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THE EFFECT OF HOLDING COMPANY AFFILIATION
UPON THE SCALE ECONOMIES OF BANKS*

While bank holding companies have existed for nearly a century, only in the past two and one-half decades has the extent and nature of their regulation become one of the most controversial issues within the banking sector. With the passage of the Bank Holding Company Act of 1956, and the subsequent amendments in 1966 and 1970, increasing cognizance has been taken of this form of business organization by regulators and legislators, both state and federal. Increasing concern is being expressed in both the public and private sectors regarding the impact bank holding companies (BHCs) have upon bank structure, conduct, and performance.

The Bank Holding Company Act and its amendments establish the parameters within which the Board of Governors of the Federal Reserve System evaluates requests either to establish a holding company or to permit existing holding companies to acquire one or more banks. The principal competitive concern relates to the probable effect that an acquisition or formation will have upon competition in any relevant banking market. Applications involving adverse competitive effects are denied by the Board unless there is evidence of sufficient public benefits to outweigh the adverse competitive effects.

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This proviso has stimulated a number of research efforts examining the performance of BHCs and their affiliated banks. One of the more frequently studied questions is the effect BHCs have upon the costs of their affiliates. In support of an acquisition, holding companies frequently argue that through affiliation some type of economies in the operation of the acquired bank can be achieved. This may reflect the adoption of new technologies or new organizational methods for the acquired firm. If operating economies do result and can be passed on to the public, then it may be argued that the resulting public benefits are substantial enough to offset, in part or perhaps in whole, any anti-competitive effects inherent in the application. While this argument is frequently presented by holding company applicants, it is less frequently supported by relevant data. Thus, it is the purpose of this paper to explore further the impact of the holding company form of organization upon the costs of production of affiliate banks.

Methodology

The theoretical basis for this study rests upon the proposition that the cost function of a cost minimizing competitive firm is the mirror image of its production function [18, 22, 24]. Thus, if increasing returns to scale characterize the production function, economies of scale should be reflected in the cost function. In order to avoid spurious results, however, it is necessary to specify correctly the cost-output relationship and to measure both cost and output properly.

Three basic approaches have been taken to the study of cost functions in banking. Early studies tended to use an unweighted stock as the measure of bank output--for example, Gramley's use of total assets [8]. Using this sort of measure assumes that the bank produces only one type of output and ignores the multiproduct nature of the banking enterprise.

To remedy this difficulty, more recent analyses have emphasized two other approaches. The first is to assume an independent production function (and thus cost function) for each of the different activities performed by banks. This approach has been taken by Bell and Murphy [1], Benston [2], Longbrake and Haslem [14], and Mullineaux [16, 17]. The main criticism of this approach is that it assumes the production functions for the various bank activities are technologically independent and, as a consequence, (seemingly) defines banking activities too narrowly.

The other approach, taken by Greenbaum [9], Powers [20], Schweitzer [21], and Kalish and Gilbert [13], is to build a weighted index of bank output utilizing items from both the income statement and the balance sheet to produce an estimate of bank output. The regression coefficients obtained by regressing loan revenue against a number of loan categories are viewed as interest rate approximations. These are then used to weight the corresponding loan categories to construct an index of total bank output. It is this methodology which is employed in the present study.

The Present Study

Cross-sectional analysis is used to test the equality of the cost functions of independent and affiliated banks. The sample is comprised of 208 Seventh Federal Reserve District commercial banks participating in the Federal Reserve System's Functional Cost Analysis Program in 1976. Data are taken from the individual bank's Report of Income and Report of Condition for the year 1976. Characteristics of the sample and the subgroups are described in Table I.

Estimating loan revenue. Bank output is defined as estimated loan revenue for a competitive bank plus revenue from securities plus revenue from other sources.¹ Similar to the definition employed by others [9, 13, 20, 21], the first step in estimating loan revenue is to establish index weights for the different loan categories in a bank's portfolio. This is accomplished by deriving a regression equation predicated upon the accounting identity,

$$\text{LNREV} = \sum_{i=1}^n r_i L_i \quad (1)$$

where LNREV is loan revenue, the r_i 's are the interest rates for each loan category, and n is the total number of loan categories.

The objective, however, is to approximate a competitive return as closely as possible. To do so requires the inclusion of those factors hypothesized to cause rates to vary among banks. The following structural factors are selected for inclusion in the estimating equation:

¹Revenue from other sources includes such things as interest on balances with other banks, income from direct lease financing, and trust department income.

