

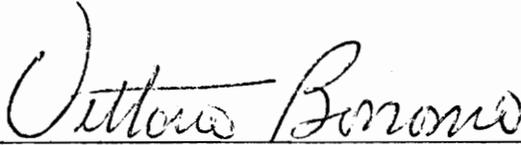
A STUDY OF REGULATORY GOALS AND CONTROLS,
FIRM SIZE IN THE SAVINGS AND LOAN INDUSTRY

by

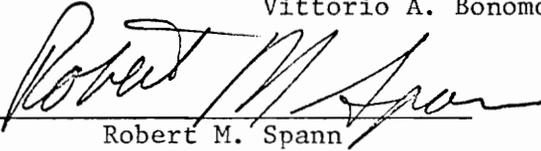
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I must also make room here for Willelyn Morelle, without whom both the author and his dissertation would be very different and much poorer for it.

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CHAPTER 1

AN INTRODUCTION TO THE PROBLEM

Since the transformation of S&L associations in the New Deal from private collectives of savers and home buyers into regulated financial institutions, government has played a dominant role in shaping both the firm and the industry. The legislative efforts then and since to encourage home ownership have delineated the scope of S&L activity, creating a specialized industry to serve the residential mortgage market.

As part of that legislative effort, the Federal Home Loan Bank System was created in 1932 to promote and to regulate the industry. The FHLBS was empowered to charter new associations, to control the opening of new offices by existing associations, and to regulate mergers. Similar powers were held by state authorities over non-federal associations. These powers have proven to be exceptionally effective tools, partly because the postwar growth of the industry was accompanied by profound changes in where people lived and partly because of the limited geographical area from which any one office could expect to be able to draw savings account customers.

The power to decide whether to grant new charters, that is, to allow a new firm to enter the industry, or to favor the expansion of existing firms through branching has been an important determinant of

industry structure. Combined with control over mergers, it has given the regulators the ability to enforce an industry structure policy when many other regulatory agencies have found themselves embattled in the courts over their attempts to prevent mergers, to break up large firms, and to control the structure of local markets.

The dependence of firm growth on obtaining permission to acquire or develop new offices can be seen in the characteristics of the sample developed for use in our cost analysis. It includes 1878 of the 5100 firms and 158 of the 276 SMSAs in the nation in 1975.¹ The largest branching institution in the sample held \$1.2 billion in assets, seven times the holdings of the largest single office (unit) association (\$266 million.) The average branching firm in the sample held \$116 million in assets compared to an average of \$23 million for single office firms. Branching and merger policies, and the way such developments as the remote automated teller machines and the point of sale machines are handled will determine the mix of small and large firms in the next few decades.

The question is what size firm is consistent with the goals the regulatory authorities have committed themselves to. They want efficient firms, and safe ones too. Beyond that, they want efficient

¹The sample is somewhat biased against the very large branching associations in that a firm must have obtained 90% of its deposits from a single SMSA market area to be included in the sample (The purpose of this criteria was to allow market areas to be quantified in terms of labor prices, market concentration, and the like.) This meant that the very largest of associations, the multiple SMSA giants of California, that in 1975 were ranging up to the five billion dollar asset class, were excluded from the sample.

markets, for ultimately the industry is regulated to serve the public's need for a market to finance housing.

The trend is toward large firms and, since, even in the S&L industry, it is infinitely more difficult to dismantle large firms than it is to prevent their formation, it is important that the evidence for and against them be assembled and reviewed now. At present, the large firm is well enough represented in the industry for research but not so well represented as to render the research of little practical value.

The Purpose of this Study

There has been a great deal of work focused on determining the extent of the economies of scale available to large firms. The question of whether a large firm can perform the functions of a savings and loan more cheaply than can a collection of small ones provides a central theme of this study. Much of our attention will be concentrated on the functional form of the cost function in an effort to determine whether the significant economies found in the past are real. This study also attempts to look at a range of goals the regulators have committed themselves to and to determine whether a policy of encouraging large firms contributes or detracts from those goals. If firm efficiency is not a function of firm size, and that is one of the tentative findings of this study, then the safety of the firm and the efficiency of the industry as a financial intermediary between depositors and homeowners may become the decisive issues.

Policy Considerations Other Than Economies of Scale

Safety has been a major goal. On a case by case basis, this has meant that a new office, whether a branch or a new association, should not impair the health of existing offices. Besides that, an applicant must prove that his site is capable of supporting an office, and, thirdly, that he is capable of sustaining it until it is paying for itself. The first two of the requirements have tended to limit the opportunities for new firms and for new branches of established firms as well. The third requirement is weighted in favor of the branching of existing associations since their personnel are a known quantity and their firms' net worths are likely to provide larger reserves for meeting start-up expenses than the backers of potential associations. Abstracting from these start-up considerations, there is the question of whether large firms do have net worth positions that make them substantially safer than small firms.

A second goal of the regulators has been to maintain a competitive market structure. A basic assumption of the regulators is that the industry is competitive and that the effects on market concentration of allowing a few firms to supply a large portion of the new offices required has been a growing concern. An appraisal of the market performance of large firms in concentrated areas would contribute to policy making. In this study Herfindahl indexes, based on mortgage holdings and on deposit holdings, are calculated for 158 market areas. Since the organization of S&Ls leaves some ambiguity about who is the residual claimant of the income of associations, the Herfindahl indexes

are correlated with operating expenses, on the theory that the management of the firm will extract a significant fraction of any rents that are available to the firm.

Another goal has come with the development of a secondary market for mortgages and mortgage backed instruments. The regulatory authorities have promoted this market as a means of increasing the efficiency of an industry that has found itself compartmentalized by political boundaries. The market makes special demands upon the associations that use it, and not all have invested the resources to develop the management skills required to buy and sell on the secondary mortgage market. Large firms are seen as having tended to make more use of it than small ones. This study attempts to see if large firms, in fact, show this tendency. More generally, it attempts to determine if there have been systematic changes in portfolios as firms grew and if those changes were consistent with the regulators' goal of increasing the industry's efficiency.

The Limitations of the Study: An Economic Perspective

While this dissertation attempts to provide much of the evidence that policy makers, and the public, must have in order to decide the future course of the evolution of the industry's structure, it is not without its limitations. The spread of a secondary market in mortgages, for example, is treated as a desirable thing, though it should be obvious that many will not think so. A fully functioning secondary market will transfer funds from surplus to deficit areas and this will be fine if you are in a deficit area. Those supplying savings deposits

in surplus areas will find that they do not gain from their association's mortgage buying because their return is limited by law. The secondary benefits the savers enjoyed due to the mortgage activity in their own areas, in the form of construction jobs, increased property tax base, more liberal lending standards, and lower mortgage rates, will disappear. The mortgage money of associations is valuable and any policy that reassigns it will not be a matter of indifference to the public. In at least one metropolitan area, Washington, D.C., associations found it necessary recently to make public the breakdown of their liabilities and assets by geographical area: Virginia, Maryland suburbs, or the District of Columbia. It is too early to tell, but fights over S&L funds may become quite important in the future. The buzz word, red lining, which stands for the practice of associations of avoiding making loans in areas that for some reason have fallen into ill repute with loan committees, has reached the lips of the President and has introduced questions of racial and sexual bias into the fight to control where mortgage money will come to rest.

The Outcome of the Working of the System

There is more to the competition question than whether the price of a mortgage is close to the one that would prevail under perfect competition. Interest rates may well be determined by the mortgage market, which is an important assumption of this paper. Yet other aspects of the market may prove costly to society as well if they are not determined competitively. The author, in the course of preparing this study, has had occasion to talk with homeowners about their

experiences with S&Ls. The conclusion was hard to avoid that mortgages are much more difficult to obtain the farther away a house design was from the conventional styles selling in the local market. The reason is simple: the value of a house with a discernible difference is uncertain and it may take a longer time on the market before its full cost can be recovered by a repossessing association. Architects were well aware of this and counceled their clients accordingly. A small item, perhaps, but it seems likely that a decline in the number of firms competing to finance mortgages will remove the Frank Lloyd Wright houses from the landscape before raising mortgage prices.

Does Regulation Cause or Cure Market Problems?

When the FHLB System was founded in the 1930's, it found it difficult to attract the volume of investors needed to revitalize the industry. Perhaps partly as a result of this the boards of directors and the officers of S&Ls today are often faced with conflicts of interest. Directors often serve on boards of other associations and of commercial banks. Some associations seem dominated by real estate developers, lawyers specializing in title searches, builders, and the like. This is the very sort of thing that regulatory agencies were created to control.

The Regulation of Competition

Competition figures prominently in this study not only as an assumption about the industry, but also as an important goal of the regulators. It is not an unambiguous goal, however, as regulators must

be of two minds on the subject. Real competition implies firms are driven to exit the industry at times, and new firms inspired to enter at other times. There can be no doubt that the authorities dislike for various reasons--some better than others--such movements. Competition as a system, they do not assail, rather it is the outcome of the workings of that system that is viewed as being likely to make their job much more difficult.

A Peaceful and Quiet Industry

One of the things that motivated this paper was the power of the regulatory agencies to control the development of the industry with substantial freedom from outside interference. This legal position, combined with the regulators' inclination to make things as orderly as possible, has led to some odd results not considered in the study. One came about because of the organizational form of some associations. The majority of S&Ls are still mutual associations and the savings depositor is actually a shareholder with the right to vote on such things as who shall govern the association. In practice, however, depositors have automatically delegated their powers, often to the directors and the officers of the association. These proxies have even been passed from father to son. It is to be expected that the management of an association hardly welcomes groups of shareholders determined to wage a proxy battle to wrestle control away from them. They have often denied the shareholders access to the proxy records, to prevent them from contacting passbook holders that are unaware of the fight. The FHLB Board (the governing body of the FHLB System)

agreed to intermediate such disputes and promulgate appropriate regulations. The resulting rules effectively foreclosed future fights by denying shareholders information about their fellow passbook holders.

The Bank Board's action is understandable, for proxy fights can take the control of an association out of the hands of its old management and put it in the hands of people that probably have quite different ideas about how things should be run. They represent a new, unknown element to the authorities. Firm failures are very much public goods, and every association benefits from the safety that the public feels in dealing with the S&L industry. The authorities take this public trust very seriously. A proxy fight could endanger the success of a firm under some circumstances, so it is reasonable that the authorities would discourage such things. On the other hand, such restrictive regulations must be viewed with some uneasiness. The workings of the regulatory agencies have heightened a market imperfection and it is difficult to make this sound like an achievement.

Survival of the Weakest

Perhaps the most telling shortcoming of this paper is that it does not capture the character of the regulated industry. Risk, for example, becomes hard to quantify. Individually, firms can still suffer a loss of deposits, due to demographic changes in their market areas or due to simple bad management. They can also suffer portfolio losses, again due to demographic or management problems. But the statistics show that it is hard to do either to the extent that the association fails.

Competition is rarely allowed to seriously weaken firms. The most common causes of failures are malfeasance and misfeasance--criminal and incompetent management, respectively. For the industry as a whole, the risk of financial embarrassment is even less. The industry has experienced a net outflow of funds only a few times during the post war period.

The reason for this safety is the umbrella provided by the regulatory authorities. On the firm level they work to promote financial stability and responsibility. (Regulators in conversation often seem to think of their charges as somewhat retarded children.) The more conservative the portfolio and the longer the term of the liabilities the associations have, the less often the authorities have to step in to protect the financial position of the firm or the industry. On the industry level, when circumstances have demanded it, the regulators have defended their industry quite successfully. So successfully, in fact, that they have a difficult time making associations hedge their financial positions at all.

This is the heart of the regulatory problem. The individual S&L perceives the risk of holding a long term portfolio with very short term liabilities as being much lower than such a position would be for any unregulated institution. Unless the authorities are suddenly sent packing, there is little chance that those liabilities (savings deposits) won't remain in the institution. With this protection the association values long term liabilities at a much lower rate as a means of reducing risk than an unregulated holder of a similar portfolio.

This type of behavior is observable in other dimensions. S&Ls in New England "irresponsibly" devised a legal fiction that allowed them to convert savings accounts into interest bearing checking accounts (the NOW account). They did this with the assumption (which appears to be well justified) that they would be able to keep this new power without jeopardizing their governmental protections. Associations are constantly trying to figure out new ways to make loans that meet the letter but not the intent of the tax laws designed to encourage them to hold home mortgages. Service corporations and REITs (real estate investment trusts) are both ways of straining the protective, enveloping arms of the regulators without actually wiggling free.

The result is suggested by the title of this section. The firms that spread themselves the thinnest, that expose themselves to the greatest risks, are the most successful, for the risk is to a great extent illusory. The regulatory authorities will drag them back into line and prop them up before things get too bad. The government is committed to doing that. For its part, the authorities must continuously produce regulations to cover the new outbreaks of inventiveness. And the harder they sit, the more squirmy the child becomes.

The response to such protection has not reached a level in the S&L industry to match that which has been reached in the commercial banks in their response to the Federal Reserve. The vigor of the commercial banks has often left the regulators trying to catch up with events that the banks have caused rather than heading off developments at the pass. One can be of two minds on whether all this is to the

good. The evolution of financial instruments and institutions may have been speeded up by the repressive tendencies of the authorities. On the other hand, the efforts to strengthen the S&L, and the commercial bank, by increasing the regulatory load on each industry has tended to make them more artificial and delicate, hothouse industries.

An example of the problem is the recently (November 1977) proposed way of handling the competitive potential of electronic funds transfer machines. It was suggested that the machines be allowed to dispense money, but not be allowed to accept money. The intent is clear: to prevent associations from competing for deposits too fiercely. But the method employed represents what can only be described as an arbitrary constraint on the technology. (In fact, one might argue that this idea has little potential since a vast number of deposits are made by mail and many people have their paychecks directly deposited by their employers.)

Many of the issues we have raised in this chapter are problems of public policy and not so much problems that are simply waiting for economists to tackle. The government has proven to be quite successful at carrying out programs with relatively straight forward goals. Whether it is politically feasible to untangle the conflicting goals that have been given to the regulatory agencies, to create and operate an industry of S&Ls, is difficult to predict.

CHAPTER 2

THE STATE OF THE ART

Writers speculated about the advantages of size long before the first empirical study. Two centuries ago, Adam Smith put forth his now well known proposition that the division of labor's tasks into many specialized parts would allow each man to do more.¹ Chamberlin, a century and a half later, suggested that some factors of production could not be scaled up and down to suit the needs of every size of firm.² They were indivisible and only certain levels of production would employ those factors efficiently.

More recently, in the 1930's and 40's, there was speculation about the relative costs of large and small financial institutions, and the effect of branch banking on the size-cost equation.³ The concensus

¹Adam Smith, *An Inquiry into the Nature of the Wealth of Nations*, Modern Library Edition (New York: Random House, 1937).

²E. H. Chamberlin, *The Theory of Monopolistic Competition: A Re-orientation of the Theory of Value* (Cambridge: Harvard University Press, 1948).

³J. M. Chapman and R. E. Westerfield, *Branch Banking* (New York: Harper & Brothers, 1942); Baines T. Cartinhour, *Branch, Group, and Chain Banking* (New York: MacMillan, 1931); C. W. Collins, *The branch Banking Question* (New York: MacMillan, 1926); and S. D. Southworth, *Branch Banking in the United States* (New York: McGraw-Hill, 1928). See Paul M. Horvitz, *Private Financial Institutions* (Englewood Cliffs, New Jersey: Prentice-Hall, 1963) for a review of this literature.

was that an increase in the size of a financial firm was likely to lower average cost and that branching, while perhaps increasing some costs, was the preferred tool for increasing size. A source of cost economies unique to financial institutions was also introduced. It was thought that large financial institutions could safely borrow and lend their resources in larger lump sums than could smaller firms. Other arguments favoring expansion in size were advanced, such as, a new member of a branch system did not have the costs of developing and maintaining correspondence accounts with other institutions. Some of the arguments applied more to banks than to financial institutions. Some of the arguments applied more to banks than to financial institutions in general: it was recognized that large New York banks are simply not in the same lines of business as small New England banks. By and large, though, the idea that large financial houses could do business at a lower cost was firmly entrenched in the literature, and in the minds of the legislators that produced the regulatory structures that oversee our financial institutions today.

It was not accidental that legislators and economists both believed that financial institutions should show increasing returns to scale, but it was the legislators that provided the economists with the persuasive evidence rather than the other way around. To see just what brought this to pass, we must look at some of the other writings that economists were producing. That most famous exchange on empty economic boxes in the early 1920's is an example of the suspicion that was rising

about the stability of certain types of industries.⁴ To brush the details of the arguments presented, the problem with an industry where the elasticity of output is greater than unity is that, as long as this condition prevailed, there would be a tendency for that industry to collapse into a single monopolistic enterprise. This was a black hole for economists that matches the one currently bedeviling astronomers.

Financial institutions, however, hold a special position in the minds of the public. The franchise to do business, either as an S&L, a commercial bank, or as one of a number of other institutions, is limited by government regulation. It is this regulation that prevents the collapse, or at least, prolongs the period over which economies of scale are consistent with a wide variety of sizes of firms being represented.

Lawrence Klein appears to be the first researcher to make use of the implications of this type of regulation.⁵ He was investigating the railroad industry which was, by this time, heavily controlled. (There can be little doubt that the excesses of the late nineteenth century had much to do with the regulations that have dominated industries in the twentieth.) Railways are a special case, as they are

⁴J. H. Clapham, "Of Empty Economic Boxes," *The Economic Journal* 32 (1922): 305-14; A. C. Pigou, "Empty Economic Boxes: A Reply," *The Economic Journal* 32 (1922): 458-65; and D. H. Robertson, "Those Empty Economic Boxes," *The Economic Journal* 34 (1924): 16-30. Reprinted in George J. Stigler and Kenneth E. Bouldings, eds., *A.E.A. Readings in Price Theory* (Homewood, Ill.: Richard D. Irwin, Inc. 1952).

