A Study of the Desirability and Feasibility of a Risk-Based Deposit Insurance Premium System

A report pursuant to Section 220(b)(1) of the Financial Institutions Reform, Recovery, and Enforcement Act of 1989, submitted to the United States Congress by the Federal Deposit Insurance Corporation.

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CONTENTS

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EXECUTIVE SUMMARY

All depository institutions that are insured by the Federal Deposit Insurance Corporation (FDIC) are assessed at a flat rate for their deposit insurance coverage and share proportionately in any premium rebates.[1] As a result, deposit insurance rates do not vary with the level of risk that a depository institution poses to the insurance fund. Due to the record losses of the commercial bank and savings and loan insurance funds during the 1980s, and the subsequent increased assessment rates, the implications of flat-rate deposit insurance assessments are being given greater scrutiny.

The system of flat-rate premiums has been criticized because it provides an inducement for a bank or thrift to increase its portfolio risk without incurring any additional insurance premium expense. Moreover, it is argued that flat-rate premiums subsidize "high-risk," poorly managed institutions at the expense of the well-run institutions. These considerations support a system in which institutions which pose a greater risk to the FDIC fund would be assessed a higher insurance premium than would lower-risk institutions.

Section 220(b)(1) of the Financial Institutions Reform, Recovery, and Enforcement Act of 1989 (FIRREA) requires the FDIC to study the establishment of premium assessment categories related to types of risk to the insurance funds and report its recommendations to Congress by January 1, 1991. Many proposals have been offered to date on risk-based deposit insurance assessments. These proposals can be broadly categorized into two groups: (a) those using market information to assess risk, e.g., private reinsurance, and (b) those using non-market information to assess risk, e.g., an adjusted capital approach.

Deposit insurance premiums have been assessed at a flat-rate since the inception of federal deposit insurance in 1933. However, risk-based deposit insurance has been a recurring subject of study and debate. In the 1983 study, Deposit Insurance in a Changing Environment, risk-based deposit insurance was examined as part of a comprehensive study of deposit insurance reform. The study concluded that, in spite of the difficulties associated with the assessment and pricing of risk, the development and eventual implementation of a system based on reasonably sound measures of

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[1]Please refer to Chapter One, footnote 2, for a review of recent developments regarding deposit insurance assessments.

risk, e.g., capital levels, should be pursued. Risk-based deposit insurance was again examined in 1986 when the FDIC considered a system of risk-based premiums based on bank performance, as measured by the data available on each bank's operations and condition. A subsequent study, Deposit Insurance for the Nineties, provided further support for risk-based premiums. Finally, in this study, the FDIC's current position on risk-based premiums is presented.

In the study that follows this Executive Summary, Chapter One reviews the conceptual framework of deposit insurance pricing, examining several pricing issues as well as several alternative methods for establishing risk-based deposit insurance. Chapter Two develops a proposal for risk-based deposit insurance which employs an adjusted capital approach. Chapter Three presents the study's conclusions.

There are many proposals for the pricing of deposit insurance that merit consideration, and this report is not intended to preclude any of these options. One example is the Adjusted Capital approach discussed in Chapter Two of this report. An alternative approach would involve private insurance companies in the pricing decision by means of reinsuring a portion of the risk for individual insured banks (viz., a pricing approach along the lines of that contained in legislation that is being sponsored by Senator Dixon (Ill.) -- S. 3040). A summary of the Adjusted Capital and Reinsurance approaches to deposit insurance pricing are presented below, followed by the study's conclusions.

Risk-based Premiums: Adjusted Capital Approach

An adjusted capital approach to risk-based premiums would use a depository institution's capital-to-asset ratio, adjusted for some performance measure(s), as the basis for its deposit insurance premium. In the proposal that follows, an adjustment to capital is constructed which measures the extent to which a bank's actual loan-loss reserves differ from a target level of reserves, where the target level is measured as some percentage of its stock of assets that are not performing according to the stated terms of their contracts (i.e., noncurrent assets).

Holding other things constant, if allowances for losses are insufficient relative to a bank's noncurrent assets, then its unadjusted capital measure will be an inflated (or overstated) measure of its solvency position. Similarly, if allowances are more than sufficient, then its unadjusted capital measure will understate its solvency position. With the adjusted capital approach, an institution's core capital would be adjusted upward or downward by the amount by which its capital measure is estimated to be understated or overstated. Therefore, this approach offers a more accurate picture of an institution's risk to the insurance fund, and so, forms the basis for premium differentials among insured institutions. This approach, in part, will compensate the FDIC fund for those risks which are not sufficiently capitalized by the banking industry and reward insured institutions for holding more core capital.

The adjusted capital-to-asset ratio (i.e., adjusted capital ratio) can be written as:

$$\text{Adjusted Capital Ratio} = \frac{\text{Capital - Adjustment Factor}}{\text{Total Assets}}$$

The individual components of the Adjusted Capital Ratio are defined as follows.

Capital: This is the Tier 1 (or Core) Capital measure as defined under the risk-based capital rules.

Adjustment Factor: The capital adjustment factor is the amount by which a bank's current level of reserves falls short of (or exceeds) a target level of reserves. In particular, the adjustment factor is equal to:

Target Loan-loss Reserves - Current Total Loan-loss Reserves.

Target Reserves is a measure of the expected total charge-offs for an institution, given its stock of noncurrent assets. Target Reserves is set as a percentage -- Z -- of an institution's stock of noncurrent assets (where Z is established either through the statistical relationship between charge-offs and noncurrent assets for the banking industry or a supervisory rule of thumb regarding this relationship). Therefore, Target Reserves is equal to:

Z * (Noncurrent Assets).

For example, if the target level of reserves is above the current level of reserves (which means that the bank has reserved too little relative to its stock of noncurrent assets), then this difference is the adjustment factor and is deducted from the bank's capital level to form an adjusted capital level.

Total Assets: This is defined as the sum of an institution's net balance-sheet assets and the balance-sheet equivalent value of its off-balance-sheet assets. Thus, Total Assets includes both balance-sheet and off-balance-sheet assets.

Risk-based Premiums: Reinsurance Approach

The reinsurance approach is an integrated system of public and private insurance that is intended to determine a market price for each bank's deposit insurance. The market price results from a competitive bidding process among qualified reinsurers. This is largely the approach that is taken in Senator Dixon's proposed legislation -- "Deposit Insurance Reform Act of 1990" (S. 3040). The relevant aspects of this bill are summarized below.

Basic Concept -- create a risk-sharing system, based on the reinsurance approach, under which the FDIC purchases coverage for 10 percent of its risk that a covered depository institution will fail from qualified private reinsurers. The FDIC bases the premium it assesses the covered institution on the risk-based price set by the reinsurer.

Covered Depository Institutions -- the reinsurance approach is designed explicitly for large banks and thrifts defined as follows:

(i) a bank or thrift that is part of a bank or S&L holding company with over $1 billion in assets;

(ii) a bank or thrift that is not part of a holding company, but that has over $1 billion in assets; and

(iii) any smaller bank that either directly or through a holding company is exercising insurance, security, real estate, or investment powers.

Banks and thrifts that do not qualify as a "covered" institution under (i), (ii) or (iii) would be subject to a simplified, partial risk-based premium system.

Eligible Reinsurers -- any qualified insurance company. Bank holding companies would be permitted to establish insurance affiliates to offer this coverage with the proviso that they could not reinsure affiliated banks. The FDIC would establish financial criteria which all reinsurers would have to meet to become and remain eligible (minimum capital requirements, etc.).

Establishing a Risk-based Premium -- the FDIC would not negotiate with eligible reinsurers. Instead, a market-based premium would be established through institutions' negotiations with the reinsurers. The FDIC's premium would be based on the price established in the negotiation. The FDIC could adjust its premium so that the total revenue flowing to the FDIC is sufficient to maintain the insurance fund target reserve.

Risk-based Premium Contract Terms -- insurance contracts would be for a maximum period of two years. ~~However, the~~ reinsurer would have the ability to adjust the premium rate charged on a quarterly basis (monthly, if the covered bank was below the regulatory capital minimum), subject to an appropriate cap. However, four consecutive maximum premium increases (or two quarters) would trigger an option with the covered bank to terminate coverage with one reinsurer and obtain coverage with another reinsurer.

Recommendations

(1) The FDIC should be given the authority to levy risk-based premiums. A risk-based deposit insurance premium system is not a panacea for the problems facing the banking system, and cannot serve as a substitute for supervision and adequate capital. Nevertheless, a risk-based premium system would mitigate the subsidy to "high-risk" institutions provided by "low-risk" institutions, and it would give all insured depository institutions a financial incentive to control risks.

(2) The FDIC would seek comments on a number of proposals for the pricing of deposit insurance, including capital-based and reinsurance approaches.

(3) The FDIC would not implement a risk-based premium plan until the FDIC has received comments from all interested groups regarding the plan, and until the plan has been coordinated with the other bank regulatory agencies and the Administration.

(4) The FDIC recognizes that any risk-based premium system could create additional hardships for insured depository institutions that are in financial trouble because these institutions may be required to pay higher insurance premiums at a time when they can least afford it. It is important that this not lead to higher insurance losses, thus partially defeating the purpose of risk-based premiums.

(5) Implementation of a risk-based premium system must be coordinated with other reforms to the deposit insurance system, and options should be evaluated in the context of the proposals made in the Treasury Study of the system.

CHAPTER ONE

CONCEPTUAL FRAMEWORK FOR RISK-BASED PREMIUMS

I. Introduction

One facet of the current debate on deposit insurance reform concerns the desirability and feasibility of a risk-based deposit insurance system. Under such a system, the deposit insurance assessment would be related to the degree of risk which an insured institution poses to the deposit insurance funds administered by the FDIC. The question whether to revise the current system of flat-rate deposit insurance premiums in favor of a risk-based system is not new.[1] However, the losses incurred by the deposit insurance funds for thrifts and commercial banks over the past decade have given this issue a new sense of urgency.

Under the current flat-rate deposit insurance system, all FDIC-insured depository institutions are assessed at a flat rate for their deposit insurance coverage and share proportionately in any premium rebates.[2,3] As such, these premiums are invariant to the level of risk that a bank poses to the insurance funds.[4] The system of flat-rate premiums has been criticized on the grounds that it encourages excessive risk-taking by insured institutions and that it inequitably distributes the burden of insurance losses among banks. The current flat-rate system allows a bank to increase the risk in its portfolio without incurring any additional insurance premium expense. Moreover, it is argued that "high-risk" institutions are receiving a subsidy on their deposit insurance coverage at the expense of "low-risk" institutions under the current system. These considerations would support a system in which institutions with riskier portfolios would be assessed a higher premium for their deposit insurance coverage than would the more conservatively run institutions.

Thus, it is argued that a system of risk-related premiums could alleviate some, if not all, of the subsidies and inequities associated with the current flat-rate system. If so, risk-related premiums would represent a substantial step toward a more equitable and efficient banking system. However, it also must be determined whether it is possible to design a risk-based system that will be both desirable and feasible. That is, the insurer must not only be concerned with how well an insured institution's risk to the insurance fund can be measured, but also whether such a risk-based system can be implemented in a practical manner.

Deposit insurance premiums have been assessed at a flat rate since the inception of federal deposit insurance in 1933. However, risk-based deposit insurance has been a recurring subject of study and debate by the FDIC. In the 1983 study, Deposit Insurance in a Changing Environment, risk-based deposit insurance was examined as part of a comprehensive study of deposit insurance reform. The study concluded that, in spite of the difficulties associated with the assessment and pricing of risk, the development and eventual implementation of a system based on reasonably sound measures of risk, e.g., capital, should be pursued. Risk-based deposit insurance was again examined in 1986 when the FDIC considered a system of risk-based premiums based on bank performance, as measured by the data available on each bank's operations and condition. A subsequent study, Deposit Insurance for the Nineties, provided further support for risk-based premiums. Finally, in this study, the FDIC's current position on risk-based premiums is presented.

The purpose of this chapter is to examine the conceptual framework of deposit insurance pricing. First, several important issues concerning deposit insurance are considered. Next, an overview of several alternative methods for establishing risk-based deposit insurance is presented, followed by a discussion of the advantages and disadvantages of these approaches to the so-called "pricing-problem."

II. Issues Regarding the Pricing of Deposit Insurance

A. Mispricing and Risk-Taking

A deposit insurance pricing policy that fails to account for the risk that an insured institution poses to the insurance fund potentially has two undesirable effects for the deposit insurance system as a whole--the cross-subsidization from low-risk to high-risk banks and increased risk-taking by banks.

Premiums as a Subsidy or Tax. The provision of a credible guarantee to pay off depositors in the event of a bank's insolvency allows insured institutions to attract deposits at a risk-free rate, or at some rate less than the proper risk-adjusted rate. This guarantee, absent any deposit insurance premium, gives insured institutions a competitive advantage over uninsured institutions. Thus, the deposit insurance premium can act as a subsidy or tax, depending on whether the deposit insurance premium is below or above the risk premium that creditors would demand were the bank an uninsured provider of financial services. In the case where deposit insurance premiums act as a subsidy, the mispricing could induce growth among those riskier banks that would come at the expense of uninsured providers of financial services. Conversely, in the case where insurance premiums act as a tax, those affected banks would be at a competitive disadvantage relative to uninsured institutions.

