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DEPOSIT INSURANCE AND THE COST OF CAPITAL

by William P. Osterberg and James B. Thomson

William P. Osterberg and James B. Thomson are
economists at the Federal Reserve Bank of Cleveland.

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ABSTRACT

Using a single-period model, the impacts of deposit insurance and forbearance on the costs and value of uninsured deposits and equity capital are shown under three regimes: with only uninsured deposits, with both insured and uninsured deposits, and with both insured and uninsured deposits with forbearance to uninsured depositors in some states of the world. Underpricing of deposit insurance and forbearance policies to uninsured depositors increase the value of the uninsured deposits. Under certain conditions, underpriced deposit insurance increases the value of equity.

DEPOSIT INSURANCE AND THE COST OF CAPITAL

I. Introduction

Research in the area of deposit insurance and capital regulation has focused on four basic areas: deposit insurance pricing (Ronn and Verma [1986], Marcus and Shaked [1984], and Pennacchi [1987]); capital regulation and portfolio choice (Koehn and Santomero [1980], Santomero and Watson [1977], and Chen and Lam [1985]); implicit deposit guarantees and capital forbearance (Kane [1986], Pyle [1986], Penati and Protopapadakis [1986], and Thomson [1987a, 1987b]); and deposit insurance and bank regulation (Kareken and Wallace [1978], Buser, Chen, and Kane [1981], and Benston, Eisenbeis, Horvitz, Kane, and Kaufman [1986]). This study examines the impacts of deposit insurance guarantees and forbearances on the cost of capital for banks.

The models used in the paper are the single-period and multiperiod capital asset pricing models (CAPM) similar to the ones used by Chen (1978). Within this framework we show the relative values of depositor and stockholder positions in the bank under three different deposit-insurance regimes. Under the first regime, we assume that no deposits are insured. Under the second regime, we allow for explicit deposit guarantees but no implicit guarantees. Finally, under the third regime, we have both insured and uninsured deposits and allow for the guarantee of the uninsured deposits in some of the failure states. Furthermore, we examine the effects of mispriced deposit guarantees in regimes two and three.

The costs of equity capital and uninsured deposits are explored under each

regime. Under the no-insurance regime, our results are identical to Chen's. If the deposit guarantees are correctly priced, then under regime two the costs of uninsured deposits and equity capital are invariant to the deposit mix. This result does not hold up **if** the insurance is mispriced. Under regime three, the cost of uninsured deposits is a function of the forbearance policy of the deposit guarantor. In this case, the costs of debt and equity capital are not invariant to the deposit mix even when the explicit guarantee is priced correctly.

In section II, we present the single-period results for each regime. In section III, we compare the value and cost of uninsured deposits and equity across the three regimes to see the effects of deposit insurance mispricing and forbearance policy. In section IV, we present the multiperiod version for the third regime. Finally, in section V, we provide our conclusions.

II. The Cost of Capital for Banks in Static Models

To determine the effects of mispriced deposit insurance and FDIC forbearance policy on the cost of debt (deposit) capital and equity capital for banks, we utilize the single-period CAPM valuation equation used by Chen (1978) and derived by Sharpe (1964), Linter (1965), and Mossin (1966). The key assumptions underlying this model are: (1) a fixed, risk-free rate of interest, (2) perfectly competitive capital markets, (3) homogeneous expectations with respect to the distributions and expected yields on risky assets, and (4) risk-averse investors who seek to maximize the expected utility of terminal wealth. The following notation is used in this section:

B = Total promised payment when there is no deposit insurance

K = Total promised payment when some deposits are insured $(= B_i + B_u + z)$

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

Y_{bi} = Value of the end-of-period cash flows to insured depositors

Y_{bu} = Value of the end-of-period cash flows to uninsured depositors

Y_e = Value of the end-of-period cash flows to stockholders

Y_{fdic} = Value of the end-of-period cash flows to the FDIC

V_{bi} = Value of insured deposits

V_{bu} = Value of uninsured deposits

V_e = Value of bank equity

V_{fdic} = Value of the FDIC claim

V_f = Value of the bank

$E(R_{bi})$ = Expected rate of return on insured deposits

$E(R_{bu})$ = Expected rate of return on uninsured deposits

$E(R_e)$ = Expected rate of return on bank equity

r = Risk-free rate of return

$F(X)$ = Cumulative distribution function for X

$CEQ(X)$ = Certainty-equivalent of X, equal to $E(X) - \lambda\, COV(X, R_m)$

λ = The market risk premium

R_m = Return on the market

We assume that all deposits are discount instruments, so that the total promised payment to each class of depositor includes both principal repayment and interest.

