A Comparison of Risk-Based Capital and Risk-Based Deposit Insurance

by Robert B. Avery
and Terrence M. Belton

Robert B. Avery is a senior economist in the Division of Research and Statistics at the Board of Governors of the Federal Reserve System. Terrence M. Belton is a senior economist at the Federal Home Loan Mortgage Corporation.

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Introduction

The perception of increased bank risk-taking has raised concerns as to whether changes and improvements are needed in our system of regulatory supervision and examination. These concerns clearly underlie recent proposals for risk-based capital standards issued by all three bank regulatory agencies—the Federal Reserve Board, the Federal Deposit Insurance Corporation (FDIC), and the Comptroller of the Currency—as well as proposals by the FDIC and Federal Savings and Loan Insurance Corporation (FSLIC) for risk-based deposit insurance premiums. None of these approaches has, as yet, been implemented, and each is still under active consideration by at least one regulatory body.

As part of an ongoing evaluation of the potential effectiveness of various methods of controlling bank risk-taking, this paper presents a comparison of risk-based capital and risk-based deposit insurance premium proposals. Although these proposals may appear to represent quite different methods of controlling bank risk, the results presented below suggest that this need not be the case and that, if implemented properly, the two methods can produce a similar level of bank risk-taking.

The paper also suggests that differences that exist between the two methods lie not in the fact that one controls premiums and the other capital levels, but that one prices risk and the other sets a risk standard. This is discussed informally in section I, while evidence of how both a risk-based insurance and risk-based capital system could be implemented using similar measures of risk is presented in the section that follows.

I. Discussion

In the current regulatory environment, commercial banks are subject to a fixed minimum level of primary capital per-dollar of assets and a fixed deposit insurance premium per-dollar of domestic deposits regardless of the risk that they present to the FDIC. As many critics have pointed out, this presents a potential problem of incentives in that banks may not bear the full social costs of increased risk-taking. Both a risk-based capital and risk-based insurance system are designed to address this problem by inducing banks to internalize the expected costs that their risk-taking imposes on the FDIC and society in general.[1] The programs appear to differ significantly, however, in how they attempt to achieve this goal.

As proposed, a risk-based deposit insurance system would explicitly price risk-taking behavior on the part of insured banks. Periodically, the FDIC would assess the risk represented by each bank and charge an insurance premium reflecting the expected social

1 Another objective may be to distribute the costs of risk-taking more equitably across banks even if such differences stem from exogenous factors and if issues of moral hazard and allocative efficiency are irrelevant.

Risk Variables

Symbol	Definition
KTA	percent ratio of primary capital to total assets,
PD90MA	percent ratio of loans more than 90 days past due to total assets,
LNNACCA	percent ratio of nonaccruing loans to total assets,
RENEGA	percent ratio of renegotiated loans to total assets,
NCOFSA	percent ratio of net loan charge-offs (annualized) to total assets,
NETINCA	percent ratio of net income (annualized) to total assets.

Source: Board of Governors of the Federal Reserve System.

TABLE 1

costs attributable to it.[2] Because banks would in principle bear the full expected cost of their actions, they would either be deterred from excessive risk-taking or would pay the full expected costs to the FDIC.

A risk-based capital standard works by setting a standard that, by absorbing losses, limits the amount of risk an insured bank can impose on the FDIC, rather than by explicitly pricing risk. If the regulators determine that a bank represents a risk above the allowable standard at its current level of capital, they would require the bank to raise more capital. By adjusting capital "buffers," regulators can control the size of potential losses irrespective of bank behavior.

The regulator uses information on differences in risk-taking behavior across banks to require different amounts of capital or coinsurance, not to charge different premiums. Indeed, since adjustment of the capital buffer is used to reduce the risk represented by each bank to the same level, it is then appropriate that they be charged a flat premium rate.[3] Bank risk-taking behavior may be deterred because banks would recognize that they will incur higher expected capital costs, an implicit price, even though banks do not face explicit prices for risk. In both schemes, overall system risk-taking would be reduced because banks would take full account of the expected consequences of their actions, either through explicit insurance premiums or implicit prices via higher capital costs.

Current Proposals on Risk-Based Deposit **Insurance and** Risk-Based Capital

In recent years, there have been several specific proposals made by the federal regulatory agencies for basing insurance premiums or capital requirements on the perceived risk of depository institutions. In 1986, for example, the FDIC asked for legislation authorizing the adoption of a risk-based deposit insurance system and has developed a specific proposal for implementing such a system. More recently, the Federal Reserve Board, in conjunction with the Bank of England and with other U.S. banking regulatory authorities has published for public comment a proposal for risk-based capital requirements.

The FDIC proposal for risk-based deposit insurance utilizes two measures for assessing bank risk-taking.* The first measure is based on examiner-determined CAMEL ratings for individual commercial banks. CAMEL ratings, which range from 1 through 5 (with 5 representing the least healthy bank) are intended to measure the bank's capital adequacy (C), asset quality (A), management skills (M), earnings (E), and liquidity (L). The FDIC's problem-bank list consists of all banks with CAMEL ratings of 4 and 5.

