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AN ECONOMIC ANALYSIS OF BANK BEHAVIOR UNDER SUPERVISORY CONSTRAINT: THE CASE OF BANK CAPITAL SUPERVISION

By

Evelyn F. Carroll

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To My Parents

ABSTRACT

AN ECONOMIC ANALYSIS OF
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Regulation and supervision have a pervasive influence on the United States financial system. Regulatory, supervisory, and legal restrictions touch virtually every aspect of financial intermediation, influencing the options of banks at nearly every stage of the productive process and playing a major role in shaping the banking industry. In spite of these facts, economic analysis of the effects of regulation on bank behavior and the effectiveness of regulation in achieving its goals has been very limited.

Regulatory policy often has been formulated with a very narrow focus and without consideration of the interaction between market pressures and regulatory constraints. In many cases, this approach has perverse results. In general, a profit-maximizing firm reacts to regulatory constraint by seeking to minimize the impact of the constraint on profit. As a result, the constrained equilibrium position may involve changes in all decision variables available to the firm rather than only those variables which explicitly are constrained. Unless a regulatory constraint is constructed with recognition of the firm's reaction to it, the equilibrium position of the constrained firm may be inconsistent with the goals of regulatory policy.

This dissertation develops a framework within which the interaction of bank behavior with regulatory policy goals may be analyzed for the case of bank capital supervision. The model developed permits us to understand the interaction between bank financial decisions, capital supervision, and holding company affiliation.

The bank and the holding company are viewed as neoclassical, profit-maximizing firms operating in purely competitive markets under conditions of uncertainty. Within this context, a model of financial decision-making is constructed and the determinants of the private market equilibrium capital position are outlined.

Bank capital supervision has attempted to induce banks to hold greater levels of capital than those implied by the private market equilibrium. Our model demonstrates that a bank facing supervisory pressure will generally choose to operate with a capital level somewhere between the private market equilibrium and the supervisory target. The precise level chosen will depend on the relationship between the bank's private cost function and the cost of supervisory sanctions against banks which fail to meet supervisory targets. This result provides a means by which to predict systematic variations in the impact of supervisory pressure across banks.

The impact of holding company affiliation on the relative magnitudes of private and supervisory costs is analyzed, and it is demontrated that within the traditional supervisory environment, the bank holding company may offset the effects of bank supervisory compliance by adjusting internal financial arrangements. Accordingly, the effective cost of equity capital is lower for a holding company affiliate than for an independent bank, and affiliate banks may be expected to perform better in meeting supervisory targets than do their independent couterparts. Our empirical

tests, based on data from Reports of Examination of banks headquartered in the Second Federal Reserve District over the 1970-77 period, generally support this conclusion.

Our results are contrary to the conventional wisdom which holds that bank holding company affiliation has a negative impact on bank capital levels. In addition, our results provide indirect evidence on the nature of the bank capital decision. If a Modigliani-Miller world prevailed and no private market financial equilibrium existed, it seems unlikely that banks would resist supervisory pressures regarding capital adequacy. In such a world, our model would predict that all banks would meet supervisory leverage targets, since the cost of doing so would be zero. Holding company affiliation would have no effect on bank behavior across banks. Our results thus support the view that there is a private market optimal bank financial structure.

Finally, our results have important policy implications. Specifically, they suggest that supervisors should evaluate holding companies in the same manner as does the private market--that is, as consolidated entities. Under the traditional supervisory approach, supervisory capital ratings were misleading indicators of bank soundness, since they ignored intracompany financial arrangements. Our conclusions are generally supportive of the more recent Federal Reserve System policy on bank holding company capital evaluation.

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The dissertation was completed while I was employed by the Federal Reserve Bank of Minneapolis. I wish to thank Arthur J. Rolnick of that Bank for encouragement and advice in the final stages and the Administrative Services Section for producing the final manuscript.

While the dissertation could not have been completed without the cooperation of the Federal Reserve System, the views expressed herein are my own and not necessarily reflective of the views of the Federal Reserve Bank of New York, the Federal Reserve Bank of Minneapolis, or the Federal Reserve System.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Regulation and supervision have a pervasive influence on the United States financial system. Regulatory, supervisory, and legal restrictions touch virtually every aspect of financial intermediation, influencing the options of banks at nearly every stage of the productive process and playing a major role in shaping the banking industry. In spite of these facts, economic analysis of the reactions of banks to regulatory intervention and the effectiveness of regulation in achieving its goals has been limited.

In other regulated industries, such as public utilities, the reaction of firms to particular types of constraints, such as rate of return regulation, has been the focus of a good deal of theoretical and empirical investigation. In a landmark article, Averch and Johnson [1] demonstrated certain conditions under which the impact of rate of return regulation leads to inefficient operation of the regulated firms as a result of excessive use of capital inputs. The question of the general validity of the Averch-Johnson hypothesis under varying conditions of risk, rate of return, and restrictiveness of regulatory constraint has been the subject of controversy among industry and academic economists alike. What cannot be disputed, however, is the fundamental principal which leads to the Averch-Johnson result. That principal is that a profit-maximizing firm reacts to regulatory constraint by seeking to minimize the impact of the constraint on profit, with the result that the constrained equilibrium position may involve changes in all decision variables available to the firm rather than only those variables which explicitly are constrained. Accordingly, the individual firm is able to minimize, and possibly even avoid altogether, the impact of regulation on its own objectives.

Unless a regulatory constraint is constructed in recognition of the firm's reaction to it, the equilibrium position of the constrained firm may be inconsistent with the goals of regulatory policy. In the case of the Averch-Johnson hypothesis, for example, the reaction of firms leads to an inefficient utilization of resources. This is counter to the regulatory goal of ensuring a continuing supply of the regulated commodity at a reasonable price to consumers.

The reactions of banks to particular constraints have been recognized by bank regulators in some cases. It has been argued, for instance, that banks have tended to compensate for the safety provided by deposit insurance through reductions in capital levels [24]; that deposit interest rate ceilings have resulted in payment of substantial rates of implicit interest [15]; and that reserve requirements have affected bank asset and liability structures [19]. What is lacking, however, is a solid theoretical framework within which the effectiveness of bank regulation and supervision may be evaluated in the context of the profit-maximizing, purely competitive banking firm. This is an important omission, since the avoidance of regulatory intervention has widespread impacts on the effectiveness of regulation. This dissertation develops such a framework and demonstrates its applicability, using the reaction of banks and bank holding companies to bank capital supervision as an example.[1/]

The model developed permits us to understand the interaction between bank financial decisions, capital supervision, and holding company

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[1/] We are using the terms "regulation" and "supervision" somewhat loosely and interchangeably in this introduction. Generally, "regulation" is used to refer to intervention which takes the form of absolute constraint while "supervision" refers to less rigid ongoing oversight of an industry or firm.

affiliation. The model predicts that bank holding company subsidiaries facing traditional capital supervisory policies will tend to hold greater amounts of equity capital than will similarly supervised independent banks. This predicted positive relationship between holding company affiliation and bank capital levels is contrary to conventional wisdom on the subject.

In addition, the model demonstrates the interaction of regulatory policy and bank behavior. The reaction of bank holding companies to capital supervision affects the meaningfulness of supervisory assessment of bank capital adequacy. The model suggests that capital supervision will be effective only if aimed at the consolidated bank holding company rather than solely at the bank.

Chapter I presents a general model of bank and bank holding company behavior. The bank and the holding company are viewed as neoclassical, profit-maximizing firms operating in purely competitive markets under conditions of uncertainty. Within this context, a model of financial decision-making is constructed. It is demonstrated that profit maximization implies minimization of cost of funds, given any particular output level. The equilibrium conditions relevant to the bank's financial decisions are derived.

Chapter II presents an analysis of the current state of bank capital supervision in institutional and economic terms. It is argued that the primary goal of bank supervision is bank soundness. The supervisory structure is intended to increase the safety of individual institutions and reduce the probability of their insolvency. The ultimate purposes of this activity are to protect the public (depositors) and to protect the payments mechanism. It is demonstrated that these goals result in super-

visory target levels of capital (and of deposit leverage) that differ from private market equilibrium levels. A model of supervisory intervention is developed, which provides insight into the equilibrium financial position of the supervised bank.

Within our model of intervention, it is demonstrated that the equilibrium position of the supervised bank generally will be somewhere between the private market equilibrium and the supervisory target. The precise equilibrium level will depend upon the bank's private cost function and the cost of supervisory sanctions against banks which fail to meet supervisory targets.

The impact of holding company affiliation on the relative magnitudes of private and supervisory costs is analyzed, and it is demonstrated that within the traditional supervisory environment, the bank holding company may offset the effects of bank supervisory compliance by adjusting internal financial arrangements. Accordingly, the effective cost of equity capital is lower for a holding company affiliate than for an independent bank, and affiliate banks may be expected to perform better in meeting supervisory targets than do their independent counterparts.

Using these results, we formulate a theory of the determinants of a particular supervisory rating scheme, New York Formula rating. The equilibrium rating for a particular bank is shown to depend, in part, on bank holding company affiliation, bank charter and membership status, and bank asset size.

In Chapter III we present the results of estimation of the components of New York Formula rating for commercial banks headquartered in the Second Federal Reserve District over the 1970-77 period. The results for early years are generally consistent with our theory.

The final chapter discusses the policy conclusions of our results. Our essential conclusion is that the reaction by the supervised firm to supervisory intervention can and does have important implications for the efficiency of the supervisory process. Supervisory policies must be framed with awareness of this reaction. Otherwise, the ultimate result of supervisory action may well be contrary to policy intent. For our particular case, we conclude that supervisory agencies should view bank holding company financial structures as the private market does--on a consolidated basis. Emphasis on the subsidiary bank alone provides the supervisor with misleading results.

Chapter I

THE GENERAL THEORY OF THE COMMERCIAL BANKING FIRM

This chapter presents a general model of behavior of the commercial bank, based on the neoclassical theory of the firm. Section 1 discusses the productive process of the bank; Section 2 derives the equilibrium conditions for a bank operating under conditions of uncertainty within a simple, two-input, two-output model; Section 3 derives the financial equilibrium of the bank within the context of the general model; and Section 4 explores the significance of holding company affiliation for bank behavior. Throughout this chapter, the bank is analyzed in the absence of supervisory influence. Subsequent chapters discuss the impact of supervision on the bank's behavior.

I.1 The commercial bank as a neoclassical firm

There is no general agreement among economists regarding the appropriate model of the commercial banking productive process. Studies of various aspects of decision-making have used partial models to suit particular purposes, while conceding that precise identification of the productive process is difficult. Those interested in describing the bank's role in money supply determination have uniformly relied on models in which deposits are considered to be the outputs, and loans and investments the inputs in the productive process [13, 14, 25, 39]. Those concerned with analyzing commercial banking cost conditions have tended to argue that "services" of various types are the outputs of the banking process [2, 3, 16, 20], but they have differed in their views on measurement techniques.

Most studies of the bank capital decision have avoided the issue by relying on portfolio theory [27, 28] or simply not mentioning any formal objective function for the firm [18, 19]. A notable exception is the capital decision model constructed by Peltzman [24] that views labor, deposits, and capital as inputs in the production of liquidity, brokerage, and accounting (and similar) services.

It has been suggested that this diversity in views of the banking firm is acceptable (if not necessary), since each view serves a different purpose [3, 16]. Sealey and Lindley [34] have demonstrated the danger in this view, however, showing that improper specification of the productive process may result in improper policy recommendations. In response, they have developed a straightforward model that permits analysis of the bank as a neoclassical, profit-maximizing firm. With some modifications, we shall follow their approach.

The Sealey and Lindley model is based on the traditional neoclassical theory of production, wherein production is defined as "a process of transformation, directed by human beings, which is considered desirable by some individuals" [34, p. 1252]. For the commercial banking firm, inputs such as loanable funds, labor, physical capital, etc., are transformed into various services that are purchased by borrowers and depositors. This classification of inputs and outputs is similar to that used by Peltzman, referred to above.[1/]

[1/] Sealey and Lindley argue that services to depositors should be excluded from consideration as outputs inasmuch as these services generally are provided at prices below cost in order to attract deposit funds and yield no direct profit to the bank. We take exception to this view. Absent restrictions on direct payment of market rates of interest on deposits, deposit services also would be priced at market rates. Inasmuch as we wish to analyze bank behavior in the absence of supervisory intervention, we would include deposit-related services as outputs. The resulting model could in fact be used to predict bank reaction to interest ceilings.

