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The Cost Structure of the Consumer Finance Industry

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Abstract

This paper estimates the cost function of the consumer finance company industry to explore the questions of existence of scale economies and elasticity of costs by loan size. Using a more appropriate functional form and much newer data than in earlier studies, this study confirms their general conclusion that economies of scale in the industry are limited at the firm level but exist at the office level. Scale economies are found only at smaller offices, however; and they become exhausted as office size increases. Elasticity of operating costs with respect to loan size is shown to be well less than unity.

Erosion of market segmentation in consumer financial services in recent years inevitably raises the issue of future industry structure. If new opportunities to expand produce declining unit costs, a few large firms may come to dominate the market, possibly with adverse effects on market competition. If, large firms have no cost advantage, there will be more firms of various sizes, unless entry is artificially restricted.

In examining the costs of suppliers of financial services, researchers have focused most of their attention on commercial banks and savings and loan associations (SLAs).[1] Undoubtedly, the size and importance of these types of financial institutions account for this attention (along with the existence of readily available data), but focusing solely on banks and SLAs misses much of the picture. Particularly noticeable is the absence of recent studies of consumer finance companies, which hold the second largest share of consumer installment credit (after commercial banks).

The same issues of costs, market structure, and potential competitive impacts that arise concerning banks and SLAs also surface in the case of the consumer finance industry. Long regarded as specialized and possibly old fashioned, consumer finance companies recently have attracted other institutions' attention because of the finance companies' branch systems, which have always been largely free from regulators'

[1] .For an overview of the research and references, see Clark (1988), Humphrey (1990), or Berger, Hunter, and Timme (1993).

geographical restraints, and because of their profitability during some difficult times for banks and SLAs. By themselves these features should focus competitive attention on finance companies' cost structure. More generally, however, as financial-product market segmentation continues to break down, all market participants must become more aware of their own and competitors' costs if they are to survive and prosper.

Despite this, researchers have undertaken relatively few cost studies of the consumer finance industry, especially recently.[2] The major previous effort was by George Benston (1972b) for the National Commission on Consumer Finance. Benston concluded from his statistical work that, because scale economies at the firm level were slim to nonexistent, "large companies, as such, are unlikely to dominate the industry because of a 'natural' cost advantage (1972b, p. 153).[3] This view has become the conventional wisdom and has been consistent with casual observation that both large and small consumer finance companies compete in various markets. The question is whether, more than 20 years later, changing conditions (for example, advances in information and computer technology) might produce a different outcome and another conclusion.

Two possibilities suggest themselves. First, technological changes in both risk management and loan administration in the last quarter century might argue for existence of larger scale economies than in the past. Large firms, for example, might have better access to sophisticated mathematical credit scoring and other new and expensive techniques for credit evaluation. Likewise, larger firms might be better able to afford computerized marketing, record keeping, and collection procedures and equipment. If such techniques and equipment improved the productivity of large firms relatively more than small ones, economies of scale might be more evident recently than decades ago.[4] Second, if, in contrast, new technology today is as available to small firms as to large, then economies of scale might not be more evident recently than further in the past, even if large and small firms both might operate more efficiently today. Even though the former of these two possibilities might seem more likely, certainly the other possibility remains distinctly possible. Ultimately, the issue of scale economies is an empirical question to be answered by appealing to the data.

The purpose of this paper is to estimate the cost function for the consumer finance company industry using a more appropriate functional form than that employed in older studies and using much newer data. This estimation will pen-nit exploration of the issue of scale economies in this industry as well as discussion of costs by size of loan. Both explorations should be useful for analyzing consumer lending because finance company lending activities produce cost data that are relatively uncontaminated by other products and influences.

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[2] The most recent studies are by Benston (1972b, 1977a, 1977b) using 1968-1970 data.

[3] Durkin and McAlister (1977) found similar results in a regional study using a similar methodology.

[4] Rogers (1974), Longbrake (1974)" , and Lawrence and Shay (1986) investigated the effect of computers on the cost of consumer lending at commercial banks. The data are from commercial banks participating in the Federal Reserve's Functional Cost Analysis Program, and the most recent of these studies uses data from 1979-1982. The results of these studies suggest that labor and computers were substitutes. They found little or no overall cost savings and no difference in estimates of scale economies attributable to the use of computers. Because of substantial innovation in computer technology since that time, these results are probably dated.

The remainder of this paper is divided into three sections. Section 2 discusses the functional form of the estimation equation and describes the data to be used. Section 3 presents the empirical results, and section 4 offers a brief summary and conclusions.

2. Functional form and data

Four important questions arise in any attempt to estimate statistical cost relationships: (1) identification of the production or cost function; (2) the proper specification of the production or cost relations; (3) the definition of output; (4) the availability of data appropriate for estimation.

