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ON THE VALUATION OF DEPOSIT INSTITUTIONS

by Aslı Demirgüç-Kunt

Aslı Demirgüç-Kunt is an economist at The World Bank, Washington, D.C., and was formerly a dissertation fellow at the Federal Reserve Bank of Cleveland. The author wishes to thank Steve Coslett, Edward Kane, Huston McCulloch, and James Thomson for helpful comments and discussion.

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I. Introduction

Valuing a deposit institution's capital is not easy. Current accounting principles allow managers of deposit institutions to disclose less than their best estimate of the value of their institution's portfolio. Federal regulators often find that deposit institution managers have privileged information about the riskiness of their firm's operations. Legal authority to use book-value accounting allows these managers to cover up adverse information and weakens the effect of market controls that would otherwise discipline institutions' risk exposure. On the regulatory side, book-value accounting prevents deposit insurers from discovering problem situations quickly and delays timely interventions.

The consequences of delaying the closure of institutions with inadequate capital and the costs these institutions are likely to impose on the taxpayer are fully discussed in the finance and economics literature. Work by Meltzer (1967), Scott and Mayer (1971), Black, Miller, and Posner (1978), Merton (1977, 1978), Karaken and Wallace (1978), Buser, Chen, and Kane (1981), Kane (1981a, 1981b, 1985, 1989), McCulloch (1981), Guttentag and Herring (1982), Karaken (1983), and Pyle (1984) warns federal officials of the dangers of such actions.

In most cases, when failure cannot be prevented, the sooner the bank is declared insolvent and its management changed, the smaller the losses will be. Barth, Brumbaugh, and Sauerhaft (1985) compile data showing that the cost of resolving a savings and loan association's (S&L) insolvency rises on average with the length of time that regulatory response is delayed. Their results indicate that delay is indeed expensive, with costs increasing between $254,000 and $371,000 for each month that an institution is permitted to remain operating after it has become insolvent under generally accepted accounting principles (GAAP).

More than 1,000 U.S. banks were closed during the 1980s, with 427 closed in 1988-89 alone (see table 1). At least some of these closures could have been prevented, or would have been less costly to taxpayers, if regulators had better information on the institutions' capital.

This paper seeks to develop a model for valuing the capital of deposit institutions. A concept of regulatory capital developed by Kane (1989) is modeled and estimated for a sample of failed and nonfailed institutions. Using data of failed institutions is helpful in highlighting the risk-taking incentives of low-capital institutions. Results confirm the importance of enforcing timely closure rules.

The paper is organized as follows: The next section introduces the necessary concepts. Section III develops the model, and section IV presents and interprets the empirical results. Finally, section V summarizes and concludes the analysis.

II. Valuation of Deposit Institutions' Capital

A firm's capital may be identified as a particular measure of its net worth: the difference between the value of the firm's assets and nonownership liabilities. In order to determine the level of capital, assets and liabilities must be itemized, and an appropriate valuation rule must be adopted (Kane [1989]).

In defining capital, various categories of assets and liabilities, both implicit and explicit, are recognized. Implicit assets and liabilities are defined as all sources of positive and negative future cash flows that are considered "unbookable" by the accounting profession.

Valuation of capital is crucial. Using different valuation rules leads to different asset and liability values. Historical-cost principles, which measure capital according to the historical cost at which banks acquired their balance-sheet positions, provide the basis for determining the book values of U.S. banks' balance-sheet accounts. Book values are recorded in terms of acquisition costs. As market prices change, these costs tend to depart from market values. Kane (1989) notes two shortcomings of historical-cost accounting. First, using acquisition costs undervalues an institution's best portfolio decisions and overvalues its worst ones. Second, by not modifying the acquisition costs to reflect market developments, historical-cost accounting neglects potentially observable changes in the value of a firm's investments. This method exaggerates the economic relevance of the acquisition costs of the institution's assets and liabilities and fails to appraise its investment successes and failures on an ongoing basis.

To determine a depository institution's level of capital for regulatory purposes, it is helpful to decompose its capital into two components: enterprise-contributed equity and federally contributed equity (Kane [1989]). Enterprise-contributed equity is the capital of the institution net of the capitalized value of its deposit insurance guarantees. To the extent that federal guarantees are underpriced, the deposit insurer contributes de facto capital to the institutions. Federally contributed capital is determined by the amount of risk that insurance agencies stand ready to absorb. These valuable guarantees are actually equity instruments that make the U.S. government a de facto investor in deposit institutions. Unless an appropriate recapitalization rule is imposed on managers and stockholders, the capitalized value of the guarantees increases as the institution's enterprise-contributed equity decreases or as the riskiness of either its portfolio or its environment increases. Clearly, the value of the federally contributed capital should not be counted as a part of the institution's capital for regulatory purposes.

The appropriate insolvency criterion that regulators should adopt is the market value of enterprise-contributed capital, which can be obtained by subtracting the value of federal guarantees from the institution's market value of equity. The capitalized value of the federal guarantees can be estimated using one of the several approaches explained in section III.

De facto or market-value insolvency exists when an institution can no longer meet its contractual obligations from its own resources. This occurs whenever the market value of the institution's nonownership liabilities exceeds the market value of its assets; in other words, when the market value of its enterprise-contributed equity becomes negative. However, in determining official insolvency, regulators tend to look for book-value insolvency rather than market-value insolvency.

Book-value insolvency exists when the difference between the book values of an institution's assets and liabilities is negative. Even when an institution is book-value solvent, it may be insolvent according to market value because of refinancing difficulties that surface as an ongoing liquidity shortage. A liquidity shortage occurs whenever an institution's cash, reserve balances, and established lines of credit prove insufficient to accommodate an unanticipated imbalance in the inflow and outflow of customer funds. If a continuing liquidity shortage is not relieved by outside borrowing or government assistance, assets may have to be sold at fire-sale prices--at less than their equilibrium value. Such sales erode the institution's capital and may cause its uninsured customers to move their funds to safer locations. The resulting run on the institution's resources could cause the institution to borrow nondeposit funds or to sell earning assets. Given that these runs are typically motivated by the presence of large unbooked losses in an institution's balance sheet, asset sales push the book value of the institution's assets toward their market value, eventually resulting in the institution's book-value insolvency.

Official (de jure) insolvency occurs when market-value insolvency is officially recognized and the firm is closed or involuntarily merged out of existence. De facto failure can be defined more broadly than closure as any regulator-induced cessation of autonomous operations. These different concepts are listed and briefly defined in table 2. They are consistent with the conventional concepts found in Benston et al. (1986) and Kane (1985, 1989).

These definitions clarify the concept of economic insolvency for financial institutions. Clearly, an institution's official insolvency and closure should be determined by its economic insolvency.[1] The next section discusses alternative approaches for measuring economic insolvency.

III. Measure of Economic Insolvency: Net Value

In the literature, regressors used to explain the financial condition of individual institutions (or their failure, since the distinction is not usually made) are primarily ratios that are computed from banks' periodic financial statements.[2] Akaike's information criterion, which employs the log-likelihood function of a model adjusted for the number of estimated coefficients, is commonly used to select the combination of variables that best fits a given set of data (Akaike [1973]). Usually, a large number of financial ratios are tried before a final model is obtained.

This paper seeks to develop a measure of economic insolvency as opposed to book-value insolvency. The concept of economic insolvency is stressed because the analysis considers implicit as well as explicit assets. This paper further seeks to avoid the traditional ad hoc choice of regressors common to balance-sheet and income-statement analysis. The choice of candidate regressors in the accounting-ratio models lacks a compelling theoretical foundation. Financial ratios are simply utilized in various statistical procedures until they "work."

One alternative approach, introduced by Kane and Unal (1990) and applied by Thomson (1987), is the statistical market value accounting model (SMVAM). SMVAM decomposes the market capitalization of a firm (the value of a firm's stock) by using accounting and capital-market information to explain the value of the institution's equity. SMVAM allows the empirical analysis of the institution's financial condition to be based on a theoretical foundation and permits an estimate of the enterprise-contributed equity of the institution to be constructed.

For a deposit insurer, enterprise-contributed equity is the appropriate indicator of a financial institution's economic insolvency, as explained in the previous section. Different methods for subtracting federally contributed capital to obtain the enterprise-contributed equity are presented below.

The Statistical Market Value Accounting Model

Assuming efficient markets, SMVAM develops two distinctions that decompose the market capitalization of a firm into three parts. The first distinction decomposes market value into hidden capital reserves and recorded capital reserves under GAAP. The second distinction decomposes hidden capital reserves into values that are "unbooked but bookable" by accountants under GAAP and into values that they treat as unbookable off-balance-sheet items. The model develops explicit estimates of both components of hidden capital.

At any time, a firm's market capitalization (MV) is the product of its share price and the number of shares outstanding. MV may be expressed as the market value of bookable and unbookable assets, $(A_m+A'_m)$, minus the market value of bookable and unbookable nonequity liabilities, $(L_m+L'_m)$. Isolating the value of federal guarantees (F_{CG}) from other unbookable assets, the following relationship is obtained:

$$MV = [F_{CG} + (A'_m-L'_m)] + (A_m-L_m). \qquad (1)$$

Since recorded assets and liabilities are carried at historical cost, even the bookable equity $(A_m-L_m)=B_e$ is not observed directly. It is assumed that market participants estimate the market value of bookable equity elements by applying a valuation ratio (k) to the value of the institution's book equity (BV), i.e., the book value of assets minus the book value of liabilities. Expressing the value of unbookable equity $[F_{CG} + (A'_m-L'_m)]$ as U_e and allowing for an approximation error, equation (1) is rewritten as

$$MV = U_e + kBV + e. \qquad (2)$$

Kane and Unal (1990) term this equation SMVAM. The equation can be estimated either from time series for individual banks, cross-sectionally in each period, or for pooled time-series, cross-sectional data.