<u>Moral Hazard</u>. Mispriced deposit insurance most often is discussed in terms of its implications for the risk-taking behavior of depository institutions. The current flat-rate system has been alleged to create incentives for banks to increase their portfolio risk. Market participants are normally confronted with a risk-return trade-off: higher yields can only be obtained at the expense of greater risks. In the absence of deposit insurance, the gains that stockholders may realize from moving to riskier positions would be limited by depositors, who would demand additional compensation for increased risk-taking by the bank.

However, with deposit insurance, insured depositors no longer require risk premiums commensurate with the level of risk since their investment is safe and, under a flat-rate premium structure, banks' insurance costs will be the same regardless of their risk position. As a result, banks may take on additional risk without having to pay higher interest rates on deposits or higher insurance premiums. The risk-return trade-off has been altered such that the price of assuming greater risk has been reduced and, consequently, the bank has an incentive to move to a riskier position. In the context of deposit insurance, this is often referred to as the "moral hazard" problem.

Thus, there are two aspects to the mispricing of deposit insurance. First, deposit insurance may act as a subsidy or tax, in which case an insured institution will be at a competitive advantage or disadvantage relative to uninsured institutions. Second, the flat-rate pricing system provides incentives toward greater risk-taking, with the result that some risky investment projects might be funded with insured deposits that may not otherwise have been undertaken. As a consequence, bank failures are likely to be more numerous and more costly than if insurance prices varied with the level of risk.

B. Countervailing Factors

There are aspects of the bank regulatory structure, apart from the pricing of deposit insurance, that can limit the degree of risk-taking by insured institutions (*i.e.*, the moral hazard problem).

Market Discipline. To the extent that uninsured liabilities are at risk, these debt-holders will exert some discipline on bank risk-taking. In addition, the owners (including stockholders) of an institution have an important stake in its survival. Provided that they have invested sufficient capital and are sufficiently averse to risk, owners will place limits on management's risk-taking activities. Thus, even under the current flat-rate system, the market discipline imposed by uninsured creditors and owners can limit the risk-taking behaviors of institutions.

Regulatory Discipline. In practice, risk-taking also is limited by other costs, in addition to the statutory premiums that banks incur under the current system. The provision of deposit insurance requires that insured institutions submit to federal supervision and regulation. Regulators periodically examine banks to determine if they are being operated in a safe-and-sound manner, and undesirable behavior is penalized through issuance of cease-and-desist orders, removal of bank officers or directors for certain violations, and the levying of fines. In addition, regulations prevent insured institutions from engaging in certain financial activities and set minimum capital requirements. These regulations and supervisory sanctions limit the ability of some banks to engage in overly risky activities and they represent an implicit cost of deposit insurance. To the extent that these implicit costs vary with the riskiness of the bank, they act as a system of risk-related premiums and constrain risk-taking.

C. General Problems in Pricing Bank Risk

The pricing of bank risk is problematic for the insurer primarily because of the difficulty in accurately measuring the risk that each bank poses to the insurance fund.

Ex Ante vs. Ex Post Risk. Nearly all insurance settings are characterized by asymmetric information concerning the insured's risk type, i.e., the insured possesses better information about his or her risk type than does the insurer. For example, automobile drivers know their own driving patterns and behavior better than the insurer and, if they were honest with themselves, could better assess their own risk than could the insurer. However, high-risk drivers have incentives to hide their true risk characteristics and to pose as low-risk types. In order to overcome this problem, insurers attempt to bridge the information gap by using actuarial information to make judgments about a driver's risk type based on age, sex, etc.. This type of information about the insured's riskiness can be gathered by the insurer prior to any outcomes that are covered under the insurance contract being observed. This is referred to as ex ante information. In addition, the insured's driving record (traffic tickets, accidents, etc.) can be used to obtain information about the driver's risk type. This information is available to the insurer only after outcomes that are covered under the insurance contract are observed, and is referred to as ex post information. Of course, even with this information the insurer will not know the driver's true risk type with certainty.

Although automobile insurance differs from deposit insurance in many respects, the example helps to illustrate the general problems associated with asymmetric information. Just as in the case of drivers, banks possess more information about their risk type than does the FDIC. Moreover, determining a bank's risk type ex ante is arguably more difficult than in most insurance settings. A major function of banks is to assess the risks of lending to idiosyncratic borrowers (i.e., borrowers who are obtaining credit for information-intensive projects). For many of these borrowers, public information on their economic condition and prospects is so limited and expensive that the alternative of issuing marketable securities is not economically viable.[5] Thus, banks specialize in obtaining information about the very events, i.e., credit risks, that are most likely to result in a loss to the insurer. Because of this specialized knowledge, the ex ante information gap between the insurer and the insured is perhaps larger than in most other insurance settings.

Adverse Selection. Asymmetrical information regarding the insured's risk type results in two problems common to insurance settings: the problem of controlling the insured's risk-taking once insurance is granted (i.e., the moral hazard problem) and the problem of correctly classifying a client's risk type (sometimes referred to as the adverse-selection problem).

The insurer can reduce the adverse-selection problem by obtaining more information about the client. Of course, the benefits of greater information, such as more appropriately priced insurance, would have to be weighed against the costs of additional resources needed to obtain information.

Another solution to the adverse-selection problem is to offer incentive-compatible contracts.[6] For example, automobile insurers offer varying amounts of deductible insurance in combination with different premium rates. If a driver feels that he or she is a particularly safe driver, he or she probably will opt for a relatively high-deductible, low-premium contract, and vice versa for a high-risk driver. By allowing insurance contracts to vary by more than one characteristic, for example, price and coverage, the incentive-compatible contract is designed to induce insureds to signal their true risk type.

An incentive-compatible deposit insurance contract could involve offering banks the choice of various price/capital combinations. Banks that choose higher capital levels would pay lower insurance premiums, and vice versa. The idea is that obtaining additional capital would be less expensive for low-risk banks than for high-risk banks. Thus, low-risk banks would prefer to select a high-capital/low-premium combination, while the opposite would be true for high-risk banks. The goal would be to adjust the price/capital combinations so that the long-run revenues of each risk category would be sufficient to cover long-run costs. In doing so, each risk category could be assessed an actuarially fair premium and cross-subsidization between risk classes would be eliminated.

In banking, the difficulty for the insurer is determining when the revenues of any particular category are sufficient to cover expected costs. In casualty insurance, this is relatively easy since the events being insured against are independent events that are fairly evenly distributed over time. As a result, an automobile insurer will learn in rather short order whether the premium revenues are sufficient to cover the long-run costs of any risk category. However, bank failures are not evenly distributed over time. Instead, they tend to be associated with the business cycle or economic shocks. In this environment, adjusting the price/capital combinations so that the long-run revenues are sufficient to cover the long-run costs of each risk category would be a more difficult process.[7,8]

Monitoring the Insured. After granting insurance, the insurer must guard against the client taking actions that increase the insurer's potential loss. The moral hazard problem will vary depending on the extent to which the insured has incentives to take actions that increase his or her risk and the extent to which these actions are unobservable by the insurer.

In many insurance settings, moral hazard is controlled by making the insurance payout contingent on the insured party acting in a specified manner. For example, an insurance company will not pay off on fire damage if the insured party commits arson. However, payouts to depositors contingent on bank behavior would not be feasible, since it would reintroduce the problem of bank runs. Alternatively, the moral hazard problem may be dealt with by monitoring bank behavior, e.g., through examinations, and imposing penalties on managers and owners when undesirable behavior is observed.

III. Proposals for Risk-Based Premiums

There is widespread acceptance that a flat-rate premium structure, by itself, creates perverse incentives toward greater risk-taking and penalizes more conservatively run institutions. There is less agreement whether a more explicit risk-related pricing system could be developed that would be a significant improvement over the current system. A number of proposals for establishing risk-related premiums have been made; each has some advantages and disadvantages when compared to the current system. These proposals generally can be categorized into those that try to incorporate the market's assessment of bank risk and those that rely on the public insurer's assessment of risk.

A. Market-Based Risk Assessments

One line of argument states that the pricing of deposit insurance could be improved if deposit insurance was assessed at a rate equivalent to the risk premium required by the market for bearing the same amount of risk in the absence of a federal guarantee. More specifically, whether an accurate measure of this market-based risk premium can be obtained will determine, in large part, the success of this pricing method. Several methods that rely on the use of market information to price deposit insurance are found in the literature. The risk premium required by the market on uninsured deposits has been suggested as one such measure. As well, integrated systems of public and private insurance and option pricing theory have been advanced as methods of replacing the governmental pricing of deposit insurance with market-based risk assessments.

Interest Rates on Uninsured Deposits. Because deposit insurance provides explicit coverage for deposits of $100,000 or less, leaving uninsured those deposits greater than $100,000, it has been proposed that deposit insurance premiums could be determined from the market rates paid on uninsured deposits (Peltzman (1972), Thompson (1987)). Fundamental to this approach is the idea that depositors will demand a risk premium if they perceive that their uninsured deposits are at risk. Since depositors could place their uninsured funds in an alternative investment with the same level of risk, such as a money market or bond fund, there should exist a similar risk premium with either investment option.

Thompson (1987) shows that under certain conditions the market's estimate of the fair-value of deposit insurance can be observed and can be used to provide, at a minimum, a benchmark or lower bound for the fair-value premium. Specifically, if banks are closed when they are found to be insolvent and if uninsured depositors bear their full share of losses, then the fair value of deposit insurance can be determined. This result is based on conditions that are somewhat restrictive, assuming, among other things, efficient, frictionless markets and the issuance of unconditionally uninsured deposits, namely deposits not covered by the federal insurer in the event of failure.[9]

In practice, this approach is limited by the existence of market imperfections. Notably, investors may perceive that large banks will not be allowed to fail. This expectation of de facto coverage for uninsured deposits may obviate the need for uninsured depositors to demand an appropriate risk premium, especially in the case of large banks. As well, to the extent that the market for bank deposits is less than perfectly competitive, market imperfections will be reflected in the rate differential between insured and uninsured deposits. That is, in addition to differences in risk, other factors will be included in the rate differential that will cause it to differ from its desired level. As an example, the FDIC currently assesses premiums against both insured and uninsured deposits. The extent to which banks pass this cost on to uninsured depositors will be reflected in the rate differential. That is, banks would pay less than the full risk premium to their uninsured depositors. Also, if insurance premiums were based on the market rates paid on uninsured deposits, riskier banks would have an incentive to parcel large, otherwise uninsured, deposits into multiple insured accounts. As a result, the observed risk premiums would not reflect the full range of bank riskiness (that should be captured in a risk-based deposit insurance assessment).

Given _de facto_ coverage of uninsured deposits and the presence of market imperfections, it is likely that the rate paid on uninsured deposits will not be an accurate measure of the desired risk premium. As well, it may be both impractical and impracticable to isolate the "true" premium, _i.e._, the risk factor, from the rate differential that is observed.[10]

Integrated Systems of Public and Private Insurance. Some combination of public and private insurance has been suggested as a way to overcome the shortcomings associated with purely public or private deposit insurance systems.[11] This integration of public and private sectors creates an insurance structure in which the comparative advantages of government and the marketplace are utilized -- the government's ability to handle externalities and the market's ability to assess and price risk. In order to achieve this goal, the integrated system must be structured so that the private insurers face the same risks as does the federal insurer. Specifically, losses must be shared on a _pro rata_ basis.

Coinsurance and reinsurance schemes are two approaches to this integration.[12,13]

Under one such proposal (Baer (1985)), production and pricing would be separated in a coinsurance scheme. Government would determine which classes of deposits are to be insured and would provide most of the insurance coverage. Private insurance companies would bid for the right to directly insure the remaining portion of those deposits. The bidding process among private insurers would determine the deposit insurance premium that would be assessed on deposits insured by the public and private insurer alike. Private insurers would be required to fully collateralize their maximum loss exposure with short-term Treasury securities. This collateral (or 100 percent reserve) is intended to guarantee the private insurer's solvency and, in turn, eliminate insured depositor runs and reduce the private insurer's incentive to gamble on the bank's recovery. Some terms of the private insurance contract, such as the risk premium, could be renegotiable, however, a non-cancellation clause would prohibit the private insurer from cancelling a contract unless the insured bank was able to find an alternate carrier. In the event that none is found, the bank would be declared insolvent and sold by the insurer at auction to the highest bidder.

More recently, the use of private reinsurance has been suggested as a way of integrating the respective abilities of the public and private insurers. As under a coinsurance scheme, deposit insurance pricing would be based on a market assessment of risk, determined in this case by private reinsurers. For some subset of insured banks, the public insurer would reinsure (i.e., purchase insurance coverage for) a small portion of its risk that a covered bank would fail. The premium charged the public insurer by the reinsurer for this risk-sharing would form the basis for the public insurer's deposit insurance premiums.

An example of the reinsurance approach to deposit insurance pricing can be found in Senator Dixon's proposed legislation, the "Deposit Insurance Reform Act of 1990" (S. 3040). While this bill addresses deposit insurance reform issues other than pricing, the following comments focus on the pricing aspects of the proposed legislation.

The basic concept is to create a risk-sharing system under which the public insurer (FDIC) reinsures with a qualified private insurer ten percent of its risk that a covered depository institution will fail. In effect, this procedure elicits a "market price" on which the covered bank's total premium assessment can be based.