2.1. Identification

In most cases, estimates of long-run cost curves and scale economies are possible only by using cross sections of firms in an industry. This involves the implicit assumption that the observations trace out the cost curve for a typical firm, although no one firm is followed over the whole range of output. Bell and Murphy (1968) and Benston (1972a) have argued that a long-run cost function is identified for a cross section of financial firms because it is reasonable to assume that the level of output is exogenous.[5] Finns have no access to secret technology or processes that might provide them an inherent production advantage over their rivals. Therefore, demand is not cost determined but rather the opposite. Although technological changes in credit granting and marketing functions might appear to suggest that some firms could have a cost advantage, the technology, including automated credit scoring, is well known to all and widely available through credit bureaus. It is still true that each branch office operates in its own local market subject to the vagaries of demand in its own area.[6] In effect, companies compete in a succession of local markets with basic technology that is known to all. Under these circumstances, local demands for loans determine the level of output. The cost function can be estimated by a single equation using cross-section data on costs and output. This approach seems appropriate and is adopted here.

2.2. *Specification of cost relations*

The single-product nature of the consumer finance company industry simplifies specification of the cost relationship.[7] Consumer finance companies, of course, are financial intermediaries that have a source and use of funds, but unlike the depository and insurance-type intermediaries, whose sources of funds (deposits, policies, pension plans) are products in themselves, the consumer finance companies' funds sources (bonds and commercial paper issued locally and on Wall Street) are largely incidental to the lending function, at least in terms of costs. Therefore, arbitrary cost allocations are unnecessary. Similarly,

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[5] The level of output is not entirely exogenous, however. Firms can affect demand by advertising and promotions.
[6] For discussion of the local nature of the market for consumer financial services, see Elliehausen and Wolken (1992).
[7] See Baumol, Panzar, and Willig (1982) for a general discussion of multiproduct cost functions. Clark (1988) and Humphrey (1990) discuss recent studies of costs at depository institutions.

if consumer finance companies produce only one product, there can be no output-cost complementarities or scope economies, and scale and scope economies do not confound.[8]

Total operating costs are a function of input prices and output, with output homogeneity and company structure variables to account for differences in types of loans extended and branch structure among companies. The empirical model estimated here employs the translog cost function, which includes all of the cross products to allow for interactions. [9]

The translog cost function to be estimated is shown in equation 1:

$$\begin{aligned}\ln C = {} & a_0 + a_Q \ln Q + \tfrac{1}{2} b_{QQ} (\ln Q)^2 + a_L \ln P_L + a_K \ln P_K + \tfrac{1}{2} b_{LL} (\ln P_L)^2 \\ & + \tfrac{1}{2} b_{KK} (\ln P_K)^2 + b_{LK} \ln P_L \ln P_K + b_{QL} \ln Q \ln P_L + b_{QK} \ln Q \ln P_K + d_A \ln A \\ & + \tfrac{1}{2} d_{AA} (\ln A)^2 + d_{AQ} \ln A \ln Q + d_{AL} \ln A \ln P_L + d_{AK} \ln A \ln P_K \\ & + d_0 \ln O + \tfrac{1}{2} d_{QQ} (\ln O)^2 + d_{AO} \ln A \ln O + d_{OQ} \ln O \ln Q \\ & + d_{OL} \ln O \ln P_L + d_{OK} \ln P_K \ln O, \qquad (1)\end{aligned}$$

where
C = total operating cost;
Q = output quantity;
P_L = price of labor;
P_K = price of capital;
A = average size of loans made;
O = total number of branch offices.

To correspond to a well-behaved production function, a cost function must be positively linearly homogeneous in input prices. This theoretical requirement imposes the following restrictions on the parameters of the translog cost function:

$$\begin{aligned}& a_L = a_K = 1; \qquad b_{QL} + b_{QK} = 0; \qquad b_{LL} + b_{LK} = b_{LK} + b_{KK} = 0; \\ & d_{AL} + d_{AK} = 0; \qquad d_{OL} + d_{OK} = 0. \qquad (2)\end{aligned}$$

The translog is a valid local second-order approximation to an arbitrary cost function. Under reasonable assumptions (nonnegative, real valued, nondecreasing function of output, linearly homogeneous in input prices), the translog is dual to a general production or transformation function, although it is not directly derivable from them (Diewert, 197 1; Caves, Christensen, and Tretheway, 1980). It offers a number of advantages. First, it permits estimation of symmetric U-shaped average cost curves.[10] Second, it permits

[8] Traditional cost studies possibility could confound scale economies and differences in X-efficiency of firms operating at different output levels. This potential problem does not appear to be of practical significance, however. Several researchers have estimated scale economies for financial firms using both traditional cost functions and frontier estimation methods and found little or no differences in results from the two approaches (Berger and Humphrey, 1991; Bauer, Berger, and Humphrey, 1993; McAlister and McManus, 1993; Mester, 1993). For further discussion, see Bauer, Berger and Humphrey (1993).
[9] Sometimes, the effects of control variables are of interest as much as the effect of output on cost. For example, the inclusion of average loan size as an output homogeneity variable permits calculation of a cost elasticity with respect to average size of loan.
[10] If this assumption does not hold generally, then the cost function would be misspecified and estimates of scale economies derived from it would be biased. In studies of commercial bank costs, bias in translog estimates of scale economies appears to

exploration of how factor prices may affect scale economy results (nonhomotheticity).[11] Third, it permits estimation of scale, branch office, and loan size economies and allows them to vary by size of institution.