The second measure of bank risk employed in the FDIC proposal is a risk index developed by the FDIC that is based on publicly available Call Report data. The index is defined as:

$$(1)\quad I = .818 - .151KTA + .211PD90MA + .265LNNACCA + .177RENEGA + .151NCOFSA - .347NETINCA,$$

where all variables are defined in table 1. The weights in the index were estimated from historical data with a probit model that predicts whether or not an individual bank is on the FDIC's problem-bank list. The index can be interpreted as providing a measure of the likelihood that a bank is a problem bank. Banks with higher index values of the index are more likely to be problem institutions and therefore more likely to impose higher expected costs on the FDIC.

Premiums would be assessed, under the FDIC proposal, by defining two premium classes. Banks having a positive value of the risk index and a CAMEL rating of 3, 4, or 5, would be classified as above-normal risk. These

2 If the FDIC cannot fully assess the ex-ante risk represented by each bank, perhaps because monitoring costs would be excessive, then the "optimal" risk premium would also include "penalties" over and above the FDIC's estimate of each bank's expected social cost.

3 Assuming the risk-based capital requirement is binding so that no institution holds capital in excess of its requirement.

4 The proposal is described in "Risk-Related Program," FDIC Discussion Paper, September 20, 1985, and Hirschhorn, E., "Developing a Proposal for Risk-Related Deposit Insurance," *Banking and Economic Review*, FDIC, September/October 1986.

Summary of Risk Weights and Major Risk Categories for State Member Banks and Bank Holding Companies

Category **A1** (0 percent weight)
Cash—domestic and foreign
Claims on Federal Reserve Banks

Category **A2** (10 percent weight)
Short-term (one year or less) claims on U.S. Government and its Agencies.

Category **A3** (25 percent weight)
Cash items in process of collection.
Short-term claims on domestic depository institutions and foreign banks, including foreign central banks.
Claims (including repurchase agreements) collateralized by cash or U.S. Government or Agency debt.
Claims guaranteed by the U.S. Government or its Agencies.
Local currency claims on foreign central governments to the extent that bank has local currency liabilities.
Federal Reserve Bank stock.

Category *A4* (50 percent weight)
Claims on U.S. Government-sponsored Agencies.
Claims (including repurchase agreements) collateralized by U.S. Government-sponsored Agency debt.
General obligation claims on states, counties and municipalities.
Claims on multinational development institutions in which the U.S. is a shareholder or contributing member.

Category **A5** (100 percent weight)
All other assets not specified above, including:
Claims on private entities and individuals. Long-term claims on domestic and foreign banks.
All other claims on foreign governments and private obligators.

Source: Board of Governors of the Federal Reserve System.

TABLE 2

institutions would be charged an annual premium equal to one-sixth of one percent of domestic deposits, or twice the current premium level. All other institutions (that is, institutions having either a negative value for the risk index or a CAMEL rating of 1 or 2) would be classified as normal-risk banks and be charged the current premium of one-twelfth of one percent.

The risk-based capital requirement proposed by the Federal Reserve Board, in conjunction with other regulatory authorities, measures bank risk-taking in a somewhat different fashion than the FDIC's deposit insurance proposal. Capital requirements would be assessed, under the Board's proposal, as a fraction of the on- and off-balance-sheet activity of individual commercial banks.[5] Specifically, the proposal defines five asset categories that are shown in table 2. These categories are intended to measure, in broad terms, assets having varying degrees of credit risk. Cash and claims in Federal Reserve Banks (category A1) are deemed to have no credit risk and require no capital support. Commercial loans to customers other than banks, (Category A5) are deemed to have the greatest amount of credit risk. The minimum primary capital level, K, required under the proposal would be defined as:

$$(2) \quad K = a(0A1 + .10A2 + .25A3 + .5A4 + 1A5),$$

where a denotes the minimum required ratio (not yet specified in the proposal) and A1 to A5 denote the asset categories defined in table **2.**

The requirement shown in equation (2) effectively imposes different minimum capital standards on each of the five asset categories. If a is set at 7 percent, for example, all

5 The proposal is described in two press releases of the Board of Governors of the Federal Reserve System titled "Capital Maintenance: Revision to Capital Adequacy Guidelines," dated February 12, 1987 and March 18, 1987.

commercial loans, except those to other banks (category A5), would effectivelyhave minimum required capital ratios equal to 7 percent; claims on U.S. government-sponsored agencies (category A3) would have required capital ratios equal to 1.75 percent; and short-term treasury securities (category A2) would have required capital ratios of 0.7 percent.[6]

It is clear that a major difference between the risk-based capital and risk-based deposit insurance proposals just described is the type of information that is used to assess bank risk-taking. The risk-based deposit insurance proposal focuses on measures of bank performance, such as earnings and asset quality; the risk-based capital proposal focuses on the types of activities in which banks are involved. The former view is based on statistical evidence that suggests these performance measures provide the best forecast of future bank problems? The latter approach to measuring bank risk-taking is based on the view that certain activities are inherently more risky than other activities and that these more risky activities should be capitalized at higher levels.

