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5 Estimates of Capital and Its Adequacy

5.1 Introduction

Measures of capital adequacy require estimates of the level of expected net worth. To accomplish this task, one must first make an estimate of the level of economic capital, then add or subtract the expected amount of net earnings and of capital contributions less dividend payments.

In simplified financial theory, one should be able to obtain a useful estimate of a unit's net worth from its market value. This would then be available as a starting point, to which estimates of expected changes could be added. However, as already noted, the direct estimate of values from market observations may not be possible. Only a limited number of banks have active markets for shares of their common stock or other liabilities. Furthermore, the prices paid for bank stock may depend upon government regulations or insurance procedures, or other artificial forces. The cost and availability of information may lead to inaccurate valuations. The prices quoted may be inordinately influenced by cyclical or other expectational forces that do not affect the risks of insolvency but rather result from expectations that future returns will be lower or have an increased volatility.

This chapter adds information on the problem of determining net worth and on how this influences risks. It considers some of the factors that enter into a proper capital definition and the procedures used to measure and project banks' net worth. It discusses some of the tensions that exist between banks and their regulators over a proper level of capital.

The previous analysis showed that estimates of capital could be improved by using market information to estimate the value of individual

activities, which could then be summed to obtain the value of the portfolio, of liabilities, and of net worth, which is the residual between assets and liabilities.

This chapter considers in greater depth:

1. Proper definitions of capital.
2. The economic costs of capital to a bank and the economy.
3. Some market estimates of net worth compared with those based on book figures.
4. Measures of capital adequacy and fair insurance premiums.

The concluding discussion in this chapter uses past experience and the resulting probability estimates of changes in net worth to show how they affect specific prototype banks. Such banks include those at the average and at the extremes of risk-taking. In place of an attempt to measure the net worth of specific banks, the estimates of fair insurance premiums for the prototype banks are calculated for a range of possible net worths. The information for the prototype banks is supplemented by a specific case example, that of the First Pennsylvania Bank.

Capital is risk-offsetting because it can cover losses. It can bridge negative cash flows and pay off creditors. It also earns returns but does not require cash payments or engender interest rate risk. Yet banking history reflects a steady decline in the ratio of capital to assets. Why has this occurred? Why has leverage—the ratio of borrowed money to capital—steadily increased?

Financial theory offers two conflicting answers. One emphasizes the advantages to stockholders of increasing leverage—advantages arising out of the tax and regulatory system. While, in theory, arbitrage among investors and lenders should wipe out any profits from leverage, this probably does not happen under existing conditions.

In contrast, traditional theory posits a falling cost curve until leverage reaches some optimum point. It pays to reduce the capital ratio until that point is reached. If leverage continues to expand among banks, it is an indication that the market judgment is that leverage has not reached the optimum.

In this latter view, failure to pick the optimum point of capital reduces welfare by wasting scarce resources. On the other hand, if leverage has expanded primarily because it is subsidized by the government, regulations that prevent it from expanding as far as the market wants do not create a social loss. While neither view can be proved, many believe that bank capital may be far lower now than it would be in a completely free, competitive market. In banking, unlike other industries where excess capital and fixed assets are wasted, most capital is lent out. There are no obvious advantages to substituting one form of liquid capital for another, in contrast to whatever ratio a free market would select.

5.2 Capital and Capital/Asset Ratios

Capital is desired as an offset to risks of fluctuations in the value of assets and liabilities. Capital must earn an adequate return if it is to be invested. For analysis of the risks of individual banks, the amount of capital per se is not significant; the important thing is its relationship either to the bank's total assets or liabilities or to a subcategory such as assets at risk or earning assets.

In our studies, we primarily compare capital with net earning assets. When we seek a measure of capital adequacy, we consider the ratio of these two items. Both these totals must be defined if we are to understand what they include and exclude. It is recognized, however, that what constitutes an adequate ratio may differ considerably from bank to bank based on their individual risks.

5.2.1 Defining Capital

Capital accounts in banks consist of equity capital, surplus, undivided profits, reserves for contingencies and other capital reserves, and perhaps capital notes and debentures. Of these, all but the last clearly fit a proper criterion for capital. In addition, reserves for bad debt losses and other reserves on loans and securities are available to offset losses. Deferred taxes also can reduce risks. At a minimum, these offset assets and require no cash outflow. If the firm is in an unprofitable situation, they usually work their way into other accounts.

Over the years, a major debate has developed about whether capital notes and debentures should be counted as part of capital. The answer depends on the purpose for which capital is being defined. If capital is to protect the FDIC and uninsured depositors when a bank becomes insolvent, then subordinated notes and debentures serve as capital. But if capital is to protect against the occurrence of a negative net worth this need not be true.

The prime advantage of debentures in reducing the risk of insolvency is that they usually have fixed interest rates and payment dates and a longer duration than other liabilities. Their interest rate risk tends to be negatively correlated with that of assets. If interest rates rise, the economic liability of debentures to the bank will fall. Since their usefulness follows from their duration, a debenture coming due shortly or with variable rates is equivalent to any other liability and should not be counted as capital.

For most analyses, notes and debentures are not a significant factor in banks. If included as part of bank capital, they make up less than 6 percent of the total. They have been issued by an even smaller percentage of banks than this. On the other hand, most large banks have raised

between 25 and 35 percent of total equity plus bond capital through debentures, and in some the ratio is as high as 50 percent. In most of this volume, we have included debentures as capital in much of our analysis, even though we recognize their inability to substitute for equity capital in particular cases. In most of the statistical analysis, because so few banks have issued capital notes, results depend primarily upon banks without existing debentures.

5.2.2 Net Earning Assets

We are rarely concerned with the amount of capital per se. Bank A could have one hundred times the capital of bank B, but if its deposits were two hundred times as large, it would not be in as strong a position. Capital must be related to the risks it is expected to absorb. Assets are also a useful base in analyzing earnings. While recognizing the arbitrariness of a particular definition, in our studies we primarily work with the ratio of capital to net earning assets (NEA), the primary assets at risk. The regulatory agencies frequently use total assets or total deposits. They also use the concept of risk assets, which excludes government securities from NEA. To measure net earning assets, we exclude from total assets cash and due from banks (except interest-earning deposits), fixed assets, other assets, and acceptances. On the liability side, to offset these subtractions, we have also excluded acceptances and have subtracted cash and due from banks from demand deposits to arrive at net demand deposits.

The exclusion of acceptances from both sides is straightforward. The pertinent balance-sheet item should be the value of the put option that the bank writes when it accepts a bill. It also seems clear that cash items in process of collection (float) should be subtracted from both sides.

However, more questions can be raised about the other adjustments. Banks receive some services from their reserves and the balances they hold with other banks. Fixed and other assets also furnish services and incidental income. In contrast, currency and coin are an expense. The particular definition we use may bias income and expense statements slightly, but in most cases we have compared analysis based on the use of total assets in place of NEA and have found no significant differences. Risks of loss from the items excluded are slight. Using net earning assets gives a better measure of risk as well as a more accurate base for analyzing earnings and losses.

A more difficult problem arises from the fact that some of the condition reports used for much of our analysis and for that in many banking studies contain information only for the bank and its domestic subsidiaries. Until 1976, most series excluded data for branches and subsidiaries abroad. For many large banks, foreign assets and liabilities are critical. More than 17 percent of the total earning assets of the American banking system are

now held abroad. Many published statements of the ratio of equity to net earning assets for the banking system are biased upward by a failure to include foreign assets. As an example, the ratio of capital to domestic net earning assets for our five largest bank holding companies in 1979 was about 8 percent. When their foreign earning assets are added, the ratio of capital to net earning assets falls to about 4 percent. Yet figures based only on the banking system's domestic assets are frequently cited in capital ratios.

In our study we have used domestic balance sheet and earnings data for analysis when we felt this would not bias the results. For the larger banks and the past four years (when more foreign data are available), we have used data that include foreign operations whenever available.

To give some indication of differences, when domestic net earning assets are used as a base compared with total earning assets, the reported capital ratios increase by about 20 percent. The ratio is about 40 percent greater than if worldwide total assets are the base. The use of domestic NEA gives a ratio about 18 percent higher than if worldwide net earning assets are used, with of course much larger differences for the biggest banks.

5.3 End-of-Year Capital/Asset Ratios

The risk of inadequate capital, as we saw in figure 2.1, is that negative variances will affect the expected net worth; that is, the value of liabilities will exceed the value of assets. In addition to the initial net worth, the expected change in net worth between examinations must be analyzed. Changes in net worth depend on net earnings and on a bank's dividend and capital policies. Since risk depends on the ratio of capital to liabilities, the growth in liabilities must also be estimated.