SMVAM can use any flexible or functional form. However, the linear approximation is adopted as a convenient specification. Having a small number of parameters allows rich interpretations:

U_e is the market's estimate of unbookable equity. It is the market value of off-balance-sheet items that also includes the value of federal guarantees. A positive (negative) value implies that unbookable equity serves as a net source of (drain on) capital for stockholders.

kBV is the market's estimate of the value of the components of accounting or book net worth. k is the valuation ratio of the market to book value of the itemized assets and liabilities. Only if this ratio equals unity is the accounting value of an institution's equity an unbiased estimate of the bookable components of stockholder equity. A market premium (discount) exists when the ratio is greater (less) than one.

The model envisages that market participants estimate the market value of the elements of bookable equity by applying an appropriate markup or markdown ratio, k, to the accounting net worth reported by the institution. The model also presumes that, to construct the market value of the institution's equity, market participants add their estimate of unbookable equity: the market value of off-balance-sheet items, which includes the value of FDIC guarantees.

Hence, in equation (2), U_e is the portion of market value accounted for by unbookable equity and kBV is the portion of market value accounted for by bookable equity. The theoretical values of the intercept and the slope coefficient are zero and one, respectively, if no off-balance-sheet items exist and if the bookable assets and liabilities are marked to market.

SMVAM allows us to study the economic solvency (or insolvency) of an institution by studying the determinants of the market value of its equity. To estimate the enterprise-contributed equity, it is first necessary to estimate the value of federal guarantees.

Federally Contributed Equity

The market value of a firm's capital is equal to the market value of its enterprise-contributed capital plus the market value of its insurance guarantees (federally contributed capital). Federal guarantees provide credit enhancements that allow insured institutions to operate with less enterprise-contributed equity, making the U.S. government a de facto investor in deposit institutions. The market value of deposit insurance guarantees can be defined as the incremental value these guarantees add to the market value of a financial institution's enterprise-contributed equity. Alternatively, we may call enterprise-contributed equity the net value of the institution after the value of the guarantees is taken out.

The literature presents different approaches on how to value deposit insurance guarantees operationally. A common approach is to estimate this value using an extension of the Black-Scholes (1973) contingent claims model. Merton (1977), Markus and Shaked (1984), Ronn and Verma (1986), and Schwartz and Van Order (1988) take this approach, viewing the insurance guarantee as a put option that gives depositors the right to sell their claims on the institution to the insurer at face value. Calculating the value of the guarantee under this approach requires data on the market value of the institution's capital, its assets, and the instantaneous variance of the market value of its assets.

An alternative approach is discussed in Benston et al. (1986). They argue that the market value of a guarantee can be estimated either from the benefits the insured party receives or from the costs the insurer incurs. Guarantee benefits are defined as the capitalized value of the annual interest savings (net of guarantor fees) that the guaranteed party achieves with the help of its guarantee. Guarantee costs are defined as the risk-adjusted present value of a fund of reserves that is sufficient to cover both the monitoring and insolvency-resolution costs of the insurer. In a competitive equilibrium, the two counterparts give the same value.

Following portfolio theory, the funding interest rate (R_w) of an institution that does not have a credible guarantee rises with its leverage and with the riskiness of its portfolio. In contrast, assuming perfect markets, a completely guaranteed institution could borrow unlimited amounts at the riskless, or Treasury, interest rate (R_T) regardless of its leverage or the riskiness of its portfolio. Then the gross benefits of a guarantee can be determined by the difference between these two rates: R_W-R_T. To find the net benefits of this guarantee, subtract all forms (implicit and explicit) of annualized per-dollar premiums the guarantor collects in exchange for its services. To avoid subsidies or taxes, this premium (R_G) should vary with the riskiness of the institution and correspond to changes in R_W.

The insured institution's annual benefits per dollar of guaranteed liabilities are the difference between the ex ante risk premium and the per annum guarantee fee: $(R_W-R_T)-R_G$. For any R_W, unless R_G equals the ex ante risk premium R_W-R_T, the institution is either taxed or subsidized. To calculate the value of the guarantee using this approach, one must estimate the institution's funding rate had it been uninsured (R_W) and the value of the per annum implicit and explicit guarantee fee (R_G).

Another approach, discussed in Benston et al. (1986) and applied by Kane and Foster (1986), is to treat guarantee value as an implicit asset on an institution's balance sheet. The estimate of the guarantee value is obtained as a residual value by subtracting the market value of bookable and unbookable assets from the market value of bookable and unbookable liabilities plus the market value of the institution's stock.

This calculation of F_G is possible if every other off-balance-sheet source of value is accounted for. Kane and Foster (1986) use this approach to value the Federal National Mortgage Association's (FNMA) guarantee value. It is relatively easy to apply this approach to FNMA because of its simple balance sheet, which consists mostly of priceable mortgages. To be able to use this approach for a commercial bank, however, one must price the bank's more heterogeneous and infrequently traded assets.

It is also possible to estimate the guarantee value within SMVAM. SMVAM develops an estimate of the capitalized value of federal guarantees with the help of certain simplifying assumptions.

SMVAM and the Value of Federal Guarantees

Assuming that capital markets are efficient, the stock price of the institution incorporates the per-share value of federal guarantees. If one could also readily obtain a market value of the institution's enterprise-contributed equity, then the value of the deposit insurance guarantees would be the difference between these two values. The relationship is clarified in figure 1. We would expect the market value to approach enterprise-contributed equity (NV) at large positive values. This is because the value of the insurance guarantees becomes negligible as the institution becomes healthier, or has more of its own capital. In other words, for a well-capitalized institution, federal guarantees do not provide a significant level of credit enhancement. For positive values of enterprise-contributed equity, the 45-degree line represents the asymptote to which the market value approaches. When the enterprise-contributed equity is zero (at the origin) so that the institution becomes market-value insolvent, its value is comprised solely of its deposit insurance guarantees.

Unfortunately, the market value of enterprise-contributed equity is not readily available. Instead, the book value of equity is used as a proxy for this variable. The relationship is now different for three reasons: 1) book values are not marked to market, 2) book values do not include off-balance-sheet items, and 3) book values are not necessarily exogenous.

As already discussed, the market value of bookable equity (B_e) is not observed, because recorded assets and liabilities are carried at historical cost. To obtain B_e, BV is adjusted by a valuation ratio. Kane and Unal (1990) interpret SMVAM by imposing identifying restrictions on a two-equation model of U_e and B_e:

$$U_e = a_u + b_u BV + e_1 \tag{3}$$

$B_e = a_e + b_e BV + e_2$.

Because all four coefficients cannot be identified using only BV, SMVAM is a reduced form of these two equations that can be solved by restricting b_u and a_e to zero. As Kane and Unal discuss, to the extent these restrictions do not hold, SMVAM is less effective in separating the components of hidden reserves.

The value of federal guarantees is excluded from enterprise-contributed equity by definition. Book values also exclude other off-balance-sheet items, because under GAAP, implicit assets or liabilities cannot be itemized. Again, using only one instrumental variable (BV), it is not possible to distinguish between the value of federal guarantees and other off-balance-sheet items.

Treating BV as exogenous is another restriction. As Kane and Unal discuss, BV may not be exogenous because GAAP gives recording options to institutional managers and because regulators penalize low BV. Therefore, managers of troubled deposit institutions especially use accounting options to overstate capital and to reduce regulatory pressure.

These restrictions introduce errors into the relationship. A final restriction is the linearity of the assumed relationship between MV and BV. However, as Kane and Unal note, for a representative sample of the banking universe, the range of variation (both upside and downside) is controlled by market forces. Large holdings of capital are limited by takeover discipline, since they reduce deposit-insurance subsidies. Low levels of BV are also limited because of regulatory penalties (Buser, Chen, and Kane [1981]).

To obtain an estimate of federally contributed equity, one or more additional restrictions must be imposed. Assuming that the unbookable equity of the institution consists of the FDIC guarantees, U_e can be taken as an estimate of $g_{i,t}$, the standardized value of federal guarantees. This assumption is overly strong, especially for large institutions that have access to a broad range of off-balance-sheet activities. The nonlinear version of SMVAM explained in the next section is an attempt to remedy this problem.

Having obtained an estimate of $g_{i,t}$ from SMVAM, the enterprise-contributed equity or net value (NV) is given by subtracting $g_{i,t}$ from the predicted market value of the institution's stock. The equation is estimated from time series for individual banks and from pooled time-series, cross-sectional data for all institutions.

A Nonlinear Version

One of the assumptions SMVAM makes is the linearity of the relationship between the market value and book value of the institution's equity. This is not an adverse assumption if the sample is representative of the banking universe. However, this may not be true for a sample of unhealthy institutions. The nonlinearity assumption may become overly violated for institutions with almost zero or negative book values. To test the sensitivity of results to this possible nonlinearity, I also consider a nonlinear version of SMVAM.