The reinsurance approach is designed explicitly for large banks and thrifts. In the proposed legislation, covered depository institutions are defined as follows: (i) a bank or thrift that is part of a bank or S&L holding company with over $1 billion in assets; (ii) a bank or thrift that is not part of a holding company, but that has over $1 billion in assets; and (iii) any smaller bank that either directly or through a holding company is exercising insurance, security, real estate, or investment powers. Banks and thrifts that do not qualify as a "covered" institution as defined above would be subject to a simplified, partial risk-based premium system.

Eligible reinsurers are defined as any qualified insurance company. Eligibility criteria for qualified private reinsurers would be established by the public insurer (subject to state insurance laws). In order to help insure adequate capacity, bank holding companies would be allowed to establish insurance affiliates for reinsurance purposes with the proviso that affiliated banks could not be reinsured.

In order to determine the reinsurance premium, covered banks would negotiate directly with qualified private reinsurers for coverage of ten percent of their risk of failure. In turn, the private reinsurer would bill the FDIC for the reinsured risk. The FDIC then can use this price as a basis for the covered bank's entire premium, (including the 90 percent of the risk that is not being reinsured). The FDIC could also adjust its part of the premium so that the total revenue flowing to the FDIC is sufficient to maintain the insurance fund target reserve.

Reinsurance agreements would have a maximum contract length of two years, and would include an allowance for periodic premium adjustments. Specifically, the reinsurer would have the ability to adjust the premium rate charged on a quarterly basis (monthly, if the covered bank was below the regulatory capital minimum), subject to an appropriate cap. However, four consecutive maximum premium increases (or two quarters) would trigger an option with the covered bank to terminate coverage with one reinsurer and obtain coverage with another reinsurer.

The integration of public and private insurance attempts to bridge the gap between a purely private or purely public insurance system. It incorporates the private sector into the pricing and monitoring aspects of deposit insurance and places an independent source of private capital at risk. The success of such a system could result in better pricing and earlier detection of problems. However, its implementation may present practical difficulties. There may be problems involved in governmental monitoring of a large group of private insurers. There may be instances where the objectives of the public insurer may conflict with those of the private insurer, particularly in the areas of closure and failure resolution policies. The extent to which private insurers would be willing to provide such insurance under terms consistent with public policy objectives is unclear. Overall, an integrated approach, particularly the reinsurance approach, deserves further investigation and study.

<u>Option Pricing</u>. Option pricing theory has been suggested as a method of determining the value of deposit insurance to a bank. In this literature, an analogy is drawn between deposit insurance and a put option. Options, as financial contracts, have been popular because they confer on the holder the right, but not the obligation, to buy or sell specified property at a fixed price and on or until some fixed future date. There are two basic types of option contracts. The call option gives the holder the right to buy an asset at a specified price, called the exercise or strike price, on some future date. The put option, in contrast, gives the holder the right to sell an asset at the exercise price on some future date.

The value of the put option at maturity depends on the current value of the underlying asset relative to the contract's exercise price. If, at the option's expiration or maturity date, the asset price is greater than the exercise price, the option is not worth exercising and therefore the value of the option is zero. In this case, the put is termed "out-of-the-money." However, if the asset price is less than the exercise price, the option is termed "in-the-money." It will be exercised, since the asset can be sold at a price that is greater than the asset's current market value. The option holder will realize a profit equal to the difference between the exercise price and the asset price. Therefore, the value of the put option at maturity is equal to the maximum of the difference between the exercise price and the asset price, or zero.

Similarly, the value of an option prior to its maturity or expiration date will depend on the probability of the option being in-the-money.

The option pricing framework posits that, in purchasing deposit insurance, the bank has purchased a put option, and has the right to sell, or put, its assets at a price equal to its insured liabilities. If the value of the bank's assets falls below the bank's obligations to insured depositors, the insurer will appropriate the bank's assets and, in turn, protect insured depositors. This option to put its assets to the insurer at a price equal to the value of the bank's insured liabilities has value to the bank because it makes insured deposits perfectly safe and allows the bank to attract deposits at a risk-free rate.[14]

Merton (1977) was the first to suggest that option pricing theory could be used to determine the value of deposit insurance to a bank. Using the option pricing framework developed by Black and Scholes (1973), Merton derives an option pricing formula for valuing deposit insurance. When the option pricing framework is applied to the problem of pricing deposit insurance, the relationship between the value of the put, which represents the value of deposit insurance to the bank, and the probability of insolvency is underscored. Notably, changes in the capital position of the bank lead to changes in the value of the deposit insurance contract. For example, if the value of the bank's assets were to decrease relative to the value of its liabilities, the value of the put and deposit insurance to the bank's owners would increase. Similarly, an increase in the variability or volatility of the bank's return on assets would increase the probability of insolvency which would be reflected in an increase in the value of the put and deposit insurance to the bank's owners.[15]

The feasibility of using option pricing theory to price deposit insurance depends on the ability of the insurer to adequately measure the return volatility of bank assets in a timely manner. This requires considerably more information than is available for most banks and, therefore, would be difficult to implement for most institutions.

B. Nonmarket-Based Risk Assessments

When it is not possible or when it is undesirable to utilize the market's assessment of bank risk, the federal insurer would be left with the task of developing its own method(s) for assessing risk. An important distinction among the nonmarket approaches is whether they measure risk in an *ex ante* or *ex post* fashion. The former attempts to measure the inherent risk of banking activities regardless of the institution's current performance, while the latter measures risk after it has materially affected the performance of the institution. While *ex ante* measures are conceptually preferable, most proposals have used _ex post_ measures due to the difficulty of measuring risk _ex ante_.

Asset Risk Baskets. This approach attempts to measure risk in an _ex ante_ fashion by classifying assets into broad categories according to their perceived credit risk and attaching risk weights to these categories. This is the approach taken under the risk-based capital guidelines that have been approved by the bank regulatory agencies. Under the risk-based capital rules, a bank is required to hold capital against the total risk-adjusted stock of assets (including off-balance-sheet assets). For example, any commercial loan on a bank's balance sheet carries a risk weight of 100 percent. This means that the risk-adjusted stock of a bank's commercial loans would be equal to 100 percent times the book value of its commercial loans. In the same way, other assets categories (with their own risk weights) would be converted from their book values to risk-adjusted values.

It would be possible, although not necessarily desirable, to devise a risk-based premium system using the same approach. The measurement of risk under this system may be questioned on the grounds that it simply attaches risk weights to individual asset types, while ignoring the composition of assets within the entire portfolio. Furthermore, an institution would be able to increase the risk in its portfolio, without a corresponding increase in its risk measure, by moving to the risky end of each asset category and by having concentrations of assets in particular areas (either sectoral or geographic). Such problems underscore the difficulty in finding acceptable ex ante measures or risk.

Ratings Based on Examination Information. It has been suggested that information derived from the regulatory agencies' onsite examinations could be used as a basis for risk-related premiums. As a result of the examination process, each bank is assigned an overall rating from 1 to 5 (5 being the worst) based on the bank's financial condition. This rating is commonly referred to as the CAMEL rating and is derived from the examiner's evaluation of a bank's capital adequacy, asset quality, management, earnings and liquidity.[16] The examination information embodied in a CAMEL rating can be considered an ex ante measure of risk since the examiner's purpose is to determine whether the bank is being run in a safe and sound manner, and to evaluate the institution as an "on-going concern" based on its policies, practices and performance. A major argument in favor of using information derived from examinations is that it may contain inside information on a bank's operations that is not obtainable through other means (i.e., offsite monitoring).

A major objection to using examination ratings as the sole basis for assigning risk premiums is that it could have a negative impact on the examination process. One of the advantages of onsite examinations is that they allow examiners to use their experience and judgment to tailor their assessments and solutions to unique situations. However, because of the financial stakes involved with basing premiums on examinations, extreme care would need to be taken to ensure the application of uniform standards and procedures for rating banks. With greater reliance on rules and procedures for assigning premiums, an important attribute of onsite examinations -- examiner discretion -- may be lost. Furthermore, basing premiums on examinations introduces an adversarial relationship into the examination process, and the flow of information that normally occurs during an examination probably would be reduced. While the examination process can have an adversarial aspect, the purpose also is to provide useful information to bank management and regulators about the soundness of its operation and about how it may be improved. Increasing the financial stakes of the examination outcome could lessen the extent to which an examination would serve this purpose.[17]

Failure-Prediction Models. Some proposals for risk-related pricing schemes have been based on information provided by bank failure-prediction models.[18] Failure-prediction models utilize historical information to determine the importance of various financial variables (usually taken from the reports which are submitted to the federal bank regulators) in predicting the success or failure of an institution. Those financial variables (e.g., measures of nonperforming loans, earnings, capital levels, etc.) that have been consistent predictors of past failures can then be used as a basis for a risk-related pricing system. That is, pertinent financial data can be used to estimate the likelihood of failure for currently operating institutions, and insurance premiums can be assigned on the basis of each bank's probability of failure. More recently, these types of models have been modified to estimate each bank's expected insurance cost (roughly equal to the probability of failure, multiplied by the FDIC's average cost when a bank fails). The expected cost then can be used as a basis for the insurance premium.[19]

Not surprisingly, the financial variables that turn out to be most successful in predicting failures are primarily ex post measures of risk and, as a consequence, the predictive power of these models declines rather rapidly when predicting failures much beyond a year. In a study by Hirschhorn (1986), the financial variables that did the best job of replicating the FDIC's problem bank list included variables describing a bank's capital level, its earnings performance, and the quality of its loans. Using a model based on December 1983 Call data and limiting the designation of high-risk banks to roughly 20 percent of all banks,[20] the model classified about 90 percent of all failures in 1984 as high-risk banks. However, using the same model (i.e., based on 1983 Call data) only about 60 percent of the failures in 1985 were classified as high risk. This profile is common in failure-prediction models, and illustrates the difficulty in detecting and pricing risk in a timely manner.[21]

Adjusted Capital Approach. This approach would use a depository institution's capital-asset ratio, adjusted for some measure of asset quality and/or other performance measure(s), as the basis for the institution's deposit insurance assessment rate. One such proposal can be found in FDIC (1983), Chapter II. Capital is important to the federal insurer because it provides a protective cushion against adverse changes in an institution's asset quality and earnings. Also, the more wealth (in the form of capital) that owners or stockholders have at stake in the long-term profitability of the bank, the greater is their incentive to ensure that the institution is run in a safe and sound manner (i.e., greater market discipline). It is this direct relationship between more capital and a lower probability of failure which serves as the foundation for the adjusted capital approach. Three issues must be addressed in formulating the adjusted capital measure: (1) the definition of capital; (2) the adjustment(s) to capital; and (3) the definition of total assets. The first issue would involve questions regarding what should be included in the capital measure (i.e., common equity, allowances for loan losses, subordinated debt, etc.) With regard to the second issue, the adjustment to capital could be based on the industry's historical relationship between nonperforming assets (i.e., assets categorized as past-due and/or nonaccrual) and charge-offs, with this relationship then applied to each institution's current level of such assets. The third issue would involve whether to include some or all of the "off-balance-sheet" assets in the definition of total assets. In sum, this approach has advantages in its simplicity, its use only of information currently reported to the federal banking agencies, and its reliance upon the most proximate measure of risk to the insurance fund--capital.

Ex post Settling up. This proposal for risk-related premiums involves an ex post settlement for failed banks.[22] As a condition for receiving federal insurance, banks could be required to establish an escrow account with the FDIC, or bank shareholders could be legally subject to extended liability. In the event of a failure, ex post penalties could be assessed depending on the insurer's actual loss experience. Extended liability would expose the bank's owners or stockholders to an extended set of negative outcomes resulting from its investment behavior and thereby lower its expected return, rather than limiting the set of negative outcomes to their initial equity investment.

A general problem with these types of ex post settlement proposals is that they may result in increased costs for all commercial banks regardless of their current risk position. Extended liability for stockholders will increase the costs of retaining and attracting capital, since stockholders will demand additional compensation for the increase in their potential losses should the bank fail.[23] Requiring banks to maintain escrow accounts is equivalent to increasing capital requirements, while restricting the earnings potential of the added capital. While these proposals have the potential to reduce the incentives toward risk-taking, they also have the potential to significantly increase banks' cost of capital, regardless of the actual risk position of individual banks, and could overly restrict the growth of the banking industry relative to other financial-service providers.

Multi-test Risk-based Pricing Schemes. Some suggestions for structuring a risk-related system include the use of combinations of the previously mentioned approaches. For example, statistical models utilizing Call Report data could be used to estimate the risk of failure or the expected cost to the FDIC. Premiums based on these estimates could be double-checked by noting the rates paid on uninsured deposits or other uninsured debt, by comparing them to the most recent CAMEL rating, or by using option pricing techniques. Further, depending on the size of an institution, different risk classification techniques might be used in order to improve risk measurements. Although potentially more complicated, a multi-test risk-based pricing scheme could instill greater confidence in the regulator's risk assessments, and could, avert any serious mismeasurement of an institution's risk.

IV. Arguments For and Against Risk-Based Premiums

A. The Use of Market Information

Conceptually, the advantage of utilizing market information is that it represents the assessment of numerous individuals who have a financial stake in correctly assessing bank risk. However, basing insurance premiums on some form of market information raises questions regarding the quality of market information that could be obtained and whether a market-based scheme would, in reality, lead to more accurate pricing. With respect to this issue, most market-based approaches face some sort of information problem. For example, basing premiums on the rates paid for uninsured deposits would require well-developed markets for both large and small banks. Even in the absence of "too-large-to-fail," regional interest-rate differentials and the lack of markets for small banks' uninsured deposits would make such an approach difficult to implement.

