Forbearance, Subordinated Debt, and the Cost of Capital for Insured Depository Institutions

by William P. Osterberg
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Introduction

Among the proposals intended to prevent the commercial banking industry from suffering a fate similar to that of the nation's savings and loans (S&Ls) is the requirement that banks issue subordinated debt. The claims of the holders of such debt are subordinate to the claims of the Federal Deposit Insurance Corporation (FDIC), which reduces the agency's exposure to loss. Furthermore, the rates paid on subordinated debt theoretically reflect a bank's riskiness; thus, a subordinated debt requirement penalizes relatively risky institutions by imposing market discipline. However, as is the case with competing regulatory proposals, the efficacy of a subordinated debt requirement is directly affected by regulators' adherence to stated guidelines.

In this article, we emphasize that a subordinated debt requirement interacts with other regulatory forces such as deposit insurance. The role of subordinated debt will also change when the risk-based capital system for U.S. banks becomes effective in December. Under the old system of capital regulation, primary capital had to be at least 5.5 percent of on-balance-sheet assets and total capital had to be at least 6 percent of assets, with subordinated debt included in total capital but not in primary capital. Under the new system, subordinated debt is included in Tier 2 capital, and the total of Tier 1 and Tier 2 capital must be at least 8 percent of risk-weighted assets. Although the impact of subordinated debt will be affected by the process of risk-weighting, such debt is a relatively small component of total capital, amounting to only 10 percent of equity capital (the largest component of total capital) for FDIC-insured commercial banks in 1992:IQ (see FDIC [1992]).

As background for understanding the issues surrounding a subordinated debt requirement, it is worth considering recent experience in the S&L industry. Several of the same factors that contributed to losses incurred in the bailout may also be behind the current deficit in the FDIC's deposit insurance fund. These include fraud and mismanagement, outdated regulations, and regulatory laxity. In addition, mispriced deposit insurance has provided incentives for S&L managers to maintain relatively risky portfolios. With fixed-rate deposit insurance, the riskiness of an institution's portfolio does not impact the rate it must pay for deposits. Regulatory capital forbearance, which occurs when regulators supplement bank capital rather than adhering to stated guidelines, may have increased the incentives for insolvent S&Ls to take on more portfolio risk in an attempt to regain solvency. In fact, these incentives can become so perverse that speculative investments with little chance of paying off may be underwritten by insured institutions. The failure of deposit insurance premiums to correctly reflect risk and, to a lesser extent, regulatory forbearance are unfortunately also present in the commercial banking industry.[1]

Proposals to reform the current system of bank regulation can be described in terms of their reliance on market mechanisms. At one extreme are calls to replace government deposit insurance with a private, market-based system. More widely discussed is the proposal to implement a system of risk-based government deposit insurance in which an individual bank's premium would vary with the composition of its portfolio. The feasibility of this approach has been studied by Flannery (1991), Merton (1977, 1978), Ronn and Verma (1986), and Pennacchi (1987b).[2] An analogous system is the risk-based capital standard, which would reduce the subsidies to risk-taking embedded in the current system.

Some proposals are intended to lessen the exposure of the insurer. These include limiting coverage (by restricting coverage to one account per individual or by reducing the total dollar amount insured) or changing banks' capital structure through, among other techniques, a subordinated debt requirement.[3] The maturity of subordinated debt generally exceeds that of uninsured deposits, so holders of such debt are less likely to "run." Consequently, as we point out later in this paper, forbearance is more likely to be extended to uninsured depositors than to subordinated debt holders, who receive principal and interest payments only after the claims of senior creditors are satisfied. Since subordinated debt claims are junior to those of the FDIC, the agency's exposure would be reduced.

In addition, by increasing the risk exposure of claimants subordinate to the FDIC, this proposal would utilize market incentives; that is, rates on subordinated debt would presumably reflect a bank's riskiness. Baer (1985), Benston et al. (1986, chapter 7), and Wall (1989) favor such an approach. Osterberg and Thomson (1991) analyze the theoretical impact of a subordinated debt requirement on both the cost of capital and the value of deposit insurance. Unfortunately, the empirical evidence on using subordinated debt to enhance market discipline is mixed (see box 1).