2.3. Definition of output

To estimate a statistical cost function, it is necessary to relate cost measurements directly to measures of the outputs that produce the costs. The consumer finance industry has a number of potential output measures: number of loans made, dollar amount made, number serviced, amount serviced, and total assets devoted to lending. Because many cost-causing activities such as recording and booking loans and payments must be undertaken for each loan and probably vary very little with size of loan, numbers of loans made or serviced probably are better candidates for the output variable than dollar amount of loans. Of these, the number serviced seems the more reasonable choice. Most consumer loans require periodic payments (typically monthly), and so both the number of employees and the size of the systems, paperwork, and compliance efforts involve more than just making loans. Therefore, the size or scale of a lending operation seems more dependent on the number of loans serviced than on loans made (which may be more irregular and discontinuous). Consequently, the output variable employed in this study is number of loans outstanding (that is, serviced) rather than number made.

Average size of loans outstanding is included in the regression as an output homogeneity variable. Care and credit checking and some other cost-causing activities of making and servicing a loan generally are greater for larger loans than smaller loans. Larger loans also are more likely than smaller loans to be secured, a process that creates added costs.

2.4. Data

Cost data for estimation are from the American Financial Services Association (AFSA), the renamed trade group that supplied finance-company data to Benston in 1972. The AFSA surveyed its finance company members annually between 1960 and 1989 to collect information on the consumer finance industry.[12]

Data for 1987-1989 were available for this study. Survey schedules include detailed balance sheets, income and expense statements, loan activity, delinquency, and loss reports. Companies providing usable reports numbered 84 to 101 over the three years. These companies ranged from very small (one-third were single-office companies) to the largest finance companies in the industry. In all, the companies had total

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result largely from differences in the output mixes of small and large banks (McAlister and McManus, 1993). This consideration probably would not bias translog estimates of scale economies for consumer finance companies because consumer finance companies essentially produce a single product.

[11] Both homogeneity and homotheticity can be imposed on the translog by constraining the parameters in estimation. Thus, homogeneous, homothetic, and Cobb-Douglas forms can be tested as subsets of the analysis. Tests by the authors (available on request) reject homotheticity and homogeneity and, therefore, the Cobb-Douglas formulation. An important implication is that the percentage change in cost resulting from a given percentage change in output is not the same at different levels of output. In other words, economies of scale are not constant over all output levels.

[12] These surveys were discontinued after 1989.

assets of $245-350 billion. Their gross consumer receivables represented 73-88% of the Federal Reserve's estimate of total consumer credit at consumer finance companies, depending on the year.

For this study, we used data for 51 companies that had greater than 50% of their receivables in consumer credit and reported costs in each of the three years. These restrictions ensure that the results reflect the costs of consumer lending rather than business lending or leasing and that any differences among the years are not due to differences in the composition of the samples.[13]

Table I defines the variables used in the statistical estimation and lists the sample means and standard deviations for these variables. The dependent variable is total annual operating expense excluding losses, advertising (which concerns demand, not production costs), and cost of funds. Independent variables are output (average number of loans serviced during the year), input prices (labor and capital prices), average size of loans serviced, and a structural variable (average number of branch offices). The price of labor for a company is the average annual wage rate, which is calculated as total annual salary and wage expenses including social security and fringe benefits divided by the average number of employees. The price of capital is the replacement cost per square foot of office buildings. It is computed for each company by weighting regional estimates of the cost of office space compiled by the EW. Dodge Company (1987-1989) by the proportion of the company's offices located in each region. The AFSA's office directory provided the addresses necessary for calculating the weights.

Table 1. Variable definitions and descriptive statistics.

	Mean (Standard Deviation)		
Variable	1987	1988	1989
Operating cost, excluding losses, advertising, and cost of funds; in thousands of dollars (C)	145,244.8 (388,211.7)	158,032.7 (381,124.0)	173,154.8 (397,775.9)
Output, average of number of loans outstanding at the beginning and end of the year, in thousands (Q)	569.0 (1413.2)	600.9 (1447.1)	629.8 (1442.7)
Price of labor, annual wage and salary expense divided by average of number of employees at the beginning and end of the year, in thousands of dollars (P_L)	25.2 (6.3)	25.8 (6.7)	27.0 (6.4)
Price of capital, replacement cost per square foot for office buildings, in dollars (P_K)	82.1 (8.6)	88.2 (11.8)	93.6 (10.9)
Average size of loans serviced, average of the dollar amount to the number of loans outstanding at the beginning and the end of the year, in thousands of dollars (A)	3.2 (2.8)	3.5 (3.2)	3.7 (3.6)
Number of offices, (branches), average of the number of offices at the beginning and end of the year (O)	189.9 (280.6)	204.9 (317.7)	204.0 (317.1)

[13] The business of these firms was concentrated heavily in consumer lending. On average, consumer receivables were about 95% of the total number of accounts and 90% of the total dollar amount of receivables at these companies during 1987-1989. Only about one-fifth of the companies had consumer receivables equal to less than 80% of total receivables. The subsample of 51 companies preserves the range of company sizes in the full sample. The logarithm of the proportion of consumer lending (and its square and cross products) were not significantly related to cost for the 51 firm subsample.