Below we present the expected end-of-period payments to depositors, stockholders, and the FDIC under three different deposit-insurance regimes. Under all three regimes, bankruptcy costs and taxes are assumed to be zero. The **first** regime replicates Chen's results for the the cost of debt (deposit) capital and equity capital when there is no deposit insurance. In the second regime, banks issue both insured and uninsured deposits. However, the FDIC does extend forbearances to any class of creditors or stockholders. We build in FDIC forbearance policy in the third regime.

A.   Regime **I** : No Deposit Insurance

Banks issue uninsured deposits only, and the end-of-period cash flows accruing to the depositors, Y_b, are:

$$Y_b = \begin{vmatrix} B \\ X \\ 0 \end{vmatrix} \quad if \quad \begin{vmatrix} X > B \\ B > X > 0 \\ 0 > X \end{vmatrix}$$

The value of the deposits, V_b, is the risk-adjusted discounted value of Y_b.

(1a) $V_b = (1 + r)^{-1}[B[1 - F(B)] + CEQ_0^B(X)]$.

The cost of debt (deposit) capital, or the required rate of return on the deposits, is $E(R_b) = E(Y_b)/V_b$.

$$(2a) \quad E(R_b) = (1+r)\frac{B[1-F(B)] + E_0^B(X)}{B[1-F(B)] + CEQ_0^B(X)} - 1.0.$$

As in Chen, the cost of debt (deposit) capital is a function of the risk-free interest rate, the firm's systematic risk (as measured by $\lambda COV(X,R_m)$), and the probability of bankruptcy $(F(B))$.

For the stockholders, the expected end-of-period cash flows, Y_e, equals:

$$Y_e = \begin{vmatrix} X - B \\ 0 \end{vmatrix} \quad if \quad \begin{vmatrix} X > B \\ B > X \end{vmatrix}$$

and from the single-period CAPM valuation equation, the value of stockholder equity, V_e, equals:

$$(3a) \quad V_e = (1 + r)^{-1}(CEQ_B(X) - B[1 - F(B)]).$$

As in the case of debt capital, the cost of equity capital, or the required rate of return on equity, is $E(R_e) = Y_e/V_e$.

$$(4a) \quad E(R_e) = (1+r)\frac{E_B(X) - B[1-F(B)]}{CEQ_B(X) - B[1-F(B)]} - 1.0.$$

As in Chen, the cost of equity capital for a bank is a function of its systematic risk, the level of total promised payment, the probability of bankruptcy, and the risk-free interest rate.

The value of the firm is the sum of the value of all claims against the firm, that is, $V_f = V_b + V_e$.

(5a) $V_f = (1+r)^{-1} CEQ_0(X)$.

B. Regime II: Insured and Uninsured Deposits, But No FDIC Forbearances

In this regime, we allow for the explicit insurance of some of the bank's deposit liabilities. We assume that the FDIC charges the bank a premium of p on each dollar of insured deposits and that the premium is collected at the end of the period. The total liability claim against the bank, K, is the sum of the end-of-period promised payments to the insured depositors, B_i; the uninsured depositors, B_u; and the FDIC, $z = \rho B_i$. The effect of deposit insurance on the value and cost of capital depends on whether the guarantees are underpriced, fairly priced, or overpriced.' However, in this paper we generally assume that the FDIC underprices its guarantees and, therefore, that K < D.

The end-of-period cash flows for the insured deposits, Y_{bi}, equals the promised payment to insured depositors, B_i, in every state. Therefore, the value of the insured deposits is $V_{bi} = (1+r)^{-1} B_i$ and the required return on the insured deposits is $E(R_{bi}) = r$. The cost of insured deposit capital to the bank is $r + p$.

