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Foundations of the Structure-Conduct-Performance Paradigm in Banking

NUMEROUS EMPIRICAL STUDIES have sought to estimate the relationship between market structure and various aspects of bank conduct and performance as implied by the structure-conduct-performance (hereafter SCP) paradigm. Without exception, these studies have not been based on an explicit model of the banking firm. This paper employs such a model to derive formally and thereby assess critically the most commonly tested relationships in this large literature. These include the relationships between market structure on one hand and bank loan rates, bank deposit rates, and bank profit rates on the other. Special emphasis is given to the roles of market concentration and market share (which are allowed to differ across the markets in which banks operate) as implied by the SCP paradigm. The necessary assumptions and simplifications implicit in past empirical studies of these relationships are outlined, and implications for empirical testing are presented.[1] Distinctions between the predictions of the SCP and the alternative "relative efficiency" paradigm are also drawn.

[1]To save space, these implications are not listed here. A brief rundown of some of the more salient of them is presented in the concluding section.

The author thanks Dean Amel, Allen Berger, Nellie Liang, Stephen Rhoades, and John Wolken for helpful comments. The opinions expressed herein do not necessarily represent the views of the Federal Reserve Board of Governors or its staff.

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Journal of Money, Credit, and Banking, Vol. 23, No. 1 (February 1991)

1. A MODEL OF THE BANKING FIRM

In contrast to previous studies, the following examination of the relationship between bank conduct and market structure focuses on an explicit model of the banking firm. The model employed is most closely related to that developed by Klein (1971), chosen because of its direct applicability to questions of market structure and bank behavior. In the interest of simplicity, it omits a number of aspects of bank modeling typically introduced in the literature to address other questions. These omitted characteristics include, most notably, intertemporal considerations and the explicit treatment of risk.[2] A multiperiod analysis would add little to the primary results of the paper, but the inclusion of risk, introduced typically with the assumptions of risk aversion and covariance of asset and liability returns, could prove of some importance to some of the issues addressed. For those issues in which this is the case, qualifications associated with absence of an explicit treatment of risk in the model are noted. The implications of other simplifying assumptions are also discussed.

To maintain generality at this point, consider a bank that has M different types of deposits and uses deposit and capital funds to purchase securities and make N different categories of loans. I will assume (and note the implications of this assumption below) that variable costs are separable by activity, allowing bank i's profit per unit of time to be expressed as

$$\pi^i = \sum_{n}^{N} (r_L^{in} - c_L^{in}) L_n^i + (r_s - c_s^i) S^i - \sum_{m}^{M} (r_d^{im} + c_d^{im}) D_m^i - C_f^i , \qquad (1)$$

where r_L^{in}, c_L^{in}, and L_n^i represent the interest rate, variable noninterest cost per dollar, and dollar quantity associated with the nth category of loans held by bank i; r_d^{im}, c_d^{im}, and D_m^i denote the same concepts as they apply to the mth category of deposits; and r_s, c_s^i, and S^i are equivalently defined for the securities (treated as a single aggregate security) held by bank i. The term C_f^i represents bank i's fixed costs.

Because individual banks account for a very small part of the market for securities, I follow Klein (1971) and others in assuming that the bank is a price taker in the securities market (hence r_s is not scripted by i).[3] Because of product differentiation and because of the local nature of many loan and deposit markets, bank i is presumed to exercise some market power in pricing its N types of loans and M

[2]See Santomero (1984) for a thorough review.

[3]This assumption is common in models of the banking firm and implies through marginal conditions that the rates associated with all other financial assets and liabilities of the bank are "pegged" to this rate. An alternative situation emphasized by Fama (1985) is the case in which loan demand is strong enough to eliminate all securities from the bank's portfolio held for reasons other than liquidity management, with the marginal cost of funding accounted for by large denomination CDs sold in the national market. Assuming this rate to be invariant with respect to the bank's behavior, the analysis would be similar to that in the text, with the CD rate replacing the security rate.

categories of deposit. At this stage, the markets relevant to each type of loan and deposit are allowed to differ one from another. Consistent with this, loans and deposits emanating from different local markets are counted as different types of loans and deposits.

Bank i is assumed to maximize profits represented by (1) subject to the constraint that assets equal liabilities plus capital, or

$$\sum_{n}^{N} (L_n^i) + S^i = (1 - \rho) \sum_{m}^{M} (D_m^i) + K^i \ , \tag{2}$$

where K^i represents bank i's capital, ρ represents the reserve ratio, assumed to apply to all categories of deposits, and all remaining terms are as previously defined.

2. BANK PRICING BEHAVIOR AND MARKET STRUCTURE

In deriving the relationship between bank prices and market structure, I assume for simplicity that marginal noninterest costs are constant and, as seems reasonable for the banking industry, that some product differentiation exists. Bank i's pricing of both loans and deposits are considered in turn.

Loan Pricing

Solving (2) for S^i, substituting for S^i in (1), and differentiating with respect to r_L^{in} yields the first-order condition:

$$\partial \pi^i / \partial r_L^{in} = L_n^i + r_L^{in} dL_n^i / dr_L^{in} - (r_s + c_L^{in} - c_s^i) dL_n^i / dr_L^{in} = 0 \ , \tag{3}$$

where dL_n^i / dr_L^{in} denotes the change in L_n^i brought about by a unit change in r_L^{in} after accounting for conjectured rival reactions to a price change. Loan categories are presumed to be defined broadly enough to make cross-category price effects negligible, implying, as indicated in (3), that a change in the nth loan rate alters demand only for the nth type of loan.