3. Empirical results

This paper estimates the cost function (equation (1)) restricted to be positively linearly homogeneous in input prices (equation (2)) jointly with input-demand equations (equations (3) and (4), which follow). The input demand equations are obtained by differentiating the translog cost function with respect to the input prices, PL and PK: [14]

$$\partial \ln C/\partial \ln P_L = S_L = a_L + b_{LL} \ln P_L + b_{LK} + \ln P_K + b_{QL} \ln Q + d_{AL} \ln A + d_{QL} \ln O \quad (3)$$

and

$$\partial \ln C/\partial \ln P_K = S_K = a_K + b_{KK} \ln P_K + b_{LK} \ln P_L + b_{QK} \ln Q + d_{AK} \ln A + d_{QK} \ln O, \quad (4)$$

where SL and SK are the cost shares of labor and capital. This procedure is recommended by Christensen and Green (1976) because the input-demand equations add degrees of freedom without adding any unrestricted regression parameters, resulting in more efficient parameter estimates than would be obtained by estimation the cost function alone.[15]

Random disturbance terms are added to the cost function and input-demand functions. We assume that the disturbances are correlated across equations but not across firms (see Zellner, 1962). Because cost shares must sum to unity, one of the input-demand equations is redundant. The capital input-demand equation therefore is dropped, and the cost function and labor input-demand function are estimated jointly using the iterated version of Zellner's seemingly unrelated regression procedure. This procedure produces maximum likelihood estimates of the parameters, which are invariant to which one of the input-demand equations is dropped (Kmenta and Gilbert, 1968).

Table 2 presents results of estimation. According to the likelihood-ratio test, the estimated cost and input-share equations are significant in each of the three years 19871989. Adjusted values of R 2 of the cost functions are between 0.980 and 0.988.

3.1. Estimates of economies of scale

Economies of scale are measured as the percentage change in cost resulting from a small percentage change in output. Two types of estimates of scale economies, which involve different assumptions about the relationship between costs and outputs, have been derived SCE values less than I indicate the presence of scale economies; values equal to I indicate constant costs; and values more than 1 indicate diseconomies of scale.

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[14] This result is known as Shephard's lemma (Sheppard, 1953).

[15] In other recent studies of financial firms' costs, Benston, Hanweck, and Humphrey (1982) and Gilligan, Smirlock, and Marshall (1983) estimated only cost functions. Mester (1987) and Kim and Zion (1989), on the other hand, estimated cost functions jointly with input-demand equations.

Table 2. Cost function parameter estimates (standard errors in parentheses).

Variable and Parameter		1987	1988	1989
Constant	(a_0)	1.548	1.580	1.606
		(0.110)**	(0.095)**	(0.104)**
ln$Q$	(a_Q)	0.730	0.638	0.589
		(0.087)**	(0.77)**	(0.084)**
(ln$Q$)^2	(b_{QQ})	0.071	0.060	0.045
		(0.066)	(0.044)	(0.046)
lnP_L	(a_L)	0.769	0.863	0.876
		(0.068)**	(0.050)**	(0.070)**
lnP_L lnP_K	(b_{LK})	−0.149	−0.202	−0.191
		(0.046)**	(0.032)**	(0.047)**
ln$Q$ lnP_L	(b_{QL})	−0.077	−0.067	−0.054
		(0.016)**	(0.012)**	(0.012)**
ln$A$	(d_A)	0.288	0.202	0.180
		(0.127)*	(0.112)	(0.122)
(ln$A$)^2	(d_{AA})	0.138	0.161	0.110
		(0.174)	(0.149)	(0.161)
ln$A$ ln$Q$	(d_{AQ})	−0.041	0.002	0.086
		(0.084)	(0.007)	(0.081)
ln$A$ lnP_L	(d_{QL})	−0.044	−0.067	−0.078
		(0.027)	(0.021)**	(0.022)**
ln$A$ ln$O$	(d_{AO})	−0.007	−0.037	−0.102
		(0.099)	(0.082)	(0.097)
ln$O$	(d_O)	0.274	0.387	0.409
		(0.121)*	(0.108)**	(0.119)**
(ln$O$)^2	(d_{OO})	0.079	0.071	0.115
		(0.098)	(0.069)	(0.077)
ln$O$ ln$Q$	(d_{OQ})	−0.072	−0.065	−0.077
		(0.070)	(0.044)	(0.046)
ln$O$ lnP_L	(d_{OL})	0.071	0.058	0.045
		(0.018)**	(0.014)**	(0.014)**
Adjusted R^2		0.980	0.985	0.988
Likelihood ratio		87.945	87.807	84.347

*/** Coefficient is significantly different from zero at the 95/99% confidence level.

for financial institutions (see Benston, Hanweck, and Humphrey, 1982). A simple scale economies measure is the cost elasticity when the number of production facilities (offices) does not change as output varies. An augmented scale economies measure allows the number of offices to vary along with output.