This article provides a theoretical analysis of the extent to which subordinated debt prices apply market discipline to banks. In theory, the required rate of return will vary positively with the bank's riskiness, reducing the subsidy provided by deposit insurance and ensuring that the bank's investment decisions will take risk into account. In addition, regulators could utilize the information contained in the secondary market prices of subordinated debt. As is the case with other proposals that rely on market discipline, however, the effectiveness of such an approach will depend on whether the government implicitly insures the claims of subordinated debt holders or other technically uninsured claims. Several studies (Allen and Saunders [1990], Osterberg and Thomson [1990], and Thomson [1987a, 1987b]) show how forbearance influences the values of deposit insurance and insured institutions, as well as the rate of return on uninsured deposits.

In this paper, we analyze the impact of forbearance on the values of and required rates of return on subordinated debt, uninsured deposits, and deposit insurance. Our results are consistent with those of Gorton and Santomero (1990) in that we find ranges over which subordinated debt acts like either debt or equity. We also find a nonlinear relationship between asset risk and the rate of return required on subordinated debt. The manner in which we incorporate forbearance into our analysis is similar to techniques used by Allen

■ 1 Many studies have analyzed the risk-taking incentives embedded in the current deposit insurance system (see Kane [1985, 1989a, 1989b]). If deposit insurance were "fairly" priced, as discussed by Thomson (1987b), then the premium would set the value of the insurer's claim to zero and would not distort the market incentives for risk-taking. It is not clear, on average, whether deposit insurance is fairly priced (see Pennacchi [1987b]). However, since all banks pay the same premium per dollar of deposits, relatively risky banks are obviously being subsidized by relatively safe ones. Analyzing the impact of deposit insurance is also complicated by the presence of regulations. In fact, Buser, Chen, and Kane (1981) present a rationale for combining underpriced deposit insurance with capital regulation.

■ 2 The FDIC Improvement Act of 1991, which mandated that the agency do a similar study, is to some degree the driving force behind its recent announcement of a risk-sensitive deposit insurance schedule. While this proposed premium schedule is a step in the right direction, it will only marginally alter the degree of mispricing and hence will have little effect on adverse incentives. For a critical evaluation of the FDIC's plan, see the statement of the Shadow Financial Regulatory Committee (1992).

■ 3 One alternative proposal is to institute depositor preference laws. Without such laws, uninsured deposits, insured deposits, nondeposit claims, and the claims of the insurer have equal priority in the event of bankruptcy. With such laws, depository claims, which are inherited by the insurer, have priority over nondeposit claims. Hirschhorn and Zervos (1990) analyze these laws empirically and note that their effectiveness can be seriously diluted if they lead to an increase in the amount of collateralized claims. Another alternative is to require stockholders to post surety bonds, which would be used to offset creditors' losses if a bank failed (see Kane [1987] and Osterberg and Thomson [1991]). This would effectively reestablish the double call provision that existed prior to the Banking Act of 1935.

BOX 1

Empirical Evidence on Market Discipline

In general, evidence regarding the extent to which market prices reflect risk is mixed (see Gilbert [1990]). Except for Randall (1989), studies of bank equity prices show that they indeed reflect portfolio risk. Valid criticisms of Randall's work can be found in Gilbert's summary of this literature.

Studies of rates paid on certificates of deposit and on subordinated debt are more ambiguous. The two most relevant studies for our purposes are those of Avery, Belton, and Goldberg (1988) and Gorton and Santomero (1990). Both papers examine the empirical relationship between risk premia on bank subordinated debt and balance-sheet measures of bank risk. Each finds weak evidence that market risk premia on subordinated debt are related to risk proxies constructed from accounting data in the current regulatory environment. These results contrast with those of earlier studies by Baer and Brewer (1986) and Hannan and Hanweck (1988), who find a significant relationship between risk premia and risk proxies in deposit markets.

Gorton and Santomero develop an explicit pricing model for subordinated debt showing that sometimes it acts like equity and other times like debt. Specifically, when the bank's asset value is expected to be above (below) the value of claims against it, subordinated debt acts like debt (equity). Also crucial in the analysis are assumptions about the overall regulatory environment. Many studies (see Marcus [1984] and Pennacchi [1987a]) have emphasized the role that assumptions about closure policies play in analyzing deposit insurance. Gilbert (1990) points out that the banks analyzed by Avery, Belton, and Goldberg were mainly large firms whose subordinated debt holders were likely to have been insured de facto. This again highlights the important role that de facto regulation plays in interpreting the informativeness of market prices and rates of return.[a]

a. The test for market discipline in Gorton and Santomero and in Avery, Belton, and Goldberg simultaneously examines the assumptions regarding model specification, closure rules, and the accuracy of accounting ratios as measures of risk. In addition, the results may be sensitive to the particular sample period used. Gorton and Santomero's findings suggest that the weak relationship between the subordinated-debt risk premium and risk proxies constructed from accounting data in Avery, Belton, and Goldberg is not due to either model specification or closure rules. However, since the sample period encompasses the failure of Continental Illinois Bank, where the FDIC fully protected the subordinated debt holders of the parent holding company, it is not clear that these studies' results generalize to other sample periods.