Defining the elasticity of demand for bank i's nth category of loans as

$$e_L^{in} = - (r_L^{in} / L_n^i)(dL_n^i / dr_L^{in}) > 0 \ ,$$

(3) may be rewritten as

$$r_L^{in} = (r_s + c_L^{in} - c_s^i)[e_L^{in} / (e_L^{in} - 1)] \ . \tag{4}$$

Since all terms in (4) are unaffected by the level of other decision variables under bank i's control, condition (4) alone determines the optimal level of r_L^{in}. This results from the assumptions of separable variable costs, separable loan demands, and infinite elasticity of security supply. Risk aversion, together with imperfect correlation of returns across loan and deposit categories, would also require a departure from this simple treatment. The results of relaxing these assumptions will be discussed below, after more concrete implications of this simple model are developed.

A simple comparative static analysis of this relationship implies that the loan rate is (i) increasing in the security rate, r_s, (ii) increasing in the differential between the marginal noninterest cost associated with nth-category loans, c_L^{in}, and the marginal noninterest cost associated with securities, c_s^i, and (iii) decreasing in the absolute value of the elasticity of loan demand, e_L^{in}. While most of these effects are self explanatory, note that the cost differential between making loans and buying securities, $c_L^{in} - c_s^i$, plays a role in this analysis because the optimal loan rate is determined by the extent to which it is profitable to replace securities with loans in the bank's portfolio.

With elastic demand ($e_L^{in} > 1$) required for $r_L^{in} > 0$, the loan rate will in general be greater than the security rate adjusted for cost differentials, $r_s + c_L^{in} - c_s^i$, but will approach it as e_L^{in} approaches infinity. Since perfect competition or perfect contestability as it applies to the market for the nth category of loans implies that bank i perceives e_L^{in} to be infinite, it follows that

$$r_L^{in} = r_s + c_L^{in} - c_s^i$$

under either perfect competition or perfect contestability. As noted below, however, the assumption of product differentiation implies that loan rates will not fall to this level even in the least concentrated of markets.

Consider next the role of market structure as implied by the SCP paradigm. While there are many alternative routes by which a relationship between the loan rate and market structure may be derived, the following derivation is chosen because it relates most directly to the assumption of product differentiation. I assume first that the change in bank i's nth category of loans perceived to result from a change in its price (r_L^{in}) depends on perceived rival reactions, such that

$$dL_n^i/dr_L^{in} = \partial L_n^i/\partial r_L^{in} + \sum_{j \neq i} \alpha_{ij}^n \, (\partial L_n^i/\partial r_L^{jn}) \, , \tag{5}$$

where r_L^{jn} denotes the rate charged for nth-category loans by competitor j and $\alpha_{ij}^n = dr_L^{jn}/dr_L^{in}$ indicates bank i's conjecture concerning rival j's price reaction as it applies to the nth category of loan, with $\alpha_{ij}^n \leq 1$. Following Waterson (1984, p. 27), a weighted-average price conjecture for bank i is defined as

$$\alpha_i^n = \sum_{j \neq i} \alpha_{ij}^n \left[(\partial L_n^i/\partial r_L^{jn}) / \left(\sum_{k \neq i} \partial L_n^i/\partial r_L^{kn} \right) \right] , \tag{6}$$

where the weights, $[(\partial L_n^i/\partial r_L^{jn})/(\Sigma_{k \neq i}\, \partial L_n^i/\partial r_L^{kn})]$, indicate the relative effects of changes in competitors' prices on bank i's nth-category loans. Rearranging (6) and substituting into (5) yields

$$dL_n^i/dr_L^{in} = \partial L_n^i/\partial r_L^{in} + \alpha_i^n \left(\sum_{j \neq i} \partial L_n^i/\partial r_L^{jn} \right) . \tag{7}$$

Multiplying both sides of (7) by r_L^{in}/L_n^i and rearranging terms yields

$$e_L^{in} = (1 - \alpha_i^n)\, \eta_L^{in} + \alpha_i^n \eta_L^{In} , \tag{8}$$

where η_L^{in} represents the absolute value of the elasticity of demand for bank i's nth category of loans if rivals do not change their price in response to bank i's price change, and η_L^{In} represents the absolute value of the elasticity if rivals completely match bank i's price change. It follows that

$$\eta_L^{in} > \eta_L^{In} ,$$

since increases in competitor loan rates increase the demand for bank i's loans.

A role for market concentration is introduced into the analysis if interdependence is more easily recognized in more concentrated markets. This is perhaps one of the most fundamental notions in all of industrial organization, and invoking it here implies formally that

$$\alpha_i^n = \alpha_i^n(CR_L^n) , \tag{9}$$

with

$$\partial \alpha_i^n / \partial CR_L^n > 0 ,$$

where CR_L^n denotes the level of concentration in the market for the nth category of loans.