Sealey and Lindley present their model for the case of a bank that uses one type of financial input--deposits--to produce two types of outputs--loans and securities. The model assumes zero risk of default for both classes of outputs. Since some inputs and all outputs are denominated as funds, the bank's production process is subject to a balance sheet constraint requiring that the volume of loans and securities not exceed the volume of deposits (and, in the multiple-input case, other sources of funds).[2/] Sealey and Lindley demonstrate that, within this model, profit maximization occurs at the output point where the marginal revenue from each category of loan and security equals the marginal cost of producing that category. In general, the equilibrium conditions are those of the traditional neoclassical model.[3/]

In order to analyze the bank's financial decision-making process, we shall modify the Sealey and Lindley approach to incorporate uncertainty. The existence of uncertainty and risk is implicit in the general neoclassical model of the firm in the concept of "normal profit." In a purely competitive equilibrium, each firm earns a "normal profit" and

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[2/] Sealey and Lindley impose a deposit reserve requirement on the bank and incorporate that requirement into the constraint described. Since imposition of a reserve requirement may be considered a form of supervisory intervention, we would prefer to omit such an assumption from the basic model. However, the general results are unaffected by this assumption.

[3/] The outcome is complicated by the balance sheet constraint, however, so that the financial input is limitational; that is, the financial input has a zero elasticity of substitution with other inputs. Under this condition, certain of the marginal conditions do not hold in equilibrium. Specifically, it will not generally be true that the value of marginal product of the financial input is equated to its price. Our concern is with the breakdown of total financial input into its constituent parts. This is unaffected by the balance sheet constraint. Accordingly, we shall omit that constraint.

"economic profits" are zero. As described by Henderson and Quandt [9, p. 115]:

> The long-run cost and supply curves include "normal profit," i.e., the minimum remuneration necessary for the firm to remain in existence. It is the profit that accrues to the entrepreneur as payment for managerial services, for providing organization, for risk-bearing, etc. If the intersection of the demand curve and the long-run supply curve occurs at a price at which firms in the industry earn more than normal profit, new entrepreneurs may be induced to enter.

The model developed in the following section incorporates uncertainty explicitly and introduces the risk-taking entrepreneurial input into the firm's profit function. In a corporate environment, owners of equity shares perform the ultimate risk-taking role generally attributed to the neoclassical entrepreneur.[4/] Returns to other inputs are specified by contracts, while shareholders have a claim on the residual of the firm's earnings (and, in liquidation, assets). Other suppliers (particularly suppliers of other sources of funds) also accept some risk if they are not paid immediately upon delivery of the inputs. We may include the market return to suppliers (including shareholders) for risk-taking in the firm's cost function and assume that the firm operates so as to maximize "economic profit." The next section constructs a model of the banking firm in this manner.

I.2 Market equilibrium in a risky environment

Following the Sealey and Lindley approach, we view the bank as a neoclassical firm which, through a production process within a given technological environment, transforms inputs, such as labor and funds, into

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[4/] The managerial and organizational roles are performed by management employees--a type of labor input.

outputs in the form of various services. We assume that the bank faces competitive input and output markets, but that output prices are not known with certainty.[5/] In this risky environment, we assume that the bank operates in such a manner as to maximize expected economic profit, where economic profit is defined as in the previous section.[6/]

While the productive process occurs continuously over time, it is useful, in order to clarify the nature of the decision-making process, to construct a time reference for the bank's activities, indicating which take place at the beginning of, during, and at the end of each time period. At the beginning of each period, the bank and all input suppliers face a set of known contractual input prices, a known probability distribution of price for each output, and a known production function. On the basis of this information, the bank makes all input and output decisions and contracts with input suppliers. During the period, inputs are delivered according to contract and production takes place as planned. At the end of the period, outputs are sold at prevailing market prices. Using the revenue from sale, the bank pays for each input according to contract. If total revenues fall below total contractual obligations to input suppliers, payments to suppliers are determined by a bankruptcy payment rule.

[5/] In order to simplify the exposition, we introduce risk in output prices only. The basic result would be unaltered by risk incorporated into the production function or, in a multi-period model, in future input prices.

[6/] By definition, the expected value of economic profit in a competitive industry is zero over the long run. We note that the assumption that the bank maximizes expected economic profit implies that the bank itself is risk neutral. As will be evident in the development of the model, the bank's reaction to risk is determined by the reactions of other market participants to risk and the impacts of those reactions on prices facing the bank.

In order to keep the exposition simple, we will consider a two-input, two-output case. The bank uses loanable funds, K, and labor, L, to produce services denoted by two assets, q_1 and q_2. The production function may be written implicitly as:

(1) $$F(q_1,q_2,L,K) = 0.$$

We assume that F is well behaved and possesses the usual properties, being continuous, strictly concave, and twice differentiable in all variables.

Loanable funds may be purchased by the bank in two forms--deposits, d, and equity capital, e. The proportion of deposits to total funds, d/K, is denoted by α; this ratio is referred to as deposit leverage. Contractual prices of labor, debt, and equity are denoted as w, r_d, and r_e, respectively. Prices of q_1 and q_2 are denoted by p_1 and p_2, respectively, and are random variables with probability distributions $f_1(p_1)$ and $f_2(p_2)$, respectively. For any given combination of outputs, (q_1^*,q_2^*), total revenue from sale, denoted by I^*, is a random variable with probability distribution $f_I^*(I^*)$. This distribution is derived from f_1 and f_2.

In order to further simplify the problem, we shall assume that conditions are such that total revenue does not fall below the bank's contractual obligation to suppliers of labor; that is, $I \geq wL$ under all circumstances. We assume, further, that contract or law stipulates that labor holds a prior claim on the bank's revenue over suppliers of deposits and equity capital and that depositors hold a claim superior to that held by equity shareholders. Denoting actual end-of-period payment to depositors and equity shareholders per unit supplied as R_d and R_e, respectively, we may summarize the bank's payment rule as follows:

$$(2) \qquad R_d = r_d, \qquad \text{if } I \geq (wL+r_d d)$$
$$= (I-wL)/d, \qquad \text{if } (wL+r_d d) > I > wL$$
$$= 0, \qquad \text{if } I = wL; \text{ and}$$

$$R_e = (I-wL-r_d d)/e, \quad \text{if } I > (wL-r_d d)$$
$$= 0, \qquad \text{if } (wL+r_d d) \geq I.$$

Actual payment to labor is equal to the contracted wage rate, while actual payment per unit to suppliers of funds depends upon the levels of I, wL, d, and e. R_d and R_e are random variables with probability distributions g_d and g_e, respectively. These distributions may be obtained from $f_I(I|q_1,q_2)$ through a transformation of variables and expressed, conditional on the payment rule, as:

$$(3) \qquad g_d(R_d|q_1,q_2,wL,d); \text{ and}$$
$$g_e(R_e|q_1,q_2,wL,r_d d,e).$$

From our payment rule, we know that the expected value of R_d varies inversely with wL and d and directly with the expected value of I, denoted E(I); and the expected value of R_e varies inversely with wL, $r_d d$, and e, and directly with E(I).

We assume that contractual market supply prices of deposits and equity, r_d and r_e, are dependent upon the probability distributions of actual payments, R_d and R_e, and on suppliers' utility functions. We may write:

$$(4) \qquad r_d = h_d(g_d(R_d|q_1,q_2,wL,d)); \text{ and}$$
$$r_e = h_e(g_e(R_e|q_1,q_2,wL,r_d d,e)),$$

where the forms of h_d and h_e are determined by the forms of the suppliers' utility functions. We shall assume that suppliers are risk averse expected utility maximizers, and that expected utility varies directly with expected value of actual payment. Under these assumptions, the following relationships hold:

(5) $$\frac{\partial r_d}{\partial E(I)}, \frac{\partial r_e}{\partial E(I)} < 0; \text{ and}$$

$$\frac{\partial r_d}{\partial wL}, \frac{\partial r_d}{\partial d}, \frac{\partial r_e}{\partial r_d d}, \frac{\partial r_e}{\partial e} > 0.$$

In addition, we know:

(6) $$r_d \geq E(R_d);$$

$$r_e \geq E(R_e); \text{ and}$$

$$r_e > r_d.$$

In summary, the following information is known to all participants at the beginning of the period:

(a) the production function, $F(q_1,q_2,L,K) = 0$;

(b) the wage rate, w;

(c) the output price probability distributions, f_1 and f_2 (and, for any combination (q_1^*,q_2^*) the revenue probability distribution, f_I^*); and

(d) the market supply functions, h_d and h_e.

Using this information, the bank makes its production decision in such a manner as to maximize expected economic profit, $\bar{\pi}$. The bank chooses the input (deposit, capital, and labor) combination and the output (loan) combination. It then contracts for inputs and makes loans. At the end of

the period it receives payment (interest and principle) for the loans made. It pays input suppliers (labor, depositors, and shareholders) according to contract. The amount paid to each supplier depends on the amount received from the loan repayments.

Recalling the notation $\alpha = d/K$, we may write the bank's objective function as:[7/]

(7) Maximize $\bar{\pi} = \bar{p}_1 q_1 + \bar{p}_2 q_2 - wL - K(\alpha r_d + (1-\alpha) r_e)$

subject to

$$F(q_1, q_2, L, K) = 0.$$

We may perform this maximization using the Lagrange multiplier:

(8) $$\Gamma = \bar{p}_1 q_1 + \bar{p}_2 q_2 - wL - K(\alpha r_d + (1-\alpha) r_e) + \lambda F(q_1, q_2, L, K).$$

This expression is maximized at the point where first partial derivatives with respect to q_1, q_2, L, K, and α equal zero and all second derivatives are negative. Assuming that second-order conditions hold, the maximum is the point where the following conditions are satisfied:

(9a) $$\frac{\partial \Gamma}{\partial q_1} = \bar{p}_1 - (\alpha \frac{\partial r_d}{\partial q_1} + (1-\alpha)\frac{\partial r_e}{\partial q_1})K + \lambda \frac{\partial F}{\partial q_1} = 0;$$

(9b) $$\frac{\partial \Gamma}{\partial q_2} = \bar{p}_2 - (\alpha \frac{\partial r_d}{\partial q_2} + (1-\alpha)\frac{\partial r_e}{\partial q_2})K + \lambda \frac{\partial F}{\partial q_2} = 0;$$

(9c) $$\frac{\partial \Gamma}{\partial L} = -w - (\alpha \frac{\partial r_d}{\partial L} + (1-\alpha)\frac{\partial r_e}{\partial L})K + \lambda \frac{\partial F}{\partial L} = 0;$$

[7/] This formulation of the profit function assumes that the bank faces no restrictions on use of deposits or equity. Given a reserve requirement of x on deposits, the production function would be $F(q_1, q_2, L, K(1-\alpha+\alpha x)) = 0$.

$$(9d) \qquad \frac{\partial \Gamma}{\partial K} = -(\alpha r_d + (1-\alpha) r_e) - (\alpha \frac{\partial r_d}{\partial K} + (1-\alpha)\frac{\partial r_e}{\partial K}) + \lambda \frac{\partial F}{\partial K} = 0;$$

$$(9e) \qquad \frac{\partial \Gamma}{\partial \lambda} = F(q_1, q_2, L, K) = 0; \text{ and}$$

$$(9f) \qquad \frac{\partial \Gamma}{\partial \alpha} = -K(\alpha \frac{\partial r_d}{\partial \alpha} + r_d - r_e + (1-\alpha)\frac{\partial r_e}{\partial \alpha}) = 0.$$

The first five of these conditions are analogous to the conditions which describe the equilibrium position of a firm operating in a certainty environment, the difference being substitution of expected for actual prices and the inclusion of terms expressing the impact of the bank's decision on prices of deposits and equity. The final condition is of particular interest as it describes the bank's equilibrium financial position. This condition is examined in the following section.

I.3 Market equilibrium financial position

The financial equation in (9f) may be written:

$$(10) \qquad r_d + \alpha \frac{\partial r_d}{\partial \alpha} + (1-\alpha)\frac{\partial r_e}{\partial \alpha} = r_e.$$

The left-hand side of this equation may be interpreted as the direct and indirect marginal cost of deposits and the right-hand side the marginal cost of equity. According to this condition, the bank will choose that leverage ratio that equates the marginal costs of the two financing alternatives. The corresponding second-order condition is given by:

$$(11) \qquad \frac{\partial^2 \Gamma}{\partial \alpha^2} = -K(\alpha \frac{\partial^2 r_d}{\partial \alpha^2} + 2(\frac{\partial r_d}{\partial \alpha} - \frac{\partial r_e}{\partial \alpha}) + (1-\alpha)\frac{\partial^2 r_e}{\partial \alpha^2}) < 0.$$

Assuming that the second-order condition is satisfied, we may solve (10) for the optimal leverage ratio, α^*:

$$(12) \qquad \alpha^* = \frac{(r_e - r_d) - \frac{\partial r_e}{\partial \alpha}}{\frac{\partial r_d}{\partial \alpha} - \frac{\partial r_e}{\partial \alpha}}.$$

This expression describes the equilibrium financial position for the unsupervised banking firm, if such an equilibrium exists.