and Saunders (1990) and others (see box 1). Our findings, which point out the need to specify carefully and correctly the regulatory environment in place when market performance is measured, are broadly consistent with those of Gilbert (1990).

The model is presented in section I. Section II reports the results of an earlier, single-period analysis of a bank with uninsured deposits, insured deposits, and subordinated debt (see Osterberg and Thomson [1991]). We show that subordinated debt affects the value of the insured bank only through its impact on the size of the deposit insurance subsidy, and that the fair value of deposit insurance is a function of the subordinated debt requirement. In section III, we extend the analysis to include the possibility of FDIC bailouts of uninsured liability holders. Section IV then investigates the effects of mispriced deposit insurance and FDIC forbearances on the values of subordinated debt capital and deposit insurance. We find that the usefulness of subordinated debt as an equity-like buffer is reduced by FDIC forbearance policy and that investors' required rate of return on subordinated debt is inversely related to forbearance. Conclusions and policy implications are presented in section V.

I. The Model

To determine the effects of subordinated debt and surety bonds on the cost of banks' debt and equity capital, we utilize the single-period capital asset pricing model (CAPM) as employed by Chen (1978) and Osterberg and Thomson (1991). The value of a bank equals the present value of its future cash flows. Debt and equity values are in turn equal to the present value of these respective claims on the firm's cash flows. Certain cash flows are discounted at the risk-free rate of return, while uncertain cash flows are converted to certainty-equivalent flows by deducting a risk premium from the expected cash flow. The CAPM implies that the risk premium is simply the market price of risk multiplied by nondiversifiable risk.

Our primary assumptions are 1) the risk-free rate of return is constant, 2) capital markets are perfectly competitive, 3) expectations are homogeneous with respect to the probability distributions of risky asset yields, 4) investors are risk averse, seeking to maximize the utility of terminal wealth, and 5) there are no taxes or bankruptcy costs.

In section II, we assume that at the end of the period, perfect "me-first" rules are enforced. That is, all claimants receive payment according to the

BOX 2

Variable Definitions

B_i = Total promised payments to insured depositors

B_u = Total promised payments to uninsured depositors

z = Total promised payments to the FDIC (= ρB_i)[a]

ρ = Deposit insurance premium per dollar of insured deposits

S = Total promised payments to subordinated debt holders

B = Total promised payments when subordinated debt (= $B_i + B_u + z$) is absent

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

Y_{bi}, Y_{bu}, Y_s, Y_e, and Y_{FDIC} = End-of-period cash flows to insured depositors, uninsured depositors, subordinated debt holders, 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's claim, respectively

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

V_f = Value of the bank

r = Risk-free rate of return ($R = 1 + r$)

X = 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 = Market risk premium

R_m = Return on market portfolio

$\lambda COV(X, R_m)$ = Nondiversifiable risk

a. For simplicity, we express the premium as a function of insured deposits. However, the results of interest here would not be materially affected by adopting the more realistic assumption that premiums are levied on the total of domestic insured and uninsured deposits.

priority of their claim. Realized cash flows are used to satisfy the claims of senior creditors (depositors and the FDIC) before junior creditors (subordinated debt holders) are paid. Equity holders receive any residual cash flow after all creditor claims are satisfied. In sections III and IV, forbearance by the FDIC occurs when the agency fails to enforce me-first rules and allows payments to other creditors (senior or junior) or equity holders at the expense of its own claim.

