Economic Review

Federal Reserve Bank of San Francisco

Spring 1988 Number 2

Changes in Bank Risk-Taking

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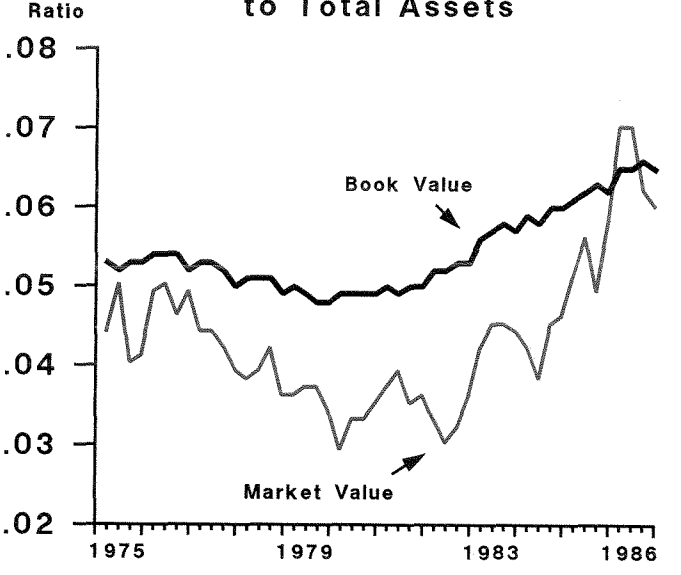
Comments by Christopher James, James O'Brien and Michael Keely on earlier drafts are appreciated. Research assistance provided by John Nielsen and Janice Ferry. Editorial committee members were Hang-Sheng Cheng, Christopher James and Ramon Moreno.

In the 1980s, two countervailing developments are evident among large bank holding companies — improvements in capital positions and increases in asset risk. Empirical evidence presented in this paper indicates that the net effect has been to increase the default risk of large bank holding companies and to raise the risk exposure of the deposit insurance system. The findings, however, do not support the view that the requirement to raise capital to meet minimum capital standards in the 1980s contributed to greater risk-taking among large BHCs.

Capital positions among large bank holding companies improved dramatically during the 1980s. Chart 1 shows that the average ratio of book value, primary capital to assets for 98 of the largest publicly traded bank holding companies (BHCs) rose from about 4¾ percent in 1980 to about 6½ percent in 1986[1] The rise in capital ratios was even more remarkable when measured in terms of market values.[2]

From a regulatory perspective, this decrease in bank leverage represents a positive development since it should serve to reduce default risk among the banking institutions and to protect the deposit insurance system, everything else equal. Default risk and the liability of the insurance system, however, also depend on the degree of asset risk assumed by banking organizations. This is relevant, since in the 1980s, the problems associated with energy loans, real estate loans, and lending to lesser developed countries, as well as higher volatility in financial markets likely have contributed to greater asset risk for banks. Thus, greater asset risk may have offset part or all of the beneficial effects of the higher levels of bank capital.

Chart 1
Primary Capital to Total Assets



Changes in capital regulation in the 1980s also may have raised bank asset risk indirectly. In December 1981, the bank regulatory authorities announced the imposition of the first explicit minimum capital-to-asset ratios for banks and BHCs. These requirements, which became effective in mid-1982, were amended in 1983 and again in 1985.[3] The new capital requirements had the effects of making the minimum requirements uniform for virtually all banks and BHCs and of increasing regulatory capital requirements for those BHCs with relatively low capital-to-asset ratios at the beginning of the decade.

The shift to uniform minimum capital standards has raised the concern that they may have had the unintended side-effect of allowing more asset risk for banks in general. This worry was expressed by the Federal Reserve in its 1986 proposal for new risk-based capital standards, which were said to be needed "to temper the disincentives inherent in the existing guidelines to hold low-risk, relatively liquid assets."

Another concern is that the BHCs that were required to raise their capital ratios to meet higher capital standards may have reacted by increasing asset risk.[4] This view of the effect of capital regulation can be found in a number of academic studies as well as in the popular press (see Furlong and Keeley, 1987a, for a discussion of the articles maintaining this view). Their implication is that BHCs forced by regulation to raise capital would be expected to increase asset risk relative to the other BHCs.

Purposes

The purposes of this paper are to examine empirically the change in asset risk among the large BHCs in the 1980s, and to evaluate the net effects of the improvements in capital positions and changes in asset risk on the default risk of large BHCs and on the risk they pose to the deposit insurance system. The paper also investigates whether changes in asset risk, default risk, and the value of the deposit insurance subsidy were different for those BHCs required to increase capital ratios to satisfy the new regulatory standards during the 1980s than for the BHCs that already met the minimum standards at the start of the decade.