In the 1970s, for banks as a whole, net earnings on equity have been in the neighborhood of 12 percent. Dividends have averaged about 40 percent of earnings, so that undistributed profits have been over 7 percent of net earning assets. In addition, however, banks raised capital and added to their reserves. As a result, in an average year, total capital and reserves available to absorb losses have grown at a rate of 10 to 12 percent a year. Since earning assets grew at a somewhat faster pace, the ratio of capital to total assets fell.

Chapter 11 discusses procedures by which the expected capital/asset ratio for a bank can be calculated. The technique explained there is the use of time-series transfer function analysis. This allows one to extract the maximum information from the recent history of the bank, but it also enables one to use projected or ranges for significant exogenous variables, such as the occurrence of a recession or sharp movements in interest or inflation rates. In any case, the most critical factor is to find the

actual value of the bank's net worth and assets. When these have been determined, the projection to the end of the year is likely to be a second-order problem.

The procedures outlined may illumine some of the uses for and problems with existing bank examinations. Much of the examination process can be thought of as an attempt to project a capital/asset ratio. In effect, examiners project losses in capital by their loan classifications. If well done, this is a useful function, particularly when accompanied by suggestions for improving operations and increasing capital.

The process, however, remains too subjective. Measurements of capital and of liquidity are not modeled carefully or correctly. Knowledge of potential losses needs to be embedded in a more complete model if it is to be of maximum benefit.

5.3.1 Costs of Capital and Leverage

The higher the percentage of capital compared with assets or liabilities, the lower the risk of insolvency. The steady downward trend in this capital ratio is demonstrated in table 5.1. In 1939, the banks that survived the depression were extremely cautious. Their equity capital was 10.33 percent of their total assets. During World War II banks expanded their assets rapidly, but most of the expansion was in government securities. Their capital ratio fell to 6.86 percent, but they were deemed not to have increased their risk excessively because their ratio of capital to loans was still over 25 percent.

During the 1960s and 1970s, the ratio of capital to assets kept declining, and the ratio of capital to loans fell even more rapidly as the share of loans in portfolios rose. Of course the increased loan percentage may not have added to risk as much as conventional wisdom believed if it simultaneously lowered the duration, and therefore the interest rate risk, in portfolios.

When we examine banks by size, as in the second half of table 5.1, we note that the distribution of capital is very uneven. The ten largest banks

Table 5.1 Bank Equity Capital as a Percentage of Total Book Assets for All Banks in the United States

By Year		By Bank Size in 1979	
Year	Percent	Bank Size	Percent
1939	10.33	<\$100 million	8.07
1949	6.86	\$100 million to \$1 billion	6.89
1959	7.90	Over \$1 billion	4.63
1969	7.45	Ten largest banks	4.02
1979	5.75		

Source: Federal Reserve and Comptroller of the Currency.

had 4.02 percent of capital to total assets. In contrast, banks with under \$100 million in assets averaged over 8 percent in capital. National banks have tended to hold less capital than other banks. The percentage of capital to assets for the five largest national banks in 1979 was 3.80 percent. Capital adequacy has become a question of prime concern because some observers, including bankers, fear that the level of capital may have fallen too far. A constant battle is waged as regulators try to encourage or to force banks to increase their capital ratios.

Obviously, forces are at work tending to drive capital ratios down below prior levels and under those that regulators believe are adequate. What are these forces? Do such pressures arise from the normal operation of a free market, or are they the result of the special regulatory environment of banks? If the pressure to reduce capital is based on market forces, will the market, left to itself, bring about an optimum capital ratio? Or are there problems such as those of information and transaction costs that can either lead to a market failure or mean that a regulated market will perform better than one left to itself?

Answers are not simple. Financial theory offers two conflicting views on the forces that determine the optimum capital/asset or capital/liability ratio (leverage). However, both views agree that our existing regulatory and tax system may make it profitable for banks to reduce their capital below the level that would be set in an unconstrained market. Thus the pressure from regulators to increase capital may reflect their view of what a free market would demand. However, it may also reflect lack of knowledge. There have been no objective standards in establishing sound capital ratios. As a result, critics of the existing system believe that significant costs arise both for a bank and for the economy when regulators insist on more capital than is optimum.

5.3.2 The Optimum Level of Leverage

Van Horne (1977) gives an excellent exposition of two main views in the theory of finance as to leverage and the cost of capital. He discusses them as the traditional and the Modigliani-Miller (MM) theories. Under the traditional theory, up to a point, the marginal and average costs of capital fall as the ratio of debt to equity increases. After that point they rise. This U-shaped cost curve results from two separate pressures. Initially the rates paid for liabilities such as deposits, federal funds, or debentures are less than the cost of equity. As a bank raises money from such liabilities, its average cost of capital, which depends on the ratio between the more expensive equity and the lower-cost borrowings, falls.

This decrease in average borrowing costs cannot go on forever. As the bank increases its leverage, risk—and therefore the rate it must pay on its equity—rises. After a point, the cost of borrowing rises also. Lenders demand higher rates as their risk increases with higher leverage. The

average cost of financing the bank starts to rise when the effect of the increasing costs from added risks exceeds the falling costs that result from mixing cheaper debt with more expensive equity. Under the traditional concept, a competitive market will force the firm to operate at an optimum point where its average costs of funds are at a minimum.

In contrast to this view, Modigliani and Miller (1958) show that, under the particular assumptions they posit and ones commonly adopted in financial theory, the value of the firm and its cost of capital are independent of its financing decisions. The leverage decisions or financial structure of the bank are irrelevant to its value or to the cost of its capital. In perfect competitive financial markets, individuals, providing they have equal access to the market, can undo any leverage decision of the firm.

One explanation of the irrelevance of corporate financial structure draws upon the concept of arbitrage. If there were an optimum level of debt equity and the firm failed to choose it, individuals could make a profit by buying the optimum ratios of the firm's debt and equity in the market and issuing new securities against them. Based on issuing at this optimum ratio, they would receive more than they had paid. Since such arbitrage profits are inconsistent with equilibrium, opportunities for them should not exist in a well-operating market. The value of a bank should be constant across all leverage ratios. Stiglitz (1974) has shown that corporate financial policy is irrelevant under still broader conditions. His proof is based on the fact that, under rather general conditions, individuals' decisions are independent of the debt equity ratio of firms, and they can undo any firm decisions by shifting their relative debt equity ratios.

5.3.3 Leverage in the Banking System

Since banks seem under constant pressure to increase their leverage, something must happen when the theories are applied to the facts. Why do bankers believe they can improve profits by increasing their leverage? Why do they believe their minimum cost of capital or the maximum value for their stock to be at a point with greater leverage than in the past?

Modifications of the Theories

For a number of reasons, the theories must be modified in application. The literature is full of such debates. Some major qualifications generally agreed to as potentially important are listed in Van Horne as the following:

1. Bankruptcy costs may be significant. If they are, as they seem to be for banks, then, as leverage increases, the new, more highly leveraged financial packages threaten losses that make them less attractive. As the possible cost of bankruptcy grows with leverage, so does the bank's borrowing cost. The risk to managers may rise even faster. To the degree

that this is so, strong internal pressures should develop against borrowing even the amount optimum from the shareholder's point of view. Many observers believe that this accounts for the relatively low leverage of nonfinancial firms.

2. The capital markets may not work as well as assumed. There may be high transaction costs when banks, especially small ones, try to issue stock or bonds. This raises their cost of capital compared with deposits and leads to pressure for increased leverage.

3. Institutional factors and market imperfections similarly may raise individuals' borrowing costs even more than those of banks. The arbitrage process may be much more difficult than theory assumes. If the perceived risks of personal leverage exceed those of corporations, optimum arbitrage would be still further reduced.

Also significant are (4) taxes, (5) information deficiencies, and (6) deposit insurance. More detailed discussions of these last three items follow.

The Corporate Income Tax

The MM theory applies in a world without corporate income taxes, or at least in a world where taxes are neutral with respect to payments for raising funds through debt or equity. This is not true of the United States. Under our system, since interest payments are tax deductible, greater leverage lowers the after-tax cost of capital. In fact, many observers believe that, given the high rate of corporate taxation, the minimal cost of capital would be achieved when all or nearly all funds were borrowed.