Sections II through IV utilize the definitions in box 2. We assume that all debt instruments are discount instruments, so that the end-of-period promised payments to depositors and subordinated debt holders include principal plus interest. We also assume that the deposit insurance premium is paid at the end of the period.[4]

II. No FDIC Bailouts

In this section, we present results from Osterberg and Thomson (1991) for a bank with insured deposits, uninsured deposits, and subordinated debt. The FDIC charges a fixed premium of ρ on each dollar of insured deposits. Total liability claims against the bank, K, equal the sum of the end-of-period promised payments to uninsured depositors (B_u), to insured depositors (B_i), to subordinated debt holders, S, and to the FDIC ($z = \rho B_i$). We assume that on average the FDIC underprices its deposit guarantees and provides a subsidy that reduces the cost of capital for banks as it increases their value.[5]

Given these assumptions, the end-of-period cash flow to insured depositors, Y_{bi}, equals the promised payments, B_i, in every state. Regardless of capital structure, the value and expected return of one dollar of insured deposits are $V_{bi} = R^{-1} B_i$ and $E(R_{bi}) = r$, respectively.

The cash flows to uninsured depositors depend on promised payments as well as on the total level of promised payments net of the subordinated debt, $K - S$:

4 For simplicity, we view the premium as an end-of-period claim on the bank. This is equivalent to assuming that the premium is subordinate to B_i and that, in effect, the bank receives coverage without necessarily paying the full premium. Although this condition influences the size of the subsidy, it does not qualitatively affect the key results.

5 Buser, Chen, and Kane (1981) introduce regulatory taxes into a similar framework.

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

Notice that although the total promised payments to debt holders and the FDIC equals K, the effective bankruptcy threshold equals K less the claims of subordinated debt holders. Assuming that $K - S$ is less than the previous threshold without subordinated debt, the value of uninsured deposits would rise with S. However, as we discuss below, whether or not this occurs depends on deposit insurance pricing, which influences z and thus K. The value of and the required rate of return on uninsured deposits are

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

$$(2) \quad E(R_{bu}) = R\frac{1 - F(K-S) + [1/(K-S)]\, E_0^{K-S}(X)}{1 - F(K-S) + [1/(K-S)]\, CEQ_0^{K-S}(X)} - 1.$$

Equation (2) shows that the cost of uninsured deposit capital is a function of the bank's nondiversifiable risk, $\lambda COV(X, R_m)$, total promised payments to depositors and the FDIC, $K - S$, the probability that losses will exceed the level of subordinated debt, $F(K - S)$, and the risk-free rate of return, r. As stated above, the cost of uninsured deposit capital, $E(R_{bu})$, is influenced by deposit insurance pricing. Specifically, Osterberg and Thomson (1990, 1991) show that underpriced (overpriced) deposit guarantees lower (raise) both the effective bankruptcy threshold for senior claims, $F(K - S)$, and the bankruptcy threshold, $F(K)$. Furthermore, underpricing (overpricing) increases (reduces) uninsured depositors' claims relative to both senior claims, $B_u / (K - S)$, and total claims, B_u / K. The size of this effect depends on the FDIC's pricing error per dollar of insured deposits and the deposit mix.

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

$$Y_s = S \quad \text{if } X > K,$$
$$X + S - K \quad \text{if } K > X > K - S,$$
$$0 \quad \text{if } K - S > X.$$

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

$$(3) \quad V_s = R^{-1}\left\{S[1 - F(K-S)] - K[F(K) - F(K-S)] + CEQ_{K-S}^{K}(X)\right\} \text{ and}$$

$$(4) \quad E(R_s) = \left\{[S[1 - F(K-S)] - K[F(K) - F(K-S)] + E_{K-S}^{S}(X)]/[S[1 - F(K-S)] - K[F(K) - F(K-S)] + CEQ_{K-S}^{K}(X)]\right\} - 1.0.$$

Equations (3) and (4) show that the cost and value of subordinated debt capital depend on the probability of bankruptcy, $F(K)$, the face value of subordinated debt, S, total promised payments, K, and the probability that senior claimants will not be repaid in full, $F(K - S)$. Again, since K is influenced by insurance pricing, so are V_s and $E(R_s)$. Note that the last two terms in equation (3) represent the claims of subordinated debt holders 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, senior claims, $K - S$, total claims, K, and the variance of X (which influences $F(\cdot)$ over the relevant ranges in equation [4]) have a nonlinear impact on the risk premium.