In studying the relationship between MV and the market value of enterprise-contributed equity, I use BV as a proxy for the unobserved enterprise-contributed equity. This results in a similar but more complicated version of the relationship given in figure 1. The nonlinear relationship between market and book values is approximated by the following function (see figure 2):

$$MV = 0.5b(BV-a) + \sqrt{0.25b^2(BV-a)^2 + c^2} + u. \qquad (4)$$

Figure 2 makes simplifying assumptions that are later relaxed. It assumes that all bookable equity is booked and marked to market ($BV=B_e$) and that there are no off-balance-sheet items except for federal guarantees (A'_m-L'_m=0).

Then equation (4) collapses to equation (1) with a=0 and b=1, and BV is an unbiased proxy for NV. As explained below, parameters a and b are introduced to capture biases when the above assumptions are relaxed. The numerical parameters 0.5 and 0.25 ensure that for large MVs, the function approaches the 45-degree line in the absence of biases in BV. For large negative BVs, the function has asymptote MV=0, i.e., MV approaches zero.

The two asymptotes of the function are theoretically plausible. Institutions that are well capitalized may have high levels of BV (=NV, given the above assumptions), in which case MV approaches BV. This is consistent with the diminishing value of credit enhancements that federal guarantees provide for well-capitalized institutions. Because BV is assumed to be an unbiased estimate of the market value of bookable equity, the slope of the asymptote (b) equals unity. In addition, since a stock price cannot become negative, at negative book values the MV approaches zero (the horizontal axis).

At any point in figure 2, the MV of the institution differs from its BV (=NV) by the value of its federal guarantees. Thus, also at the origin, when BV equals zero, the MV of the institution differs from zero by the value of its insurance guarantees. Given the above assumptions, the enterprise-contributed equity also becomes zero (NV=0) when book value equals zero. In this way, a standardized value of the insurance guarantees can be approximated by the market value of the institution at the point of economic insolvency (a). In figure 2, this corresponds to the height (c) of the function when BV equals zero, at (a). It is important to note that the value of the guarantee is conditional on the regulator's closure rule. If the authorities allow institutions to operate even after they are economically insolvent, and the stockholders are allowed to claim future profits, this possible additional value reflects in a higher capitalized value of the guarantees.

Figure 3 relaxes the assumption that BV is an unbiased estimate of NV. There are two possibilities: 1) BV overestimates B_e, or off-balance-sheet items are a drain on the institution's capital, and 2) BV underestimates B_e, or off-balance-sheet items are a source of the institution's capital. Again, the extent of this overestimation or underestimation may be affected by the regulators' closure rule and their capital requirements. Because financial institution managers can alter the value of BV under GAAP, greater penalties for low levels of BV without the adoption of MV accounting rules may persuade the institutions to become increasingly deceptive in their accounting practices as BV declines into penalty ranges.

In the first panel of figure 3, BV overestimates the market value of bookable equity. As a result, the institution's market value of bookable liabilities exceeds that of its bookable assets before its BV becomes zero. If off-balance-sheet items (other than federal guarantees) are also a drain on equity (or at least not a great enough source to offset the first effect), the institution's enterprise-contributed equity becomes zero at point a, where BV is still positive. To the right of point a, where the institution is economically solvent, MV approaches BV. However, since BV overestimates B_e, there is a market discount and the slope (b) of the asymptote is less than unity. To the left of point a, where the institution becomes more and more economically insolvent, MV approaches zero. Again, conditional on the regulator's closure rule, the standardized value of the insurance guarantees is given by the height (c) of the function at the point of economic insolvency.

The interpretation of the second panel of figure 3 is similar. In this case, BV underestimates the market value of bookable equity, or the off-balance-sheet items are a source of equity (or not a significant enough drain to offset the first effect). Then, the institution becomes economically insolvent only after its BV becomes negative. With BV a downward-biased estimate of B_e, the right asymptote has a slope that is greater than unity. In other words, a market premium exists. The MV starts approaching zero to the left of point a, and depending on the closure rule, the value of the guarantees is again given by the height of the curve at a.

In light of this explanation, the parameters of the nonlinear model have the following interpretations:

a - The point at which enterprise-contributed equity becomes zero and the institution is economically insolvent. If there are no off-balance-sheet items, and BV is an unbiased estimate of B_e, then BV is also an unbiased estimate of the enterprise-contributed equity (BV-NV) and point a is where BV equals zero. If BV overestimates (underestimates) B_e, or off-balance-sheet items are a drain on (source of) equity, the institution becomes economically insolvent where BV is greater (less) than zero.

b - As with the slope coefficient in SMVAM, the slope of the asymptote reflects the valuation ratio of the market to book value of the institution's bookable equity. If BV represents an unbiased estimate of bookable equity, the slope is equal to unity. Otherwise, there is a market discount (premium) and b is less (greater) than unity.

c - At the point of economic insolvency, the MV of the institution differs from zero by the value of its deposit insurance guarantees. Given a particular closure rule, the standardized value of the guarantees is given by the height of the function at point a.

It is also possible to discuss the above model within an option-pricing framework. The FDIC receives a compound option in exchange for its guarantee. The received option is a call option, written not directly on the firm's assets, but on the right to close out the firm's stockholders and to put a given percentage of the insolvent firm's unallocated losses to the uninsured depositors by liquidating the firm (Kane [1986]). However, as Kane emphasizes, the ability of regulators to exercise this option is limited by their constraints and incentives.

To minimize its losses, the FDIC should exercise its takeover option and close the institution as soon as it becomes economically insolvent. If the FDIC could exercise its option at the point of market-value insolvency, the put half of the compound option need not be exercised, since net worth is approximately zero and any losses would be minimal. Delays in exercising the takeover option due to aforementioned constraints and incentives encourage an already insolvent institution to take risks that make it likely to become more insolvent, causing the put half of the compound option to gain importance once the call half is eventually exercised. The implicit and explicit costs to the FDIC increase to the extent that regulatory constraints prevent this put half of the option from being exercised.

Therefore, it is possible to consider point a, the onset of market-value insolvency, to be the theoretical exercise price of the call option. In theory, an unconflicted agent would take over the equity of the firm at the point of market-value insolvency. However, in practice, conflicted agents delay action because of constraints and incentives. To the left of point a, if the institution is allowed to operate, the FDIC's call option is out of money, because any incurred losses primarily accrue to the insurance agency.

This nonlinear version can be used to test the sensitivity of the results to nonlinearity. To obtain an estimate of the guarantee value within the nonlinear version of SMVAM, we assume that the value of the institution's stock price reflects a standardized value of federal guarantees when the institution's NV is zero ($c = g_{i,t}$). The nonlinear version is expected to produce a more accurate estimate of guarantee value, since it is measured at the point where

NV=0, whereas the estimate of the linear version is obtained at BV=0. With this specification it is also possible to parameterize c to be a function of the riskiness of the bank and the size of its liabilities (Black, Miller, and Posner [1978], Karaken and Wallace [1978], Sharpe [1978], and Kane [1985, 1989]). The average annual stock price range is used to proxy risk, and liabilities are given by total assets minus the book value. In this way, the FDIC guarantee value varies both across time and among institutions with respect to their size and riskiness ($c_{i,t}=g_{i,t}$). The construction of NV parallels the linear case, except that c is used as an estimate of the guarantee value instead of U_e.

The equation is estimated for pooled time-series, cross-sectional data.

Comparison of SMVAM and its Nonlinear Version

To show the relationship between SMVAM and its nonlinear version, equation (4) can be rewritten as follows:

$$MV = c + b(BV-a) + \phi + u, \tag{5}$$

where $\phi = \sqrt{0.25b^2(BV-a)^2 + c^2} - (c + 0.5b(BV-a))$.

ϕ is the nonlinearity factor that SMVAM omits. Rearranging (5) as

$$MV = c - ba + bBV + \phi + u \tag{6}$$

gives SMVAM (2) with U_e=c-ba, k=b, and e=ϕ+u.

The nonlinear version collapses to SMVAM if BV is an unbiased estimate of B_e (a=0) and if there is no source of nonlinearity (ϕ=0).

Nonzero a affects only the U_e coefficient of SMVAM. To clarify this effect, it is useful to remember that U_e is the intercept (the height of the function at BV=0). In contrast, c is the height of the function at NV=0. Therefore, c changes if BV underestimates or overestimates B_e, whereas U_e is always given by the intercept. Thus, for nonzero a, c does not equal U_e. If a is greater (less) than zero, c is greater (less) than U_e. In addition, if the relationship between MV and BV is nonlinear, SMVAM is misspecified and its coefficients are biased. These biases, resulting from nonzero a and nonlinearity, are further discussed in Demirgüc-Kunt and Thomson (1988).

In summary, both the linear and nonlinear SMVAM describe the de facto deceptiveness of GAAP. Unless $U_e=0$ and $k=1$ for SMVAM, and $b=1$ and $c=a=0$ (or $a=c^2/BV$) for its nonlinear version, the accounting value of a bank's capital represents a biased estimate of the market value of stockholder equity. If the estimated U_e and c are significantly positive, unbookable equity serves as a net source of the institution's capital. A negative U_e value in SMVAM is interpreted to indicate that unbookable equity is a drain on institutional capital. The nonlinear version does not allow a negative c by definition, since MV cannot be negative for any BV. A slope bias also exists if $k\neq1$ and $b\neq1$. Then, the changes in accounting values are also biased estimates of the changes in the bookable equity of the institution. A k or b less (greater) than unity is interpreted as a discount (premium) of the amount (1-k) or (1-b).