The rest of the paper is organized as follows. Section I presents opposing views on how higher regulatory capital requirements would be related to the incentives for banks to take risk. Section II presents empirical evidence that asset risk rose among large bank holding companies between 1981 and 1986. That section also offers evidence suggesting that the rise in bank asset risk has more than offset the benefits from higher capital ratios, resulting in a rise in default risk among the large BHCs and an increase in the risk they present to the deposit insurance system. Section III provides a summary and conclusions.

I. Views on Bank Asset Risk

In recent years, attention focused on how a bank's decisions regarding asset risk are affected by the current system of fixed-rate deposit insurance premiums. Several studies have shown that, with fixed-rate deposit insurance, the value of a bank's equity is positively related to the riskiness of its assets as well as its degree of leverage.[5] That is, the value of a bank increases as the bank shifts to more risky assets and as it increases leverage (reduces its capital-to-assets ratio). Under these circumstances, if leverage were constrained by regulators, a value-maximizing bank would be expected to hold the most risky asset portfolio permitted under bank regulation.

With underpriced deposit insurance, therefore, much of the burden of constraining asset risk among value-maximizing banks would fall on the regulatory authorities. In principle, for asset-risk regulation to be effective, regulators must impose costs on a bank that violates the regulations that are at least equal to the gains the bank realizes from increasing asset risk. Thus, developments that mute the regulatory response to risk-taking would tend to foster more asset risk.

One such development may have been the adoption of uniform minimum capital standards for banks and BHCs in the 1980s. The application of explicit, uniform capital ratios could have hindered the process through which judgmental adjustments are made by bank examiners as to the amount of capital required of banks and BHCs with different asset portfolios. That is, the explicit minimum ratio may have limited the extent to which required capital ratios have been adjusted upward to compensate for higher asset risk.

As stated earlier, one reason given by the regulatory authorities for wanting to switch from the current uniform minimums to risk-based capital requirements is that the latter standards, in principle at least, would vary automatically among banking institutions according to the degree of asset risk. Without such systematic adjustments, it is possible that a bank meeting the capital standards now

may be able to hold a riskier portfolio than it previously could at the same degree of leverage. Under these circumstances, and with the system of fixed-rate deposit insurance premiums, asset risk in banking can be expected to rise.

Another critical question in the regulation of asset risk in banking is how a bank's incentives to take on asset risk are affected by changes in the stringency of capital requirements. The traditional argument is that higher capital standards lead to more asset risk because banks that are required to increase capital will shift to higher yielding, riskier assets to increase the rate-of-return on equity. For example, Kahane (1977) and Koehn and Santomero (1980) claim to show that, within a two-parameter Markowitz portfolio model, more stringent capital requirements would cause a utility-maximizing bank to increase asset risk. Unfortunately, their models do not hold for value-maximizing banks, for which the liability exposure of the deposit insurance system is especially relevant. Moreover, it has been shown in a previous issue of this *Review* (Furlong and Keeley, 1987a),[6] that these studies have internally inconsistent models and that their results cannot be used to support their claims.

There are other arguments, however, that suggest that higher capital requirements could lead to banks holding more risky combinations of assets.[7] James (1987), for example, shows that higher capital requirements on new investments can exacerbate an underinvestment problem. That is, an institution faced with raising relatively more capital to fund new projects would tend to forego certain low risk ventures in which it might otherwise invest. The implication is that the resulting asset portfolio would tend to be smaller and include relatively more risky assets than if capital requirements were lower.

While the possibility that higher capital requirements can lead to greater asset risk cannot be ruled out, it certainly can be shown that increases in regulatory capital requirements do not have to lead banks to take on more asset risk. Given that a bank has incentives to increase asset risk owing to the presence of mispriced deposit insurance, Furlong and Keeley (1987b) show that the effect of a given change in asset risk on the value of a bank is negatively related to a bank's capital-to-asset ratio. That is, with underpriced deposit insurance, the marginal gain to a bank from increasing asset risk declines as its capital position increases.[8]

This finding implies that regulatory constraints on asset risk sufficient to restrain a bank at a given level of leverage also would be sufficient at any lower level of leverage. The conclusion to be drawn from this view of banks and bank regulation is that higher capital requirements should not lead to greater asset risk.

The validity of the last statement depends on the assumption that regulatory constraints are not eased. This is an important qualification since, as stated earlier, the issue is whether, for a given level of leverage, a bank meeting capital standards now may be able to hold a riskier portfolio.

II. Empirical Results

This section empirically investigates changes in risk-taking in banking between 1981 and 1986. Evidence is presented first on how asset risk among a sample of large BHCs changed over this period. Then, changes in default risk, which is related to both the asset risk and the leverage of an institution, among the sample of large BHCs is examined along with the change in the risk these BHCs pose for the deposit insurance system. This section also studies whether the requirement for a BHC to raise its capital-to-asset ratios to meet the new regulatory requirements in the 1980s was related to the BHC's changes in asset risk and default risk.