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

$$Y_e = X - K \quad \text{if } X > K,$$
$$0 \quad \text{if } K > X.$$

The value of equity and the expected return to stockholders are

$$(5) \quad V_e = R^{-1}\left\{CEQ_K(X) - K[1 - F(K)]\right\} \text{ and}$$

$$(6) \quad E(R_e) = R\frac{E_K(X) - K[1 - F(K)]}{CEQ_K(X) - K[1 - F(K)]} - 1.0.$$

The value of equity is unaffected by the subordinated debt requirement as long as total claims, K, remains unchanged. K, of course, is influenced by S and the pricing of the premium, z.

Equation (7) gives the total value of a bank with subordinated debt.

$$(7)\quad V_f = R^{-1}\Big\{CEQ_0(X) + B_i F(K-S) - z[1-F(K-S)] - [(B_i+z)/(K-S)]\,CEQ_0^{K-S}(X)\Big\}.$$

Subordinated debt affects the bank's value only through the last three terms on the right side of (7). As we show below, these terms equal the net value of deposit insurance to the bank. However, the definition of correct pricing of deposit insurance implies that its net value is zero, and that a subordinated debt requirement has no impact on bank value. Note, however, that pricing deposit insurance correctly requires the premium to vary with the size of the subordinated debt requirement. In this case, the impact of such a requirement depends on insurance pricing.

The net value of deposit insurance is simply the value of the FDIC's claim on the bank. The end-of-period cash flows to the agency and the value of its position are

$$(8)\quad Y_{FDIC} = \begin{cases} z & \text{if } X > K-S, \\ (B_i+z)X/(K-S) - B_i & \text{if } K-S > X > 0, \\ -B_i & \text{if } 0 > X, \text{ and} \end{cases}$$

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

Notice that the FDIC now receives the full premium z over a wider range, since $K-S<K$. Because the effective bankruptcy threshold has changed, equation (8) can be interpreted as showing the impact of the equity-like buffer provided by subordinated debt. The subordinated debt requirement affects the value of the FDIC's position by changing the probability that the put options corresponding to the agency's guarantee will be "in the money" at the end of the period. Equation (8) also makes clear that if deposit insurance is to be priced fairly ($V_{FDIC} = 0$), the premium must be influenced by the subordinated debt requirement.

III. Banks' Cost of Capital and the Value of the Insurance Fund: The Impact of Forbearance

Section II explained how subordinated debt affects a bank's value through its influence on the deposit insurance subsidy. Here, we show how forbearance affects the value of an insured bank with subordinated debt in its capital structure. Previous empirical analyses of subordinated debt prices have failed to account for the possibility that the FDIC conditionally guarantees some uninsured liabilities, a practice defined here as forbearance.

We consider two types of FDIC forbearances that differ in their assumed treatment of subordinated debt holders versus uninsured depositors. In case A, the FDIC bails out all uninsured creditors when earnings, X, fall between G_b and G_l and $K-S > G_b$. In other words, subordinated debt holders are paid in states where they would otherwise receive nothing. In the same states, uninsured depositors receive the balance of their promised claim from the FDIC.

In case B, the FDIC extends forbearances to all uninsured creditors when earnings are less than G_b but greater than G_l, and $K > G_b > K-S$. Subordinated debt holders are paid off when they otherwise would have received partial payment, as well as when they would have received nothing without forbearance.

We assume that the income range over which the FDIC forbears is known to market participants. For each case, we model only one set of bounds for FDIC bailouts of uninsured creditors. The analysis follows that in Osterberg and Thomson (1990) and also holds for multiple and disjoint bailout states.

Case A. For uninsured deposits, the introduction of FDIC forbearances into the capital structure results in the following end-of-period cash flows:

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

Comparing equations (9) and (10), below, to (1) and (2) makes apparent the difference between the two scenarios: In some states where uninsured depositors had previously received $B_u X/(K-S)$, they now receive B_u. Thus, it is clear that V_{bu} will increase and $E(R_{bu})$ will fall.

The value of and the required rate of return on uninsured deposits are now functions of the size and probability of the FDIC bailout. The threshold $K-S$ will be influenced by the impact of forbearance on the insurer's choice of premium, z.

$$(9)\quad V_{bu}=R^{-1}\left\{B_u[1-F(K-S)+F(G_b)-F(G_l)]\right.$$
$$\left.+[B_u/(K-S)][CEQ_0^{K-S}(X)-CEQ_{G_l}^{G_b}(X)]\right\}.$$

$$(10)\quad E(R_{bu})=R\left\{[1-F(K-S)+F(G_b)-F(G_l)\right.$$
$$+[1/(K-S)][E_0^{K-S}(X)-E_{G_l}^{G_b}(X)]]$$
$$+[1-F(K-S)+F(G_b)-F(G_l)$$
$$+[1/(K-S)][CEQ_0^{K-S}(X)$$
$$\left.-CEQ_{G_l}^{G_b}(X)]]\right\}-1.0.$$