TABLE I

CHARACTERISTICS OF BANK SAMPLE

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>TOTAL</u>
Number	28	47	78	34	21	208
Range-Total Assets ^a	5.6/24.9	25/49.9	50/99.9	100/199.9	200/635.1	5.6/635.1
Mean-Total Assets ^a	16.680	36.234	71.016	145.308	345.847	95.73
SMSA	10	24	36	28	21	119
MBHC	2	6	10	6	9	33
OBHC	2	4	15	6	6	33
Range-Lending Output ^a	.26/1.65	1.7/3.7	3.1/6.7	6.2/13.0	13.0/44.9	.26/44.9

^aMeasured in millions of dollars.

Numbers Equivalent (NE) - The inverse of the Herfindahl Index, such that larger numbers imply lower concentration in a market. The relevant market for the purpose of this study is the SMSA if applicable, the county otherwise. While not ideal as a definition, there is ample precedent for its usage. If market concentration is a factor, loan revenue should be negatively related to NE (-).

Growth (GRO) - Defined as the percentage change in total assets from 1975 to 1976. No sign is hypothesized for this variable

Appending these variables to the loan revenue accounting identity, equation (1), the competitive loan revenue equation to be estimated is:

$$\text{LNREV} = a + \sum_{i=1}^n r_i L_i + b_1 \text{NE} + b_2 \text{GRO} + \mu \quad (2)$$

where $n = 16$ and the r_i 's are estimates of the gross yields on the elements in the bank's loan portfolio.²

Recognizing the wide range in the sizes of the banks in the sample, this equation was tested for heteroskedasticity. The most likely cause of heteroskedasticity is the size dispersion of the banks in the sample, which was preliminarily substantiated by an analysis of the residual plot. The Goldfeld-Quandt test was performed by sorting the sample into ascending order according to asset size and then dividing it into three groups: small, medium, and large (76, 56, and 83 observations, respectively). Comparing the adjusted error sum of squares for the large group with the adjusted error sum of squares for the small group, heteroskedasticity was found to be present ($F = 11.996$).

The finding of heteroskedasticity in the residuals indicates that this equation is not an efficient estimator of the regression coefficients and must be respecified. Since bank size appears to be the cause of the misspecification, the remedy chosen is to deflate all variables in equation (2) by total assets. Thus the general form of the normalized

² Some loan categories, as noted in Table II, were combined because they comprised a very small proportion of the balance sheet.

equation to be estimated becomes:

$$\text{LNREV/TA} = a(1.0/\text{TA}) + \sum_{i=1}^{16} r_i (L_i/\text{TA}) + b_1(\text{NE/TA}) + b_2(\text{GRO/TA}) + \epsilon \quad (3)$$

requiring the reciprocal of total assets (1.0/TA) be included in the new equation with the dependent variable being interpreted as loan revenue per dollar of total assets.

Reciprocal of Total Assets (1.0/TA) - There seems to be agreement that larger banks tend to make larger loans at lower interest rates. If so, this variable should be positively related to loan revenue per dollar of assets (+).

Since total assets is not specified as an independent variable in equation (2), 'a' becomes the coefficient of the reciprocal of total assets and there is no intercept term in equation (3). Total assets was considered as an explanatory variables in equation (2) but rejected as it could be collinear with a number of the loan portfolio components resulting in unreliable estimates of their coefficients. When tested for heteroskedasticity, equation (3) showed no evidence of this problem (F = .320).

Estimates for the competitive yields on sixteen loan categories are found in Table II. Most have high t-statistics and seem to be reasonable estimates, with the exception of the rate on mobile home loans which appears lower than one might expect. The years 1974, 1975, and 1976 were, however, marked by rather high delinquency and default rates on this type of loan, a fact that could explain at least in part the small size of this coefficient.

The structure variables GRO and the reciprocal of total assets both enter the equation with the expected sign, the former being significant at the .01 level (two-tail test) and the latter being significant at the .05 level (one-tail test).

The concentration variable, numbers equivalent (NE), included to represent a summary measure of concentration taking account of both the number and size distribution of the firms, has the expected sign but is not statistically significant. Alternative specifications were tried using the Herfindahl Index and also the market share held by each bank. In both cases these variables had the predicted sign, but were not statistically significant.