BHC Sample

The basic sample of institutions considered consists of 98 large, publicly traded BHCs with financial data available on the Compustat tapes for the years 1975 to 1986. Among this set of institutions, about one-fourth had book value, primary capital-to-asset ratios that were below the minimum standards announced by the regulatory authorities in December 1981. The minimum primary capital standard announced in 1981 for most BHCs with $1 billion or more in assets was 5 percent.[9]

When the minimum capital ratios were set in 1981 the majority (two-thirds) of the large BHCs with primary capital ratios below the minimum were multinational holding companies. Technically, the minimum standards did not apply to the multinational institutions. Nevertheless, the multinational BHCs were under regulatory pressure to increase capital ratios, and it is reasonable to assume that the BHCs anticipated that they eventually would be subject to the formal minimum standards. Indeed, by June 1983, the multinationals were subject to the same minimum capital standards that applied to other holding companies with assets of $1 billion or more. In 1985, the minimum primary capital ratio for all BHCs was set at a uniform 5½ percent.[10]

Since one of the issues to be investigated is whether being required to increase its capital ratio after 1981 affected the risk assumed by a BHC, the institutions not meeting the 1985 minimum primary capital requirements on average during 1981 are identified as the BHCs that should have been most directly influenced by the higher capital standards. In the basic sample of 98 institutions considered, 24 are classified as not meeting the capital requirements. For convenience of presentation, these 24 institutions are referred to as the "capital-deficient BHCs," and the other institutions in the sample are referred to as either "capital-sufficient BHCs" or "other BHCs."

Changes in Asset Risk

In finance theory, asset risk commonly is represented by the variation in the economic rate-of-return on assets. Specifically, asset risk is assumed to be positively related to the variability of the return on assets. Following this approach, the analysis of asset risk in this paper focuses on the standard deviation of the return on assets as the appropriate measure of risk. In addition, since the regulatory authorities have expressed specific concern over a shift by institutions away from low-risk, liquid assets, changes in the relative holdings of such assets among the sample of large BHCs also are reviewed.

The problem posed by using the standard deviation of the return on assets in an empirical analysis of changes in risk is that the variation in the economic (market value) rate-of-return on assets is not observable. Fortunately, it can be estimated from other "observable" variables. This is done in another study related to risk in banking, by Ronn and Verma (1986).

Using the results from Black and Scholes (1973), Ronn and Verma represent the equity value of a banking organization as a call option on the value of its assets. The argument for doing so is that the debtholders can be thought of as effectively owning the assets of a firm and giving the stockholders the option to buy the assets back at maturity (under the assumption the maturities of assets and liabilities are equal). At maturity, the value of the equity (the option) would be the difference between the value of the assets and the face value of the liabilities if that difference were positive, and zero otherwise.

In this model, the exercise price is equal to the face value of the bank's debt at maturity, and the option would be exercised by the stockholders only if the value of the assets were to exceed that of the liabilities. If the value of the liabilities were to exceed the value of the assets at maturity, the stockholders would not exercise the option and, in effect, would allow the debtholders to keep the assets.

Given that most, if not all, bank debt is either explicitly or implicitly federally insured to some degree, the deposit insurance system is in effect the primary creditor of banks. For this reason and for simplicity, we assume that the maturity of the equity call option is related to the renewal period of the insurance guarantee, which is assumed to be once a year, at a known date.

With this simplification, the Black-Scholes option pricing formula applied to the equity of a BHC is

$$E = A\,N\left(\frac{ln\left(\frac{A}{D}\right)+\left(\frac{s_A^2}{2}\right)}{s_A}\right) - D\,N\left(\frac{ln\left(\frac{A}{D}\right)+\left(\frac{s_A^2}{2}\right)}{s_A} - s_A\right) \qquad (1)$$

and

$$s_A = \frac{E}{A\,N\left(\frac{ln\left(\frac{A}{D}\right)+\left(\frac{s_A^2}{2}\right)}{s_A}\right)}\, s_E \qquad (2)$$

where

- E = market equity,
- A = market assets,
- D = the current face value of the bank's debt,
- s_A = standard deviation of the rate-of-return on market assets,
- s_E = standard deviation of the rate-of-return on market equity, and
- $N(x)$ = the standard normal cumulative density function evaluated at x.

Of the variables in equations 1 and 2, only equity can be observed directly. To reduce further the number of unknown variables in the system, it is assumed that the market's evaluation of s_E, which in the context of the model is made *ex ante* and assumed to be constant over the one-year life of the option contract, is based on the past value of the standard deviation of the return on equity. The specific assumption used is that the option contract is set just prior to the beginning of a calendar year, and the value of s_E is equal to the standard deviation of the return on equity for the previous twelve months. With this assumption, E and s_E can be treated as known parameters in the equation system.[11] That leaves a system of two equations and two unknowns, A and s_A, that can be solved simultaneously using a numerical approximation technique.