For the uninsured depositors, the end-of-period cash flows, Y_{du}, depend on the promised payment to the uninsured depositors and on the total level of promised payments.

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

The value of the uninsured deposits, V_{bu}, and the cost of the required rate of return on these deposits, $E(R_{bu})$, are:

(1b) $V_{bu} = (1+r)^{-1}[B_u[1-F(K)] + (B_u/K)CEQ_0^K(X)]$, and

(2b) $E(R_{bu}) = (1+r)\dfrac{B_u[1-F(K)] + (B_u/K)E_0^K(X)}{B_u[1-F(K)] + (B_u/K)CEQ_0^K(X)} - 1.0.$

As in the first regime, the cost of debt (uninsured deposit) capital is a function of systematic risk, total promised payments, the probability of bankruptcy, and the risk-free rate of interest. However, the cost of debt capital is explicitly a function of the deposit mix when the FDIC guarantees are mispriced. That is, underpriced deposit guarantees lower the bankruptcy threshold, $F(K)$, and increase the proportional claim of the uninsured depositors relative to the insured depositors and the FDIC. The degree to which this effect operates is a function of the FDIC's pricing error per dollar of insured deposits and of the deposit mix.

As in regime one, the stockholders' expected end-of-period cash flows are earnings less total promised payments in the nonbankruptcy states, and zero in the bankruptcy states. However, the total promised payment and the probability of a bankruptcy state are now a function of the deposit mix and of the pricing of the deposit guarantees.

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

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

(3b) $V_e = (1 + r)^{-1}(CEQ_K(X) - K[1-F(K)])$, and

(4b) $E(R_e) = (1+r)\dfrac{E_K(X) - K[1-F(K)]}{CEQ_K(X) - K[1-F(K)]} - 1.0.$

As in the case of uninsured deposits, the cost of equity capital is a function of the deposit insurance pricing and the deposit mix. In other words, the subsidy that arises when the FDIC misprices its deposit guarantees affects the cost and value of debt (uninsured deposit) capital and equity capital.

The FDIC subsidy can be seen when we aggregate the claims of the debt-holders (insured and uninsured) and equity-holders in the firm. The total value of the bank is:

(5b) $V_f = (1+r)^{-1}[CEQ_0(X) + B_i F(K) - z[1-F(K)] - [(B_i+z)/K]CEQ_0^K(X)].$

The end-of-period cash flows and the value of the FDIC's position in the bank (the FDIC's subsidy) are:

$$Y_{FDIC} = \begin{vmatrix} z \\ (B_i+z)X/K - B_i \\ -B_i \end{vmatrix} \quad \text{if} \quad \begin{vmatrix} X > K \\ K > X > 0 \\ 0 > X \end{vmatrix}$$

(6b) $V_{FDIC} = (1+r)^{-1}[z[1-F(K)] + [(B_i+z)/K]CEQ_0^K(X) - B_i F(K)].$

The value of the FDIC's claim is a function of the probability of bankruptcy, $F(K)$; the level of promised payments to insured depositors, B_i; the

systematic risk of the bank as reflected in $CEQ_0^K(X)$; the risk-free rate, r; and the insurance premium, z. If we add (5b) and (6b), the resulting equation is identical to equation (5a) in the no-insurance regime. In fact, when $V_{FDIC} = 0$, the insurance is correctly priced and equation (5b) is identical to equation (5a).

C. Regime III: Insured and Uninsured Deposits and FDIC Forbearances

We extend the analysis to include the conditional guarantee of uninsured deposits in bankruptcy states when earnings, X, fall between S_1 and S_2. We assume that S_1 and S_2 are determined by FDIC policy and are known to market participants. For simplicity, we model only one set of bounds for FDIC bailouts, but the analysis holds for multiple and disjoint bailout states.