In contrasting the two approaches to measuring bank risk, it should be emphasized that the different measures used do not represent an inherent difference between risk-based capital and risk-based insurance. Indeed, both systems could, in principle, use identical information in assessing the risk of individual banks. The difference between the two systems lies not in what information the regulator collects, nor in how it uses that information to assess bank risk; rather, the difference results primarily because one system controls risk by a ***standard*** and the other by *explicit prices*. In the next subsection, we describe how these differences affect both banks and bank regulators.

Differences Between Risked-based Capital and Risk-based Deposit Insurance

Because one system is based on a minimum standard and the other on a price, a number of differences are likely to exist between risk-based capital and risk-based insurance. One difference is that enforcement of a risk-based capital system is likely to offer the ***regulator more*** *flexibility* and potential for discretion than a risk-based premium system. If an annual insurance assessment appeared on a bank's income statement, and therefore was public, it would be difficult to waive or adjust the fee without alerting competing banks, financial market participants, and the public. Moreover, enforcement would likely be very mechanical. Banks would be assessed a fee, and examiners would have to deal individually only with those banks that could not or would not pay.

However, enforcement of a risk-based capital standard is likely to be of a very different nature. Enforcement might focus only on those firms close to or under the standard, and would likely entail more individual examiner input. Moreover, the judgement of whether or not a bank with a continually changing balance sheet meets the standard—and if not, how long it has to comply—is likely to offer considerable potential for discretion. Thus, in a regulatory environment based on judgement and discretionary supervision and regulation, a risk-based capital standard might be more attractive.

Another difference is that because a risk-based premium system prices risk rather than limiting it by forced capital adjustments, it is likely to offer *banks a more flexible,* and therefore potentially more efficient, means of response. Under a risk-based capital system, a risky bank facing abnormally high capital costs does not have the option of paying the FDIC for the right to take excessive portfolio risk even though this may be its most cost-effective response.[8] This feature is likely to favor a risk-based premium approach under virtually all regulatory environments. It might be argued that banks should not be allowed too much freedom as they may not properly respond to prices. However, this could be accommodated in a risk-based premium system by shutting down banks with excessive risk-taking or by altering their behavior by other supervisory means.

The two proposals are also likely to have significant differences in the amount of information that they reveal to the public. At

6 In addition to imposing capital requirements on various balance-sheet asset categories, the proposal also addresses the risk from off-balance-sheet activities. Capital requirements for those activities are determined by first converting the face-amount of off-balance-sheet items to a balance-sheet equivalent. This is done by multiplying the face amount of the off-balance-sheet contract by an appropriate credit conversion factor. The resulting balance-sheet equivalent is then assigned to one of the five risk categories depending on the identity of the obligator and, in certain cases, on the maturity of the instrument.

7 In addition to the empirical work on predicting problem banks, the literature also suggests that earnings, capital and asset quality measures are important predictors of future bank failure. See J. Bovenzi, J. Marino, and F. McFadden, "Commercial Bank Failure Prediction Models," in Economic Review, Federal Reserve Bank of Atlanta (November 1983) and Robert B. Avery, Gerald A. Hanweck and Myron L. Kwast, "An Analysis of Risk-Based Deposit Insurance for Commercial Banks," *Preceedings* of a Conference on Bank Structure and Competition *(1985),* Federal Reserve Bank of Chicago.

8 Technically, raising capital is not the only adjustment available to the bank as it can adjust any factor used in the regulator's assessment of risk. Thus, the relevant price banks face is the price of the minimum-cost method of meeting the standard. If this price is not equal to the regulator's price, there will be an inefficiency.

most, a risk-based capital standard would reveal only whether or not a bank met the standard. One could not even infer that a bank adding capital was doing so because it had become excessively risky; the extra capital might be needed because of anticipated expansion, etc. However, it would be very difficult to keep a bank's insurance premium confidential. Low-risk banks would have an incentive to advertise this fact and investors would have incentives to identify high-risk banks. This might cause particular problems in the use of confidential data to calculate premiums. Knowledge of a bank's premium could be used to draw strong inferences about values of any confidential inputs used. To the extent that this would deter the use of confidential data in a risk-based premium system, it might mean that risk assessment with a risk-based capital system would be more accurate and therefore fairer.

Moreover, even if confidential data were not used, public disclosure of a bank's premium might create the possibility of bank runs. The official declaration of the FDIC that a bank was risky, even if based on a mechanical calculation from publicly available balance sheet data, might be sufficient to induce significant withdrawals.

