	2.266	0.276
1976[a]	0.355	—	0.508	−0.024	1.278	−0.988
1977[a]	0.254	−0.101	0.358	−0.150	0.288	−0.990
1978[a]	0.205	−0.049	0.264	−0.092	0.224	−0.064
1979[a]	0.179e[b]	−0.026	0.223	−0.041	0.128	−0.096

Source: Cols. 1 and 2 from FDIC annual reports; cols. 3–6 from COMPUSTAT tapes.
[a]Fully consolidated.
[b]e = estimated.

losses do not depend upon prior levels of risks or income. There is only a slight correlation between broad classifications of portfolios and movements in losses from year to year.

The ratio of losses to net earning assets obviously depends on the share of loans in the portfolio. Banks investing primarily in securities rather than loans have a lower percentage of loan losses to assets than banks with a high ratio of loans. A correlation also exists between losses and gross earnings on assets in one year and the following year's level of losses. Firms that take greater risks to earn larger sums experience more losses and are more apt to see their losses increase. But the correlation is not high. Past losses and gross earnings together predicted less than 10 percent of losses in 1974 and about one-quarter in 1975.

The type of loans in the portfolio also influences the level of losses. Using a four-way classification, we find that, as the percentage of commercial and industrial and consumer loans in a portfolio rises, so do losses. On the other hand, home mortgage loans lower the loss ratio. However, the R^2s for the level of loan losses compared with their composition was under 0.05 in 1974 and was 0.12 in 1975. From other data, we know that if loans are further subdivided into more classes, some, such as land development and construction, will show still higher rates of losses.

When a sharp jump in losses occurs, the relationship between past behavior and the level of losses becomes still more attenuated. Thus in 1974 and 1975, when losses jumped sharply, correlations of the amount of losses with beginning of the year portfolios were reduced compared with prior years when losses stayed steady. Unanticipated losses were a much higher percentage of the total.

Skewness

The distribution of loan losses in any year is not normal. It is skewed to the right. As pointed out, the median loan losses in 1979 for all banks was 0.11 percent, but the mean was at 0.21 percent. Nearly one-quarter of all banks had no loan losses. Among banks under $10 million in size, nearly half fell into this category of no loan losses. On the other hand, small banks sustained a considerably higher percentage of large loan losses.

In 1979 the percentage of small banks either with no loan losses or with losses exceeding 2.0 percent of net earning assets was 2.5 times as high as for banks in the largest size category. In 1975, when unexpected losses increased sharply, skewness was even greater. No large banks had loan losses above 2.55 percent of net earning assets, while there were 66 banks in the under-$500 million category whose losses exceeded 3 percent of earning assets, and 5 banks actually had loan losses that exceeded 10 percent of their total assets. This seems to reflect the lesser chance for smaller banks to adequately diversify their portfolios and profit from the law of large numbers. Again, these large losses skew the distribution of

losses to the right. If the distribution were normal, we would expect about 7 banks in the smallest category to have loan losses higher than 1.27 percent (three standard deviations from the mean). Instead, the number of banks with losses exceeding this level was over 100. Among all banks we would expect about 18 to have loan losses exceeding 2 percent of their net earning assets, but 158 banks had losses above that point.

4.4.3 Cross-Sectional Data

We should expect that changes in loan losses from one year to the next will be largely unanticipated or random. No bank will knowingly take a loan it has reason to expect will default. Some banks will select portfolios that have higher average losses, but unless they change their selection process suddenly, their choice of a higher risk portfolio will have been reflected in higher loss rates in prior years also. There is also a correlation between higher gross revenues and loan losses in each year.

On the other hand, a tendency does exist, as one would expect, for banks having above-normal losses in one year to move back toward the mean in the next. Both managerial and regulatory pressures are exerted on banks to bring their losses into line. In 1974 the regression of change in loan losses on the previous year's level of losses was negative, with an R^2 of 0.3, while it was negative with an R^2 under 0.1 for 1975. In that year the previous level of gross revenues also had a small impact. Otherwise, changes in losses in both years seemed unrelated to previous experience. To the degree that this is true, we can estimate risks under the assumption that they are stochastic. We can measure them by fitting distributions to past unanticipated changes. Such distributions by size of bank are shown in table 4.7.