3.1.1. Simple scale economies. The simple scale economies measure (*SCE*) is derived by differentiating the translog cost function with respect to output:

$$SCE = \frac{\partial \ln C}{\partial \ln Q} = a_Q + b_{QQ} \ln Q + b_{QL} \ln P_L + b_{QK} \ln P_K + d_{AQ} \ln A + d_{OQ} \ln Q. \tag{5}$$

Equation *(5)* indicates that scale economies depend on the level of factor prices, average loan size, and number of offices as well as output. For estimates of the simple scale economies measure, we hold all variables constant except output. In the first three columns of table 3, *SCE* is computed at various levels of output for *1987-1989,* given that other variables *(PL, PK,* A, and 0) are held constant at the means of the third output quintile. These SCE estimates can be viewed as scale economies facing a typical medium-sized firm.[16]

Estimates of the simple scale economies measure suggest that there are economies of scale in the operating costs of consumer finance companies and that these scale economies diminish as output increases. For a medium-sized firm operating at low levels of output, *SCE* estimates indicate that a 10% increase in output raises costs about 4-6% in the 0.63.4 thousand loans output range. Scale economies gradually fall from the second to the fourth output quintiles; a 10% increase in output raises costs about *5-7%* in the second quintile and about *7-9%* in the fourth quintile. In the fifth quintile, economies of scale appear to be exhausted. Estimates of the scale economies measure generally are not significantly less than I for the fifth quintile.

As mentioned, these estimates of scale economies apply to the medium-sized firms in terms of number of offices. Different values of *SCE* would be obtained if the number of offices were different, although the finding of significant scale economies generally would hold. The assumption that firms keep the number of offices constant may be appropriate in the short run, but it probably is unrealistic over longer periods of time. Finns might avoid diseconomies of scale by opening additional offices, or to the extent allowed by the size of their geographic markets, they may realize scale economies by consolidating loans in a smaller number of offices.

3.1.2. Augmented scale economies. To allow adjustment of the number of offices for the level of output, Benston et al. (1982) developed an augmented scale economies measure as

$$SCE^{*} = SCF + (\partial \ln C/\partial \ln O)/(\partial \ln O/\partial \ln Q), \qquad (6)$$

where $\partial \ln C/\partial \ln O$ is a measure of office economies and $\partial \ln O/\partial \ln Q$ indicates the change in offices associated with a change in output. Again, values less than 1 indicate the presence of scale economies; values equal to 1 indicate constant costs; and values more than 1 indicate diseconomies of scale.

For the translog function, the measure of office economies is $\partial \ln C/\partial \ln O = d_O + d_{oo} \ln O + d_{OQ} \ln Q + d_{OL} \ln P_L + d_{OK} \ln P_K + d_{AO} \ln A$. We estimate the change in offices associated with a change in output, $\partial \ln O/\partial \ln Q$, by the regression $\ln O = e_O + e_1 \ln Q + e_2 (\ln Q)^2$.

To estimate SCE^{*}, we use the same output levels that were used for estimates of the simple scale economies measure and the appropriate means number of offices for each quintile. Factor prices and average loan size are held constant; we use means of the third output quintile for P_L, P_K, and A to maintain comparability with estimates of the simple scale economies measure.

780.0	0.974	0.871	0.762*	0.981	0.960	0.938
Fifth quintile						
1,236.8	1.007	0.899	0.783*	0.982	0.956	0.941
1,839.9	1.035	0.923	0.801	0.982	0.955	0.931
5,645.0	1.115	0.991	0.851	0.985	0.955	0.903

a Evaluated at mean values of P_L, P_K, A, and O in the third output quintile.
b Evaluated at mean values of P_L, P_K, and A for the third output quintile and quintile means of O.
*/** Coefficient is significantly less than one at the 95/99% confidence level.

The augmented scale economies measure provides a better indication of scale economies facing the firm. None of the estimates of the augmented scale economies measure shown in the last three columns of table 3 is significantly less than 1. This result suggests that firms can adjust the number of offices to exploit all scale economies. According to these estimates, even relatively small firms are able to operate at approximately constant costs. None of the estimates of the augmented scale economies measure is significantly greater than 1 either, which suggests that firms also can adjust the number of offices to avoid diseconomies of scale.

The effect of varying the number of offices on costs is illustrated in table 4, which shows average cost per dollar of loans (panel A) and average cost per loan (panel B) in 1989 at various levels of output per office.[17] For example, a first quintile firm having 3.4 thousand loans and two offices would have average office size of 1.7 thousand loans and operating expenses of $0.06 per dollar of loans or $220 per loan. A substantially larger fourth quintile firm with 528.7 thousand loans could have the same average office size and about the same operating expenses with 311 offices. By consolidating loans in half the number of offices, the second firm might reduce operating expenses to $0.05 per dollar of loans or $163 per loan, although limits on the size of local markets could prevent the firm from servicing the 2.8-3.4 thousand loans per office needed to attain that level of operating costs.

Table 4. Average cost per dollar of loan and average cost per loan by output level and number of loans per office.