This approach was followed to derive two sets of estimates for s_A and A for each BHC using data for the years 1981 and 1986. The year 1981 is the year before the new capital standards were imposed and before the general rise

in bank capital positions, while 1986 is the last full year for which data are available. Equity, E, is estimated using the sum of the market value of common stock and the par value of preferred stock at the end of each year. The estimate of the standard deviation of the return on equity, s_E, is derived using the monthly stock price data for each year.

The top row of Table 1 presents the average of the standard deviations of the rates-of-return on assets for all the BHCs in the sample for each year, as well as the change in the averages. From 1981 to 1986, the increase in the average standard deviation is statistically and economically significant. Over that period, the measure of asset risk doubled.[12]

The bottom portion of Table 1 presents evidence on the change in asset risk for the two subgroups, the capital-deficient and the capital-sufficient BHCs (other BHCs). For both groups, the increase in asset risk was substantial and highly significant. However, the change in the average of the standard deviations of the rates-of-return on assets for the two groups is not statistically significant. That is, the increase in asset risk was not greater for the BHCs with low capital-to-asset ratios that were forced by regulatory authorities to raise their capital ratios after 1981, compared to the BHCs that satisfied the requirements in 1981.

While the variation in the return on assets is an appropriate measure of asset risk, as pointed out earlier, regulatory authorities have expressed specific concern over banks shifting away from low-risk, liquid (or marketable) assets — that is, they have been concerned with a decline in such assets relative to total assets. From the Compustat data, the items that might be included in the category of low-risk, liquid assets include vault cash, interbank deposits (due from banks), and reserves held with the Federal Reserve as well as Treasury and agency securities.

The argument for focusing on these assets is that, all else equal, the lower the relative holdings of assets with little or no default risk, the higher the overall risk of assets. This line of reasoning, however, is not necessarily valid. The net impact on an institution from increasing or decreasing a given type of investment has to be evaluated in terms of the composition of the institution's overall asset portfolio — that is, it has to take into account the covariances in the returns on assets, as does the variation of the return on total assets.

Recognizing the limitations of using the relative holdings of liquid assets as an indicator of asset risk, Chart 2 shows that the average of the ratios of these assets to total assets declined markedly for both groups of BHCs after 1981. This evidence is consistent with the finding of an increase in asset risk in Table 1. It also tends to support the regulatory authorities' concern that banks have shifted away from assets with low default risk under the capital standard adopted in 1981.

Table 1

Asset Risk

(Standard deviation of the estimated rate of return on market value assets)

	Mean standard deviation		Difference
	1981	1986	1986-1981
All BHCs	0.010	0.020	0.010* (10.49)
Capital-deficient BHCs	0.007	0.016	0.009* (2.07)
Other BHCs	0.012	0.021	0.009* (9.49)
Difference	−0.005* (3.26)	−0.005* (3.20)	0.000 (0.02)

Absolute value of t-statistics in parentheses.

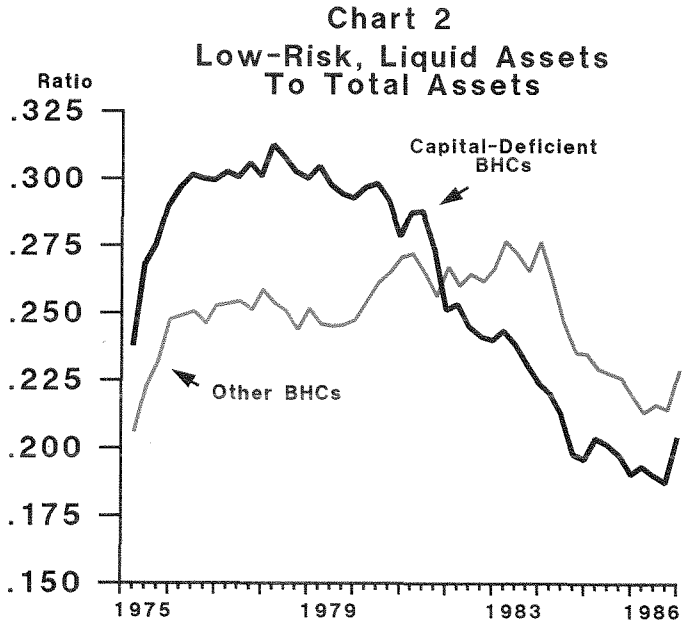
** Significant at the 95 percent level or higher.*

However, other factors could account for this decline in the ratios of low-risk, liquid assets to total assets. Other causes seem likely because it is evident from Chart 2 that the decline in the average ratio for the capital-deficient BHCs was under way prior to 1981.