The end-of-period cash flows to the subordinated debt holders are

$$\begin{aligned} Y_s &= S && \text{if } X>K,\\ &X+S-K && \text{if } K>X>K-S,\\ &0 && \text{if } K-S>X>G_b,\\ &S && \text{if } G_b>X>G_l,\\ &0 && \text{if } G_l>X. \end{aligned}$$

The value of the subordinated debt and its required rate of return are

$$(11)\quad V_s=R^{-1}\left\{S[1-F(K-S)+F(G_b)-F(G_l)]\right.$$
$$\left.-K[F(K)-F(K-S)]+CEQ_{K-S}^{K}(X)\right\}\text{ and}$$

$$(12)\quad E(R_s)=R\left\{[S[1-F(K-S)+F(G_b)-F(G_l)]\right.$$
$$-K[F(K)-F(K-S)]+E_{K-S}^{K}(X)]$$
$$\div[S[1-F(K-S)+F(G_b)-F(G_l)]$$
$$-K[F(K)-F(K-S)]$$
$$\left.+CEQ_{K-S}^{K}(X)]\right\}-1.0.$$

In some states where X falls below $K-S$, S is now received instead of zero. Thus, V_s must rise and $E(R_s)$ must fall. We show this below through a formal comparison of equations (11) and (12) to (3) and (4). Failure to account for this effect could lead empirical investigators to conclude that risk premia for certain banks are too low to be consistent with market discipline. In Osterberg and Thomson (1990), we show that the impact of extending forbearance to uninsured creditors is entirely captured by those creditors and that there is no effect on equity holders. However, forbearance influences the values of deposit insurance and the bank.

Equations (13) and (14) indicate the value of the bank and of FDIC guarantees when the bailout occurs for X between G_b and G_l.

$$(13)\quad V_f=R^{-1}\left\{CEQ_0(X)-z[1-F(K-S)]\right.$$
$$-[(B_i+z)/(K-S)][CEQ_0^{K-S}(X)$$
$$-CEQ_{G_l}^{G_b}(X)]-CEQ_{G_l}^{G_b}(X)+B_iF(K-S)$$
$$\left.+(S+B_u)[F(G_b)-F(G_l)]\right\}.$$

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

$$(14)\quad V_{FDIC}=R^{-1}\left\{z[1-F(K-S)]\right.$$
$$+[(B_i+z)/(K-S)]$$
$$[CEQ_0^{K-S}(X)-CEQ_{G_l}^{G_b}(X)]$$
$$+CEQ_{G_l}^{G_b}(X)-B_iF(K-S)$$
$$\left.-(S+B_u)[F(G_b)-F(G_l)]\right\}.$$

The crucial role of deposit insurance pricing in determining the impact of forbearance is most easily seen by noting that the bank's value in equation (13) is simply the sum of the value of an all-equity firm and the net value of implicit and explicit FDIC guarantees (from [14]): $V_f=R^{-1}CEQ_0(X)+V_{FDIC}$. Of course, if the FDIC prices its guarantees fairly, then $V_{FDIC}=0$ and $V_f=R^{-1}CEQ_0(X)$, the value of the all-equity firm. The impacts of the subordinated debt requirement, forbearance, and capital structure are reflected in the value of the deposit insurance subsidy. In this case, the pricing of both the explicit and implicit guarantees will influence the impact of subordinated debt.

Case B. Introducing FDIC forbearances into the capital structure when X is less than G_b ($G_l > K - S > G_b$) results in the following end-of-period cash flows to uninsured depositors:

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

Again, the value of and the required rate of return on uninsured deposits are functions of the size and probability of the FDIC bailout. However, unlike the previous case, when the uninsured depositors suffered some losses after the subordinated debt was exhausted, this policy guarantees their claims for all values of X above G_l. Thus, V_{bu} will rise and $E(R_{bu})$ will fall.