⁵Lawrence R. Klein. *A Textbook of Econometrics* (White Plains, New York: Row, Peterson, and Company, 1953), pp. 226-36.

usually considered natural monopolies, so one of the functions of the public authorities was to set the prices that could be charged. Klein observed that a railroad under these circumstances was left in the short run with little more to do than minimize the cost of serving the customers attracted at that price. In the longer period, naturally, a firm can affect the factors that go into the price setting decision and, indeed, can affect the very viability of the industry in competing with industries producing substitutes.

The particulars of the effects of regulation on the S&L industry differ from Klein's example. For one thing, output prices are not regulated; they are set in relatively free competition. Real life is stranger than fiction, though, as input prices are regulated while profits are not. For another, the largest banks and associations have grown up while under regulation. Size is not just a matter of history. We shall come back to these points, and develop some others, towards the end of this chapter.

To appreciate the development of the work that has been done in this field, we must temporarily suspend our desire to delve into the theoretical implications of the limited franchise of financial institutions. One should stop for a moment and imagine that, the only published work in the field was merely speculation about the probability of scale economies in banking and related institutions, yet the need for regulation to prevent such economies from promoting monopoly was an article of faith for the public.⁶

⁶The reader is cautioned that monopoly has other causes as well. See A.D.H. Kaplan, *Big Enterprise in a Competitive System*, The Brookings

Early Studies

That is pretty much how things stood when Alhadeff's study was published in 1954.^{7,8} His sample was limited to California commercial banks, hereafter simply banks, and contained only four that operated any branches. These four were quite large compared to the unit banks in the sample. Looking past the limitations imposed by the sample, however, the results were interesting because they suggested both that the conventional view had overstated the case for large firms and that the simple correlation between size and cost might be deceptive. They showed that there were substantial benefits to be gained by moving into the \$5 million asset class, but, above that, there was a plateau on the average cost curve that extended to the \$50 million mark. Above that, costs appeared to fall again, but not at as rapid a rate. Branching was found to be more expensive, but the limitations of the sample did not allow much confidence to be placed in this.

The study was an analysis of variance and did not employ any techniques to make allowances for the cost factors that he found that could affect the relationship of cost and size. He did find that large banks do an appreciably different type of business than do smaller ones

Institution, Washington, D.C. 1954, for a description of the development of public feeling toward big enterprises.

⁷David A. Alhadeff, *Monopoly and Competition in Banking* (Berkeley: University of California Press, 1954).

⁸At least one study has been published: J.C. Gibson, *Report on Bank Cost Study* (University of Wisconsin, School of Commerce, Bureau of Business Research and Service, Madison, 1947).

and that unit banks are not readily comparable with branch systems for the same reason. His tentative conclusion was that scale economies are likely to be the main advantage branch systems have, but comparable unit banks are likely to have lower overhead; no distinction being made between overhead attributable to the additional offices of branching and that attributable to other sources.

Horvitz, in 1963, using a similar methodology, extended Alhedeff's sample to include all FDIC insured institutions.⁹ He also defined output not as total assets but, rather, as total loans and investments. The difference being what they call the load factor of the firm. Not all assets are usable by a financial institution for earning income, since it must keep precautionary and reserve balances. They argued that the loading factor, or, the fraction of total holdings that can be considered "output," does not vary regularly with firm size, so it would be misleading to use total assets as a proxy for output. It is somewhat difficult to evaluate their claims. Clearly, some components of the reserves an institution will hold are determined by the risk the management, or the regulatory authorities, perceives of a drain of funds, and that risk is a function of the size of the pool of deposits the firm holds. On the other hand, as later studies noted, large banks made bigger loans and, in part, that was because of the lower risk they ran in making such loans compared with small banks: the law of large

⁹Paul M. Horvitz, "Economies of Scale in Banking," in *Private Financial Institutions*, Commission on Money and Credit (Englewood Cliffs, New Jersey: Prentice-Hall, 1963).

numbers offers more protection the larger the number involved. Thus a bank might economize on its precautionary balances by consistently giving preferential treatment to small loans.

The results of the study are strikingly similar to those of Alhadeff. He found that average costs declined with increases in size until the firm reached the \$5 million mark, and then did not decline significantly again until the \$500 million level was passed. Branching was more expensive, but this conclusion did not take into account the differences in output mix and size of loans observed between unit and branching, and large and small, banks. Branching costs, indeed, were balanced against the higher rates they received from their loans to give them a net rate of return equal to the unit firm's return. He concluded that labor efficiency and changes in the composition of the firm's output were likely to be the primary sources of cost reductions associated with growth.

On the negative side, there were several things that flawed the work. The data were not for individual firms, but rather average ratios for firms that fell into a size class. There were no data on the number of offices held by any size of bank and, as a result, it is rather hard to make a policy lesson out of one of his most widely quoted results, that four \$15 million firms were superior to a branch bank of \$60 million with the number and the size of its branches unspecified. As before, the very variedness of the firms under observation suggested that the pure relationship between cost and size had not been identified. He presented evidence relating to the differences in output mix, but

failed to follow through in combining it with his cost measures. He did consider the ratio of time deposits to total deposits as it varied with size, but the influences of the market surrounding each firm were not dealt with, mainly, one suspects, because of the limitations of the data he used.

The year before Horvitz's work appeared, Shaw published a cost study of the S&L industry in California.¹⁰ In a striking table he presents the ratios of non-interest, or "operating," expenses to total assets for each of seven size classes of firms.¹¹ For each class he calculated the maximum ratio (highest cost per dollar of assets), the minimum (lowest) cost firm, and the average costs for the first and third quartiles. Looking only at the highest average cost column, the cost to asset ratio drops as soon as the firm moves out of the under \$5 million asset class, but does not drop again substantially until the over \$300 million class is reached. The minimum case (i.e. the lowest cost firm in each size class) presents almost the opposite picture, but the numbers are not so dramatic. Those under \$5 million, as well as those over \$300 million have the lowest ratios. The first and third quartile cases both show steady drops in ratios as firm size increases.

Shaw also fits a simple regression to his data (58 firms):

$$\text{Total operating costs / total assets} = \alpha + \log(\text{total assets}).^{12} \quad (1)$$

¹⁰Edward S. Shaw, *Savings and Loan Market Structure and Market Performance* (California Savings and Loan Commissioner: 1962).

¹¹Ibid., p. 104.

¹²The symbol α represents the constant term in the equation.

He found that the majority of cost reductions came to relatively small firms making modest increases in their size, but that even the largest firm in his sample, with over \$1 billion in assets, had not completely exhausted the cost advantages.

This very simple specification of the relationship of cost and size contrasts with the body of his work. His market analysis is detailed and his knowledge of factors affecting the firms he studied is far in excess of what previous, or later, work demonstrated. He does cite evidence that the ratio of labor to assets almost halves from the smallest to the largest firm and suggests that this is not likely to be due completely to changes in product mix. There is no attempt, however, to differentiate changes in output mix and internal economies in the regression. Market forces--i.e. the size and quality--are not explicitly accounted for either, but he finds that branching pays, in part, because it allows firms to leave crowded markets in search of new ones to penetrate. To grow faster than the local market, that is, at the expense of competitors, is a slow and costly process. Branching, viewed in this light, provides a cheaper alternative. Unit associations must cultivate more and more intensively their home grounds and this necessarily brings about diminishing returns to the incremental outlay.

Improved Techniques

Two early studies to use multiple regression analysis were done by Schweiger and McGee, and Gramley in 1961 and 1962,

respectively.^{13,14} They were both attempting to explain the average costs of commercial banks. As had the previous work we have covered, they used operating expenses as "cost." This excluded interest expenses and such miscellaneous items as advertising. There were some differences in the equations they estimated, and Schweiger-McGee divided their sample into size classes, while Gramley did not. Gramley used the log of total assets as the measure of firm size. Schweiger-McGee's classes were based on total deposits. These were gross figures, as opposed to the usable assets measures of Alhadeff and Horvitz.

S-M's conclusions from their ratio work were that the advantages of size fell off rapidly as one moved from the \$50 to the \$200 million class, and, above that, there were few cost benefits from growth. This, they observed, fit in well with the average size of bank in their sample (\$58 million, with the four largest banks excluded). The results of their ratio analysis guided them in specifying their regressions.

The complete specification of their equation was as follows:

$$\begin{aligned} \text{Average cost} = & \alpha + \text{firm size class} + \text{unit/branching dummy} + \text{ratio time/} \\ & \text{total deposits} + \text{ratio commercial and industrial/total} \\ & \text{loans} + \text{ratio farm/total loans} + \text{community type code} + \\ & \text{percentage change in population in recent period} \quad (2) \end{aligned}$$

¹³Irving Schweiger and John McGee, "Chicago Banking," *The Journal of Banking* 34 (1961): 203-366.

¹⁴Lyle E. Gramley, *A Study of Scale Economies in Banking* (Federal Reserve Bank of Kansas City: 1962).

They ran the regressions for three classes: under \$50 million, \$50-200 million, and over \$200 million. Their results agreed with their previous findings except for the cost advantages associated with size accruing to firms with more than \$200 million in assets. The regression suggests the savings are quite small for such large firms.

A substantial improvement made by this study was that it paid considerable attention to the environment surrounding their sample. They used samples with varying degrees of geographic homogeneity (i.e. the city of Chicago, small Illinois towns, the Chicago SMSA, etc.). This accounted for at least some of the possible input biases. Their output mix variable, however, failed to account for the possibility that the size of the loan made, and the size of the deposit held, might vary with firm size. The functional form of the regression, which divided one side of the equation by total deposits, but not the other, provides some conceptual problems when one turns to the implied total cost function.

Both the regression and the tabular work they presented suggested that branching banks have higher cost than unit ones. They prove to be their own worst critics, however, when they concluded that it is wrong to compare branch and unit banks of the same size because the branch systems have many smaller offices and, therefore, serve the public better than unit banks. They also suggested that using the total deposits of a branch system as a measure of its size introduces a bias against branching when there are economies of scale, since it mixes the effects of the plant and the firm on costs and output together.

The problem, as shall be seen, has only been treated properly in a minority of studies.¹⁵

Gramley, using a different sample (270 10th District banks), developed the following explanation of average costs:

$$\begin{aligned} \text{Average cost} = & \alpha + \log(\text{total assets}) + \text{ratio time/total deposits} + \\ & \text{ratio loans/total assets (the "load" factor)} + \text{ratio} \\ & \text{non-government securities/total assets} + \text{ratio con-} \\ & \text{sumer/total loans} + \text{four year growth of total} \\ & \text{assets.} \end{aligned} \quad (3)$$

He found cost advantages for firms under \$10 million in assets, but little advantage for those larger. His sample, though, did not have very many large firms (over \$200 million). He did find that labor's share of cost declined with firm size and that the larger the firm, the higher the rate it paid to obtain funds. Larger firms also paid higher wages, but employed lower skilled people in greater proportions. He recognized that his function is under-specified in several areas. The size of loan or deposit is unaccounted for and the only environmental variable used is for growth. And, like previous work, there is no attempt to explicitly take into account the possible substitution effects between operating and interest expenses.

¹⁵ Rents and efficiency become inextricably tangled in the single office firm. Is it efficiency, or merely luck in having so good a site for collecting deposits, that gives a firm low average costs? A branch network with many offices is more likely to be efficient than merely lucky, since "good" locations are almost by definition rare, than to reflect its high (low) efficiency. This will be dealt with more fully in the next chapter where we deal with the theory of the firm in this industry.

Greenbaum, in 1967, published a banking study of two Federal Reserve Districts, Richmond and Kansas City.¹⁶ He estimated an equation of the form:

$$\text{Average cost} = \alpha + \text{adjusted total revenue/total assets } (R/A) + (R/A)^2 + (R/A)^3 . \quad (4)$$

It differed from previous work in several ways. The most obvious difference was that output was defined as the revenue the firm would have earned on its mix of earning assets if it has received the industry average rate of return on each type of asset. This measure was constructed by using auxiliary regressions for sixteen categories of assets to determine the aggregation weights. Whatever the theoretical problems this procedure has, it compares favorably with the two or three categories of loans taken into account in previous regression studies.¹⁷

The square and cubic terms in his equation allow a non-linear cost curve to be fitted to the data. This specification was justified by his finding that a U-shaped curve existed in both district samples. The Richmond curve became U-shaped only when the equation was estimated with both unit and branching banks in the sample. The Kansas City

¹⁶Stuart L. Greenbaum, "A Study of Bank Costs," *National Banking Review* 4 (1966-67): 415-434.

¹⁷To the extent differences in interest rates are based on real differences in cost, this method conceals information that should be available to the regression. On the other hand, the less variation there is in the rates between firms, the less the effect of his technique.

district banks demonstrated the curve regardless of whether branch banks were included. Branch banks were more costly to operate compared to unit banks when the number of offices they maintained were not taken into consideration, and their larger-than-average size meant that they contributed to the rising part of the U--at least in the Richmond sample.

Greenbaum's analysis of branching costs provides a significant improvement in methodology. He compares branch banks with given output, and a given number of offices, to collections of unit banks having equal levels of output and offices. The cost function was fitted to two sets of data: one for branch banks and one for unit banks. (This work was done mainly with the Richmond district since the Kansas City sample had few areas in which branching was permitted. Each equation was then used to calculate the cost of maintaining various levels of output and numbers of offices. This, in effect, poses the question of whether branching is more expensive than unit banking, given the average size of office operated.

By considering the branching equation alone, he could determine whether branch systems would lower or raise their costs by adding another average sized office to their system. This contrasts with the treatments of Alhadeff, Schweiger and McGee, and Horvitz, where the size of plant, or office, operated by the branch system did not enter into the cost comparisons explicitly. As we shall see, Benston, and Bell and Murphy include the number of offices maintained in their regressions, but do not divide their samples and, thus, do not allow unit and branch firms

to differ in the slopes as well as the intercepts of their cost equations. This is unfortunate, since we would like to know something about the marginal cost conditions facing firms; whether adding another firm can reduce costs or whether the expansion of existing offices is the only way.

His results were mixed. The Kansas City banks that had branched were more costly in operation than unit banks, but just the opposite was the case for Richmond. One feature of the Richmond sample was that cost fell regardless of whether growth was through an increase in average size of office or whether it was through the addition of another office, of average size, to a system.

The empirical side of his study is hard to accept because of the unsatisfactory specification of the cost function. No allowance is taken for the variations in the risk premiums attached to each category of asset in the formulation of his output measure. Nor was any allowance made for factor costs, such as wages and deposit rates. Market area factors, such as local population and the number of competing institutions, are only included in the auxiliary regressions determining the output weights. His division of the sample into unit and branch systems clarifies the problem of constraining them to be the same but for a constant term; it does not get around the problem of the number of offices being correlated with the size of the firm. The simplicity of his equation prevents him from isolating the cost effects he wishes to obtain. He considers the question of whether the single

cost equation he used is identified statistically, but there is little justification presented other than the "common practice" argument.

Improved Theory

Benston's 1965 study of banking also represented a step forward in theory and technique.¹⁸ He divided up the functions of a bank into six categories, and estimated an equation both for operating costs directly attributable to each function, and for three categories of indirect operating expenses. His purpose was to break down the functions of an integrated firm. For demand deposits he used the functional form:

$$\begin{aligned} \text{Total direct costs}_{DD} = & \alpha + \text{the number of accounts}_{DD} + \text{average size of} \\ & \text{account}_{DD} + \text{weighted items per account}_{DD} + \\ & (\text{weighted items per account}_{DD})^2 + \text{ratio checking/} \\ & \text{total number of accounts} + \text{ratio regular service} \\ & \text{charges/checking deposits} + \text{branching dummies} \\ & + \text{measure of deposit variability} \quad (5) \end{aligned}$$

All variables are in logarithms, so this is a multiplicative model. Other functions have similar specifications. The data came from the Functional Cost Survey conducted by the Federal Reserve System. His sample had an upward limit of only \$50 million in firm size.

His results are interesting, though, because he found that by taking into account the differences in the size of the instruments the

¹⁸George J. Benston, "Economies of Scale and Marginal Costs in Banking Operations," *National Banking Review* 2 (1964-65): 507-49.

bank dealt with (e.g. the average size of demand deposit held by the firm), the apparent returns to scale were reduced to the point that they were characterized as being "slight." While modest cost reductions are not inconsistent with the size range of his sample, he does show that the size of the instruments negotiated by firms has an important effect on their comparability.

While no systematic cost theory is presented, the author does suggest several sources of downward bias in the coefficients estimated with his equations. Measurement errors in allocating expenses are one possibility. The use of just the number of offices to account for the plant effects of branching does not cover the underlying distribution of office sizes in each branching system. Similarly, the average size of account may or may not accurately reflect the variations in the type and quality of business banks can attract. There is also always the possibility that there is a correlation between cost and demand curve movements that would impart a downward bias to a single equation estimation procedure.

Bell and Murphy, in their study of banking, finally provided a theoretical base for identifying a reduced form cost equation for financial institutions.¹⁹ They chose to use a CES production function, but derived their cost function from a special case: the Cobb-Douglas. The actual form of their cost equation followed quite closely that of

¹⁹Fredrick W. Bell, and Neil B. Murphy, *Costs in Commercial Banking*, Research Report No. 41 (Federal Reserve Bank of Boston: April 1968).

Benston.²⁰ Their sample was appreciably larger and they exploited the potential of the functional cost data collected by the Federal Reserve much more fully. (Their most elaborate work, involving separating the costs of various functions, does not directly interest us since S&Ls do not perform those services and, as mentioned previously, that type of data is not available for savings and loans.)²¹ For any bank function:

$$\begin{aligned} \text{Total direct costs} = & \alpha + \text{number of accounts} + \text{activity per account} + \\ & \text{mix of account types} + \text{wage rate} + \text{branching} \\ & \text{dummies.} \end{aligned} \quad (6)$$

All variables are in logarithms and the sample included firms with assets in excess of \$800 million.