SMVAM: Specification

The specification of SMVAM is tested for omitted variables, functional form, the stationarity of coefficient estimates, and the validity of OLS assumptions.

To test for omitted variables, additional candidate regressors (such as stock market index, bank failure rate, business failure rate, interest rates, volatility of interest rates, etc.) are included in SMVAM. The alternative specifications, including the proxy variables and their various combinations, are evaluated by F-tests.

In addition to the choice of regressors, the choice of functional form can also introduce specification error into an equation. Given the nature of our data set, SMVAM's linearity assumption may be too restrictive. Furthermore, visual inspection of the data indicates a nonlinear relationship between MV and BV. As a simple test of fit, inclusion of squared BV (to represent a quadratic form) as a regressor produces a significantly higher R^2. Thus, the theoretically justified nonlinear version is also estimated to test the sensitivity of results to this form of nonlinearity.

Stationarity of SMVAM parameters is also tested for using the Chow test (Chow [1960]). For the pooled sample, the null hypothesis of stationarity cannot be rejected at the 5 percent significance level. However, to allow for possible differences among individual institutions, the equation is estimated separately for each bank. The possibility of parameter shifts for different groups of institutions is also investigated, using various partitions such as failed/nonfailed banks, market-value solvent/insolvent banks, and large/giant banks. Since preliminary results indicate significant differences among the coefficient estimates of different subsamples, differences among all subgroups are studied simultaneously to handle overlaps among partitions. This is done using slope and intercept dummy variables.

Presence of autocorrelated disturbances is detected by the Durbin-Watson test (Durbin and Watson [1950, 1951, 1971]). Because the above-mentioned tests presumably establish that the model specification is adequate, it is not surprising that attempts to remove autocorrelation by including additional exogenous variables prove unsuccessful. The equation is reestimated using the Cochrane-Orcutt (1949) technique. The correlation coefficient is assumed to be constant across institutions for the pooled sample. For individual-bank regressions, the correction is made based on individual-bank correlation coefficients.

Presence of heteroscedasticity is also detected using Breusch-Pagan (1979) and Goldfeld-Quandt (1965, 1972) tests. The formal model of the process generating heteroscedasticity in the equation is not known. Still, since we might suspect that error variance differs due to differences in the size of the included institutions, the equation (including the constant term) is deflated alternatively by both total assets and book value. However, tests conducted following these corrections still indicate the presence of heteroscedasticity. Instead of specifying additional ad hoc error structures, White's (1980) consistent estimator of the variance-covariance matrix is calculated.

Data-Related Problems

Data-related difficulties also need to be considered. In estimating SMVAM for failed institutions owned by bank holding companies (approximately one-fifth of the failed sample), an additional problem arises. The book value and market value of equity used are the individual bank's book value and the holding company's market value, respectively, since the stock of the bank seldom trades separately. As Kane and Unal (1990) also discuss, to the extent that holding companies have other bank and nonbank subsidiaries and to the extent that the book value of these subsidiaries is correlated with the book value of the bank, the regression estimates of SMVAM would be biased.

This problem does not arise for the sample of nonfailed banks. Included in this subsample are one or multibank holding companies without nonbank subsidiaries. Holding-company market value and consolidated book value are used in estimating the regressions. However, by using consolidated data, options of differential treatment of some components are neglected, such as different banks owned by the same holding company. In other words, the relationship studied is between the holding-company market value and overall book values of the subsidiaries.

In addition, the book-value data used in this study include loan loss reserves. To the extent that loan loss reserves represent an estimate of anticipated losses, they deserve to be offset against these losses. Only the amount over anticipated losses belongs in the book value of equity. Including gross reserves overstates the capital of the institutions.

Furthermore, the sample of institutions in this study is far from being representative of the banking universe. This is a study of large commercial banks; whether the results obtained here are applicable to other institutions is an issue that remains to be investigated.

Data Set

Panel data are used in estimating this model. A sample of failed and nonfailed banks is chosen so that stockholder-contributed equity and guarantee value can be compared and contrasted for the two groups of institutions.[3] Analyzing data of failed banks is important because their federal guarantee value and stockholder-contributed equity should differ drastically from those of the nonfailed banks.

A list of failed banks with assets greater than $90 million (smaller banks seldom prove to have actively traded stocks) is obtained from the Federal Deposit Insurance Corporation's Annual Reports from 1973 to 1989. Annual data on number of shares, book value per share, total assets, and price range are collected from Moody's Bank Manual for each bank, where possible, from 1963 up to the date of failure. Variable definitions are given in table 3.

Table 4 lists the names of the 32 failed banks for which complete data could be collected. Banks have an asset size range of $92 million to $47 billion. Three-fourths of the failed banks are from southern states (Texas, New Mexico, Oklahoma, Louisiana, Mississippi, Tennessee, and California), and the rest are from New York, Pennsylvania, Wisconsin, Illinois, and Alaska.

The universe of nonfailed banks is identified from Moody's Bank Manual in three steps. First, each listed bank is screened to choose the banks that come from the aforementioned 12 states. Second, all of these banks that fall within the failed-bank asset range are kept. Finally, all FDIC-member banks with actively traded stock (as reported in the Bank Manual) are chosen to constitute the universe of nonfailed banks. The banks in this universe are FDIC members and have traded stock throughout the sample period (1963, or the date of charter, to 1987).

The candidate banks are then separated into two groups based on their home state. A random sample of 50 nonfailed banks is chosen from the two groups of candidate banks such that the nonfailed sample has the same geographic dispersion: 75 percent from the southern states, and 25 percent from the rest. The resulting control sample also has an asset-size dispersion roughly similar to that of the failed sample. The same annual data are collected for the nonfailed banks.

IV. Empirical Results

Final specifications for the SMVAM are presented in tables 5, 6, and 7. All of the reported results are obtained after the corrections listed above.

The SMVAM coefficients describe the de facto deceptiveness of GAAP. Only if both U_e=0 and k=1 would the book value of a bank's capital represent an unbiased estimate of the market value of its stockholder equity. If the estimated intercept is positive (negative), unbookable assets and liabilities serve as a net source of (drain on) institutional capital. In addition, changes in accounting values are biased estimates of changes in the market value of bookable equity if the estimated k is not equal to one.

In this paper, SMVAM is used to obtain an estimate of the capitalized value of federal guarantees and therefore the value of enterprise-contributed equity. However, as emphasized in the previous section, U_e is an estimate of unbookable equity and may overestimate or underestimate the value of federal guarantees, depending on the magnitude and effect of other off-balance-sheet items on the capital of the institution.

The nonlinear version may be interpreted as an attempt to remedy this shortcoming. By allowing the guarantee value to be estimated at the point where the enterprise-contributed equity becomes zero, the c parameter is expected to be a more accurate estimate. Allowing c to vary with the riskiness of the institution and the size of its liabilities captures additional information neglected by the linear version. A positive c indicates that federal guarantees are a source of capital for the institution. Similarly, positive (negative) values for the d and e parameters indicate that the value of the guarantee increases (decreases) with an increase in the riskiness or liability size of the institution. Parameter a measures the extent to which BV misrepresents the enterprise-contributed equity. A positive (negative) a indicates that enterprise-contributed equity becomes zero although BV is positive (negative). This shows that BV overvalues (undervalues) its market value or that off-balance-sheet items are a drain on (source of) the institution's capital. Finally, b corresponds to k in SMVAM.

SMVAM Results

Table 5 presents time-series results for individual banks. Table 6 gives results of preliminary regressions obtained by partitioning the data in three ways. The following sample partitions are considered: 1) failed/nonfailed banks, 2) market-value solvent/insolvent banks, and 3) large/giant banks. Sample partitions allow us to investigate the sensitivity of the results to different breakdowns and to compare and contrast findings for different groups of institutions.

The breakdown between failed and nonfailed banks is straightforward and employs the failure definition adopted in this paper. The second breakdown, between market-value solvent and insolvent banks, is subject to estimation error, since the market-value insolvency of institutions is not observed. Before institutions can be identified as solvent or insolvent, an initial estimation of the equation is necessary. The breakdown is based on the estimate of the market-value-insolvency point, a, obtained from the nonlinear version of SMVAM instead of the estimated NV obtained from SMVAM, which seems to be the most obvious choice.[4] However, although NV gives us a ranking of institutions according to their degree of solvency, it proves negative in only two observations. This is the result of nonnegative book values. Partitioning according to the economic insolvency point obtained from the nonlinear model produces plausible results. All failed banks are identified as market-value insolvent at least one year before they fail.

The third breakdown, between large and giant institutions, is rather arbitrary, however. Institutions with total assets greater than the mean asset size of the whole sample ($1.9 billion) are considered giant. The "too large to fail" preferences of regulators can be used to justify such a partition.

The results for individual banks, and preliminary linear and nonlinear results obtained for various sample partitions, are given in tables 5 and 6. The individual-bank coefficient estimates can be summarized as follows:

U_e, the unbookable equity, is significant at 5 or 1 percent levels for 40 percent of the banks. Its sign is positive in almost all cases, implying that the off-balance-sheet items serve as a net source of the institution's capital. One positive component of the intercept is the value of the federal deposit insurance guarantee. The positive sign is consistent with the hypothesis that underpriced deposit insurance becomes capitalized into the market value of undercapitalized institutions (Kane [1985]).

k, the valuation ratio, is highly significant and positive for 85 percent of the banks. It is significantly (at the 5 or 1 percent level) different from unity in 53 percent of the cases and less than unity in 43 percent of the cases. The combined U_e=0 and k=1 condition necessary for recorded equity to be an unbiased estimate of market value holds only for 26 percent of the banks. These figures are consistent with Kane's (1985) claim that accounting representations of the economic performance of major banks are deceptive de facto.