Estimating loan revenue. The procedure for the calculation of the loan revenue for each bank is predicated on the rearrangement of the terms in equation (3) to solve for the expression $\sum_{i=1}^{16} r_i L_i$. Since the adjustment is not entirely straightforward, $\sum_{i=1}^{16} r_i L_i$ is substituted for $\sum_{i=1}^{16} r_i L_i$ as the amount of loan revenue per bank to be included as part of bank output.

$$\sum_{i=1}^{16} r_i L_i = (\text{LNREV}_j / \text{TA}_j) \text{TA}_j - a(1.0 / \text{TA}_j) \text{TA}_j - b_2 (\text{GRO} / \text{TA}_j) \text{TA}_j \quad (4)$$

where $j = 1, \dots, 208$. Numbers Equivalent (NE) is omitted from the adjustment since its coefficient is not significantly different from zero.

Calculating bank output. As indicated earlier, bank output, (OUTPUT), is defined as the summation of the three items: $\sum_{i=1}^{16} r_i L_i$, the calculated loan revenue for each bank, plus the revenue from securities (SECREV), plus the revenue from other sources (OTHREV).³ Revenue from securities is assumed to be determined in a nearly competitive market, while the components of OTHREV individually comprise a very small percentage of total bank output. Although there could be some monopoly influences operating in these components, the complexities and problems involved in accounting for this influence are prohibitive. Thus, bank output is viewed as the value of credit extended plus the value of other services performed by the bank.

³For the definition of OTHREV, see footnote 1.

The Model

The form of the model selected here as the mode of investigation is a cost function of the Cobb-Douglas type. In its logarithmic form this function has a long history of successful application in the empirical analysis of the cost and production relationships of firms in a wide variety of industries. This equation takes the general form:

$$tc = k q^{1/n} r^{\alpha/n} w^{\beta/n} \quad (5)$$

where $k = n(\alpha\alpha\beta\beta)^{-1/n}$, q = output, r and w are the prices of two different inputs, and $n = \alpha + \beta$. When converted to logarithms equation (5) becomes:

$$TC = K + (1/n)Q + (\alpha/n)R + (\beta/n)W \quad (6)$$

where the capital letters denote the logarithms of the lower case letters in equation (5).⁴ It has been shown by Shephard and Uzawa that there is a unique relationship between the cost function as estimated here and its underlying production function; namely, these are two different, but equivalent ways of looking at the same thing. Two conditions must be met, however. Cost minimization on the part of the firm must be assumed and the prices of the inputs must be included in the cost function.

There are several advantages to the Cobb-Douglas specification of

⁴Nerlove [18, p. 107]. The derivation of the cost function from the production function has had wide exposure in a large variety of literature; consequently this derivation will not be presented here. See, among others, Bell and Murphy [1], Nerlove [18], or Wallis [25].

the cost function. First, it is log-linear with respect to output and the input prices, so that the coefficients can be interpreted as elasticities, although a disadvantage is that these coefficients are constant over the range of observations of the sample. Second, this functional form can accommodate increasing, decreasing, or constant costs and often, erroneously, an estimate of the degree of homogeneity of the production function (returns to scale) is derived by taking the reciprocal of the coefficient of the output variable.⁵ Last, this form also tends to reduce heteroskedasticity in the data.

Cost of loan output. The definition of the dependent variable, the cost of loan output (CLO), for the banks as employed in this study is the same as that used by Schweitzer [21], namely, the "bank's total operating expenses, less service and exchange charges on deposit accounts" (p. 259). These charges are a reimbursement of the costs incurred in acquiring one of the inputs (demand deposits), and represent an approximation, although admittedly a deficient approximation, of the costs incurred by the bank in clearing checks. To the extent clearing costs actually exceed these charges, they should be included in the cost of loan output. While this definition can be criticized,

⁵It is frequently stated that the reciprocal of the coefficient of the output term represents the degree of homogeneity of the production function. For example, an output coefficient of .944 supposedly implies a production function homogeneous of degree 1.059. If the error term, ϵ , has a log-normal distribution, and the usual assumptions about the error term are made, the regression coefficients are unbiased, efficient, and consistent. Taking the reciprocal of the regression coefficient, however, involves a non-linear operation which does not result in an unbiased estimate of n since $E(1/b)$ does not equal $1/E(b)$. See Wallis [25].

the alternatives appear less desirable.

Independent variables. The output variable (OUTPUT) is defined and calculated in the previous section. Several other variables are hypothesized to play a role in determining bank costs. As indicated, the prices of inputs must be included to maintain the unique relationship between the cost function and the production function, despite the fact that their inclusion in other studies has not shown them to have a significant impact. Unfortunately, the prices of only two inputs, time and savings deposits and labor, could be approximated with any degree of accuracy.