Their results were that marginal cost remained below average costs for the entire range of firms under observation. Branching, however, offset those economies of scale and they concluded that when branching was the predominant form of growth, constant returns to scale would be observed. It is not clear, though, that they effectively isolated

²⁰ Benston and Bell and Murphy worked closely together and Benston's study is reprinted in its entirety as an appendix to their work.

²¹ Even if one makes the argument that S&Ls are now moving into the demand deposit business, it is hard to make the case for taking the experience of commercial banks as representative of what S&Ls might be paying. For one thing, S&Ls have generally not turned to specialized checking machines, relying on their time sharing systems to take up the marginal increase in bookkeeping. For another, S&Ls, by offering interest on its checking accounts, have been able to obtain the highest quality accounts available--much higher quality than is representative of the market for demand deposits in general.

the plant vs firm effects through their dummies. The problem lies in the fact that firm size (and, therefore, operating costs) are correlated with the size of the branch system maintained. Ten million dollar banks do not operate 100+ office networks.

The data allowed detailed breakdowns of both bank functions and the sources of scale economies to be made. Yet, such market factors as the level of local market concentration of banking services, were not explicitly included in the cost functions estimated. The question remains whether, as they maintained, all banks are really output constrained by the presence of regulation.

Two Studies of S&Ls

Benston repeated his work, estimating a Cobb-Douglas cost function for six years (1962-66) of S&L data.²² The sample contained over 3,000 of the 5,000 or so associations that then composed the industry (the industry has been slowly shrinking in terms of chartered firms, but has been growing rapidly in terms of offices). The equation took the form:

$$\begin{aligned} \text{Operating expenses} = & \alpha + \text{output measure} + \text{ratio of the number of loans} \\ & \text{made/serviced} + \text{ratio of average borrowings/} \\ & \text{outstanding mortgage balances} + \text{ratio purchased/} \\ & \text{total mortgages} + \text{size of construction loans} + \end{aligned}$$

²²George J. Benston, "Cost of Operations and Economies of Scale in Savings and Loan Associations," in *Study of the Savings and Loan Industry* (Federal Home Loan Bank Board: 1970), pp. 677-761.

size of loans purchased + ratio conventional/
total mortgage servicing + ratio withdrawals and
deposits/total savings deposits + size of savings
accounts + dummy variable for federal and state
charters + dummies (3) for date of charter
insurance + number of offices + wage rate + ratio
of real estate owned/total assets + rate of
change in output for (1) previous and (2) current
year + variance in output for (1) previous and
(2) current year + cost of foreclosure (7)

As costs were unavailable by function, he employed three alternative measures of output: mortgage servicing, mortgage making (origination), and saving deposit servicing. They were not specified in dollars, but as the number of instruments handled: the number of mortgages serviced or made, and the number of saving accounts maintained. Expenses were divided into employee, plant, and residual categories. Salaries and benefits amounted to 58% of total operating expenses, occupancy 7%, and other 35%. Advertising, tax, and interest and dividend costs were not included in the analysis (nor have they been included in any of the previous analyses discussed).

The two variables, the ratio of loans made to loans serviced, and the ratio of average funds borrowed to mortgage holdings, were included to take into account the mix of activities inherent in the firm, since only one output variable appeared in the cost function at a time;

the output variables were highly correlated with one another. All variables were in log form.

Some variables were tried, but proving inconsequential, were dropped. These included the examiners' ratings and the ratio of scheduled items (bad debts) to mortgages: the latter variable figuring prominently in the former.

The most important variables proved to be the output measures. While it makes a good deal of conceptual difference which measure is chosen, empirically there was little to choose between in performance. The number of loans serviced provided, by a small margin, the best fit. The ratio of loans made to the total number serviced, the sizes of mortgages purchased and saving accounts maintained, savings activity, the cost of foreclosures, the number of offices, the chartering agency, the price of labor, and the ratios of real estate owned to assets, conventional mortgages serviced to total servicing, and borrowed funds to mortgage holdings proved to play significant roles in explaining costs in the equations.

Benston's results indicated that economies of scale were present and that they were constant over the range of firms he observed: his sample compares fairly well with the distribution of firm sizes in the population of associations as a whole. It ranges from \$300 thousand to \$500 million firms. It does, though, miss the larger associations that range up into the billions of dollars in assets. Occupancy costs showed the smallest elasticity of output and the residual category of expenses ("miscellaneous costs") the largest, but all were less than

one. For the different output equations, the elasticity of output for saving account servicing expenses was always greater than for loan origination or servicing expenses.

Branching proved to be expensive. Occupancy costs in particular increased. Salary expenses also went up, but at a much lower rate. The additional costs were more pronounced for the lending than the savings models.

His incorporation date variables are difficult to interpret because of the "grandfather" clause in the FSLIC insurance regulations that allows for a phase-in period of reserve requirements after an association acquires deposit insurance.²³ This has produced the phenomena of larger associations (with older charters) merging with newer and smaller firms, with the resulting S&L appearing under the newer charter, the newer charter allowing the firm to hold a lower level of reserve deposits.²⁴ In addition, there have been substantial population movements in the post 1930 period and the incorporation dates may pick up substantial amounts of locational effects. The result of this is that while one can have no objection to his finding that the younger the association, the higher its costs, one is hard put to discern just why that should be so.

²³The Federal Savings and Loan Insurance Corporation (FSLIC) provides S&Ls with services similar to those supplied to commercial banks by the FDIC.

²⁴My thanks to Don Edwards of the Federal Home Loan Bank Board for bringing this problem to my attention.

Federal associations had significantly higher costs than those with state charters, but Benston was unable to place an interpretation on this. Stock associations, outside of California, also had higher costs than state and federal mutuals. California stock S&Ls, however, showed just the opposite relationship with their costs being below that of California state mutuals. In addition, California federal mutuals did not have higher costs than the mutuals of that state.

His risk variables also pose an interpretation problem. The first, the ratio of scheduled items to mortgage holdings, has an erratic and marginal effect, at best, and he drops it from his final analysis. His second variable, the ratio of borrowed funds to mortgage holdings, is significant and enters with a positive coefficient. The problem arises in his interpretation of this variable as being indicative of risk taking. Since outside borrowing (either from the FHLBanks or from other, non-government, sources) is more costly in interest payments than savings deposits, the firm presumably exhausts the funds readily available in the regulated saving deposit market before resorting to that. Thus, a positive coefficient on this variable is, at the very least, also consistent with the hypothesis that borrowing is correlated with high operating expenses, which are not due to the firm's taste for risk as much as its attempt to minimize the cost of funds (which is part of its efforts to maximize its profits).

The above does suggest one of the major problems in accepting the results of this study: is there a satisfactory theoretical justification for the firm minimizing operating expenses as opposed to total

(interest and operating) expenses? The very fact that there are restrictions on interest payments argues that non-price competition will occur. During the time period he examined the average number of branch offices per association, for the industry, grew from one quarter of an office to one and a third; five times as many.

A somewhat lesser problem is that the use of mortgage servicing, origination, and saving account maintenance as output measures is somewhat hard to incorporate into the existing theory of the firm. To begin with, if one is to use the theory of the firm, one should attempt to consistently adopt the conventions of that doctrine. To be fair, there are good reasons for one to tend to be uncomfortable in calling savings deposits just another input into the firm's production process. Savings, after all, is a unique input from the point of view of economists involved with the matters of public policy for financial institutions. It is this input that is, in part, responsible for the unique character of the industry's regulation. The public does not view itself as just another supplier of an input. If both saving and lending are outputs though, one is placed in a position similar to that encountered by those attempting to measure the cost effectiveness of government. The author feels that one must come back to the position that an S&L does not try to maximize the price (cost) of saving deposits, however noble a goal this may be in the minds of the public. Rather, it has striven to hold down the cost of this most important of inputs and--given the limits of the political strength of any pressure group--it has done rather well at it over the recent years.

The point to be made is more a behavioral one than a normative one. Reasonable people can differ over what should be considered the output of S&Ls. But the question of what do associations appear to be treating as their output and what appears to be their inputs, is relatively easy to answer. On a micro-economic level, this amounts to almost a truism. Savers are just a group of atomistic suppliers that sell the use of their funds to associations who, in turn, convert this into a very different product; a long term, moderate sized instrument that is not callable on demand (i.e. a non-demand instrument).

We have dwelt upon the Benston study at length because it was one of the few extensive studies that has been done of S&Ls. Brigham and Pettit conducted a second.^{25,26} They combined cross section data for three cities (Los Angeles, Chicago, and Detroit-Cleveland) with a five year time series (1962-66). They used two dependent variables: average operating costs and a measure of average profits, average profits being defined as the ratio of income (before taxes) plus interest payments on deposits to average net worth plus average deposits. The equations took the following form (only total assets is in logs):

²⁵Eugene F. Brigham and R. Richardson Pettit, "Effects of Structure on Performance in the Savings and Loan Industry," in *Study of the Savings and Loan Industry* (Federal Home Loan Bank Board: 1969), pp. 971-1209.

²⁶Other studies include: *Operating Ratios of Seventh District Savings and Loan Associations 1966: A Study of the Cost Structure of Associations in Illinois and Wisconsin* (Federal Home Loan Bank of Chicago: 1967); and *Mortgage Banking Survey of Single Family Loan Operations 1967* Research Committee Operations Report No. 1 (Mortgage Bankers Association: October 1969).

$$\begin{aligned}
 \text{Average cost (profit)} = & \alpha + \log(\text{total assets}) + \text{number of branches} + \\
 & \text{average deposit account size (not available} \\
 & \text{for all regressions)} + \text{ratio fixed/total} \\
 & \text{assets} + \text{growth rate of portfolio} + \text{ratio fee/} \\
 & \text{gross income} + \text{ratio bad debts/mortgage} \\
 & \text{assets} \qquad \qquad \qquad (8)
 \end{aligned}$$

All the cost equations (there are thirty, one for each year, city, and dependent variable) suggest that economies of scale are present. When the average size of savings deposit was included in the equation, however, the coefficient for the log of total assets (his elasticity of output for a change in costs) was significantly reduced for Chicago and Detroit-Cleveland, but not for L.A. On a statistical level, the problem was that the average deposit size was strongly correlated with firm size. The economic implication was that one could not interpret the coefficient on total assets (when average deposit size was omitted) as a measure of the cost reductions that would be available if the regulatory authorities encouraged small firms to merge to create large associations. Some institutions must hold the small depositor's money and there are only a limited number of large account customers available.

In general, Los Angeles proved that it is doubtful to assume that regional variations do not significantly affect the cost and profit performance of S&Ls. In Los Angeles, average deposit size did not affect the coefficient of the asset size of the firm variable significantly and it, in itself, did not have a t-value above one except for

one year. The size of the firm was positively related to the average profit variable in Chicago and Detroit-Cleveland, but only marginally so in Los Angeles.

Branching was a cost increasing and profit reducing variable, but the authors recognize that it is correlated with firm size and their estimates are not reliable; there are no very large unit associations that compare with the size of the larger branching networks. They use their results, however, to calculate the cost of operating various sized branch systems to compare with the costs of similar groups of unit associations. On this basis, branching lowers costs (and, as they are careful to point out, competition as well). Among other things, it is hard to know just how much of their result depends upon their assumption about the size of the unit associations to be "added up" to form their synthetic branching firms. There is no reason to believe that their distribution of sizes is very close to the average for branching institutions.

The question of stock versus mutual association behavior was explored using the above cost or profit equations. An additional dummy for organizational form was added. In the cost equations, organization did not always seem related to expenses in any systematic way. In two of three cities the dummy was significant and indicated that stock companies had higher costs. In Los Angeles, however, the dummy was also significant, but with the opposite implication: stocks had lower costs than mutuals. The general conclusion, though, was that the t-values for the dummy were quite low at times and that, combined with

the sign reversals, suggested that little could be made of the argument that one form was more efficient than the other.

The authors recognized that their dummy scheme allowed only for differences in the intercept term and not for the possibility that the slope of the relationship between cost and size differs from stock to mutual. When they broke up their sample along organizational lines, their results improved slightly. They did not report whether the differences in the coefficients for the two samples were statistically important.

The profit equation results were no more conclusive, either with a dummy scheme, or divided samples. Only a small amount of the variance was explained by organization and again fluctuations in the sign of the dummy were present. Their conclusion, though, was that stock companies' profits followed the cyclical behavior of the local housing market more closely than did the mutual associations; their profits on the up side of the housing cycle were higher, but, on the down side, this advantage vanished and, in Los Angeles, even fell below the mutual's performance.

This study suffers from many of the same problems that have already been mentioned in connection with previous work. The unique part of it lies in the questionnaires they distributed among firms that had an active history of merging or branching, and among the various supervisory agencies, asking about the motivations given for such activities. In response to a question about why the non-surviving association merged, the answers fell into the following categories. A

third of the mergers were due to financial problems and another 20% were "weak institutions," too small to compete. Forty percent were described by the survey responses as being due to management deficiencies (due to death or lack of skill). This last category can be understood better if one realizes that many very small institutions rely on volunteer and part-time workers. When they become unavailable often the association's officers either must become actively involved in running things or seek a merger with a larger association that has the work force to supply their needs. Even fair sized institutions may not be able to train their own replacements for the more responsible positions.

Some of these reasons are hard to distinguish between. In the "weak institution, too small to compete" category, for example, one response was that the association could not afford to pay as well, both in terms of direct pay and in terms of the psychic benefits of management, as the firm it merged with. And, Brigham and Pettit point out, at some later date, without the merger, the above example might have fallen into circumstances that would have forced a merger due to insolvency.

The motives of the surviving associations were, in the main, given as either a desire to "help out the industry" (i.e. acquiring an S&L that would otherwise be liquidated) or an interest in growth. Holding companies consolidated their associations with the parent mainly to achieve increased efficiency, and to prevent their being classified as multi-firm holding companies under the 1968 Holding Company Act.

All in all, Brigham and Pettit present a good deal of evidence that the presence of restrictive regulation has been the binding constraint on industry structure. They were also the most concerned with developing the theoretical implications of the industry's situation.

Recent Developments

Baltensperger in 1972 suggested that the principles of insurance be applied to an inventory model of the banking firm.^{27,28} He showed that the greater the number of accounts, or instruments, handled, the lower the losses of reserve funds (either through unanticipated withdrawals or defaults) that could be expected, as a percentage of the total. Thus, one would assume, given the size of accounts, the cost of maintaining a fund against the unexpected would rise proportionately with the size of the institution.

What he does not demonstrate, as pointed out by Borts and Murphy, is that large institutions can make small loans at a lower cost than can small firms.²⁹ There are really two issues under question. Large banks, it is generally agreed, can make large loans at lower risks to

²⁷Ernst Baltensperger, "Economies of Scale, Firm Size, and Concentration in Banking," *Journal of Money, Credit, and Banking* 4 (1972): 467-88.

²⁸Idem, "Cost of Banking Activities: Interactions Between Risk and Operating Costs," *Journal of Money, Credit, and Banking* 4 (1972): 595-611.

²⁹George Borts, "Ernst Baltensperger's 'Cost of Banking Activities', A Comment by George Borts," *Journal of Money, Credit, and Banking* 4 (1972): 612-13; and Neil B. Murphy, "Costs of Banking Activities: Interactions Between Risk and Operating Costs, A Comment by Neil Murphy," *Journal of Money, Credit, and Banking* 4 (1972): 614-15.

themselves. (And, in fact, we often see very large banks pooling risks in joint ventures.) Small banks, conversely, may be more efficient in gathering information about the potential problems in their local markets. They are more likely to follow closely the progress of individual transactions, thus minimizing the size of the loss they might suffer. It is a matter of counterbalancing information, production costs, and the law of large numbers.

What is at stake is whether one should consider the larger average loan of big institutions as a potential source of scale economies or as a factor to be held constant in order to make the cost/size relationship of big and small firms comparable. Baltensperger is not entirely convincing, since he does not demonstrate that large firms are close substitutes for small firms, in the sense that large firms could make the loans small ones do at a lower price. What he does show is that by ignoring the size of loans, there is a bias introduced in favor of large firms. Accounting for the bias does provide us with a stronger test of the cost reduction potential of size.

Recently Mullineaux has written a series of papers on scale and branching costs.³⁰ In one he discussed a single equation cost function:

$$\begin{aligned} \text{Current operating expenses} = & \alpha + \text{total operating revenue} + \text{ratio of} \\ & \text{interest on deposits/average total time} \\ & \text{deposits} + \text{ratio wages and benefits/} \\ & \text{number of employees} \end{aligned}$$

³⁰ Donald J. Mullineaux, *Branch Versus Unit Banking: An Analysis of Relative Costs* (Federal Reserve Bank of Philadelphia: 1973).

+ ratio demand/time deposits + ratio consumer/total loans + ratio real estate/total loans + ratio business/total loans + Federal Reserve membership dummy + SMSA dummy + branching dummies + holding company affiliation dummy (9)

All variables are in logarithms (this is a Cobb-Douglas, reduced form cost function) and the interest and wage variables are interpreted as prices for raw materials: the price of demand deposits is recognized, but not treated explicitly in the equation. The sample was divided up by organization (unit versus branch) and by size (0 to \$5 million, 5 to 25, 25 to 100 and 100+ in assets).