This is somewhat less true for banks. In comparison with other corporations, banks have extremely high leverage. Also, banks on average have lower corporate taxes. These can frequently be reduced to zero because of special provisions for items such as state and local bonds, leasing income, and taxes paid abroad. Thus banks may not achieve as large tax advantages for their stockholders compared with other corporations by increasing their leverage. When all things are considered, however, the form of the corporate income tax probably does serve to increase the optimum level of leverage even for banks.

Information Deficiencies

Another factor not considered in the simplified theories is the cost and amount of information available to depositors and lenders in comparison with that possessed by managers or owners. Ross (1977) and others have shown that when there are problems of disparate information, and particularly when moral hazards can exist, the amount of leverage may be a significant factor in determining the cost of capital.

Information has been a particularly troublesome question for banks. On the one hand, regulators seemed to feel, until recently, that the public

ought to depend on regulations rather than try to obtain information on the soundness of banks. The less the public knew, the better. On the whole, depositors and lenders went along with this thesis. They depended on the regulators either to establish capital levels adequate to ensure solvency or to bail out even the uninsured depositors if something went wrong.

Risk and Insurance

In chapter 8, Sharpe demonstrates what happens as the FDIC offers insurance to all banks at the same rate irrespective of their risk level. It is profitable for banks to increase both the riskiness of their assets and their leverage. As a result, under existing procedures the regulators must impose limits on the banks. Bank profits increase to the extent that they are able to exceed the regulator's limits.

An assumption that the regulators are guaranteeing the safety of a bank's debt lowers its cost even at extreme levels of leverage. The increase in the cost of debt with rising risk, which is assumed to limit leverage in corporations, would not be effective for banks if their deposits are insured or their safety guaranteed.

5.3.4 The Costs of Increased Capital

We have pointed out important advantages gained by banks that expand through borrowing. As long as depositors are insured or believe they are insured, stockholders can profit by increasing leverage. Under the present insurance system, normal market operations do not work to hold down leverage. There are, however, at least two major unresolved issues in this generalization.

Managers may believe that they will not be fully compensated for increasing risks in their banks. Even though profits rise with risk and leverage, managers' inability to spread risks because so large a part of their wealth may be tied to a single bank should make them more cautious. Heavy losses, a requirement for a large capital infusion, a forced merger, or bankruptcy will be far more traumatic the larger is the share of the bank in an individual's wealth or income.

Lenders on capital notes or subordinated debentures are also not protected by insurance. Yet in recent years many large banks have been able to increase their stock leverage by issuing debentures. Such issues took place even though it was often recognized that the issues were requested by regulators who felt that the bank's ratio of capital to deposits or risk assets was falling too low. Either (1) the purchasers were poorly informed and the market was not performing well, or (2) the level of leverage deemed inadequate by the regulators was not worrisome to the bond market or at least was adequately covered by a higher promised return, or (3) bondholders placed a low probability on regulators' allow-

ing a large bank to fail. (While interest rates paid were higher than those paid by other corporate borrowers, they were not much higher. In 1980, yields on bonds of banks were 40 to 70 basis points, or 4 to 6 percent, higher.)

It is not clear which explanation is correct. Evidence exists that those who bought bonds of the banks that failed in 1973–75 had not given sufficient attention to the risks involved. The purchasers of debentures, who included among their number some large and theoretically sophisticated lenders, were unaware of the degree of risk they were assuming. On the other hand, even after it became clear that bank debentures were far more risky than deposits, the rates for most banks did not move out of line with those of other securities. The market apparently is willing to accept very high leverage ratios.

A number of empirical studies have been conducted on the effect of leverage on the cost of bank capital. The results have been mixed. In most cases, added leverage did not seem to increase the cost of debt capital—nor, however, did it significantly reduce the average cost of funds. But, as in so many empirical tests, specific results depend greatly upon the specification of the model and the choice of variables (Orgler and Wolowitz 1976; Weaver and Herzig-Marx 1978).

Overcapitalization

A critical question in the debate over leverage is who gains or loses if regulators demand and succeed in enforcing either too high a level of capital or, conversely, too low a level of leverage. The models of risk show that the dangers of insolvency and costs to the insurer and society fall rather rapidly as capital ratios are increased. The functions are nonlinear, so at critical points risk is reduced greatly by small additions to capital, whereas, at levels not too much higher, additional capital has very little effect.

Bankers clearly believe they lose if they are forced to increase their capital needlessly. They lose tax advantages. They lose whatever gains they are now making at the expense of the FDIC. Raising additional capital is costly. There are marketing costs for new issues. In addition, prices must be sufficiently below the market so that the issue will sell. For most banks, markets are extremely limited. Selling new stock may mean diluting control. Selling bonds, except to correspondent banks, may be almost impossible.

It is not as clear that the costs to the public or society of overcapitalization of banks are serious or even positive. Part of the argument depends upon how closely the theory of MM fits the facts in this case.

There is a basic difference between the investment of capital in a financial institution and investment in fixed assets. Excess investment in fixed assets means that resources are standing idle. Added capital to a

financial institution does not reduce the amount of real resources. It simply means that intermediation takes place in a different form than it otherwise would. The analysis in this case requires dealing primarily with the theory of capital structure and the theory of intermediation.

The gains to banks from monopoly positions and from gaming against the FDIC are costs to the public that we would be better off without. The tax breaks also probably cost the public. By law we have created tax expenditures (some prefer the term subsidies) to increase the use of debt over equity. If regulators require excess capital, they force banks to give up this tax break. The Treasury would gain. Tracing whether a cost to the public arises from such an action depends upon a complex analysis of the reason this particular tax expenditure was established, and of what gains and losses were expected.

Santomero and Watson (1977) believe they have shown that there may be serious costs for both under- and overcapitalization. Undercapitalization increases the risks of insolvency and therefore imposes whatever social or public, as opposed to private, costs appear when a bank fails.

Their argument for costs of overcapitalization seems weaker. They argue that, if banks are required to lower their leverage, individuals must hold more bank capital and fewer deposits. If individuals substitute bank capital for loans in their portfolios rather than deposits, interest rates will rise and investment and capital accumulation will fall.

A similar but somewhat less complete argument is made by Scott and Mayer (1971). They say, in effect, that forcing investment in a low-risk or risk-free asset causes a deadweight loss of the difference between the rate a firm can earn on its capital and the risk-free rate.

These arguments, however, seem in conflict with the MM thesis. The irrelevancy argument will apply. As is demonstrated in chapter 8, in a complete financial market there is no "optimal" financing mix. In more general terms it is not clear why there should be a social loss if banks are required to issue somewhat less risky capital than they would otherwise prefer. Depending on their attitude toward risk, investors will shift their portfolios so that some will hold more and some fewer bank stocks. Investors can also adjust their other holdings. There would not seem to be a loss to the economy if a high percentage of bank stocks are held by widows and orphans or risk averters, as opposed to risk-seeking institutions.

The strongest argument for a social cost, but one financial economists tend to disbelieve and downplay, stems from the possible existence of highly segmented and noncompetitive markets. Banks and savings and loans cannot buy common stocks or, frequently, corporate bonds. If markets are not efficient, excluding potential sources of funds could make a difference in availability and in what borrowers in these sectors must pay. Conversely, restricting savings and loans primarily to the mortgage

market by tax inducements or regulation is assumed to lower interest rates on mortgages.

If segmentation occurs, it is most likely to affect small, high-risk borrowers in local markets. In these markets, competition and efficiency are constrained by a limited number of lenders, together with poor information for those at a distance who might be willing to enter.

Specific information on segmentation is scarce enough so that regulators frequently make (but usually not simultaneously) two common but opposing arguments. One states that requiring excess capital is dangerous for banks because it will increase their capital costs and thereby affect their ability to compete with other types of financial institutions. The second argument is that requiring excess capital with its higher costs is dangerous because banks, as a noncompetitive group, will raise their charges or make more risky loans to cover these costs. If markets are not highly segmented, neither of these situations should occur. Depositors and investors can alter their choice of assets and liabilities in such a manner as to equalize financial investing and lending rates among markets. There should not be any basic alteration in real capital or the physical investments of the economy.

Arguments against change that depend for their validity on the existence of segmentation are frequently, in fact, disguised arguments in favor of more change and more competition.