Another observation from Chart 2 is that the decline in the average ratio between 1981 and 1986 is larger for the capital-deficient BHCs than for the other BHCs. A separate comparison of the changes in the ratios reveals that the difference is statistically significant. However, based on the evidence in Table 1, the larger drop in the relative holdings of liquid assets with little or no default risk does not seem to have resulted in a larger increase in overall asset risk for the capital-deficient BHCs.[13] The last observation points up the potential danger of evaluating the risk of an institution based on a subset of its assets in isolation from the rest of its portfolio.

Default Risk

The preceding evidence indicates that asset risk has increased substantially since 1981. However, over this same period, the capital positions of the BHCs in the sample also increased sharply (Chart 1). The greater asset risk and the reduced leverage would have opposite effects on the overall risk or default risk of the BHCs. From a regulatory perspective, an important question is: what has been the net effect on the default risk among the BHCs and the liability they impose on the federal deposit insurance system? To answer this question, we first present evidence on the change in default risk and then turn to the related issue of the change in the risk exposure of the deposit insurance system.



One approach to evaluating the default risk of an institution is presented in Boyd and Graham (1986) and Wall (1985). This approach uses an indicator that is related to the probability of failure, which in turn is a function of the variation in income and the capital position of an institution. Specifically, an institution fails when losses exceed capital. That is,

$$\text{Probability of failure} = \text{Probability}(\text{profits} < -\text{E}). \quad (3)$$

Dividing both terms of the inequality in the parentheses by E, the probability of failure can be expressed as being equal to the probability that the rate-of-return on equity, r_E, is less than negative one,

$$\text{Probability}(r_E < -1). \quad (4)$$

Assuming that the return on equity is distributed as a normal random variable, and standardizing the terms in statement 4, the probability of failure is equal to

$$\text{Probability}((r_E - \bar{r}_E)/s_E) < z) \quad (5)$$

where $\bar{r}_E$ is the expected rate-of-return on equity and

$$z = (-1 - \bar{r}_E)/s_E. \quad (6)$$

The variable z then is the standard normal variate, representing the number of standard deviations the rate-of-return would have to fall below its expected value for the bank to fail. To be consistent with the other studies that have used this measure of default risk, we will use the negative of z and denote it as Z. Thus, higher Z-values indicate a lower probability of failure.[14]

To test for changes in default risk, Z-values were estimated for each bank in the sample for the two years 1981 and 1986. One difference between the Z-values derived in this study and those calculated in other studies is that in this study the Z-values are based on estimates of the market values of the returns on equity and the standard deviations of the returns on market equity, rather than on book value measures.[15] The expected return on equity was estimated using the average market return on equity in each year for each institution. The standard deviations of the returns on equity are the same as those used in the calculations for Table 1.

The top portion of Table 2 shows that the mean value of Z for the overall sample of BHCs was significantly lower in 1986 than in 1981. The lower value of Z indicates a higher

probability of failure. This means that the increase in asset risk more than offset the decrease in leverage, and thus led to higher default risk on average.

The bottom portion of Table 2 reveals that, on average, the default risk did increase for the capital-deficient BHCs. However, for that group of BHCs, the change in Z was not significantly different from zero. For the other BHCs, the value of Z did decline on average and the decline is significant. Default risk, then, did not increase more among the BHCs that were required to increase capital after 1981 than among the other BHCs. In fact, as reflected by the changes in the Z-values, the default risk was not significantly lower for the capital-deficient group compared to the other BHCs in 1986, whereas the difference between the two groups of institutions was not significant in 1981.

Deposit Insurance System Risk

As a complement to the evidence on the changes in Z-values, estimates of the change in the risk exposure of the deposit insurance system between 1981 and 1986 can be used to evaluate the net effect of the rise in asset risk and the decrease in leverage. Merton (1977) shows that the deposit insurance guarantee can be modeled as a put option. Building on Merton's model of a Black-Scholes put option and assuming an examination interval of one year, Ronn and Verma (1986) express the value of the insurance guarantee per dollar of deposits as

$$I = N\left(\frac{ln\left(\frac{D}{Ad}\right) - \left(\frac{s_A^2}{2}\right)}{s_A} + s_A\right) - d\left(\frac{A}{D}\right) N\left(\frac{ln\left(\frac{D}{Ad}\right) - \left(\frac{s_A^2}{2}\right)}{s_A}\right). \quad (7)$$

With the exception of I, which is the per dollar of deposit value of insurance, and d, which is one minus the dividend rate relative to assets, all the other variables in equation 7 are found in equations 1 and 2.

In this expression of the value of the deposit insurance guarantee (equation 7), the face value of the debt at maturity represents the exercise price.[16] The bank can be thought of as choosing to exercise the put option (sell the assets to the insurance system) if, at the end of the insurance guarantee period (assumed to be one year), the face value of the debt were greater than the value of the assets. Whereas, if the value of assets were higher – that is, equity were positive, the bank can be thought of as not exercising the put option and holding on to the assets.

