Working Paper 9012

THE EFFECT OF SUBORDINATED DEBT AND SURETY BONDS ON BANKS' COST OF CAPITAL AND ON THE VALUE OF FEDERAL DEPOSIT INSURANCE

by William P. Osterberg and James B. Thomson

William P. Osterberg is an economist and James B. Thomson is an assistant vice president and economist at the Federal Reserve Bank of Cleveland.

October 1990

Abstract

This paper examines two proposals to correct the risk-taking incentives embedded in the current deposit insurance system and to provide protection to the deposit insurance fund. The first would require banks to issue subordinated debt, and the second would require bank stockholders to post surety bonds. We use the cash-flow version of the Capital Asset Pricing Model to show how each proposal would affect the values and rates of return on uninsured deposits and equity. We then indicate the impact that each proposal would have on the values of the Federal Deposit Insurance Corporation claim and on the bank, emphasizing the role of deposit insurance pricing.

I. Introduction

It is generally accepted that the subsidy inherent in the current fixed-rate deposit insurance system creates perverse incentives for risk-taking by insured depository institutions (see Kane [1985]). The ongoing deposit insurance debacle in the thrift industry has focused increasing attention on both the inherent defects and the potentially large costs associated with the current system of deposit guarantees, and on the need for fundamental reform.

Two alternative methods have been suggested for reducing the subsidy provided by the current deposit insurance system and thus the perverse incentives generated by mispriced deposit guarantees. The first is to rein in the subsidy through changes in explicit and implicit deposit insurance coverage and through the adoption of risk-based pricing of the deposit guarantees. A growing volume of literature has examined the feasibility of pricing deposit insurance (Flannery [1989], Merton [1977, 1978], Ronn and Verma [1986], and Pennacchi [1987]); the impact of forbearance policies on the value of deposit insurance and insured depository institutions (Allen and Saunders [1990], Osterberg and Thomson [1990], and Thomson [1987a, 1987b]); and the incentive problems in the current deposit insurance contract (Kane [1989a, 1989b]).

The second way to reduce the deposit insurance subsidy is to alter the capital structure of banks so that the loss exposure of the Federal Deposit Insurance Corporation (FDIC) is lessened. This can be accomplished by increasing the risk exposure of parties whose claims on the bank are subordinate to those of the FDIC. Baer (1985), Benston et al. (1986, chapter 7), and Wall (1989), among others, suggest that the FDIC's claim could be enhanced by requiring banks, as a condition of the insurance contract, to issue debt that is subordinate to the claims of depositors and the FDIC. Another option, suggested by Kane (1987), is to increase the liability of bank shareholders by requiring them to post surety bonds. This proposal would reestablish the double call provision that existed for shareholders of national banks and many state-chartered banks before the Banking Act of 1935 was adopted.[1]

Avery, Belton, and Goldberg (1988) and Gorton and Santomero (1990) examine the empirical relationship between the risk premia on bank subordinated debt and balance-sheet measures of bank risk. Their studies find no conclusive evidence that, in the current regulatory environment, market risk premia on subordinated debt are related to risk proxies constructed from accounting data. These results contrast with those of earlier studies (Baer and Brewer [1986] and Hannan and Hanweck [1988], among others), which found a significant relationship between risk premia and risk proxies.

This paper provides a theoretical analysis of the impact of subordinated debt and surety bonds on the cost of capital for banks and on the value of FDIC deposit guarantees. We agree with Gorton and Santomero's view that analyzing such proposals requires a more rigorous theoretical framework than has been generally applied. We extend the single-period cash-flow version of the Capital Asset Pricing Model (CAPM) developed in Chen (1978) and modified by Osterberg and Thomson (1990) to include mandatory subordinated debt. We also consider the impact of Kane's (1987) proposal to strengthen shareholder discipline by requiring shareholders to post surety bonds.