For the sample taken as a whole there were "mild" economies for both branch and unit banks, branching being somewhat more costly. Systems with more than four offices in particular experienced increasing costs as they added more offices. Factor prices did not enter significantly, but this was found to be due to the dominant variable effect of his output measure on the equation. He did not delete them from the specification because they are necessary for the duality theorem to hold that relates cost and production functions.³¹

Unit banks as a group, however, seemed quite different than branch banks. The asset mix variables were all significant determinants of

³¹W.E. Diewert, "Applications of Duality Theory," in M.D. Intriligator and D.A. Kendrick, eds., *Frontiers in Quantitative Economics* (Amsterdam: North-Holland, 1974), pp. 106-70.

costs for unit, but not for branching firms. Federal Reserve membership was not significantly related to costs for unit banks, but was positively correlated with multi-office banks.

When he broke his sample into size categories, his results changed. There were no economies of scale in the 0 to \$5 million asset group, and only branch banks systems exhibited significant economies in the next largest class (\$5 to \$25 million). The constant term (α) for the branching equation, he argued, implied that the make up of the branch system involves diseconomies as well, so that only a small system (two or less offices, for firms under \$25 million) were consistent with lower costs for systems than for unit firms. For the large size firms (\$25 to 100 million, and \$100 million+) branch and unit banks were combined, due to the scarcity of unit banks. There were no economies found associated with size in these groups and branching was a source of diseconomies for firms under \$100 million. Once that size had been reached, though, branching involved no important cost penalty.

Mullineaux goes on to try constructing assemblages of unit banks comparable to branch systems. One problem was that the firms in different size classes were remarkably different in their output-cost relationships. Two different schemes were used, one combining equal sized unit banks and the other using several small banks combined with a single large one, but it developed that the results were similar. When he held the number of offices constant, and allowed assets to vary, branch systems were only less expensive when they maintained a very

small number of offices (under four) and approached the upper limit of the \$5 to \$25 million class in size.

Since average costs flattened out above \$25 million, branch systems tended to cost more, with no size advantages to offset the diseconomies of additional offices. (Recall, though, that there were so few unit banks in this size range that direct comparisons were not possible.) Above \$100 million, branching did not appear to exact any penalty.³² The result, then, is that the public policies favoring very large branch systems may be appropriate if branching provides services not available from unit banks. There is another way of interpreting the results: if large firms impose unacceptable market structures, then only modest numbers of offices should be granted to modest sized banks. There is no evidence here and there is little in Bell and Murphy, to recommend the large bank approach on cost grounds. Such banks have their justification mainly on the grounds that large and small banks are very dissimilar in their activities.

In the final section of his study, he develops a multi-product cost analysis, similar to the work of Bell and Murphy. His conclusion was that the scale economies reported by them could be explained by their failure to separate unit banks, which enjoyed pronounced economies, and branch banks. Only for real estate operations did branching banks enjoy significant cost drops as their size increased. The general

³²While the sample included all 1st, 2nd, and 3rd district banks, there were only seven \$100 million plus banks in it.

result was that the functional cost data did not suggest that scale economies ever overcame the diseconomies of branching.³³

For our purposes, a cost analysis, several points are important. S&Ls can function as brokers, as well as dealers, though this does not occur to the same extent as it does in banking. Mulleneaux does not attempt to distinguish between the two activities in his single equation cost function, even though broker activities may have a different cost--size relationship than dealer activities. This is just another way of saying that it is difficult to directly compare a large New York bank with one of its smaller, more sedate, relatives. Broker activities should be taken into account in an S&L study. Another point is that Mullineaux was aware of the restrictiveness of the Cobb-Douglas form: some of the results of previous work, he argued, may be due to those restrictions. A final point; he was also aware of the fact that the size distribution of the offices within branching networks was unaccounted for in his equation.

Where to from Here?

More generally, the studies discussed have several persistent faults. While it may, to some degree, make good sense to assume (without testing) that output is exogenous for railroads and electric utilities, it is not so obvious that regulatory constraints on the S&L industry have had the same effect on the individual association. The

³³ Only 37 unit banks were in this sample, but the total sample included all the first, second, and third district banks that participated in the 1970 Federal Reserve Functional Cost Analysis Program.

structure of the industry, even to the casual observer, belies this view of the fatalistic nature of associations. The lion's share of the branch offices has been awarded to a few handfuls of firms. They, with assets that run, for some, into the billions of dollars, have actively sought and consistently obtained permission from the authorities to expand. Mergers have occurred in impressive numbers over the years, and only a handful have been "shotgun" affairs, in which a failing firm is taken over by another association to prevent a failure. Expansion has been a dominant theme in the activities of the larger associations, and holding companies, branching, and mergers have been effective tools. What is important is whether this picture, of uneven growth and a wide diversity of firm sizes, is the result of the peculiar nature of the functioning of regulatory bodies, or whether market conditions have been the guiding force in the development of these large firms. Have many associations felt the urge to expand, but only a few have successfully talked the authorities in letting them, or have the firms that have grown large been in markets where low costs and little competition have inspired them?

Such market conditions have been poorly treated in cost studies. One would assume that the decision to branch, or merge, or form a holding company, is made when the marginal cost of obtaining an additional increment in output from existing facilities exceeded the cost of obtaining a new charter and establishing a new office. Yet, no variables for local market saturation, or local firm concentration have been used. In part, this has been because little attention was

paid when samples were selected to defining an appropriate market area. (Older studies tended to be less at fault in this respect than the more recent, larger, and more sophisticated studies have been.)

It is remarkable that most of the analysts cited here have chosen to define a concept they call operating expenses as the relevant cost that the firm wishes to minimize. Most studies, while excluding interest, have included such variables as the ratio of passbook to certificate of deposit interest payments in their cost equations, and their results have indicated that "operating expenses" and interest expenses are not independent of each other. This would seem to be a serious omission in the treatment of costs, since one would presume that services an association offers to its customers, which are included in its operating expenses, are part of its overall strategy to minimize what it pays for funds. Market structure, of course, should play a role in this as well. At the very least, it must be said that there has been no theory offered as to why a financial institution would choose to minimize some subset of its input expenses.

As has been mentioned previously, the treatment of branching costs has not been satisfactory. If office size, as well as firm size, is important in scale economies, then it is not the average size of office in a network as much as the size distribution of those offices that will determine the cost level of the firm. The fact that some associations can support large portfolios without resorting to branching raises the question of whether some locations provide their owners with rents, a question that has not been considered previously: it

has been implicitly assumed that locations do not vary in their favorableness.

With few exceptions, analysts have also paid little attention to the implications of the form of the production function implied by their cost functions. The Cobb-Douglas, as will be discussed in the next chapter, implies some very specific constraints, such as on the values the elasticity of substitution can take on (it must be constant and equal to unity) and on the values the elasticity of output for a change in all inputs can take on (it also must be constant, but its value is not fixed.) One of our goals, then, will be to develop a more general equation that does not require so many assumptions in its form. Another of our goals will be to provide a theoretical justification for the separation of interest and operating expenses. Appendix A presents the C-D model as it is employed in the papers reviewed in this chapter and it can be usefully compared with the treatment of the problem in the next chapter and in Appendixes B and C.

It is not likely that these assumptions of previous work will all be proved wrong, or even critical to their results. What is important is to formulate the problem in such a way as to eliminate as many of the alternative hypotheses that would explain their results as possible. Progress, if you will, is not so much a process of new discoveries as it is the development of better experiments; to make sure that what we all "know" is really true.

CHAPTER 3

A THEORY OF THE FIRM

This chapter develops a method of examining empirically the questions we proposed to answer in Chapter 1. Our first consideration is for what kind of analysis the special nature of the S&L industry suggests can be successfully made. Then, as a preparatory step in formulating our methodology, we present in Appendix A a classical development of the theory of the firm and derive the necessary and sufficient conditions for that theory to be applicable to the S&L industry. The next step involves developing a theoretical model of the S&L association that is more descriptive of their actual functions. Since data are not available to estimate this model, a third model is proposed, one that can be estimated and one that will allow us to determine if the loss of descriptive power will bias our results. This third model provides us with a cost equation that can be used to determine the relative efficiency of different sizes of firms. We elaborate on the specification of this cost equation at some length since we want to isolate the size-cost relationship from other factors related to size (though we are interested in those relationships as well) and from real differences in firms that exist even in an industry in which their business, and how they conduct it, is circumscribed by regulations. Finally, some alternative forms of specification are

introduced as we attempt to extract the most information possible about the shape of the cost curve of the firm from our cost function.

Some Necessary Conditions

The unique nature of the industry allows our questions to be dealt with empirically. Economics seldom allows the researcher to perform controlled experiments and many phenomena that exist in theory are not readily observed in the real world. To wit, increasing returns to scale and competition are not compatible: competition allows only the most efficient to survive. S&Ls are, by all appearances, price takers, both for savings deposits and for mortgages, and that would seem to rule out the possibility of our finding increasing returns to size. Deposit gathering, though, is a localized business and that, combined with the artificial barriers imposed by regulation on entry, branching, and mergers means that economies of size do not rule out the persistence of a wide range of firm sizes, even under perfect competition. The actual range among firms is from less than one hundred thousand dollars in deposits up to firms with five billion dollars.

Not only must there be a wide range of firm sizes, there must be markets providing a wide range of conditions if we are to find out if concentration matters, or if large firms use secondary markets. Market concentration varies considerably: a Herfindahl index, based on an SMSA definition of market areas and including commercial bank deposits comparable to those held by S&Ls, ranges in 1975 from close to zero (where there are many small firms) to .95 (the index has a maximum of

one and reaches it when one firm constitutes the whole market.) The wide geographical distribution of all sizes of firms allows for differences in local market conditions that determine whether a firm is interested in secondary market transactions. Thus if we think of economic model estimation as the performance of a conceptual experiment, then the S&L industry seems to meet the conditions needed for the economic "experiment" proposed in this chapter. A formal statement of the necessary and sufficient conditions that our work requires can be found in Appendix A.

A Model of the Firm: Money to Mortgages

Though there is insufficient data to estimate such a complex model, the savings and loan association, shaped by government regulation, can be likened to a vertically integrated steel company. Deposits of iron ore and coal can be compared to the pool of savings deposit customers available to the association. Both firms produce, as an intermediate product, their own raw materials: money vs. iron and coke. These products are combined with more labor and capital to produce the final, saleable, commodity: the services of money and steel.

This model is developed formally, using a Cobb-Douglas production function, in Appendix B, and yields a cost function that breaks down into two equations:

$$C = a + b_1 K_1 + b_2 L_1 \text{ and}$$

$$c = a + b_1 w + b_2 q + b_3 K_2 + b_4 L_2 \quad .^1$$

¹_c = C - rD* = expenses net of interest = "operating" expenses.

This type of development is similar to the functional cost analysis approach discussed in the previous chapter, and, if not explicitly stated, it is also the basis of the econometric cost studies that were reviewed in that chapter as well. The functional analysis involves an accounting process that divides costs by function: deposit gathering, loan making, and loan servicing. The single equation studies concentrated on cost functions for expenses other than interest. In effect, they were estimating only the second equation. This is acceptable as long as interest and other costs are truly independent quantities. If this condition holds, the development of the second equation is identical to the treatment of Appendix A.

From a practical standpoint there are two problems with this model. First, in reality, capital and labor expenditures are extremely difficult to assign to functions. Even the stopwatch approach to dividing up a platform officer's time, often used in functional cost studies, does not capture the true cost allocations. Such an officer is hired and paid for performing the function he is called upon to do that has the highest skill requirements. He may only spend ten percent of his time making judgements on loan applications, but that, rather than opening savings accounts, is what determines the qualifications of his position. Secondly, the interest cost of deposits may not be completely independent of the capital and labor expenditures of the firm. If $i=f(K,L)$, then the cost function is no longer separable into two equations.

Since S&Ls must obtain both deposits and mortgages, for our purposes no vital information is lost by lumping the functional categories together into one cost function. The model, as developed in Appendix C, also redefines the interest price of deposits as some function of the interest payments and of the efforts the association makes to provide services to its depositors. The cost function that is derived, however, requires the cost of capital, an exogenous variable, rather than the interest cost of savings deposits, which is less than the cost of capital by the amount of services provided to attract customers. To obtain the cost of capital for each firm, we have to add in the effects of the firm's actions on the interest cost of deposits. This can be done by using an ordinary least squares procedure to quantify the effects of such variables under the firm's control as advertising expenses (as a fraction of total costs), the ratio of operating to interest expenses, and a dummy scheme for giveaway campaigns and other tactics designed to attract depositors. To incorporate this additional information into our "price" variable, the coefficients will be used to adjust the reported interest rates that associations paid their customers. Once this is done, equation 6a in Appendix C is the equivalent of equation 20 in Appendix A.

Aggregation Errors

The cost equation derived in Appendix C must be modified before it can be estimated. For one thing, it abstracts from differences in portfolios by assuming that each type of asset is equally costly to make and service. It also ignores the differences in the number of offices

that a firm may have used to obtain its deposits, differences in the structure of the market surrounding the firm, and differences in the firm's place in that structure. Each of these will be dealt with in turn.

Savings and Loans do not hold identical portfolios of loans, nor do they maintain the same mix of time and savings deposits. Our measure of output, the Q of Appendix C, is the simple sum of the firm's earning assets and that implicitly gives equal weightings to each category of loans. Ignoring the variations will, at best, bias our estimates of the cost equation towards zero. If some differences in loan, or deposit holdings are correlated with size, the bias will be determined by the sign of the coefficient of the omitted weights and whether the difference variables were positively or negatively correlated with the included explanatory variables. To correct for this aggregation error we need to determine the premium or discount that should have been used in the aggregation process. Appendix D presents a method of creating variables to do this.

The first portfolio category to account for is the fraction of the firm's holdings that are actually in mortgage loans and contracts for family dwellings. This is what politically justifies the protective legislation that surrounds the industry. The second category is the level of loans on "other improved real estate." This includes apartment houses and non-residential buildings. A third category is the firm's loans on land without buildings. These are made to finance purchases or to prepare land for building (sewer and roads, for example.) Loans

in these three categories are unlikely to have equal origination and servicing costs. Just as importantly, we will also want to know if these categories change in their relationship with the whole as the firm grows.

Bad loans affect costs and are a safety consideration as well. For our purposes bad loans are not only foreclosed ones and those that have been classified as "slow loans," either by the association or by the regulatory authorities (that is, a loan that is in trouble because of missed payments or some other reason), they include the loans that have been made, on eased terms, to facilitate selling previously foreclosed properties.

Secondary mortgage market activities also affect costs. Since the cost of originating and marketing an instrument is included in its price, the selling association has those expenses in its cost figures, but does not have an offsetting item in its portfolio. The purchasing firm has lower operating expenses, since the instrument's cost of production appears only as an addition to its selling price: in effect, the production cost of the purchased instrument appears on the asset side of the ledger rather than on the cost side.

There is a secondary market of sorts on the deposit side of the industry as well, but not on the same scale as on the mortgage side. Some firms have made use of the funds available from the FHLBanks to supplement what was available to them from the savings public. (And a few have even borrowed from commercial banks.) We are interested in both the effect of advances on our cost function and its relationship

with firm size. The regulators have often, if not consistently, expressed a desire to operate the industry in a countercyclical fashion. (The housing industry today tends to lead us into and out of recessions.) The FHLBB needs associations willing to accept funds that will be controlled by the dictates of a government stimulus policy. One might ask, then, whether any particular size of association has shown a propensity to seek out the short term funds that have been offered on that basis, funds that in the long run must be replaced with cheaper savings deposits when the rate of deposit formation catches up with mortgage closings.

Implicit in our model is the assumption that every firm uses the same number of offices. In effect, we are aggregating over offices when we use firm level data. Instead of a simple ratio, as was used in the previous aggregation problems discussed, a Herfindahl index is used to combine the relative size and the number of offices the firm has. Besides its operating cost considerations, we also want to know if multiple offices affect the rate of interest the firm pays its customers. Does the convenience of several offices compensate the customer of large associations for the lack of personal service available from small ones, or do large associations have to pay him higher rates? In Chapter 5 we will see whether the interest rate the firm pays for its funds can be explained by our office index, the size of the firm, and the ratio of operating to interest expenses.

As our cost equation stands now, it implicitly assumes that every firm faces the same market conditions. One of our objectives is to

determine whether market concentration affects the firms in that market. Our hypotheses is not that the individual associations have significant control over the price of savings deposits or mortgages--it is a question of whether each and every market attains the competitive price vector for the inputs and output of S&Ls. Firms can be price takers if the gains from price cutting are so small as to eliminate such behavior, and there is good reason to suspect that this is the case for S&Ls. In fact, in the S&L industry price information is nearly perfectly available and it is difficult to imagine an association failing to match the offer of a neighboring S&L if it experienced any change in the flow of funds to it. The industry as a whole is protected by regulation from situations that would cause a loss of deposits: the individual association could conceivably, though, lose much of its deposit base if it did not meet the market offer for deposits. The author is not aware of this situation occurring often. On the contrary, it is remarkable how persistent associations are and how steady a business they do. If concentration exacerbates the problem of noncompetitive pricing, we would expect the price of savings to be lower with higher concentration and the price of mortgages to be higher.

Taking the market structure into account imposes the most restrictive criteria used in selecting the sample. Herfindahl indexes, using deposit and mortgage holdings for delineating the relevant market, were constructed. The SMSA was chosen as the market area and the asset and liabilities of commercial banks that were similar to

those found in S&Ls were included in the calculation of the indexes. (Approximately one hundred S&Ls were excluded from the sample because they had spread outside their home SMSA or had offices in two or more SMSAs.) Index numbers for 171 SMSAs were calculated. Our sample was then selected on the basis that the firm had to be unambiguously situated in a single SMSA. Those that had access through branch offices to other markets were excluded from the sample--but not from the indexes.

How does the index enter the cost function? Well, we have hypothesized that the market's firms are price takers and the market structure may determine the level of those prices. This suggests that market structure will enter as a multiplicative adjustment to the prices faced by the firm, and that is the approach we adopt.