The question of whether an optimal financial structure exists, for a bank or for any other firm, has, of course, been the center of a good deal of controversy in the financial literature. It has been demonstrated that the degree of financial leverage is irrelevant in the firm's decision-making process for the case of perfect capital markets, no transactions costs, zero taxes, and zero bankruptcy costs [22, 37, 38]. However, the existence of a cost-minimizing degree of leverage has been demonstrated in the presence of insolvency costs (a type of transactions cost), positive probabilities of default and of bankruptcy (which lead to differential rates for borrowers), and tax advantages to debt financing [27, 35, 38].

Our formulation of financial decision-making is equivalent to that contemplated by traditional financial theory. According to the traditional approach, the optimal leverage ratio is that which yields the minimum overall average cost of funds for a given combination of outputs and nonfinancial inputs [36]. Within our model, total funds is denoted by K. The overall average cost of funds, r_K, may be expressed as:

$$(13) \qquad r_K = \alpha r_d + (1-\alpha) r_e.$$

This equation is minimized at the point (if such point exists) where $\frac{\partial r_K}{\partial \alpha} = 0$ and $\frac{\partial^2 r_K}{\partial \alpha^2} > 0$; that is:

$$(14) \qquad \frac{\partial r_K}{\partial \alpha} = r_d + \frac{\partial r_d}{\partial \alpha} - r_e + (1-\alpha)\frac{\partial r_e}{\partial \alpha} = 0; \text{ and}$$

$$(15) \qquad \frac{\partial^2 r_K}{\partial \alpha^2} = 2\left(\frac{\partial r_d}{\partial \alpha} - \frac{\partial r_e}{\partial \alpha}\right) + \frac{\partial^2 r_d}{\partial \alpha^2} + (1-\alpha)\frac{\partial^2 r_e}{\partial \alpha^2} > 0.$$

These expressions are identical to expressions (10) and (11) above. Solving (14) for α gives the expression shown for α^* in equation (12). Traditional theory posits that equation (13) is u-shaped, as shown in Figure 1. This approach assumes conditions (14) and (15) are satisfied.

The assumptions needed to ensure the existence of an optimal financial structure may be derived from our model. A necessary condition for α^* to represent an internal minimum is that its value falls between zero and 1; that is:

$$(16) \qquad 0 < \frac{(r_e - r_d) - \frac{\partial r_e}{\partial \alpha}}{\frac{\partial r_d}{\partial \alpha} - \frac{\partial r_e}{\partial \alpha}} < 1;$$

or

$$(17) \qquad 0 < (r_e - r_d) < \frac{\partial r_d}{\partial \alpha}.$$

The cost per dollar of equity must exceed the cost per dollar of deposits, and the cost per dollar of deposits must be an increasing function of the degree of leverage. Further, the marginal impact of leverage on the cost of deposits must not be cancelled out by the effect of the changing ratio of deposits/equity on the average cost of funds. The first two of these conditions are assured by the form of our payment rule, given by (5) and (6), above.

Substituting $\frac{(r_e - r_d - \frac{\partial r_e}{\partial \alpha})}{\alpha^*}$ for $(\frac{\partial r_d}{\partial \alpha} - \frac{\partial r_e}{\partial \alpha})$ in equation (15) we may derive the sufficient condition for α^* to be an internal minimum as follows:

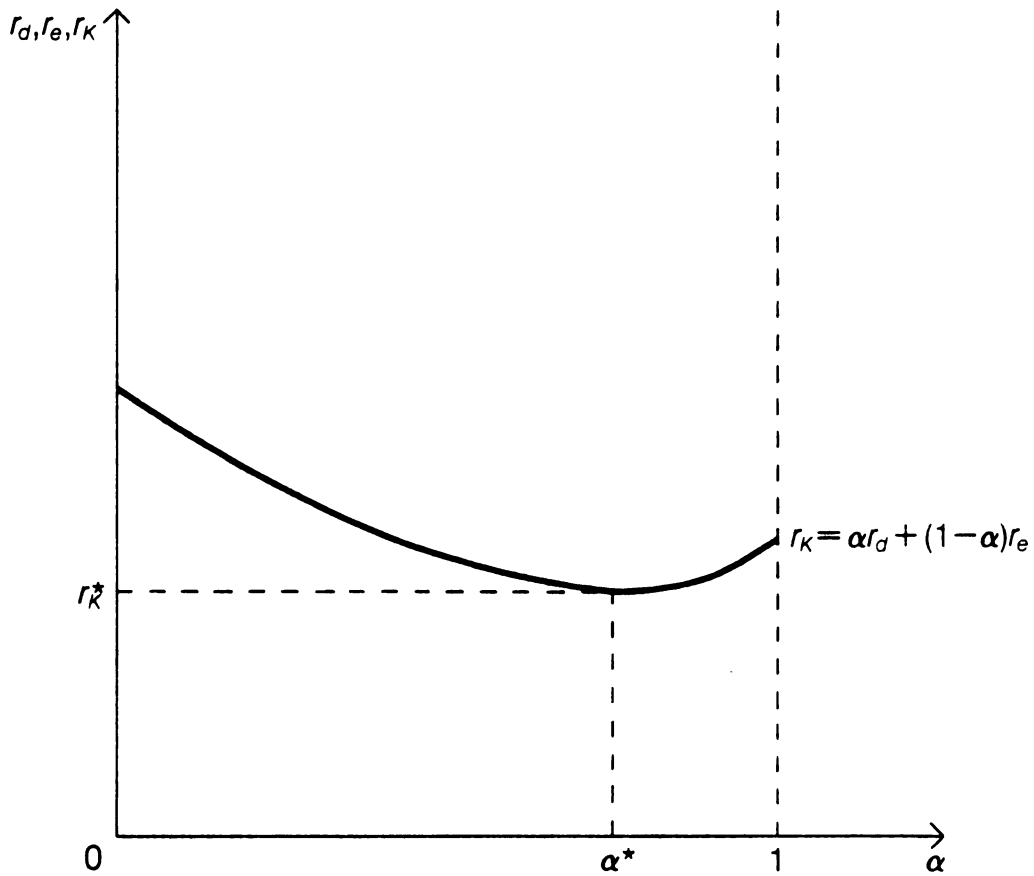

Figure 1. Optimal Deposit Leverage

$$(18) \qquad \frac{2(r_e - r_d - \frac{\partial r_e}{\partial \alpha})}{\alpha^*} + \alpha^*(\frac{\partial^2 r_d}{\partial \alpha^2} - \frac{\partial^2 r_e}{\partial \alpha^2}) + \frac{\partial^2 r_e}{\partial \alpha^2} > 0.$$

From inequality (16), we know that $(r_e - r_d) > 0$. The following additional conditions would ensure that inequality (17) holds at α^*:

$$(19) \qquad 0 \leqq \frac{\partial^2 r_e}{\partial \alpha^2} < \frac{\partial^2 r_d}{\partial \alpha^2}; \text{ and}$$

$$(20) \qquad \frac{\partial r_e}{\partial \alpha} \leqq (r_e - r_d).$$

Thus, α^* will be an internal minimum as long as the cost of deposits changes at a faster rate than does the cost of equity as α increases, and the difference between the cost per dollar of equity and the cost per dollar of deposits exceeds the marginal impact of on the cost per dollar of equity.

One interesting result of this analysis is that a positive relationship between the cost per dollar of equity and financial leverage is not a necessary condition for α^* to exist as an internal minimum. Thus, there is nothing to preclude a declining cost of equity with increased leverage. The reason for this result may be understood through examination of equation (4) above. The cost of equity funds depends upon the levels of both debt and equity outstanding. The conditions in (5) ensure that $\frac{\partial r_e}{\partial d} > 0$ and $\frac{\partial r_e}{\partial e} > 0$. For a constant level of K, an increase in leverage implies both an increase in d and a decrease in e. It is not necessary to assume that one of these opposing effects outweighs the other.

Thus, the existence of an optimal leverage depends upon satisfaction of certain conditions regarding relationships between the marginal costs of financial inputs with respect to leverage. As mentioned above, there would appear to be at least some circumstances under which these

conditions are satisfied. Whether the banking industry embodies those circumstances is not immediately evident, but empirical tests of our model should provide some insight on the question. If the financial decision is irrelevant to the bank, we would not expect to observe systematic variations in financial structure across banks.

As a final note, we should point out that the simple model presented here may be readily generalized to consider additional sources of loanable funds. As an illustration, we may outline the optimization process including a third funding source, bonds. This illustration will be useful in our later examination of holding company behavior. Denoting the dollar volume of bonds issued by b, the contractual price of bonds as r_b, and the actual payment per bond dollar as R_b, we have $K = d + b + e$. We may designate a payment rule similar to that given by (2) as follows:

$$
\begin{aligned}
(21)\qquad R_d &= r_d, && \text{if } I \geq (wL+r_d d)\\
&= (I-w_L L)/d, && \text{if } (wL+r_d d) > I > wL\\
&= 0, && \text{if } I = wL\\
\\
R_b &= r_b, && \text{if } I \geq (wL+r_d d+r_b b)\\
&= (I-wL-r_d d)/_b, && \text{if } (wL+r_d d+r_b b) > I > wL + r_d d\\
&= 0, && \text{if } (wL+r_d d) \geq I\\
\\
R_e &= (I-wL-r_d d-r_b b)/_e, && \text{if } I > (wL+r_d d+r_b b)\\
&= 0, && \text{if } (wL+r_d d+r_b b) \geq I.
\end{aligned}
$$

This payment rule defines probability distributions of actual payments to depositors, bondholders, and equityholders analogous to those defined by (3) for depositors and equityholders as:

(22) $g_d(R_d|q_1,q_2,wL,d)$;

$g_b(R_b|q_1,q_2,wL,r_d d,b)$; and

$g_e(R_e|q_1,q_2,wL,r_d d,r_b b,e)$.

Contractual supply prices, similar to those derived in (4), are given as:

(23) $r_d = h_d(g_d(R_d|q_1,q_2,wL,d))$;

$r_b = h_b(g_b(R_b|q_1,q_2,wL,r_d d,b))$; and

$r_e = h_e(g_e(R_e|q_1,q_2,wL,r_d d,r_b b,e))$.

Letting $\alpha_1 = d/K$ and $\alpha_2 = b/K$, we have the bank's profit function as:

(24) $\bar{\pi} = \bar{p}_1 q_1 + \bar{p}_2 q_2 - wL - K(\alpha_1 r_d + \alpha_2 r_b + (1-\alpha_1-\alpha_2) r_e)$.

Maximizing expected profits with respect to q_1, q_2, L, K, α_1, and α_2 using the Lagrange multiplier yields the first-order condition for financial equilibrium as:

(25) $$\frac{\partial \Gamma}{\partial \alpha_1} = K(\alpha_1 \frac{\partial r_d}{\partial \alpha_2} + r_d + \alpha_2 \frac{\partial r_b}{\partial \alpha_1} + \frac{\partial r_e}{\partial \alpha_1} - \alpha_1 \frac{\partial r_e}{\partial \alpha_1} - r_e - \alpha_2 \frac{\partial r_e}{\partial \alpha_1}) = 0$$

$$\frac{\partial \Gamma}{\partial \alpha_2} + K(\alpha_1 \frac{\partial r_d}{\partial \alpha_2} + \alpha_2 \frac{\partial r_b}{\partial \alpha_2} + r_b + \frac{\partial r_e}{\partial \alpha_2} - \alpha_2 \frac{\partial r_e}{\partial \alpha_2} - r_e - \alpha_1 \frac{\partial r_e}{\partial \alpha_2}) = 0.$$

These two equations may be solved to give expressions for α_1^* and α_2^*, the optimal proportions of deposit and bond funding, in terms of marginal costs of the various funding sources.