Probabilities of Unanticipated Losses

The table shows a distribution of changes in loan losses between 1974 and 1975 by size of bank. This was the year of the largest increase in losses in postwar history. The weighted average of loan losses as a percentage of

Table 4.7 **Change in Loan Losses as a Percentage of Net Earning Assets 1974–75 by Size of Bank**

Size in Millions	Mean	σ	Median	Percentile 75	90	95	99	Var. log(1+Δ)
>500	0.19%	0.298%	0.12	0.24	0.54	0.82	1.16	.000009
50–500	0.10	0.431	0.06	0.16	0.39	0.64	1.85	.000018
10–49	0.01	0.419	0.02	0.12	0.27	0.42	1.09	.000017
<10	−0.04	0.403	0	0.04	0.17	0.53	1.05	.000016

Source: FDIC sample tape.

net earning assets for all banks rose from 0.265 percent to 0.422 percent. When we examine the table, however, we note that the increase in losses occurred almost entirely among the relatively small number of larger banks. The unweighted mean and median of banks with less than $50 million in earning assets show that virtually no change occurred.

Even though the largest banks had on average the sharpest jump in losses, their actual risk or danger of insolvency is offset somewhat by their smaller variance around the mean. As a result, when one reaches the right-hand side of the distribution for those with the largest losses, no great difference appears in the amount of change experienced among classes of banks. The major exception is for the unusual 99th percentile figure for the banks in the $50 to $500 million class.

The standard deviation of the entire distribution is 0.413 percent. When we compare the numbers of banks whose losses exceed two or three standard deviations with the number expected in a normal distribution, we find that the fit is good for the two classes containing the bulk of banks (banks with less than $50 million), but the number with higher than expected changes in the two larger bank classes is considerable. For these classes, it might be sensible to fit a symmetric Paretian rather than a normal distribution.

A major point of the table, however, is that even in a year with maximum unanticipated changes, the total impact of loan losses on risks is not large. Risks are measured by the probability that losses will increase sufficiently to wipe out all capital. The measure of this risk is the variance of the log of the change in asset values as a result of unanticipated losses. This variance is found in the last column of table 4.7. The risks from loan losses as measured in this way not only are small, but are relatively small compared with interest rate risks.

4.4.4 Time-Series Estimates of Loss Probabilities

In addition to estimating probable loan losses by size from cross-sectional data as in table 4.7, we can also estimate these probabilities from the time-series data on individual banks shown in table 4.6.

The variance of the logs of the change in asset values as a result of the year-to-year movements in loan losses for 96 large banks from 1967 to 1979 was 0.0000031. This is only about one-quarter of the cross-sectional estimate of this same probability, which equaled 0.0000165, based on the changes in loan losses between 1974 and 1975.

When we examine the extremes among these large banks, we find a large range; but, still, even that bank with the largest variance does not reflect a high risk. Several large banks experienced virtually no net loan losses over this period. Each of them had variances of the logs of about 0.0000003. In contrast, a few had considerably larger losses than average, but the worst had a variance of 0.0000375. This amount is somewhat larger than the estimate of high risks from the cross-sectional data.

The time-series data seem to confirm the cross-sectional data. The use of a distribution based upon the worst year of unanticipated changes that occurred in the postwar period is probably a fairly good indicator of loan loss risk. One problem with both types of information of course, is that they exclude the banks that actually became insolvent in these years. These totaled four banks in 1974 and thirteen in 1975. In addition, the regulatory agencies issued a slightly larger number of cease and desist orders or actions to terminate insurance, primarily because of threatened loan losses. These stopped banks from assuming as much risk as they desired.

Similarly for the large bank sample, data are not included for United States National Bank and Franklin National Bank because they failed during this period. These banks clearly had much larger variances than the highest continuing bank, given their large losses in their final year.

4.4.5 Total Losses from Poor Performance

The next chapter contains estimates of the total risk in banks calculated to match the interest rate, operating, and loan loss risks that prototype banks have assumed by their past portfolio and operating choices.

Tables 4.8 and 4.9 give another picture of operating and loan losses. They contain information for all banks that in 1975 reported book losses of 1 percent of net earning assets, either from operations before loan losses, or 1 percent from loan losses, or 1 percent from a combination of the two. The tables were prepared from data reported for each individual bank in the United States.

About 3 percent of all banks had operating losses before loan losses in 1975. Of these, 169, or 1.2 percent, lost more than 1 percent of their net earning assets. These were heavily concentrated in the smallest banks, of which 2.5 percent lost more than this amount. The table shows a smaller and smaller number of banks as the size of operating loss increases. Before loan losses, none lost over 6 percent of assets.

The number of banks where loan losses exceeded 1 percent of earning assets was far larger, with 572, or 4 percent of the total. In this category the distribution by size of bank is considerably different. The largest banks had a higher percentage with sizable loan losses, though none had losses above 3 percent. Among smaller banks, a few had large loan losses, rising to over 10 percent of assets for three small banks.