In section II, we present the results of a single-period analysis of a bank that has both uninsured and insured deposits as derived in Osterberg and

Thomson. Section III extends the model to include subordinated debt, and section IV presents the results for surety bonds. In sections III and IV, we compare the values of uninsured deposits, equity, and deposit insurance for each capital structure with the values presented in section II in order to ascertain the effects of each policy on the cost of capital. Conclusions and policy implications are presented in section V.

II. Banks' Cost of Capital and the Value of the Insurance Fund: With Insured and Uninsured Deposits Only

To determine the effects of subordinated debt and surety bonds on the cost of debt and equity capital for banks, we utilize the single-period CAPM valuation equation employed by Chen and by Osterberg and Thomson. Our primary assumptions are (1) the risk-free rate of interest is constant, (2) capital markets are perfectly competitive, (3) expectations are homogenous with respect to the probability distributions of the yields on risky assets, (4) investors are risk-averse, seeking to maximize the utility of terminal wealth, and (5) there are no taxes or bankruptcy costs.

In sections II through IV we utilize the following definitions:

B_i = Total promised payment to insured depositors.

B_u = Total promised payment to uninsured depositors.

z = Total promised payment to the FDIC ($=\rho B_i$).

ρ = Deposit insurance premium per dollar of insured deposits.

S = Total promised payment to subordinated debtholders.

C = Total dollar value of surety bonds posted by stockholders.

B = Total promised payment when subordinated debt and surety bonds ($=B_i+B_u+z$) are absent.

K = Total promised payment when subordinated debt is present ($=B_i+B_u+z+S$).

D = Total promised payment when surety bonds are posted ($=B_i+B_u+z$).

Y_{bi}, Y_{bu}, Y_s, Y_e, and Y_{FDIC} = End-of-period cash flows to insured depositors, uninsured depositors, subordinated debtholders, stockholders, and the FDIC, respectively.

V_{bi}, V_{bu}, V_s, V_e, and V_{FDIC} = Values of insured deposits, uninsured deposits, subordinated debt, bank equity, and the FDIC claim, respectively.

V_f = Value of the bank.

$E(R_{bi})$, $E(R_{bu})$, $E(R_s)$, and $E(R_e)$ = The expected rates of return on insured and uninsured deposits, subordinated debt, and equity, respectively.

r = The risk-free rate of return ($R = 1 + r$).

X = The end-of-period gross return on bank assets.

F(X) = Cumulative probability distribution function for X.

CEQ(X) = Certainty-equivalent of X ($=E[X] - \lambda COV[X,R_m]$).

λ = The market risk premium.

R_m = Return on the market portfolio.

We assume that all debt instruments are discount instruments, so that the total promised payment to all depositors and subordinated debtholders includes both principal and interest. In addition, we assume that the deposit insurance premium is paid at the end of the period.

In this section we present results from Osterberg and Thomson for a bank with only insured and uninsured deposits. The FDIC charges a fixed insurance premium of ρ on each dollar of insured deposits. The total liability claims against the bank, B, is the sum of the end-of-period promised payments to the uninsured depositors, B_u, the insured depositors, B_i, and the FDIC, z ($=\rho B_i$). We assume that, on average, the FDIC underprices its deposit guarantees and, in the absence of regulatory taxes (Buser, Chen, and Kane [1981]), provides a subsidy that reduces the cost of capital for banks while increasing their value.

Given these assumptions, it is clear that the end-of-period cash flows to the insured depositors, Y_{bi}, equal the promised payments to insured depositors, B_i, in every state. Therefore, regardless of a bank's capital structure, the value, expected return, and cost of one dollar of insured deposits are $V_{bi} = R^{-1}B_i$, $E(R_{bi}) = r$, and $r + \rho$, respectively.