Price of Time Deposits (PRIDEP) - Calculated by dividing total interest paid on time and savings deposits by total time and savings deposits. The average rate of interest should be positively related to the cost of loan output (+).

Price of Labor (WAGE) - Calculated by dividing total salaries by the number of employees. This variable should also be positively related to the cost of loan output (+).

Because no estimate of nor proxy for the price of capital could be found, it is assumed constant over the sample of banks.

Another factor considered potentially important in influencing bank costs is whether the bank is located in an SMSA:

SMSA - An intercept dummy with a value of 1 if the bank is in an SMSA, 0 otherwise. If competition is greater in SMSAs than in non-SMSAs, banks located in SMSAs may be required to make larger expenditures for advertising or they may be required to offer more services, or both. This variable should be positively related to total cost (+).

Of the 208 banks included in this study, 66 are affiliated with a bank holding company; thirty-three are owned by one-bank holding companies (OBHC) and a like number are subsidiaries of multibank holding

companies (MBHC). As there is no a priori reason to anticipate that similar traits will characterize both types of affiliates, the sample is grouped by the form of organizational structure: independent, OBHC affiliates, and MBHC affiliates.

To test whether the organizational form has any impact upon the scale economies of the individual bank, a multiplicative dummy variable is introduced for each type of holding company affiliate. $OBHCD = (OUTPUT \cdot D)$ where D takes on a value of 1.0 for affiliates of one-bank holding companies and zero otherwise and $MBHCD = (OUTPUT \cdot D)$ where D takes on a value of 1.0 for multibank affiliates and zero otherwise. Consequently, the coefficient of the output term (OUTPUT) represents the elasticity of cost with respect to output for independent banks. The coefficients of these multiplicative dummy variables measure the magnitudes of the differential scale effects attributable to the different organizational forms.

In addition, the coefficient of either slope dummy can be combined linearly with the coefficient of the output variable. A t-test can then be performed on the resultant coefficient to determine if it is significantly different from unity, thereby implying economies or diseconomies of scale.⁶

⁶The significance test for a linear combination of the regression coefficients takes the form:

$$t = \frac{w'b - w_0}{s \sqrt{w'(X'X)^{-1}w}}$$

with $w'b$ representing the sum or difference of the two coefficients under consideration. In this instance the null hypothesis is that $w_0 = \text{unity}$, subject to a two-tail test. See Theil [23, p. 138].

The final factor taken into account is the impact of branching upon the costs of the individual bank.

BR₁ - Five intercept dummy variables with a value 1 for each branch up to five with BR₅ representing five or more branches. Branch offices should increase the cost of operations for the individual bank through increased overhead and problems that arise coordinating the operations of multiple offices. This variable should be positively related to total cost (+).⁷

The cost function thus takes the form,

$$\begin{aligned} \log \text{CLO} = & \alpha + b_1 \log \text{OUTPUT} + b_2 \log \text{PRIDEP} + b_3 \log \text{WAGE} + b_4 \text{SMSA} \\ & + b_5 \text{MBHCD} + b_6 \text{OBHCD} + b_7 \text{BR}_1 + b_8 \text{BR}_2 + b_9 \text{BR}_3 + b_{10} \text{BR}_4 \\ & + b_{11} \text{BR}_5 + \epsilon \end{aligned}$$

with $\alpha = \log 'a'$ and incorporating the prices of all omitted factors of production. The regression coefficients represent elasticities and the error term, ϵ , is assumed to be independent and normally distributed with a mean of zero and a constant variance, σ^2 .

The Results

The regression results for the total sample and for the five subsamples are presented in Table III and Table IV. The adjusted coefficients of determination suggests that for the entire sample and the subgroups both specifications do a good job in explaining the variation in total cost. The following discussion will center around Table III and will first focus upon the total group and then upon the subgroups.

⁷An alternative specification is to include only one intercept dummy variable with a value of 1 if the bank has branches, 0 otherwise. These regression results are shown in Table IV. As can be seen, alternative specification does result in some change in the other variables, but does not alter the basic conclusions.

The Total Sample. The overall equation gives evidence that there are statistically significant, but not substantial, economies of scale accruing to independent banks over the range of observations. The scale coefficient of .944 implies that there are increasing returns to scale for the production function. The equation also suggests that banks located in SMSAs tend to incur higher costs than non-SMSA banks. As indicated, this could be due to greater competition necessitating greater advertising, more (free) services or both.