The final sector shows losses including both those from operations and those from loans. The number is smaller than those with loan losses above 1 percent because many banks had positive operating earnings against which to offset loan losses. Eight banks out of 14,400 lost over 6.0 percent of earning assets, and each of these lost more than 10 percent.

Perhaps more important than the losses compared with assets are losses compared with book capital. In 1975, the worst year for banks, 1.9 percent lost more than 10 percent of their capital. Of these, 36 banks lost

Table 4.8 **Number of Banks That Lost over 0.99% of NEA in 1975, Classified by Size and Amount of Loss**

Class of Banks by Net Earnings Assets ($ Millions)	Number of Banks in Size Group	Operating Loss before Loan Losses of Net Earning Assets (%)				Loan Losses of Net Earning Assets (%)				Operating Losses, Including Loan Losses of Net Earning Assets (%)			
		1.0 to 1.99	2.0 to 2.99	3.0 to 3.99	4.0+	1.0 to 1.99	2.0 to 3.99	4.0 to 5.99	6.0+	1.0 to 1.99	2.0 to 3.99	4.0 to 5.99	6.0+
>500	203	0	0	0	0	14	3	0	0	1	1	0	0
50–500	1,778	2	0	0	0	75	13	3	1	13	5	2	1
10–49	6,853	20	7	5	4	215	67	12	2	65	31	16	3
<10	5,205	56	35	22	18	110	42	12	3	88	72	32	4
All banks	14,039	78	42	27	22	414	125	27	6	167	109	50	8
		Percentage of All Banks in Class											
>500		0	0	0	0	6.9%	1.5%	0	0	0.5%	0.5%	0	0
50–500		0.1%	0	0	0	4.2%	0.7%	0.2%	0.1%	0.7%	0.3%	0.1%	0.1%
10–49		0.3%	0.1%	0.1%	0.1%	3.1%	1.0%	0.2%	*	0.9%	0.5%	0.2%	*
<10		1.1%	0.7%	0.4%	0.3%	2.1%	0.8%	0.2%	0.1%	1.7%	1.4%	0.6%	0.1%
All banks		0.6%	0.3%	0.2%	0.2%	2.9%	0.9%	0.2%	*	1.2%	0.8%	0.4%	0.1%

Note: Excludes banks not reporting assets or income for full year.
*Less than 0.05%.

Table 4.9 **Number of Banks That Lost over 0.99% of NEA in 1975, Classified by Size and Amount of Loss**

Class of Banks by Net Earnings Assets ($ Millions)	Operating Loss before Loan Loss, % of Book Equity				Loan Loss, % of Book Equity				Operating Loss Plus Loan Loss, % of Book Equity			
	10–19%	20–49%	50–74%	75+	10–19%	20–49%	50–74%	75+	10–19%	20–49%	50–74%	75+
>500	0	0	0	0	12	4	0	0	1	1	0	0
50–500	3	0	0	0	79	11	3	1	11	8	1	1
10–49	23	11	2	1	216	84	9	6	49	45	17	6
<10	41	14	0	0	111	39	6	3	62	42	5	6
All banks	67	25	2	1	418	138	18	10	123	96	23	13
					Percentage of All Banks in Class							
>500	0	0	0	0	5.9%	1.9%	0	0	0.5%	0.5%	0	0
50–500	0.2%	0	0	0	4.4%	0.6%	0.2%	0.1%	0.6%	0.4%	0.1%	0.1%
10–49	0.3%	0.2%	*	*	3.2%	1.2%	0.1%	0.1%	0.7%	0.7%	0.2%	0.1%
<10	0.8%	0.3%	0	0	2.1%	0.7%	0.1%	0.1%	1.2%	0.8%	0.1%	0.1%
All banks	0.5%	0.2%	*	*	3.0%	1.0%	0.1%	0.1%	0.9%	0.7%	0.2%	0.1%

Note: Excludes banks not reporting assets or income for full year.
*Less than 0.05%

50 percent or more, with one bank reporting losses of over 100 percent of capital. In addition, of course, the FDIC paid off the depositors of 3 banks and assisted 10 others by advancing funds for mergers. Some other banks merged or sold out voluntarily during the year because of losses. In many ways, table 4.8 is important for analyzing risks from defaults and operations. It shows the total distribution of banks that did badly in the banks' worst year.

4.4.6 Bank Size

The difference in losses experienced by banks of various sizes, illustrated in tables 4.8 and 4.9 and earlier tables in this chapter, is interesting but not critical. Larger banks borrow more money and purchase a higher percentage of liabilities. They take somewhat riskier loans and average somewhat higher income from loans and investments. They also engage in more miscellaneous activities. However, because they have higher operating expenses, pay more for their liabilities, and have larger loan losses, on average their income as a share of earning assets is lower. They also have a smaller amount of equity behind each dollar of assets; their income as a percentage of equity has also been lower; but in 1979 there was virtually no difference in earnings on equity by size. The lower earnings on assets were offset by less capital behind each dollar of assets.