	Number of Loans per Office (in thousands)					
	0.65–0.68		1.7		2.8–3.4	
Output Level (in thousands)	Average cost/$	Number Offices	Average Cost/$	Number Offices	Average Cost/$	Number Offices
A. Average Cost per Dollar of Loan:						
First quintile						
3.4	$0.08	5	0.06	2	0.06	1
Second quintile						
8.5	0.09	13	0.06	5	0.06	3
Third quintile						
79.9	0.09	118	0.06	47	0.05	24
Fourth quintile						
528.7	0.09	778	0.06	311	0.05	156
Fifth quintile						
1,091.4	0.10	1605	0.06	642	0.05	321
B. Average Cost per Loan:						
First quintile						
3.4	$282	5	$220	2	$195	1
Second quintile						
8.5	289	13	216	5	193	3
Third quintile						
79.9	300	118	210	47	172	24
Fourth quintile						
528.7	318	778	209	311	163	156
Fifth quintile						
1,091.4	328	1605	210	642	160	321

Average cost is evaluated at mean values of P_L, P_K, and A for the third output quintile.

[17] Calculations of average costs for 1987 and 1988 data would be almost the same as the numbers for the 1989 data shown in the table.

The finding of economies of scale at the office level (SCE) but not at the firm level (SCE*) is consistent with Benston's earlier findings. Therefore, our analysis indicates Benston's findings are robust, despite the simplifying assumptions implicit in his methodology. Although we find economies of scale at the office level, or estimates indicate that these exonomies decrease as output increases. [18]

3.2. Cost elasticity of average loan size

We also estimated cost elasticities of average loan size, which show relationship between operating costs and the average size of loans in creditors' portfolios. An elasticity less than 1 suggests that firms producing smaller loans have higher costs per dollar of credit than firms producing larger loans. Such might be the case if some expenses of consumer credit-for example, recording and booking loans and payments-are relatively constant and not related to the size of the loan.

For the translog cost function, the cost elasticity of average loan size (SCA) is

$$SCA = \frac{\partial \ln C}{\partial \ln A} = d_A + d_{AA} \ln A + d_{AQ} \ln Q + d_{AL} \ln P_L + d_{AK} \ln P_K + d_{AO} \ln O.$$

Like *SCE* and *SCE*,* SCA depends on the values assumed for number of loans outstanding, factor prices, and number of offices as well as average loan size. We assume average values of Q, P_L, P_K, and O in the third output quintile. Values chosen for A lie between the 10th and 90th percentiles of the sample distribution of average loan size.

Estimates of *SCA* shown in table 5 are significantly less than 1 for most average loan sizes, suggesting that smaller loans indeed are relatively more expensive to produce than larger loans. At an average loan size of $2210 (the median average loan size in the sample), for example, a 10% increase in average loan size would increase costs about 2.53.0%, or about 1% for a $1 increase in average loan size. At an average loan size of $8620 (the 90th percentile), estimated values of SCA indicate that a 10% increase in average loan size would increase costs about 4.5-5.0%, which is about 0.5% for a $1 increase in average loan size. Again, these estimates represent costs of the typical medium-sized firm.

Table 6 presents average cost per dollar of loans in 1989 at the same average loan sizes as the previous table. For the typical medium-sized firm (middle column), average cost per dollar of loan falls from $0.18 per dollar of loans for an average loan size of $980 to $0.04 per dollar of loans for an average loan size of $8620. The table also shows that the level of average cost per dollar of loans and its relationship with average size of loan for small and large firms are similar to that for medium-sized firms, which suggests that the size of firm does not confer a cost advantage in processing loans of a particular size.

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[18] An appendix to an earlier version of this paper updates Benston's estimations using data from the more recent period. The estimated scale economies at the office and firm levels for 1987-1989 using Benston's methods are similar to his 1968-1970 estimates. A copy of this appendix is available from the authors on request.

Our finding that operating costs at finance companies rise much less than proportionately with increases in average loan size is similar to results of earlier studies.[19] Unlike earlier studies (which constrained cost elasticities of average loan size to a constant value because they used Cobb-Douglas cost functions), our estimates of the cost elasticity of average loan size rise as average loan size increases (table 5). This result seems reasonable. Finns may evaluate credit applications more carefully, take collateral, monitor more frequently, and make greater efforts to collect overdue accounts on larger loans than on smaller loans.

Table 5. Cost elasticity of average loan size by average loan size.

Average Loan Size (in Thousands of Dollars)[a]	Cost Elasticity of Average Loan Size (SCA)[b] 1987	1988	1989
0.98 (10th percentile)	0.153**	0.146**	0.211**
1.38 (25th percentile)	0.200**	0.201**	0.249**
2.21 (50th percentile)	0.265*	0.277**	0.300**
4.52 (75th percentile)	0.363	0.392**	0.379**
8.62 (90th percentile)	0.452	0.496*	0.449**

a Values of *A* are selected points of the sample distribution of average loan size between the 10th and 90th percentiles.
b Evaluated at mean values of P_L, P_K, A, and O for the third output quintile.
*/** Coefficient is significantly less than one at the 95/99% confidence level.