Substitution of (9) into (8) and (8) into (4) yields

$$r_L^{in} = (r_s + c_L^{in} - c_s^i)\{\eta_L^{in} + \alpha_i^n(CR_L^n)[\eta_L^{In} - \eta_L^{in}]\} \\ /\{\eta_L^{in} + \alpha_i^n(CR_L^n)[\eta_L^{In} - \eta_L^{in}] - 1\} ,$$

which, among other things, expresses r_L^{in} as a function of CR_L^n. Total differentiation of the relevant first-order condition yields[4]

$$\partial r_L^{in}/\partial CR_L^n = \{[r_L^{in} - (r_s + c_L^{in} - c_s^i)](\eta_L^{In} - \eta_L^{in})(\partial \alpha_i^n/\partial CR_L^n) \\ (L_n^i/r_L^{in})\}/(\partial^2 \pi^i/\partial r_L^{in2}) > 0 . \tag{10}$$

[4]To see this, note that the first-order condition (3) may be expressed as $\partial \pi^i/\partial r_L^{in} = [(1 - e_L^{in}) + (1/r_L^{in})(r_s + c_L^{in} - c_s^i)e_L^{in}]L_n^i = 0$. Substitution of (8) for e_L^{in} and total differentiation yields (10).

The expression in brackets is positive by (4). Assuming the second-order condition for profit maximization, $\partial^2\pi^i/\partial r_L^{in2} < 0$, is satisfied, it follows that $\partial r_L^{in}/\partial CR_L^n > 0$.

Equation (10) formalizes the prediction of the SCP paradigm that the rate changed for nth-category loans increases with concentration in the market for such loans. If we posit $0 \le \alpha_i^n \le 1$ as a realistic range of the price conjecture, where $\alpha_i^n = 0$ implies no expected change in rivals' prices and $\alpha_i^n = 1$ implies that all rivals are expected to fully match bank i's price change, then r_L^{in} will rise with concentration from a potential low of

$$r_L^{in} = (r_s + c_L^{in} - c_s^i)[\eta_L^{in}/(\eta_L^{in} - 1)]$$

with $\alpha_i^n = 0$, to a potential high of

$$r_L^{in} = (r_s + c_L^{in} - c_s^i)[\eta_L^{In}/(\eta_L^{In} - 1)]$$

with $\alpha_i^n = 1$. Note that because the value of η_L^{in} is less than infinite under product differentiation, the value of r_L^{in} observed in even the least concentrated of markets will exceed that of $(r_s + c_L^{in} - c_s^i)$ implied by perfect competition.

Market share is another characteristic that, according to proponents of the SCP paradigm, may correlate with firm market power. Clearly, market share may correlate with firm prices and profits for reasons that have nothing to do with firm market power—reasons that, as discussed more fully below, have formed the basis of some well-known criticisms of the SCP paradigm. Here, however, I treat only that relationship between market share and bank pricing emphasized by a number of proponents of the SCP paradigm. As an example, Shepherd (1986, p. 34) argues that within a market with some product differentiation, "each firm's degree of market power will usually vary directly with its market share," reflecting greater consumer loyalty and scope for restraining rivals and newcomers on the part of firms with higher market shares. This notion may be introduced formally into this analysis by allowing η_L^{in}, the price elasticity prevailing in the absence of a rival price response, to vary inversely with market share, or

$$\partial\eta_L^{in}/\partial MS_i^n < 0 ,$$

where MS_i^n represents bank i's share of the nth-category loan market.[5] Total differentiation of the appropriate first-order condition yields

$$\partial r_L^{in}/\partial MS_i^n = \{[r_L^{in} - (r_s + c_L^{in} - c_s^i)](1 - \alpha_i^n)(\partial\eta_L^{in}/\partial MS_i^n)$$
$$(L_n^i/r_L^{in})\}/(\partial^2\pi^i/\partial r_L^{in2}) > 0 , \quad (11)$$

indicating that this role of market share, as envisioned by the SCP paradigm, results in a positive relationship between market share and the loan rate. Note also that with

[5]Since η_L^{In}, the elasticity of demand if price changes are fully matched, is in essence the market demand elasticity, there is little reason to presume that it varies systematically with market share.

a weighted-average price conjecture (α_i^n) equal to one, the right-hand side of (11) is equal to zero, indicating that market share plays no role in determining the rate charged for *n*th-category loans. This implies, plausibly, that firm-specific market power plays no role in determining price if concentration is such that collusion is total. As discussed below, these predictions may be employed to distinguish empirically between this and other hypothesized relationships between market share and firm behavior.

Deposit Pricing

Consider next the interest rate that bank *i* offers depositors for the *m*th category of deposit, r_d^{im}. Substitution of (2) for S^i in (1) and differentiation with respect to r_d^{im} yields

$$\partial\pi^i/\partial r_d^{im} = - D_m^i - r_d^{im} dD_m^i/dr_d^{im} + [(r_s - c_s^i)(1 - \rho) - c_d^{im}]dD_m^i/dr_d^{im} = 0 \ , \quad (12)$$

where dD_m^i/dr_d^{im} denotes the change in D_m^i brought about by a unit change in r_d^{im} after accounting for conjectured rival reactions to a price change. This equation implies that the optimal r_d^{im} is such that the expense of obtaining an additional dollar of deposits equates with the gain net of costs, $[(r_s - c_s^i)(1 - \rho) - c_d^{im}]$, derived from using that dollar to hold additional securities.