I.4 The impact of holding company affiliation on the commercial bank

Under the Bank Holding Company Act of 1956, as amended, a bank holding company is defined as a company which "has control over" a bank [70

Stat.133.2.(a)(1)]. Because it is so general, this definition does not lend itself particularly well to formal specification of a model of bank holding company behavior. Control, of course, may be achieved through any of a number of means, including share ownership, possession of share voting rights, imposition of restrictions based on a creditor-debtor relationship, etc. We shall limit our analysis to those companies that are bank holding companies by virtue of share ownership. All further references to bank holding companies shall imply this definition.

The effect of holding company affiliation on bank behavior and performance has been the subject of a good deal of empirical investigation. However, that investigation has been remarkably unsupported by theoretical basis.[8/] Most of these studies have begun with the assertion that there is some fundamental difference between bank holding company management and bank management.

Our model, on the other hand, discusses bank behavior in very general terms. In the absence of supervisory intervention, bank behavior would be expected to be unaffected by ownership status. That is, there is no reason to assume, within the context of our model, that a bank which is wholly owned by a holding company and thus has one shareholder would operate differently from a bank that is owned directly by individual shareholders.

Viewing the bank holding company as a banking firm, we would expect the bank holding company to operate in such a manner as to maximize

---

[8/] A typical example is [17].

expected profit on a consolidated basis.[9/],[10/] The equilibrium consolidated position of a holding company is given by the conditions discussed in the previous section for the commercial bank. The relationship between the consolidated bank holding company equilibrium position and the subsidiary bank equilibrium position will depend on the nature of the holding company's operations.

To illustrate, let us consider the case of a pure one bank holding company. In such a company, the parent entity is nothing more than a financial shell. It raises money in the capital markets and invests the funds in its subsidiary bank. Let us assume that the parent holding company may raise funds only by issuing common equity shares, while the subsidiary bank may purchase loanable funds from the parent by issuing equity and from the public by issuing deposits. Assume that the banking production function is unaltered by holding company ownership. Finally, assume the payment rule governing shares issued by the holding company is identical to that governing shares issued by the bank as given by (2). In this case, the decision function facing the (consolidated) holding company is given by:

$$\text{(26)} \qquad \text{Maximize } \bar{\pi}_{HC} = \bar{p}_1 q_1 + \bar{p}_2 q_2 - wL - K_{HC}(\alpha r_d + (1-\alpha) r_{eP})$$

[9/] Consolidated profit equals the sum of profits of the parent and subsidiary companies, net of intracompany transactions. In the case of a subsidiary that is less than wholly owned, only the parent company's share of the subsidiary's profits would be included.

[10/] This decision function does not imply that the bank holding company has absolute control over the operations of the subsidiary bank. In the case of a less than wholly owned subsidiary, the risk attitudes (and capital fund supply price functions) of minority shareholders would, of course, be one of the parameters of the decision process.

subject to $F(q_1, q_2 L, K_{HC}) = 0$ where the subscript HC designates a consolidated holding company variable, the subscript P designates a parent holding company variable, and nonsubscripted variables are at the bank level.

From our assumptions, we have:

(27) $K_{HC} = e_P + d$; and

$r_{eP} = r_e$.

Consolidated total loanable funds equals the sum of funds purchased as equity by the parent from the general public and funds purchased as deposits by the bank from the general public. Funds purchased by the bank from the parent are netted out in consolidation. The cost of equity funds to the parent is equivalent to the cost of equity funds to an independent bank as defined by equation (4), since an identical payment rule has been assumed to hold in both cases.

Maximization of the expression given by (26) yields an equilibrium position for the consolidated company that is identical to that given for the independent bank in (9). This solution also uniquely defines the equilibrium for the subsidiary bank, since it specifies levels of q_1, q_2, and L at the bank level. This also implies $e \equiv e_p$--the equilibrium level of bank equity (sold to the parent) is necessarily equal to the equilibrium level of parent equity (sold to the public). Thus, ownership of the bank by a holding company has no effect on the bank's decision-making process within this simple model.

A similar result occurs for the case where the parent company and the bank each have an additional source of funds--bonds. This is an extension of the three-source bank model described in the previous section. Assume that the parent may issue bonds to the public and the bank

may issue bonds to the public or to the parent. In this case, total loanable funds purchased by the consolidated holding company is given by:

$$(28) \qquad K_{HC} = d + b_{HC} + e_P$$

where b_{HC} is the sum of bonds issued by the parent and bonds issued to the public by the bank.

If the payment rule places bonds issued by the parent on an equivalent level with those issued by the bank, the financial equilibrium of the consolidated company will be identical to that for an independent bank as given by the solution to (25).

In general, as long as holding company affiliation does not affect the efficiency of the banking productive process, the equilibrium consolidated position of the company will be equivalent to that of an identical independent bank or, in the case of a company with more than one subsidiary, the sum of the equilibria for independent companies identical to the subsidiaries. Economies or diseconomies associated with the holding company organizational form would, of course, affect the consolidated equilibrium. Economies or diseconomies of scale would affect the firm's production function, while economies of diversification could reduce risk for suppliers and alter the supply price functions facing the firm.

It is often hypothesized that holding company affiliation does provide economies related to geographic and product diversification that is prohibited to banks. This has led to the expectation that bank holding companies would tend to operate with consolidated financial structures that differ from the aggregate of financial structures of a group of comparable independent companies. Specifically, a number of economists have hypothesized that the relative marginal costs of deposit and equity

funds are altered by holding company affiliation in such a manner that the equilibrium financial structure for the holding company implies a higher degree of deposit leverage on a consolidated basis than for an independent bank [8, 17]. However, recent empirical evidence casts some doubt on the idea that holding companies can achieve product diversification much greater than that of an independent bank, since most of the activities permitted to "nonbank" subsidiaries of holding companies also are commercial banking activities.[11/] On the whole, there is little evidence to suggest that economies of holding company affiliation are significant, and it seems reasonable to expect that holding company financial behavior on a consolidated basis would be similar to financial behavior of an identical collection of independent firms.

At the bank level, in our simple one-bank, deposit/equity model, we have shown that holding company affiliation will have no effect on financial behavior. For a more complex model (multi-subsidiary or multi-fund source) this question is not so clear. In general, the impact of holding company affiliation on the subsidiary will be determined by the legal environment.

If independent banks and affiliated banks are treated equivalently under the law (and, therefore, the parent company has no greater liability to creditors of a subsidiary than do other shareholders), then the equilibrium position of an affiliated bank would be identical to that of an independent bank.

[11/] Preliminary results of a study by Boyd, Hanweck, and Pithyachariyakul [4] suggest that the "optimal" degree of holding company investment in nonbank subsidiaries to minimize probability of bankruptcy is quite small. That is, the gains to diversifying beyond commercial banking are minimal.

If, however, the legal or practical position of the parent company is such that the subsidiary's creditors consider the parent liable for the subsidiary's debts (including deposits), the equilibrium position of the subsidiary may differ from that of the independent bank. If all risk is borne by suppliers of loanable funds, the nonfinancial decisions of the subsidiary may be unaltered; however, no single financial equilibrium position would exist. The bank's funds suppliers would be concerned primarily with the consolidated financial structure of the holding company, and intracompany financial arrangements would be of little consequence. For wholly-owned subsidiaries, equity capital would be little more than a bookkeeping entry and the capital decision of the bank would be inconsequential. This is the case for our one-bank, three-fund source example.

Available evidence suggests that the latter example may best approximate the actual legal environment. While the subsidiaries of a holding company are considered to be separate legal entities, it is likely that the courts would "pierce the corporate veil" and hold the parent liable for debts upon which a subsidiary defaults, especially in the case of a company that has operated as a single entity [11]. Some economists have argued that the parent company should treat its holdings as investments, buying and selling subsidiaries according to the dictates of portfolio theory and taking no part in management of those subsidiaries [10, 12]. However, the preponderance of evidence indicates that holding companies actually operate as single entities, with the parent exercising a

significant degree of control over subsidiary management, particularly in financial decision-making [29].[12/]

In summary, available evidence suggests that holding companies are perceived by private markets as consolidated entities. Our model predicts that a one bank holding company would pursue a consolidated financial strategy identical to that of a similar independent bank. In addition, our model predicts that the optimal financial structure of a subsidiary bank itself is indeterminate.

[12/] One reason why we might not expect a portfolio approach to be followed is founded in the regulatory environment. Purchase of bank equity shares requires prior approval by the Federal Reserve System, and the filing of an application for such approval can be very costly to the holding company [31]. Accordingly, continual buying and selling of blocks of bank equity shares may not be cost efficient.

Chapter II

THE ECONOMICS OF BANK CAPITAL SUPERVISION

This chapter analyzes the impact of capital supervision on the banking industry and on the bank capital decision. Section 1 discusses the rationale for capital supervision and derives the conditions for determining the "socially optimal" level of capital; Section 2 outlines the means through which supervisory authorities have sought to induce banks to operate at this social optimum; Section 3 presents a model which incorporates this supervisory intervention into our model of the banking firm and predicts the equilibrium financial position of the supervised bank; and Section 4 analyzes the impact of holding company affiliation on the equilibrium capital position of the supervised bank.

II.1. Bank capital and social welfare

The relationship between the social and private optimal levels of bank capital may be examined theoretically within the framework already developed to analyze the bank's decision process. Whereas we would expect a bank to use the combination of money input sources that implies the lowest overall cost of funds for a particular output stream, the supervisory objective is to induce the bank to use that combination of inputs that implies the minimum overall social cost of production.

Supervisory concern generally has focused on the social cost of bank failure [23, 24, 33]. The economic justification for this concern lies in the perception of a stable payments mechanism as a "public good," in that it directly affects the ability of the economy to function smoothly. Since free market forces will, under certain conditions, lead to suboptimal production of a public good [32], we may expect that, in the

absence of supervisory influence, the payments mechanism will be less stable than socially optimal.

Since the banking industry encompasses the major portion of the payments mechanism, the public goods aspects of the payments mechanism spill over into the industry. In particular, we would expect that, in a private market equilibrium position, banks tend to operate in a more risky manner than is socially optimal. Accordingly, it is the role of the supervisor to attempt to induce each bank to move toward the social optimum.

We recognize that there is no general agreement that the currently established role of bank supervision is the proper one. In particular, since bank supervision aims at reducing the probability of failure of individual institutions, it may interfere in a very basic way with the efficient operation of markets. Economic theory suggests that inefficient firms enjoy lower profits than more efficient ones and the least efficient ultimately fail. This phenomenon of "survival of the fittest" helps to ensure efficient use of scarce resources. Tussing [40] presents a compelling case on this basis for promotion of bank competition and against policies which protect individual institutions from market pressures. The trade-off between payments stability and efficiency in the banking industry can only be evaluated subjectively. The analysis of this chapter presumes that a subjective judgment in this regard already has been made.

The overall social cost, r_s, of employing a particular deposit leverage ratio is equal to the sum of the private cost of funds, r_K, plus the additional social cost of risk, c_r, resulting from the bank's production decisions and not reflected in the market contractual supply prices of deposits and equity capital. As discussed above, the perceived social cost

of bank risk may be expressed in terms of the probability of bank failure. Accordingly, we may write c_r as the product of the social cost of bank failure and the probability of bank failure:

$$(1) \qquad c_r = c_B * Pr(B),$$

where c_B = the social cost (in excess of private cost) of bank failure; and

$Pr(B)$ = the probability of bank failure.

Using the terminology established in the previous chapter, we shall assume that a bank experiences failure at the point where earnings, I, fall short of contractual obligations, $wL + r_d d$, by an amount which exceeds the bank's equity capital account, e; that is, when net worth becomes negative.[13/] Accordingly, we may express the probability of failure as follows:

$$(2) \qquad Pr(B) = Pr[I < wL + r_d d - e].$$

Multiplying through by K/K, we may write this probability in terms of $\alpha(=d/K)$ as follows:

$$(3) \qquad Pr(B) = Pr\{I < wL + K[\alpha(1+r_d)-1]\};$$

or, alternatively (recalling our assumption that $I \geq wL$):

$$(4) \qquad Pr(B) = \int_{wL}^{wL + K[\alpha(1+r_d)-1]} f_I(I)dI .$$

[13/] This assumption is not entirely realistic inasmuch as we are precluding the bank from raising needed funds in an emergency situation by borrowing, issuing additional equity capital, or liquidating assets. A model permitting such emergency adjustments is considerably more complicated and adds little to our understanding of the basic issues.