$$(15) \quad V_{bu} = R^{-1}\left\{B_u[1 - F(G_l)] + [B_u/(K-S)]\,[CEQ_0^{G_l}(X)]\right\} \text{ and}$$

$$(16) \quad E(R_{bu}) = R\left\{[1 - F(G_l) + [1/(K-S)]\,E_0^{G_l}(X)] \div [1 - F(G_l) + [1/(K-S)]\,CEQ_0^{G_l}(X)]\right\} - 1.0.$$

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

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

The value of subordinated debt and its required rate of return are

$$(17) \quad V_s = R^{-1}\left\{S[1 - F(G_l)] - K[F(K) - F(G_b)] + CEQ_{G_b}^{K}(X)\right\} \text{ and}$$

$$(18) \quad E(R_s) = R\left\{[S[1 - F(G_l)] - K[F(K) - F(G_b)] + E_{K-S}^{K}(X)]/[S[1 - F(G_l)] - K[F(K) - F(G_l)] + CEQ_{K-S}^{K}(X)]\right\} - 1.0.$$

Since $G_l > K - S > G_b$, a comparison with the no-bailout case shows that V_s rises and $E(R_s)$ falls. Equations (19) and (20) indicate the value of the bank and of FDIC guarantees when the FDIC bailout occurs for X between G_b and G_l.

$$(19) \quad V_f = R^{-1}\left\{CEQ_0(X) - z[1 - F(K)] - [(K-S)/(K)]\,CEQ_{G_b}^{K}(X) - CEQ_{G_l}^{G_b}(X) + B_i F(K) + B_u[F(K) - F(G_l)] + S[F(G_b) - F(G_l)] - [(B_i + z)/(K-S)]\,CEQ_0^{G_l}(X)\right\}.$$

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

$$(20) \quad V_{FDIC} = R^{-1}\left\{z[1 - F(K)] - (B_u + B_i + S)[F(G_b) - F(G_l)] - B_i F(G_l) + [(B_i + z)/(K-S)]\,CEQ_0^{G_b}(X) + [B_u/(K-S)]\,CEQ_{G_l}^{G_b}(X)\right\}.$$

As in case A, the bank's value depends on both the FDIC's pricing of its explicit guarantees and the value of its implicit guarantees via forbearance.

IV. The Effects of Mispriced Deposit Guarantees and Forbearance on the Value of Subordinated Debt Capital

In this section, we use the results of sections II and III to analyze explicitly the impact of mispriced deposit insurance and FDIC forbearance policies on the value of, and hence the required return on, subordinated debt.

Mispricing deposit insurance increases the value of subordinated debt. To see this, first define D as total promised payments to liability holders and $Y_{s,d}$ as the respective cash flows accruing to subordinated debt holders per dollar of promised payment when insurance is mispriced or fairly priced.[6]

In order to calculate the impact of mispricing on the value of subordinated debt, we construct a replicating portfolio for the one-dollar par-value subordinated debt claim when deposit guarantees are mispriced. This portfolio consists of one unit of a one-dollar par-value subordinated debt claim when deposit insurance is fairly priced, and a second security $\Delta_d Y_s$ $(= y_s - y_{s,d})$ with the following cash flows:

$$\Delta_d Y_s = \begin{cases} 0 & \text{if } X > D, \\ (D-X)/S & \text{if } D > X > K, \\ (D-K)/S & \text{if } K > X > D-S, \\ 1+(X-K)/S & \text{if } D-S > X > K-S, \\ 0 & \text{if } K-S > X. \end{cases}$$

The value of this security is

$$(21) \quad \Delta_d V_s = (RS)^{-1} \Big\{ D[F(D) - F(D-S)] - CEQ_K^D(X) - K[F(K) - F(K-S)] + CEQ_{K-S}^{D-S}(X) + S[F(D-S) - F(K-S)] \Big\},$$

which is positive if

$$CEQ_{K-S}^{D-S}(X) > (K-S)[F(D-S) - F(K-S)].$$

Equation (21) shows that mispricing deposit insurance affects the value of subordinated debt capital by altering the probability that subordinated debt holders will be repaid in full. In effect, deposit insurance subsidies alter the ranges over which subordinated debt prices behave like equity and debt prices. Forbearance policies also affect the value of, and thus the rate of return on, subordinated debt. In either case, however, forbearance both increases the value of subordinated debt and changes pricing.