The Curve of Costs

The cost function so far, even in its enhanced form, does not give us a very satisfactory means of determining the relationship between size and cost. The problem is that the cost elasticity of output is specified as a constant: whatever economies of size there may be, they are assumed to apply evenly to all sizes of firms. This may be so, but a U-shaped cost curve, if it existed, would suggest significantly different policy recommendations than a log linear cost curve. Two alternatives are available, a generalized cost function and a quantitative dummy scheme. We will consider each in turn.

Our first alternative allows us to relax the stringency of several of the assumptions inherent in our choice of a production function and,

by extension, our cost function. The Cobb-Douglas is homothetic; the marginal rate of substitution between inputs is solely a function of the ratio in which they are being used and, thus, independent of the level of output. Nor can the elasticity of output for increases in either input vary with the level of output: the C-D is homogenous as well. And this implies a third condition. The sum of the output elasticities, that is, the elasticity of output for a change in both inputs, or, more familiarly, the returns to size, will be constant over the range of observed production.²

These are assumptions and, if possible, they should be tested for their validity. Fortunately, recent work has suggested ways of modifying the specification of the production relationship to allow for such an examination. We can develop a more general form of production function that will, if the assumptions of the C-D are correct, collapse into our original functional form upon empirical estimation. To begin with, our original production function (equation 1 of Appendix A) can be written as a linear function if we transform the variables into logarithms.

$$\ln Q_1 = \beta_0 + \beta_1 K_1 + \beta_2 \ln L_1 + \varepsilon_1 \quad (1 = 1 \dots n \text{ firms } .) \quad (1)$$

The coefficients β_0 , β_1 , and β_2 are estimates of α , κ , and ω .

²The term, economy of scale, is only properly defined when we are confining ourselves to homogeneous production functions (those with linear expansion paths). Since we are shortly going to develop a more general functional form which allows for non-linear relationships between variables, we shall use economies of size to represent the more general concept of increasing, constant, or decreasing average cost.

The ACMS, constant elasticity of substitution production function, differs from the Cobb-Douglas in that that the output elasticities of the inputs are not constant and the elasticity of substitution between inputs does not have to equal one. Kmenta has shown that a Taylor series approximation to a CES production can be written as follows:

$$\ln Q_1 = \beta_0 + \beta_1 \ln K_1 + \beta_2 \ln L_1 + \beta_3 (\ln K_1 - \ln L_1)^2 + \varepsilon_1. \quad (2)$$

If β_3 is not significantly different from zero, then we may accept the restrictions of the C-D functional form. Notice that this would give us the same functional form as we had in (1).

Equation (2) is not homogeneous, but it is homothetic. We can take its last term and expand it into a still more general form, as has been suggested by Griliches and Ringstad.⁴

$$\ln Q_1 = \beta_0 + \beta_1 \ln K_1 + \beta_2 \ln L_1 + \beta_3 (\ln K_1)^2 - 2\beta_4 (\ln K_1 \ln L_1) + \beta_5 (\ln L_1)^2 + \varepsilon_1. \quad (3)$$

If the underlying relationship is really homothetic, then $\beta_3 = \beta_4 = \beta_5$. If the relationship is homogeneous as well, then $\beta_3 = \beta_4 = \beta_5 = 0$.

³Jan Kmenta, *Elements of Econometrics* (New York: Macmillan Company, 1971), p. 463.

⁴Ziv Griliches and V. Ringstad, *Economies of Scale and the Form of the Production Function: An Econometric Study of Norwegian Manufacturing Establishment Data* (Amsterdam, London: North-Holland Publishing Company, 1971), p. 10.

Our cost function can be similarly expanded into a general form.⁵

$$\begin{aligned} \ln c_1 = & \beta_0 + \beta_1 \ln Q_1 + \beta_2 (\ln Q_1)^2 + \beta_3 \ln r_1 + \beta_4 \ln w_1 + \beta_5 (\ln r_1)^2 \\ & - 2\beta_6 (\ln r_1 \ln w_1) + \beta_7 (\ln w_1)^2 + \beta_8 (\ln Q_1 \ln r_1) \\ & + \beta_9 (\ln Q_1 \ln w_1) + \varepsilon_1 . \end{aligned} \quad (4)$$

Diewert has shown that a lemma to the Samuelson-Shepard duality theorem is that the general form (4) will provide us with a local (i.e. over the observed range of values taken on by the variables included in its specification) approximation to any continuous cost function.⁶ The Cobb-Douglas cost function is a special case: if $\beta_2 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = 0$, then the C-D relationship would not be rejected. If only β_6, β_8 , and β_9 were equal to zero, however, we could not accept, say a CES type of relationship, since there are other classes of functions that cannot be ruled out.

Another price that must be paid for this degree of generality is that any error in the measurement of the variables will have a much more decided effect on the nonlinear terms of our equation than on the linear ones. It is well known that random measurement errors in variables impart a downward bias to their coefficients in the least

⁵Recently Christensen and Greene, "Economies of Scale in U.S. Electric Power Generation," *Journal of Political Economy* 84, no. 4, part 1 (August 1976) have this form of cost function in a study of electric power generation.

⁶W. E. Diewert, "Applications of Duality Theory," in M.D. Intriligator and D. A. Kendrick, eds., *Frontiers in Quantitative Economics* (Amsterdam, London: North-Holland Publishing Company, 1974), pp. 106-170.

squares procedure. Griliches has shown that, for a simple squared term added to a linear equation, the coefficient of that term is biased downwards with the square of the bias of the linear term.⁷

Since we are concerned with the elasticities of our functional form, we should examine the most important of them as they appear in (4). The underlying production function will be homothetic if the coefficients β_8 and β_9 equal zero. It will be homogeneous if β_2 as well as β_8 and β_9 are not significant. In Appendix A we defined economies of scale, or, more accurately, economies of size, as the elasticity of output with respect to a change in all inputs. A more appropriate definition for us would be to define it as the effect of a change in output for a change in total costs.⁸ The elasticity of size for (4) would be,

$$\frac{\partial \ln c}{\partial \ln Q} = \beta_1 + 2\beta_2 \ln Q + \beta_8 \ln r + \beta_9 \ln w, \quad (5)$$

assuming that the appropriate production function is neither homogeneous nor homothetic. If it is homothetic, then (5) reduces to (6), since this condition implies that the terms associated with β_8 and β_9 are not important.

⁷Ziv Griliches, "Error in the Variables Bias in Non-Linear Contexts," *Econometrica* (March 1970): 368-70.

⁸G. Hanoch, "The Elasticity of Scale and the Shape of Average Costs," *American Economic Review* 65, no. 3 (June 1975): 492-97; and Christensen and Greene, "Economies of Scale in U.S. Electric Power Generation," *Journal of Political Economy* 84, no. 4, part 1 (August 1976): 655-76.

$$\frac{\partial \ln c}{\partial \ln Q} = \beta_1 + 2\beta_2 \ln Q \quad (6)$$

Finally, if our original Cobb-Douglas production relationship is valid, we get the following;

$$\frac{\partial \ln c}{\partial \ln Q} = \beta_1 \quad (7)$$

That is, the level of a firm's output does not alter the cost economies to be gained from a further increase in its size.

The elasticity of substitution must also be restricted if we are not going to reject the C-D form of specification. It assumes that this elasticity is constant and equal to one. (This is the implication of the simple multiplicative form of equation.) For this condition to hold, the β_5 , β_6 , and β_7 terms must not be significantly different from zero.

Our second alternative for exploring the shape of the cost curve is simpler, though it does not simultaneously explore the elasticity of substitution. It relies on the simple Cobb-Douglas class cost function we have developed previously. A quantitative (0-1) and a qualitative (0-Q) dummy is used to determine whether there are changes in the slope of cost at some point along the curve. If the dummies have significant coefficients, then the assumption that scale economies do not vary with size cannot be accepted.

We are now ready to estimate a cost function for a firm in the S&L industry, using both the generalized functional forms and the dummy scheme, and employing the variables we have discussed. In Chapter 5 we do this and analyze the other observable size-related factors.

CHAPTER 4

DATA

The data to test our model are from the financial statements and reports submitted to the Federal Home Loan Bank Board (FHLBB) by all S&L associations with Federal Savings & Loan Insurance Corporation (FSLIC) insurance, the Federal Deposit Insurance Corporation (FDIC) Call Reports on commercial banks, and the Bureau of Labor Statistic's (BLS) Area Wage Surveys.

The output of associations, their total assets, is represented by the end of year, 1975, figures reported in the Semi-Annual Report made to the FHLBB. Total costs are derived from the same source. Two "total cost" figures were obtained. One included interest expenses, along with the normal operating cost of the firm and such items as advertising expenses. The other excluded interest expenses so that the dominant variable effect of interest payments could be determined.

While the loan portfolios of S&Ls tend to be much more uniform than those of commercial banks, there are variations in lending activities that affect costs. So, as described in Chapter 3, several ratios of lending categories to total assets are needed. The largest single item in the association's portfolio is mortgage loans and contracts. These are instruments involving buildings: single family, detached, dwellings predominate, with multi-family and larger structures making up the balance. Our first ratio variable measures the division

between housing, either single family or multiple family units, and those larger buildings. (The term larger is not particularly apt, since the main distinction appears to be over whether the holder of the mortgage is intending to live in the building or not. Larger buildings include mobile home parks, nursing homes, churches, stores, and the like. A housing mortgage, on the other hand, might be the debt of someone desiring to purchase an apartment in a condominium.) The second variable is the ratio of loans for real estate, as opposed to loans for buildings and the real estate they are situated on, to the total assets of the firm. Loans in this category include lending to developers to buy and prepare land for construction. Inevitably some associations wind up taking possession of some property and making "soft" loans in order to divest themselves of it. The third ratio is the fraction of the firm's assets that has been classified as slow, or foreclosed, or soft. The fourth ratio is a residual to account for the association's loan activities outside the usual categories.

It is a fair generalization to say that S&Ls obtain their funds through the savings account balances of the public, and that those funds go into making mortgages in that same area. Like all generalizations, there are some exceptions. Not all S&L funds come from savers: associations can borrow from the FHL Banks, the money coming in the form of an "advance," or from private sector sources. Ratio number five takes this into account. Similarly, secondary mortgage markets have

allowed associations to buy and sell mortgage instruments.¹ Two final ratios are necessary to complete our specification of the firm's output; the ratio of loans the association is servicing for others, to total assets--that is, the loans the firm has made and then sold, but still services (i.e. collects the payments and generally watches over the investment)--and the ratio of loans serviced by others to total assets--that is, loans that the association has purchased with the understanding that the originating institution would continue to service them.

Branching is dealt with by using a Herfindahl index of the concentration of the association's deposits. If the firm has one office, the index reaches the value of 1; n equal sized offices, where n is large, would produce an index near 0. The index is sensitive both to the number of offices within the firm's network and to the equality of their sizes.

¹There are four basic instruments: 1) GNMA's, Government National Mortgage Association mortgage backed, modified pass-through, securities, are shares in a pool of FHA-VA mortgages assembled by any government approved (FHA and GNMA) private institution. The pools must be a minimum size of \$1 million and the minimum transaction in shares is \$25,000 (the average is \$250,000). The shares are government guaranteed and traded in a well organized market. 2) PCs, participation certificates, are interests in groups of loans assembled by the Federal Home Loan Mortgage Corporation. Certificates run from \$100,000 to \$1 million. FHLMC buys its whole loans from S&Ls and other mortgage originating institutions. 3) Loan participations are shares in mortgage packages that are directly purchased and sold by S&Ls to each other. Transactions run from half a million dollars to \$5 million. They are regulated, but not government guaranteed, and associations are limited to holding no more than 20% of their assets in participations that are from areas outside the firm's direct lending area. 4) Whole loans are similar to 3), but the outside limit is 15% and loan servicing may be either by the buyer or the seller.

The prices of the inputs, savings deposits and labor, come from different sources. The first is the average rate paid by the firm for deposits and is derived from the association's semi-annual report. The second is based on the surveys conducted by the BLS for the salaries offered for various job definitions in a sample of SMSAs. There was no job description uniquely tailored for measuring the cost of labor in financial institutions. The job category selected, a low grade of secretary, was chosen both because it seemed representative of the skill pool S&Ls would draw their labor from and because it was a category for which BLS was able to consistently collect data reliable enough to publish. In general, the wage rates applied to SMSAs. In a few instances, however, several SMSAs were linked together in a single survey heading, i.e. West Texas Plains.

One complication that arose with the wage rate data was that the BLS surveys were not normalized to any one date. It was necessary, in the light of the changes in wage rates that took place during 1975 to adjust the surveys to some common time (June 1975). The method employed was to obtain two consecutive surveys for each SMSA, so that they bracketed the common date. From these a June 1975 figure was interpolated on the basis of the national wage rate data for secretaries which was available by months.²

²For those with a statistical mind, this required the author to obtain surveys from the middle of 1974 to mid-1976; around 350 surveys in all. My thanks to the kind people at BLS for helping me find the data I needed and for providing me with some of the empirical wisdom necessary to steer clear of some of the many blunders one can make using survey data.

The selection of associations for the sample was made on the criterion that they must obtain all but a small fraction of their deposits (10%) from a single SMSA. This allows us to define the SMSA as the market area relevant to the firm. There is no iron clad argument that demonstrates that the SMSA is the best of all market definitions, but the various geographical restrictions on S&L activities, and the empirical rules used in formulating the SMSA definitions, both help to justify our choice. The location of the association's business was made by examining the addresses of each of its branches, and by using the deposits of the offices to determine whether the association met the criterion. There was only one state where this methodology gave us some pause. That was California, where some of the largest associations in the industry have been allowed to branch into several SMSAs. These associations had to be excluded, since there was no way to define their markets that was consistent with the rest of the sample.

Several market variables were obtained with the help of the FDIC Call Reports, generously made available to the author by the Federal Reserve Board of Governors. Two basic figures were obtained: the total liability holdings of banks in each SMSA that were competitive with the types of savings instruments S&Ls offer, and the total asset holdings of banks in each SMSA that were in categories of assets held by S&Ls. These figures, combined with the appropriate assets and liabilities of S&Ls, gave us measures of the amount of business that was conducted in each SMSA. A Herfindahl index was constructed for

each city and a CRI (the one firm--S&L--concentration ratio) was constructed for each association.

As there was no right way of constructing an index using the scanty information available about the assorted accounting conventions that associations employ in computing the interest they owe their depositors, a simple scheme was used. The firm was assigned a zero if it used the most unfavorable (to the saver) of all methods; the more generous it was, the higher its mark. The top, a five, represents a firm paying interest for the full month on deposits made by the 10th day of that month, compounding continuously, and awarding prizes to savers that opened, or added to their accounts.

The final sample includes 1,878 associations in 158 SMSAs, with 13,000 offices. Of the total, 1,204 associations had branches. The smallest firm had deposits of just under \$1 million, and the largest had around \$1.2 billion. The few extremely large firms in California, that did not meet our market criteria, are the most serious source of unrepresentiveness in the sample.

CHAPTER 5

THE RESULTS: THE COSTS AND BENEFITS OF SIZE

In this chapter we will examine the evidence to see whether the large firms of today serve the authorities' goals better than the small ones. A progression of functional forms is used to explore the relationship between cost and firm size. Most of the forms are expansions of the Cobb-Douglas cost function. Their purpose was to determine whether the C-D's constraints on the elasticity of substitution between inputs, on the elasticity of output for a change in any input, and on the elasticity of output for a proportional change in all inputs create specification errors that affect our results. While none of these expanded forms proved wholly satisfactory, one clearly indicated that the elasticity of output for a change in all inputs (the elasticity of scale) varied with firm size, a result that is at odds with the assumption of unvarying returns of the C-D. A quantitative and qualitative dummy scheme has been used to evaluate the change in scale over the range of firm sizes in our sample. We only observed economies of scale in firms under \$50 million in assets. Above that size, the cost curve appears to be very much flatter than previously thought.

This finding tends to diminish the importance of the argument of economies of scale in policy formulation and greatly increase the weight

of the other arguments--safety and market efficiency. The examination of these suggests that while large firms are not demonstrably safer than small ones, they do appear to contribute to the success of the secondary mortgage market. They may also be more receptive to a more aggressive counter-cyclical use of the FHLBB's lending powers, but they also appear to make fewer of some categories of loans that the FHLBB has declared to be socially desirable.

The Efficiency of the Firm

Our cost function was estimated for three sets of data (the full sample of 1878 firms, the branching institutions only, and the unit associations only), and for six different specifications of the functional form. The different forms reflect the differing combinations of assumptions being tested. The most restricted form assumes a homogeneous cost function with unitary elasticities of substitution between inputs, the C-D case. A functional form that assumed homotheticity and also one that made no assumption about the elasticity of scale or the elasticity of output for a change in input prices were tried. These three forms were estimated both with and without the assumption of unitary elasticities of substitution between inputs. Before we report our results for these equations, we must examine the properties of one of the variables that plays an important role in them: the interest price of deposits.

A Test of the Exogenism of an Input Price

In Chapter 3 the question was raised as to whether the interest price of S&L deposits was exogenous or endogenous. If it were to be endogenous the cost function we proposed to use would not be a reduced form and the interpretation of our results would be complicated. A test was proposed to see if the interest rate paid by associations could be explained by such factors as the advertising expenditures of the firm or by indexes of the attractiveness of the associations' savings plans.¹ A Herfindahl index was included to determine whether market concentration affected rates. The Herfindahl index was based on deposit holdings and included those deposits of commercial banks that were the equivalent of those held by S&Ls.