We may write c_r as a function of c_B and the determinants of Pr(B) as follows:

$$(5) \qquad c_r = c_r(c_B, f_I(I), K, \alpha, r_d).$$

For any given combination of q_1 and q_2, this becomes:

$$(6) \qquad c_r = c_r(c_B, \alpha).$$

Therefore we may write:

$$(7) \qquad r_s = r_d + (1-\alpha)r_e + c_r(c_B, \alpha).$$

Minimizing this expression with respect to α, we may derive the socially optimal degree of bank leverage, α_s^*:

$$(8) \qquad \alpha_s^* = \frac{(r_e - r_d - \frac{\partial r_e}{\partial \alpha} - \frac{\partial c_r}{\partial \alpha})}{(\frac{\partial r_d}{\partial \alpha} - \frac{\partial r_e}{\partial \alpha})}.$$

This differs from the private optimal degree of leverage, α^*, as derived in equation (12) in Chapter I, in the subtraction of $\frac{\partial c_r}{\partial \alpha}$ in the numerator. The relationship between α^* and α_s^* thus depends upon the sign of this term.

Assuming $\frac{\partial c_B}{\partial \alpha} = 0$,[14/] we have:

$$(9) \qquad \frac{\partial c_s}{\partial \alpha} = c_B \frac{\partial Pr(B)}{\partial \alpha}.$$

From equation (4), we see that α enters the expression for Pr(B) only in the upper limit of integration. For any constant level of total funding,

---

[14/] This is a simplifying assumption. Since denotes the proportion of a bank's funding that is derived from deposits, losses to depositors would tend to vary directly with α. If a high social value is attached to deposit safety, $\frac{\partial c_B}{\partial \alpha}$ may be positive. This would not alter our conclusions.

K, the limit of integration varies directly with α according to the following:

$$(10) \qquad \frac{\partial}{\partial \alpha} = (1 + r_d + \alpha \frac{\partial r_d}{\partial \alpha})K.$$

We have already assumed that $\frac{\partial r_d}{\partial \alpha} > 0$. Accordingly, as long as $f_I(I)$ is continuous, $\frac{\partial Pr(B)}{\partial \alpha}$ must be positive.

Thus, it is reasonable to assume that $\frac{\partial c_r}{\partial \alpha} > 0$, and as long as the social cost of bank failure is positive, the supervisory optimal level of bank capital will exceed the private optimal level. This relationship is demonstrated graphically as in Figure 2. The social cost of bank funds may be expressed as a shift upward and to the left of the private cost of funds curve, and the socially optimal leverage ratio is thus a point such as (α_S^*, r_S^*), above and to the left of the private optimal leverage ratio, (α^*, r_K^*).

Under these conditions, the goal of bank supervision is to induce the bank to operate with a lower leverage ratio than the private optimal ratio. Provided that no offsetting adjustments are made, the cost to the bank of operating with the socially optimal degree of leverage would be the difference between the minimum overall private cost of funds and the overall private cost of funds α_S^*; that is, $(r_K^{**} - r_K)$. If the private market equilibrium results in zero economic profits for the firm, as discussed in the previous chapter, the increased cost resulting from supervisory influence would lead to negative economic profit.[15/]

[15/] If all banks were forced to operate at the socially optimal position, we would expect to observe shifts in the bank output supply curves and decreases in the market equilibrium outputs. The accompanying increase in equilibrium output prices would raise the economic profit of each bank to zero.

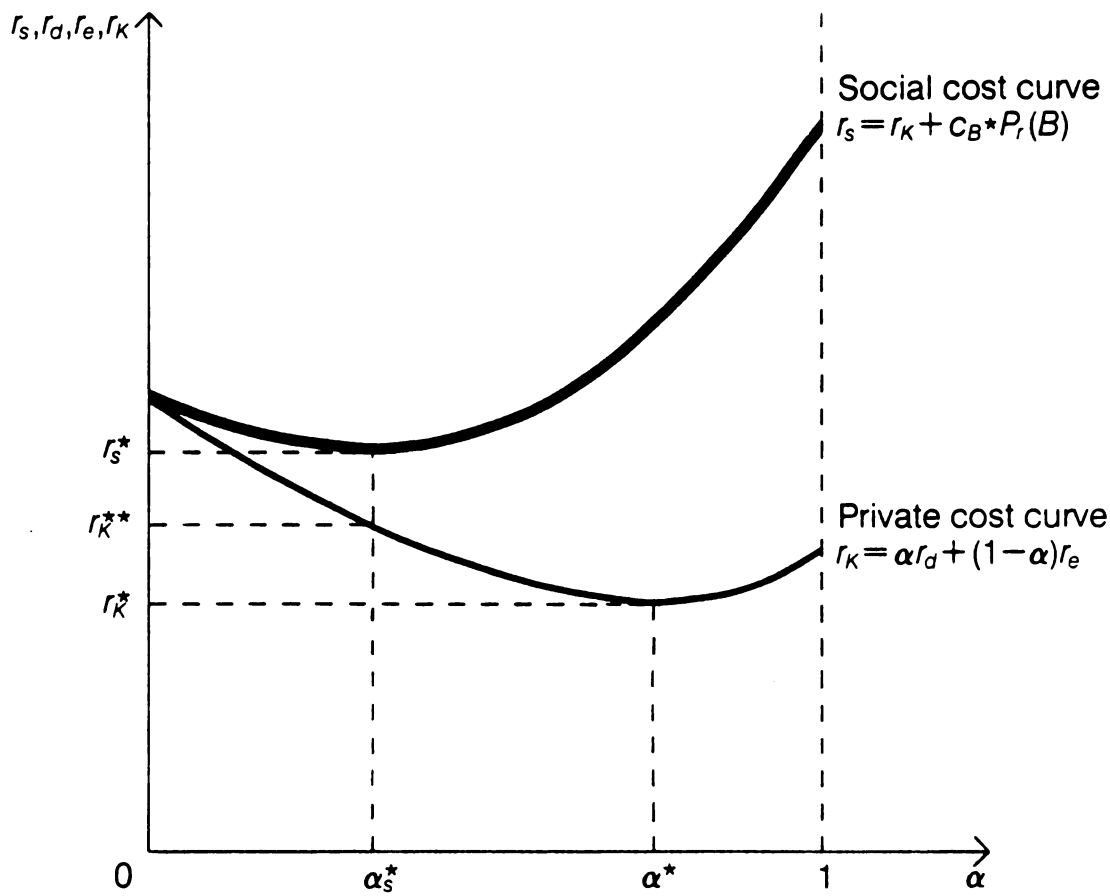

Figure 2. Socially Optimal Deposit Leverage

Thus, each bank has the incentive to avoid or offset regulatory influences, and the bank supervisor and the private market represent opposing forces in the bank's financial decision-making. The following sections discuss the equilibrium position of the bank facing these two forces.

II.2 Bank capital supervision in practice

It should be obvious, even from our simple model of bank activity, that determination of the socially optimal bank deposit leverage and capital structure is not a simple matter. In practice, supervisory agencies assess bank capital adequacy through recourse to simplified guidelines and rules of thumb. While each supervisory agency has interpreted its mandate with respect to capital supervision somewhat independently, the typical approach is based on directives such as that to the Board of Governors by the Federal Reserve Act, which states at 12 U.S.C. 329:

> No applying bank shall be admitted to membership unless it possesses capital stock and surplus which, in the judgment of the Board of Governors of the Federal Reserve System, are adequate in relation to the character and condition of its assets and to its existing and prospective deposit liabilities and other corporate responsibilities . . .

Capital adequacy is to be gauged in terms of the character and condition of the bank's assets and in the context of its deposit responsibilities.

The concern over deposit safety led supervisors in the early twentieth century to evaluate capital needs on the basis of level of deposit liabilities. A commonly accepted rule of thumb suggested that a bank should have capital in an amount equal to 10 percent of its deposits. Many states incorporated this 10 percent ratio into their banking laws, and the Comptroller of the Currency suggested its use as a minimum standard for

national banks. According to Crosse and Hempel [6], the 10 percent rule prevailed until the Second World War, at which time it was recognized that the deposit expansion that had occurred could not be backed by so large a capital base. At this point, the direction of capital supervision shifted away from deposits and toward assets. In addition, the scope of capital evaluation widened to include consideration of such factors as management quality.

Crosse outlines three variants on asset-based capital standards which have been widely applied in recent years. The simplest and most commonly used is the ratio of capital to risk assets, adopted first by the Comptroller of the Currency in 1948, and commonly referred to as the "risk-asset ratio." Risk assets include all assets with the exception of cash (and balances due from banks) and U.S. government securities. Originally, a risk-asset ratio of 20 percent was considered to be adequate. Variants on the simple risk-asset ratio have been developed which net out other minimal risk assets such as loans secured by government securities, but all such variants suffer from a common imprecision in estimating the degree of risk embodied in a bank's asset portfolio.

Probably the most complex capital adequacy standard in common use in recent years was that developed by the staff of the Board of Governors of the Federal Reserve System. Calculated on the "Form for Analyzing Bank Capital" and referred to as the "ABC Formula," this standard established minimum levels of capital needed to support a number of categories of assets. As indicated on the facsimile of the ABC Form, reproduced below in Figure 3, the percentage requirements varied from 0.0 percent for cash and 0.5 percent for short-term government securities to 100 percent for fixed assets and "loss" portion of loan and investment port-

FR 363
April 1956

FORM FOR ANALYZING BANK CAPITAL
(See Notes on Reverse Side)

BANK ______________________________

LOCATION ______________________________

BASED ON REPORT OF EXAMINATION AS OF ____________________ DISTRICT NO. ________

(Dollar Amounts in Thousands)

	AMOUNT OUTSTANDING	CAPITAL REQUIREMENT Per Cent	CAPITAL REQUIREMENT Amount
(1) PRIMARY AND SECONDARY RESERVE			
Cash Assets	$	0%	
Guar. Portion of CCC or V-loans			
Comm. Paper, Bnk Accept. & Bnks' Lns			
U.S. Govt. Secs		0.5%	$
Bills			
Certificates, etc. (to 1 yr.)			
Other (1-5 yrs.) (incl. Treas Inv. Series A & B)			
Other Secs. inv. Rtngs 1 & 2 or Equiv. (to 5 yrs.)		4.0%	
TOTAL	$		
(2) MINIMUM RISK ASSETS			
U.S. Govt. Secs. (5-10 yrs.)			
Ins. Portion FHA Rep. & Nat'n Loans			
Loans on Passb'ks, U.S. Secs. or CSV Life ins.			
Short-term Municipal Loans			
TOTAL	$	4%	
(3) INTERMEDIATE ASSETS			
U.S. Govt. Secs. (Over 10 yrs.)			
FHA and VA Loans			
TOTAL	$	6%	
(4) PORTFOLIO ASSETS (Gross of Res.)			
Investments (not listed elsewhere)			
Loans (not listed elsewhere)			
TOTAL	$	10%*	
* Plus 15% of 1st $100,000 of portfolio, 10% of next $100,000 and 5% of next $300,000.			
(5) FIXED, CLASSIFIED & OTHER ASSETS			
Bk Prem., Furn. & Fixt., Other Real Est.			
Stocks & Defaulted Secs.		100%	
Assets Classified as "Loss"			
Assets Classified as "Doubtful"		50%	
Assets Classified as "Substandard"		20%	
Accruals, Fed. Res. Bk. Stock, Prep. Expen.		0%	
TOTAL ASSETS	$		
(6) ALLOWANCE FOR TRUST DEPT. (Amt. equal to 300% of annual gross earnings of Department)			
(7) EXTRA CAP. REQD. IF ANY ASSETS IN GROUPS 2-4 USED FOR LIQUIDITY (zero if line C in Liquidity Calculation is zero, otherwise Total in line H)			
(8) ALLOW. FOR SPEC. OR ADDIT. FACTORS, IF INFO. AVAILABLE (+ or −) (see notes on reverse side)			
(9) TOTAL CAPITAL REQUIREMENT (1 thru 8)			$

LIQUIDITY CALCULATION

47% of Demand Deposits i.p.c.	$
36% of Time Deposits i.p.c.	
100% of Deposits of Banks	
100% of Other Deposits	
100% of Borrowings	
Allow. for spec. factors, if info. available (+ or −)	
A. Total Provision for Liquidity	
B. Liquidity available from Prim. and Secondary Res. ("amt. outstanding" less cap. required thereon)	
C. Liquidity to be provided from assets in Groups 2, 3 or 4 (zero if B equals or exceeds A, otherwise A less B)	
D. Liquidity available from Min. Risk Assets (90% of "amt. outstanding" in line 2)	
E. Liquidity to be provided from assets in Groups 3 or 4 (zero if D equals or exceeds C, otherwise C less D)	
F. Liquidity available from Intermediate Assets (85% of "amt. outstanding" in line 3)	
G. Liquidity to be provided from Portfolio Assets (zero if F equals or exceeds E, otherwise E less F)	

Extra Capital Required on Any Assets in Groups 2-4 Used for Liquidity

6.5% of line C	
4.0% of line E	
9.5% of line G	
◄ H. Total Extra Cap. Req.	$

(10) ACTUAL CAP., ETC. (Sum of Cap. Stock, Surplus, Undiv. Profits, Res. for Conting., Loan Valuation Res., Net unapplied Sec. Valuation Res., Unallocated Charge-offs, and any comparable items) (Exclude Depreciation and Amortization Reserves)	$
(11) AMOUNT BY WHICH ACTUAL IS MORE than requirement (10 minus 9)	+ $
or LESS than requirement (9 minus 10)	− $
(12) RATIO OF ACTUAL CAPITAL, ETC. TO REQUIREMENT (10 divided by 9)	%

NOTES REGARDING FORM FOR ANALYZING BANK CAPITAL

A thorough appraisal of the capital needs of a particular bank must take due account of all relevant factors affecting the bank. These include the characteristics of its assets, its liabilities, its trust or other corporate responsibilities, and its management--as well as the history and prospects of the bank, its customers and its community. The complexity of the problem requires a considerable exercise of judgment. The groupings and percentages suggested in the Form For Analyzing Bank Capital can necessarily be no more than aids to the exercise of judgment.