Defining the elasticity of supply for bank *i*'s *m*th category of deposits as $e_d^{im} > 0$, (12) may be rewritten as

$$r_d^{im} = [(r_s - c_s^i)(1 - \rho) - c_d^{im}][e_d^{im}/(e_d^{im} + 1)] \ . \quad (13)$$

As above, a simple comparative-static analysis of (13) implies that the deposit rate is (i) increasing in the security rate, r_s, (ii) decreasing in the marginal cost of handling deposits and securities, c_d^{im} and c_s^i, (iii) decreasing in the reserve requirement, ρ, and (iv) increasing in the elasticity of supply, e_d^{im}. If perfect competition were to prevail, then (with e_d^{im} infinite), the deposit rate would equal the security rate adjusted for costs and reserve requirements, or $[(r_s - c_s^i)(1 - \rho) - c_d^{im}]$. With product differentiation, however (implying a finite e_d^{im}), the value or r_d^m in general will fall short of this level even in the least concentrated of markets.

The relationship between market concentration and bank *i*'s deposit rate decision may be derived in a manner analogous to that of the loan rate decision. This yields[6]

$$\partial r_d^{im}/\partial CR_d^m = - \{ [(r_s - c_s^i)(1 - \rho) - c_d^{im} - r_d^{im}](\eta_d^{Im} - \eta_d^{im}) (\partial\alpha_i^m/\partial CR_d^m)(D_m^i/r_d^{im})\}/(\partial^2\pi^i/\partial r_d^{im2}) < 0 \ , \quad (14)$$

[6]A detailed derivation is available on request.

where CR_d^m, α_i^m, η_d^{im}, and η_d^{Im} denote the level of concentration, the weighted average price conjecture, and the bank-specific elasticities of deposit supply with no expected rival price reactions and with full expected rival price matching, respectively, as they apply to deposit market *m*. With interdependence more easily recognized in more concentrated markets,

$$\partial \alpha_i^m / \partial CR_d^m > 0 \ , \tag{15}$$

the right-hand side of (14) is negative, thus formalizing the prediction of the SCP paradigm that the rate paid for the *m*th category of deposits decreases as concentration in the market for such deposits increases. The relationship between deposit rates and market share (not shown) is equivalent (but opposite in sign) to that derived above for loan rates, under the same assumptions.

Relaxing the Assumptions of the Model

It is at this point useful to consider the differences in implied pricing behavior that would result from relaxation of a number of the assumptions that have made the above analysis a relatively straightforward one. Relaxation of the assumptions of no cross-price effects among loan (deposit) categories, the assumption of separable costs as they apply to different types of loans (deposits), or the assumption of profit maximization in favor of risk aversion with imperfect correlation of returns would allow for interdependence among loan (deposit) rates for reasons other than a common dependence on the security rate. For the purpose of this paper, the implied change of primary interest would be the addition of variables describing conditions in other loan markets (that is, markets other than the *n*th market) to the list of determinants of r_L^{in}, and similarly for deposits. If in addition we relax these assumptions as they apply to the interactions of loans and deposits, then r_L^{in} would be in principal a function of the conditions not only of all the loan markets in which the bank participates but of all the relevant deposit markets as well. Similar implications apply to deposit rates offered by banks. Tests of the validity of the simplifications implied by these assumptions are suggested below.

3. BANK PROFITS AND MARKET STRUCTURE

Although the relationship between bank profits and market structure has been the object of many more empirical studies than has the price-structure relationship,[7] its greater complexity makes it somewhat more difficult to model. In this section, I focus on the relationship between bank profits and market concentration. To derive this relationship, note first that substitution of (2) into (1) allows bank *i*'s profits to be expressed as the sum of the variable profits earned in each type of loan and deposit category plus profits earned directly with capital funds, less total fixed costs, or

[7]See Gilbert (1984) and Rhoades (1982) for detailed reviews.

$$\pi^i = \sum_{n}^{N} [r_L^{in} - r_s - (c_L^{in} - c_s^i)] L_n^i (r_L^{in}, \mathbf{r}_L^{\mathbf{Jn}})$$

$$+ \sum_{m}^{M} [(r_s - c_s^i)(1 - \rho) - c_d^{im} - r_d^{im}] D_m^i (r_d^{im}, \mathbf{r}_d^{\mathbf{Jm}})$$

$$+ (r_s - c_s^i) K^i - C_f^i , \tag{16}$$

where $\mathbf{r}_L^{\mathbf{Jn}}$ and $\mathbf{r}_d^{\mathbf{Jm}}$ denote the vector of rates offered by competitors of bank i for nth-category loans and mth-category deposits, respectively. Since r_L^{in}, $\mathbf{r}_L^{\mathbf{Jn}}$, r_d^{im}, and $\mathbf{r}_d^{\mathbf{Jm}}$ are functions of market concentration, the relationship between profits and market concentration may be expressed more abstractly as

$$\pi^i = \sum_{n}^{N} \pi_L^{in} (CR_L^n) + \sum_{m}^{M} \pi_d^{im} (CR_d^m) + (r_s - c_s^i) K^i - C_f^i , \tag{17}$$

where π_L^{in} and π_d^{im} represent variable profits attributable to category n loans and category m deposits, respectively, with each shown as a function of the level of concentration in the relevant market.