Table 6. Average cost per dollar of loans serviced in 1989 by average size of loans serviced and output level.

Average Loan Size (in Thousands of Dollars)[a]	Number of Loans (in Thousands) 3.4	46.2	1236.8
0.98 (10th percentile)	$0.14	0.18	0.14
1.38 (25th percentile)	0.11	0.14	0.11
2.21 (50th percentile)	0.08	0.10	0.08
4.52 (75th percentile)	0.06	0.06	0.05
8.62 (90th percentile)	0.04	0.04	0.03

Average cost is calculated at mean values of P_L and P_K for the third output quintile and at output quintile means for number of offices (two offices at 3.4 thousand loans, 47 offices at 46.2 thousand loans, and 642 offices at 1,236.8 thousand loans).
a Values of *A* are selected points of the sample distribution of average loan size between the 10th and 90th percentiles.

4. Conclusions

Scale economies are an important factor determining the structure of an industry. If scale economies exist, an industry may come to be dominated by a few large firms. Such an outcome would reduce the cost of providing a product, but it also could adversely affect competition. Research conducted in the early 1970s concluded that significant scale economies existed in the consumer finance industry at the office but not at the firm level. The results suggested that, although larger finance companies were no more efficient than

[19] For 1968-1970, Benston (1972b) estimated cost elasticities of average loan size between 0.391 and 0.592 depending on year; and in a regional study, Durkin and McAlister (1977) obtained average loan size cost elasticities between 0.293 and 0.504 for 1968-1973.

smaller finance companies, firms nevertheless could have reduced costs by consolidating business in fewer offices. This anomaly results from the use of a restrictive functional form, the Cobb-Douglas cost function, which limits estimates of scale economies to a constant value. Consequently, estimates of scale economies may not reflect the cost relationships at all levels of output.

This study uses the more general transcendental logarithmic functional form and newer data to investigate scale economies in the consumer finance company industry. The results reject the restrictive assumptions of the Cobb-Douglas cost function. Significant scale economies are found at the office level, and these scale economies decline as output increases. Therefore, increasing office volume beyond a certain number of loans (for the typical medium-sized firm of table 3 about 1 million loans in 47 offices) yields no additional savings in operating costs. The finding of a limit to the size of offices is an important difference from previous estimates of scale economies that relied on the CobbDouglas formulation.

At the firm level, neither significant economies nor diseconomies of scale are detected throughout most of the range of output levels in the industry. This finding-together with the finding of significant, decreasing scale economies at the office level-is consistent with the view that finance companies generally are able to adjust their offices to exploit scale economies or avoid scale diseconomies. Size of firm does not confer a cost advantage.

Failure to find scale economies at the firm level (and the finding of decreasing scale economies at the office level) suggests that the benefits of technological change in the lending business over the past two decades have accrued not exclusively to the benefit of larger firms. There have been important developments in office automation equipment, of course, but these do not appear to have generated significant scale economies in consumer lending at finance companies. Likely, the availability of smaller and smaller computers with ever-greater computing power at lower and lower cost has been important in this respect. Today, office automation equipment is within the budget of even the smallest companies. Similarly, sophisticated mathematical credit evaluation systems have become within the reach of even the smallest firms in recent years with the development of generic scoring-model results that are available instantaneously from credit bureaus with routine purchase of individual credit reports. It is not obvious that large firms have any decided advantage in this area either.

Our results also confirm earlier findings that operating costs rise less than proportionately with average loan size (table 5). This result suggests that smaller loans are relatively more expensive to produce than larger loans. However, we also find that the relative savings in operating costs decline as loan size increases, probably because firms incur greater costs for credit evaluation, obtaining collateral, monitoring, and collection for larger loans than for smaller loans.

In sum, our findings for consumer finance companies are consistent with most of the recent evidence on scale economies at other financial institutions, which find little or no evidence of economies or diseconornies of scale. We find that smaller finance companies do not operate at a cost disadvantage to larger finance companies. Despite advances in information and computer technology, many of the activities associated with loan acquisition and maintenance may still be labor intensive and not provide much opportunity for scale economies. Also, personal computers are accessible to even the smallest finance companies, so that any cost savings from this source would be available to all. Thus, operating costs would not lead to consolidation in the consumer finance industry. The implications of these findings are that public policies that promote competition better serve customers than those that might seek cost savings by restricting entry or encouraging consolidation of firms.

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References

Bauer, Paul B., Allen N. Berger, and David B. Humphrey. Efficiency and Productivity Growth in U.S. Banking. In H.O. Fried, C.A.K. Lovell, and S.S. Schmidt, eds., *The Measurement of Productive Efficiency: Techniques and Applications.* Oxford: Oxford University Press, 1993, pp. 386-413.

Baumol, William J., John C. Panzar, and Robert D. Willig. *Contestable Markets and the Theory of Industry Structure.* New York: Harcourt Brace Jovanovich, 1982.