Yet another difference between the two methods is likely to occur in the regulatory response lag. Because it is based on a standard, a risk-based capital system may have a built-in response lag that is not present with a risk-based premium system. Under a risk-based premium system, a bank could be required to compensate the FDIC immediately for its risk exposure. In contrast, particularly if it entails raising new capital, adherence to a capital standard would likely entail some lag, thereby delaying the ability of the insurer to control its risk exposure.

Finally, even if the FDIC's assessment rate were adjusted so that it bore equivalent actuarial risk, there may be some differences in the number of bank failures under the two systems. Either system should reduce the number of bank failures from current levels because of the reduced risk-taking that should result when banks are required to bear the full costs of their risk-taking? The magnitude of this reduction, however, may differ for the two systems. As noted earlier, risk-based deposit insurance systems allow banks the flexibility of holding capital levels below those required under a comparable risk-based capital system and of offsetting the higher risk by paying larger insurance premiums. For those banks that opt to hold capital levels below those required under a capital standard and pay correspondingly larger insurance premiums, the incidence of failure would be higher under a risk-based insurance system than that observed under a risk-based capital standard.

By the same token, a risk-based insurance system would provide other banks the flexibility of holding capital levels well above those required under a risk-based capital standard and of being compensated for this increased capital by paying lower insurance premiums. For such banks, the incidence of failure will be lower under a risk-based insurance system than under a capital standard. This difference between the two systems stems from the fact that a capital standard does not reward banks for having capital greater than the minimum standard; a risk-based insurance system provides such a reward in the form of a reduced premium.

The foregoing analysis suggests that, in the aggregate, it is unclear which of the two systems would reduce bank failures by the greatest amount. Prediction of whether an individual bank's capital would be greater under a risk-based capital standard than under a risk-based premium system depends on the cost of capital faced by the bank and upon the degree to which the risk-based insurance system penalizes banks for reductions in their capital. When the cost of raising capital in the private market (or other adjustment methods) is high relative to the penalty rate charged by the deposit insurer for reductions in capital, banks will be more likely to choose lower capital levels under a risk-based insurance scheme than that required under a risk-based capital standard. Conversely, when the insurance system assigns a relatively steep penalty rate for reductions in bank capital, individual banks would be more likely to hold larger amounts of capital under a risk-based insurance system, implying a lower incidence of bank failure.

Despite these differences, if based on the same method of assessing bank risk, proposals for risk-based capital and risk-based insurance should have a similar impact on bank risk-taking. To provide a glimpse as to how such proposals might work, a practical system of risk-based deposit insurance and risk-based capital is developed and presented in the next section. Both proposals are based on the same method of

9 Some critics have charged that a risk-based capital or deposit insurance system might actually increase failures and incentives for risk-taking because regulators would measure risk poorly or misprice it. While this may be true, it should be pointed out that the current system assumes all banks represent the same risk. The relevant question, therefore, is not whether regulators would do a perfect job, but whether they could differentiate among banks at all.

Sample Variable Statistics

Variable	Means of Failed Banks	Means of Nonfailed Banks
KTA	6.14	9.26
PD90MA	3.41	0.77
LNNACCA	3.64	0.57
RENEGA	0.28	0.07
NCOFSA	2.89	0.43
NETINCA	-2.94	0.90

Source: Board of Governors of the Federal Reserve System.

TABLE 3

assessing bank risk. As this represents only part of an on-going effort to develop such systems, we only briefly summarize our work.[10]

II. A Model of Bank Risk

Both the risk-based capital and risk-based insurance premium proposals require an accurate method of assessing bank risk. Forming an index or rank ordering of banks by risk entails two steps. First, variables must be selected that are good predictors of risk; and second, weights must be calculated to transform values of the vector of predictor variables into a single-valued index.

Development of a good index is a substantial task and is well beyond the scope of this paper. It was decided somewhat arbitrarily, therefore, to use the same six predictor variables used by the FDIC in its risk-based insurance proposal (see table 1). One good method of forming weights for the index is to use historical data to "fit" values of the predictor variables to an observable ex-post measure of loss. Candidates for ex-post measures of bank performance might be bank failure and FDIC losses when failure occurs, or bank earnings or loan charge-offs. Although we use other measures of bank performance in other work, for the illustrative proposals developed for this paper it was decided to utilize bank failure. The basic strategy followed was to use historical data on bank failure to estimate weights that could be used to transform values of the six variables listed in table 1 into an index of risk. This index forms the basis of both our risk-based capital and risk-based deposit insurance proposals.