The end-of-period cash flows to the uninsured depositors depend on the promised payment to the uninsured depositors and on the total level of promised payments:

$$Y_{bu} = \begin{cases} B_u & \text{if} \quad X > B \\ B_uX/B & \text{if} \quad B > X > 0 \\ 0 & \text{if} \quad 0 > X. \end{cases}$$

The value of the uninsured deposits and the required rate of return on these deposits are

$$V_{bu} = R^{-1}\{B_u[1-F(B)] + (B_u/B)CEQ_0^B(X)\}, \text{ and} \tag{1}$$

$$E(R_{bu}) = R\frac{[1-F(B)] + (1/B)E_0^B(X)}{[1-F(B)] + (1/B)CEQ_0^B(X)} - 1.0. \tag{2}$$

Equation (2) shows that the cost of debt (uninsured deposit) capital is a function of the bank's systematic risk (as measured by $\lambda COV[X,R_m]$), total promised payments (B), the probability of bankruptcy (F[B]), and the risk-free rate of return. Osterberg and Thomson show that when the FDIC misprices its guarantees, the cost of uninsured deposit capital also depends on the deposit mix, because underpriced (overpriced) deposit guarantees lower (raise) the bankruptcy threshold, F(B), and increase (reduce) the claim of the uninsured depositors relative to total claims, B_u/B. The size of this effect is a function of the FDIC's pricing error per dollar of insured deposits and of the deposit mix.

Stockholders receive the residual earnings in nonbankruptcy states, but they receive nothing if bankruptcy occurs:

$$Y_e = \begin{cases} X - B & \text{if} \quad X > B \\ 0 & \text{if} \quad B > X. \end{cases}$$

The value of equity and the expected return to stockholders are

$$V_e = R^{-1}\{CEQ_B(X) - B[1-F(B)]\}, \text{ and} \tag{3}$$

$$E(R_e) = R\frac{E_B(X) - B[1-F(B)]}{CEQ_B(X) - B[1-F(B)]} - 1.0. \tag{4}$$

Equation (4) shows that the cost of equity capital, like the cost of uninsured deposits, is a function of systematic risk, total promised payments, the probability of bankruptcy, the risk-free rate of return, and the deposit mix (when deposit insurance is mispriced). Equations (1) through (4) indicate that the cost and value of uninsured deposit capital and equity capital are affected by FDIC pricing errors.

If the FDIC underprices its guarantees, it directly reduces the cost of insured deposits to banks. However, equations (2) and (4) imply that by underpricing its deposit guarantees the FDIC reduces not only the cost of uninsured deposits but the cost of equity capital as well (see Osterberg and Thomson for a detailed analysis of this result). The relationship between the values of the insured bank and the FDIC position can be seen by aggregating the claims of depositors, stockholders, and the FDIC. The end-of-period cash flows and the value of the FDIC's position are

$$Y_{FDIC} = \begin{cases} z & \text{if} \quad X > B \\ (B_i+z)X/B - B_i & \text{if} \quad B > X > 0 \\ -B_i & \text{if} \quad 0 > X, \text{ and} \end{cases}$$

$$V_{FDIC} = R^{-1}\{z[1-F(B)] + [(B_i+z)/B]CEQ_0^B(X) - B_iF(B)\}. \tag{5}$$

Osterberg and Thomson show that the value of the uninsured bank is $R^{-1}CEQ_0(X)$. The value of the insured bank, V_f, equals the value of the uninsured bank minus equation (5), which is the value of the FDIC's claim:

$$V_f = R^{-1}\{CEQ_0(X) + B_iF(B) - z[1-F(B)] - [(B_i+z)/B]CEQ_0^B(X)\}. \tag{6}$$

V_{FDIC} is negative (positive) when the FDIC underprices (overprices) its guarantees, and is equal to zero when deposit insurance is fairly priced. The net value of FDIC guarantees is a function of the risk-free return, the probability of bankruptcy, the level of promised payments to depositors, the bank's systematic risk, and the deposit insurance premium.