5.3.5 Measuring Capital

While most discussions of capital ratios are based on calculations like those in table 5.1, which show the relationships between book capital and a bank's assets also valued at book, the figures actually needed to measure risks may be quite different. It is the true, or economic, net worth that protects a bank's liability holders or the FDIC, not the values shown on a bank's books. To measure risks, the economic net worth must be estimated. Valuable intangible assets may not be entered on the books, while the recorded value of assets may differ considerably from their actual or market value. As a partial list of differences between book and economic capital, there may be:

1. Unrecorded gains or losses in the portfolio, depending upon past interest rate movements.
2. Because of interest rate ceilings (regulation Q), liabilities for deposits as shown are higher than their true liability to the bank. Payments against them will not rise as fast as market interest rates because crediting interest on demand deposits is prohibited, and interest rate ceilings on savings and consumer time deposits have been below the market in most years. The capitalized difference between their cost and market rate adds net worth to the bank.

3. The value of customer relationships, goodwill, knowledge of individual loans, and similar information, which has been paid for in the past and serves to reduce future costs, is usually not shown on the bank's books.

4. The reserves against loan losses may be over- or underestimated. In their examinations, regulators decrease estimates of available capital by, requiring additions to reserves in accordance with the amount of loans classified by the examiners.

5. The balance sheet also contains furniture, fixtures, computers, and fixed assets. Regulators in the past have assumed that investments in such forms are not available to serve capital needs. While these items may have only slight liquidity, their actual earnings value and ultimate worth may be as large as or larger than that of other assets.

6. Many balance sheets also contain other reserves, such as for deferred taxes or contingencies. These also serve to decrease the probability of insolvency.

7. In contrast, certain types of commitments, such as for future loans or for foreign exchange, are likely to be drawn upon when they will be costly to the bank. They serve to lower net worth.

Chapter 3 pointed out some of the advantages and disadvantages of attempting to measure capital values by use of market quotations of both common stocks and bonds. Many experts believe that the market is the best and truest measure of net worth. However, because of the lack of data for most institutions and because of questions on how to relate the risks reflected in changes in stock values to the risks of insolvency, other techniques have been suggested to measure net worth.

Market quotations of rates of return on bank securities can be used as guides to value the assets and liabilities of banks whose securities lack a market. At the coarsest level, the average price/earnings ratio for bank stocks obtained from the market can be used as a multiplier applied to the reported book earnings of an individual bank in order to secure an estimate of its net worth. Since the reported earnings are on a book basis in both cases, the multiplier provides a rough equivalent of economic value. However, the dispersion of price/earnings ratios of individual banks is very wide. Consequently, this procedure results in estimates over a similar broad band. It is difficult to judge where in this range the individual bank under consideration would fall. In addition, this method suffers from whatever general disabilities apply to market quotations for individual institutions.

Somewhat more accurate would be the use of rates of return in the market applied to individual similar activities within a bank. Applied to an institution's own activities, these can be used to adjust the values of classes of assets and liabilities from a book to a market basis. A big problem is the difficulty of finding the values of intangibles and determin-

ing how much difference they make for individual banks. Still, this procedure can be used as an alternative to the grosser technique.

A third method is described in the papers by Morrison and Pyle and Nadauld (chaps. 13 and 14). It utilizes the concept that the generalized price of risk can be estimated from market quotations. The values of future cash flows depend on their certainty equivalencies and on the discount rate currently being applied to funds that will be received in the future. This discount rate is measured by the term structure of risk-free interest rates. If the comparative risk can be calculated for each activity by adding to the risk-free rate a factor for its added risk, then its expected cash flows can be capitalized by using the market rates of return for activities with equivalent risks.

5.3.6 Market-to-Book Value Ratios

The past movements of common stock prices compared with book values yield a general picture of how market and book values have been related and how the relationships have varied. Such data are shown in table 5.2.

Table 5.2 Relationship of Market Value of Bank to Book Value

<i>Part 1: Banks Included in Standard and Poor's Bank Stocks Index</i>							
Year	Ratio	Year	Ratio	Year	Ratio	Year	Ratio
1950	0.986	1957	1.074	1964	1.652	1971	1.444
1951	1.056	1958	1.372	1965	1.436	1972	1.584
1952	1.367	1959	1.556	1966	1.345	1973	1.615
1953	1.107	1960	1.403	1967	1.270	1974	0.943
1954	1.291	1961	1.874	1968	1.743	1975	0.967
1955	1.493	1962	1.529	1969	1.439		
1956	1.220	1963	1.641	1970	1.345		
<i>Part 2: Percentile Distribution of Banks with Data Available on COMPUSTAT Tape</i>							
Years	Percentile						
	1	5	10	50	90	95	99
1968-70	0.93	1.01	1.09	1.43	2.07	2.36	2.66
1971-73	0.64	0.82	0.84	1.25	2.05	2.40	3.51
1974-76	0.33	0.40	0.47	0.65	1.03	1.53	1.66
1977-79	0.30	0.42	0.49	0.66	1.00	1.10	1.36

Source for Part 1: L. Goodman and W. Sharpe, "Perspective on Bank Capital Adequacy: A Time Series Analysis," NBER Working Paper, tables A-3-1 and A-3-2. Includes nine New York banks (bank holding companies) and sixteen outside New York banks (bank holding companies) in 1976.

Note: Part 2 is based on COMPUSTAT tape data for 1968-79. By 1977, most observations were for bank holding companies.

The first part of the table shows the year-to-year movement in the ratio of market value to book value of the banks in Standard and Poor's Stock Indexes of New York City and Outside New York City Bank Stocks (Goodman and Sharpe 1978). The combined weights are based on 1976 book values. During most of the past thirty years, the market valued banks at about 135 percent of their book value. Sharp fluctuations occurred around this average, such as the nearly 46 percent jump from 1967 to 1968 and the more than 40 percent fall from 1973 to 1974.

Such differences are even clearer when we examine the second part of the table. It shows the distribution of market-to-book ratios of individual banks at selected percentiles. It contains average market-to-book ratios for the three-year periods 1968–70, 1971–73, 1974–76, and 1977–79.

The table reflects a major shift during this period of the market's valuation of individual banks, of banks as a group, and of common stocks as a group. In the period 1968–70, the average or median bank had a market-to-book ratio of 1.43 (the mean was 1.49), and fewer than 5 percent of banks showed ratios under 1.0. For the next three-year period, a minor drop of 13 percent, to 1.25, occurred in the median (the mean fell less, to 1.40). The spread of the distribution increased considerably. The top 10 percent of banks had higher ratios than the top 10 percent in the previous period, while the bottom 10 percent fell by more than the average.

The year of the big drop was 1974. In comparison with 1971–73, the market's valuation of book assets fell nearly half. Furthermore, the amount of decline was approximately the same all across the distribution. It was not a case of riskier banks being assigned a higher cost of risk after the insolvency of several large banks in 1973 and 1974. Rather, all banks were judged to be far riskier. While data for individual banks show some movement in the following five years, through 1979 the average bank continued to be valued in the market at about two-thirds of its book value. Either intangibles were considered to be negative, or they were heavily outweighed by losses of capital values not taken into the books.

5.3.7 Price/Earnings Ratios

A major factor explaining the large drop in the valuation of banks can be found in table 5.3. It contains data that show the weighted average market price/earnings (P/E) ratio for 81 large banks from 1967 through 1979. It also presents information on the average return these banks earned on their book assets, as well as the price/earnings ratios of stocks in the Standard and Poor's Stock Index.

The market's valuation of intangible capital can alter either because banks are earning less on their tangible and intangible assets or because the market capitalization of such earnings falls. In turn, an increase in discount rates can reflect a general marketwide increase or one applicable to a particular industry.

Table 5.3 Stock Market Valuation of Income (Price/Earnings Ratios)

Year	Banks ^a	Standard and Poor's 500 Stocks ^b	Price/Earnings Ratios of Banks to Standard and Poor's 500	Bank's Percentage Earned on Book Value ^c
1967	11.7	17.7	.66	11.2
1968	15.8	18.1	.87	11.0
1969	14.7	15.1	.97	11.5
1970	11.9	16.7	.71	12.0
1971	11.7	18.3	.64	12.2
1972	13.8	19.1	.72	12.0
1973	11.6	12.3	.94	12.4
1974	6.6	7.3	.90	12.5
1975	7.3	11.7	.62	11.7
1976	9.3	11.0	.85	11.3
1977	7.3	8.8	.83	11.6
1978	6.1	8.3	.73	13.0
1979	5.5	7.4	.74	13.9

Source: Cols. 1 and 4, COMPUSTAT tape; col. 2, Standard and Poor's.

^aEnd-of-year stock prices

^bDecember average stock prices.

^cAfter taxes.