The requirements indicated by the various items on the form are essentially "norms" and can provide no more than an initial presumption as to the actual capital required by a particular bank. These "norms" are entitled to considerable weight, but various upward or downward adjustments in requirements may be appropriate for a particular bank if special or unusual circumstances are in fact present in the specific situation. Such adjustments could be made individually as the requirements are entered for each group of assets; but it usually is preferable, particularly for future reference, to combine them and enter them as a single adjustment under Item 8, indicating on the Analysis Form or an attached page the specific basis for each adjustment.

The requirements suggested in the Analysis Form assume that the bank has adequate safeguards and insurance coverage against fire, defalcation, burglary, etc. Lack of such safeguards or coverage would place upon the bank's capital risks which it should not be called upon to bear.

ITEM (4) – PORTFOLIO ASSETS

Concentration or Diversification. – The extra requirement of 15% of the first $100,000 of portfolio, 10% of the next $100,000, and 5% of the next $300,000, as specified in item 4, is a rough approximation of the concentration of risk (lack of diversification) which is likely in a smaller portfolio, and which is usually reflected in the somewhat larger proportion of capital shown by most banks with smaller portfolios. This requirement is applied to all banks, but is naturally a larger portion of the total capital requirements of banks with smaller portfolios. However, a particular portfolio, whatever its size, may in fact have either more or less concentration of risk than other portfolios of similar size. If there is in fact substantially greater or lesser concentration of risk in the portfolio assets of the particular bank--as for example dependence upon a smaller or larger number of economic activities--it would be appropriate to increase or decrease requirements correspondingly.

Drafts Accepted By Bank. – When drafts have been accepted by the bank, ordinarily the customers' liability to the bank should be treated as Portfolio Assets if the acceptances are outstanding, or the acceptances themselves should be so treated if held by the bank.

ITEM (5) – FIXED, CLASSIFIED, AND OTHER ASSETS

Rental Properties. – Bank premises, furniture and fixtures, and other real estate are assigned a 100% requirement as a first approximation, since these assets usually are not available to pay depositors unless the bank goes into liquidation, and even then they usually can be turned into cash only at substantial sacrifice. However, some properties which bring in independent income, such as bank premises largely rented to others, may be more readily convertible into cash by selling or borrowing on them, and in such situations it may be appropriate to reduce the 100% requirement by an amount equal to an assumed "sacrifice" value, such as, say, two or three times the gross annual independent income.

Stocks. – In the case of stocks, their wide fluctuations in price suggest a 100% requirement as a first approximation. However, in some cases it may be appropriate to reduce the 100% requirement against a stock by an amount equal to an assumed "sacrifice" value, such as the lowest market value reached by the stock in, say, the preceding 36 or 48 months.

Hidden Assets. – In some cases assets may be carried at book values which appear to be below their actual value, and may thus appear to provide hidden strength. However, any allowance for such a situation should be made with great caution, and only after taking full account of possible declines in values and the great difficulty of liquidating assets in distress circumstances.

ITEM (6) – ALLOWANCE FOR TRUST DEPARTMENT

Deposited Securities. – The requirement for the trust department should in no event be less than the amount of any securities deposited with the State authorities for the protection of private or court trusts, since such securities are not available in ordinary circumstances to protect the bank's depositors.

LIQUIDITY CALCULATION

Percentages of Deposits. – The provision for 47% liquidity for demand deposits of individuals, partnerships and corporations actually represents 33-1/3% possible shrinkage in deposits, plus 20% of the remaining 66-2/3%. 36% of time deposits i.p.c. represents 20% shrinkage, plus 20% of the remaining 80%. In both instances, the provision for 20% liquidity for remaining deposits is to help the bank continue as a going concern even after suffering substantial deposit shrinkage.

Among possible special factors to be considered in connection with the liquidity calculation would be concentration or diversification of risk among deposits. This might be due to such things as dependence upon a smaller or larger number of economic activities, or preponderance of large or small deposits--large deposits usually being more volatile.

Liquidity Available from Assets. – Liquidity available from primary and secondary reserves is assumed to equal the amount of those assets less only the regular capital required thereon, since the regular capital specified for these assets assumes forced liquidation. However, the regular capital specified for other assets (i.e., those in Groups 2-4) is only a portion (approximately 40%) of that required for forced liquidation. Therefore, in determining the liquidity available from such other assets, the amount of such other assets must be reduced by more than the regular specified capital.

Extra Capital Required. – This extra capital is to cover possible losses in forced liquidation of assets other than primary and secondary reserves in case they had to be used to provide liquidity. The 4% indicated for Line E amounts to an automatic addition to the 6.5% that has already been applied to Line C, and results in a total extra requirement of 10.5% of the liquidity to be provided from Intermediate Assets. Similarly, the total extra requirement on the liquidity to be provided from Portfolio Assets is 20%. If the same amounts of extra capital were stated as percentages of the assets to be liquidated rather than of the liquidity to be provided, the percentages would be smaller, namely, 6% of Minimum Risk Assets, 9% of Intermediate Assets, and 15% of Portfolio Assets.

Figure 3. Form For Analyzing Bank Capital

folios. For "normal risk" assets, the formula required 10 percent backing plus an extra capital requirement against the first $500,000 of "normal risk" portfolio. This extra requirement established a higher overall standard for smaller banks. A requirement was also assessed to support the activities of the bank's trust department and an additional requirement levied on the basis of relative liquidity of assets and liabilities.

A middle ground is represented by the formula which has been used by the Federal Reserve Bank of New York to assess capital adequacy, commonly referred to as the "New York Formula." This formula requirement is calculated as shown in Figure 4. The formula distinguishes among six rough groupings of assets on the basis of risk. The first category consists of the bank's reserves and highly liquid assets. The second category includes assets judged to embody minimal levels of risk, such as long-term U.S. government securities, government guaranteed loans, etc. The third category includes the bank's "normal risk" assets, bearing a requirement of 12 percent. The fourth category, requiring a 20 percent capital backing, is comprised mainly of loans and investments considered to be "substandard." The fifth category may be termed "work-out" assets. These include assets which are generally expected to be eliminated from the bank's balance sheet, either through charge-off or sale, and require capital backing of 50 percent. Finally, fixed assets (such as physical plant) and assets classified as loss require backing of 100 percent capital.

Prepared by _____ (Examiner, Assistant or Analyst)

Checked by _____ (Analyst)

(Name of Bank) (Location) (Exam. Date)

A MEASURE OF CAPITAL ADEQUACY

ASSETS	AMOUNT (Amounts in thousands)	MARGIN	REQUIRED CAPITAL
Riskless Assets			
Cash and Due from banks			
Accruals and Prepaid Expenses			
F.R.B. Stock			
*U.S. Govt. Securities Maturing Within 5 Years			
*U.S. Govt. Securities-Bond Trading Account			
*U.S. Govt. Securities Purchased under Resale Agreement			
Federal Funds Sold			
*Brokers' Loans Secured by U.S. Govt. Securities			
.....			
Sub-total		0	
Minimum Risk Assets			
*U.S. Govt. Securities Maturing 5 Years and Over			
Other Securities-Bond Trading Account			
Other Group 1 Securities Maturing Within 5 years			
F.H.A. Mortgages and 50% of V/A Mortgages			
Loans Secured by: *U.S. Govt. Securities			
C.S.V. of Life Insurance			
Passbooks and Cash Collateral			
Other Brokers' Loans			
Commercial Paper Purchased			
F.H.A. Title 1 Loans (90%)			
Guaranteed Student Loans			
Guaranteed Portion of S.B.A. Loans			
.....			
Sub-total		5%	
Normal Risk Assets			
Balance of Group 1 Securities			
**Other Loans and Overdrafts (Except classified)			
O.R.E. (Except classified)			
Other Assets (Except classified)			
.....			
Sub-total		12%	
Substandard Assets			
Loans			
O.R.E.			
Other Assets			
.....			
Sub-total		20%	
Doubtful or Workout Assets			
Depreciation in Group 2 Securities			
Loans			
O.R.E.			
Capitalized Bank Premises Income (Income X 5)			
Other Assets			
.....			
Sub-total		50%	
Fixed Assets and Losses			
Depreciation in Groups 3 and 4 Securities			
Loans			
O.R.E.			
Bank Premises _____ less Capitalized Income (Income X 5) _____			
Furniture and Fixtures			
Other Assets			
.....			
Sub-total		100%	
**Total Assets		Required Capital	

Book Capital Funds.....

Valuation Reserve for Loan Losses.....

Gross Capital Funds.....

Capital Index (Gross Capital Funds as a Percentage of Required Capital).....

*U.S. Governments (Direct and Guaed.) and U.S. Govt. Agencies and Corporations, also Public Housing Authorities (Local Issues)

**Net of Unearned Discount on Loans.

Figure 4. New York Formula

Capital adequacy is measured by comparing the bank's actual capital holdings[16/] with the minimum requirement calculated according to the formula. A ratio of actual capital to formula requirement of 100 percent is officially considered to be the minimum acceptable, and a bank is considered to have adequate capital if this ratio is at least 125 percent. In practice, determination of adequacy on the basis of the formula ratio is left to the discretion of the examiner. Other factors such as management quality, profitability, and liquidity are considered in the examiner's judgment, and many banks may be considered to be adequately capitalized with ratios below 100 percent.

As may be obvious from this brief outline, while supervisory capital standards are based on the perception of social cost of bank risk outlined in the previous section, they are quite imprecise. In practice, supervisors tend to rely on comparisons with peer group averages to a great extent in singling out banks in need of increased capital. In addition, the sanctions at the disposal of supervisors are somewhat limited. A chartering authority may revoke the charter of an institution which it considers to be inadequately capitalized, and the Federal Reserve System

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[16/] It should be noted that, while the focus of capital supervision is on the bank's equity capital base, shareholders' equity is only one component of a bank's capital. In addition, reserves for loan loss and a limited amount of subordinated long-term debt are considered by supervisors to fulfill the role of capital. Reserves for loan loss represents that portion of a bank's funds that has been set aside in anticipation of future asset losses. Since equity is viewed by the supervisor as a buffer against such losses, loss reserves are considered equivalent to equity by the supervisor. Subordinated long-term debt is subordinated to the claims of depositors. Since a major concern of supervisors is to protect depositors against bank losses, debt is considered to some extent to be a substitute for equity capital. However, since equity and debt are not precisely identical in protecting depositors, debt is considered to be capital only up to a limited percentage of equity. Within the context of our model, these components of capital are considered equivalent to shareholders' equity.

may withhold membership from an errant institution, but these sanctions virtually never are invoked. In practice, supervisory authorities resort most heavily to moral suasion or increased examinations frequency as means to induce banks to abide by capital guidelines, although pressure also is exerted in acting on applications by banks wishing to expand their operations.