III. Banks' Cost of Capital and the Value of Deposit Insurance:

The Case of Subordinated Debt

Subordinated debt can serve two possible roles in deposit insurance reform. First, a requirement that banks include subordinated debt in their capital structure as a condition of the deposit insurance contract introduces another party (in addition to equity holders) whose claim on the bank's assets is subordinate to those of depositors and the FDIC. Subordinated debt thus becomes an additional cushion protecting the FDIC and uninsured depositors from loss. The second role of a subordinated debt requirement is to create a class of claimants who face the same incentives as depositors and the FDIC. As a result, the pricing of subordinated debt capital should reflect bank risk and reduce the risk-taking incentives associated with the current deposit insurance system. This paper investigates the first of these two functions. We indicate how the introduction of subordinated debt into a bank's capital structure influences the costs and values of deposits and equity capital and affects the value of the insurance subsidy. The introduction of subordinated debt has no impact on the value or cost of insured deposits.

For uninsured deposits, the introduction of subordinated debt into the capital structure results in the following end-of-period cash flows:

$$Y_{bu} = \begin{cases} B_u & \text{if} \quad X > K - S = B_i + B_u + z \\ B_u X/(K-S) & \text{if} \quad K - S > X > 0 \\ 0 & \text{if} \quad 0 > X. \end{cases}$$

While the total promised payments to debtholders and the FDIC equal K, the effective bankruptcy threshold for uninsured depositors is K less the claims of the subordinated debtholders. The value of and the required rate of return on uninsured deposits are

$$V_{bu} = R^{-1}\{B_u[1-F(K-S)] + [B_u/(K-S)]CEQ_0^{K-S}(X)\}, \text{ and} \tag{7}$$

$$E(R_{bu}) = R\frac{1-F(K-S) + [1/(K-S)]E_0^{K-S}(X)}{1-F(K-S) + [1/(K-S)]CEQ_0^{K-S}(X)} - 1.0. \tag{8}$$

Comparing equations (7) and (8) to equations (1) and (2) shows that introducing subordinated debt into a bank's capital structure changes the value and cost of uninsured deposit capital by reducing the probability of loss for the uninsured depositors from F(B) to F(K-S).

To find the impact of subordinated debt on the value of uninsured deposits, we normalize the expected cash flows by the level of uninsured deposits and compare banks with and without subordinated debt in their capital structure. We then separate the expected cash flow to an uninsured deposit (with a par value of one dollar) in a bank with subordinated debt into two instruments: one that is identical to the uninsured deposit in section II, and a second that has the following end-of-period payoffs:

$$\Delta_s Y_{bu} = \begin{cases} 0 & \text{if} \quad X > B \\ 1 - X/B & \text{if} \quad B > X > K - S \\ X/(K-S) - X/B & \text{if} \quad K - S > X > 0 \\ 0 & \text{if} \quad 0 > X. \end{cases}$$

If the value of $\Delta_s Y_{bu}$ is positive (negative), then stochastic dominance requires the value of an uninsured deposit in a bank with subordinated debt to be greater (less) than its value without subordinated debt:

$$\Delta_s V_{bu} = R^{-1}[F(B)-F(K-S) - (1/B)CEQ^{B}_{K-S}(X) + \delta CEQ^{K}_{0}(X)], \tag{9}$$

where, $\delta = 1/(K-S) - 1/B$. Equation (9) represents the additional value of the income stream accruing to one dollar of uninsured deposits when subordinated debt with face value S is issued. Equation (9) is positive because $B[F(B)-F(K-S)] > CEQ^{B}_{K-S}(X)$ and $\delta > 0$. δ is positive because $K-S < B$. Therefore, the introduction of subordinated debt into a bank's capital structure increases the value of an uninsured deposit relative to its par value of one dollar.

The end-of-period expected cash flows accruing to the subordinated debtholders are

$$Y_s = \begin{cases} S & \text{if} \quad X > K \\ X + S - K & \text{if} \quad K > X > K - S \\ 0 & \text{if} \quad K - S > X. \end{cases}$$

The value of the subordinated debt and the required rate of return on subordinated debt capital are

$$V_s = R^{-1}\{S[1-F(K-S)] - K[F(K)-F(K-S)] + CEQ^K_{K-S}(X)\}, \text{ and} \tag{10}$$

$$E(R_s) = R\frac{S[1-F(K-S)] - K[F(K)-F(K-S)] + E^K_{K-S}(X)}{S[1-F(K-S)] - K[F(K)-F(K-S)] + CEQ^K_{K-S}(X)} - 1.0. \tag{11}$$

Equations (10) and (11) show that the cost and value of subordinated debt capital depend on the probability of bankruptcy, F(K), the face value of the subordinated debt, S, total promised payments, K, and the probability that senior claimants will not be repaid in full, F(K-S). Note that the last two terms in equation (10) represent the claims of subordinated debtholders in states where they are the residual claimants.