The decline in the stock market's valuation of bank assets was not caused by any decrease in the yield that banks reported earning on their assets. Column 4 of table 5.3 shows the reported book net income after taxes as a percentage of banks' earning assets. In 1974, market values took their sharpest drop even though the return on assets remained stable. By 1979 the rate of reported book earnings was at a high for the period and 13 percent above the rate of earnings reported for 1973, but the market valuation of bank assets was less than half that of the former period.

Most of the large decrease in the valuation of earnings appears to have been a general market phenomenon. The price/earnings ratio on the Standard and Poor's 500 stock average dropped more than 55 percent between 1971-73 and 1979. In this period, bank reported earnings became somewhat suspect because they failed to include losses in capital values from higher interest rates. Still, the drop in the P/E ratios for banks was almost identical to that for the overall market. This drop in the valuation of book earnings more than accounts for the entire fall in estimated net worth shown in table 5.2. The market capitalization rate for earnings was far lower than the reported percentage return on book values.

Because the difference between book earnings and real earnings probably fluctuates more for banks than for other industries, or at least has a different timing, one would expect to see banks' P/E ratios move inde-

pendently of stocks as a whole. The table shows that this is the case, but differences appear to average out.

5.3.8 Estimating Risks in Prototype Banks

When they select their portfolios, banks alter the degree to which they risk insolvency. Their choices of assets and liabilities, their operating procedure and expense, their off-balance-sheet commitments, and their capital policy, determine their expected end-of-period ratio of net worth to assets as well as the possible variance in this proportion. If their assets end up less than their liabilities, they will be insolvent. Their risk of failure depends on their expected capital/asset ratio, on the potential variance in their portfolios, and on the time period under consideration.

Table 5.4 shows how banks might vary the volatility of their assets and how such choices influence their risks and fair insurance premiums. The table is only illustrative. It brings out differences that can arise when banks select activities with interest, credit, and operating risks that diverge from the average. The table employs somewhat arbitrary

Table 5.4 Example of Risks and Fair Insurance Premiums

	Bank A	Bank B	Bank C
<i>Section 1</i>			
Interest rate risk	.0006539	.0008627	.0021111
Credit risk	.0000002	.0000031	.0000375
Operating risk	.0000010	.0000064	.0000309
Sum of variances	.0006551	.0008722	.0021795
Fair Insurance Premiums per \$ of Liabilities			
5% capital/NEA	.0002210	.0005206	.0033026
10% capital/NEA	.0000001	.0000010	.0002308
<i>Section 2</i>			
Interest rate risk	.0006539	.0008627	.0021111
Credit risk	.0000090	.0000165	.0000185
Operating risk	.0000298	.0000320	.0000683
Sum of variances	.0006927	.0009112	.0021979
Fair Insurance Premiums per \$ of Liabilities			
5% capital/NEA	.0002630	.0005670	.0033390
10% capital/NEA	.0000002	.0000020	.0002110
<i>Section 3</i>			
Fair Insurance Premiums with Interest Risk Based on Chapter 10			
5% capital/NEA	.0047 ^a	.0065 ^a	.0090 ^a
10% capital/NEA	.0028	.0039 ^a	.0054

Source: See text. Fair insurance premiums for sections 1 and 2 are based on table 1, Merton, *Journal of Banking and Finance*, 1 (1977): 3–11.

^aInterpolated.

assumptions with respect to variations among risks and in net worth. The chapters in part 2, which contain other assumptions, illustrate how vital are measurements of maturities and duration in obtaining specific risk estimates.

Table 5.4 measures degrees of risk, first by summing the variances of the three types of risk contained in the portfolios assigned to the prototype banks. It then uses these variances to calculate the fair insurance premium that would be needed to guarantee full payment to liability holders despite any shortfall in assets at the end of a year (Merton 1977 *a*).

5.3.9 Time-Series Estimates of Variances

Section 1 of the table shows estimates constructed from the variances of movements in time series of total returns in a bank's activities. In the table, the portfolio of bank A includes activities with minimum risks. Bank B represents an institution that conducts its operation in a manner closer to the averages for the banking system. Bank C is assumed to take risks at the high levels of the risk spectrum.

Examine the components of possible future changes for bank A. It takes an interest rate risk equivalent to that existing in an average net portfolio with a duration of not quite two years. Its probable fluctuations are assumed to equal the variance recorded between 1965 and 1976 in the log of the end-of-the-year prices of a two-year government note. The estimate of operating and credit risks for bank A is based on the year-to-year movements in operating earnings and loan losses experienced from 1967 to 1979 by the bank at the low end of the banks contained on the COMPUSTAT data.

Bank B's activities are more typical of an average bank. Its interest rate risk is assumed equal to that experienced by the holder of a three-year government note. Its estimated variances for operating and credit risks are derived from the weighted average of the banks shown in tables 4.4 and 4.6.

Finally, bank C—the riskiest—is assumed to accept an interest rate risk equal to that on a five-year government note. Its operating and credit risks are those experienced by the bank with the largest variances contained in the final columns of tables 4.4 and 4.6.

Although total returns on government securities at different maturities are used to measure interest rate risk, we do not know exactly what movements in net worth typically result from interest changes. Chapter 10 illustrates that the interest elasticity of bank net worth depends on a complex averaging of the duration effects of both assets and liabilities. The next example—that of the First Pennsylvania Corporation—demonstrates that a specific estimate of duration requires an examination of each of the major components of the bank's balance sheet. It also

depends, as later chapters show, on what assumptions are made about whether the cash inflows received during a period are paid out or, if they are not, at what rates new assets are bought.

In addition to differences among prototype banks shown by the sum of their variances, the bottom data in each section estimate fair insurance premiums per dollar of liabilities based on their variances and capital/asset percentages of 5 and 10 percent. These premiums are taken from tables prepared by Merton under the assumption that the Black-Scholes option pricing model applies (Merton 1977a).

Examining section 1 of table 5.4 lays out at least three important factors. In the first place, the danger of adverse interest rate movements engenders by far the largest share of the risks. The past variances of interest rates account for 95 percent or more of the total.

Second, wide differences exist in the risks accepted by different types of banks and therefore in the costs to the economy or an insurer for protecting each against defaults. If the expected ratio of capital to net earning assets is 5 percent, the premium for insuring bank C with its risky portfolio choices is more than six times as large as for bank B—the average bank. Moreover, these differences are sufficiently large so that banks may appreciably increase their profitability by taking excess risks.

Finally, we note that the amount of capital compared with assets or liabilities is extremely important in determining total risk. Given the type of variances shown for the prototype banks, the risks of insolvency fall rapidly as the expected net worth rises. At a 10 percent capital-asset ratio, the estimated risks for banks A and B become almost negligible. Even bank C, which chooses a portfolio with much greater variances, can offset most of the added changes by increasing its expected capital/asset ratio to 10 percent.

5.3.10 Other Estimates of Risks

Sections 2 and 3 of table 5.4 are based on alternative methods of calculating the variance in the prototype banks. In section 2 the prototype banks use the same estimate of interest rate risk as in section 1. However, the estimates for credit and operating risks are based on cross-sectional data. The variances are based on the logs of changes in asset values arising from loan losses of individual banks between 1974 and 1975, and changes in operating income before loan losses and taxes between 1970 and 1971. These are the years of maximum changes in the postwar period. Bank A uses banks with over \$500 million in assets; bank B uses the data for all banks; and bank C uses data for banks under \$10 million in assets, which have the greatest variance. This method of calculating the variances raises the estimates for these risks considerably, but they remain minor compared with the risks from interest movements.

In the techniques used here, how the credit and operating risks are calculated makes little difference. However, an examination of the underlying data indicates that, as with interest rate movements, the actual changes may not follow a normal distribution. Especially among smaller banks, outliers in the negative direction exceed normal expectations. If possibilities of fraud and insider abuse were added, the risks from these and other factors would also be somewhat greater than shown in the table.

Some idea of the rapidity with which risks can rise if one takes account of these other factors is shown in section 3. It presents an estimate of the fair insurance premiums required if one believes that a log-symmetric stable distribution rather than a log-normal distribution ought to be fitted to project possible future movements in yields. According to McCulloch's tables (chap.10), with a capital-to-net earning asset ratio of 5 percent the symmetric distributions show an estimated risk of failure ten to thirty times as great as under an assumption of a normal distribution.

The amount of risk will also exceed that shown for the banks in sections 1 and 2 if other distributions are used for credit and operating risks, and if adjustments are made for maldiversification and for moral hazard. Unfortunately we do not have estimates of how much these will raise the possible variances. It does not seem likely, however, that they will increase so much as to make these other hazards equal to interest rate risk.