The assumptions and informational requirements of the option pricing model also present problems that may prevent it from being a practical approach to pricing deposit insurance. In order to provide estimates of the value of deposit insurance for all banks, some estimate of asset returns and their volatility over time must be made. Studies which have used option pricing to estimate the value of deposit insurance have typically relied on changes in an institution's stock price over some historical period to estimate returns and their volatility. But these estimates are based on historical returns and do not necessarily represent the returns that an institution expects to receive based on its current investment decisions. To the extent that expected returns deviate from historical returns, the option price will be incorrect. Moreover, as Pyle (1983) has pointed out, small errors in the estimation of the value of assets or their volatility can have major effects on the value of the option contract (i.e., the insurance premium). A further difficulty is knowing the appropriate closure rule. If assumptions concerning closure rules are wrong, the value of the put may be in substantial error.[24]

Another practical problem with using the option pricing model is that stock-market information is available only for the largest banking organizations. While a proxy for stock prices can be estimated, it is not clear how well this kind of estimation technique would work. Moreover, where stock-price information is available, it only is available for the holding company and not for individual banks.

A more fundamental question is whether the market's assessment of individual banking risks is measurably better than information derived from other sources that are potentially available to regulators. A major reason why borrowers obtain loans from intermediaries rather than issue marketable securities is that public information on their economic condition and prospect is extremely limited and expensive. Thus, with respect to the quality of a bank's loans, the bank possesses information that is generally not publicly available.[25] To some extent, the very existence of banks (and other intermediaries) is explained by the inability of markets to act as efficient devices for valuing these loans. If this is the case, we should not expect markets to be particularly efficient at evaluating credit risks in individual banks.

B. The Use of Nonmarket Information

If market information is not used in setting insurance premiums, then it should be recognized that an alternative risk-related scheme amounts to a set of administratively determined prices (either explicit or implicit). The question then turns on how accurately we believe regulators can price risk.

Obtaining accurate *ex ante* measures of bank risk is perhaps more difficult than in many other areas of insurance. In an *ex ante* sense, the insured nearly always has better information about the potential risk he or she faces than does the insurer. In the case of banks, assessing the financial risks of making information-intensive loans is a central function of the enterprise. As a result of this specialized knowledge, the *ex ante* information gap between the insured and insurer is perhaps larger than in most other insurance settings.

This large informational asymmetry between the insured and insurer is perhaps one of the reasons for the inability of researchers to find good ex ante measures of risk. Although there are steps that the insurer could take to increase the amount of information concerning the risks of specific institutions (such as becoming intimately familiar with an institution's credits), the costs of acquiring this information may well be prohibitive. On the other hand, using ex ante measures that are not based on highly specific information (specific with respect to an institution's credit risks or other portfolio risks) would likely be ineffective and, more importantly, runs the risk of influencing risk-taking behavior and credit allocation in undesirable ways. Thus, most analyses have concluded that any workable system of risk-related premiums would be restricted to one based largely on ex post measures of risk.[26]

There have been two major criticisms of basing risk-related premiums on ex post measures of risk. First, it is argued that if risk is recognized by a premium system only after an institution's asset quality has deteriorated, then the premium structure has not served its purpose of inhibiting risk-taking.[27] This argument, however, fails to recogize that after-the-fact penalties may still provide some deterrent effect. While the best approach may be to levy a higher premium for a higher level of risk regardless of the assets' current performance status, if a lender knows that a premium penalty will be charged for poorer asset quality, the lender will be forced to internalize this cost into the lending decisions, thereby acting as a deterrent to excessive risk-taking.[28]

The second criticism of ex post measures of risk is that they will penalize banks when they can least afford it, i.e., when they have encountered difficulty. A deterioration in asset quality diminishes a bank's earnings and puts pressure on its capital buffer. A premium penalty which is based on some measure of asset quality will put an additional strain on both earnings and capital. While this premium cost is internalized by the lender, the premium charge must not be so large as to threaten the viability of an otherwise sound institution. In addition, credit quality typically declines during a downturn in economic activity. Increasing premiums during an economic downturn could further aggravate banking problems, even though loan-quality problems would not be necessarily the result of poor management decisions.

Any ex post system (say, using nonperforming assets as a measure of risk) must balance the need to impose penalties sufficiently large to deter excessive risk-taking, against the possibility that excessive penalties may aggravate banking conditions when banks are already in a weakened condition. Realistically, the use of ex post risk measures places substantial constraints on the size of the penalty that could be levied against a high-risk bank. If risk could be detected before a bank's performance has deteriorated, a relatively heavy penalty could be levied that may alter its behavior without jeopardizing its existence. However, levying a large penalty against a bank that is already performing poorly would probably ensure its eventual failure. Such a punitive policy would be analogous to an early closure rule.[29] For a bank with a very low stock of capital, the insurer could levy an assessment rate that would be large enough to transfer the remaining capital from the bank into the insurance fund. While an early closure policy could be integrated into a risk-based deposit insurance premium policy, each of these policies is meant to address a different aspect of deposit insurance, and so, each should stand separately on its own merit.

Avery, Hanweck, and Kwast (1985) suggest that one way of dealing with this problem might be to refrain from collecting the full premium penalty from a high-risk institution at the time of its difficulties, but retain a contingent claim on the bank's future income if it returns to a healthier condition. During the period when the institution is classified as high risk, but still deemed to be solvent, modest financial penalties could be imposed and supervisory actions taken to reduce the bank's risk profile. However, as the authors note, temporary forgiveness of high premiums lessens the incentives for healthier banks to reduce the chance that they will eventually appear in the high premium category. Regardless, limitations in the ability to detect risk in a timely manner, together with the fact that the FDIC is a public monopolist (i.e., banks cannot choose another insurer), argue in favor of assessing a relatively modest risk penalty while a bank is experiencing difficulties.

It was indicated earlier that the current system of supervision may act as a system of implicit risk-based premiums. To the extent that this is true, implicit and explicit risk-based premiums are complementary in that they have the common purpose of affecting the behaviors of banks so that they operate in a more safe and sound manner.[30] For example, a bank which has instituted policies and practices that have led to poor capital adequacy, deteriorating asset quality or excessive loan concentrations can be persuaded to change these practices by charging them higher insurance premiums, or by taking more stringent supervisory oversight of the bank's activities.

While explicit and implicit risk-based pricing schemes share a common objective and could work well together overall, there are operational differences in the two approaches. One of the more important differences is considered here. From the regulator's perspective, implicit pricing offers advantages in the form of greater flexibility and discretion. For many of the current forms of implicit pricing, such as letters of agreement and enforcement actions resulting from the examination process, regulators have considerable discretion in tailoring sanctions and solutions to individual cases. On the other hand, the institutions that are regulated sometimes view regulatory discretion as subjective or even arbitrary. From this perspective, explicit pricing rules would offer greater uniformity among banks. Therefore, a properly constructed combination of explicit and implicit risk-based pricing schemes would have the advantages of both, that is, explicit rules that would apply across the board while maintaining regulatory discretion.

FOOTNOTES

[1]Over the past decade, the banking and thrift industries, their regulators, and the Congress have been engaged in an ongoing dialogue on the state of the deposit insurance system that has included discussion of the desirability and feasibility of a risk-based deposit insurance system. Risk-based premiums have been examined as part of the studies required of the banking agencies under the Garn-St Germain Act of 1982. These include the Federal Deposit Insurance Corporation's (FDIC) Deposit Insurance in a Changing Environment and the Federal Home Loan Bank Board's Agenda for Reform. As well, risk-based deposit insurance has been examined by the U.S. General Accounting Office's Staff Study Deposit Insurance: Analysis of Reform Proposals (September 1986) and the Working Group of the Cabinet Council on Economic Affairs' Recommendations for Change in the Federal Deposit Insurance System (January 1985). More recently, risk-based deposit insurance was considered by the FDIC's Deposit Insurance for the Nineties: Meeting the Challenge (see Chapter 3, "Deposit Insurance Pricing"). The Financial Institutions Reform, Recovery, and Enforcement Act of 1989 (FIRREA) mandated the FDIC to study and report to the Congress on the desirability and feasibility of a risk-based deposit insurance system. As well, the topic is being covered within the FIRREA mandated, interagency study of deposit insurance reform that is being directed by the Department of the Treasury.

[2]As mandated by FIRREA, institutions insured by the Savings Association Insurance Fund (SAIF) currently are assessed .208 percent of total domestic deposits. This assessment will increase to .23 percent from January 1, 1991, through December 31, 1993, and decrease to .18 percent from January 1, 1994, through December 31, 1997. The assessment rate will be set at .15 percent from January 1, 1998, onward. Bank Insurance Fund (BIF) institutions currently are assessed at .12 percent. As of January 1, 1991, this rate will increase to .15 percent. For both SAIF & BIF institutions, FIRREA sets the reserve ratio (for the fund to insured deposits) at a target of 1.25 percent of estimated insured deposits. This ratio can be adjusted to a maximum of 1.50 percent if it is deemed necessary by the FDIC Board of Directors to insure against future fund losses. If necessary, in order to maintain the mandated reserve fund ratios, the assessment rates for SAIF & BIF institutions may be increased up to a maximum of 0.325 percent, with the rate increase in any one year not to exceed 0.075 percent. In accordance with this provision, the FDIC Board of Directors recently moved to increase the assessment rate for BIF institutions to .195 percent.

In October 1990, Congress enacted the "FDIC Assessment Rate Act of 1990." As a result, a number of the FIRREA provisions outlined above have been rendered obsolete, most notably the annual caps on assessment rate increases, the maximum assessment rate, the upper ceiling on the designated reserve ratio, and the timing of rate increases. The Act also affects FDIC's ability to borrow from the U.S. Treasury. In summary, the FDIC Assessment Act of 1990: (1) permits the Board of Directors of the FDIC to set premiums for Bank Insurance Fund members at a rate determined by the Board to be appropriate to maintain the actual reserve ratio of the BIF to the designated reserve ratio; (2) allows the FDIC to make mid-year adjustments in assessments rates; (3) eliminates the 1.50 percent designated reserve ratio ceiling and the requirement that investment earnings on reserves in excess of 1.25 percent of insured deposits will be distributed to fund members; and (4) permits the FDIC, on behalf of the BIF or the SAIF to borrow from the Federal Financing Bank. Such borrowings are subject to the same obligations limitation as borrowings from private lenders.

[3]The deposit insurance systems of other industrialized countries have premium structures that fall into two categories, neither being a risk-based approach in the sense that an individual institution is assessed a premium on the basis of its risk to the insurance fund. One approach, similar to the current U.S. premium structure, assesses an insured institution at a flat rate of its deposit base. Foreign countries using this approach include West Germany and Japan, whose annual premiums are 0.03 percent of deposits and 0.012 percent of savings deposits, respectively. The other approach involves the assessment of participating institutions based on losses to the insurance fund during the year, with some ceiling on an institution's contribution. France and Italy are countries where this approach is used. As well, there are countries whose approach to funding their deposit insurance systems integrate elements from each of these two approaches. For example, Britain's premium structure requires some initial contribution from its insured institutions, with further assessments being called when necessary.

[4]From this point on, unless otherwise stated, the term "bank" will refer to any insured depository institution.

[5]See Goodhart (1987) for a discussion of this issue.

[6]The term incentive-compatible simply means that there are incentives for the insureds to choose the premium/attribute combination that is appropriate for their risk class.

[7]The problem here is similar to knowing whether the long-run revenues under the current pricing scheme are adequate to handle the long-run costs. Because of the systemic nature of bank failures, even 57 years of experience cannot tell us with much certainty whether the rate at which the fund is being accumulated is sufficient to meet long-run costs.

[8]Some sort of ex post settling-up or extended liability schemes could be termed incentive-compatible as well. These schemes would expose stockholders and management to more of the downside risk associated with alternative investment strategies and their implementation would not depend on accurate actuarial information.

[9]The assumptions of the model include: the semi-strong form of the efficient-markets hypothesis and the dissemination of adverse information concerning insured banks; the absence of transaction costs and indivisibilities in deposit and insurance markets; the absence, at the margin, of external social benefits from deposit insurance; the absence of FDIC forbearance for insolvent banks; and the issuance of some uninsured deposit liabilities. Given these assumptions, the fair value of deposit insurance will be equivalent to the market's risk premium on uninsured deposits. When the assumption of timely closure is relaxed (allowing FDIC forbearance) the model yields a lower-bound estimate for the fair value of deposit insurance.

[10]In addition, some uninsured depositors may feel that they always will have sufficient warning to withdraw their funds prior to failure. If so, risk premiums on these deposits may not be appropriate for setting insurance premiums.

[11]A purely private system of deposit insurance has been advocated as an alternative to the current public system. (See, e.g., Short and O'Driscoll (1983). Ely (1990) and Ely and Wallison (1990) develop a private deposit insurance system based on private-sector cross-guarantees). Proponents argue that a competitive private system would overcome much of the deposit insurance mispricing associated with the current system. However, the existing evidence on private insurance reveals the inadequacies of a purely private system. Historically, private insurance systems have been unable to handle systemic problems. Notably, the state-sponsored insurance funds have been unable to protect depositors and, in turn, the financial system during periods of crisis. As well, unless deposit insurance contracts are long-term in nature and include non-cancellation clauses, the problem of intertemporal adverse selection would likely arise. That is, banks would choose to be insured only during times when they expected a high probability of default, and private insurers would choose to insure banks only if the insurance contract included a cancellation clause. Note also with private insurance, depositors still would need to monitor the health of the private insurer. Thus, even in

the absence of the systemic-risk problem, private insurance would generate a new set of adverse selection/moral hazard problems.