Our expression for $E(R_s)$ is consistent with Gorton and Santomero's expression for the risk premium on subordinated debt. Here, the senior claims, K-S, the total claims, K, and the variance of X (which influences $F(\cdot)$ over the relevant ranges in equation [11]) have a nonlinear impact on the risk premium.

The end-of-period cash flows accruing to stockholders are

$$Y_e = \begin{cases} X - K & \text{if} \quad X > K \\ 0 & \text{if} \quad K > X. \end{cases}$$

The value of equity and the expected return to stockholders are

$$V_e = R^{-1}\{CEQ_K(X) - K[1-F(K)]\}, \text{ and} \tag{12}$$

$$E(R_e) = R\frac{E_K(X) - K[1-F(K)]}{CEQ_K(X) - K[1-F(K)]} - 1.0. \tag{13}$$

Subordinated debt affects the value and cost of equity capital through its effect on total promised payments and thus on the probability of bankruptcy. For K greater (less) than B, subordinated debt reduces (increases) the value of equity capital because it increases (decreases) the probability of bankruptcy and reduces (increases) the residual cash flows in nonbankruptcy states. The impact of the proposal is therefore related to deposit insurance mispricing as well.

A comparison of equations (3) and (12) indicates that the change in the value of equity due to the imposition of a subordinated debt requirement is calculated as

$$\Delta V_e = R^{-1}\{(B-K)[1-F(K)] + B[F(K)-F(B)] + CEQ_B^K(X)\} < 0. \qquad (14)$$

Equation (15) indicates the value of a bank with subordinated debt in its capital structure:

$$V_f = R^{-1}\{CEQ_0(X) + B_iF(K-S) - z[1-F(K-S)] - [(B_i+z)/(K-S)]CEQ_0^{K-S}(X)\}. \qquad (15)$$

Subordinated debt only affects the value of the bank through the net value of deposit insurance to the bank (the last three terms on the right side of equation [15]).

To calculate the effect of subordinated debt on the net value of the FDIC's guarantees, we compare the value of the FDIC's position in a bank with subordinated debt to the net FDIC subsidy presented in section II. For a bank with subordinated debt, the end-of-period cash flows to the FDIC and the value of its position are

$$Y_{FDIC} = \begin{cases} z & \text{if} \quad X > K - S \\ (B_i+z)X/(K-S) - B_i & \text{if} \quad K - S > X > 0 \\ -B_i & \text{if} \quad 0 > X, \text{ and} \end{cases}$$

$$V_{FDIC} = R^{-1}\{z[1-F(K-S)] + [(B_i+z)/(K-S)]CEQ_0^{K-S}(X) - B_iF(K-S)\}. \qquad (16)$$

Equation (16) can be interpreted as showing that the equity-like buffer provided by subordinated debt affects the value of the FDIC's position by lowering the probability that the put options corresponding to the FDIC guarantee will be "in the money" at the end of the period.

To sign the direction of change in the value of the FDIC's position, we normalize equations (16) and (6) by the level of insured deposits and then subtract the net FDIC guarantee per dollar of insured deposits in section II from that in section III. This results in equation (17):

$$\Delta_s V_{FDIC} = R^{-1}\{(1+\rho)[F(B)-F(K-S)] - [(1+\rho)/B]CEQ_0^{K-S}(X) + \delta(1+\rho)CEQ_0^{K-S}(X)\} > 0. \qquad (17)$$

Recall that if the FDIC underprices its guarantees, the value of its position in the bank is negative. Therefore, an increase in the value of the FDIC's claim on the bank represents a reduction in both the subsidy per dollar of insured deposits and in the value of the bank.