The number of observations available for each institution varies. The fit of individual-bank regressions, as measured by their respective R^2 values, seems to be directly related to the number of observations in their samples. To increase the sample size and to capture cross-institution effects, observations on all institutions are pooled. To allow for differences among institutions and to group them into classes with similar parameter estimates, the aforementioned partitions are considered.

The linear and nonlinear SMVAM results (table 6) with panel data, using the partitioned samples, indicate significant differences among failed/nonfailed, insolvent/solvent, and large/giant institutions. However, analyzing these results individually may be misleading if partitions overlap. The extent of divergence between coefficient estimates for large and giant institutions especially signals that differences among other partitions may be driven by the size partition. To investigate whether this is true, all partitions are studied simultaneously, using dummy variables. Results are given in table 7.

The linear version is used as a benchmark in choosing the significant partitions, since nonlinear estimation runs into convergence difficulties when all partition dummy variables are included at once.

When all partitions are considered, only the size and failure partitions prove significant. One possible explanation for why the market-value solvent/insolvent partition is significant when studied separately, and insignificant when studied simultaneously, is that this partition involves estimation error. Insignificance of this partition may also be due to dominance by the other two partitions.

Interpretation of Linear and Nonlinear SMVAM Coefficients

Linear version results indicate that the unbookable equity (U_e) of giant institutions is significantly greater than that of others. In fact, although positive for all, the unbookable equity is significant only for giant institutions (approximately 40 percent of mean NV). The other sample partitions do not appear to affect the magnitude of unbookable equity. U_e captures the value of off-balance-sheet items as well as the value of federal guarantees. Thus, this large U_e value may be the result of giant banks' greater access to a broader range of off-balance-sheet activities. Another possible explanation is the greater value of federal guarantees for these giant institutions. For very large institutions, administrative, political, and economic difficulties may cause the regulators to consider these institutions "too big to fail" (Seidman [1986]). Federal regulators may be especially reluctant to deal with these insolvencies, since such failures tend to be more visible and more difficult to carry out successfully, causing greater damage to the regulators' performance image.[5]

For the estimate of valuation ratio (k), size and failure partitions lead to significant differences. The BV of giant institutions is significantly discounted by the market, particularly if the institution is also from the failed group. However, for smaller nonfailed institutions, the market-to-book valuation ratio indicates a significant premium.

Nonlinear-version results provide additional information. The significant and positive a (a, a1, and a2) coefficients indicate that BV overestimates enterprise-contributed equity, NV, for all institutions. The extent of overestimation is greater for giant (a1) institutions and is even greater for failed (a2) institutions. As a percentage of mean total assets, the overestimation is 2.9 percent for large nonfailed banks. An additional bias of .49 and 1.6 percent exists for giant and failed banks, respectively.

As in the linear case, the market valuation ratio (b) for large nonfailed banks indicates a premium. Again, the BV of giant and failed institutions is significantly discounted. The discount is larger for failed institutions, and even larger if the failed institution is a giant bank.

The coefficients of risk (d) and liability size (e) are also positive and significant. This result indicates that greater riskiness increases the value of federal guarantees, as argued in section II. The risk coefficient captures the destabilizing effect of the current deposit insurance system. Also, the greater the deposit debt of an institution, the greater the value of its deposit guarantee, since the insurance agency suffers increased losses in the case of failure. The implied value of federal insurance guarantees ($\bar{c}$) is positive for all institutions. However, this guarantee is significantly larger for giant institutions (40 percent of mean NV as opposed to 30 percent for smaller institutions).

In conclusion, recorded equity under GAAP is deceptive. BV is a biased estimate of NV for all institutions. The market discounts BV for both giant and failed institutions. All institutions appear to enjoy a positive guarantee value, although it is not significant in the linear version. This federally contributed equity is significantly greater (in both versions) for giant institutions. Risk-taking incentives provided by mispriced deposit insurance are evidenced by the positive and significant coefficient found for the risk variable. The theoretical discussion in section II is also supported by the data. Riskier institutions have the advantage of increased amounts of federally contributed equity, which undermines market discipline for all institutions.

According to SMVAM results, market values are not adequately proxied by book values. This finding underlines the importance of using market data in studying bank insolvencies.

V. Summary and Conclusions

This paper seeks to develop an empirical model to value a financial institution's capital for regulatory purposes. It is emphasized that enterprise-contributed equity is the appropriate capital definition.

Through the use of Kane and Unal's (1990) SMVAM, the market value of the institutions' equity is decomposed. My findings indicate that the accounting or book value of a bank's capital represents a biased estimate of the market value of stockholder equity for all institutions, and especially for giant ones. GAAP as well as the more lenient Regulatory Accounting Principles (RAP) have been used deceptively by financial institutions that feel the need to hide their true value. For regulatory purposes, it is important to adopt market-value accounting, which provides a reliable measure of the firm's strength.

These results are further evidence of the government's de facto capital investment in financial institutions. By allowing those that are market-value insolvent to operate, the government has accumulated a large de facto equity stake in deposit institutions. Results obtained also support the hypothesis that the government's stake is greater in giant institutions and grows with an increase in the institution's riskiness and liability size. This evidence supports the idea that the present deposit insurance system has a destabilizing effect. It is in the interest of all institutions to increase their riskiness in order to substitute federal equity for stockholder equity. Greater risk-taking increases the government's equity stake in these institutions, thereby increasing the loss exposure of the insurance agency and the taxpayer. These policies destabilize the financial system by encouraging excessive risk-taking for all institutions. To protect taxpayer interests, market discipline must be restored.

In other papers, I (Demirgüç-Kunt [1990a, 1990b]) use the estimate of NV developed in this paper to study the failure decision-making of federal regulators. The failure model developed adopts the SMVAM and its nonlinear version as the insolvency equations. The results confirm the superiority of NV over BV in predicting bank failures. Furthermore, taking into account the nonlinearity of the relationship between MV and BV leads to a more accurate estimate of institution's NV. The greater discriminatory power of NV, estimated using nonlinear SMVAM, results in improved fit of the failure equation and in higher classification accuracy.

Although the nonlinear version of SMVAM does seem to produce an estimate of NV that has a greater discriminatory power by itself, the results of the out-of-sample prediction indicate that the linear version also does well. The linear version may be preferred in practice, since it simplifies the estimation of the model considerably.

The model developed in this paper could be used to determine the net value for S&Ls and then to compare and contrast findings that apply for banks and S&Ls.

Footnotes

1. Unfortunately, this is hardly the case. In other papers, I (Demirgüç-Kunt [1990a, 1990b]) analyze empirically the failure determinants of U.S. commercial banks. Results indicate that economic, political, and bureaucratic constraints and regulatory incentives are just as important in determining failure as the economic insolvency of the institutions.

2. For a review of empirical literature on bank failures, see Demirgüç-Kunt (1989).

3. The enterprise-contributed equity in our case is stockholder-contributed equity, since the institutions considered in this study are stockholder-owned rather than mutually owned.

4. As already mentioned, the market-value solvent/insolvent breakdown is based on an initial estimation. As the estimated coefficient a in table 6 indicates, BV overestimates MV for both failed and nonfailed institutions. The extent of overvaluation as a percentage of total assets is about 4 percent for nonfailed banks and 6 percent for failed banks. Thus, it is possible to classify failed banks with less than 6 percent book-to-asset ratio and nonfailed banks with less than 4 percent book-to-asset ratio as market-value insolvent.

5. For a model of regulatory failure-decision process and empirical estimation, see Demirgüç-Kunt (1990a, 1990b).

Table 1 U.S. Bank Closures For Various Subperiods, 1934-1989

	Average Number of Closings per Year		Average Deposits in Closed Banks ($ Millions)	
Years	All Banks	Insured Banks	All Banks	Insured Banks
1934-40	64.2	51.1	68.2	62.3
1941-50	7.3	6.1	10.3	9.9
1951-60	4.3	2.8	11.5	10.5
1961-70	6.3	5.0	34.2	33.5
1971-80	8.3	7.9	537.2	529.1
1981-85	59.8	59.8	6,023.4	6,023.4
1986	138	138	6,471.1	6,471.1
1987	184	184	6,281.5	6,281.5
1988	220	220	37,200.0	37,200.0
1989	207	207	21,400.0	21,400.0

Sources: Federal Deposit Insurance Corporation Annual Report, 1987, and telephone calls to FDIC.