[12]While the term coinsurance sometimes is employed to describe risk sharing between depositors and the deposit insurer, it is used in this case to describe risk sharing between public and private insurers of deposits.

[13]Reinsurance is insurance by one insurer of another insurer's risk exposure. It commonly is used in the insurance industry to spread risk and expand capacity. That is, reinsurance is used to minimize the threat of systemic risk and increase the amount of insurance that an insurer is allowed, under state regulation, to write. For the purposes of deposit insurance, the ability of the reinsurer to accurately underwrite risk and thereby price the risk to the public insurer is emphasized rather that the reinsurer's risk-sharing capabilities.

[14]The concept of deposit insurance as a put option could be broadened to cover all deposits, both insured and uninsured, in the event of an insolvency or a failure. This interpretation may be more reflective of current failure policies of the insurer.

[15]The put option analogy also reveals other factors that influence the value of deposit insurance. Among these are the lifetime of the put option, as measured by the time between bank examinations, and the total amount of insured deposits, referred to as the strike or exercise price of the put option. Additionally, the closure rule followed by the regulators will affect the total amount of liabilities covered by insurance and therefore the exercise price.

[16]The Office of Thrift Supervision has a comparable rating system for the thrifts it regulates.

[17]If premiums were based on examination ratings, it would be desirable to examine banks at least once a year. The FDIC now is moving in that direction.

[18]Failure-prediction models can be used for several purposes. Many failure-prediction or problem-bank identification models have been designed primarily as early-warning systems. Early-warning systems assist regulators in identifying potential problems and in better allocating supervisory resources to deal with these problems. Some failure-prediction models also have been designed for the purpose of identifying the causes of past failures, rather than for predicting future behavior (Pantalone and Platt (1987)).

[19]See Avery, Hanweck and Kwast (1985).

[20]Once the parameters of the failure-prediction model have been estimated using historical data, the number of institutions that will be designated as high risk can be varied by simply changing the probability of failure threshold. The threshold level is the dividing line between what would be considered a high-risk bank (or alternatively a potential failure or a problem bank) and a low-risk bank. By lowering the threshold level one can increase the number of actual failures that are designated as high risk, but only at the cost of designating more nonfailures as high risk.

[21]Another factor limiting the accuracy of these estimates is the fact that not all banks report accurate Call Report data. Examinations often reveal that banks have underestimated the true extent of their problems. Perhaps assessing banks penalties when examinations reveal that they have underreported problems would partially solve this problem.

[22]See Benston, et al., (1986) and Merrick and Saunders (1985).

[23]This problem is accentuated by the fact that extended liability is not a feature of other businesses.

[24]Brickley and James (1986) provide some empirical evidence on this point. They show that for the S&L industry during the early 1980s, the assumption that closure would occur at the point of insolvency resulted in an understatement of the option value of deposit insurance. Insurance would have been underpriced with this assumption.

[25]Of course, this will vary from bank to bank. Some banks, particularly large banks, may make a considerable amount of loans to corporate borrowers for which markets generally possess a considerable amount of information, or some banks may have portfolios that are weighted more heavily with marketable securities or loans that are more easily evaluated by markets, such as mortgages.

[26]For example, see Avery, Hanweck and Kwast (1985) and Merrick and Saunders (1985).

[27]See Horvitz (1983).

[28]This deterrence could take the form(s) of the lender holding higher capital levels and/or holding a less risky portfolio.

[29]An early closure policy typically refers to the case in which a bank would be closed by regulators when its capital stock is minimal but above zero.

[30]An explicit premium has the additional objective of having riskier institutions pay the insurance fund a higher fee that is more commensurate with the risk to which they expose the fund.

CHAPTER TWO

AN ADJUSTED CAPITAL PROPOSAL FOR RISK-BASED PREMIUMS

I. Introduction

In general, an adjusted capital approach to risk-based premiums would use a depository institution's capital-asset ratio, adjusted for some performance measure(s), as the basis for its deposit insurance premium. In the proposal that follows, an adjustment to capital is constructed which measures the extent to which a bank's actual loan loss reserves differ from some target or expected level.

Whether an insured institution makes sufficient allowances for losses on its assets will affect the accuracy of its (unadjusted) capital measure as an indicator of its solvency. Holding other things constant, if allowances for losses are insufficient relative to nonperforming assets, then the unadjusted capital measure will be inflated. Similarly, if allowances are more than sufficient, then the unadjusted capital measure will be understated.

Under an adjusted capital approach, an institution's core capital would be adjusted upward or downward by the amount by which their capital is estimated to be understated or overstated. Therefore, this approach offers a more accurate picture of an institution's risk to the insurance fund, and so can form the basis for premium differentials among insured institutions. This approach, in part, will compensate the FDIC fund for those risks which are not sufficiently capitalized by the banking industry and reward insured institutions for holding capital above some benchmark level.

In order to develop such an adjustment to capital, some measure of the difference between a bank's actual loan loss reserves and its target or expected level must be established. The level of "target reserves" could be based on supervisory experience or, alternatively, the industry's historical relationship between noncurrent assets (i.e., assets that are not performing according to the stated terms of the contract) and charge-offs. For the later case, measures of, or proxies for, the following three variables are required: nonperforming assets; allowances for losses; and the historical percentage of noncurrent assets that are charged off (expected charge-offs). Of these measures, expected charge-offs must be estimated. The adjustment to capital will be based on the extent to which actual loan-loss reserves deviate from expected charge-offs.

Once the adjustment factor is determined, an adjusted capital-asset ratio can be formed. The capital measure used in this ratio is Tier I or core capital, from which the adjustment factor will be subtracted. The denominator of the ratio, total assets, is defined as the sum of net balance-sheet assets and converted off-balance-sheet assets. Net balance-sheet assets is the total balance-sheet assets net of loan-loss reserves and transfer risk reserves. Off-balance-sheet assets are converted to on-balance-sheet equivalents using credit conversion factors as specified by the risk-based capital rules.

As an example, consider the case of a bank characterized by the following data (in millions):

Net balance-sheet assets = $250

Converted off-balance-sheet assets = $50

Noncurrent assets = $10

Target Reserves = $5

Current Reserves = $3

Core capital = $15

This choice of a target reserve formula could be based on an arbitrary supervisory rule of thumb, or based on a statistical model. Here, purely for the sake of illustration, a target reserve of 50 percent of noncurrent assets has been assumed.

This bank will have an adjustment factor of $2 (target minus current reserves), which will be subtracted from core capital. Their adjusted capital-asset ratio, as calculated using this proposal (see section II, equation (1)) is 4.3 percent, as compared to an unadjusted ratio of 5.0 percent. Under this proposal, an institution with an adjusted capital-asset ratio between four and five percent would be assessed at a higher rate than institutions with relatively higher adjusted capital ratios.

It must be noted that it may be impossible to establish a formula for appropriate loan loss reserves which would be fair to all institutions. Inevitably, some institutions would be unduly penalized and others unduly benefited by such a formula. A similar criticism, however, can be leveled against the current system of flat-rate premiums. The real question for any capital-based premium system is whether an estimate of over- or under-reserving based on a formula will yield, on balance, a more accurate description of risk to the FDIC fund than would the use of reported capital.

Some observers have expressed concerns that an adjusted capital approach to setting insurance premiums would add a third capital standard to the leverage requirement and risk-based capital requirement that already exist. It is argued that the incentives created by this proposal could conflict with those existing under the risk-based capital standard. In this regard, it also should be noted that if the risk-based standards do not capture all dimensions of risk, an adjusted-capital premium system may provide useful additional incentives to control risks.

assets (which we denote as Z). Then, Target Reserves is the fraction (Z) of an institution's current stock of noncurrent assets:

Target Reserves = Z * (Noncurrent Assets)

The various statistical approaches taken to measure "Z" are discussed in the Technical Appendix.

1.2. Capital

In order to maintain consistency with the definitions of capital which regulators place on banks and to have a not-too-expansive definition of capital, capital would be defined as the Tier 1 (or core) capital measure under the risk-based capital rules. For example, for a commercial bank the elements of Tier 1 capital are:[1]

Tier 1 capital = Common stockholders' equity capital
+ Noncumulative perpetual preferred stock
+ Minority interest in the common stockholders equity capital of consolidated subsidiaries
- all intangible assets other than mortgage servicing rights.

1.3. Total Assets

The denominator of the adjusted capital ratio is the stock of total assets in the period. The definition of assets is:

Total Assets = Net Balance-Sheet Assets
+ Converted Off-Balance-Sheet Assets.

Net Balance-Sheet Assets is the total balance-sheet assets of the institution, net of total loan-loss reserves. "Converted Off-Balance-Sheet Assets" is the stock of total off-balance-sheet assets that are converted to balance-sheet equivalents by using a credit conversion factor (specified in the risk-based capital rules). Since some of the off-balance-sheet assets are contingent exposures, they would not necessarily be equivalent to balance-sheet assets at a one-for-one rate, although many are converted at one-for-one.

Note that there is a subset of smaller (under $1 billion) and relatively well-capitalized commercial banks that are not required to complete the Call Report schedule (Schedule RC-R) which details the credit equivalent values of their off-balance-sheet exposures (nonreporting institutions).[2] One approach would be to estimate their converted off-balance-sheet assets, while a second approach would be to ignore the off-balance-sheet assets for these institutions. The approach used here is to separate reporting (i.e., those institutions that report their off-balance-sheet credit equivalent amounts) and nonreporting institutions. Each group is again divided into similar (balance-sheet) asset-size subgroups. For each asset-size subgroup of reporting institutions, the average ratio of converted off-balance-sheet assets-to-total off-balance-sheet assets is calculated. This average value is then assigned to each nonreporting institution in the corresponding nonreporting asset-size category. An estimate of each nonreporting institution's converted off-balance-sheet assets is formed by computing its total off-balance-sheet assets (from Schedule RC-L of the Call Report), and multiplying this by the average ratio taken from the reporting institution asset-size peer group.

1.4 Summary of Part 1

The task in Part 1 of the project is to form a measure of an adjusted capital ratio. The following is a summary of the points made regarding the components of the adjusted capital-total asset measure.

Capital Adjustment Factor

- The capital adjustment factor is equal to an institution's level of target reserves that are set by the insurer based on its current condition minus its stock of current reserves.

- Current Reserves is equal to an institution's general plus specific loan-loss reserves.

- Target Reserves is the level of reserves that a safe and sound institution should hold against its assets given its current asset quality. The level of Target Reserves can be determined through a supervisory rule and/or through statistical techniques regarding the historical relationship between charge-offs and noncurrent assets (i.e., denoted as Z). See the Technical Appendix for a discussion of the statistical approach.

Capital

• "Capital" is defined as Tier 1 capital under the risk-based capital rules.

Total Assets

• "Total assets" is defined as the sum of an institution's net balance-sheet assets and its converted off-balance-sheet assets.

• For institutions that do not report converted off-balance-sheet amounts on the Call Report, an estimate of this can be made.

As a test, adjusted capital ratios were calculated for all banks using an industry-wide value for Z that was estimated as the weighted (by asset size) average ratio of total charge-offs to nonperforming assets based on Call Report information from 1987 through 1989 (i.e., Z = .543938; see Table 2A, column (1) in the Technical Appendix). Each bank was then assigned to an adjusted capital ratio group. The resulting distribution of banks, along with other summary statistics, is given below in Table 1.

TABLE 1

Adjusted Capital Ratio	Number of Banks		(000's) Averages	Minimum	Maximum
LT 0%	108	Core Capital	-6,067		
		Adjust. Factor	2,751		
		On. Assets	247,008	3,087	10,845,466
		Off. Assets	10,615		
0 - 2%	107	Core Capital	6,570		
		Adjust. Factor	1,642		
		On. Assets	419,553	5,129	15,242,326
		Off. Assets	52,240		
2 - 3%	96	Core Capital	107,335		
		Adjust. Factor	8,495		
		On. Assets	2,393,143	4,595	166,755,000
		Off. Assets	1,402,186		
3 - 4%	193	Core Capital	110,380		
		Adjust. Factor	-21,122		
		On. Assets	2,581,764	6,790	84,136,740
		Off. Assets	1,101,590		
4 - 5%	344	Core Capital	84,428		
		Adjust Factor	-11,423		
		On. Assets	1,712,918	3,251	70,725,390
		Off. Assets	456,756		
5 - 6%	865	Core Capital	43,113		
		Adjust. Factor	-3,695		
		On. Assets	757,189	4,682	88,306,000
		Off. Assets	88,163		
6 - 7%	1,780	Core Capital	21,650		
		Adjust. Factor	-1,507		
		On. Assets	334,453	2,738	22,003,162
		Off. Assets	22,697		
7 - 8%	2,370	Core Capital	11,141		
		Adjust. Factor	-618		
		On. Assets	150,907	2,415	9,806,857
		Off. Assets	6,589		
8 - 9%	2,148	Core Capital	8,757		
		Adjust. Factor	-351		
		On. Assets	102,983	1,749	9,296,527
		Off. Assets	4,806		

TABLE 1 (cont.)