In selecting data used in this study for both estimation and model evaluations, the following specific procedures were used. The sample was restricted to insured commercial banks headquartered in the United States. Mutual savings banks were excluded. Microdata were collected for each bank for each of the five semiannual call and income reports filed from December 1982 through December 1984.[11]

Each of the "calls" represented a potential observation with the following adjustments (thus each bank could appear in the sample five times). Because new banks are thought to follow a different behavioral process, all calls were eliminated whenever a bank had not been in continuous existence for three years at that point. Banks without assets, deposits, or loans were also eliminated. The sample was further reduced by eliminating all banks with assets above $1 billion (approximately two percent of all banks) because of the virtual absence of large bank failures.[12] These adjustments reduced the banks available in December 1984, for example, from 14,460 to 13,388. The actual estimation sample was further reduced by only using 10 percent (randomly selected) of the calls reported by banks that did not fail within a year of the call.

This stratification of the nonfailed banks (which was corrected for in the estimation procedure) was done to create an estimation data-set of manageable size. All calls where the bank failed within a year of the call were used (thus a failed bank could contribute two calls to the sample). The final estimation sample consisted of 6,869 observations, 160 of which represented calls for banks that failed within six months of the call and 138 for banks that failed between six months and a year after the call.

The data used for the study were taken directly from the bank's filed call report, with slight adjustment. June values for the two income variables—charge-offs and net income—were recalculated to reflect performance over the previous year rather than the 6-month period reported. Means of the variables for the estimation data are given in table 3. The data were fit using a logistic model to predict bank failure

10 See Robert B. Avery and Gerald A. Hanweck, "A Dynamic Analysis of Bank Failures," Proceedings of a Conference on Bank Structure and Competition *(1984)*, Federal Reserve Bank of Chicago; Robert A. Avery, Gerald A. Hanweck and Myron L. Kwast, "An Analysis of Risk-Based Deposit Insurance for Commercial Banks," Proceedings of a Conference on Bank Structure and Competition *(1985)*, Federal Reserve Bank of Chicago; and Terrence M. Belton, "Risk-Based Capital Standards for Commercial Banks," presented at the Federal Reserve System Conference on Banking and Financial Structure, New Orleans, Louisiana, September 1420, 1985.

11 More time periods could have been used. However, it was decided to limit the length of the estimation period so that an "out of sample" measure of the model's performance could be computed.

12 The elimination of large banks had virtually no effect on the results,

where a bank was deemed to have failed if it failed within a year following the call. The estimated risk index is:

$$(3)\quad R = -2.42 - .501\,KTA + .428\,PD90MA + .314\,LNNACCA + .269\,RENEGA + .223\,NCOFSA - .331\,NETINCA,$$
$$(3.07)\quad (4.89)\quad (5.16)\quad (4.31)\quad (1.07)\quad (1.60)\quad (2.68)$$

where the logistic form of the model implies that the probability that a bank will fail within a year is,

$$(3a)\quad PROB = \frac{1}{1 - exp\,(-R)}$$

T-statistics for the estimated coefficients are given in parenthesis under each weight.[13] All weights are statistically significant except those for NCOFSA (which has a perverse sign) and RENEGA.[14]

Although the overall fit of the model suggests that predicting bank failure is difficult, the failed banks in the sample had an average predicted probability of failure of 0.24, a number 69 times larger than the average predicted failure probability of nonfailed banks in the sample. Hence, the model clearly does have some ability to discriminate between high- and low-risk banks.

III. Risk-Based Deposit Insurance Premiums

Several somewhat arbitrary assumptions were used to convert the estimated risk-assessment model into a risk-based deposit insurance premium system. First, the FDIC's expected cost of insuring each bank (per-dollar of deposits) was computed as the estimated probability of failure (from the formula in [3]) times the average FDIC loss when failure occurs (13.6 cents/ per dollar).[15] Assessment of this premium, which averaged 7.2 basis points per dollar of deposits in December 1985, would be actuarially fair if there were no monitoring or social costs. Since these factors are not known, and to provide comparability with the current system, an intercept (or flat premium) of 1.1 basis points per dollar of deposits was added to the risk-based assessment so that the total assessment would be equivalent to the FDIC's actual revenues as of December 1985 (with the current flat-rate assessment of 8.3 basis points). While certainly not a necessary ingredient of a risk-based system, the FDIC revenue constraint was adopted in order to allow the concentration of effort and discussion on estimating the risk-based component of the premium while not having to address the issue of what the appropriate level of gross revenues should be. Finally premiums were "capped at 100 basis points because of the belief that premiums above this level would be difficult to collect.

Estimates of December 1985 risk-based premiums under this system are presented in table 4. Premiums are computed across seven asset-size classes of banks (rows [1] through [7]) and six premium-size intervals (columns [1] through [6]). It should be emphasized that while premiums for banks with over $1 billion in assets are computed and reported, these are extrapolations as no banks of this size were included in the sample used to estimate the risk index. Rows (8) and (9) show the premium distribution for banks that subsequently failed in 1986 and 1987 (through September 30), giving an idea of the system's capacity to identify and penalize risky banks. Row (10) and column (7) present totals for all banks. The first number in each cell is the average risk-based premium expressed in basis points of total domestic deposits. The second number is the average estimated (percentage) probability of failure by banks in that cell, and the third figure is the number of banks, based on the total of 13,522 banks used to compute the premium, that are predicted to fall into each size and risk-class category.