The position of the insured depositors is not affected by FDIC bailout policies. However, Y_{du}, V_{du} and $E(R_{du})$ are all functions of the FDIC bailout policy.

$$
Y_{du} = \left| \begin{array}{l} B_{du} \\ B_u X/K \\ B_u \\ B_u X/K \\ 0 \end{array} \right. \quad \text{if} \quad \left| \begin{array}{l} X > K \\ K > X > S_2 \\ S_2 > X > S_1 \\ S_1 > X > 0 \\ 0 > X \end{array} \right.
$$

(1c) $V_{bu} = (1+r)^{-1}[B_u[1-F(K)+F(S_2)-F(S_1)] + (B_u/K)(CEQ_0^K(X)-CEQ_{s_1}^{s_2}(X))].$

The cost of debt (uninsured deposit) capital is now a function of the probability of an FDIC bailout and the size of the uninsured depositors'

bailout.

$$(2c) \quad E(R_{bu}) = (1+r)\frac{B_u[1-F(K)+F(S_2)-F(S_1)] + (B_u/K)[E_0^K(X)-E_{s1}^{s2}(X)]}{B_u[1-F(K)+F(S_2)-F(S_1)] + (B_u/K)(CEQ_0^K(X)-CEQ_{s1}^{s2}(X))]} - 1.0.$$

The value of the FDIC bailout is entirely captured by the uninsured depositors and does not affect the position of the stockholders. As seen below, Y_e, V_e, and $E(R_e)$ are identical to those in the previous regime.

$$Y_e = \begin{vmatrix} X - K \\ 0 \end{vmatrix} \quad if \quad \begin{vmatrix} X > K \\ K > X \end{vmatrix}$$

$$(3c) \quad V_e = (1+r)^{-1}(CEQ_K(X) - K[1-F(K)]).$$

$$(4c) \quad E(R_e) = (1 + r)\frac{E_K(X) - K[1-F(K)]}{CEQ_K(X) - K[1-F(K)]} - 1.0$$

However, as seen in equation (5c), the value of the firm is a function of the FDIC's bailout policy. The last two terms on the right side of (5c) reflect the net value of the FDIC forbearances to uninsured depositors.

$$(5c) \quad V_f = (1+r)^{-1}[CEQ_0(X) + B_i F(K) - [(B_i+z)/K]CEQ_0^K(X)] - z[1-F(K)]$$
$$- (B_u/K)CEQ_{s1}^{s2}(X) + B_u[F(S_2)-F(S_1)].$$

The end-of-period cash flows to the FDIC and the value of the FDIC's claim on the bank now include the cost of guaranteeing the uninsured deposits in the bailout states.

$$
Y_{FDIC} = \begin{vmatrix} z \\ (B_i + z)X/K - B_i \\ X - B_i - B_u \\ (B_i + z)X/K - B_i \\ -B_i \end{vmatrix} \quad if \quad \begin{vmatrix} X > K \\ K > X > S_2 \\ S_2 > X > S_1 \\ S_1 > X > 0 \\ 0 > X \end{vmatrix}
$$

The expected cost of providing forbearances to uninsured depositors in the bailout states is reflected in the last two terms on the right side of equation (6c). As before, the sum of (5c) and (6c) equals the value of the firm in 5(a).

$$
(6c) \quad V_{fdic} = (1+r)^{-1}[z[1-F(K)] + [(B_i+z)/K]CEQ_0^K(X) - B_iF(K)
$$
$$
- B_u[F(S_2)-F(S_1)] + (B_u/K)CEQ_{S_1}^{S_2}(X)].
$$

III. The Effects of Mispriced Insurance and Forbearance on the Cost and Value of Debt and Equity Capital

As seen in section II, mispriced deposit insurance and FDIC forbearances affect the cost of capital and the value of debt and equity shares in banks. The presence of mispriced FDIC guarantees and FDIC forbearances has an impact on the value of uninsured deposits. The value of equity is also affected by mispriced deposit guarantees. In this section, we show the direction of change in the value of capital from FDIC policies.