The results of this equation are shown in the first regression in Appendix E. The variables explained only four percent of the variance in interest costs and, significantly, advertising expenditures, as a fraction of total costs, did not seem to be related to interest prices. The significant positive coefficients on most of the variables suggest that the use of deposit attracting strategies represented in the equation are due to the competitive demands of the savings market. The sole negative coefficient seems to imply that giveaways are substitutes

¹The indexes of deposit attractiveness reflected whether the saver will receive interest from the date of deposit to the date of withdrawal, whether deposits made by the tenth of the month will collect interest on the whole month, whether the opening of a new account or the growth of an established one will earn the saver a gift, and whether interest is compounded daily.

for high interest rate offers. All the strategies involving the calculation of the interest rate on deposits are already implicitly included in the reported cost of funds figures and the inclusion of the effect of giveaways does not affect the figures substantially, nor does it affect the regression results of our cost functions. This suggests that the reported deposit costs can be assumed to fairly represent a competitive market price. In other words, it is an exogenously determined price as is the wage price of labor for the firm.

The Cost Function

Only the basic Cobb-Douglas (homogeneous) functional form and the homothetic functional form for each of the data groups are included in Tables 1 and 2 of this chapter. The other four functional forms, including the homogeneous and homothetic forms that do not assume the elasticity of substitution between inputs was equal to one, can be found in Appendix E. In all the data sets, the terms generalizing the basic (C-D) cost function, to allow for non-homogeneity, for non-homotheticity and for non-unitary input substitution elasticities, did not contribute significantly to our explanation of cost, except for the total assets squared term which was intended to allow for the cost elasticity of size varying with the size of the firm (i.e. the homothetic equations).

Estimates of the elasticity of cost with respect to firm size, calculated using the formulas developed in Chapter 3, are shown in Table 3 for all the functional forms and all the data sets. The two

most important results are those for the C-D form and the homothetic form. The Cobb-Douglas estimates of .876 and .911 for unit and multi-office associations respectively, suggest significant economies of scale. (A value of 1.0 would have implied constant returns and a value greater than one would have implied decreasing returns, meaning that costs are increasing on more than a proportionate basis with firm size.) These estimates are similar to those reported by other workers. The difference in the unit and multi-office coefficients can be interpreted as the difference in the cost of plant and firm expansion. The cost elasticity estimates of the homothetic functional form, which differed from the C-D form by the addition of a size squared term, are so small that, from an economic standpoint, they are unrealistic. Our nonlinear functional form appears to be too powerful for our data set. There is clear evidence though, that the C-D assumption of fixed scale economies is inadequate, so the next step is to attempt to fit a functional form that makes more modest demands for data.

Firm Size and Economies of Size

The specification of the cost function was modified by the addition of quantitative (intercept) and qualitative (slope) dummies. The quantitative dummies are the familiar 0-1 kind that take on the value of 1 inside a particular firm size range and take on the value of 0 otherwise. The qualitative dummies were calculated by multiplying our quantitative dummies by our total assets variable. The first equation in Table 4 divides the branching sample by firm size into four

sets and allows the OLS procedure to fit a slope and an intercept for each one of them. The sets are exhaustive and mutually exclusive, so the coefficients can be interpreted unambiguously in the same manner as are conventional dummy variable coefficients.²

The division of the sample into subsets was along traditional lines. Firms with less than \$50 million in assets are considered rather different in their operation from those with \$50 to \$100 million in assets. In turn, \$100 to \$200 million asset firms are thought to have changed their operating procedures considerably to handle the larger volumes of business. Firms with more than \$200 million in assets are considered to be among the small group of large firms that are candidates for permission to expand into ultra-large, billion dollar firms. Ultimately, all schemes to classify firms must be arbitrary. The scheme proposed here has often been used in industry analysis and represents the informal consensus of opinion as a useful way of categorizing the industry. In the branching sample of 1204 firms, 324 fell between \$50 and \$100 million, 230 fell between \$100 and \$200 million, and 118 exceeded \$200 million in assets.

The first equation in Table 4 suggests that, in the branching sample, scale economies do vary significantly with firm size. The coefficient on our familiar total cost term now only represents the cost elasticity of size for firms under \$50 million. For firms with

²See Potluri Rao and Roger LeRoy Miller, *Applied Econometrics* (Belmont, California: Wadsworth Publishing Company, 1971), p. 81 for a more complete description of this procedure.

less than that, growth would appear to substantially reduce their cost of operation. To determine the elasticity of cost for firms in the \$50 to \$100 million category, we must add to the coefficient for total assets the coefficient for the corresponding qualitative (slope) dummy. The elasticity is very nearly one (.992) and that means that there are no cost benefits from growth in that range. In the next subset, the \$100 to \$200 million range, the slope coefficient's t-value was 1.25 and that is too small for us to be confident that the coefficient is as large as estimated. The final subset included all firms with over \$200 million in assets and the elasticity coefficient was even a little higher than the one for the \$50 to \$100 million range. At 1.006, the coefficient does not support the growth of firms beyond the \$200 million mark.

The second equation in Table 4 uses the unit association sample and divides the data into only two subsets because unit firms do not have the size range of branching firms. There are only ten offices in the unit sample that exceeded \$100 million. The estimated cost elasticity of size for unit firms exceeding \$50 million, at 1.07, is as striking as the figure for branching firms. Above \$50 million, office as well as firm economies are exhausted. These results suggest that limiting the number of offices in a market area may produce some large single office firms, but while they may achieve deposits of \$50 million or more (there are 45 such offices in our unit sample), they do not provide any increase in efficiency to offset the inconvenience that must be borne by the public because of the dearth of offices.

Our results depend upon the specification of the cost function. The Cobb-Douglas form indicates that there are significant returns to scale available to the industry, which is consistent with previous studies. Our work with more general functional forms, however, suggests that the assumption that scale economies do not vary with size is incorrect and the C-D results may be biased. The expanded form also suffered problems. It may well be that the very low values for the elasticity of scale are due to the error in the variable problem, which is a problem whenever real world data are used to represent economic variables, and which is exacerbated by the use of power terms, with the downward bias on the coefficients of squared terms being squared.³ The slope-intercept scheme, substituted for the size squared term in an attempt to attenuate both the left out variable problem of the C-D and the error in the variable problem involved in the use of power terms, yielded results suggesting that constant returns to scale predominate above \$50 million. There is no rigorous way for us to choose among the functional forms, so a definitive result will have to await future studies. It is possible to say, though, that the evidence no longer provides compelling proof that there are economies of scale in the industry when a small change in the assumption about the way costs may vary with size affects the results so significantly.

³See J. Johnston *Econometric Methods* (New York: McGraw-Hill, 1963), p. 148, and Ziv Griliches "Error in Variables Bias in Nonlinear Contexts," *Econometrica* (march 1970): 368-70, for more complete explanations of the bias due to errors in the measurement of variables.

The Other Terms of the Cost Function

Wage and interest rates are significant parts of the explanation of operating costs. The cost of labor is important to us in identifying the relationship between cost and efficiency. Generally, we want to be able to distinguish between efficient firms with high labor costs and inefficient firms enjoying low cost labor. Specifically, we want to determine whether large firms are more efficient than small ones, and large firms require large market areas and the larger SMSAs tend to have higher labor costs, so wage rate data is necessary to remove the bias against large firms from the cost data. In fact, the wage rate data are positively correlated with firm size. (Note: wage data are only available on an SMSA basis, thus the general tendency for large firms to pay more for their employees has not been netted out of the cost-size relationship.) The sign on the coefficient for the price of labor has the expected value--higher wages mean higher operating expenses.

The price of deposits is also an important variable for identifying efficiency. The higher paying instruments issued by associations, mainly certificates of deposit, are less expensive to maintain than the traditional savings account because regulations make these instruments less liquid. Fewer teller hours are required since savers investing in CDs tend to maintain higher balances than savers investing in savings accounts, and the withdrawal penalties discourage the many small movements of funds that typify regular accounts. Thus, it is not surprising that high average interest rates are associated with low non-interest (operating) expenses.

Unlike the wage rate data, which are only available by SMSA, the deposit interest rates were obtained at the level of the individual firm. Table 5 indicates that the correlation between firm size and the price of deposits is not significant, suggesting that large firms pay neither more nor less than other sized firms for their savings. This result is quite different from the one we obtained with a measure of the composition of deposits that we constructed. The variable we used was the ratio of interest expenses paid on accounts earning the passbook rate, or less, to total interest payments. If the firm offered nothing beyond the regular passbook rate, the ratio reaches its maximum value of 1: if all deposits were in accounts earning more than the passbook rate, the ratio reaches its defined lower limit of 0. This ratio is inversely related to firm size, suggesting that while the average cost of deposits is not correlated with firm size, the management strategy used to attract deposits is related to the size of the firm. Large firms issue more certificates of deposit than small firms, but the average price they pay for all their funds is the same. Just how this came about is something of a mystery and will have to await future research for a solution.

The interest payment ratio provides us with another problem when we look at its influence on our cost functions (Tables 1 and 2). For the sample taken as a whole, the ratio has little significance. The branching subsample shows a definite relationship between operating costs and the composition of interest expenses. As was hypothesized above, the greater the contribution of low interest passbook accounts

to the total, the higher were operating expenses. The opposite relationship was true for the single office subsample: the composition of payments was related to costs, but this time the lower the passbook contribution, the higher the operating costs. Various hypotheses are possible, but again, further study is necessary.

Asset Hetrogeneity

There are four variables that represent portfolio aggregation adjustment indexes. The first one, the ratio of loans serviced by other institutions to total loans, presents a curious problem. For the sample as a whole, it doesn't appear to affect costs. For branching firms, though, a high fraction of total loans being serviced by others seems to be associated with lower operating costs. This is reasonable, and, in fact, that was the anticipated relationship, since a loan serviced by someone else should reduce the operating expenses of the financing association. The single office firm equation, however, shows just the opposite relationship. The only explanation available seems to be that unit firms exhaust the loan potential of their single offices more readily than branch firms. If this were the case, a disproportionate fraction of the unit firms purchasing loans might have high costs due to their poor local prospects. In effect, the secondary market would be allowing them to do what their single office status prevents them from doing: moving out of their home areas. This is not an entirely satisfactory explanation and more work is needed.

The next variable, the ratio of loans being serviced for others to total assets, has a positive and significant coefficient in all three equations. This is because loans serviced for other institutions are carried on the books of the supplier of the permanent financing and taken off the ledgers of the selling institutions. The selling association has all the expenses attendant with making the loans, assembling the mortgage packages, selling them, and then collecting the payments and otherwise servicing the mortgages for the institution that purchased them.

The composition of our measure of "bad" loans will be discussed later in this chapter, in the section on safety, so all that will be said here is that the loans in this category are failing or have failed. It is not surprising that greater than average rates of bad loans should result in higher than average operating costs. Loans that are not performing well and foreclosed properties require extensive management efforts to minimize losses.

Auto loans, mobile home loans, loans for education and home improvements, and consumer loans are all part of the "other" loan category. The higher the fraction of assets invested in these types of loans, the higher the operating cost, judging by the coefficient in the full sample and the subsamples. Given that these loans tend to be for shorter periods and for smaller amounts than home mortgage loans, the results are as expected.

Liability Heterogeneity

The preceding four variables have represented aggregation adjustments of our measure of firm size (total assets). Those assets also imply an aggregation of liabilities. Two adjustment variables are included in our cost equations. One, the ratio of all interest payments to those made on accounts earning the passbook rate or lower, has already been discussed. The second liability composition variable adjusts for the funds that have been borrowed from the FHLB System, from commercial banks, and from other lenders. Formally, it is the fraction of liabilities from advances and from loans from other sources. The unit and branching equations reveal substantial differences in borrowing behavior. While borrowing money does not constitute a major source of funds at present, the associations in the branching sample were borrowing at twice the rate of unit associations, 5% versus 2.7%. Borrowing was not significantly related to operating costs in unit associations, but it was for branching systems.

Since this paper has not developed a dynamic model of S&L adjustment to fluctuations in deposit and mortgage flows, we can not give a complete explanation as to why large borrowings are associated with higher operating costs. Borrowing has tended to be short term, and is usually triggered by what is perceived as a temporary shortfall in the inflow of funds to finance the demand for mortgages. The temporary nature of the situation suggests that the association would not take steps to cut costs, such as firing employees and the like. And since the borrowing tends to be for short term rather than for long term

financing, the firm is likely to borrow a little less than it can absorb, to be sure that deposit inflows in the near future will provide permanent financing for the loans made with borrowed funds. Thus, the borrowing firm would be out of equilibrium, with higher than normal costs.

Organizational Differences Between Firms

Three out of the remaining five variables in the cost function have to do with the organization of the firm. The first is a fraction again: it is the fraction of the firm's assets that are invested in its service corporation. From what has already been said, it is to be expected that service corporations would raise operating costs and in our sample they do. The second and third are dummy variables: the second is equal to one when the association is organized as a stock rather than as a mutual firm, and the third is equal to one if the association is chartered as a federal rather than as a state firm.

There has been much debate over the virtues of stock and mutual firms, and the evidence has tended to support one form some years and the other form in other years. Our sample, which is from 1975, suggests that stocks were not as efficiently operated as mutuals at that time. The sample also suggests that federal associations tend to have somewhat higher operating expenses than those operating under state regulation. The general policy of the FHLBB has been to allow federal associations to do no more than state association regulations permit but, as the following example suggests, there are significant differences in the

strictness of the enforcement of regulations by the states. In two states, Florida and Illinois, state associations were not allowed to branch and so federal associations were denied the right to do so as well. A few years ago, it came to the attention of the federal officials that some state associations had a lot of offices, given that branching was not allowed. What was happening was that state associations were being given permission to move their home offices, while leaving a branch office behind. This particular situation eventually led to federal associations being permitted to branch in the states.

Market and Firm Structure

The final two variables are indexes of structure: one of firm structure and the other of market structure. Both are Herfindahl indexes. The first measures the dispersion of an association's funds over its office(s). Since the index equals one for single office associations, the variable is omitted from the regressions using the unit firm subsample. The results, in the other equations, are consistent with previous research. Operating a lot of small offices means higher operating costs.

The second variable measures the concentration of savings deposits for the SMSA of each association. The deposits of commercial banks as well as those of S&Ls are included in this calculation. A similar measure was constructed using the assets of S&Ls, and those assets of other financial intermediaries that were comparable to those held by S&Ls, but it is the deposit gathering side of the firm that imposes the

most binding constraint on S&Ls and so the deposit measure was adopted. Concentration is relatively low in the SMSAs included in our sample and there appeared to be little opportunity for market power to be exerted by members of the sample.⁴ Operating costs were not affected by market concentration.

Other Considerations of Size

The lack of significant scale economies in our cost function analysis increases the importance of assessing the other effects of firm size on the goals of the regulators. Of these goals, the safety of the firm and the efficiency of the mortgage market were dealt with here.

Safety of the Firm

Safety is not a matter of analyzing the statistics of firm failures. There are very few failures and, as far as the public is concerned, they are merely inconveniences that last only a day or so until the insurance authorities can reopen the institutions. Regulators, of course, do not view things in quite the same way. The health of financial institutions like the health of humans, is better safeguarded by preventative measures than by death defying efforts administered to a weakened individual. S&Ls are only as healthy as their assets are since an association is, in essence, nothing more than a bundle of

⁴The mean of the deposit based index was .012 for our sample and the mean for the asset based index was .024.

assets and liabilities. In the eyes of the regulators, the failure and forced merger rate is low in the industry because the assets associations acquire are of high quality. It has been suggested that large associations cannot know their own territories and clients as well as can small ones. If this were true and assuming the additional information was valuable, then larger ones should have higher rates of bad loans in their portfolios.

To test this hypothesis we must know something about what is a bad loan in the minds of the regulators. The worst of all possible loans is one that ends with the association foreclosing. However, just the dollar value of loans foreclosed would not indicate the true dimensions of an association's problem. There is also the matter of the category of loans that are listed under the name of non-conforming loans. Loans of this sort are made on unusually favorable terms (hence the name) in order to entice a buyer to purchase the property that has come into the hands of the association. S&Ls are in the business of writing mortgages and the way to recoup on a failed loan is to write another one. A third category of worrisome loans are those that have not failed, but are performing poorly enough for the authorities to classify them as "slow loans." The sum of these are our measure of "bad" loans.

The sum of these three categories, divided by the total portfolio holdings of the firm, represents a measure of the performance of management in the eyes of the authorities. Over the industry this ratio ranged in value from zero to 13.94%. The mean was .38%. There is a

significant positive relationship between the size of the firm and the proportion of its assets that are of doubtful quality: large firms make more than their share of doubtful loans. Moreover, the ratio of net worth to assets, a measure of their ability to weather losses on loans, is negatively correlated with firm size. If we subtract the doubtful loan ratio from the net worth ratio, the resulting ratio is also negatively related to firm size: the larger the firm, the smaller its financial cushion in the eyes of the regulators. The ratio of income to net worth, a measure of return on capital, is not significantly correlated with firm size. This seems to be consistent with our other results.^{5,6}

Efficiency of the Market

The next issue is the regulatory goal of improving the efficiency of the home mortgage market. Three aspects of this issue are considered here.

⁵The figures used in the calculation in this paragraph include all associations reporting to the FHLBB that had positive net worths (4032). (A firm with positive net worth could have a negative difference between its net worth ratio and our doubtful loan ratio, since net worth is only net of realized losses and our measure includes potential losses as well. Negative net worth can occur when, for example, a natural disaster destroys a significant portion of the structures underlying the firm's asset base, and it must file its financial report before the insurance settlements can be made.)

⁶The correlation coefficient between our "bad" loan ratio and firm size is .085. The correlation between the net worth ratio and firm size is -.055. The difference between these two ratios has a correlation with size of -.073. Correlation coefficients with absolute values above .032 are significant at the 95% confidence level.