Examination of the branching dummies indicate that banks with three or more branches tend to have higher costs than banks with fewer than three branches. The branching dummy in Table IV suggests, however, that banks with branches, in general, have higher costs than do banks without branches.

Since the coefficient of the multiplicative output dummy variable, MBHCD, is positive and significantly different from zero (although marginal at the 10 per cent level), it appears that banks belonging to multibank organizations have a smaller degree of scale economies than do independent banks. When the coefficients of OUTPUT and MBHCD are combined linearly ($.944 + .015 = .959$), the resulting coefficient is significantly different from unity ($t = 4.074$). This means that multibank affiliates, for the total sample, are characterized by decreasing costs but the scale coefficient is closer to unity than that of independent banks.

In contrast, the multiplicative dummy representing one-bank affiliates is not significantly different from zero, but the test on the linear combination of the coefficients of OUTPUT + OBHCD ($.944 + .003 = .947$) indicates the resultant coefficient is significantly different from unity

($t = 4.291$). One-bank affiliates, therefore, share the same production function as independent banks.

Small and Medium Small Banks. For Groups A and B, constant returns to scale seem to prevail. Representing output up to approximately \$3.7 million and assets up to \$50.0 million, the scale coefficient of neither group of banks is significantly different from unity. Also, neither of the dummy output variables is significantly different from zero for either group. When the coefficient of the dummy output variables are combined with the output coefficient and tested, none are found to be statistically different from unity. Thus the two smallest size classes appear characterized by a cost function exhibiting constant costs, regardless of organizational structure.

Medium Banks. The medium size group, Group C, shows some interesting properties. The scale coefficient indicates that independent banks are recipients of rather substantial scale economies with an elasticity coefficient of .868 implying a production function characterized by increasing returns. Furthermore, the model indicates that banks in this group located in SMSAs incur significantly higher costs than do non-SMSA banks.

The coefficient of the output dummy for multibank affiliates, while not significantly different from zero, is statistically different from unity when combined linearly with the coefficient of OUTPUT ($t = 2.460$). This indicates that multibank affiliates and independent banks in this size class share the same production function. The coefficient of OBHCD, on the other hand, is statistically different from zero and when combined with the output coefficient shows that one-bank affiliates display greater scale economies than do independent banks ($t = 3.394$)

and thus do not share the same production function.

Medium Large Banks. The regression results from the medium large group, Group D, give evidence of some economies of scale accruing to independent banks (.902) although less than that for medium size banks. The production function is therefore subject to increasing returns.

With regard to the other explanatory variables the price of time and savings deposits (PRIDEP) takes on statistical significance for the first time and has the correct sign. The dummy variable denoting banks with five or more branches (BR_5) is also statistically significant and indicates that these banks tend to have higher costs. In addition, Table IV suggests that medium large banks with branches tend to have higher costs overall.

Neither of the two output dummy coefficients is statistically different from zero, but, when added to the output coefficient, both are different from unity. This indicates that multibank and one-bank affiliates have the same elasticity of cost with respect to output as do independent banks ($t = 1.915$ and $t = 1.778$, respectively).

Large Banks. The last group, Group E, represents banks larger than \$200 million in assets and \$13 million in output. These banks are characterized by constant costs since the output scale coefficient is not significantly different from unity. As might be expected with banks of this size, all are located in SMSAs and consequently this variable is not included in the equation.

The branching dummies suggest that large banks with branches do not incur higher costs until the number of branches is at least five, although this is still not a statistically significant difference. Once again, however, the branching dummy in Table IV indicates that large banks with

branching systems have significantly higher costs than do large banks without branching systems. The reconciliation of these results is not completely apparent.

The multiplicative dummy output variables, when combined with the output variable for independent banks, are not significantly different from unity. Thus it appears that the production function is essentially the same for all banks in this size class, regardless of whether they are independent or affiliated with a one-bank or a multibank holding company, and that this cost is characterized by constant costs.

Summary and Conclusions

Least squares estimates of the scale coefficients in this study indicate that some moderate economies of scale are exhibited by independent banks, but that these economies manifest themselves primarily in the medium and medium large banks.

The more important question hinges on the impact of affiliation upon the cost functions of banks and whether the introduction of scale economies can be considered as a possible offset to any anticompetitive consequences inherent in the acquisition of a bank or the formation of a bank holding company.