The value of the uninsured deposits (per dollar of promised payment) is increased by the presence of mispriced deposit insurance. To demonstrate this,

we divide Y_b and Y_{bu} in regimes one and two by B and $B_{,,,}$ respectively. By subtracting Y_b/B from Y_{bu}/B_u, we can split the uninsured deposit in regime two into two instruments: one that is identical to the uninsured deposit in regime one, and a second that has the following payoffs next period.

$$\Delta_g Y_{bu} = \begin{vmatrix} 0 \\ 1 - X/B \\ X/K - X/B \\ 0 \end{vmatrix} \quad if \quad \begin{vmatrix} X > B \\ B > X > K \\ K > X > 0 \\ 0 > X \end{vmatrix}$$

If the value of $\Delta_g Y_{bu}$ is positive (negative), then stochastic dominance requires that the value of an uninsured deposit (with a par value of one dollar) in regime two must be greater (less) than its value in regime one.

(7) $\Delta_g V_{bu} = (1+r)^{-1}([F(B)-F(K)] - (1/B)CEQ_K^B(X) + \gamma CEQ_0^K(X))$.

In equation (7), $\Delta_g V_{bu}$ is the value of the income stream that accrues to uninsured depositors when the FDIC underprices its deposit guarantees. The first term on the right side is positive, the second term is negative, and the third term is positive when deposit guarantees are underpriced. γ equals $1/K$ minus $1/B$, which is positive because $K < B$.

From the bankruptcy condition in regime one, we know that $B[F(B) - F(K)] > E_K^B(X) > CEQ_K^B(X)$, and that $F(B) - F(K) > (1/B)CEQ_K^B(X)$. Therefore, equation (7) is positive, and the value of the uninsured deposits increases when deposit insurance is underpriced. $\Delta_g V_{bu} B_u$ can be interpreted as the value of FDIC subsidies accruing to uninsured depositors from underpriced deposit guarantees.

The introduction of FDIC forbearances when $S_1 < X < S_2$ further increases the value of uninsured deposits (per dollar of promised payment). Following the procedure used in the previous case, we separate an uninsured deposit in regime three into two instruments: one that is identical to an uninsured deposit in regime two, and a second that has the following end-of-period payoffs:

$$\Delta_g Y_{bu} = \begin{vmatrix} 0 \\ 0 \\ 1 - X/K \\ 0 \\ 0 \end{vmatrix} \quad \text{if} \quad \begin{vmatrix} X > K \\ K > X > S_2 \\ S_2 > X > S_1 \\ S_1 > X > 0 \\ 0 > X \end{vmatrix}$$

The value of $\Delta_F Y_{bu}$ is:

(8) $\Delta_F V_{du} = (1+r)^{-1}([F(S_2)-F(S_1)] - (1/K)CEQ_{s1}^{s2}(X))$.

A sufficient condition for equation (8) to be positive is $K \geq S_2$, which holds by definition. Furthermore, FDIC forbearances represent a call option, which implies that $\Delta_F V_{du}$ must be nonnegative. Therefore, equation (8) is positive, and the extension of forbearance to uninsured depositors in some bankruptcy states increases the value of those deposits.

For the equity-holders, section II shows that FDIC forbearances to uninsured depositors do not affect the value of their shares. On the other hand, underpriced deposit insurance does affect the value of bank equity. The change in the payments to equity-holders from regime one to regime two is:

$$\Delta_g Y_e = \begin{vmatrix} B - K \\ X - K \\ 0 \end{vmatrix} \quad \text{if} \quad \begin{vmatrix} X > B \\ B > X > K \\ K > X \end{vmatrix}$$

As before, we have divided the equity claim in regime two into a claim identical to the equity claim in regime one and an instrument whose value is:

$$(9) \quad \Delta_g V_e = (1+r)^{-1}(CEQ_K^B(X) + (B-K)[1-F(B)] - K[F(B)-F(K)]).$$

We know that $E_K^B(X) > K[F(B)-F(K)]$; however, it is not clear that $CEQ_K^B(X) > K[F(B)-F(K)]$ because $E_K^B(X) > CEQ_K^B(X)$. Equation (9) will be positive if $(B-K)[1-F(B)] - \lambda Cov_K^B(X,R_m) \geq 0$, or if $(B-K)[1-F(B)] - \lambda Cov_K^B(X,R_m) < E_K^B(X) - K[F(B)-F(K)]$. It is likely that this condition holds and that equation (9) is positive. Furthermore, if paying too little for deposit insurance lowers a bank's value, the bank could always remove this redistributive effect by voluntarily increasing its payments to the FDIC. Therefore, equation (9) must be nonnegative.