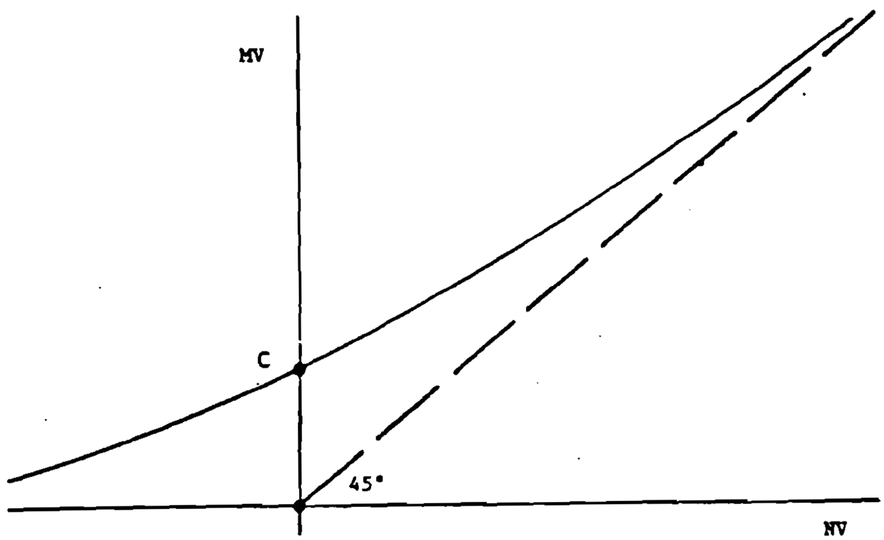
Table 2 Bank-Failure Concept Definitions

Federally Contributed Equity	- the capitalized value of the deposit insurance guarantees.
Enterprise-Contributed Equity	- the capital of the institution net of the federally contributed equity.
Book-Value Insolvency	- when the book value of assets minus the book value of liabilities (book value of the net worth) is negative.
Market-Value Insolvency Economic Insolvency De Facto Insolvency	- when the market value of assets minus the market value of liabilities net of the value of insurance guarantees (enterprise-contributed equity) is negative.
Official (De Jure) Insolvency Closure De Jure Failure	- when the regulators judge capital to be inadequate and the institution is closed or merged out of existence.
De Facto Failure	- any regulator-induced cessation of autonomous operations.

Source: Author.

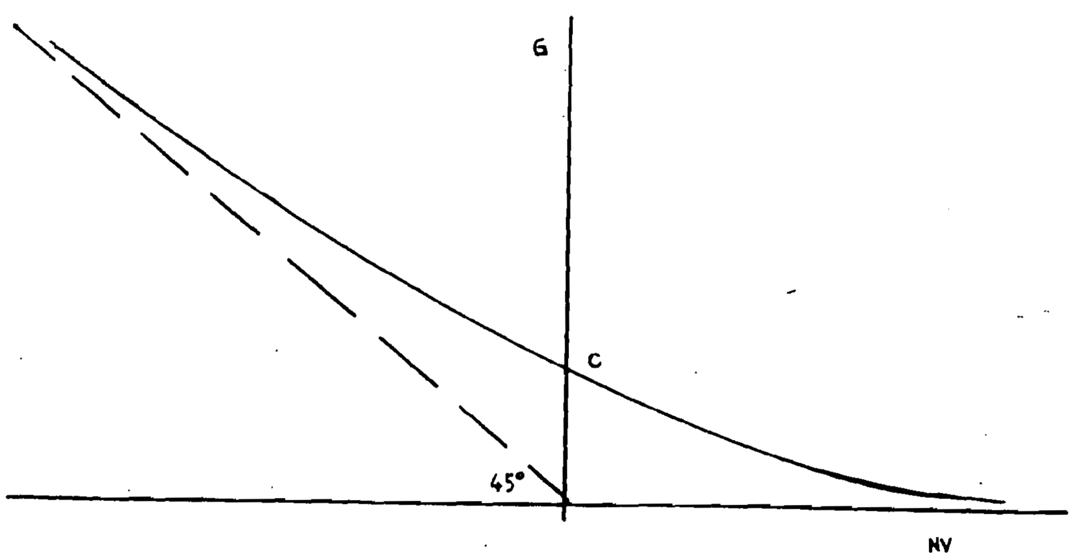
Figure 1 The Relationship Between MV and NV

$$MV = 0.5NV + \sqrt{0.25NV^2 + c^2}$$



The Relationship Between G(NV) and NV

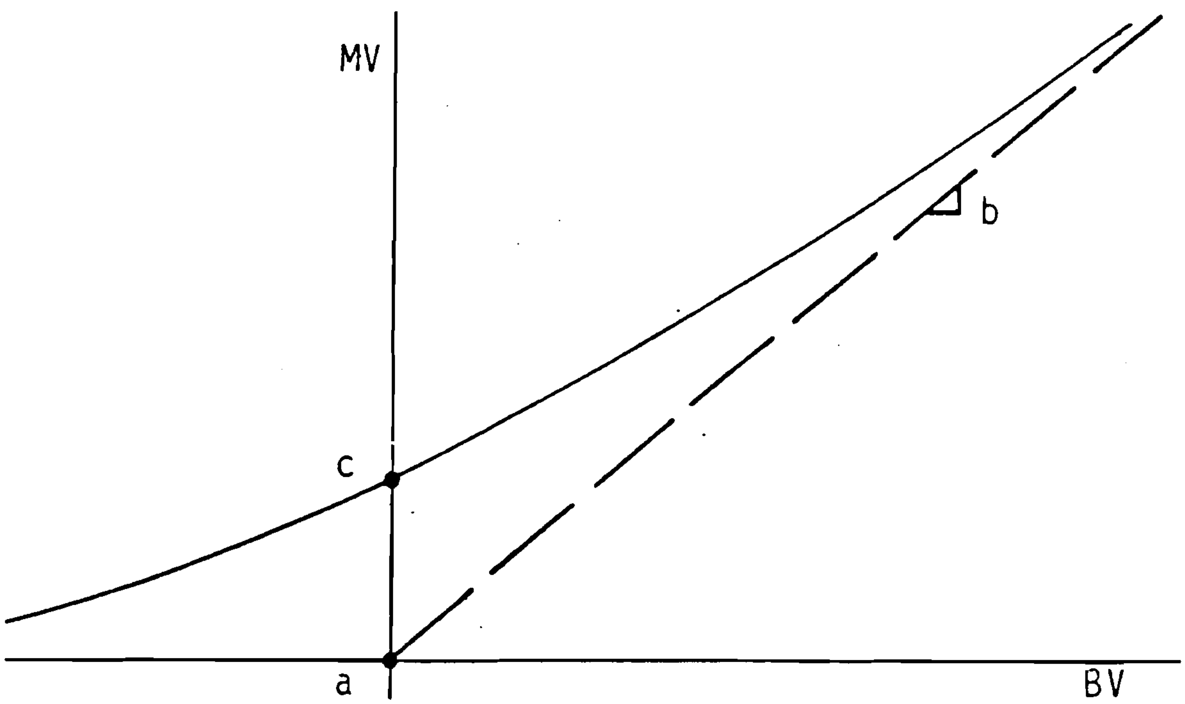
$$G(NV) = -0.5NV + \sqrt{0.25NV^2 + c^2}$$



Source: Author.

Figure 2 The Nonlinear Relationship Between BV and MV when BV=NV

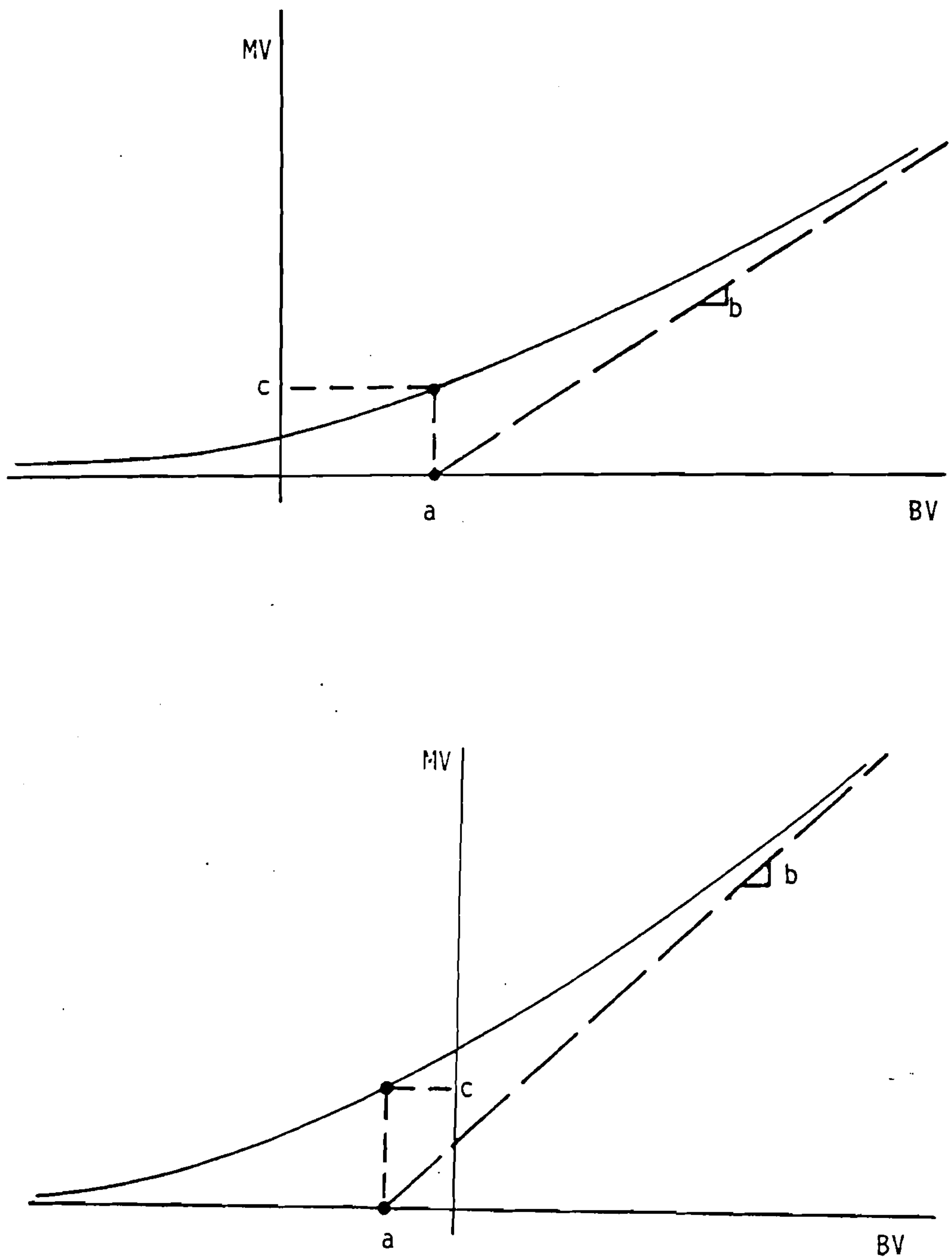
$$MV = 0.5b(BV-a) + \sqrt{0.25b^2(BV-a)^2 + c^2} + u$$



Source: Author.