This question rarely arises in the case of one-bank holding companies, by their very nature. Nevertheless, by way of recapitulation, it appears that one-bank holding company affiliates do not, with a single exception, have cost functions significantly different from those of independent banks. The exception is the case of medium size banks, where affiliates exhibit greater scale economies. Since total operating costs, as defined here, do not include taxes, this result cannot be

attributed to any tax advantage accruing from the holding company form of organization. It could be attributable to greater diversification or specialization on the part of the holding company, but this assumes that holding companies participate in a larger number of nonbank activities than do independent banks.⁸

For banks belonging to multibank holding companies the situation is completely different. The question of whether inherent anticompetitive effects can be offset by scale economies takes on a premiere role. The evidence found here suggests that, overall, multibank affiliates actually have a scale coefficient closer to unity than do the other two organizational forms. Medium and medium large affiliates in particular exhibit scale economies but only to the degree as independent banks. It would thus appear that the often voiced argument that some economies of scale can be achieved through affiliation which are not available to independent banks is without foundation. At best, the affiliate can only expect to achieve the same degree of scale economies.

The concept of minimum optimal scale is a crucial one for micro-economic theory and for industrial organization in particular. Analysis of the subgroups presented in Table III indicates that long-run total cost is increasing less than proportionately to output only in the medium and medium large groups. Since the output coefficients for these two groups are approaching unity from below, and since the output coefficient for the large group is not significantly different from unity, it appears

⁸This assumption is not as obvious as it might first appear, since national banks, and probably many state banks, can participate in nearly all the nonbank activities that holding companies can, and some that holding companies cannot. See [Drum].

that long-run average cost reaches a minimum, and thus minimum optimal scale is achieved, somewhere in the upper range of the medium large group (i.e., around \$200 million in assets). This conclusion holds regardless of the organizational form under consideration.

The estimate for the overall scale economies for unit banks is quite similar to that found by both Bell and Murphy [1] and Schweitzer [21] and is close to that found by Mullineaux [17], although another study by Mullineaux [15] found substantially greater scale economies. Comparison of the subgroup results with other studies is not possible as there are no other studies with comparable subgroups.

While the evidence here indicates that the cost curve for multibank affiliates lies above that of unit banks, which is consistent with the findings of Kalish and Gilbert [13], it contradicts, in part, the findings of Schweitzer [21], who found that banks belonging to large bank holding company groups incur lower costs than do independent banks. Mullineaux [17] found that affiliation with a group increases the costs of branch banks but leaves the costs of unit banks unchanged.

Last, whether a bank has a branching system or not appears to play an important role in explaining the costs incurred by banks in general and medium large and large banks in particular. Since this coefficient is positive in all cases, it indicates that there are some organizational diseconomies associated with branching, a finding consistent with a number of other studies. Since this sample is drawn from states allowing only limited branching or limited service branching, this conclusion cannot be extended for cases involving statewide branching.

TABLE II
ESTIMATE OF LOAN REVENUE EQUATION

<u>Variable</u> ¹	<u>Coefficient</u>	<u>t-Value</u>
Loans for Construction	.0868	4.566
Loans Secured by Farmland	.0955	8.085
Residential Real Estate Loans - Single and Multi-Family, Insured	.0795	3.317
Residential Real Estate Loans - Single and Multi-Family, Conventional	.0815	26.504
Nonfarm, Nonresidential Real Estate Loans	.0861	12.436
Loans to other Financial Institutions (Including REIT and Mortgage Companies)	.0500	2.173
Loans to Farmers	.0640	20.264
Commercial and Industrial Loans	.0807	24.877
Automobile Loans	.0964	13.657
Loans for Credit Card and Revolving Credit Plans	.1626	9.691
Mobile Home Loans	.0544	4.085
Loans for Other Retail Consumer Goods	.1117	5.660
Loans for Repair and Modernization	.0681	3.606
Other Instalment Loans	.0988	7.258
Single-Payment Loans	.0649	8.223
All Other Loans ²	.0499	3.839
Reciprocal of Total Assets	.0388	1.875
Growth	-.0005	3.078
Number of Equivalent	-.0012	.480
⁻² R	.9957	
Standard Error	.0029	
F	2546.0	
d.f.	189	

¹All loan categories are taken as a percent of total assets.

²Comprised of the categories: All Other Loans, Loans to Domestic Commercial Banks, Loans to Banks in Foreign Countries, Loans to Brokers and Dealers in Securities, and Loans for Purchasing and Carrying Securities.