Note that (17) implies that total bank profits are a separable function of a potentially large number of concentration measures that may differ across loan and deposit products as well as across the local markets in which the bank operates. The additivity of this relationship follows from the assumptions of profit maximization, separable costs, no cross-price effects among loan and deposit categories, and a security rate that does not vary with bank i's security holdings. Clearly, these are simplifying assumptions that are likely to be more reasonable in some applications than in others. The assumption of no "cross-price" effects, for example, is more likely to be valid, the broader are the defined loan and deposit categories. Failure of these assumptions to hold would not change the implication that total profits of the bank are a function of the structure of all the markets in which the bank participates. However, since profits attributable to each activity would be dependent on the structure of markets other than the market for the activity itself, the simple additivity expressed by (17) would not follow.

It is straightforward, although somewhat cumbersome, to show that variable profits attributable to each loan and deposit category are a positive function of the level of market concentration relevant to the category. This may be shown for the case of nth-category loans by noting that, as derived in the appendix,

$$\partial \pi_L^{in} / \partial CR_L^n = [r_L^{in} - (r_s + c_L^{in} - c_s^i)]$$

$$\left[\sum_{j \neq i}^{J} (\partial L_n^i / \partial r_L^{jn}) \, \delta_{ij}^n - \sum_{j \neq i}^{J} (\partial L_n^i / \partial r_L^{in}) \, \alpha_{ij}^n \right] (\partial r_L^{in} / \partial CR_L^n) , \tag{18}$$

where $\delta^n = (\partial r_L^{jn}/\partial CR_L^n)/(\partial r_L^{in}/\partial CR_L^n)$ is the ratio of the incremental change in competitor j's price resulting from a change in concentration to that applying to firm i. All other terms are as previously defined. Since the term in the first brackets is positive by (4), it follows that this expression will be positive if

$$\sum_{j\neq i}^{J} (\partial L_n^i/\partial r_L^{jn})\, \delta_{ij}^n > \sum_{j\neq i}^{J} (\partial L_n^i/\partial r_L^{jn})\, \alpha_{ij}^n \,. \tag{19}$$

Since $\partial L_n^i/\partial r_L^{jn} > 0$, a sufficient condition for satisfying (19) is $\delta_{ij}^n > \alpha_{ij}^n$ for all j. Since $\delta_{ij}^n =$ is a ratio of concentration effects exhibited by one firm relative to another, it can clearly take on values that are either greater or less than one and will equal one if the prices of market competitors change proportionately as a result of a change in concentration. If, contrary to assumptions, banking markets were characterized by product homogeneity, then δ_{ij}^n would equal one by virtue of the equality of all rates within the market. Thus firm-specific deviations from $\delta_{ij}^n = 1$ are attributable solely to the heterogeneity assumption. The value of price conjectures represented by α_{ij}^n, however, cannot realistically exceed one (the case in which price changes are expected to be fully matched) and may take on values that include zero (the case of Bertrand competition). Thus condition (19) is not particularly restrictive and should hold in general unless the individual price conjectures, α_{ij}^n, are close to one, in which case monopoly pricing and profits are obtained. Assuming this condition to be met, it follows that $\partial \pi_L^{in}/\partial CR_L^n > 0$.

A similar derivation for the mth deposit category implies that

$$\begin{aligned}\partial \pi_d^{im}/\partial CR_d^m = {} & [(r_s - c_s^i)(1-\rho) - c_d^{im} - r_d^{im}] \\ & \left[\sum_{j\neq i}^{J} (\partial D_m^i/\partial r_d^{jm})\, \delta_{ij}^m - \sum_{j\neq i}^{J} (\partial D_m^i/\partial r_d^{jm})\, \alpha_{ij}^m\right] (\partial r_d^{im}/\partial CR_d^m)\,, \end{aligned} \tag{20}$$

where α_{ij}^m and δ_{ij}^m are defined equivalently to α_{ij}^n and δ_{ij}^n for the case of category m deposits. Since cross-price effects and $\partial r_d^{im}/\partial CR_d^m$ are negative, it follows that if condition (19) (as defined for the deposit market) holds, then $\partial \pi_d^{im}/\partial CR_d^m > 0$. Subject to this condition, we may conclude that, because of the greater recognized interdependence in more concentrated markets as expressed in (9) and (15), the variable profits attributable to each loan and deposit category are a positive function of the level of market concentration relevant to the category. It follows from (17) that total bank profits, π^i, are also (according to the SCP paradigm) a positive function of the level of concentration of each market in which the bank operates.

4. IMPLICATIONS FOR EMPIRICAL STUDIES

This section considers in detail the implications of the above analysis for empirical estimations of the relationship between prices and market structure and profits and market structure in banking. While in a number of cases these implications are not surprising, reference to an underlying model such as that developed above helps to make explicit the simplifications involved in specifying proposed empirical models.

Bank Prices and Market Concentration

Implications for investigations of bank pricing behavior are perhaps the least complicated and most obvious. In explaining bank pricing behavior as it applies to either deposits or loans, an attempt should be made to control for the security rate (in time series), relevant bank cost differences, reserve requirement changes (in deposit rate estimations over time), and any market or bank characteristic that may influence the perceived elasticity of supply (in the case of deposits) or the elasticity of demand (in the case of loans). Market concentration and market share are examples treated above.