Figure 3 The Nonlinear Relationship Between BV and MV when BV≠NV

$$MV = 0.5b(BV-a) + \sqrt{0.25b^2(BV-a)^2 + c^2} + u$$



Source: Author.

Table 3 Variable Definitions and Sources

MV_t	-	market value of the institution's equity at time t. MV is the price per share multiplied by the number of shares outstanding. All data are obtained from Moody's Bank Manuals.
BV_t	-	book value of the institution's equity at time t. BV is the book value of assets minus the book value of liabilities and is given by the sum of capital stock, surplus, undivided profits, and reserves. Data are obtained from Moody's Bank Manuals.
A_t	-	total asset size of the institution at time t, as given in Moody's Bank Manuals.
L_t	-	total liabilities of the institution at time t, as given in Moody's Bank Manuals.
RISK	-	average annual stock price range (high price-low price)/ [(high price + low price)/2]. High and low prices for the year are obtained from Moody's Bank Manuals and The Wall Street Journal.

Source: Author.

Table 4 Failed Banks With Assets More Than $90 Million, 1973-1989

Failure Date	Bank	Assets	Failure Type
Oct. 1973	United States National Bank, San Diego, California (USN)	$1.3 billion	P&A
Oct. 1974	Franklin National Bank, New York, N.Y. (FNB)	3.6 billion	P&A
Oct. 1975	American City Bank & Trust Co., N.A., Milwaukee, Wisconsin (ACB)	148 million	P&A
Jan. 1975	Security National Bank, Long Island, New York (SNB)	198 million	P&A
Feb. 1976	The Hamilton National Bank of Chattanooga, Tennessee (HNB)	412 million	P&A
Dec. 1976	International City Bank & Trust Co., New Orleans, Louisiana (ICB)	176 million	P&A
Jan. 1978	The Drovers' National Bank of Chicago, Illinois (DNB)	227 million	P&A
Apr. 1980	First Pennsylvania Bank, N.A., Philadelphia, Pennsylvania (FPC)	5.5 billion	DA
Oct. 1982	Oklahoma National Bank & Trust Co., Oklahoma City, Oklahoma (ONB)	150 million	P&A
Feb. 1983	United American Bank in Knoxville, Knoxville, Tennessee (UAB)	778 million	P&A

Table 4 (continued)

Failure Date	Bank	Assets	Failure Type
Feb. 1983	American City Bank, Los Angeles, California (ACB)	$272 million	P&A
Oct. 1983	The First National Bank of Midland, Midland, Texas (FNM)	1.4 billion	P&A
May 1984	The Mississippi Bank, Jackson, Mississippi (MBJ)	227 million	P&A
July 1984	Continental Illinois National Bank & Trust Co., Chicago, Illinois (CIB)	47 billion	DA
Aug. 1986	Citizens National Bank & Trust Co., Oklahoma City, Oklahoma (CNO)	166 million	P&A
May 1986	First State Bank & Trust Co., Edinburg, Texas (FSB)	134 million	P&A
June 1986	Bossier Bank & Trust Co., Bossier City, Louisiana (BBT)	204 million	P&A
July 1986	The First National Bank & Trust Co., Oklahoma City, Oklahoma (FNB)	1.6 billion	P&A
Sept. 1986	American Bank & Trust Co., Lafayette, Louisiana (ABL)	189 million	P&A
Dec. 1986	Panhandle Bank & Trust Co., Borger, Texas (PBT)	107 million	P&A

Table 4 (continued)

Failure Date	Bank	Assets	Failure Type
Aug. 1986	First Citizens Bank, Dallas, Texas (FCB)	93.8 million	P&A
Nov. 1986	First National Bank & Trust Co. of Enid, Enid, Oklahoma (FBT)	92.4 million	P
Jan. 1987	Security National Bank & Trust Co., Norman, Oklahoma (SBT)	174.4 million	P&A
Oct. 1987	Alaska National Bank of the North, Alaska (ANB)	189 million	P&A
Feb. 1988	Bank of Dallas, Dallas, Texas (BOD)	170 million	P&A
March 1988	Union Bank & Trust Co., Oklahoma City, Oklahoma (UBT)	167.5 million	P&A
Apr. 1988	First City Bancorp of Texas, Houston, Texas (CBT)	11 billion	DA
Apr. 1988	Bank of Santa Fe, Santa Fe, New Mexico (BSF)	151 million	DA
July 1988	First Republicbank Dallas, N.A., Dallas, Texas (FRC)	19.4 billion	P&A
March 1989	Mcorp, Dallas, Texas (MCP)	20 billion	P&A

Table 4 (continued)

Failure Date	Bank	Assets	Failure Type
1989	Texas American Bancshares Inc., Texas (TAB)	$5.9 billion	P&A
1989	National Bancshares Corp. of Texas, Texas (NBC)	2.7 billion	P&A

Notes: P&A - Purchase & assumption transaction (27)

DA - Open bank assistance (4)

P - Deposit payoff (1)

Sources: Federal Deposit Insurance Corporation Annual Reports and American Banker.

Table 5 Linear SMVAM Results for Individual Banks

Banks	U_e	k	R^2
<u>Failed Banks</u>			
USN	14.13**	0.89**	0.89
1963-72	(4.18)	(0.14)	
FNB	151.04**	0.02..	0.23
1963-73	(36.89)	(0.34)	
ACB	-0.40	1.29**	0.61
1963-74	(2.85)	(0.34)	
SNB	32.64	0.78*	0.56
1963-74	(24.19)	(0.34)	
HNB	4.81	1.15*	0.34
1963-75	(10.28)	(0.50)	
ICB	6.50	0.43	0.12
1966-75	(4.05)	(0.50)	
DNB	-3.84	1.57*	0.71
1963-77	(10.15)	(0.78)	
FPC	130.08	0.50	0.64
1968-79	(167.69)	(0.63)	
ONB	1.54**	0.85**	0.82
1963-81	(0.43)	(0.09)	
UAB	1.91	0.94**	0.48
1963-82	(5.17)	(0.23)	
ACB	-2.16	2.01**..	0.86
1964-82	(20.00)	(0.26)	
FNM	6.38	1.46**..	0.93
1963-82	(72.40)	(0.13)	
MBJ	3.62	0.46**..	0.49
1963-83	(1.92)	(0.21)	

Table 5 (continued)

Banks	U_e	k	R^2
<u>Failed Banks</u>			
CIB 1963-83	446.24** (98.32)	0.39**$_{**}$ (0.09)	0.68
CNO 1966-85	10.04** (1.44)	0.52**$_{**}$ (0.13)	0.45
FSB 1974-85	1.97 (1.97)	0.87* (0.28)	0.68
BBT 1967-85	4.90** (0.68)	0.41**$_{**}$ (0.06)	0.72
FNB 1963-85	20.43 (14.93)	0.87** (0.16)	0.79
ABL 1963-85	2.18 (1.62)	0.89** (0.19)	0.50
PBT 1963-85	0.74 (0.60)	1.02** (0.19)	0.61
FCB 1970-85	2.24** (0.45)	0.24**$_{**}$ (0.08)	0.76
FBT 1970-85	4.52* (2.24)	0.42 (0.30)	0.36
SBT 1978-86	10.39 (5.16)	0.44 (0.29)	0.64
ANB 1964-86	2.23 (2.07)	0.74** (0.19)	0.68
BOD 1963-87	0.88 (1.44)	1.65**$_{**}$ (0.27)	0.87
UBT 1972-87	2.52* (1.19)	1.21** (0.15)	0.82
CBT 1963-87	166.58* (72.81)	0.51**$_{**}$ (0.14)	0.79

Table 5 (continued)