Adjusted Capital Ratio	Number of Banks		(000's) Averages	Minimum	Maximum
9 - 10%	1,567	Core Capital	7,780		
		Adjust. Factor	-282		
		On. Assets	82,818	1,843	5,155,716
		Off. Assets	2,609		
10 - 11%	994	Core Capital	7,672		
		Adjust. Factor	-353		
		On. Assets	74,551	1,535	5,910,236
		Off. Assets	1,842		
11 - 12%	668	Core Capital	7,292		
		Adjust. Factor	-253		
		On. Assets	64,217	2,416	2,198,251
		Off. Assets	1,631		
12 - 13%	483	Core Capital	7,739		
		Adjust. Factor	-141		
		On. Assets	61,322	1,426	1,594,041
		Off. Assets	2,107		
13 - 14%	324	Core Capital	6,908		
		Adjust. Factor	-205		
		On. Assets	52,240	3,400	1,178,646
		Off. Assets	724		
14 - 15%	240	Core Capital	5,762		
		Adjust Factor	-142		
		On. Assets	40,334	2,770	379,561
		Off. Assets	478		
15 - 16%	171	Core Capital	9,467		
		Adjust. Factor	-169		
		On. Assets	60,043	6,481	1,284,341
		Off. Assets	1,991		
16 - 17%	111	Core Capital	6,680		
		Adjust. Factor	-145		
		On. Assets	40,579	1,187	488,849
		Off. Assets	639		
17 - 18%	91	Core Capital	6,812		
		Adjust. Factor	-187		
		On. Assets	39,573	3,613	304,683
		Off. Assets	539		

TABLE 1 (cont.)

Adjusted Capital Ratio	Number of Banks		(000's) Averages	Minimum	Maximum
18 - 19%	50	Core Capital	5,959		
		Adjust. Factor	-124		
		On. Assets	32,766	4,848	186,686
		Off. Assets	387		
19 - 20%	49	Core Capital	6,628		
		Adjust. Factor	-315		
		On. Assets	35,384	3,453	438,802
		Off. Assets	416		
GT 20%	296	Core Capital	10,766		
		Adjust. Factor	-86		
		On. Assets	29,803	328	1,809,760
		Off. Assets	4,794		

Note: The "Off-Balance-Sheet" item is a credit-converted value which is intended to make it equivalent to the "Balance-Sheet" item.

Note: The "Adjustment Factor" and "Off-Balance-Sheet" items are computed on the basis of industry-wide factors.

Note: The expected total charge-offs for an individual year were estimated using banks that were operating in that year, but not necessarily over the entire 1985-1989 period.

Part 2: Adjusted Capital-Asset Ratio Groups and Assessment Rates

Given that an adjusted capital ratio can be computed for each institution, then the second part of the project is to form a set of adjusted capital ratio groups to which institutions are assigned, and to attach an assessment rate to each adjusted capital ratio group. A general example, based on the numbers generated for Table 1, of an approach to this second part is given here.

2.1 Adjusted Capital Ratio Groups

A set of 21 adjusted capital ratio groups are formed, as shown in Table 2, ranging from less than 0% to greater than 20%. A large number of adjusted capital ratio groups, with a narrow range for the ratios in each group, are chosen in this example to make the move to a higher adjusted capital ratio group less difficult. The rationale for this approach is to make the incremental steps to higher adjusted capital and lower premiums more attainable.

2.2 Assessment Rates and FDIC Revenue

It is assumed that the risk-based premium schedule is to be revenue-neutral relative to the 19.5 basis point flat-rate system. Given this assumption, the risk-based premium schedule is developed as follows. An benchmark is established at the 7-8% adjusted capital ratio group with an assessment rate of 18.5 basis points. The benchmark is arbitrary in that it is set in order to make the schedule revenue-neutral. Each adjusted capital ratio group with a lower ratio is assessed progressively at a 1 basis point higher rate. Therefore, institutions in the 6-7% group are assessed at 19.5 basis points of their deposit bases, institutions in the 5-6% group are assessed at 20.5 basis points, and so on. In the same manner, each adjusted capital ratio group with a higher ratio relative to the benchmark is assessed progressively at a .5 basis point lower rate. For example, institutions in the 8-9% group are assessed at a rate of 18.0 basis points. The largest assessment rate is 24.5 basis points for the 0-2% group, and the smallest assessment rate is 12.0 basis points for the greater than 20% group. The assessment rates, total deposit bases and the resulting FDIC revenue for each adjusted capital ratio group are shown below in Table 2 (which is based on the distribution of banks in Table 1).

TABLE 2

Adjusted Cap.-Asst. Ratio	Deposit Base ($000's)	Flat-rate System Assessment Rate	Flat-rate System FDIC Revenue ($000's)	Risk-based System Assessment Rate	Risk-based System FDIC Revenue ($000's)
LT 0%	22,152,251	------	------	-------	------
0-2%	33,019,076	.00195	64,387	.00245	80,897
2-3%	79,036,598	.00195	154,121	.00235	185,736
3-4%	245,513,438	.00195	478,751	.00225	552,405
4-5%	343,743,905	.00195	670,301	.00215	739,049
5-6%	457,635,297	.00195	892,389	.00205	938,152
6-7%	446,026,250	.00195	869,751	.00195	869,751
7-8%	283,069,068	.00195	551,985	.00185	523,678
8-9%	177,317,765	.00195	345,770	.00180	319,172
9-10%	107,376,098	.00195	209,383	.00175	187,908
10-11%	60,744,874	.00195	118,453	.00170	103,266
11-12%	33,541,210	.00195	65,405	.00165	55,343
12-13%	23,339,795	.00195	45,513	.00160	37,344
13-14%	13,060,861	.00195	25,469	.00155	20,244
14-15%	7,831,628	.00195	15,272	.00150	11,747
15-16%	7,654,612	.00195	14,926	.00145	11,099
16-17%	3,249,404	.00195	6,336	.00140	4,549
17-18%	2,698,135	.00195	5,261	.00135	3,642
18-19%	1,216,632	.00195	2,372	.00130	1,582
19-20%	1,268,678	.00195	2,474	.00125	1,586
GT 20%	4,119,143	.00195	8,032	.00120	4,943
TOTAL	2,353,614,718		4,546,352		4,652,095

Note: This table is based on the distribution of banks in Table 1.

FOOTNOTES

[1]The definition of Tier 1 Capital for thrifts differs somewhat from that of banks.

[2]All thrifts are required to complete the entire Risk-based Capital Schedule that is part of their financial reports to the Office of Thrift Supervision.

CHAPTER THREE

CONCLUSIONS

There are compelling reasons to consider risk-based deposit insurance premiums as an alternative to the current flat-rate premium system. While not a panacea for the problems facing banking and the deposit insurance system, risk-based premiums offer the possibility of an improvement, i.e., the opportunity to partially offset or lessen the subsidies and inequities associated with flat-rate premiums.

There are many proposals for deposit insurance pricing that merit consideration, and this report is not intended to preclude any of these options. One example is the Adjusted Capital approach discussed in Chapter Two of this report. An alternative approach that merits investigation would utilize private firms to reinsure a portion of the FDIC's liabilities.

Of the market-based alternatives, the reinsurance approach offers certain advantages. Its primary purpose is to create a risk-sharing system from which the public insurer is able to obtain an accurate assessment of, or "market price" for, the portion of its risk that is reinsured. If successful, such underwriting by private reinsurers would bring an independent and apolitical assessment of risk to the deposit insurance system. Likewise, an additional source of capital would be introduced into the system. This approach deserves further study.

An adjusted capital approach to risk-based premiums would use a depository institution's capital-to-asset ratio, adjusted for some performance measure(s), as the basis for its deposit insurance premium. Under this approach, an institution's core capital would be adjusted upward or downward by the amount by which its capital measure is estimated to be understated or overstated. This approach offers a more accurate picture of an institution's risk to the insurance fund, and so, forms the basis for premium differentials among insured institutions. Thus, the FDIC fund would be compensated, in part, for those risks that are not sufficiently capitalized by the banking industry and insured institutions would be rewarded for holding more core capital.

Our analysis of these issues concerning deposit insurance pricing yields the following recommendations:

(1) The FDIC should be given the authority to levy risk-based premiums. A risk-based deposit insurance premium system is not a panacea for the problems facing the banking system, and cannot serve as a substitute for supervision and adequate capital. Nevertheless, a risk-based premium system would mitigate the subsidy to "high-risk" institutions provided by "low-risk" institutions, and it would give all insured depository institutions a financial incentive to control risks.

(2) The FDIC would seek comments on a number of proposals for the pricing of deposit insurance, including capital-based and reinsurance approaches.

(3) The FDIC would not implement a risk-based premium plan until the FDIC has received comments from all interested groups regarding the plan, and until the plan has been coordinated with the other bank regulatory agencies and the Administration.

(4) The FDIC recognizes that a risk-based premium system could create additional hardships for insured depository institutions that are in financial trouble because these institutions may be required to pay higher insurance premiums at a time when they can least afford it. It is important that this not lead to higher insurance losses, thus partially defeating the purpose of risk-based premiums.

(5) Implementation of a risk-based premium system must be coordinated with other reforms to the deposit insurance system, and options should be evaluated in the context of the proposals made in the Treasury Study of the system.

TECHNICAL APPENDIX

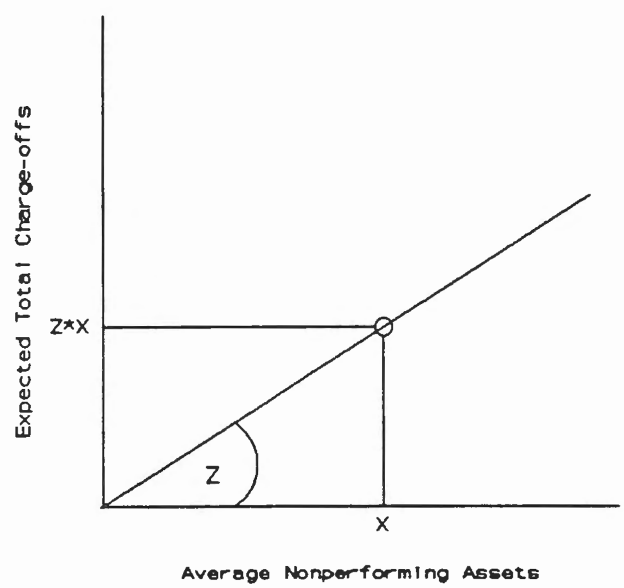
This appendix discusses the statistical models that were used to estimate the historical relationship between total charge-offs and noncurrent assets (i.e., Z in Chapter Two of the text), and presents the estimates obtained. The statistical models can be divided into (1) the First Moment model and (2) Econometric models where the former relies upon the average (or the first moment in statistical parlance) of ratios involving total charge-offs and noncurrent assets (i.e., assets not performing according to the stated terms of the contract), and the latter uses regression analysis to estimate the relationship between these two variables.

Under the statistical approach the term Target Reserves, in Chapter Two of the text, is equated with Expected Total Charge-offs (i.e., E(TCOF)), and the equation for Target Reserves can be written:

(1a) E(TCOF) = Z * (Noncurrent Assets)

Equation (1a) assumes a particular relationship between expected total charge-offs and noncurrent assets which is illustrated in Figure 1A.

FIGURE 1A



In Figure 1A, the horizontal axis is the dollar value of an institution's average noncurrent assets and the vertical axis is the dollar value of its expected total charge-offs. Assume that we have derived a value for the historical relationship between total charge-offs and noncurrent assets, represented as Z. Then based on equation (1a), we can draw a straight line from the origin of the graph with a slope of Z. This line is the conversion factor from noncurrent assets to expected total charge-offs. For example, if at the beginning of the year an institution holds a stock of noncurrent assets equal to $X, then according to Figure 1A that institution would be expected to have total charge-offs equal to $(Z*X) over that year.

It should be noted that since Z embodies information for a broad cross-section of the banking industry we should not expect the estimate of expected total charge-offs for any individual institution to be perfect. With that said, however, a good statistical estimate of Z will generally reflect the behavior and asset quality of the banking industry over the recent past, and will change as these factors change. Since there are potential sources for error in generating a statistical estimate of Z that are based on Call Report data (including the intentional misreporting of information by institutions), the derived value for Z should be subject to review by informed participants. In other words, Z should be consistent with the conventional wisdom of the FDIC. A second qualification to a model that attempts to quantify the relationship between charge-offs and noncurrent assets is the timing (or lag) between the point at which an asset becomes noncurrent and the point at which it is charged-off. Since different types of assets involve different lags and since institutions differ in the amount of time they are willing to allow noncurrent assets to remain on their books, this timing element is an additional source of error in the estimation process.

While equation (1a) assumes a particular relationship between expected total charge-offs and noncurrent assets, it also puts limitations on the statistical models that are used to estimate the historical relationship between total charge-offs and noncurrent assets. The First Moment model is fully consistent with equation (1a), but the Econometric models require some restrictions. As noted above, equation (1a) places two restrictions on the regression equation that is used to estimate the relationship between total charge-offs and noncurrent assets -- (1) the equation must have an endpoint at the origin (termed the "origin restriction"), and (2) the equation must be linear (termed the "linearity restriction"). The origin restriction means that an institution would be expected to have zero charge-offs if it has zero noncurrent assets on its balance sheet. The linearity restriction means that every additional dollar of noncurrent assets has the same marginal value as every existing dollar of noncurrent assets, and so, is charged-off at the same rate. As we shall see later, these restrictions will generally be binding on the regression equation since the data does not generally conform to these restrictions. This issue of restrictions on the regression equations will be addressed in Section 2 of this appendix. We now turn to the definition and derivation of Z for the various statistical models.