The primaty conclusion to be drawn from table 4 is that the risk-based system depicted there would divide banks into three major groups. First, even with the FDIC revenue constraint imposed, the vast majority of banks

13 Coefficients for a logistic model have a less straightforward interpretation that those in regression models. When multiplied by PROB (1-PROB) each coefficient represents the expected change in the probability of failure resulting from a one-unit change in the variable. Thus, if a bank with a probability of failure of 01 raised its capital ratio one percentage point, the model implies that its probability of failure would fall by .045, that is, (-.501 x .1 x .9). Although they were estimated using the same variables, and with data drawn from similar time periods, the coefficients in (3) differ somewhat from those in (1). This occurs, in part, because the FDIC model was estimated using a probit rather than logistic specification, which effects the scaling of the variables (logistic coefficients should be approximately 1.8 times as large). It also stems from the fact that the FDIC used problem-bank status rather than bank failure as a dependent variable.

14 The model's log-likelihood R squared, a concept similar to the R squared in a regression model, is 0.22. The sign on the weight of NCOFSA may be not be as perverse as it appears. The coefficient on charge-offs represents the marginal impact on failure holding net income constant. Because charge-offs are also in net income, they are effectively counted twice. The positive sign on charge-offs indicates they have less impact on failure than other contributory factors toward earnings. The total impact of charge-offs (the sum of the coefficients of NCOFSA and NETINC) has the expected negative sign.

15 This number is the average ratio of the FDIC's loss reserve to total domestic deposits calculated for banks that failed between 1981 and 1984. See Avery, Hanweck, and Kwast "An Analysis of Risk-based Deposit Insurance."

Estimated Commercial Bank Risk-based Premiums — December 1985

(Basis Points of Total Domestic Deposits)

First number is the average premium for banks in the cell. Second number is average estimated probability of failure in percent. Third number is number of banks.

Asset Size Class ($ millions)	Premium Size Class						
	(1) < 8.3	(2) 8.3-12.4	(3) 12.5-24	(4) 25-49	(5) 50-99	(6) 100	(7) All Banks
(1) < $10	2.4	10.1	17.2	32.1	61.6	100.0	6.3
	.1	.6	1.2	2.3	4.5	34.5	1.1
	933.0	29.0	23.0	16.0	9.0	25.0	1035.0
(2) $10 — $25	2.6	10.0	17.2	33.3	68.8	100.0	6.9
	.1	.7	1.2	2.4	5.0	42.7	1.2
	3135.0	109.0	131.0	61.0	44.0	78.0	3558.0
(3) $25 — $50	2.9	10.1	17.1	35.0	70.4	100.0	5.9
	.1	.7	1.2	2.5	5.1	33.6	.7
	3258.0	112.0	105.0	47.0	26.0	54.0	3602.0
(4) $50 — $100	3.1	9.9	16.8	33.9	74.3	100.0	5.9
	.2	.7	1.2	2.4	5.4	35.6	.7
	2485.0	116.0	72.0	29.0	19.0	36.0	2757.0
(5) $100 — $500	3.7	9.8	16.4	32.9	71.7	100.0	5.7
	.2	.6	1.1	2.3	5.2	71.1	.5
	1859.0	85.0	65.0	28.0	7.0	16.0	2060.0
(6) $500 — $1000	4.3	9.3	17.3	29.4	69.7	100.0	7.5
	.2	.6	1.2	2.1	5.0	54.8	.9
	171.0	14.0	9.0	3.0	3.0	2.0	202.0
(7) > $1000	5.1	9.8	15.9	37.7	78.8	0.0	7.0
	.3	.6	1.1	2.7	5.7	0.0	.4
	230.0	60.0	15.0	2.0	1.0	0.0	308.0
(8) Banks failing in 1986	4.8	10.8	17.1	38.1	71.5	100.0	68.7
	.3	.7	1.2	2.7	5.2	51.8	30.1.
	17.0	8.0	9.0	12.0	12.0	75.0	133.0
(9) Banks failing in 1987	4.6	10.2	16.9	32.2	69.8	100.0	37.3
	.3	.7	1.2	2.3	5.1	35.6	9.3
	44.0	11.0	20.0	17.0	9.0	31.0	132.0
(10) All Banks	3.0	9.9	16.9	33.6	69.8	100.0	6.2
	.1	.7	1.2	2.4	5.0	37.4	.8
	12071.0	525.0	420.0	186.0	109.0	211.0	13522.0

Source: Board of Governors of the Federal Reserve System.

TABLE 4

would pay a lower insurance premium under the estimated risk-based scheme than the current gross premium of 8.3 basis points. As may be seen from the table, this is true for all size classes, with the proportion paying less ranging from a low of 75 percent to 90 percent. Overall, 89 percent of all institutions are estimated to pay less with an average premium of 3.0 basis points.