Assuming the particular role for market share derived above, an interesting interaction between market share and market concentration may be inferred. This may be seen in the case of loan pricing by rewriting (8) to show functions of concentration and market share:

$$e_L^{in} = [1 - \alpha_i^n(CR_i^n)]\eta_L^{in}(MS_i^n) + \alpha_i^n(CR_i^n)\eta_L^{In} \; .$$

From the definition of η_L^{in} and η_L^{In}, it follows that as market share approaches one, η_L^{in} approaches η_L^{In}. In this case, concentration has no influence on e_L^{in} or the loan rate. Conversely, if concentration is high enough to produce perfect collusion ($\alpha_i^n = 1$), it follows that market share, as envisioned by the SCP paradigm, plays no role in determining e_L^{in} and the bank's loan rate. This implies that a term indicating the interaction of market share with concentration should be considered in bank price regressions, with the coefficient of the interaction term predicted to be opposite in sign to that predicted for the coefficients of market share and concentration.

Also of importance is the issue of what other determinants need to be accounted for in explaining bank pricing. Under the assumptions of the model, loan rate and deposit rate estimations need not include as explanatory variables measures describing the conditions prevailing in other markets in which the bank participates. The reason for this is that all rates under the assumptions of the model are pegged to the security rate but are otherwise independent of each other. With the security rate accounted for (implicitly in cross-section estimations and explicitly in time series), information concerning other markets is irrelevant.

Whether or not these assumptions hold can be tested readily by the inclusion of explanatory variables that pertain to the other markets in which the bank participates. If the other markets in question are thought to be competitive, then the exogenous (loan or deposit) rates observed in those markets are good candidates for inclusion, while (to avoid endogeneity) structure measures should be included in place of observed rates if those markets are not thought to be competitive. The finding of nonzero coefficients of these additional variables would constitute evidence that the simplifying assumptions of the model are violated in a material way. In their time-series analysis of bank commercial loan rates, Slovin and Sushka (1983) employ such a methodology to demonstrate the independence of bank commercial loan rates from developments in deposit markets—a clear implication of the model. More detailed testing of these assumptions in different empirical contexts offers a fruitful avenue for further research.

Bank Profits and Market Concentration

Consider next the implications of the above analysis for estimations of the more complex relationship between profits and concentration. Almost all empirical studies of the concentration-profitability relationship estimate the relationship between concentration and the return on assets or the return on equity rather than the relationship between concentration and total profits. To derive the relationships actually estimated in these studies, consider first the relationship between total profits and concentration and the problems inherent in its estimation. Equations (18) and (20) may be reexpressed in terms of elasticities as[8]

$$\partial \pi_L^{in}/\partial CR_L^n = (1/e_L^{in})(e_L^{in} - \eta_L^{\delta n})(\partial r_L^{in}/\partial CR_L^n)L_n^i > 0 \text{ , and} \tag{21}$$

$$\partial \pi_d^{im}/\partial CR_d^m = -\,(1/e_d^{im})(e_d^{im} - \eta_d^{\delta m})\,(\partial r_d^{im}/\partial CR_d^m)D_m^i > 0 \text{ ,} \tag{22}$$

$$\text{where} \quad \eta_L^{\delta n} = -(r_L^{in}/L_n^i)\left[(\partial L_n^i/\partial r_L^{in}) + \sum_{j\neq i}^{J} (\partial L_n^i/\partial r_L^{jn})\,\delta_{ij}^n\right], \text{ and}$$

$$\eta_d^{\delta n} = (r_d^{im}/D_m^i)\left[(\partial D_m^i/\partial r_d^{im}) + \sum_{j\neq i}^{J} (\partial D_m^i/\partial r_d^{jm})\,\delta_{ij}^m\right].$$

It is obvious from (21) and (22) that, given elasticities, the effects of concentration in the loan and deposit markets depends on the quantity of loans and the quantity of deposits involved. All else equal, an increase in concentration should have a larger impact on the profits of a bank with more loans and deposits than a bank with less loans and deposits. Thus profit regressions require that an adequate method be devised to account for the interaction between concentration and quantity in explaining firm profits. Unfortunately, the observed quantity of loans and deposits cannot be used directly for this purpose, since they are unlikely to be endogenous.

Perhaps because of this problem, most researchers implicitly divide both sides of (17) by total assets or total capital, and then estimate the relationship between market concentration and the return on assets (π^i/A^i) or the relationship between

[8]This may be seen for (21) by noting that the terms in the first brackets in (18) equal r_L^{in}/e_L^{in} [by (4)]. The term in the second brackets in (18) may be shown to equal $(L_n^i/r_L^{in})(e_L^{in} - \eta_L^{\delta n})$. The derivation of (22) is equivalent.

market concentration and the return on capital (π^i/K^i), where A^i represents bank i's total assets. As we will see, however, this does not completely resolve the issue if banks differ in terms of the mix of products that they produce.

Because of the more frequent use of the return on assets as the dependent variable, the foundations for this type of estimation will be examined in detail. Division of (17) by total assets yields

$$\pi^i/A^i = \sum_{n}^{N} \pi_L^{in}/A^i + \sum_{m}^{M} \pi_d^{im}/A^i + (r_s - c_s^i)K^i/A^i - C_f^i/A^i \; . \tag{23}$$

Note first that (23) implies that the capital-asset ratio (K^i/A^i) and the ratio of fixed costs to assets (C_f^i/A^i) should be accounted for in explaining the return on assets. Assessments of the role of concentration in this relationship are complicated by the fact that concentration may influence total assets, A^i, as well π_L^{in} and π_d^{im}. As it turns out, concentration in the loan markets does *not* influence the level of assets in the model, while concentration in the deposit markets does. This implies that, all else equal, changes in deposit-market concentration have a bigger effect on the return on assets than do changes in loan-market concentration.