IV. The Multiperiod Model

We analyze the multiperiod version of the third regime discussed above: the bank issues both insured and uninsured deposits; there is a fixed deposit insurance premium that may or may not be equal to the "fair" premium that reduces to zero the value of the FDIC's claim; and in states S_1 through

S_2, there is FDIC forbearance to uninsured depositors. In a multiperiod context, **if** the bank cannot meet all of its obligations from its cash flow, **it** is able to issue equity to meet the claims of the depositors. **If** the total of cash flow and equity is insufficient to meet all claims, the total available funds are split proportionately among all claimants.

We make several assumptions in addition to those stated above for the single-period model. First, equity is issued to help meet promised payments as long as shareholder wealth is positive. Bankruptcy can be avoided even **if** the terminal value of the bank is negative, as long as the total of the equity value and the net operating income at least meets promised payments. Second, in deriving the expressions for market values and the implied required rates of return below, we assume that the term structure of interest rates is flat. Third, we assume that the price of risk is constant over time. Fourth, we deal with a zero-growth bank and assume that the distribution of net operating income is constant over time. Finally, we assume that, ex-ante, the bankruptcy point in future periods equals its value in the first period.

All terms are defined as above, except that we replace B, and B_u, the total promised payments due insured and uninsured depositors in the single-period model, by D_i and D_u, the principals due on deposits. The other portions of the payments received by depositors are I_{di} and I_{du}, the interest payments due insured and uninsured depositors, respectively. The wealth of insured depositors is equal to their interest payments received over the period plus the value of their claims at the end of the period (V_{di+1}), discounted at the risk-free rate of interest, **r**.

$$Y_{di} = I_{di} + V_{di+1}$$

$$V_{di} = [1/(1+r)](I_{di} + V_{di+1}).$$

By repeated substitution, this leads to:

$$V_{di} = (1/r)I_{di}$$

$$E(R_{di}) = r.$$

Uninsured depositors will receive only a portion of the total of earnings and funds raised through equity issue unless earnings and equity funds are sufficient to meet the total of all claims $(K = I_{di}+I_{du}+D_i+D_u+z)$ or unless the FDIC bails out the bank. The FDIC is assumed to bail out uninsured depositors if bank earnings fall between S_1 and S_2.

$$Y_{du} = \begin{cases} I_{du} + V_{du+1} & X > h = K - V_e \\ [(I_{du} + D_u)/K][X + V_e] & h > X > S_2 \\ I_{du} + D_u & \text{if} \quad S_2 > X > S_1 \\ [(I_{du} + D_u)/K][X + V_e] & S_1 > X > -V_e \\ 0 & -V_e > X \end{cases}$$

$$(10) \quad V_{du} = [1/(r+F(h))]\{[1-F(h)]I_{du} +$$

$$[(I_{du}+D_u)/K][CEQ_{S2}^h(X)+CEQ_{-V_e}^{S1}(X)]$$

$$+ [(I_{du}+D_u)/K]V_e[F(h)-F(S_2)+F(S_1)-F(-V_e)]$$

$$+ (I_{du}+D_u)[F(S_2)-F(S_1)]\}.$$

The expected, or required, return on uninsured deposits is derived from the condition that $V_{du} = E(Y_{du})/[E(R_{du})+F(h)]$.

(11) $E(R_{du}) = [r+F(h)][H/(H-q)] - F(h)$

$H = \{[1-F(h)]I_{du} + [(I_{du}+D_u)/K][E_{s2}^h(X) + E_{-Ve}^{s1}(X)]$

$+ [(I_{du} + D_u)/K]V_e[F(h)-F(S_2)+F(S_1)-F(-V_e)]\}$

$q = [(I_{du} + D_u)/K][\lambda COV_{s2}^h(X,R_m)+\lambda COV_{-Ve}^{s1}(X,R_m)].$

The value of the uninsured deposits and the rate of return required on them by depositors depend on the expected value of equity as well as on the factors emphasized in the single-period model. The value of the deposits depends on the expected value of equity through the default premium, $F(h)$, and as it affects the total funds available to be split among claimants. The default premium enters the risk-adjusted rate, $r + F(h)$, now used to discount cash flows. Because it is now the total of net operating income plus expected funds raised through equity issue that will be split among claimants, the value of equity directly enters the expressions for the value and required rate of return on uninsured deposits.