Banks	U_e	k	R^2
<u>Failed Banks</u>			
BSF 1963-87	1.04* (0.42)	0.75**$_{**}$ (0.05)	0.92
FRC 1963-87	190.18** (38.48)	0.51**$_{**}$ (0.06)	0.87
MCP 1963-87	79.00 (53.29)	0.61**$_{**}$ (0.09)	0.91
TAB 1963-87	10.34 (14.77)	0.91** (0.08)	0.90
NBC 1963-87	-0.24 (3.46)	1.15**$_{**}$ (0.04)	0.97
<u>Operating Banks</u>			
CFB 1963-87	1.03 (7.62)	0.79**$_{**}$ (0.06)	0.93
CNB 1963-87	1.86 (1.00)	0.64**$_{**}$ (0.11)	0.87
CWB 1963-87	0.47 (1.12)	0.67**$_{**}$ (0.07)	0.88
CCB 1963-87	11.20** (1.85)	-0.13 (0.14)	0.63
ONB 1964-87	2.11 (1.37)	0.63*$_{*}$ (0.25)	0.78
CCT 1963-87	4.51** (1.27)	0.33**$_{**}$ (0.10)	0.50
FNB 1963-87	0.11 (1.19)	1.19** (0.19)	0.85
FNM 1963-87	0.45 (1.20)	0.81** (0.13)	0.91

Table 5 (continued)

Banks	U_e	k	R^2
Operating Banks			
FNS 1963-87	2.03 (3.56)	0.96** (0.25)	0.76
MBT 1963-87	0.25 (0.30)	1.10**$_{**}$ (0.05)	0.95
NBT 1963-87	2.22 (1.42)	0.66**$_{**}$ (0.06)	0.91
WHC 1963-87	-21.84 (23.68)	1.52**$_{**}$ (0.17)	0.93
VNB 1963-87	0.71 (0.61)	0.76**$_{**}$ (0.08)	0.90
TCT 1963-85	7.59** (1.89)	0.35*$_{**}$ (0.18)	0.46
RNB 1965-85	1.29** (0.44)	0.91** (0.09)	0.84
FCC 1968-87	18.63 (14.55)	0.62**$_{*}$ (0.17)	0.51
PBT 1970-87	1.89 (1.89)	0.60*$_{*}$ (0.21)	0.36
CNH 1970-87	5.54** (1.39)	0.87** (0.17)	0.63
NBC 1972-87	0.78** (0.13)	0.29**$_{**}$ (0.02)	0.97
OSB 1975-87	1.71** (0.20)	0.29**$_{**}$ (0.03)	0.88
MNB 1975-87	6.04** (0.87)	-0.05 (0.10)	0.02
RCB 1976-87	19.74** (4.34)	0.002 (0.38)	0.01

Table 5 (continued)

Banks	U_e	k	R^2
Operating Banks			
DBT 1976-87	8.40 (5.53)	0.17 (0.68)	0.01
NCB 1976-87	-7.17 (3.09)	1.69**$_{**}$ (0.15)	0.89
SLB 1977-87	1.68** (0.70)	0.01*$_{**}$ (0.005)	0.77
FBO 1977-87	6.32** (0.66)	0.42**$_{**}$ (0.01)	0.72
FAB 1978-87	3.73** (0.91)	0.30*$_{**}$ (0.15)	0.39
PSB 1978-87	1.68 (1.93)	0.33$_{**}$ (0.25)	0.40
CNO 1974-85	12.62 (2.37)	-0.36 (0.21)	0.23
FMB 1975-87	9.74* (4.06)	0.21*$_{**}$ (0.06)	0.67
VBC 1964-87	-6.73 (5.03)	1.17**$_{*}$ (0.08)	0.96
CNY 1963-87	7.34** (2.13)	-0.31 (0.40)	0.30
FAC 1968-87	12.62 (25.65)	0.84** (0.19)	0.76
CBT 1972-87	12.52** (3.72)	-0.31 (0.66)	0.18
BTN 1966-87	215.52 (134.01)	0.66**$_{*}$ (0.14)	0.80
WFC 1968-87	258.10** (43.21)	0.43**$_{**}$ (0.05)	0.78

Table 5 (continued)

Banks	U_e	k	R^2
Operating Banks			
FCT 1974-87	515.51* (252.17)	0.25** (0.18)	0.47
CUC 1975-87	-23.00 (50.47)	0.88* (0.45)	0.65
CNC 1972-87	19.58 (23.48)	1.70**** (0.27)	0.75
ABI 1973-87	15.17 (61.86)	1.70**** (0.17)	0.89
BOC 1973-87	-9.97 (9.00)	0.89** (0.10)	0.92
CFI 1968-87	13.80 (16.39)	0.89** (0.15)	0.90
FES 1970-87	-44.10 (34.78)	1.15** (0.33)	0.93
RNC 1970-87	-35.92 (31.34)	1.12** (0.08)	0.93
CMN 1968-87	22.05** (3.95)	0.36**** (0.08)	0.76
CPC 1973-87	7.74* (3.00)	0.66**** (0.12)	0.75
GAC 1971-87	9.02 (11.31)	0.57 (0.29)	0.50
SMB 1968-87	-4.93* (2.02)	1.67**** (0.11)	0.97
HBM 1972-85	1.40 (4.14)	0.68*** (0.15)	0.69
BAL 1968-87	1.89 (1.82)	0.96** (0.06)	0.92

Table 5 (continued)

Notes: Superscripts: * significantly differs from zero at 5 percent
** significantly differs from zero at 1 percent
Subscripts: * significantly differs from one at 5 percent
** significantly differs from one at 1 percent
Standard errors are given in parentheses.
Variable definitions and sources are given in Table 3.

Source: Author.

Table 6 SMVAM Results for Univariate Partitions-- Linear and Nonlinear Versions

All Banks Pooled

LS:	U_e: 25.15**	k: 0.72**$_{**}$			
	(7.12)	(0.08)			
NLS:	a: 95.81**	b: 0.71**$_{**}$	d: 14.83**	e: 0.0124**	$\tilde{c}$: 27.07**
	(8.58)	(0.02)	(3.95)	(0.0012)	(1.83)

Nonfailed Banks Pooled

LS:	U_e: 14.01	k: 0.80**			
	(10.31)	(0.12)			
NLS:	a: 81.31**	b: 0.83**$_{**}$	d: 6.76**	e: 0.0056**	$\tilde{c}$: 11.04**
	(9.61)	(0.03)	(2.64)	(0.0017)	(3.02)

Failed Banks Pooled

LS:	U_e: 52.15**	k: 0.51**$_{**}$			
	(13.73)	(0.07)			
NLS:	a: 122.91**	b: 0.52**$_{**}$	d: 69.34**	e: 0.0178**	$\tilde{c}$: 54.87**
	(6.91)	(0.12)	(9.27)	(0.0033)	(6.30)

Market-Value-Solvent Banks Pooled

LS:	U_e: 11.52	k: 0.85**			
	(7.63)	(0.18)			
NLS:	a: 0.46	b: 0.99**	d: 2.00**	e: 0.0016	$\tilde{c}$: 1.62
	(1.56)	(0.01)	(1.00)	(0.0018)	(1.33)

Table 6 (continued)

Market-Value-Insolvent Banks Pooled

LS:	U_e: 45.68**	k: 0.71^{**}_{**}			
	(7.46)	(0.04)			
NLS:	a: 115.87**	b: 0.32^{**}_{**}	d: 84.09**	e: 0.0216**	$\bar{c}$: 148.24**
	(26.20)	(0.14)	(36.17)	(0.004)	(12.98)

Large Banks Pooled

LS:	U_e: 1.01	k: 1.09**			
	(1.55)	(0.18)			
NLS:	a: -0.85	b: 0.98**	d: -0.002	e: 0.0250**	$\bar{c}$: 7.60**
	(0.91)	(0.04)	(4.15)	(0.0039)	(0.92)

Giant Banks Pooled

LS:	U_e: 142.83**	k: 0.64^{**}_{**}			
	(39.72)	(0.04)			
NLS:	a: 51.71**	b: 0.78^{**}_{**}	d: 301.42**	e: 0.004	$\bar{c}$: 175.11**
	(20.62)	(0.06)	(33.78)	(0.003)	(27.16)

$\bar{c}$ = RISK*d + $\bar{L}$*e

Notes: Superscripts: * significantly differs from zero at 5 percent
** significantly differs from zero at 1 percent
Subscripts: * significantly differs from one at 5 percent
** significantly differs from one at 1 percent
Standard errors are given in parentheses.
Variable definitions and sources are given in Table 3.

Source: Author.

Table 7 SMVAM Results for All Partitions--
Linear and Nonlinear Versions

Linear

$$MV = 1.31 + 121.68^{**}\ SIZ + 1.31^{**}BV - 0.65^{**}\ BV(SIZ) - 0.25^{**}\ BV(F)$$

(3.27) (32.83) (0.14) (0.19) (0.09)

Nonlinear

$$MV = 0.5[b+b1(SIZ)+b2(F)][BV-a-a1(SIZ)-a2(F)] + [0.25[b+b1(SIZ) +b2(F)]^2[BV-a-a1(SIZ)-a2(F)] + [d(RISK)+e(L)+c1(SIZ)]^2]^{.5}$$

a: 9.08** (3.75)	a1: 53.57** (2.38)	a2: 69.89** (1.00)	
b: 1.31** (0.14)	b1: -0.52** (0.14)	b2: -0.63** (0.13)	
d: 5.92** (1.59)	e: 0.0049** (0.0017)	$\bar{c}$: 10.52** (3.13)	c1: 109.34** (3.43)

Notes: $\bar{c} = d(\overline{RISK}) + e(\bar{L})$.

SIZ and F are the size and failure dummy variables, respectively.

* Significantly differs from zero at 5 percent.

** Significantly differs from zero at 1 percent.

Standard errors are given in parentheses.

Variable definitions and sources are given in table 3.

Source: Author.

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