1. First Moment Model

Generally speaking, the First Moment model involves the use of a statistical average (a measure of central tendency for the data) as the best estimate of its future value. In the context of estimating Z, the historical relationship between total charge-offs and noncurrent assets is identified as the average ratio of total charge-offs to noncurrent assets (hereafter referred to as the TCOF-NP ratio), weighted by asset size. In particular, a TCOF-NP ratio is computed for each institution in the sample where the numerator is the end-of-year total charge-offs and the denominator is the average beginning-of-period stock of noncurrent assets over the year (i.e., the sum of noncurrent assets that an institution has on its balance sheet at the beginning of the first through fourth quarters of the year, divided by four). Finally, a weighted sample average TCOF-NP ratio is calculated, where each institution's TCOF-NP ratio is given a weight which is equal to its fraction of assets in the total stock of assets for the sample. Therefore, the TCOF-NP ratio for an institution with more assets is given a greater weight in the sample average than is the ratio for an institution with fewer assets. The weighting by asset size is done to give proportionally greater influence to the behaviors of institutions for whom the insurance fund has greater exposure (not adjusted for risk). If this modification is unnecessary, the simple average ratio would be an alternative measure.

This approach to forming expected total charge-offs for an institution from its current stock of noncurrent assets, as shown in equation (1A) has many attractive features. First, from an accounting framework, in normal circumstances assets will be classified as noncurrent for a period of time before being charged-off. Equation (1A) relies upon the proposition that future charge-offs are fundamentally determined by the stocks of noncurrent assets in previous periods. Secondly, the use of noncurrent assets to form expectations about total charge-offs is based upon an industry (or some peer group) weighted average over time. The weighting of the average TCOF-NP ratio by asset size means that the behaviors of larger banks are given greater emphasis in the calculation of Z, which is an important feature from the insurer's perspective. Thirdly, the linear relationship between noncurrent assets and expected total charge-offs (see Figure 1A) means that banks (that are in a group with the same Z) have the same marginal addition to expected total charge-offs from the last additional dollar of noncurrent assets on their balance sheets.[1] For example, if you choose any point on the horizontal axis in Figure 1 and add $1 to the stock of noncurrent assets, the marginal increase in expected total charge-offs for that $1 increase will equal $Z. Again, this will be true for any initial level of noncurrent assets in Figure 1A. Moreover, the linear relationship conforms to what we do not know about banks' stocks of noncurrent assets; that is, we have no reason to believe that the last dollar of noncurrent assets would be any more or less valuable than the previous dollars of noncurrent assets. In contrast, a relationship that is concave (to the origin) would mean that as banks increase their stocks of noncurrent assets, they would be expected to charge-off a lesser share of these additional noncurrent assets, implying that the value of these additional noncurrent assets is greater than the established stock of noncurrent assets.

Table 1A contains the weighted average TCOF-NP ratios for all banks and asset-size subgroups over each year of the 1986-89 period, as well as the straight average TCOF-NP ratios and the ratios of average total charge-offs to average noncurrent assets.

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[1] As is discussed later in this appendix, the data seem to support a nonlinear relationship between nonperforming assets and total charge-offs based on regression analysis applied to banks over the 1986-89 period.

TABLE 1A

	Wgt.Avg.(TCOF/NP) (1)	Avg.(TCOF/NP) (2)	Avg.(TCOF)/Avg.(NP) (3)
1989			
ALL	.603844	.662319	.465494
LT $100M	.632065	.673064	.437628
$100-500M	.615743	.608425	.469979
$500m-1B	.649725	.666933	.499278
GT $1B	.593916	.717579	.466054
1988			
ALL	.553685	.633571	.394306
LT $100M	.610359	.645760	.448643
$100-500M	.578976	.565396	.460413
$500m-1B	.581498	.595954	.498175
GT $1B	.536806	.725950	.376772
1987			
ALL	.474286	.665137	.337933
LT $100M	.642961	.688815	.471236
$100-500M	.568324	.565483	.472266
$500m-1B	.587264	.581453	.497218
GT $1B	.413650	.598458	.297321
1986			
ALL	.514145	.748152	.426341
LT $100M	.727005	.780393	.555375
$100-500M	.614069	.618857	.506740
$500m-1B	.657542	.655744	.531951
GT $1B	.435425	.553374	.377274

Note: The sample includes all banks that were operating over the entire year, but excludes those banks that reported a ratio of charge-offs-to-noncurrent assets of greater than or equal to 10.

The last two statistics indicate the effect of not weighting the average TCOF-NP ratios and the approximate effect of weighting the ratios by the size of noncurrent assets, respectively.[2] In order to prevent any bias that could be caused by abnormal results in a particular year, we take the simple average over the 1987-89 period for each of these three statistics. This is shown in Table 2A.

[2] Using a statistic that is weighted by the stock of nonperforming assets would introduce two effects. One would be a size effect that is captured by the asset-size weighting approach, and the other is the distressed bank effect which could occur as a bank finds an increasing share of its assets in nonperforming status.

Table 2A

Analysis Group	1987-89 Wgt.Avg.(TCOF/NP) (1)	Avg.(TCOF/NP) (2)	Avg.(TCOF)/Avg.(NP) (3)
ALL	.543938	.653676	.399244
LT $100M	.628462	.669213	.452502
$100-500M	.587681	.579768	.467553
$500m-1B	.606162	.614780	.498224
GT $1B	.514791	.680662	.380049

Note that column (1) of Table 2A represents values for Z if we use three years of historical information to derive the relationship between noncurrent assets and total charge-offs. There are a couple of important generalizations that can be made from the statistics presented in Table 2A. First, in every case, column (3) is less than the corresponding elements in columns (1) and (2), which implies that banks with larger volumes of noncurrent assets tend to charge-off, on average, a lower percentage of those assets. This result is consistent with distressed bank behavior in which banks with larger stocks of noncurrent assets relative to total assets delay in charging-off a portion of these assets. Secondly, for the weighted average TCOF-NP ratio, the largest banks (i.e., banks with more than $1 billion in assets), on average, charged-off a lower percentage of noncurrent assets than did the banks in the other asset-size analysis groups. We can gauge the relative effect of having a single industry-wide Z versus one for each asset-size subgroup by comparing the ratios in column 1.

2. Econometric Models

Regression analysis (viz., ordinary least squares or OLS) was an alternative approach used to estimate the historical relationship between noncurrent assets and total charge-offs (as defined in the body of the text) using data over the 1986-89 period. In this application of OLS, there were two choices that would affect the regression results: (i) the specification of the regression equation and (ii) whether or not to scale the dependent and independent variables by asset size. We now elaborate briefly on these choices.

The choice of specification for the regression equation is between a linear model or a log-linear model, and whether any restrictions should be placed on the parameters of the regression equation. We will begin by discussing these specifications in a general manner. The linear regression model is one of the most familiar econometric techniques used, and it has the form:

(3a) $Y_i = \phi_0 + \phi_1 * X_i + u_i$

where u is a normally distributed random disturbance term, X is the independent variable and Y is the dependent variable. The log-linear regression model is linear in the natural logarithms of the independent and dependent variables:

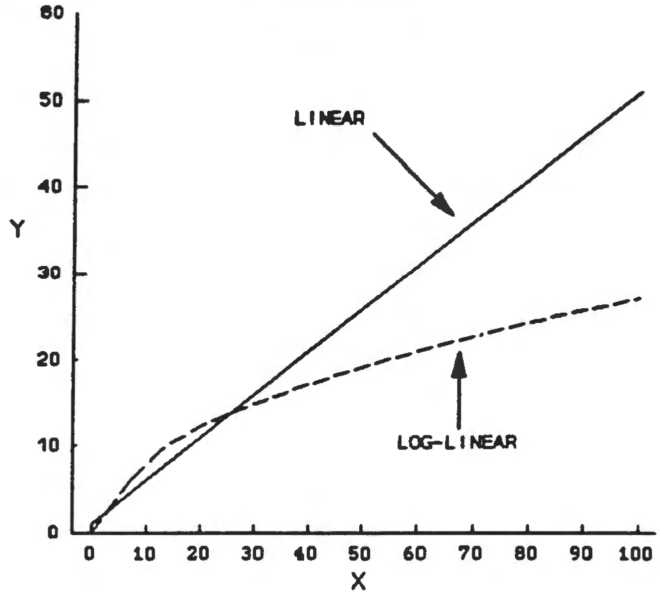
$$(4a) \quad Ln(Y_i) = \beta_0 + \beta_1 * Ln(X_i) + u_i$$

On the surface, equations (3a) and (4a) differ only in the way the independent and dependent variables are specified, equation (3a) in level form and equation (4a) in logarithmic form. If we express equation (4a) in a form that is comparable to equation (3a) (i.e., in level form), we can see a greater difference:

$$(4b) \quad Y_i = e^{\beta 0 + ui} * (X_i)^{\beta 1}$$

Comparing equations (4b) and (3a), we can see that these specifications assume a very different relationship between the independent and dependent variables. We can also see this graphically in Figure 2A below where the linear and log-linear specifications are graphed for identical parameter values ($\phi_0=\beta_0=1$ and $\phi_1=\beta_1=0.5$).

FIGURE 2A



We see that the log-linear specification yields a line that is concave to the origin for a value of β_1 that is less than one. The log-linear specification can be made linear in the (X,Y) plane if we impose the restriction that $\beta_1=1$. Moreover, equations (1a) and (2b) could be graphed as the same line (with the u term disappearing) if we imposed the restrictions that $\phi_0=0$, $\beta_1=1$, and $\phi_1=e^{\beta 0}$. Although the linear and log-linear specifications can be made to be consistent with one another in this manner, the log-linear specification should not be considered a generalized form of the linear specification since they spring from different assumptions about the underlying relationship between X and Y.

The origin and linearity restrictions discussed in the introduction to this appendix can be imposed on the linear and log-linear regression equation specifications as follows:

Linearity restriction:
- Linear specification: no restriction required;
- Log-linear specification: $\beta_1 = 1$.

Origin restriction:
- Linear specification: $\phi_0 = 0$;
- Log-linear specification: no restriction required.

When we combine these restrictions, we have:

Linearity and Origin restrictions:

Linear specification: $\phi_0 = 0$;
Log-linear specification: $\beta_1 = 1$.

It is important to note that a restricted regression equation cannot produce a better "fit" of the data than its unrestricted counterpart since the parameter estimates in the unrestricted equation are left free to take on the value imposed by the restricted equation if it produces the best "fit" of the data. For example, if we are using a log-linear regression specification and the data support a linear relationship between total charge-offs and noncurrent assets, the unrestricted estimate for β_1 will not be statistically different from one. Nevertheless, we may have good reason to prefer such a restriction on β_1 if it is believed that the behavior exhibited in the data is not generally consistent with safe and sound banking practices.

The second issue is that of specifying the independent (X) and dependent (Y) variables. We know that average noncurrent assets and total charge-offs are the independent and dependent variables, respectively; however, the issue is whether to scale each of these variables by the average asset size of the institution over the period being analyzed. This scaling would change the independent and dependent variables of the regression equation. While there may be theoretical arguments one way or the other with regard to scaling by asset size, in some cases there may be an econometric imperative to scale (for example, in the case of the linear specification where scaling would typically correct for heteroskedasticity). Scaling has an important effect on the regression results that can be identified and may be of some consequence. Scaling by asset size will mean that the data points of all banks (large and small) will fall in the same general region (probably somewhere between 0 and 0.15 for the ratio of noncurrent assets to total assets). Therefore, all banks will receive a somewhat equal weight in the calculation of the OLS parameter estimates. In contrast, without scaling the larger banks (and banks with a relatively higher quantity of noncurrent assets) will tend to be given more weight in the derivation of the OLS estimates.

We now present the estimates of the relationship between noncurrent assets and total charge-offs over the 1986-1989 period. We first present the unrestricted regression equations for both the log-linear and linear specifications so that the data is able to move the parameter estimates freely to obtain the optimal "fit". This is followed by the linearity and origin restrictions on these regression equation specifications. We begin with the unrestricted, unscaled log-linear specification which provides the best "fit" of the data as measured by the adjusted R^2.

2.1 Unrestricted Regression Models

CASE 1U: Unrestricted Log-Linear Model; Not Scaled by Asset Size

The unscaled log-linear model provides the best fit of the data (as measured by the adjusted R^2) of any regression equation specification. The regression equation is:

(5a) $Ln(TCOF)_j = \beta_0 + \beta_1 * Ln(NP)_j + u_j$

where Ln is the natural log, TCOF is the end of year j total charge-offs, NP is the average beginning-of-period stock of noncurrent assets (past-due loans 90 days or more and nonaccrual loans) for the four quarters of year j, and u is a (mean-zero) random disturbance term. The regression equation is log-linear so that the parameter estimate β_1 is the elasticity of charge-offs to noncurrent assets. Interpreting β_1 as an elasticity simply means that every 1 percent increase (decrease) in noncurrent assets results in a β_1 percent increase (decrease) in expected total charge-offs.