Using the estimates for the unobservable variables, A and s_A, from solving equations 1 and 2, and the estimates for the other variables from the Compustat data, equation 7 was evaluated for each BHC in the sample using data for 1981 and 1986. In using the calculations from equation 7 to estimate the value of deposit insurance, certain assump-

Table 2

Default Risk

	Mean Z-Value		Difference
	1981 data	1986 data	1986-1981
All BHCs	4.925	3.758	−1.167* (5.41)
Capital-deficient BHCs	4.413	3.549	−0.865 (0.72)
Other BHCs	5.108	3.832	−1.276* (5.11)
Difference	−0.695* (2.02)	−0.283 (0.82)	0.411 (0.85)

Absolute value of t-statistics in parentheses.

** Significant at the 95 percent level or higher.*

tions are being made. It is implicitly assumed that regulators applied the same closure or insurance renewal rule in both time periods: to close institutions found to have negative market capital at the scheduled examination. Different closure rules would generate different estimates of the value of deposit insurance, and, more important for the purposes of this paper, affect the estimates of the changes in the value of deposit insurance.

Given these restrictive assumptions concerning the closure rule, the results in Table 3 should be viewed with caution, particularly with regard to the estimates of the levels of the value of the insurance guarantee. As it stands, the evidence concerning the changes in I is roughly consistent with that on default risk. The mean value of I for all BHCs in the sample is significantly higher using the data for 1986 than that based on the data for 1981. Using the maximum statutory deposit insurance premium for banks, $.0008 per dollar of deposit, as a benchmark, the estimates in the top portion of Table 3 indicate that, on average, deposit insurance was overpriced in 1981 under the assumed closure rule. Likewise, the estimates based on the data for 1986 indicate that, on average, deposit insurance was overpriced for the sample of BHCs.[17]

These results are consistent with the idea that the increase in asset risk more than offset the benefits from the decline in leverage among the BHCs, and left the deposit insurance at greater risk at the end of 1986 than at the end of 1981. However, just like the results in Table 2, the findings reported in the bottom portion of Table 3 do not allow us to reject the hypothesis that the increase in the mean value of I was the same for both groups of BHCs, since the difference between changes for the two groups is not significantly different from zero.

III. Summary and Conclusions

This paper examines changes in asset risk, default risk, and the liability of the deposit insurance system for a sample of large BHCs between 1981 and 1986. For the sample, asset risk increased substantially. This increase in asset risk appears to have been large enough to offset the effects of improved capital positions among the sample institutions between 1981 and 1986. On average, the estimates of default risk among the sample institutions and the risk the institutions present to the deposit insurance system increased significantly. These findings tend to justify concerns that there has been an easing of combined capital and asset risk standards in banking. That is, institutions appear to be holding riskier assets relative to leverage.

Table 3

Deposit Insurance System Risk

(Estimated value of deposit insurance per dollar of deposit)

	Mean per dollar of deposit value of insurance		Difference
	1981 data	1986 data	1986-1981
All BHCs	2.42×10^{-6}	2.61×10^{-5}	2.37×10^{-5}* (1.79)
Capital-deficient BHCs	3.04×10^{-6}	3.60×10^{-5}	3.30×10^{-5} (1.26)
Other BHCs	2.19×10^{-6}	2.25×10^{-5}	2.04×10^{-5} (1.31)
Difference	8.52×10^{-7} (0.04)	1.35×10^{-5} (0.63)	1.26×10^{-5} (0.42)

Absolute value of t-statistics in parentheses.

* *Significant at the 93 percent level.*

The paper also considers the issue of whether BHCs forced to raise capital to meet the new minimum capital standards increased asset risk and default risk by more than other bank holding companies. The capital-deficient BHCs did tend to make larger cuts between 1981 and 1986 in their relative holdings of liquid asset with little or no default risk and (as discussed in the Appendix) showed somewhat bigger increases in loan loss reserves ratios. Despite this development, however, the evidence on the change in the variation of the return on assets indicates that, on average, the BHCs required to raise primary capital did not increase asset risk by more than the BHCs that were relatively well capitalized in 1981. In addition, between 1981 and 1986, there was no significant difference in the change in the estimates of the per dollar of deposit value of the deposit insurance for the capital-deficient BHCs compared to that for the other BHCs. The results in this paper, then, do not support the view that increases in regulatory capital standards lead banks to increase asset risk.

APPENDIX

Loan Loss Ratios as Measures of Asset Risk

Another risk measure often employed in empirical studies focuses on the "quality" of an institution's loan portfolio. That measure of loan risk is the ratio of loan loss reserves to total loans (LLR). The usual justification for using this measure is that an institution with higher risk loans would be expected to have a higher value of LLR[1]

To the extent that loan loss reserve ratios can be compared among banks, the plots in the chart point to a general deterioration in the quality of loans among the sample of BHCs. Moreover, after 1984, it is evident that the rise in LLR was noticeably larger for the capital-deficient BHCs. Separate computations show that the difference in the changes in the ratios for the two groups between 1981 and 1986 is statistically significant, suggesting a greater increase in asset risk among the capital-deficient BHCs.