The second group of banks is composed of the 9 percent of all banks that would pay an increased premium ranging from a low of 8.3 basis points to 99 basis points (columns 2 through 5). This range of almost 92 basis points is quite large and appears wide enough both to provide a strong incentive to alter current risk-taking behavior by banks and to deter excessive risk-taking in the future. Some perspective on the size of the estimated risk-based premium is given by noting that the average bank's return on total deposits in 1985 was only 82 basis points. The average bank's premium would have been almost 1 percent of its previous year's total capital, and somewhat over 4 percent of its net income. But in the higher risk categories (columns 4-6), the capital percentages range up to 25.5 percent.

The third group of banks is the one percent that would have been asked to pay an insurance premium of over one percent (capped at 100 basis points) of total domestic deposits in 1985 (column 6 of table 4). For these banks it is not unusual for the average expected cost imposed on the FDIC to exceed 500 basis points. Indeed, the total cost that would have been expected to be imposed on the FDIC in 1986 by the 211 banks in column 6 was $477 million, or 25 percent of the total expected cost of $1.9 billion for all 13,522 commercial banks for which premiums were computed. Clearly, because the size of the assessment might be sufficient, by itself, to force these banks into insolvency, special measures might be needed to deal with them.

The ability of the system to identify risky banks in advance is illustrated by the premiums that would have been charged in December 1985 to banks that subsequently have failed. Over 87 percent of the banks that failed in 1986 would have been required to pay higher premiums than they pay currently, a figure in sharp contrast to the overall figure of 11 percent. Over one-half of the 1986 failed banks would have been assessed premiums at the highest rate of 100 basis points. Figures for banks that failed in 1987 are somewhat less dramatic. Still, 67 percent of 1987 failed banks would have been required to pay higher premiums in 1985, and almost one-fourth would have been placed in the highest risk class.

IV. **Risk-based** Capital

Conversion of the bank failure model estimates into a risk-based capital system was somewhat more complicated than procedures used for the risk-based insurance premium system. To ensure comparability with the current system, it was decided to set a standard so that if all banks held exactly the required capital ratio, the expected losses to the FDIC would be identical to its expected losses under the current system. It was determined that this would occur if each bank in December 1985 were required to hold enough capital so that its probability of failure was 0.7 percent (about 95 expected bank failures per year).

A floor and ceiling were also imposed so that no bank would be required to have a capital ratio of less than 3 percent nor more than 15 percent. This particular standard was chosen in order to make the expected losses to the FDIC of the risk-based capital system as close as possible to the risk-based insurance system outlined in the previous section. Imposition of the 3 percent minimum floor was similar to the addition of an intercept term in the risk-based premium system, and is a tacit admission that any realistic risk-based capital system would have to have a floor. The 15 maximum capital standard is similar to the cap imposed on the risk-based premium.

Solution for the amount of capital each bank would have to hold follows straightforwardly from the estimated risk index. The formula given in equation (3a) implies that a bank with a risk index value of -4.95 would have a probability of failure of precisely 0.7 percent. Equation (3), therefore, implies that the required minimum capital level, KTA^*, must satisfy

$$(4)\quad -4.95 = -2.42 - .501 KTA^* + .428 PD90 MA + .314 LNNACCA + .269 RENEGA - .223 NCOFSA - .331 NETINCA,$$

or,

$$(5)\quad KTA^* = 5.04 + .854 PD90 MA + .627 LNNACCA + .537 RENEGA - .445 NCOFSA - .661 NETINCA,$$

which can be solved for each bank.[16]

Table 5 gives an indication as to how a risk-based capital system might work. It shows the December 1985 distribution of required capital by bank-size class and future failure. Rows (1) through (7) represent banks of increasing size, row (8) shows banks that failed in 1986, row (9) shows banks that failed in 1987 (through September 30), and row (10) shows the sum of all banks. The columns show the number and percent of banks in each size class that would have been assigned to various required capital classes. For each cell, the first number given is the average required capital level for banks in the cell, the second number is the percentage of banks that would have to raise capital to meet the new standard, and the third number is the number of banks in the cell.

The numbers in table 5 suggest several interesting conclusions. Eighty-six percent of all banks would have a risk-based capital assessment below 6.5 percent. A middle group would be required to hold capital ratios between 6.5 and 10 percent; and a small group (3.4 percent of the total) would have to hold capital of over 10 percent of assets. There is an indication that banks with higher risk already hold more capital than required. Thus, almost 92 percent of banks would not have to raise more capital under the risk-based standard. However, there is a small

16 The formula implies that a bank would *reduce* its index value by 0.501 for each percentage point rise in its capital ratio. Thus. a bank with a 5.5 percent capital ratio and a risk index of -3.70 would be required to raise its capital ratio 2.5 percentage points to 8 percent, that is 2.5 = [4.95 - 3.71]/.501. Banks with risk indices below -4.95 would be allowed to divest one percentage point of capital for each 0.501 they were below -4.95.