First there is the matter of improving the movement of funds (or mortgage instruments) from areas with surplus funds to areas with shortages. Important geographic restrictions on how far afield an association can place an office have limited the industry's ability to fulfill its role as an intermediary. In recent years, however, secondary market instruments have been developed that promise to significantly improve the efficiency of financing across institutional barriers.⁷ The extent of a private secondary market in mortgage

⁷The main instruments are the GNMA's (Government National Mortgage Association mortgage backed securities), PC's (mortgage participation certificates), loan participations and whole loans. GNMA's are really shares in a FHA-VA pool of mortgages held by a mortgage banker, savings and loan, or some other holder approved by the GNMA. The shares are guaranteed by the U.S. government, are very liquid, and are available in denominations as small as \$25,000, but \$250,000 is a more typical amount. Participation certificates are issued by the Federal Home Loan Mortgage Corporation on pools of 2,000 to 5,000 mortgages in denominations from \$100,000 to \$1 million. The certificates are guaranteed by the corporation and, unlike the GNMA's, no market has been developed for trading in them. Loan participations can be issued by commercial banks, S&Ls, government agencies, or anyone else dealing in mortgages. They are not guaranteed unless the underlying loans have either FHA, VA, or private insurance. Transactions tend to be in the half million to million dollar range. Whole loans have characteristics similar to those of loan participations. The difference lies in the fact that the latter instrument is a share in a pool while the former is, as its name implies, a package of whole loans.

The first two instruments are issued by governmental and quasi-governmental agencies and do not represent much in the way of difficulties to medium size associations in, say, the twenty to fifty million dollar range. The first instrument is usable by much smaller associations since it is liquid, guaranteed, and comes in small packages. The latter two instruments, though, are a good deal more demanding of both the selling and the purchasing associations. As purchases of these instruments age, they become less saleable, and, even when new, they require extensive documentation so that the seller can determine whether the loans, which are made far from the firm's mortgage making area, are desirable.

related instruments and, thus, the efficiency of the mortgage market for housing, depends upon the willingness of institutions to develop the expertise to use the market. It has been suggested that there may be significant economies of scale in using the secondary market, and that large firms would make the job of expanding the volume of business easier.

One way to test this hypothesis is to calculate the correlation between secondary market holdings, as a percentage of total holdings, and firm size. Table 5 shows that for our sample the fraction of the firm's portfolio that is serviced by other firms is strongly and positively correlated with size. (In almost all cases the originating institution continues to service the mortgage after its financing has been sold.)

The correlation between loans serviced for others, as a fraction of asset holdings, and firm size is insignificant. This was expected, since the various mortgage purchasing agencies (Fannie Mae, Ginnie Mae, etc.) create their loan pools from the mortgages made by all sizes of institutions and the industry as a whole is a net importer of mortgages (that is, they provide the permanent financing for mortgages made by someone else, such as a mortgage banker or a commercial banker). Our result, then, is that it is likely that large firms will make greater use of secondary markets than will smaller firms.

The second aspect of the market efficiency goal involves the question of large firms developing specialized management skills

that will tend to divert their attentions from their principal task of financing single family homes? This question is not easy to answer directly since the types of loans an association can hold, if it is to qualify for the special tax treatment accorded S&Ls, are spelled out in the FHLB System regulations. Thus, the portfolios of S&Ls are far more homogeneous than the holdings of commercial banks. An indirect way to attack it is to examine the case of the service corporation. The service corporation is a subsidiary of an association. It can hold loans that the parent is not permitted to hold, and it allows the association to obtain a highly leveraged position that is not permitted of ordinary S&Ls. Service corporations are not unalloyedly bad, but they represented an attempt to circumvent regulatory restrictions and were an impediment to the regulator's control of the industry. Economists have long realized that the regulation of industry must contend with the fact that industry will adapt to the regulations. If large S&Ls are more difficult to regulate and perhaps even increase the frequency with which the authorities must request enabling legislation from the state and federal legislatures to reassert their control, then the desirableness of such firms to the regulators will be lessened. (On the other hand, the willingness of the industry to accept innovations determines the flexibility the authorities have in introducing new mortgage and deposit practices.)

In our sample the correlation between firm size and the ratio of service corporation investment to total assets is strongly positive. This figure (see Table 5) might be even higher if it were not for the

restrictions governing the fraction of association funds that can be involved in a service corporation. Whether regulators want to promote firms that are able and willing to aggressively look for a means of expanding their activities would require another paper to discuss adequately.

A third aspect of the market efficiency goal of the regulators involves the fact that the housing market has suffered notoriously from cyclical fluctuations in activity. There has been considerable interest among regulators in attempting to iron out some of those variations. Their major tool so far has been to offer associations the chance to borrow funds from the FHLB System. These borrowings are known as advances and they are offered at rates that are more favorable than the associations could obtain if they tried to issue bonds on their own--the FHLBB obtains its funds by issuing bonds backed by the full faith and credit of the federal government and has, at times, offered advances below cost. The problem has been that the industry as a whole has not accepted this form of financing to any great extent. The question we might ask is whether large firms, given we have evidence that they tend to have more versatile and aggressive management, have accepted the FHLB System's initiative more readily than have the smaller members of the industry. The result in Table 5 shows that there is a strong positive connection between firm size and the ratio of borrowings to total loans. This suggests that large firms may offer regulators more opportunities to make such changes than may small firms. The evidence can only be suggestive, though, because cross-section data

can not predict whether large firms will respond more consistently to changes in FHLBB policy than will small ones.

Summary

Firm size, in and of itself, is hardly a "goal" of the regulators. Indeed, the growth of very large firms, and the increase in market concentration that accompanies it, will add to the debate over the adequacy of the regulator's management of the industry. It must be demonstrable that very large firms assist the regulators in attaining some of their espoused goals, goals that they might not attain otherwise.

What have we learned? The evidence does not all point in one direction. On the question of whether large firms can deliver their services more efficiently than can small ones, our answer is that scale economies are not as easily demonstratable as others have concluded. Such economies turn out to be crucially dependent on the way in which they are specified in the cost function. An examination of the likely biases of each functional form suggests that only relatively small firms would experience real efficiency gains from growth. Large firms seem to be neither more nor less efficient than their smaller cousins, insofar as private costs reflect public costs.

Our attempts to determine if large firms are safer than small ones provide some contradictory results. From the standpoint of choosing among applications to develop a new market area, a large established firm would seem to be the safer choice. But large firms have proportionally smaller financial "safety cushions" to protect them, and they

do not have higher rates of return than smaller associations that would allow them to recover from losses faster. In addition, our evidence is suggestive that large associations are more aggressive in seeking out and using strategies that surmount regulatory safeguards. So the regulators may well find themselves having to intervene in more situations in an industry of very large firms than they would have had to otherwise, and they may find that their ability to control the outcome of their intervention is lessened.

On the other hand, there is some evidence that large firms are more likely to support the expansion of the secondary mortgage market and advances than small firms. Whether secondary market instruments will be developed that will be attractive to small firms is a matter for future research, as is the question of whether similar changes will increase the small firm's use of advances. It may well be that a large number of small firms would provide a more predictable response to changes in advance policy than would a smaller number of very large firms. If the FHLBB finds that a countercyclical stabilization policy impossible to carry out, their interest in expanding advances may decline.

Finally, large firms are characterized by having many branch offices. This convenience to customers, however, must be weighed against our evidence that large firms tend to make fewer of the specialized smaller loans for mobile homes, home improvements and the like, than small firms and these are types of loans that the regulators have expressed a desire for associations to make.

In short we have learned that the advantages of large size firms is far more open to question than previous studies have indicated, and there is a great deal that must be resolved by future studies.

Table 1

Regression Results for the Homogeneous Cost Functions with Unitary Elasticities of Substitution Between Inputs Assumed, 1975

Full Sample (1878 firms) Method: Ordinary Least Squares

| Variable ^a | Coefficient | t-statistic |
|--|-------------|-------------|
| Constant | -2.108 | -8.953 |
| Total Assets | .878 | 144.560 |
| Wage Rate | .241 | 3.728 |
| Interest Rate | -.618 | -5.804 |
| Ratio: loans serviced <u>by</u> others to total assets | -.003 | -.055 |
| Ratio: loans serviced <u>for</u> others to total assets | .299 | 10.386 |
| Ratio: "bad" loans to total assets | 4.571 | 8.457 |
| Ratio: "other" loans to total assets | 1.574 | 7.757 |
| Ratio: borrowed funds to total funds | .515 | 3.869 |
| Ratio: interest paid on accounts earning at or below passbook rate to total payments | -.574 | -.627 |
| Herfindahl index: SMSA savings deposit concentration | .159 | 1.051 |
| Ratio: service corporation investment to total assets | 5.390 | 4.466 |
| Herfindahl index: firm's dispersion of deposits among its offices | -.00002 | -8.402 |
| Dummy: stock organization equals one, zero otherwise | .125 | 10.508 |
| Dummy: federal charter equals one, zero otherwise | .030 | 2.756 |

R² (corrected): .962

Standard Error of the estimate: .224 Mean of Dependant Variable: 6.395

F(14,1864): 3437.278

Residual Sums of Squares: 93.510

^aAll variables are in natural logarithms except the ratio, Herfindahl index, and dummy variables.

Table 1 (Continued)

Branching Sample (1204 firms) Method: Ordinary Least Squares

| Variable | Coefficient | t-statistic |
|---|-------------|-------------|
| Constant | -3.274 | -12.571 |
| Total assets | .911 | 125.660 |
| Wage rate | .172 | 2.531 |
| Interest rate | -.165 | -1.427 |
| Ratio: loans serviced <u>by</u> others to total assets | -.161 | -3.173 |
| Ratio: loans serviced <u>for</u> others to total assets | .277 | 9.308 |
| Ratio: "bad" loans to total assets | 4.245 | 8.002 |
| Ratio: "other" loans to total assets | 1.333 | 5.962 |
| Ratio: borrowed funds to total assets | .550 | 3.965 |
| Ratio: interest paid on accounts earning at or below passbook rate to total payments | 2.345 | 2.221 |
| Herfindahl index: SMSA savings deposit concen- tration | .027 | .154 |
| Ratio: service corporation investment to total assets | 5.790 | 4.892 |
| Herfindahl index: firm's dispersion of deposits among its offices | -.00001 | -4.386 |
| Dummy: stock organization equals one, zero otherwise | .071 | 5.743 |
| Dummy: federal charter equals one, zero otherwise | .019 | 1.607 |

 R^2 (corrected): .959

Standard Error of the estimate: .191 Mean of Dependant Variable: 6.932

F(14, 1190): 2002.650

Residual Sums of Squares: 43.297

Table 1 (Continued)

Unit Sample (674 firms) Method: Ordinary Least Squares

| Variable | Coefficient | t-statistic |
|---|-------------|-------------|
| Constant | -1.210 | -2.756 |
| Total assets | .836 | 74.265 |
| Wage rate | .425 | 3.288 |
| Interest rate | -1.181 | -5.819 |
| Ratio: loans serviced <u>by</u> others to total assets | .242 | 2.093 |
| Ratio: loans serviced <u>for</u> others to total assets | .338 | 5.699 |
| Ratio: "bad" loans to total assets | 6.456 | 4.967 |
| Ratio: "other" loans to total assets | 1.282 | 3.373 |
| Ratio: borrowed funds to total assets | .438 | 1.613 |
| Ratio: interest paid on accounts earning at or below passbook rate to total payments | -3.298 | -2.045 |
| Herfindahl index: SMSA savings deposit concen- tration | .237 | .936 |
| Ratio: service corpora- tion investment to total assets | 4.313 | 1.512 |
| Herfindahl index: firm's dispersion of deposits among its offices | - | - |
| Dummy: stock organization equals one, zero otherwise | .219 | 8.791 |
| Dummy: federal charter equals one, zero otherwise | .018 | .825 |

R^2 (corrected): .906

Standard error of the estimate: .258 Mean of dependent variable: 5.435

F (13,660): 498.406

Residual sum of squares: 44.019

Table 2

Regression Results for the Homothetic Cost Function with the Assumption of Unit Elasticities of Substitution Between Inputs, Using the Full Sample, the Branching Sample, and the Unit Sample. t-statistics are in Parentheses and the Data are from 1975.

| Variable ^a | Coefficient and t-statistic | | |
|---|-----------------------------|--------------------|--------------------|
| | Full Sample | Branch Sample | Unit Sample |
| Constant | 0.107 (0.313) | -0.618 (-1.080) | 4.055 (4.831) |
| Total assets | 0.414 (7.785) | 0.436 (4.746) | -0.263 (-1.687) |
| (Total assets) ² | 0.022 (8.798) | 0.021 (5.198) | 0.057 (7.075) |
| Wage rate | 0.244 (3.856) | 0.173 (2.571) | 0.334 (2.632) |
| Interest rate | -0.550 (-5.218) | -0.162 (-1.413) | -1.149 (-5.763) |
| Wage rate * interest rate | - | - | - |
| (Wage rate) ² | - | - | - |
| (Interest rate) ² | - | - | - |
| Total assets * wage rate | - | - | - |
| Total assets * interest rate | - | - | - |
| Ratio: loans serviced <u>by</u> others to total assets | -0.034 (-0.688) | -0.156 (-3.124) | 0.161 (1.405) |
| Ratio: loans serviced <u>for</u> others to total assets | 0.306 (10.858) | 0.275 (9.327) | 0.358 (1.453) |
| Ratio: "bad" loans to total assets | 4.531 (8.553) | 4.137 (7.878) | N/A |
| Ratio: "other" loans to total assets | 1.471 (7.385) | 1.275 (5.756) | 1.453 (3.898) |
| Ratio: borrowed funds to total assets | 0.505 (3.875) | 0.518 (3.772) | 0.495 (1.860) |

^aAll variables are in natural logarithms except the ratio, Herfindahl index, and dummy variables.

Table 2 (Continued)

| Variable | Coefficient and t-statistic | | |
|--|-----------------------------|----------------------|--------------------|
| | Full Sample | Branch Sample | Unit Sample |
| Ratio: interest paid on accounts earning at or below passbook rate to total assets | -0.139 (-0.154) | 2.096 (2.005) | -1.145 (-0.720) |
| Herfindahl index: SMSA savings deposit concentration | 0.150 (1.017) | 0.045 (0.258) | 0.263 (1.059) |
| Ratio: service corporation investment to total assets | 5.475 (4.628) | 5.824 (4.974) | 6.643 (2.405) |
| Herfindahl index: firm's dispersion of deposits among its offices | -0.00002 (-6.810) | -0.00001 (-4.193) | - |
| Dummy: stock organization equals one, zero otherwise | 0.118 (10.069) | 0.066 (5.415) | 0.214 (8.727) |
| Dummy: federal charter equals one, zero otherwise | 0.023 (2.112) | 0.017 (1.492) | 0.008 (0.405) |
| R^2 (corrected) | 0.964 | 0.960 | 0.909 |
| F statistic | 3344.856 | 1911.839 | 518.771 |
| Standard error of estimate | 0.220 | 0.189 | 0.254 |
| Mean of dependent variable | 6.395 | 6.932 | 5.435 |
| Residual sum of squares | 89.778 | 42.334 | 42.439 |

Table 3

Estimated Scale Economies for all Functional Forms of the Cost
Equation and for all Samples
(1975 Data)

| <u>Full Sample (1878 firms)</u> | | <u>Elasticities of substitution unconstrained</u> | | |
|---|------|---|------------|-------------|
| Firm size (Total assets in millions of dollars) | | Cost elasticity of size assumed: | | |
| | | Unconstrained | Homothetic | Homogeneous |
| 10. | .620 | .622 | .880 | |
| 50. | .656 | .658 | .880 | |
| 100. | .671 | .673 | .880 | |
| 500. | .707 | .709 | .880 | |
| 1000. | .723 | .724 | .880 | |
| 2000. | .738 | .740 | .880 | |

| <u>Branching Sample (1204 firms)</u> | | <u>Elasticities of substitution unconstrained</u> | | |
|---|------|---|------------|-------------|
| Firm size (Total assets in millions of dollars) | | Cost elasticity of size assumed: | | |
| | | Unconstrained | Homothetic | Homogeneous |
| 10. | .640 | .641 | .913 | |
| 50. | .673 | .674 | .913 | |
| 100. | .687 | .688 | .913 | |
| 500. | .720 | .721 | .913 | |
| 1000. | .735 | .735 | .913 | |
| 2000. | .749 | .749 | .913 | |

| <u>Unit Sample (674 firms)</u> | | <u>Elasticities of substitution unconstrained</u> | | |
|---|------|---|------------|-------------|
| Firm size (Total assets in millions of dollars) | | Cost elasticity of size assumed: | | |
| | | Unconstrained | Homothetic | Homogeneous |
| 10. | .264 | .286 | .837 | |
| 50. | .374 | .375 | .837 | |
| 100. | .412 | .413 | .837 | |
| 500. | .501 | .502 | .837 | |
| 1000. | .540 | .541 | .837 | |
| 2000. | .578 | .579 | .837 | |

Table 3 (Continued)

Full Sample (1878 Firms) Elasticities of substitution constrained in
unity

| Firm size (Total assets in millions of dollars) | Cost elasticity of size assumed: | | |
|---|----------------------------------|------------|-------------|
| | Unconstrained | Homothetic | Homogeneous |
| 10. | .617 | .619 | .878 |
| 50. | .653 | .655 | .878 |
| 100. | .669 | .670 | .878 |
| 500. | .705 | .706 | .878 |
| 1000. | .720 | .722 | .878 |
| 2000. | .736 | .737 | .878 |