While we cannot check the accuracy of the data from information about past insolvencies, they appear to be consistent with past events. Actual failures occur primarily among small banks and among banks with high moral hazards not caught by auditors or the examination system. The critical question is whether the present complex system of regulation is necessary to perform this task or whether alternative systems of measuring the risks and of insuring properly could arrive at a more efficient technique for guarding against large numbers of insolvencies and a threatened breakdown in the banking system.

In our examination of the measures needed to improve the system, the biggest gap appears to be in the estimates of future net worth. Except among small banks, the risk estimates seem to be reasonable, as do the techniques for relating variances to expected capital/asset ratios.

5.4 The First Pennsylvania Bank

This case of the First Pennsylvania Bank could be substituted almost without alteration for prototype bank C—the high risk-taker. It also demonstrates some of the difficulties in measuring net worth for a bank. The case is a particularly appropriate example of capital inadequate to

meet risks. It illustrates why better analysis of capital adequacy is needed. It took place in the manner predicted by our studies well after they had been submitted to the regulatory authorities and had appeared in journals.

From the published record, the bank appears to have decided that risk-taking was profitable. For a time, its shareholders and management profited from this policy decision. Their gaming—whether deliberately or not—against the FDIC by increasing the risks of the portfolio well beyond those of the average bank appeared to pay off. But when a run of adverse economic events occurred, the risk positions the bank had assumed worked against it. Its operating earnings fell and loan losses increased. In what appeared, at least to outsiders, as an attempt to recoup, the bank continued to increase its risks, particularly those of interest rate changes. The result was a disaster. This was by far the largest bank to require the assistance of the FDIC.

The \$325,000,000 below-market loan made by the FDIC to the First Pennsylvania Bank was made in accordance with section 13(c) of the Federal Deposit Insurance Act. This act authorizes the FDIC to lend money only when it has determined that action is necessary to prevent the bank from closing and “when . . . the continued operation of such bank is essential to provide adequate banking service in the community.” In this case, the FDIC recognized that it was assuming the risks that more money would be lost, and therefore it acted to recover part of its costs by requiring stock warrants that would gain value if its rescue operation was successful (see the next chapter).

5.4.1 The Record in Brief

During the 1970s, First Pennsylvania Corporation (the bank made up 85 to 95 percent of its consolidated corporation) prided itself on breaking new ground as an innovator. It steadily increased the risks in its portfolio. It raised its dependence on purchased money with a high degree of interest sensitivity. It increased its leverage by reducing the ratio of capital to assets. It raised the share of riskier loans in its portfolio. It purchased securities with longer maturities, thereby widening its exposure to interest increases.

This strategy appeared to be successful until 1973–74 brought both high interest rates and a recession. At the end of 1972, the common stock of First Pennsylvania traded at 2.7 times its reported book value and 16.6 times its reported after-tax earnings. Both of the multiples were among the highest for any bank with an actively traded stock.

In 1972, as shown in table 5.5, the bank reported earnings before loan losses and taxes equal to 1.77 percent of its earning assets. Its net charge-offs for loan losses were 0.28 percent of these assets. Its net earnings on assets were above average. Because of heavy leverage, its

Table 5.5 First Pennsylvania Corporation Operating Earnings and Loan Losses (in Millions of Dollars)

Year	Equity as Percentage of NEA ^a	Net Interest Income	Expenses ^b	Provision for Loan Losses	Net Loan Losses Charged	Net Earnings ^c	Net Earnings as Percentage of NEA	Net Loan Losses as Percentage of NEA
1967	8.7	72	37	3.8	1.9	35.1	2.21	0.12
1968	7.9	78	43	4.1	2.1	35.3	1.94	0.12
1969	7.4	95	50	4.8	2.5	44.7	2.20	0.12
1970	7.0	106	55	6.2	4.0	50.8	2.21	0.17
1971	6.2	113	59	7.0	8.6	54.4	1.91	0.30
1972	5.3	131	68	8.9	10.0	62.5	1.77	0.28
1973	5.1	147	79	11.1	11.5	68.2	1.55	0.26
1974	4.7	156	85	32.0	24.4	71.4	1.29	0.44
1975	5.0	168	106	61.5	30.0	62.1	1.06	0.51
1976	5.0	168	105	52.8	66.0	63.4	1.08	1.12
1977	4.5	177	102	51.1	54.4	75.3	1.12	0.81
1978	4.6	193	112	42.8	40.5	81.0	1.11	0.56
1979	4.2	179	128	46.8	42.5	50.8	0.61	0.51
1980 ^d	4.5	122	119	63.7	92.2	3.4	0.00	1.56

Source: Annual reports.

^aNet earning assets and book capital.

^bLess other income and excluding loan losses.

^cBefore loan losses and taxes.

^dEstimated annual rates based on preliminary six-month data.

reported earnings on equity were high. It earned 16.8 percent on its equity. Between 1967 and 1972, the price of its stock rose about four times as fast as did the average for other banks. (It rose by 200 percent, compared with an average of 50 percent.)

Those who follow such a strategy apparently fail to realize the ever-present possibility that a string of adverse events can occur. In fact, interest rates rose in seven of the eight years from 1972 through 1979, culminating in extremely large increases in the first quarter of 1980. Table 5.5 shows that changes in the economy caused sharp declines in operating earnings and an increase in loan losses from 1972 to 1976, when net loan charge-offs exceeded earnings. However, because of tax credits and differences in when losses were taken into the operating statement, the corporation was able to report after-tax earnings of \$18 million and a return on equity of 6.4 percent for 1976.

Reported earnings continued to be weak. In 1979, net earnings before tax credits dropped to 0.10 percent of earning assets. Again, however, with tax credits, earnings after taxes were reported as \$16.5 million, or 4.7 percent of book equity. The price of a share of common stock at the end of 1979 was only 0.4 times its book value and 8.2 times reported

earnings. The market/book ratio was among the lowest for all banks, while the price/earnings ratio was near the highest.

This was the record at the start of 1980. In the first three months of that year, short-term interest rates rose 32 percent, while the interest rate for a ten-year maturity government bond rose 24.5 percent. Given the interest rate risk the bank had assumed, these interest movements were sufficient to cause a negative real net worth, the start of a run by uninsured depositors on the bank, and the need for an FDIC rescue. How this situation developed can be seen in the following tables and the related discussion.

5.4.2 Interest Rate Risks

Interest rate risks result from a mismatch of maturities in a bank's assets and liabilities. The longer the maturity of its assets compared with that of its liabilities, the greater the danger. When a bank buys a fixed-rate security or makes a fixed-rate loan, its interest revenues are frozen until the investment matures. Furthermore, because no asset will sell for more than its present value, if interest rates rise the value of its portfolio falls. When the discount rates for future receipts go up as a result of increased current and projected higher future interest rates, the economic values of all future returns decline. The amount of loss grows the further into the future is the expected payment.

Current Interest Returns

A rise in interest rates in a bank with a mismatched portfolio shows up initially in higher payments for liabilities, accompanied by only a small growth in receipts. The spread narrows between what is earned on assets and what is paid on liabilities. Net interest income falls. If the spread decreases sufficiently, interest earnings will not cover operating expenses. The bank will suffer losses.

Tables 5.5 and 5.6 illustrate one aspect of First Pennsylvania's increasing interest risk. Note in table 5.6 the steady growth in the amount and percentage of interest-sensitive borrowings. After 1967 the bank expanded rapidly, but it based its growth almost entirely on borrowing in the money market. Less than 10 percent of the bank's 400 percent growth in earning assets was funded by demand and saving deposits. Such deposits have been considered safer because their rates were held down by regulations.