Estimated Commercial Bank Risk-based Required Capital — December 1985

(Percent of **total assets)**

First number is the average capital ratio for banks in the cell. Second number is percent of banks that would have to raise capital. Third number is number of banks.

Asset Size Class ($ millions)	Required Capital Class						
	(1) < 5.5	(2) 5.5-6.4	(3) 6.5-7.4	(4) 7.5-9.9	(5) 10.0-14.9	(6) 15.0	(7) All Banks
(1) < $10	4.6	6.0	7.0	8.5	11.8	15.0	6.1
	0.0	1.0	3.3	27.7	76.1	84.6	8.5
	529.0	198.0	119.0	130.0	46.0	13.0	1035.0
(2) $10 — $25	4.7	5.9	7.0	8.5	11.6	15.0	5.9
	.1	.9	9.0	50.0	92.9	97.1	10.4
	1936.0	775.0	365.0	326.0	141.0	35.0	3558.0
(3) $25 — $50	4.8	5.9	6.9	8.5	11.8	15.0	5.7
	.2	1.1	14.0	54.0	95.7	100.0	8.3
	2158.0	749.0	336.0	252.0	92.0	15.0	3602.0
(4) $50 — $100	4.8	5.9	6.9	8.4	11.7	15.0	5.6
	.4	3.0	16.7	53.8	90.2	91.7	7.8
	1752.0	535.0	239.0	158.0	61.0	12.0	2757.0
(5) $100 — $500	4.9	5.9	6.9	8.3	11.7	15.0	5.5
	.1	4.0	24.1	69.8	100.0	100.0	7.2
	1366.0	448.0	116.0	96.0	31.0	3.0	2060.0
(6) $500 — $1000	4.9	5.9	6.9	8.7	10.9	15.0	5.5
	1.5	10.8	27.8	100.0	100.0	100.0	10.4
	137.0	37.0	18.0	6.0	3.0	1.0	202.0
(7) > $1000	5.0	5.9	6.8	8.6	10.2	0.0	5.4
	3.1	29.0	47.4	100.0	100.0	0.0	15.3
	191.0	93.0	19.0	4.0	1.0	0.0	308.0
(8) Banks failing in 1986	4.6	5.9	7.1	9.0	12.4	15.0	11.5
	0.0	33.3	53.3	86.4	98.1	100.0	86.5
	5.0	3.0	15.0	22.0	54.0	34.0	133.0
(9) Banks failing in 1987	5.0	6.0	6.8	8.8	12.1	15.0	9.2
	9.1	16.7	21.0	75.5	96.7	72.7	61.4
	11.0	12.0	19.0	49.0	30.0	11.0	132.0
(10) All Banks	4.8	5.9	6.9	8.4	11.7	15.0	5.7
	.3	2.9	13.7	51.1	91.7	94.9	8.8
	8069.0	2815.0	1212.0	972.0	375.0	79.0	13522.0

Source: Board of Governors of the Federal Reserve System.

TABLE 5

group that would have to raise a substantial amount of additional capital. The efficiency of a risk-based system is evident from the fact that aggregate bank capital would be reduced by 18 percent from the actual December 1985 total, yet expected FDIC losses would be exactly the same as under the current system. This happens because the risk-based system shifts capital to those banks most likely to fail.

The evidence of the banks that failed in 1986 and 1987 is particularly telling. All but 18 of the 133 banks that failed in 1986 would have been required to raise additional capital in December 1985. *As* a group, these banks would have been required to almost double their aggregate capital. Over 60 percent of the banks that failed in 1987 would have been required to raise additional capital and over 90 percent would have been assigned a capital ratio above the current standard.

V. Final Comments

The systems presented here are meant to be illustrative and would probably require substantial modification before they could be actually implemented. They do show, however, that both risk-based capital and risk-based insurance systems could be constructed that discriminate between banks in a way that would likely affect behavior.

The similarities between the distribution of banks shown in the tables summarizing the proposals is striking. This, however, should not be surprising since both systems are based on the same risk measure. Indeed, if we had arrayed banks by the amount of new capital they would have to raise, instead of by required levels, the rank orderings of banks in the two systems would have been identical. They differ in the arrangements shown only because some banks that would otherwise have higher risk hold more capital than required under the current system, and thus, would reduce their premiums.

This does not mean that the two systems would have identical impacts on bank behavior or on overall system risk As argued earlier, the regulatory environment surrounding each system is likely to differ. If banks face prices for risk in the capital market different from those charged by the FDIC, there will be inefficiencies in a risk-based capital standard that could produce different levels of system risk.

The incentives for banks to alter their risk-taking activities are very likely to differ between the two systems. It is not clear, however, that the impact of such differences would be major. Both systems share a common basis in the principle of differentially regulating banks according to the risk they represent to society. Implementation of either type of system is likely to lead to significant progress in the battle to control bank risk.