However, as discussed in the text in connection with Table 1, the evidence on the change in the variation in the return on market assets does not show a significant difference in the increase in overall asset risk for the two groups of BHCs. A possible explanation for the difference in the behavior of LLR for the two groups in the sample in recent years is that the ratios have been affected by off-balance sheet credit extensions or loan sales, and, thus, may not accurately reflect the differences in risk associated with the lending activities of the BHC's. One reason this seems possible is that the greater rise in LLR for the capital-deficient BHCs in the 1980s was due to much slower growth in on-balance sheet loans among those BHCs than among the other BHCs, and not to a more pronounced pick-up in the growth of loan loss reserves.

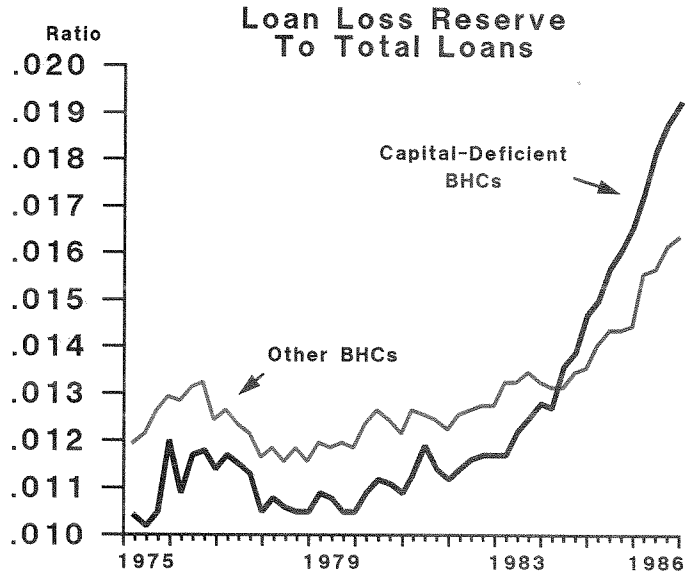
Whether the loan loss reserve ratios adequately reflect differences in the quality of assets connected with credit extensions depends in part on what accounts for the slowdown in the accumulation of loans at the capital-deficient BHCs. Take the most relevant off-balance sheet activity, standby letters of credit (SLCs), for example. To the extent that a bank uses SLCs as an alternative to direct lending, its volume of on-balance sheet loans would be less. Since SLCs generally are issued to higher quality bank borrowers (see James, 1987), the quality of the remaining on-balance sheet loans for a bank issuing SLCs should be lower on average. When compared only to on-balance sheet credits, then, the loan loss reserve ratio should be higher the greater the use of SLCs by a bank. However, the quality of the on-balance sheet loans are not representative of the bank's credit exposure via SLCs, and, thus, as SLCs grow, the loan loss reserve ratio can overstate the deterioration in quality of a bank's effective credit extensions.

The problem presented by SLCs is that they tend to lead to an overstatement of a bank's book value capital position. This is because the minimum capital standards are expressed only in terms of on-balance sheet assets and capital, and the enforcement of capital regulation does not always fully compensate for SLCs. A bank then could use SLCs effectively to increase leverage and overall risk, even if the risk of its combined on- and off-balance sheet assets were unchanged.

In contrast, if a slowing in loan growth at a bank were related to loan sales, a rise in loan loss reserve ratios would not necessarily be a distortion. Once again, the sales of loans would be expected to involve higher quality bank loans.[2] With loans sold without recourse not included on a bank's balances, the average quality of the bank's credit extensions could fall. Thus, a higher loan loss reserve ratio would be indicative of the difference in the quality of the bank's loan portfolio, everything else the same. However, while the bank's assets might be riskier, the sale of loans could lead to a reduction in leverage, which would tend to offset the adverse effects of higher asset risk.

It is not certain, then, what a higher loan loss reserve ratio that stems from slower loan growth means for the risk

of a bank's combined on- and off-balance sheet assets. And, the implications for the default risk of an institution are blurred since slower loan growth can have implications for leverage as well as for loan loss reserve ratios. With SLCs present, loan loss reserve ratios tend to overstate asset risk but understate book value leverage. In contrast, loan sales lead to higher loan loss ratios but can be used to reduce leverage, and, thereby, default risk.