What happens to banks that fund their assets through borrowing is demonstrated in the last column of table 5.6. The ratio of net interest return to assets fell steadily, from 4.7 percent in 1969 to 2.1 percent in 1979. Note especially 1974 and 1979 and the spring of 1980, when interest rates jumped. The rates paid on liabilities rose much faster than those received on assets, many of which have fixed yields. These movements

Table 5.6 First Pennsylvania Corporation Borrowing, Interest Rates, and Net Yields 1967-79

Year	NEA ^a (in Bil- lions of Dollars)	Interest- Sensitive Borrowings		Average Interest Rates (in Percent)			Net Interest Revenue	
		Amount (in Bil- lions of Dollars)	Percent- age of NEA	On Earn- ing Assets	Interest- Bearing Liabil- ities	Spread	(in Millions of Dollars)	Percent- age of NEA
1967	1.59	0.42	26.4	7.3	4.7	2.6	72	4.5
1968	1.82	0.49	26.8	7.7	5.0	2.7	78	4.5
1969	2.03	0.59	29.1	8.9	5.8	3.1	95	4.7
1970	2.30	0.86	37.6	9.2	6.3	2.9	106	4.6
1971	2.85	1.39	48.6	8.4	5.6	2.8	113	4.0
1972	3.54	1.97	55.5	8.3	5.3	3.0	131	3.7
1973	4.40	2.71	61.7	9.6	7.2	2.4	147	3.3
1974	5.53	3.62	68.7	11.0	9.4	1.6	156	2.8
1975	5.88	4.07	69.3	9.2	6.8	2.4	168	2.9
1976	5.87	3.95	67.3	8.4	5.9	2.5	168	2.9
1977	6.71	4.21	70.2	8.1	5.8	2.3	177	2.6
1978	7.28	5.30	72.8	9.5	7.4	2.1	193	2.7
1979	8.34	6.24	74.9	11.3	10.0	1.3	179	2.1
1980 ^b							122	1.7

Source: Annual reports, 1979 and 1975. Data before 1975 are not exactly comparable owing to minor adjustments from mergers, etc.

^aNet earning assets.

^bEstimated annual rate based on preliminary six-month data.

narrowed the spread and caused a sharp drop in net interest earnings. In the first six months of 1980, net interest income dropped to a rate of about 1.7 percent of net earning assets. Net earnings before loan losses and taxes were close to zero. The squeeze on interest rates meant that, even with only normal loan losses, the bank would lose money.

5.4.3 Estimating Declines in Capital Values

A second effect from interest rate moves is felt through shifts in the bank's wealth or net worth. The degree of impact depends on the degree of mismatch or, more correctly, as shown in chapter 10, on the weighted anticipated variances of a banks' assets and liabilities.

The Portfolio's Maturity Structure

It is somewhat easier to estimate the maturity of liabilities than of assets. An examination of the balance sheet of First Pennsylvania at the end of 1979 shows that earning assets were funded by four principal components. About 6 percent of earning assets were financed by the

difference between non-interest-bearing liabilities (demand deposits) and non-interest-bearing assets (cash, etc.). A second component, equity plus long-term borrowings, equaled 8 percent of earning assets. Savings accounts and certificates made up about 10 percent. Finally, the great bulk, 76 percent, come from purchased money. Most, but not all, the rates paid for the 76 percent of borrowed money change daily with the market. The study in chapter 9 shows that even though some borrowings have slightly longer maturities of one week to six months, the marginal costs of all but the equity and long-term borrowings are likely to move with market rates. If one estimated roughly that the payments on 85 to 90 percent of liabilities had a one-day maturity and moved with the market, while the remainder had fixed payments with long maturities, he would probably not be far off base.

Again, there are four principal components on the asset side. Footnotes to balance sheets report the average maturity and amount of the investment portfolio. Table 5.7 shows that, at the end of 1979, the average maturity for this component was 123 months. On average, about 20 percent of earning assets were in this category. (The table presents data for total assets.) At the opposite extreme, about one-quarter of the portfolio consisted of time balances with banks, trading account securities, federal funds sold, and resale purchases. These all have rates that move generally with the market.

The average maturity of the loan portfolio is far more difficult to measure. It is divided into two components—those with fixed rates and those with variable rates. The bank reports that approximately one-third of earning assets are loans written with rates that adjust with the prime. On the other hand, experience shows that where rates rise rapidly, as in 1974 or 1979, many customers cannot pay added amounts. Either they default, or the loans are renegotiated, allowing them to pay at lower rates and decreasing the percentage with floating rates.

Approximately one-quarter of assets are loans carrying fixed rates. Banks do not estimate specific maturities for this category, which consists of some commercial loans, consumer loans, and mortgages. Based on prior studies of portfolios of these types, one may guess that the average maturity—considering amortization—for these loans lies between two and three years. Using this estimate for the fixed rate component, the average maturity for the three components outside the investment portfolio could be between six months and one year.

Putting the Components Together

To find the interest rate risk of portfolios, one must be able to calculate the average weighted duration of both the assets and the liabilities. Most bank balance sheets do not carry enough information to determine the interest elasticity of the bank's portfolio. First Pennsylvania's is no excep-

Table 5.7 First Pennsylvania Corporation Investment Security Portfolio (in Millions of Dollars)

	Years to Maturity					Total Market	Average Maturity (in Months)	Percentage of Assets
	Within 1 year	1 year- 5 years	5 years- 10 years	Over 10 years	Total Book			
<i>1979</i>								
U.S. governments and agencies	109	325	245	498	1,177	1,015	118	13.1
States, municipalities, other	34	135	64	179	412	383	138	4.6
Total book	143	460	309	677	1,589	1,398	123	17.7
<i>1975</i>								
U.S. governments and agencies	121	170	—	—	291	292	21	4.1
States, municipalities, other	28	91	121	145	385	386	108	5.5
Total book	149	261	121	145	676	678	71	9.6
<i>1970</i>								
			Combined					
U.S. governments and agencies	15	124	—		139	n.a.	33	4.2
States, municipalities, other	41	96	177		314	n.a.	82	9.6
Total book	56	220	177		453	445	67	13.8
<i>1965</i>								
U.S. governments and agencies	48	93	20	—	161	156	28	10.3
States, municipalities, other	—	35	2	20	57	n.a.	76	3.7
Total book	48	128	22	20	218	n.a.	40	14.0

Source: Annual reports.

tion. However, even without complete data, one can make gross estimates of how net worth is affected by interest movements.

In the last section we reduced the number of components with diverse interest effects from eight to four. Rates on all of the liabilities except equity and long-term debt can be assumed to move with market rates. The average maturity (and approximate duration) of the investment portfolio can easily be calculated, and it is given in footnotes to balance sheets. The remaining assets are estimated to have an average duration of six months to a year; how long depends on the share of assets at market

rate, on what percentage of loans move with the market, and on delays occurring before rates move.

Using a variety of weighting systems for the unknowns and accepting the duration of the investment portfolio as seven years, we estimated durations for the total portfolio at the end of 1979 to be from 1.3 to 2.5 years. Between the last week of December 1979 and March 1980, a bond with a constant one-year duration lost about 3.2 percent of its capital value. The loss for securities with a seven-year duration was about 16 percent. An estimated loss in the value of First Pennsylvania's investment portfolio for this quarter was somewhat over \$125 million. (In 1979, when interest rates rose 45 percent as much, the unrecorded loss in the value of the investment portfolio was \$89 billion.)

To avoid an appearance of unjustified exactitude, we use only two estimates of how far the bank's net worth may have fallen as a result of interest rate movements. Column 2 of table 5.8 subtracts from the company's book net worth the difference between the market and book values of the security portfolio as shown in the footnotes to the balance sheet. This would be the-total decline in value if all other interest rate effects in the balance sheet just canceled each other out.

However, it is unlikely that interest rate risk will be limited to that in the investment portfolio. Mortgages and other loans also fall in value. To take these into account, assume that one-quarter of the portfolio carried no risk because it was funded by equity, long-term debt, and other liabilities whose values rise as interest rates rise. Also assume that the duration of the remaining portfolio was 2.5 years. If these conditions prevailed, the loss in value of the portfolio from an increase in interest rates would be somewhat more than twice as large as the decline in value of the security portfolio alone.

The first column of table 5.8 shows the value of First Pennsylvania's net worth as reported in its balance sheet with all assets carried at book. The second column subtracts from the reported net worth the difference

Table 5.8 **Estimates of the Economic Net Worth of the First Pennsylvania Corporation (in Millions of Dollars)**

Year	Book Value	Corrected for Market Value of Securities	Corrected for Possible Losses on Other Assets	Market Price of Equity
1977	304	279	254	220
1978	348	246	144	204
1979	350	159	-32	136
1980 (31 March)	343	28	-287	109

Source: See text.

between market and book security values. The third column doubles this reported decline to give a weight to other probable losses in the portfolio. The fourth column shows the value of net worth as estimated from the price of the common stock.

Three key points stand out:

1. The stock market's valuation in 1977, 1978, and 1979 fell between columns 2 and 3.

2. According to any of the three last columns, the bank had only a small ratio of net worth to assets at the end of 1979. Column 2 shows a net worth of \$159 million, which was 1.75 percent of total assets, while column 3, of course, showed a negative net worth.

3. Even though the official balance sheet showed a minimal change in net worth and an actual increase in the ratio of capital to total assets, columns 2 and 3 show sharp drops in value by March 1980, and an almost certain negative equity.