IV. Banks' Cost of Capital and the Value of the Insurance Fund: The Case of Surety Bonds

Kane (1987) suggests stockholder-posted surety bonds as a mechanism for reducing the incentives for marginally solvent and insolvent depository institutions to gamble their way back to solvency. Requiring stockholders to post surety bonds would reestablish the double call provision on bank stockholders that was commonplace before the Banking Act of 1935 was adopted. Extending the loss exposure of stockholders beyond their initial equity investment would increase their incentive to close or to reorganize banks before the institutions became insolvent. In addition, surety bonds protect the FDIC and the uninsured depositors from loss by serving as an additional buffer between operating losses and creditor claims.

Below we indicate the impact that requiring bank stockholders to post surety bonds has on the cost of capital for banks. As with subordinated debt, the introduction of surety bonds does not affect the cost or value of insured deposit capital. The end-of-period cash flows to uninsured depositors when stockholders post surety bonds are

$$Y_{bu} = \begin{cases} B_u & \text{if} \quad X > D - C \\ B_u(X+C)/D & \text{if} \quad D - C > X > 0 \\ B_uC/D & \text{if} \quad 0 > X. \end{cases}$$

The value of the uninsured deposits and the required rate of return on these deposits are

$$V_{bu} = R^{-1}\{B_u[1-F(D-C)] + (B_u/D)CEQ_0^{D-C}(X) + (B_uC/D)F(D-C)\}, \text{ and} \tag{18}$$

$$E(R_{bu}) = R\frac{1-F(D-C) + (1/D)E_0^{D-C}(X) + (C/D)F(D-C)}{1-F(D-C) + (1/D)CEQ_0^{D-C}(X) + (C/D)F(D-C)} - 1.0. \qquad (19)$$

As with subordinated debt, increased stockholder liability affects the value and cost of uninsured deposit capital by reducing the probability of loss. In addition, surety bonds increase the cash flows to uninsured depositors by B_uC/D in all states where liability claims on the bank exceed $X + C$.

Equation (20) shows the difference between the value of an uninsured deposit in section II and its value when stockholders post surety bonds:

$$\Delta_c V_{bu} = R^{-1}\{F(B) - F(D-C) - (1/B)CEQ_{D-C}^{B}(X) + (C/D)F(D-C) + \phi CEQ_0^{D-C}(X)\} > 0, \qquad (20)$$

where $\phi = 1/D-1/B > 0$. $\Delta_c V_{bu}$ is positive because $B[F(B)-F(D-C)] > CEQ_{D-C}^{B}(X) > 0$, and the remainder of the terms on the right side of the equation are positive. In other words, extending stockholder liability through the issuance of surety bonds increases the value of uninsured deposits.

The expected cash flows for stockholders who post surety bonds with an end-of-period value of C are

$$Y_e = \begin{cases} X - D & \text{if} \quad X > D \\ X - D & \text{if} \quad D > X > D - C \\ -C & \text{if} \quad D - C > X. \end{cases}$$

The value of equity and the expected return to stockholders are then:

$$V_e = R^{-1}\{CEQ_{D-C}(X) - D[1-F(D-C)] - CF(D-C)\}, \text{ and} \tag{21}$$

$$E(R_e) = R\frac{E_{D-C}(X) - D[1-F(D-C)] - CF(D-C)}{CEQ_{D-C}(X) - D[1-F(D-C)] - CF(D-C)} - 1.0. \tag{22}$$

Equations (21) and (22) show that stockholder-posted surety bonds affect the cost and value of equity capital both by reducing the value of the limited liability put option held by stockholders and by lessening the probability that stockholders will exercise that option.