To see this, consider the balance sheet constraint from (2)

$$\sum_{n}^{N} L_n^i(CR_L^n) + S^i = (1 - \rho) \sum_{m}^{M} D_m^i(CR_d^m) + K^i \; ,$$

where all deposit and loan categories are indicated as functions of the appropriate market concentration measure. The left-hand side indicates bank i's total financial assets, with the amount of securities, S^i, serving as a residual to balance the equation.[9] It follows immediately that since changes in loan market concentration cannot alter either deposits or capital under the model, it does not alter total financial assets. This is not true, however, of deposit market concentration. Because $\partial D_m^i/\partial CR_d^m < 0$ and because CR_d^m does not influence other categories of deposits or capital, it follows that total financial assets are negatively correlated with deposit concentration.[10]

With this consideration included in the analysis, differentiation of (23) with respect to CR_L^n and CR_d^m yields

$$\partial(\pi^i/A^i)/\partial CR_L^n = (\partial\pi_L^{in}/\partial CR_L^n)/A^i > 0 \; , \text{ and} \tag{24}$$

[9]This assumes that the constraint is binding and that capital is either fixed or, like deposits, does not have an infinite supply elasticity.

[10]This result is attributable to the role of securities as a residual. It can be shown that if loan demand were strong enough to make funding with large CDs serve as the residual, then loan market concentration would replace deposit market concentration as a determinant of firm size. Nonfinancial assets are ignored due to their relative unimportance.

$$\partial(\pi^i/A^i)/\partial CR_d^m = (\partial\pi_d^{im}/\partial CR_d^m)/A^i - [\pi^i/(A^i)^2](\partial A^i/\partial CR_d^m) > 0 \,, \tag{25}$$

where $\partial A^i/\partial CR_d^m < 0$. Both CR_L^n and CR_d^m are predicted to have positive effects on the return on assets, but if the nth loan market and the mth deposit market are equivalent in terms of the relationship between concentration and profits, deposit market concentration will register the greater effect on the return on assets.

The analysis thus far has expressed the return on assets as a function of the capital-asset ratio, the ratio of fixed costs to assets, and the level of concentration of each of the potentially large number of markets in which the bank participates.[11] However, data limitations typically allow the researcher to employ only concentration measures calculated from total deposit data. The use of a general deposit measure of concentration to account for the influence of concentration in many different markets may represent a serious compromise if the levels of concentration of the markets in which each bank operates are not highly correlated.

Proceeding under the assumption that one measure of concentration, CR, fits all markets, it follows from (24) and (25) that differentiation of (23) with respect to CR yields

$$\partial(\pi^i/A^i)/\partial CR = \sum_n^N (\partial\pi_L^{in}/\partial CR)/A^i + \sum_m^M (\partial\pi_d^{im}/\partial CR)/A^i - [\pi^i/(A^i)^2]\,(\partial A^i/\partial CR) > 0. \tag{26}$$

Thus the positive relationship between the return on assets and one measure of concentration, as typically estimated in the empirical literature, reflects the summation of the effects of concentration on the profits attributable to each of the bank's activities (divided by assets), plus a positive term reflecting the fact that increments in concentration also serve to reduce bank assets.

Consider next the issue of how the mix of activities participated in by banks can influence the estimated profit-concentration relationship. Substitution of the right-hand sides of (21) and (22) for $\partial\pi_L^{in}/\partial CR$ and $\partial\pi_d^{im}/\partial CR$ in (26) yields

$$\partial(\pi^i/A^i)/\partial CR = \sum_n^N (1/e_L^{in})\,(e_L^{in} - \eta_L^{\delta n})\,(\partial r_L^{in}/\partial CR)L_n^i/A^i + \sum_m^M -(1/e_d^{im})\,(e_d^{im} - \eta_d^{\delta m})\,(\partial r_d^{im}/\partial CR)D_m^i/A^i - [\pi^i/(A^i)^2]\,(\partial A^i/\partial CR) > 0 \,, \tag{27}$$

[11]Any variable that may be expected to influence supply and demand elasticities should, of course, also be included in the analysis.

where all terms are as previously defined. Equation (27) states that the effect of concentration on the return on assets depends on a summation of terms, each containing the ratio of a specific loan or deposit to total assets multiplied by terms reflecting the strength of the relationship between profits and concentration for that activity. Thus, banks specializing in activities for which the variable profit-concentration relationship is weak or nonexistent (for example, nonlocal lending, large CD borrowing) may exhibit a weaker relationship between π^i/A^i and CR than banks not similarly specialized. It follows that estimations of this relationship should attempt to account for the fact that some banks are more heavily involved in activities likely to be affected by local market concentration than are others. Estimating the relationship between concentration and activity-specific variable profits (if empirical proxies can be found) may prove a fruitful alternative in attempting to avoid this potentially important product-mix problem.