5.4.4 Operating and Loan Loss Risks

Tables 5.5 and 5.6 contain data reflecting the bank's operating and loan loss risks in addition to those from interest rates. Even as the share of purchased money increased, the bank raised the proportion of loans in its portfolio, particularly those in which high gross rates were paid to compensate for high risks. The gross rate of revenue from the bank's portfolio was among the highest for all banks. While loan losses went up, reflecting greater risk, net earnings on the bank's assets both before and after loan losses stayed high.

In addition to accepting riskier loans, the bank compounded its risks by increasing its leverage. As table 5.5 shows, stockholders' book equity as a percentage of net earning assets measured 8.7 percent in 1967, 5.3 percent in 1972, and 5.1 percent in 1973. Stock market valuations for the equity were higher, resulting in ratios of market-estimated net worth to earning assets of 16.6 percent in 1967, 14.3 percent in 1972, and 8.2 percent in 1973.

The high interest rates and recession of 1974 dealt a body blow to this high-risk strategy. Table 5.6 illustrates the sharp decline in the margin between earnings on assets and payments on liabilities. The bank attempted to avoid the squeeze by increasing volume even more sharply, with only slight additions to capital. Interest revenues were maintained, but with smaller margins and much greater risks.

The recession also caused nonperforming loans to balloon upward. They reached \$400 million in 1975, lowering margins still further. Net revenues were reduced more than \$30 million a year by this factor. The same forces led to much higher loan losses. Note in table 5.5 that the provision to cover loan losses shot up sharply in 1975. The big increase in actual charge-offs occurred in 1976. Although revenues fell and losses

rose, because of tax credits in 1975, 1976, and 1979 net income after taxes showed less variation than appears in this table. Reported net income after taxes was \$18.3 million in 1975, rose to \$29.0 in 1978, and fell back to \$16.5 million in 1979.

From knowledge of how operating earnings and loan losses vary, as shown in this and the previous chapter, we can see that the type of fluctuations shown by the bank should have been anticipated. The year-to-year variances were below those shown for type C banks in table 5.4. The sharpest dip in operating earnings was the 0.5 percent experienced in 1979. The largest loan loss increase was 0.61 percent in 1976. Only in that year did the combined earnings and losses become negative before the debacle.

In the first quarter of 1980, interest rates rose sharply from the previous high levels. Net interest income of the bank dropped by 40 percent compared with the same quarter of 1979. This brought about a sharp decline in earnings. The bank reported a net loss of \$7 million in the first quarter and \$30 million for the first six months. These figures were before security losses and taxes, but the six-months figure almost certainly included some excessive provision for loan losses.

In summary, the operations of the bank were obviously risky. Purchased money, risky loans, and leverage were all high. Even so, with potential tax credits and adequate loan loss reserves, the bank would not have become insolvent as a result of operations alone. As is indicated by table 5.4 and the discussion of the prototypes, for a large bank to fail a good deal of maldiversification must exist. In the case of First Pennsylvania, the critical factor was the undue interest rate risk arising from an excess concentration in long-maturity securities.

5.4.5 Market Valuation of Earnings

As First Pennsylvania increased its operating risks from 1967 to 1973, the stock market welcomed the changes. The market for a firm's stock provides independent valuations of both its earnings and capital. Although related, the prices fluctuate independently. Dividing the closing market price of a share of stock by after-tax net earnings per share yields the price/earnings ratio. Dividing the price per share by its book value gives a market estimate of the value of equity. Tables 5.2 and 5.3 show average data for these measures for the major banks with easily available information. The information they provide can be compared with that for First Pennsylvania.

For the six years, 1967-72, as growth and risks accumulated, the price/earnings ratio for the First Pennsylvania Corporation averaged 14. Although about ten percent above the bank average, this ratio was well below that of common stocks in general. In 1972, its P/E ratio was 20 percent above the bank average and close to that for all stocks.

In 1973 and 1974, rising market interest rates and a recession caused a sharp fall in the market's valuation of earnings. The average bank P/E ratio dropped from 13.8 in 1972 to 11.6, and then more drastically to 6.6 in 1974. First Pennsylvania's record was similar. It dropped from 16.6 in 1972 to 12.1, and then more sharply to 5.0. From well above the bank average, it fell below.

After 1974, First Pennsylvania's P/E ratio moved up and down along with the overall market. On the whole, it exceeded the bank average. At the end of 1979 it was 8.3, compared with the average bank's 5.5.

5.4.6 Estimating the Bank's Net Worth

The market estimates the economic value of the bank's equity. As chapters 2 and 3 explain, the bank's net worth can also be measured indirectly by using related market information. How did the market price of equity adjust to the movements in risk? From 1969 through 1973, the market valuation of net worth was high. Apparently the bank's common stock reflected a market view that important intangible sources of future earnings not carried on its books existed within the bank. A high degree of leverage and high after-tax yields on equity fostered such views. Return on equity ranged between 16 and 17 percent. For the six years 1967-72, the market value of the firm was more than twice its book value. Its market/book ratio ranked it in the top 10 percent of major banks.

However, as earnings turned downward, the market revised its estimates of capital values. The market-to-book ratio of First Pennsylvania dropped from 2.7 in 1972 to 2.0 in 1973, and then to 0.6 in 1974. Instead of selling at a premium in 1975-77, the market price averaged about 70 percent of book value. This decline was not an obvious reflection of any capital losses the bank had neglected to take. In this period, any differences between the book and market values of individual accounts were slight. Although the bank had a large volume of nonperforming loans, they improved steadily, and potential losses were covered by reserves. The market's reevaluation of the bank's equity seemed more closely related to a general disenchantment with common stocks. The discount from book for First Pennsylvania averaged about the same as for all major banks.

This situation changed drastically in 1978 and 1979. Because of the large interest risks it had assumed, rising rates hit this bank especially hard. At the end of 1979, the ratio of market to book value was only 0.39—among the lowest for any major bank.

Table 5.8 shows how the market's valuations of equity compared with those reported in the bank's balance sheet. It also shows valuations based on the indirect use of market information. The middle columns estimate values from the known interest effects on a bank's assets. They indicate much sharper declines in net worth. Although the indirect estimates show

a probable negative net worth in 1980, the stock market still assigned a positive value. This is not surprising—even in bankruptcy, the stock of corporations sells at a positive price. Stockholders' liability is limited, whereas they retain claims that may gain value during the process of reorganization in bankruptcy.

5.4.7 The Need for Rescue

The drop in economic capital led to a dangerous situation for the bank. Because it was in amounts that exceeded the insurance limits, much of the purchased money was not insured by the FDIC. Lenders recognized increased danger. If the bank were closed, long delays would occur in repayment, and losses would probably ensue. As the increased risks became more apparent, uninsured depositors began to withdraw their funds. Between 1 July 1979 and 23 April 1980, the bank lost approximately half the funds it had obtained through large certificates of deposit. Its foreign deposits also began to decline sharply.

Insured depositors did not run. They trusted the FDIC insurance and left their funds in the bank. Borrowing was also possible through sale and repurchase agreements and from companies sufficiently in debt to the bank to be able to offset any deposit losses.

Still, the bank needed to borrow heavily from the Federal Reserve to pay off fleeing lenders. When it became obvious that the probabilities were low that it would be able to repay the Federal Reserve from normal operations, the FDIC was called in. Under Pennsylvania law, a satisfactory merger or purchase was almost impossible. Faced with the prospect of a far greater liquidation task than it had ever attempted before, and recognizing the danger that a failure to bail out one of the oldest and largest banks could lead to runs on other banks, the FDIC put together its largest rescue program.

5.5 Conclusion

This chapter pinpoints some of the difficulties of measuring economic net worth. The First Pennsylvania case highlights the necessity of estimating net worth. It also indicates that, with additional effort, procedures to use market data indirectly can be developed for this purpose. The examples of the prototype banks demonstrate how existing knowledge of probable distributions of declines in value owing to interest rate movements, loan losses, and operations can be brought together to estimate the total danger in a portfolio. The variances of different portfolios can then be related to the level of economic capital in order to measure adequacy and the remaining risk.

The First Pennsylvania rescue operation worries many observers. As is noted in chapter 8, it is not illogical for managers to take excessive risks

because they can profit from the FDIC guarantee. Such prospects became even more likely if the losses that normally would accompany a poor policy are limited. Critics fear that this rescue marks another instance of unwillingness to see a large corporation pay fully for the losses engendered by its policies. They question the ultimate results of removing the threat of losses from the profit system. The next chapter discusses several related issues of this type.