Some economists have argued that bank supervision carried on in this environment is entirely ineffective in increasing bank capital levels (reducing deposit leverage) from private market equilibrium levels [18, 24]. However, there is empirical evidence which supports the view that supervisory pressures have been at least somewhat effective in influencing bank capital decisions. Pettway [26] has found that the market's evaluation of banks' securities is less sensitive to levels of capital stock currently observed than to factors such as maturity, marketability, dividends, and payout ratios. This finding is consistent with the hypothesis that supervisory views of capital adequacy have prevailed, to an extent, so that differences in capital levels among banks reflect supervisory influences rather than factors considered to be important by the private market. Mingo [21] also has presented evidence that supervisors have been successful in influencing capital levels. And more recently, Carroll and Nelson [5] have demonstrated that capital supervision has induced bank holding companies to adjust their internal financial structure.

II.3 Financial equilibrium for the supervised bank

The determinants of financial equilibrium for the supervised bank may be analyzed within the context of the bank financial model presented in Chapter I. As discussed in the previous two sections, capital

supervision is conducted in a fairly flexible manner. Rather than establishing absolute requirements, the supervisor sets a target leverage (dependent upon asset quality, etc.) for each bank and makes the target known to bank management. The supervisor does not force the bank to meet the target, but it penalizes those institutions that do not meet the target. While the supervisor would prefer that the bank adjust to supervisory pressure simply by adopting the target leverage ratio (and leaving all other decision variables unchanged), such a response from the bank is not likely as long as the target is not established as an absolute constraint. Instead, the bank perceives supervisory pressure as a cost of doing business and incorporates that cost into its decision function. Denoting target leverage by α_s^*, we may express supervisory imposed cost, C_s, as a function of deviations from that target[17/] follows:

$$(11) \qquad C_s = c_s(\alpha-\alpha_s^*)$$

where $\frac{\partial c_s}{\partial(\alpha-\alpha_s^*)} > 0$.

Incorporating this cost function, the bank's expected profit function is modified from that given by equation (7) in Chapter I to become:

$$(12) \qquad \bar{\pi} = \bar{p}_1 q_1 + \bar{p}_2 q_2 - wL - K(\alpha r_d+(1-\alpha)r_e)-c_s(\alpha-\alpha_s^*).$$

Performing a maximization similar to that performed for the unsupervised case, we may solve for the optimal leverage ratio for the supervised bank as:

[17/] We note that this formulation could also be used for the case of an absolute constraint. In that case, the supervisory-imposed cost of deviation from the "target" is infinite.

$$(13) \qquad \alpha^{**} = \frac{r_e - r_d - \frac{\partial r_e}{\partial \alpha} - \frac{\partial c_s}{\partial \alpha}}{\frac{\partial r_d}{\partial \alpha} - \frac{\partial r_e}{\partial \alpha}}.$$

This expression differs from the unsupervised optimal leverage given by equation (12) in Chapter I in the subtraction of $\frac{\partial c_s}{\partial \alpha}$ in the numerator. Accordingly, as long as $\frac{\partial c_s}{\partial \alpha} > 0$, the supervised bank will choose a leverage ratio lower than that implied by the unsupervised equilibrium.

In general, we expect the supervised bank to choose a leverage ratio in the range between that implied by the unsupervised equilibrium and that desired by the supervisor. The precise level of α^{**} compared with α^{*} depends on the relative magnitudes of $\frac{\partial r_e}{\partial \alpha}$, $\frac{\partial r_d}{\partial \alpha}$, and $\frac{\partial c_s}{\partial \alpha}$, the relative supervisory and private market marginal costs of leverage. Accordingly, the effectiveness of supervision in reducing bank leverage below the private market equilibrium level depends on these factors. This result provides a framework within which to predict differential impacts of supervision on banks of various types. Systematic differences in these marginal costs across classes of banks will systematically affect the reactions of banks to supervisory pressure. The following section demonstrates the manner in which bank holding company affiliation should affect capital behavior of the supervised bank.

II.4 Holding company affiliation and financial equilibrium

As discussed in Section I.4, in the absence of supervisory intervention, holding company affiliation would be expected to have no predictable impact on bank financial behavior, ceteris paribus. The equilibrium financial position for the supervised holding company affiliate will differ from that for the supervised independent bank, however, if holding company affiliation affects the relative magnitudes of the various factors

in equation (13) in the previous section. The impact of holding company affiliation on these factors will depend upon the supervisory attitude toward the bank holding company.

The appropriate supervisory approach to holding companies, based on the perceived impact of bank holding company operations on social welfare has been debated by economists, bank supervisors, and legislators for over half a century.[18/] Several beneficial effects of holding company ownership of banks derive from the ability of holding companies to transcend regulatory and legal restrictions which are applied to banks. For example, holding companies have been permitted by most states to control subsidiary banks statewide, despite continuing restrictions on branching by commercial banks in some states; while commercial banks are prohibited from branching across state boundaries, bank holding companies may operate nationwide through nonbanking subsidiaries which perform many commercial banking activities; and bank holding companies are able to achieve some degree of product diversification through subsidiaries engaged in activities that are outside the sphere of traditional commercial banking activities. These factors are generally thought to lend stability to the banking industry as a result of economies of scale and diversification.

At the same time, bank holding companies may potentially adversely affect the safety and soundness of subsidiary banks. Many economists have argued, for example, that bank holding companies tend to offset the benefits of diversification on their banking subsidiaries by pursuing higher levels of risk than do similar independent banks. This theory has led to the general expectation that holding company subsidiaries may tend

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[18/] For a review of the literature on this issue, see Rose [30].

to pursue higher leverage ratios than do independent banks. In this case, affiliated banks may be more susceptible to failure than are independent banks, since the subsidiaries are legally independent entities.[19/] In addition, the potential for intracompany transfers which might weaken banking affiliates often is cited. For example, it has been feared that a bank holding company might use the resources of its affiliated banks to support a weak nonbank subsidiary, assuming that bank regulatory authorities would help to bail out the banks if need should arise. Finally, it is argued that the failure of a major nonbank subsidiary might create a panic among creditors and depositors of affiliated banks, leading to runs and eventual bank failures.[20/]

In view of these concerns, supervision has focused on subsidiary banks. The strong bank supervisory stance discussed earlier in this chapter has been coupled with attempts at insulating bank subsidiaries from the nonbank sectors of the holding company, and a number of legal and regulatory restrictions limit permissible financial arrangements among subsidiaries in attempt to protect the bank from potential drains on its financial resources. Supervisors have attempted to permit holding companies to exploit opportunities for geographical and product diversification and some economies of scale while, at the same time, preventing operations deemed to be contrary to the "public interest." Under this philosophy, supervisors traditionally have virtually ignored the consolidated finan-

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[19/] This view ignores the evidence, cited in Section I.4, that holding companies are viewed by private markets and the courts as unified entities with the parent legally responsible for debts incurred by its subsidiaries.

[20/] The most frequently cited example justifying this concern is the run on Beverly Hills National Bank in 1974.

cial structure of bank holding companies. Accordingly, holding companies have been free to pursue the private market consolidated equilibrium financial position.

The impact of holding company affiliation on the equilibrium position of the supervised subsidiary bank as predicted by equation (13) will depend on the nature of the company and on the legal environment. Let us consider the case of a holding company whose only activity is owning the stock of a single bank. As discussed in Section I.4, the company may be treated as a legally consolidated company for the most purposes. And, as discussed in that section, under these conditions, the equilibrium position of the consolidated company is equivalent to the equilibrium position of an unsupervised bank. Further, intracompany financial arrangements are of no consequence to the private market and variations in those arrangements have no effect on the market supply prices of bank inputs. Subsidiary bank equity capital is little more than a bookkeeping entry.

The supervisory stance discussed above essentially ignores the consolidated financial structure of the bank holding company. In this case, we may express the expected profit function of the supervised holding company as:

$$(14) \qquad \bar{\pi}_{HC} = \bar{p}_1 q_1 + \bar{p}_2 q_2 - wL - K_{HC}[\alpha_{1HC} r_d + \alpha_{2HC} r_{bP} + (1-\alpha_{1HC}-\alpha_{2HC}) r_{eP}] - c_s(\alpha - \alpha_s^*)$$

where

HC denotes a consolidated variable;

P denotes a parent level variable;

$\alpha_1 = d/K_{HC}$;

$\alpha_2 = b_P/K_{HC}$;

$\alpha = d/K$; and

α_s^* = supervisory target level of d/K.

Supervisory-imposed cost depends upon the bank's leverage, but private market-imposed costs depend upon consolidated leverage of the holding company. Assuming that holding company bonds have risk characteristics similar to but subordinate to deposits, the holding company may pursue on a consolidated basis a financial strategy close to the unsupervised optimum, while satisfying supervisory targets in the subsidiary bank. This is accomplished by issuing debt at the parent holding company level and using the proceeds to purchase equity in the subsidiary bank.[21/]

The existence of such financing alternatives for a holding company influences the optimal supervised leverage at the bank level given by equation (13). For a holding company subsidiary bank, the value of r_e, the supply price of equity funds, is equal to the average cost of funds raised at the parent level by issuing bonds and equity. Using the terminology developed in Section I.4, this may be written:

$$r_e = \alpha_2 r_{bP} + (1-\alpha_3) r_{eP}; \tag{15}$$

where

$$\alpha_3 = \frac{b_P}{b_P+e_P}.$$

Considering the holding company on a consolidated basis, we recall that $r_{eHC} \equiv r_{eP}$ and $r_{bHC} \equiv r_{bP}$. From our payment rule we know:

[21/] The extent to which this strategy has been followed by bank holding companies is discussed in [7].

(16) $$r_d < r_{bHC} < r_{eHC}.$$

Thus, the weighted average cost of parent level equity and bonds must be less than the cost of equity issued by an independent bank for any given total leverage, $\alpha_1 + \alpha_2$. This implies that the value of r_e in equation (13) is lower for a holding company affiliate than for an independent bank.

In addition, holding company affiliation will affect the value of $\frac{\partial r_e}{\partial \alpha}$. Specifically, the value of $\frac{\partial r_e}{\partial \alpha}$ will generally be greater for a supervised holding company subsidiary than for a supervised independent bank. Desposits are debt obligations of the consolidated company, and increases in α will, ceteris paribus, increase r_{bHC} and r_{eHC}. We have:

(17) $$\frac{\partial r_e}{\partial \alpha} = \alpha_{2HC} \frac{\partial r_{bP}}{\partial \alpha_{1HC}} + (1-\alpha_1-\alpha_2)\frac{\partial r_{eP}}{\partial \alpha_{1HC}}.$$

Assumptions (17) and (20) in Chapter I ensure that this will exceed the value of $\frac{\partial r_e}{\partial \alpha_2}$ for the independent supervised bank.

Under the conditions we have outlined, each of the two affiliation effects decreases the value of α_s^{**} in equation (13), so that the impact of holding company affiliation on a supervised bank is unequivocally negative.[22/] Accordingly, we would expect that bank holding company affiliated banks would tend to come closer to meeting the supervisory target deposit leverage ratios than do their independent counterparts.

This conclusion differs from the assumption underlying earlier empirical investigations of the impact of holding company affiliation on

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[22/] For a multibank holding company, these conditions should prevail, provided that the subsidiary banks are legally separate entities so that, while the parent is responsible for the debts of all subsidiaries, no subsidiary is responsible for the liabilities of the others. This is a reasonable assumption within the current legal environment. The existence of nonbank subsidiaries should not further alter this analysis.

bank capital behavior. Studies such as Mingo [21], Mayne [17], and Jessee [11] have expected to find a negative relationship between holding company affiliation and bank capital ratios. As mentioned in the previous chapter, this expectation has typically been without theoretical basis and drawn from a relatively loose statement that holding company affiliation lowers risk for an affiliated bank or that holding company affiliates have less risk averse management than independent banks. Empirical results have been weak.

II.5 Financial equilibrium and supervisory ratings

Our model predicts that the equilibrium financial structure for a supervised bank holding company affiliate is closer to the supervisory target financial structure than is that of a similar, supervised independent bank. Accordingly, we would expect bank holding company affiliates, on average, to perform better than comparable independent banks on supervisory rating systems. As described in Section II.2, most rating systems are couched in terms of target capital levels. For any given asset size, a capital target implies a leverage target. Thus, we may interpret a supervisory capital rating as a measure of deviation of bank leverage from the supervisory target.

The most convenient supervisory rating for our purposes is the New York Formula rating. As discussed above, this rating is the ratio (expressed in percentage terms) of actual capital to target capital as calculated according to the New York Formula. This formula establishes a total capital target on the basis of asset risk distribution by assigning a percentage capital base for each type of asset and summing over asset categories. A rating of 100 generally is considered satisfactory, with a rating of 125 "desirable."