On the surface, the large banks appear to be more likely to fail, since they have riskier assets and less capital. This factor is offset to the degree that they have more diversified assets. Diversification lowers the chances of their sustaining extremely large losses. On the other hand, when they fail to diversify, their greater inherent risk/capital ratio means that other risks dominate, and the probability of their failure rises above that of smaller banks. Such increase in risks and failures has been the experience in the 1970s. In 1975 their loan losses were a higher share of available income at all points except at the extreme 99th percentile. In 1979 this crossover point occurred at the 95th percentile.

Several factors distinguish the smallest banks. They borrow less money and have more demand deposits. As a result, they earn slightly more than average from net interest. They also have somewhat higher operating expenses and considerably lower loan losses. When these various factors are put together, the smallest banks may earn above-average amounts as a percentage of both earning assets and equity. This was true in most years, but in 1979 there were only slight differences in average earnings on equity by bank size. However, the smallest banks still had a greater chance of unfortunate outcomes. Their variances of losses and changes in operating incomes are greater.

The risk that operating earnings will deteriorate seriously is more than twice as great for a bank with assets under $10 million as it is for a larger bank. Clearly, because they lack the self-insurance arising from the law of

large numbers, smaller banks are much more likely to experience either changes in liabilities and total assets, without the ability to lower expenses, or relatively larger shifts in losses. This is one of the critical reasons why a different system of regulation and insurance may make sense for small banks.

4.4.7 Are the Estimates Adequate?

The use of distributions of past movements to estimate future unanticipated changes may either understate or overstate actual probabilities. The estimates take no account of the probabilities of fraud or maldiversification. Furthermore, though we would like to estimate what risks would prevail in a free market, this is difficult to do. Bank examiners have probably reduced risk-taking below the level that would prevail if they were absent.

On the other hand, the flat charges of the FDIC, which does not penalize added risk, probably increases the amount of risk many banks can and do take. Furthermore, the estimates of this chapter are based on cross-sectional data in years of maximum change or on time series from the riskiest of large banks. To some this might appear to overstate normal risks, on the assumption that one ought to use average rather than extremes for measurements. But, as was pointed out in the previous chapter, risk calculations should be based on a complete estimate of potential events covering a long period. Insurance reserves should be built up in periods of low losses to offset more extreme shifts. The use of an estimate of risk based on the maximum change in losses or income in fourteen years may not be high enough to offset the actual maximum that might be experienced in a period two or three times as long. On the other hand, this estimate would have overstated average risks during the fourteen-year period. We do not know whether there would be a shortfall or overage over a similar future period, but it is clear that, by the use of maximum variances, some provision is being made for the probability of larger unanticipated movements in the future than occurred on average in the past.

Another problem is that, except for McCulloch's interest rate risk estimates, all the others assume a log-normal distribution. The actual distributions appear to be somewhat skewed. The next chapter gives an indication of the types of errors this can lead to. However, past movements of operating and loan losses are small enough so that even another form of distribution would not make much difference in the magnitude of the estimates.

It should also be recognized, moreover, that the assumption of a normal distribution of expected changes depends upon the bank's having a properly diversified portfolio. Any significant concentration of loans means that the future can be heavily influenced by one or a few exoge-

nous changes. It will be unlikely to follow the same type of random process that results from a wide variety of assets. A typical portfolio is likely to follow a random process because, while the level of reaction will depend on major macro movements of the economy, the degree of reaction will be limited by the need of the government and the Federal Reserve to maintain a generally viable financial system.

Banks as a whole are profitable. Bank profits have been increased by aid from the government through interest rate ceilings and limitation on competition. When these aids are removed, we would still expect the banking system as a whole to earn average profits equal to the risks it assumes. While variations in earnings occur with macroevents, such fluctuations are not likely to lead to insolvency in an industry with adequate capital bolstered by a good insurance system.

This relatively favorable view that normal risks are not unduly high is enhanced by the fact that operating revenues, even for individual banks, usually do not deteriorate suddenly. It takes poor management or fraud and insider abuse to thwart normal diversification. While errors may accumulate over time, advance warnings signal that changes in operations and capital additions usually are required.

Among small banks, most failures have resulted from fraud, insider abuse, or an accumulation of poor operations. When larger banks have failed, unanticipated interest rate changes accompanied by a concentration of loans have been more significant. The analysis in this volume shows that this is what should be expected. Risks arise primarily from a lower than normal level of capital, from a lack of proper diversification, or from continuing subnormal operations.