Following the procedure used above, we next construct a replicating portfolio for a one-dollar par-value subordinated debt claim when the FDIC bails out liability holders. The replicating portfolio for case A (case B) consists of one share of subordinated debt without FDIC forbearances and a security $\Delta_a Y_s$ $(\Delta_b Y_s)$ with the following cash flows:

$$\Delta_a Y_s = \begin{cases} 0 & \text{if } X > G_b, \\ 1 & \text{if } G_b > X > G_l, \\ 0 & \text{if } G_l > X. \end{cases}$$

$$\Delta_b Y_s = \begin{cases} 0 & \text{if } X > G_b, \\ (K-X)/S & \text{if } G_b > X > K-S, \\ 1 & \text{if } K-S > X > G_l, \\ 0 & \text{if } G_l > X. \end{cases}$$

In case A, subordinated debt holders receive payment from the FDIC equal to the par value of their claim for all values of X between G_b and G_l. In case B, they receive a partial bailout when X is between G_b and $K-S$ and a full bailout when X is between $K-S$ and G_l. The difference between the cash flows in the two cases reflects the difference in the assumed bailout policy. In case A, the FDIC extends forbearances only when losses exceed the value of the subordinated debt. In case B, forbearances are extended before losses totally exhaust the subordinated debt.

Equations (22) and (23) show that the value of the securities that replicates the value of forbearance to subordinated debt holders is positive and that $\Delta_b Y_s > \Delta_a Y_s$.[7]

$$(22) \quad \Delta_a V_s = R^{-1}[F(G_b) - F(G_l)] > 0.$$

$$(23) \quad \Delta_b V_s = (RS)^{-1} \Big\{ K[F(G_b) - F(K-S)] - CEQ_{K-S}^{G_b}(X) + S[F(K-S) - F(G_l)] \Big\} > 0.$$

As noted by Gorton and Santomero, subordinated debt is a hybrid instrument whose price and return behave like debt for high values of X, but like equity for low values of X. The possibility of FDIC bailouts when X is in the range for which subordinated debt would typically behave like equity complicates the pricing dynamics. Specifically, without forbearance, there is a range of values for X such that subordinated debt prices switch from acting like debt to acting like equity as earnings increase. The introduction of FDIC forbearances may change the switch point or introduce multiple switch points.

■ 6 When there are no FDIC forbearances and deposit insurance is fairly priced, the end-of-period expected cash flows accruing to the subordinated debt holders are

$$Y_{s,d} = \begin{cases} S & \text{if } X > D, \\ X+S-D & \text{if } D > X > D-S, \\ 0 & \text{if } D-S > X. \end{cases}$$

■ 7 To see this, note that

$$F(K-S) - F(G_l) > F(G_b) - F(G_l)$$

and $(K/S)[F(G_b) - F(K-S)] > (1/S)\, CEQ_{K-S}^{G_b}(X)$.

Previous empirical studies of the relationship between subordinated debt prices and balance sheets by Gorton and Santomero and Avery, Belton, and Goldberg do not account for the possible impact of FDIC forbearance policy. The theory presented above provides one possible explanation of previous empirical findings that risk premia on subordinated debt are weakly related to risk proxies.

V. Conclusion

Using the cash-flow version of the CAPM developed by Chen (1978) and extended by Osterberg and Thomson (1990, 1991), we develop an explicit pricing model for subordinated debt that considers the possibility of implicit guarantees of nominally uninsured debt capital. Similar guarantees have been present during the sample periods of recent empirical studies of subordinated debt prices. Our findings indicate that FDIC forbearance increases the value of subordinated debt and thus alters investors' required rates of return.

Forbearance reduces the usefulness of subordinated debt in two ways. First, the possibility of FDIC bailouts directly increases the deposit insurance subsidy. However, given the possibility of such bailouts, the size of the subsidy is reduced by a subordinated debt requirement as long as there is some chance that subordinated creditors will realize losses.

Second, forbearance reduces the rate of return required on subordinated debt of a given risk, a policy that may easily impede market discipline of bank risk-taking. This in turn reduces the amount of information in secondary market prices of subordinated debt. Forbearance thus introduces a potential source of specification error in empirical studies of the risk premium in subordinated debt markets.

As we have emphasized previously (Osterberg and Thomson [1990, 1991]), the impact of capital structure changes on insured banks depends on deposit insurance pricing. If deposit insurance is fairly priced, neither subordinated debt requirements nor forbearance will impact overall bank value. However, in the more realistic case of deposit insurance mispricing, the effects of expected capital structure changes are altered through their interaction with the overall regulatory environment.

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