To sign the effect of a surety bond requirement on the value of equity, we can examine the impact of such a proposal on the cash flows to stockholders:

$$\Delta_c V_e = \begin{cases} B - D > 0 & \text{if} \quad D - C < D < B < X \\ X - D > 0 & \text{if} \quad D - C < D < X < B \\ X - D < 0 & \text{if} \quad D - C < X < D < B \\ -C < 0 & \text{if} \quad X < D - C < D < B. \end{cases}$$

$$\Delta_c V_e = R^{-1}\{CEQ^{B}_{D-C}(X) - D[F(B)-F(D-C)] - CF(D-C) + (B-D)[1-F(B)]\}. \tag{23}$$

In equation (23), the sum of the first three terms in parentheses is the reduction in the value of equity that results from the imposition of surety bonds, and the last term is the increase in the value of equity caused by the reduction in promised payments to depositors and the FDIC. Surety bonds should reduce the value of bank equity by reducing the value of the limited liability put option held by bank stockholders. It is unlikely that D would be sufficiently smaller than B to make equation (23) positive. In addition, shareholders could voluntarily post surety bonds if doing so would increase the value of equity; we have not observed such behavior by bank shareholders, however.

Surety bonds affect the value of the bank solely through their impact on the net value of FDIC deposit guarantees, which is the sum of the last three terms in equation (24):

$$V_f = R^{-1}\{CEQ_0(X) + B_iF(D-C) - z[1-F(D-C)] - [(B_i+z)/D]CEQ_0^{D-C}(X)\}. \tag{24}$$

To demonstrate the effect of surety bonds on the net value of the FDIC guarantees, we compare the value of the FDIC's position in a bank with surety bonds to the net FDIC subsidy in section II. When stockholders post surety bonds, the end-of-period cash flows and the value of the FDIC's position in the bank are

$$Y_{FDIC} = \begin{cases} z & \text{if} \quad X > D - C \\ (B_i+z)(X+C)/D - B_i & \text{if} \quad D - C > X > 0 \\ (B_i+z)C/D - B_i & \text{if} \quad 0 > X, \text{ and} \end{cases}$$

$$V_{FDIC} = R^{-1}\{z[1-F(D-C)] + [(B_i+z)/D]CEQ_0^{D-C}(X) - B_iF(D-C) + [(B_i+z)C/D]F(D-C)\}. \tag{25}$$

Comparing equation (25) to equation (5), we see that the change in the value of the FDIC's position in the bank is

$$\Delta_c V_{FDIC} = (B_i+z)\phi CEQ_0^{D-C}(X) + (B_i+z)[F(B)-F(D-C)-(1/B)CEQ_{D-C}^{B}(X)].$$

As we noted in section III, if the FDIC underprices its guarantees, then the value (to the FDIC) of its position in the bank is negative. Therefore, an increase in the value of the FDIC's claim on the bank represents a reduction in the deposit insurance subsidy and thus in the value of the insured banking firm.

V. Conclusions

Using the cash-flow version of the CAPM as developed by Chen (1978), we show how the required rates of return and values of uninsured deposits, subordinated debt, and bank equity are influenced by two alternative proposals intended to protect the deposit insurance fund. The subordinated debt requirement increases the bankruptcy cutoff relevant to equity valuation. The surety bond proposal, on the other hand, puts additional funds on the table in order to meet the claims of creditors in the event of low asset value realization.

We then calculate the value of the FDIC guarantees under each of the two proposals. The influence of each proposition on the required rates of return for bank liabilities is shown to depend crucially on the extent of deposit insurance mispricing, as well as on the relative magnitude of the required subordinated debt or surety bonds. If deposit insurance is mispriced, the deposit mix influences the impact of the mispricing and hence the effect of each proposal on rates of return and on market discipline. This clearly implies that deposit insurance pricing must be determined in light of proposals that influence the value of the insurance fund.

Footnote

1. A third option is the adoption of depositor preference laws. We do not analyze this alternative because its qualitative impact on the cost of equity capital and on the value of FDIC insurance is the same as the impact of subordinated debt. In addition, Hirschhorn and Zervos (1990) empirically document a negative and significant relationship between the cost of uninsured deposits for thrifts and the presence of depositor preference laws.