Comparisons with Predictions of the Relative-Efficiency Paradigm

While the SCP paradigm has been the primary focus of this paper, consider briefly comparisons of the predictions of this paradigm with those of the relative-efficiency (or efficient-structure) paradigm attributable to Demsetz (1973) and others. The most common form of this alternative view argues that a positive relationship between profits and concentration stems not from market power but from the greater efficiency of firms with larger market shares—a phenomenon that produces both higher concentration and greater profitability. While this form of the relative-efficiency hypothesis yields an equivalent prediction for the concentration-profits relationship, the greater efficiency presumably exercised by dominant firms in more concentrated markets implies, if anything, opposite predictions for the relationship between concentration and price (that is, lower loan rates and higher deposit rates in more concentrated markets).[12] Thus the price-concentration predictions of the SCP paradigm, along with the profit-concentration prediction, allows it to be distinguished empirically from this alternative view.

Within-market studies of the relationship between market share and firm conduct also provide ample opportunity for distinguishing between these two paradigms in banking. The reason is that opposite price and profit predictions result, depending on whether market share is viewed as a proxy for market power (as modeled above) or relative efficiency. Predictions concerning the interaction of market share and

[12]Note from (4) and (13) that to the extent that greater efficiency is reflected in lower marginal costs, lower loan rates and higher deposit rates are implied. These contrasting predictions thus derive from the presumption that, on average, firms in more concentrated markets are more efficient. The assumption of product differentiation is of some importance here, since product homogeneity would imply no differences in prices across markets if there existed a competitive fringe with costs that are invariant across markets.

A less common form of the relative-efficiency hypothesis, based on the proposition that concentration results not from the greater efficiency of large market-share firms but from the greater inefficiency of small market-share firms, yields predictions consistent with the price-concentration predictions of the SCP paradigm but not the positive profit-concentration prediction.

concentration, such as those derived above, may also prove useful in distinguishing between these two alternative views.

5. CONCLUSION

This paper has employed an explicit model of the banking firm to derive and assess critically the relationship between bank conduct and market structure implied by the SCP paradigm. Some of the implications of this analysis are as follows:

The rate charged for each type of loan is increasing in security rates, concentration of the relevant loan market, market share of the relevant loan market, and the differential between the marginal cost associated with loans and the marginal cost associated with securities. Because of product differentiation, the loan rate even in the least concentrated of markets will exceed the security rate adjusted for cost considerations.

The rate offered for each type of deposit is increasing in the security rate and decreasing in concentration of the relevant deposit market, market share in the relevant deposit market, reserve requirements, and the marginal costs associated with handling deposits and holding securities. Because of product differentiation, the deposit rate even in the least concentrated of markets will fall short of the security rate adjusted for costs and reserve requirements.

The roles of market share and concentration, as envisioned under the SCP paradigm, imply that in estimations of the relationship between firm conduct and market structure, a term indicating the interaction of market share with concentration should have a coefficient that is opposite in sign to that predicted for the coefficients of market share and concentration.

Under the assumption of the model, total bank profits are additive in the profits attributable to each of a potentially large number of markets and are therefore a separable function of a potentially large number of concentration measures. All else equal, deposit market concentration will register a greater effect on the return on assets than loan market concentration, since it, unlike loan market concentration, has a negative effect on total assets. The positive relationship between the return on assets and concentration estimated in the empirical literature reflects the summation of the effects of concentration on the profits attributable to each of the bank's activities (divided by assets), plus a positive term reflecting the fact that increments in concentration also serve to reduce bank assets. Estimations of the relationship between the return on assets and concentration should include measures of the capital-asset ratio and the ratio of fixed costs to total assets in the regression and, most importantly, should attempt to account for the fact that some banks are more heavily involved in activities likely to be affected by local market concentration than are others.

Opportunities for distinguishing empirically between the implications of the SCP and relative-efficiency paradigms in banking are also noted.

APPENDIX

The relationship between variable profits and market concentration relevant to the nth category of loans, expressed as (18) in the text, is derived by first differentiating (16) with respect to CR_L^n, yielding

$$\partial \pi_L^{in}/\partial CR_L^n = (\partial r_L^{in}/\partial CR_L^n)\, L_n^i(r_L^{in}, \mathbf{r}_L^{Jn}) + [r_L^{in} - (r_s + c_L^{in} - c_s^i)] \left[(\partial L_n^i/\partial r_L^{in})\,(\partial r_L^{in}/\partial CR_L^n) + \sum_{j\neq i}^{J} (\partial L_n^i/\partial r_L^{jn})\,(\partial r_L^{jn}/\partial CR_L^n)\right] .$$

Factoring out $\partial r_L^{in}/\partial CR_L^n$ yields

$$\partial \pi_L^{in}/\partial CR_L^n = \{L_n^i(r_L^{in}, \mathbf{r}_L^{Jn}) + [r_L^{in} - (r_s + c_L^{in} - c_s^i)]\,[(\partial L_n^i/\partial r_L^{in}) + \sum_{j\neq i}^{J} (\partial L_n^i/\partial r_L^{jn})\,\delta_{ij}^n]\}\,(\partial r_L^{in}/\partial CR_L^n) \,, \tag{A1}$$

where $\delta_{ij}^n = (\partial r_L^{jn}/\partial CR_L^n)/(\partial r_L^{in}/\partial CR_L^n)$ is the ratio of the incremental change in competitor j's price resulting from a change in concentration to that applying to firm i. Adding and subtracting $\Sigma_{j\neq i}^J\,(\partial L_n^i/\partial r_L^{jn})\,\alpha_{ij}^n$ in the second brackets in (A1) and setting the resulting expression for $\partial \pi_L^{in}/\partial r_L^{in}$ equal to zero (implied by first-order conditions) yields (18).

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