1 *One complication encountered when relating this measure of risk to capital requirements is that loan loss reserves are themselves included in regulatory capital. Given that there are tax advantages from allocating earnings to loan loss reserves, a bank attempting to build up capital through retaining earnings would be expected to make the maximum possible contributions to loan loss reserves.*

2 *See James, 1987.*

FOOTNOTES

1. For regulatory purposes, primary capital for BHC's includes common equity, loan loss reserves, minority interests in equity accounts of consolidated subsidiaries, net mandatory convertible securities, perpetual preferred stock, and perpetual debt subordinated to the interests of depositors.

2. Market value of primary capital is estimated by the sum of the market value of common equity and the book value of preferred equity.

3. For a description of the change in capital requirements, see Gilbert, Stone and Trebling (1985).

4. Keeley (1988), shows that capital positions among large BHCs improved appreciably on a book value as well as on a market value basis in the 1980s. The results of that study also suggest that the imposition of the new capital requirements contributed to the general improvement in bank capital positions by raising capital-to-asset ratios at those BHCs with relatively low ratios at the beginning of the 1980s.

5. See for example Dothan and Williams (1980), Sharpe (1978), Kareken and Wallace (1978), Merton (1977), Pyle (1984), and Furlong and Keeley (1987a, b).

6. See also Keeley and Furlong, 1987.

7. Outside the academic literature, a common argument for why capital regulation will affect the asset risk of a bank assumes that bank managers are constrained to meet a target rate-of-return on equity. In this instance, a bank reacts to capital regulation by shifting to investments with higher expected yields to maintain a predetermined rate-of-return on equity. Such behavior would imply a shift to a more risky asset portfolio, given the usual tradeoff between asset yields and risk.

Although apparently widely held, this view of the reaction of banks to capital requirements implicitly assumes that banks do not engage in optimizing behavior because, on the margin, banks ignore the tradeoff between asset risk and return on equity.

8. This result can be shown formally by adapting a Black-Scholes put option formula to the deposit insurance guarantee along the lines of Merton (1977). This is done in Furlong and Keeley (1987b), which shows that the second derivative of the option value of deposit insurance with respect to asset risk with respect to leverage is positive. For a graphic presentation of the effects of leverage on the gains from risk-taking, see Furlong and Keeley (1987a).

9. For BHCs with less than $1 billion in assets, the minimum primary capital ratio was set at 6 percent in 1981. Minimum ratios for total capital were set at 5½ percent for BHCs with $1 billion or more in assets (excluding 17 multinational BHCs) and a 6½ percent for the smaller BHCs. (See Gilbert, Stone, and Trebling, 1985).

10. In 1985, the minimum total capital ratio was set at 6 percent for all BHCs.

11. Ronn and Verma also attempt to include in their model a regulatory closure policy in which a bank with a deficiency in capital equal to or less than a certain fraction of total debt is given financial assistance and not closed. For the estimates in this paper, it is assumed that a bank discovered to have negative capital upon examination is closed without financial assistance to the stockholders.

12. In the context of the model, the values of s_A derived using the data for 1981 and 1986 represent estimates of the market's ex ante evaluation of the standard deviations of the return on assets of the BHCs for the years 1982 and 1987 respectively.

13. The Appendix discusses another commonly used indicator of asset risk, the ratio of loan loss reserves to total loans. The change in this indicator between 1981 and 1986 for the sample of BHCs in this study points to a general rise in loan risk. The change in the loan loss reserve ratio was larger for the capital-deficient BHCs. However, from the evidence in Table 1, this does not appear to have led to a relatively longer increase in overall asset risk. The Appendix discusses how difference in off-balance sheet credit extension could possibly account for the difference in the changes in loan loss reserve ratios for the capital-deficient and the capital-sufficient BHCs.

14. In computing the Z-values, it is assumed that regulators always close a bank when the bank is found to have negative net worth upon examination. To the extent that banking organizations are allowed to operate with negative market net worth, the Z-values would tend to overstate the chances an institution would be closed by regulators.

15. Under this approach the observed equity is assumed to represent the true measure of protection to liability holders. In general, this is not the case with book value measures of capital.

16. The exercise price is $X = De^{rt}$, the face value of the organization's debt at the time of the examination, which is assumed to be one year — that is, $t = 1$. The term r is the rate paid on bank debt, which is assumed to be the risk-free interest rate.

17. Estimates from Marcus and Shaked (1984) for a smaller sample of BHCs show that deposit insurance was overpriced, on average, in 1979 and 1980. Ronn and Verma show that the value of the insurance guarantee depends on the closure rule applied by regulators. Using a less stringent closure rule than the one assumed in this paper, Ronn and Verma report results for which the average per dollar of deposit value of the insurance guarantee was about equal to .0008 in1983. This would imply that, using the rule of closing banks when equity is discovered to be zero upon examination, the Ronn and Verma results would show deposit insurance to be overpriced on average. As in these other studies, the estimates used in this paper for the value of the insurance guarantee show that it varies considerably among the institutions in the sample.

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