References

Allen, L., and A. Saunders, 1990, "Forbearance and Valuation of Deposit Insurance as a Callable Put," Baruch College Working Paper.

Avery, R. B., T. Belton, and M. Goldberg, 1988, "Market Discipline in Regulating Bank Risk: New Evidence from the Capital Markets," Journal of Money, Credit and Banking 20, 597-610.

Baer, Herbert, 1985, "Private Prices, Public Insurance: The Pricing of Federal Deposit Insurance," Federal Reserve Bank of Chicago, Economic Perspectives 9, 41-57.

Baer, Herbert, and Elijah Brewer, 1986, "Uninsured Deposits as a Source of Market Discipline: Some New Evidence," Federal Reserve Bank of Chicago, Economic Perspectives 10, 23-31.

Benston, G. J., R. A. Eisenbeis, P. M. Horvitz, E. J. Kane, and G. G. Kaufman, 1986, Perspectives on Safe and Sound Banking: Past, Present, and Future. Cambridge, Mass.: MIT Press.

Buser, S. A., A. H. Chen, and E. J. Kane, 1981, "Federal Deposit Insurance, Regulatory Policy, and Optimal Bank Capital," Journal of Finance 36, 51-60.

Chen, Andrew H., 1978, "Recent Developments in the Cost of Debt Capital," Journal of Finance 33, 863-77.

Flannery, M. J., 1989, "Pricing Deposit Insurance When the Insurer Measures Risk with Error," University of North Carolina Working Paper.

Gorton, G., and A. M. Santomero, 1990, "Market Discipline and Bank Subordinated Debt," Journal of Money, Credit and Banking 22, 117-28.

Hannan, T., and G. Hanweck, 1988, "Bank Insolvency Risk and the Market for Large Certificates of Deposit," Journal of Money, Credit and Banking 20, 203-11.

Hirschhorn, E., and D. Zervos, 1990, "Policies to Change the Priority of Claimants: The Case of Depositor Preference, Journal of Financial Services Research 4, 111-26.

Kane, E. J., 1985, The Gathering Crisis in Federal Deposit Insurance. Cambridge, Mass.: MIT Press.

Kane, E. J., 1987, "No Room for Weak Links in the Chain of Deposit Insurance Reform," Journal of Financial Services Research 1, 77-111.

Kane, E. J., 1989a, "How Incentive-Incompatible Deposit-Insurance Funds Fail," NBER Working Paper No. 2836.

Kane, E. J., 1989b, The S&L Insurance Mess: How Did It Happen? Washington, D.C.: The Urban Institute.

Merton, R. C., 1977, "An Analytic Derivation of the Cost of Deposit Insurance and Loan Guarantees: An Application of Modern Option Pricing Theory," Journal of Banking and Finance 1, 3-11.

Merton, R. C., 1978, "On the Cost of Deposit Insurance When There Are Surveillance Costs," Journal of Business 51, 439-52.

Osterberg, W. P., and J. B. Thomson, 1990, "Deposit Insurance and the Cost of Capital," Research in Finance 8, 255-70.

Pennacchi, G. G., 1987, "A Reexamination of the Over- (or Under-) Pricing of Deposit Insurance," Journal of Money, Credit and Banking 19, 340-60.

Ronn, Ehud I., and Avinash K. Verma, 1986, "Pricing Risk-Adjusted Deposit Insurance: An Option-Based Model," Journal of Finance 41, 871-95.

Thomson, J. B., 1987a, "FSLIC Forbearances to Stockholders and the Value of Savings and Loan Shares," Federal Reserve Bank of Cleveland, Economic Review (Quarter 3), 26-35.

Thomson, J. B., 1987b, "The Use of Market Information in Pricing Deposit Insurance," Journal of Money, Credit and Banking 19, 528-32.

Wall, L. D., 1989, "A Plan for Reducing Future Deposit Insurance Losses: Puttable Subordinated Debt," Federal Reserve Bank of Atlanta, Economic Review 74, 2-17.