The estimated regression line, when converted to level form, is:

(5b) $E(TCOF) = e^{\beta 0} * (NP)^{\beta 1}$

where e is the natural exponent. The regression results are shown in Table 3A.

TABLE 3A

YEAR	GROUP	e^{β_0}	β_1	R-bar^2
1989	ALL	1.0701	.8257	.6172
		(1.8)	(138.5)	
	LT 100M	2.2360	.6665	.4173
		(17.6)	(80.6)	
	100-500M	2.3981	.7431	.4082
		(6.4)	(39.3)	
	500M-1B	5.3479	.7073	.3487
		(2.9)	(10.7)	
	GT 1B	1.1576	.9282	.7746
		(0.5)	(35.4)	
1988	ALL	1.0703	.8253	.6205
		(1.9)	(141.7)	
	LT 100M	1.9308	.7014	.4514
		(14.8)	(88.9)	
	100-500M	1.7409	.7793	.4478
		(4.1)	(41.6)	
	500M-1B	4.9352	.7139	.5154
		(3.7)	(14.4)	
	GT 1B	2.2785	.8522	.6903
		(2.6)	(28.1)	
1987	ALL	1.3018	.8073	.6181
		(7.5)	(144.8)	
	LT 100M	2.1931	.7018	.4675
		(18.4)	(95.2)	
	100-500M	1.4183	.8152	.4655
		(2.5)	(42.7)	
	500M-1B	1.9415	.8247	.4559
		(1.2)	(13.0)	
	GT 1B	3.1728	.8097	.7000
		(3.8)	(27.8)	
1986	ALL	1.7095	.7920	.6272
		(16.1)	(150.3)	
	LT 100M	2.5697	.7110	.4947
		(23.3)	(102.9)	
	100-500M	1.6813	.8100	.5002
		(4.0)	(45.8)	
	500M-1B	3.6705	.7577	.4069
		(2.3)	(11.7)	
	GT 1B	1.7647	.8624	.7519
		(2.0)	(30.8)	

Note: The t-statistics are given parenthetically.
Note: The expected total charge-offs for an individual year were estimated using banks that were operating over that entire year, but not necessarily over the entire 1985-89 period. Therefore, failing banks would be included in the sample.

Case 2U: Unrestricted Log-Linear Model, Scaled by Asset Size

The regression equation is similar to equation (3a) except that the independent and dependent variables are divided by Asst which is the average stock of assets over year j:

(6a) $Ln(TCOF/Asst)_j = \beta_0 + \beta_1 * Ln(NP/Asst)_j + u_j$

The estimated regression line, when converted to level form, is:

(6b) $E(TCOF/Asst) = e^{\beta 0} * (NP/Asst)^{\beta 1}$

The regression results are reported in Table 4A.

Table 4A

YEAR	GROUP	$e^{\beta 0}$	β_1	R-bar^2
1989	ALL	.0573	.6182	.3255
		(-68.2)	(75.7)	
	LT 100M	.0511	.6005	.3202
		(-62.6)	(65.37)	
	100-500M	.0768	.6753	.3306
		(-24.9)	(33.3)	
	500M-1B	.0931	.6812	.3137
		(-7.1)	(9.9)	
	GT 1B	.2570	.8362	.5055
		(-6.6)	(19.3)	
1988	ALL	.0752	.6677	.3732
		(-65.8)	(85.5)	
	LT 100M	.0705	.6540	.3681
		(-60.2)	(74.8)	
	100-500M	.0968	.7343	.3881
		(-23.0)	(36.8)	
	500M-1B	.1018	.7055	.4964
		(-9.0)	(13.9)	
	GT 1B	.1172	.6897	.3700
		(-9.4)	(14.4)	
1987	ALL	.0890	.6768	.3896
		(-66.8)	(90.9)	
	LT 100M	.0836	.6590	.3849
		(-62.3)	(80.4)	
	100-500M	.1319	.7855	.4177
		(-20.2)	(38.7)	
	500M-1B	.1615	.7968	.4239
		(-5.8)	(12.2)	
	GT 1B	.0885	.6475	.3632
		(-11.1)	(13.8)	
1986	ALL	.1137	.6867	.4131
		(-64.5)	(97.2)	
	LT 100M	.1096	.6696	.4068
		(-59.8)	(86.2)	
	100-500M	.1521	.7869	.4557
		(-20.7)	(41.9)	
	500M-1B	.1232	.7281	.3754
		(-6.7)	(11.0)	
	GT 1B	.1067	.6999	.4238
		(-10.3)	(15.2)	

Note: The t-statistics are given parenthetically.
Note: The expected total charge-offs for an individual year were estimated using banks that were operating over that entire year, but not necessarily over the entire 1985-89 period. Therefore, failing banks would be included in the sample.

Case 3U: Unrestricted Linear Model, Scaled by Asset Size

We present only one unrestricted linear specification -- scaled by asset size. The the regression equation is:

(7a) $(TCOF/Asst)_j = \phi_0 + \phi_1 * (NP/Asst)_j + u_j$

The estimated regression line is:

(7b) $E(TCOF/Asst) = \phi_0 + \phi_1 * (NP/Asst)$

The regression results are given in Table 5A.

Table 5A

YEAR	GROUP	ϕ_0	ϕ_1	R-bar^2
1989	ALL	.0012 (15.0)	.3587 (82.0)	.3614
	LT 100M	.0012 (12.3)	.3580 (72.1)	.3644
	100-500M	.0010 (5.9)	.3713 (36.9)	.3782
	500M-1B	.0025 (2.8)	.3254 (8.7)	.2593
	GT 1B	.0035 (6.9)	.3398 (13.0)	.3160
1988	ALL	.0007 (6.2)	.4223 (84.8)	.3695
	LT 100M	.0006 (4.7)	.4279 (74.2)	.3644
	100-500M	.0007 (3.6)	.3902 (36.7)	.3894
	500M-1B	-.0001 (-.1)	.5222 (18.9)	.6454
	GT 1B	.0042 (6.0)	.2720 (8.2)	.1583
1987	ALL	.0014 (13.5)	.3969 (91.9)	.3945
	LT 100M	.0015 (12.1)	.3987 (81.0)	.3883
	100-500M	.0010 (4.8)	.3904 (39.8)	.4307
	500M-1B	.0014 (2.3)	.4026 (16.3)	.5690
	GT 1B	.0030 (5.0)	.2825 (10.0)	.2294
1986	ALL	.0019 (16.1)	.4503 (101.4)	.4335
	LT 100M	.0022 (15.7)	.4498 (90.0)	.4283
	100-500M	.0010 (4.5)	.4337 (42.5)	.4307
	500M-1B	.0012 (1.3)	.4397 (10.0)	.3330
	GT 1B	.0012 (2.3)	.3832 (12.0)	.3153

Note: The t-statistics are given parenthetically.
Note: The expected total charge-offs for an individual year were estimated using banks that were operating over that entire year, but not necessarily over the entire 1985-89 period. Therefore, failing banks would be included in the sample.

2.2 Restricted Regression Models

The Linearity and Origin restrictions are imposed upon the regression models. These restrictions make the estimated regression equations consistent with equation (1a). The restricted regression equations cannot provide a better "fit" to the data than does its unrestricted counterpart, but the restriction may provide advantages that are necessary when estimating the relationship between total charge-offs and noncurrent assets. The log-linear regression equations (with $\beta_1=1$) will be presented first, followed by the (scaled) linear regression equation (with $\phi_0=0$).

Case 1R: Restricted Log-Linear Model ($\beta_1=1$), Not Scaled by Asset Size

The regression equation is the same as equation (5a), except that $\beta_1=1$:

(8a) $Ln(TCOF)_j = \beta_0 + Ln(NP)_j + u_j$

The resulting estimated regression equation, converted to level form, is:

(8b) $E(TCOF) = e^{\beta 0} * NP$

where $e^{\beta 0}$ is equal to Z from equation (4). The regression results are given in Table 6A.

Table 6A

YEAR	GROUP	$e^{\beta 0}$	β_1	R-bar^2
1989	ALL	.383606 (-86.4)	1.0	.5898
	LT 100M	.376668 (-73.7)	1.0	.3129
	100-500M	.385351 (-42.8)	1.0	.3596
	500M-1B	.425164 (-12.2)	1.0	.2915
	GT 1B	.552823 (-15.7)	1.0	.7706
1988	ALL	.380065 (-91.8)	1.0	.5927
	LT 100M	.379242 (-78.7)	1.0	.3697
	100-500M	.363044 (-45.2)	1.0	.4121
	500M-1B	.422217 (-12.9)	1.0	.4347
	GT 1B	.501054 (-14.7)	1.0	.6704
1987	ALL	.406907 (-89.9)	1.0	.5829
	LT 100M	.412891 (-76.6)	1.0	.3831
	100-500M	.371104 (-44.6)	1.0	.4418
	500M-1B	.417428 (-13.8)	1.0	.4379
	GT 1B	.445626 (-17.6)	1.0	.6622
1986	ALL	.481510 (-77.8)	1.0	.5840
	LT 100M	.497741 (-64.6)	1.0	.4130
	100-500M	.416335 (-42.6)	1.0	.4729
	500M-1B	.437372 (-13.3)	1.0	.3680
	GT 1B	.431518 (-21.0)	1.0	.7335

Note: The t-statistics are given parenthetically.
Note: The expected total charge-offs for an individual year were estimated using banks that were operating over that entire year, but not necessarily over the entire 1985-89 period. Therefore, failing banks would be included in the sample.

Case 2R: Restricted Log-Linear Model (β_1=1), Scaled by Asset Size

The regression equation is the same as equation (6a), except that β_1=1:

(9a) $Ln(TCOF/Asst)_j = \beta_0 + Ln(NP/Asst)_j + u_j$

The estimated regression line, converted to level form, is:

(9b) $E(TCOF/Asst) = e^{\beta 0} * (NP/Asst)$

where $e^{\beta 0}$ is equal to Z from equation (4) with the left- and right-hand-side variables scaled by average asset size. The regression results are given in Table 7A.

Table 7A

YEAR	GROUP	$e^{\beta 0}$	β_1	R-bar^2
1989	ALL	.3836	1.0	.2014
		(-86.4)		
	LT 100M	.3767	1.0	.1786
		(-73.7)		
	100-500M	.3854	1.0	.2544
		(-42.8)		
	500M-1B	.4252	1.0	.2475
		(-12.2)		
	GT 1B	.5528	1.0	.4874
		(-15.7)		
1988	ALL	.3801	1.0	.2808
		(-91.8)		
	LT 100M	.3792	1.0	.2651
		(-78.7)		
	100-500M	.3630	1.0	.3376
		(-45.2)		
	500M-1B	.4222	1.0	.4120
		(-12.9)		
	GT 1B	.5011	1.0	.2965
		(-14.7)		
1987	ALL	.4067	1.0	.3008
		(-89.9)		
	LT 100M	.4129	1.0	.2819
		(-76.6)		
	100-500M	.3711	1.0	.3868
		(-44.6)		
	500M-1B	.4174	1.0	.3991
		(-13.8)		
	GT 1B	.4456	1.0	.2569
		(-17.6)		
1986	ALL	.4815	1.0	.3271
		(-77.8)		
	LT 100M	.4977	1.0	.3078
		(-64.6)		
	100-500M	.4163	1.0	.4225
		(-42.6)		
	500M-1B	.4374	1.0	.3258
		(-13.3)		
	GT 1B	.4298	1.0	.3474
		(-21.0)		

Note: The t-statistics are given parenthetically.
Note: The expected total charge-offs for an individual year were estimated using banks that were operating over that entire year, but not necessarily over the entire 1985-89 period. Therefore, failing banks would be included in the sample.

Case 3R: Restricted Linear Model (ϕ_0=0), Scaled by Asset Size

The regression equation is the same as equation (7a), except that ϕ_0=0:

(10a) $(TCOF/Asst)_j = \phi_1 * (NP/Asst)_j + u_j$

The estimated regression line is:

(10b) $E(TCOF/Asst) = \phi_1 * (NP/Asst)$

where ϕ_1 is equal to Z from equation (4) with the left- and right-hand-side variables scaled by average asset size. The regression results are given in Table 8A.

Table 8A

YEAR	GROUP	ϕ_1
1989	ALL	.4014 (119.9)
	LT 100M	.3975 (104.6)
	100-500M	.4113 (54.7)
	500M-1B	.3872 (12.5)
	GT 1B	.4624 (22.789)
1988	ALL	.4425 (116.6)
	LT 100M	.4457 (102.5)
	100-500M	.4139 (50.0)
	500M-1B	.5203 (22.0)
	GT 1B	.4047 (15.5)
1987	ALL	.4355 (134.0)
	LT 100M	.4385 (118.9)
	100-500M	.4215 (56.7)
	500M-1B	.4363 (22.0)
	GT 1B	.3833 (18.7)
1986	ALL	.4977 (148.6)
	LT 100M	.5022 (133.2)
	100-500M	.4650 (61.6)
	500M-1B	.4815 (15.6)
	GT 1B	.4373 (20.8)

Note: The t-statistics are given parenthetically.
Note: The expected total charge-offs for an individual year were estimated using banks that were operating over that entire year, but not necessarily over the entire 1985-89 period. Therefore, failing banks would be included in the sample.

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