Bell, Frederick W., and Neil B. Murphy. *Costs in Commercial Banking: A Quantitative Analysis of Bank Behavior and its Relation to Bank Regulation.* Research Report No. 41. Boston: Federal Reserve Bank of Boston, 1968.

Benston, George J. Economies of Scale and Marginal Costs in Banking Operations. *National Banking Review* 2 (1965),507-549.

Benston, George J. Economies of Scale of Financial Institutions. *Journal of Money, Credit and Banking* 4 (1972a), 312-341.

Benston, George J. The Costs to Consumer Finance Companies of Extending Consumer Credit, in National Commission on Consumer Finance. *Technical Studies, vol.* 2. Washington, DC: U.S. Government Printing Office, 1972b.

Benston, George J. Graduated Interest Rate Ceilings and Operating Costs by Size of Small Consumer Cash Loans. *Journal of Finance* 32 (1977a), 695-707.

Benston, George J. Rate Ceiling Implications of the Cost Structure of Consumer Finance Companies. *Journal of Finance* 32 (1977b), 1169-1194.

Benston, George J., Gerald A. Hanweck, and David B. Humphrey. Scale Economies in Banking: A Restructuring and Reassessment. *Journal of Money, Credit and Banking* 14 (1982), 435-456.

Berger, Allen N., and David B. Humphrey. The Dominance of Inefficiencies over Scale and Product Mix Economies in Banking. *Journal of Monetary Banking* 28 (1991), 117-148.

Berger, Allen N., William C. Hunter, and Stephen G. Timme. The Efficiency of Financial Institutions: A Review and Preview of Research Past, Present, and Future. *Journal of Banking and Finance* 17 (1993), 221-249.

Caves, Douglas W., Laurits R. Christensen, and Michael W. Tretheway. Flexible Cost Functions for Multiproduct Finns. *Review of Economics and Statistics* 62 (1980), 477-481.

Christensen, Laurits R., and William H. Greene. Economies of Scale in U.S. Electric Power Generation. *Journal of Political Economy* 84 (1976), 655-676.

Clark, Jeffrey A. Economies of Scale and Scope at Depository Financial Institutions. [Federal Reserve Bank of Kansas City] *Economic Review* 73 (1988), 16-33.

Diewert, W. E. An Application of the Shephard Duality Theorem: A Generalized Leontief Production Function. *Journal of Political Economy* 79 (1971), 481-507.

Durkin, Thomas A., and E. Ray McAlister. *An Economic Report on Consumer Lending in Texas.* Monograph No. 4. West Lafayette, IN: Purdue University, Krannert Graduate School of Management, Credit Research Center, 1977.

Elliehausen, Gregory E., and John D. Wolken. Banking Markets and the Use of Financial Services by Households. *Federal Reserve Bulletin* 78 (1992), 169-181.

E W. Dodge Division. *Dodge Construction Potentials Bulletin: Summary of Construction Contracts for New Addition and Major Alteration Projects.* New York: McGraw-Hill, 1987-1989.

Gilligan, Thomas, Michael Smirlock, and William Marshall. Scale and Scope Economies in the Multiproduct Banking Firm. *Journal of Monetary Economics* 13 (1983), 393-405.

Humphrey, David B. Why Do Estimates of Bank Scale Economies Differ? [Federal Reserve Bank of Richmond] *Economic Review* 76 (1990), 38-50.

Kim, Moshe, and Uri Ben-Zion. The Structure of Technology in a Multioutput Branch Banking Finn. *Journal of Business and Economic Statistics 7 (1989), 489-496.*

Kmenta, Jan, and Roy R Gilbert. Small Sample Properties of Alternative Estimators of Seemingly Unrelated Regressions. *Journal of the American Statistical Association 63 (1968), 1180-1200.*

Lawrence, Colin, and Robert P. Shay. Technology and Financial Intermediation in Multiproduct Banking Firms: An Econometric Study of U.S. Banks. In Colin Lawrence and Robert P. Shay, *Technological Innovation, Regulation, and the Monetary Economy.* Cambridge, MA: Ballinger Publishing Company, *1986.*

Longbrake, William A. Computers and the Cost of Producing Various Types of Banking Services. *Journal of Business 47 (1974), 363-381.*

McAleer, Ysabel B. *Finance Companies American Financial Services Research Report and Second Mortgage Lending Report.* Washington, DC: American Financial Services Association, *1987-1989.*

McAlister, Patrick H., and Douglas McManus. Resolving the Scale Efficiency Puzzle in Banking. *Journal of Banking and Finance 17 (1993), 389-405.*

Mester, Loretta J. Efficiency in the Savings and Loan Industry. *Journal of Banking and Finance 17 (1993), 267-286.*

Mester, Loretta J. A Multiproduct Cost Study of Savings and Loans. *Journal of Finance 42 (1987), 423-445.*

Rogers, David H. *Consumer Banking in New York.* New York: Columbia University Press, *1974.*

Shephard, R. *Cost and Production Functions.* Princeton, NJ: Princeton University Press, *1953.*

Zellner, Arnold. An Efficient Method for Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias. *Journal of the American Statistical Association 57 (1962), 585-612.*