TABLE III

ESTIMATED COST FUNCTION FOR ALL BANKS AND SUBGROUPS

<u>Variables</u>	<u>ALL BANKS</u>	<u>GROUP A</u>	<u>GROUP B</u>	<u>GROUP C</u>	<u>GROUP D</u>	<u>GROUP E</u>
Intercept	.009 (.105)	.175 (.547)	.084 (.272)	-.040 (.264)	-.188 (.799)	-.186 (.366)
OUTPUT*	.944 ^b (5.914) ^b	.861 (1.645)	1.021 (.236)	.868 ^b (2.809) ^b	.902 ^b (1.867) ^b	.938 (1.068)
PRIDEP	-.070 (.783)	-.153 (.576)	-.373 (1.011)	.176 (.942)	.212 (.770)	.179 (.324)
WAGE	-.008 (.199)	0.113 (.715)	.103 (.907)	-.080 (1.111)	.035 (.422)	.039 (.224)
SMSA	.019 ^a (3.167) ^a	-.011 (.336)	.023 (1.459)	.028 ^a (3.087) ^a	-.002 (.121)	--
MBHCD	.015 ^b (1.667) ^b	.625 (1.574)	.039 (.590)	.012 (.672)	.001 (.031)	.012 (.764)
OBHCD	.003 (.355)	-.859 (.929)	.089 (1.130)	-.030 ^b (1.962) ^b	-.002 (.137)	.005 (.289)
BR ₁	.011 (1.447)	.021 (.540)	.008 (.480)	.012 (1.007)	.010 (.733)	.053 (1.598)
BR ₂	.003 (.266)	.064 (1.448)	.007 (.285)	-.012 (.919)	.025 (1.038)	.019 (.426)
BR ₃	.019 ^b (1.907) ^b	.064 (.835)	.010 (.356)	.020 (1.481)	.016 (1.112)	.002 (.047)
BR ₄	.029 ^b (2.166) ^b	--	.049 (1.366)	.014 (.765)	.026 (1.327)	.023 (.608)
BR ₅	.035 ^b (3.480) ^b	--	--	.024 ^b (1.775) ^b	.039 ^b (2.265) ^b	.035 (1.725)
\bar{R}^2	.990	.909	.784	.860	.930	.973
SEE	.038	.052	.045	.034	.024	.028
F	1887.2	31.0	17.7	44.0	40.6	73.8
d.f.	196	18	36	66	22	10

^aSignificant at the .05 level (one-tail test).

^bSignificant at the .10 level (two-tail test).

^cTested against the null hypothesis that $b_1 = 1.0$.

Figures in parentheses are t-ratios.

TABLE IV
ESTIMATED COST FUNCTION FOR ALL BANKS AND SUBGROUPS

<u>Variables</u>	<u>ALL BANKS</u>	<u>GROUP A</u>	<u>GROUP B</u>	<u>GROUP C</u>	<u>GROUP D</u>	<u>GROUP E</u>
Intercept	.020 (.239)	.185 (.757)	.021 (.075)	-.044 (.289)	-.301 (1.410)	-.391 (1.324)
OUTPUT*	.951 ^b (5.291) ^b	.869 (1.663)	1.033 (.412)	.878 ^b (2.601) ^b	.904 ^b (2.069) ^b	.964 (.806)
PRIDEP	-.075 (.829)	-.154 (.695)	-.275 (.806)	.188 (1.019)	.404 ^a (1.731) ^a	.369 (1.080)
WAGE	-.020 (.477)	-.125 (.980)	.090 (.866)	-.093 (1.302)	.018 (.232)	.074 (.568)
SMSA	.019 (2.997) ^a	-.004 (.172)	.025 (1.604)	.030 (3.244) ^a	-.012 (.905)	--
MBHCD	.016 ^b (1.801) ^b	.642 (1.681)	.026 (.419)	.013 (.739)	-.001 (.108)	.003 (.205)
OBHCD	-.001 (.068)	-.834 (.958)	.086 (1.134)	-.032 ^b (2.152) ^b	.002 (.152)	.005 (.362)
BRANCH	.015 ^b (2.589) ^b	.041 (1.383)	.011 (.788)	.011 (1.250)	.019 ^b (2.141) ^b	.037 ^b (2.265) ^b
\bar{R}^2	.990	.914	.793	.855	.943	.978
SEE	.038	.051	.044	.034	.023	.025
F	2892.8	42.2	26.2	65.8	68.1	149.6
d.f.	200	20	39	70	26	14

^aSignificant at the .05 level (one-tail test).