As usual, the equity-holders have a residual claim:

$$Y_e = \begin{vmatrix} X - K + V_{e+1} \\ 0 \end{vmatrix} \quad \text{if} \quad \begin{vmatrix} X > K - V_e = h \\ X < K - V_e = h \end{vmatrix}$$

(12) $V_e = [1/(r+F(h)][CEQ_h(X)-(1-F(h))K].$

(13) $E(R_e) = [r+F(h)][E_h(X)-(1-F(h))K]/[CEQ_h(X)-(1-F(h))K] - F(h).$

The value and required rate of return on equity depend on the probability of bankruptcy, which is a function of the distribution of net operating income plus funds raised from equity issue at the end of the period (V_{e+1}).

We can explore the determinants of the fair insurance premium by examining the determinants of the value of the FDIC's claim on the bank. Once again, a fair premium sets the value of the claim to zero.

$$Y_{fdic} = \begin{vmatrix} z \\ [(D_i+I_{di})/K](X+V_e)-I_{di}-D_i \\ X+V_e-I_{di}-I_{du}-D_i-D_u \\ [(D_i+I_{di})/K](X+V_e)-I_{di}-D_i \\ -D_i \end{vmatrix} \quad if \quad \begin{vmatrix} X < K-V_e = h \\ h > X > S_2 \\ S_2 > X > S_1 \\ S_1 > X > -V_e \\ X < -V_e \end{vmatrix}$$

(14) $V_{fdic} = [1/(r+F(h))]\{H-q\}$

$H = \{z[1-F(h)] - D_i F(h)$

$\quad + [(I_{di}+D_i+z)/K][E^h_{s2}(X) + E^{s1}_{-Ve}(X) + V_e[F(h)-F(S_2)+F(S_1)-F(-V_e)]]$

$\quad + E^{s2}_{s1}(X) + V_e[F(S_2)-F(S_1)]-(D_u+I_{du})[F(S_2)-F(S_1)]\}$

$q = [(I_{di}+D_i)/K] [\lambda COV^h_{s2}(X,R_m)+\lambda COV^{s1}_{-Ve}(X,R_m)]$

$\quad + \lambda COV^{s2}_{s1}(X,R_m).$

V. Conclusion

Using the single-period and multiperiod capital asset pricing model utilized by Chen (1978), we examined the impact of mispriced deposit guarantees and FDIC forbearances on the rates of return and on the value of uninsured deposits and equity capital. In the absence of mispriced FDIC deposit guarantees and forbearances, the cost of uninsured deposits and their value does not depend on the deposit mix. However, when we allow for the insurance

to be mispriced, the required rate of return on the uninsured deposits becomes a function of both the deposit mix, the degree of mispricing, and FDIC forbearance policy. Similar results hold for the return on equity.

Furthermore, these policies affect the values of the uninsured deposits and equity. The values of equity and uninsured deposits both increase when the FDIC underprices its insurance. The value of uninsured deposits also increases in response to FDIC forbearances. In addition, we show that the values of FDIC guarantees and forbearances are a function of the insured bank's systematic risk, its probability of bankruptcy, and its deposit mix (when the insurance is mispriced). Finally, we replicate the results of section II, part C in a multiperiod setting.

<u>Footnotes</u>

1) Fair pricing of deposit insurance guarantees implies that the total value
   of the firm and the rates of return are the same as in the no-insurance
   case. The correct value of deposit insurance is a function of the deposit
   mix and the earnings distribution. However, if correctly priced, the'
   deposit insurance premium offsets the effects of the shift from "no
   insured deposits" to "some insured deposits."

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