While it is a good proxy for bank performance under supervisory standards, the New York Formula rating generally is interpreted in light of other factors. The most significant of these factors is bank asset size. The formula itself makes no adjustment for size, applying the same capital/asset factors to banks of all sizes. In practice, it is recognized that bank size affects diversification potential and perhaps managerial expertise. Accordingly, supervisors expect the largest banks to operate with a New York Formula rating somewhat below 100, while the smallest banks are expected to have a rating substantially in excess of 100.

In equilibrium, the New York Formula rating, NY, may be expressed in terms of our model as:

$$(18) \qquad NY = \phi(\alpha^{**}, \alpha^{*}_{S}, S)$$

where

α^{**} = optimal leverage for a supervised bank;

α^{*} = supervisory target leverage, and

S = bank asset size.

According to the model, $\frac{\partial \phi}{\partial \alpha^{**}}, \frac{\partial \phi}{\partial S} < 0$, and $\frac{\partial \phi}{\partial \alpha^{*}_{S}} > 0$.

Our results in the previous section imply a negative relationship between α^{**} and bank holding company affiliation. We have not developed other possible private market determinants of equilibrium bank leverage. Likewise, we have not investigated possible determinants of α^{*}_{S} other than bank size. One element likely to cause variation in supervisory targets is agency jurisdiction. The New York Formula rating is calculated by Federal Reserve examiners for most banks in the Second Federal Reserve District. However, the Federal Reserve System has primary supervisory jurisdiction only over state-chartered members of the System. Primary

federal jurisdiction over nationally chartered banks rests with the Comptroller of the Currency and authority over insured nonmember banks with the Federal Deposit Insurance Corporation. The New York Formula rating is likely to more closely reflect α_s^* for state member banks than for others.

These considerations suggest that equation (18) may be rewritten:

(19) $NY = \Omega(BHC,MEM,S,X)$

where

BHC denotes holding company affiliation;

MEM denotes membership status and charter class;

S denotes bank asset size; and

X denotes "other" variables.

Chapter III

EMPIRICAL TEST OF THE MODEL

The predictions developed in the previous chapter provide the basis for a straightforward test of our model of supervision. We have found that under our model, the traditional supervisory policies on financial structure will have differential impacts on banks according to holding company affiliation status. Specifically, since it is less costly for holding company subsidiaries than for independent banks to adjust their financial structures to supervisory desires, holding company subsidiaries will generally score better than independent banks on supervisory rating systems.

In Section II.5 we derived a general expression in equation (18) for the determinants of the equilibrium New York Formula rating under the assumptions of our model. Equation (19) incorporated more specific predictions. This equation suggests the following regression equation:

$$(1) \qquad Ln(NY) = \alpha + \beta_1(BHC) + \beta_2(MEM) + \beta_3(Ln(S)) + \varepsilon$$

where

BHC = 1 for holding company affiliates
0 for independent banks

MEM = 1 for state-chartered member banks
0 for all others

S = bank asset size (in $ thousands).

Our model predicts that $\beta_1 > 0$ and $\beta_3 < 0$. The sign of β_2 is ambiguous.

We estimated this equation for Second District commercial banks over the 1970-77 period using data derived from reports of examination.

Our sample included all banks for which complete data were available in any year.[23/] In each year the sample size exceeded 200 banks.

Table 1 presents the results of our estimation. All variables are of the expected sign for the five years, 1970-74; the BHC coefficient is significant with at least 90 percent confidence during 1970, 1971, 1973, and 1974. A Chow test indicates that the coefficients are stable over this period, with a 99 percent confidence level. During the 1975-77 period, however, the BHC coefficient is negative and not significantly different from zero.

The significant positive sign on the membership dummy is interesting. State-chartered member banks (those under the primary jurisdiction of the Federal Reserve) were consistently rated higher than banks outside of the Federal Reserve's primary responsibility. This may reflect differences in supervisory targets or differences in asset classification standards among the agencies.[24/] Alternatively, it may reflect a bias toward state member banks on the part of Federal Reserve examiners. However, the magnitude of the difference is quite small.

The results of our estimation for earlier years seem encouraging and suggest that further investigation is warranted to interpret the dramatic change that occurred in the later years. The most likely reason for the deterioration of our results lies in the fact that we have modeled a

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[23/] Some items were taken from hard copy of Reports of Examination. For some banks, these items were not available for some years. Exclusion of these banks should not have significantly affected our results.

[24/] The Federal Reserve Bank of New York uses the examination reports of the FDIC and the Comptroller in rating banks that are under primary jurisdiction of these agencies. There may well have been differences in asset rating judgments among agencies during the period covered by our study.

Table 1
Results of Estimation of: $Ln(NY) = \alpha + \beta_1(BHC) + \beta_2(MEM) + \beta_3(Ln(S)) + \varepsilon$
(1970-1977)

Year	Number of Observations	COEFFICIENTS Constant	BHC	MEM	LN(S)	R^2
1970	264	5.5457***	0.1420*	0.1490**	-0.090***	.10
		(31.78)	(1.97)	(2.59)	(-5.13)	
1971	278	5.4257***	0.1018*	0.1477***	-0.0817***	.12
		(36.97)	(1.81)	(3.09)	(-5.59)	
1972	285	5.6187***	0.0713	0.1295**	-0.1002***	.12
		(31.72)	(1.10)	(2.18)	(-5.74)	
1973	287	5.9104***	0.1390**	0.0817	-0.1281***	.20
		(37.84)	(2.57)	(1.51)	(-8.43)	
1974	277	6.1881***	0.1181**	0.1225**	-0.1523***	.25
		(35.88)	(2.02)	(2.15)	(-9.14)	
1975	269	5.6217***	-0.0365	0.1408***	-0.0980***	.19
		(36.60)	(-0.75)	(2.78)	(-6.67)	
1976	261	5.4367***	-0.0855	0.1078	-0.0762***	.14
		(33.55)	(-1.38)	(1.32)	(-5.00)	
1977	207	5.3770***	-0.0154	0.1353**	-0.0777***	.11
		(28.065)	(-0.24)	(2.268)	(-4.20)	
1970-1974	1391	5.7502***	0.1128***	0.1293***	-0.1121***	.16
		(77.79)	(4.15)	(5.22)	(-15.39)	

t values in parentheses
***, **, *, indicate coefficient significantly different from zero at 99%, 95%, and 90%, respectively.

static equilibrium. Our predicted relationship between NY and BHC is based on the assumptions that each bank is aware of the supervisory targets, can predict how its assets will be viewed by the supervisory agencies, and has adjusted its financial structure to the equilibrium one. Any unanticipated change in either supervisory targets or bank asset quality would cause the bank's financial structure and its rating to deviate from equilibrium levels. In a disequilibrium period that affects banks randomly, our model has no predictive power.

The years 1975-77 have in fact been generally perceived as a disequilibrium period for the banking industry. The general economic problems of the early 1970s had a widespread effect on bank asset quality during this time. We attempted to measure the effect of this development on our model by incorporating a measure of deviation of asset risk from its equilibrium. The measure we used was level of classified assets. Classified assets are those assets determined by the supervisory agency to be of highly doubtful quality--that is, in very real danger of partial or total loss. The New York Formula places a heavy capital burden on these assets, expecting capital backing of 50 percent for "doubtful" assets and 100 percent for "loss" assets. Thus, unanticipated deviations from the bank's equilibrium level of these assets could cause significant deviations of the bank's New York Formula rating from its equilibrium.

We estimated the following equation for 1977:[25/]

$$(2) \qquad Ln(NY) = \alpha + \beta_1(BHC) + \beta_2(MEM) + \beta_3(Ln(S)) + \beta_4\left(\frac{CA-\overline{CA}}{\overline{CA}}\right) + \varepsilon$$

[25/] Due to a series break in our data base, levels of classified assets were not available for 1975 and 1976.

where

CA = ratio of classified asset to total assets in 1977; and

$\overline{CA}$ = average ratio of classified assets to total assets during the 1970-74 period.

Assuming that the period 1970-74 was an equilibrium one, $\frac{CA-\overline{CA}}{\overline{CA}}$ would measure deviations from equilibrium. We would expect $\beta_4 < 0$.

Estimation provided the following results:

$$(3) \qquad NY = \underset{(26.74)***}{5.1047} - \underset{(-0.24)}{0.0161}\ BHC + \underset{(2.03)**}{0.1155}\ MEM$$

$$- \underset{(-2.98)***}{0.0548}\ Ln(S) + \underset{(2.09)**}{0.0027}\ \frac{CA-\overline{CA}}{\overline{CA}}$$

$R^2 = 0.11$,

Number of observations = 151,

*** designates coefficient significant at 99% confidence level,

** designates coefficient significant at 95% confidence level.

The coefficient on the bank holding company dummy is still negative and insignificant. The signs of other coefficients also are unaltered. And the sign of the classified assets variable is significant and of the opposite sign from that expected.

Our results do not verify our disequilibrium theory. The strong positive sign on β_4 suggests that changes in average classified assets were anticipated by our sample banks. However, it is possible that our measure of disequilibrium is too crude to provide meaningful results.

An alternative explanation of the deterioration in our empirical results is the possibility that Federal Reserve supervisory policy has

changed over time. The System's current approach to bank holding company supervision does consider the consolidated capital position. The following position was announced in early 1979:

> Capital is to be evaluated with regard to the volume and risk of the operations of the consolidated corporation. Emphasis on capital from the standpoint of the consolidated entity is appropriate since holding company management exercises some discretion with respect to the allocation of capital resources within the corporation. Thus, it is the company's capital on a consolidated basis that must serve as the ultimate source of support and strength to the entire corporation. [Federal Reserve Press Release, February 7, 1979]

With supervision extended to the consolidated company, a holding company would be unable to reduce supervisory-imposed cost by making internal financial adjustments. In this case, our model would predict that holding company affiliation would have no effect on bank capital ratings. If the consolidated approach were gradually adopted before its announcement, this could explain our empirical results. However, it seems unlikely that such an effect would be observed as early as 1975.

Chapter IV

SUMMARY AND CONCLUSIONS

This study outlines a general framework for understanding commercial bank decision-making in the face of supervisory intervention and applies that framework to the bank capital decision. The theoretical model developed is premised on the view that a commercial bank may be analyzed as a profit-maximizing competitive firm and that the effects of supervisory intervention may be incorporated directly into the bank's decision function. In such a model, it is possible to isolate the factors that will determine the effectiveness and efficiency of a particular supervisory policy.

The results of our analysis have three important implications. First, our analysis provides indirect evidence on the nature of bank financial decision-making. The theoretical predictions are based on the assumption that an optimal bank financial structure exists. Casual observation supports this assumption. If a Modigliani-Miller world prevailed and no private market financial equilibrium existed, it seems unlikely that banks would resist supervisory pressures regarding capital adequacy. In such a world, our model would predict that all banks would meet supervisory leverage targets, since the cost of doing so would be zero. Holding company affiliation would have no effect on bank behavior. Our results suggest that there may be systematic differences in capital behavior across banks. This adds support to the view that there is a private market optimal bank financial structure.

Second, this study provides a clearer understanding of the impact of holding company affiliation on bank behavior. It is asserted here that holding company affiliation does not, in and of itself, have any

systematic effect on bank behavior. Any observed differences between holding company affiliates and independent banks derive from the legal and regulatory environment and not from the holding company ownership itself. Failure to consider this approach has led economists over the past decade to perform a multitude of empirical investigations of holding company influence over bank behavior that have little theoretical basis. Such studies can provide very misleading results, particularly in view of the low explanatory power of static cross-sectional estimation of financial variables.

On the capital question in particular, conventional wisdom has suggested to many researchers that bank holding company affiliation has a negative effect on bank capital levels. Our theoretical model predicts the opposite, and our empirical results support our prediction over the 1970-74 period.

Finally, this study has important policy implications. In general, it points up the importance of bank reaction to supervisory policy. Whenever supervisory policy fails to view supervised entities from a market perspective, the impact of the policy will very likely differ from that intended.

With regard to bank capital supervision, this suggests that supervisors should evaluate holding companies in the same manner as does the private market--that is, as consolidated entities.[26/] Under the traditional supervisory approach, supervisory capital ratings were misleading indicators of bank soundness, since they ignored intracompany financial

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[26/] We would note that this is a positive statement and not a normative one. We are not addressing the question of whether capital should be supervised, but only how it should be supervised.

arrangements. Our conclusions are generally supportive of the more recent Federal Reserve System policy on bank holding company capital evaluation.

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