^bSignificant at the .10 level (two-tail test).

*Tested against the null hypothesis that $b_1 = 1.0$.

Figures in parentheses are t-ratios.

BIBLIOGRAPHY

1. Bell, F. W. and N. B. Murphy. Costs in Commercial Banking: A Quantitative Analysis of Bank Behavior and Its Relation to Bank Regulation. Research Report Number 41. Boston: Federal Reserve Bank of Boston, 1968.
2. Benston, G. J., "Branch Banking and Economies of Scale," Journal of Finance, May 1965, pp. 312-331.
3. Benston, G. J., "Economies of Scale of Financial Institutions," Journal of Money, Credit, and Banking, May 1972, pp. 312-341.
4. Benston, G. J., "The Optimal Banking Structure: Theory and Evidence," Journal of Bank Research, Winter 1973, pp. 220-237.
5. Daniel, D., W. A. Longbrake and N. B. Murphy, "The Effects of Technology on Bank Economies of Scale for Demand Deposits," Journal of Finance, March 1973, pp. 131-146.
6. Drum, D. S., "Nonbanking Activities of Bank Holding Companies," Economic Perspectives, Federal Reserve Bank of Chicago, March/April, 1977, pp. 12-21.
7. Ferguson, C. E. The Neoclassical Theory of Production and Distribution. Cambridge: Cambridge University Press, 1969.
8. Gramley, L. E. A Study of Scale Economies in Banking. Kansas City, Mo.: Federal Reserve Bank of Kansas City, 1962.
9. Greenbaum, S. I., "A Study of Bank Costs," National Banking Review, June 1967, pp. 415-434.
10. Heggstad, A. H. and J. J. Mingo, "The Competitive Condition of U.S. Banking Markets and the Impact of Structural Reform," Journal of Finance, June 1977, pp. 649-661.
11. Hester, D. D. and J. F. Zoellner, "The Relation Between Bank Portfolios and Earnings: An Econometric Analysis," Review of Economics and Statistics, November 1966, pp. 372-386.
12. Johnston, J. Econometric Methods, 2nd Edition. New York: McGraw-Hill Book Co., 1972.
13. Kalish, L. and R. A. Gilbert, "An Analysis of Efficiency of Scale and Organizational Form in Commercial Banking," Journal of Industrial Economics, July 1973, pp. 293-307.
14. Longbrake, W. A. and J. A. Haslem, "Productive Efficiency in Commercial Banking," Journal of Money, Credit, and Banking, August 1975, pp. 317-330.
15. Mullineaux, D. J., "Economies of Scale and Organizational Efficiency in Banking: A Profit-Function Approach," Journal of Finance, March 1978, pp. 259-280.

16. Mullineaux, D. J., "Economies of Scale of Financial Institutions," Journal of Monetary Economics, April 1975, pp. 233-240.
17. Mullineaux, D. J., "Unit vs. Branch Banking: An Analysis of Relative Costs," in Changing Pennsylvania's Branching Laws: An Economic Analysis. Philadelphia: Federal Reserve Bank of Philadelphia, 1973.
18. Nerlove, M., "Reduced Form Estimation: Returns to Scale in Electricity Generation," Chapter VI in Estimation and Identification of Cobb-Douglas Production Functions. Chicago: Rand McNally & Co., 1965, pp. 101-131.
19. Plotkin, I. H., "The Determinants of Commercial Bank Operating Costs: An Econometric Analysis of Activities and Services," Unpublished Ph.D. Dissertation, Department of Economics, Massachusetts Institute of Technology, 1968.
20. Powers, J. A., "Branch vs. Unit Banking: Bank Output and Cost Economies," Southern Economic Journal, October 1969, pp. 153-164.
21. Schweitzer, S. A., "Economies of Scale and Holding Company Affiliation in Banking," Southern Economic Journal, October 1972, pp. 258-266.
22. Shephard, R. W. Cost and Production Functions. Princeton: Princeton University Press, 1953.
23. Theil, H. Principles of Econometrics. New York: John Wiley & Sons, Inc., 1971.
24. Uzawa, H., "Duality Principles in the Theory of Cost and Production," International Economic Review, May 1964, pp. 216-220.
25. Wallis, K., "The Production Function," Chapter 2 in Topics in Applied Econometrics. London: Gray-Mills Publishing, Ltd, 1973, pp. 25-62.