Branching Sample (1204 firms) Elasticities of substitution constrained
to unity

| Firm size (Total assets in millions of dollars) | Cost elasticity of size assumed: | | |
|---|----------------------------------|------------|-------------|
| | Unconstrained | Homothetic | Homogeneous |
| 10. | .632 | .630 | .911 |
| 50. | .666 | .664 | .911 |
| 100. | .680 | .679 | .911 |
| 500. | .714 | .713 | .911 |
| 1000. | .729 | .728 | .911 |
| 2000. | .743 | .742 | .911 |

Unit Sample (674 firms) Elasticities of substitution constrained to
unity

| Firm size (Total assets in millions of dollars) | Cost elasticity of size assumed: | | |
|---|----------------------------------|------------|-------------|
| | Unconstrained | Homothetic | Homogeneous |
| 10. | .257 | .266 | .836 |
| 50. | .351 | .358 | .836 |
| 100. | .392 | .398 | .836 |
| 500. | .486 | .490 | .836 |
| 1000. | .526 | .530 | .836 |
| 2000. | .566 | .570 | .836 |

Table 4

Regression Results of Test for Multiple Intercepts and Slopes in
the Homogeneous Cost Function with Unitary Elasticities of
Substitution 1975 Data

Branching sample (1204 firms) Method: Ordinary Least Squares

| Variable ^a | Coefficient | t-statistic |
|---|-------------|-------------|
| Constant | -2.900 | -9.856 |
| Total assets | .869 | 56.689 |
| Wage rate | .160 | 2.347 |
| Interest rate | -.173 | -1.491 |
| Ratio: loans serviced <u>by</u> others to total assets | -.162 | -3.189 |
| Ratio: loans serviced <u>for</u> others to total assets | .272 | 9.149 |
| Ratio: "bad" loans to total assets | 4.133 | 7.730 |
| Ratio: "other" loans to total assets | 1.299 | 5.806 |
| Ratio: borrowed funds to total assets | .575 | 4.114 |
| Ratio: interest paid on accounts earning at or below passbook rate to total payments | 2.446 | 2.309 |
| Herfindahl index: SMSA savings deposit concentration | .069 | .388 |
| Ratio: service corporation investment to total assets | 5.754 | 4.847 |
| Herfindahl index: firm's dispersion of deposits among its offices | - | - |
| Dummy: stock organization equals one, zero otherwise | .069 | 5.591 |
| Dummy: federal charter equals one, zero otherwise | .009 | .759 |
| Dummy: \$50-100 million intercept | -1.332 | -2.211 |
| Dummy: \$100-200 million inter- cept | -.904 | -1.119 |
| Dummy: \$200+ million intercept | -1.587 | -2.994 |
| Dummy: \$50-100 million slope | .122 | 2.278 |
| Dummy: \$100-200 million slope | .085 | 1.252 |
| Dummy: \$200+ million slope | .137 | 3.261 |

R^2 (corrected): .960 F(19,1204): 1476.547

Residual sum of squares: 43.097

Standard error of the estimate: .191

Mean of the dependent variable: 6.932

^aAll variables are in natural logarithms except the ratio, Herfindahl index, and dummy variables.

Table 4 (Continued)

Unit sample (674 firms) Method: Ordinary Least Squares

| Variable | Coefficient | t-statistic |
|---|-------------|-------------|
| Constant | -1.010 | -2.335 |
| Total assets | .803 | 62.326 |
| Wage rate | .428 | 3.378 |
| Interest rate | -1.129 | -5.660 |
| Ratio: loans serviced <u>by</u> others to total assets | .219 | 1.923 |
| Ratio: loans serviced <u>for</u> others to total assets | .340 | 5.852 |
| Ratio: "bad" loans to total assets | 6.492 | 5.087 |
| Ratio: "other" loans to total assets | 1.247 | 3.345 |
| Ratio: borrowed funds to total assets | .436 | 1.636 |
| Ratio: interest paid on accounts earning at or below passbook rate to total payments | -2.802 | -1.768 |
| Herfindahl index: SMSA savings deposit concentration | .229 | .924 |
| Ratio: service corporation investment to total assets | 5.299 | 1.888 |
| Herfindahl index: firm's dispersion of deposits among its offices | - | - |
| Dummy: stock organization equals one, zero otherwise | .216 | 8.826 |
| Dummy: federal charter equals one, zero otherwise | .016 | .754 |
| Dummy: \$50 + million intercept | -2.906 | -2.337 |
| Dummy: \$50 + million slope | .273 | 2.508 |

R² (corrected): .911

F(15,658): 450.640

Standard error of the estimate: .253

Mean of the dependent variable: 5.435

Residual sum of squares: 42.233

^aAll variables are in natural logarithms except the ratio, Herfindahl index, and dummy variables.

Table 5

The Correlation Between Firm Size and other Characteristics
of the Firm (1975)
Values of R greater than .046 are significant at the 95% level.

| Firm Size (measured in terms of total assets) and the: | |
|--|-------|
| Price of labor | .052 |
| Price of capital | .030 |
| Ratio of loans serviced <u>by</u> others to total assets | .276 |
| Ratio of loans serviced <u>for</u> others to total assets | -.020 |
| Ratio of "bad" loans to total assets | .081 |
| Ratio of "other" loans to total assets | -.051 |
| Ratio of borrowed funds to total assets | .292 |
| Ratio of interest on accounts at or below regular passbook rate to total interest payments | -.048 |
| Herfindahl index: the number of offices the firm has and their deposit holding | -.669 |
| Ratio of service corporation investment to total assets | .217 |
| Dummy for stock organization | .029 |
| Dummy for federal charter | .214 |

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APPENDIX A

A SIMPLE MODEL OF THE FIRM

The basic Cobb-Douglas cost function used in this paper can be derived using classical optimization methods. The purpose of this appendix is to determine the conditions under which the cost function's parameters will provide unbiased estimates of the production function's characteristics.

We begin with the assumption that there is a well defined relationship between output Q and inputs K and L (capital, in the form of savings deposits, and labor). This relationship, $Q = f(K,L)$, is also assumed to describe only the most efficient transformation of inputs into output for any level of production.

Production functions can most easily be discussed in terms of three characteristic elasticities: the elasticity of output with respect to a change in an input, known as the output elasticity; the sum of the output elasticities for all the inputs, known as the elasticity of scale (or size, if the function is not linearly homogeneous), and the elasticity of substitution of one input for another. There are other important properties of production functions that economists are concerned with, such as the separability of inputs and outputs, but we are mainly interested in these three.

If a good deal is known about these elasticities, then the information can be incorporated into the explicit model. Unfortunately,

it is usually the case, as it is here, that these elasticities are the object of the research rather than the starting point. To build a model, however, one must make some assumptions about what values they should take on. The production function that forms the basis of our model has strong assumptions about the possible values of the elasticities, but, as shall be seen, the nature of the industry allows certain ones to be relaxed. At this point, however, the elasticities of output, scale (size), and substitution are assumed to be constant for the whole range of firm sizes observable. The elasticity of substitution is further restricted to being equal to unity.

The Cobb-Douglas form can be written as follows:

$$Q = \alpha K^{\kappa} L^{\omega}. \quad (1)$$

The product of a financial intermediary is the lending of the use of money through time, so output Q represents the stock of assets held by the S&L. The capital required to support the firm's activities, its savings deposits, is represented by K , while the labor input is contained in the variable L .

Some further assumptions are necessary: the firm is assumed to operate under competitive pressures in its factor markets, and the market for its product as well. These assumptions allow us to define the firm's profit function as simply the difference between total revenue and total cost, or

$$\pi = pQ - rK - wL, \quad (2)$$

where r , w , and p are the prices of inputs and output respectively.

We assume that the firm will attempt to maximize its profits, given the prices of its inputs and its output, and the technology implied by the production function. Equations (1) and (2) can be combined into a single function, representing the objective function of the firm, by using the technique of Lagrangian Multipliers.

$$\Pi = pQ - rK - wL - \lambda(Q - \alpha K^{\kappa} L^{\omega}) \quad (3)$$

The first order (necessary) conditions for our firm are:

$$\frac{\partial \Pi}{\partial \lambda} = Q - \alpha K^{\kappa} L^{\omega} \quad (4)$$

$$\frac{\partial \Pi}{\partial Q} = p - \lambda \quad (5)$$

$$\frac{\partial \Pi}{\partial K} = -r + \lambda \kappa \frac{K^{\kappa-1} L^{\omega}}{K} \quad (6)$$

$$\frac{\partial \Pi}{\partial L} = -w + \lambda \omega \frac{K^{\kappa} L^{\omega-1}}{L} \quad (7)$$

Setting these conditions equal to zero, we can then solve for the equilibrium levels of Q , K , and L of the firm. Equations (6) and (7) can be rewritten as:

$$r = \lambda \kappa \frac{K^{\kappa-1} L^{\omega}}{K}, \quad (8)$$

or

$$rK = \lambda \kappa \alpha K^{\kappa} L^{\omega},$$

or

$$\omega r K = \lambda \kappa \omega \alpha K^{\kappa} L^{\omega}. \quad (9)$$

Similarly,

$$w = \lambda \omega \frac{K^{\kappa} L^{\omega}}{L}, \quad (10)$$

or

$$\kappa \omega L = \lambda \kappa \omega \alpha K^{\kappa} L^{\omega}. \quad (11)$$

If we combine (9) and (11), we obtain the marginal productivity conditions of the firm in equilibrium:

$$\frac{rK}{\kappa} = \frac{wL}{\omega}.$$

Rewriting this as

$$K = \frac{\kappa w}{\omega r} L,$$

we can substitute into (10) for K.

$$w = \lambda \omega \left(\frac{\alpha L^{\omega} \left(\frac{\kappa w}{\omega r} L \right)^{\kappa}}{L} \right) = \lambda \alpha \omega L^{\omega-1} \left(\frac{\kappa w}{\omega r} \right)^{\kappa},$$

or

$$L^{\kappa+\omega-1} = \frac{w}{\lambda\alpha\omega} \left(\frac{\omega r}{\alpha w} \right)^\kappa ,$$

or

$$L = \left(\frac{w}{\lambda\alpha\omega} \left(\frac{\omega r}{\kappa w} \right)^\kappa \right)^{\frac{1}{\kappa+\omega-1}} . \quad (12)$$

Similarly, we can perform the same substitutions to obtain an expression for K:

$$K = \left(\frac{\kappa w}{\omega r} \right) \left(\frac{w}{\lambda\alpha\omega} \left(\frac{\omega r}{\kappa w} \right)^\kappa \right)^{\frac{1}{\kappa+\omega-1}} . \quad (13)$$

Finally, we can find Q by substituting into our production function (1) for our inputs K and L the expressions (12) and (13):

$$Q = \left[\left(\frac{w}{\lambda\alpha\omega} \right)^{\alpha+\omega} \left(\frac{\omega r}{\kappa w} \right)^\kappa \right]^{\frac{1}{\kappa+\omega-1}} . \quad (14)$$

Equations (12), (13), and (14) give us the optimal level of inputs and output for our firm, but we need to examine the sufficient conditions to guarantee the firm is maximizing its profit. (Equations (12)--(14) must be met by the firm and these are known as the *necessary* conditions for profit maximizing: the remaining question is whether satisfying them is *sufficient* to guarantee profit maximizing.) It is well known that the sufficiency conditions for a problem of this type can be evaluated using a bordered Hessian matrix. For our firm

to be maximizing, all the principle minors of order $2n$, or larger, where n is the number of constraints plus one, must have the sign determined by the rule of raising the number (-1) to the $n-1$ power, in this case $(-1)^1$.

$$H(Q, K, L, \lambda) = \begin{pmatrix} 0 & \alpha K^\kappa L^\omega & \alpha \kappa K^{\kappa-1} L^\omega & \alpha \omega K^\kappa L^{\omega-1} \\ \alpha K^\kappa L^\omega & 0 & 0 & 0 \\ \alpha \kappa K^{\kappa-1} L^\omega & 0 & \lambda \alpha \kappa (\kappa-1) K^{\kappa-2} L^\omega & \lambda \alpha \kappa \omega K^{\kappa-1} L^{\omega-1} \\ \alpha \omega K^\kappa L^{\omega-1} & 0 & \lambda \alpha \kappa \omega K^{\kappa-1} L^{\omega-1} & \lambda \alpha \omega (\omega-1) K^\kappa L^{\omega-2} \end{pmatrix}$$

$$|H| = (-Q^2) \lambda^2 \alpha^2 \kappa \omega K^{2\kappa-2} L^{2\omega-2} (1-\kappa-\omega) \quad (15)$$

At first sight (15) does not seem to reveal very much. The quantities Q , K , and L , however, and the coefficients α , κ , ω , and λ , can all be signed positive on economic grounds. For example, λ can be interpreted as the value of a relaxation of the production function constraint on the profit equation and, thus, should always have a positive value: in fact, it is equal to the price of output (from equation (5) of the necessary conditions). This means that for the determinant to be signed negative, κ and ω must sum to less than one.

The second principle minor that must be evaluated is formed by deleting the last row and column of the bordered Hessian.

$$H_{-1} = \begin{pmatrix} 0 & \alpha K^{\kappa} L^{\omega} & \alpha \kappa K^{\kappa-1} L^{\omega} \\ \alpha K^{\kappa} L^{\omega} & 0 & 0 \\ \alpha \kappa K^{\kappa-1} L^{\omega} & 0 & \lambda \alpha \kappa (\kappa-1) K^{\kappa-2} L^{\omega} \end{pmatrix}$$

$$|H_{-1}| = \alpha K^{\kappa} L^{\omega} (\lambda \alpha \kappa (\kappa-1) K^{\kappa-2} L^{\omega}) \quad (16)$$

The determinant must also have a negative sign. It can be seen that for this condition to hold $(\kappa^2 - \kappa)$ must be less than zero. This means that κ has to be less than one, but greater than zero. Since κ and ω are symmetrical, this restriction must hold for ω as well.

The exponents κ and ω have an important economic significance for the Cobb-Douglas production function. The elasticity of output for a change in capital is defined as:

$$\frac{Q}{K} * \frac{K}{Q} = (\alpha \kappa K^{\kappa-1} L^{\omega}) (KQ^{-1}).$$

Since $Q = \alpha K^{\kappa} L^{\omega}$, we can substitute in for Q and find that the elasticity of output for capital is equal to κ . A similar substitution produces an output elasticity for labor of ω . The sum of the output elasticities is the elasticity of scale. The common sense of the restrictions on these elasticities is that increasing returns to scale are inconsistent with an industry composed of many firms. If there were true cost advantages to size, a firm, or several firms, would shortly force out

the majority of establishments and move the industry into a less competitive form of market.

It is a crucial point, then, if this model is to be of use for a cost study looking for advantages of scale, that there be some *deus ex machina* to guarantee that competition (the presence of many firms) and economies of scale are compatible. Entry and growth have been regulated in the S&L industry since the 1930's, and such regulation may have provided the necessary mechanism. It remains to be seen, of course, whether there are benefits from size in the industry.

Notice that if κ and ω sum to one, the determinant vanishes. This has a common sense explanation as well: if there are constant returns to scale, then the optimal size of firm is indeterminate.

To derive the cost function we desire, we need, first, the cost identity

$$C = rK + wL . \quad (17)$$

We substitute equation (5) into (17) to get:

$$C = r \left(\frac{\kappa w}{\omega r} \right) L + wL = \frac{\kappa w}{\omega} L + wL$$

$$\omega C = \kappa \omega L + \omega wL = wL(\kappa + \omega)$$

$$\frac{\omega C}{w(\kappa + \omega)} = L . \quad (18)$$

Similarly, an expression can be derived for K:

$$C = rK + w \frac{\omega r}{\kappa w} K$$

$$\kappa C = \kappa rK + \omega rK = rK(\kappa + \omega)$$

$$\frac{\kappa C}{r(\kappa + \omega)} = K \quad . \quad (19)$$

Substituting into our production function (1) the expressions for K and L equations (18) and (19), we get:

$$Q = \left(\frac{\omega C}{r(\kappa + \omega)} \right)^\kappa \left(\frac{\kappa C}{w(\kappa + \omega)} \right)^\omega \quad .$$

Solving for C we get the following expression:

$$C = \left[\frac{\kappa + \omega}{\frac{\kappa}{\kappa + \omega} \frac{\omega}{\kappa + \omega}} \right] Q^{\frac{1}{\kappa + \omega}} r^{\frac{\kappa}{\kappa + \omega}} w^{\frac{\omega}{\kappa + \omega}} \quad (20)$$

If output is exogenous for the firm, then equation (20) is a reduced form cost function. The question of what is endogenous and what is exogenous is not one that can be settled for once and for all. In its simplest terms, it is a matter of which variables can be explained by the model and which must have an outside explanation. As discussed in chapter 3, it is argued that regulation has severely limited the decision making that normally falls to the firm.

APPENDIX B

THE S&L AS A VERTICALLY INTEGRATED FIRM

A more accurate description of the S&L industry would be to treat it as a vertically integrated industry, using capital and labor to collect deposits and then additional capital and labor to convert those deposits into loans.

$$D = \text{Deposits} = g(K_1, L_1)$$

$$M = \text{Loans} = h(K_2, L_2)$$

r = interest rate on deposits

i = interest rate on loans

w = wage rate

q = cost of capital

In equilibrium: $D = L$, $D = D^*$, and $M = M^*$.

$$C = rD + q(K_1 + K_2) + w(L_1 + L_2). \quad (1)$$

$$D^* = AK_1^{\alpha_1} L_1^{\beta_1} = EK_2^{\alpha_2} L_2^{\beta_2} \quad \text{By definition.}$$

$$\text{Therefore } L_1 = D^{*\beta_1} A^{-\frac{1}{\beta_1}} K^{-\frac{\alpha_1}{\beta_1}} \quad \text{and} \quad L_2 = D^{*\beta_2} E^{-\frac{1}{\beta_2}} K^{-\frac{\alpha_2}{\beta_2}}$$

Restating (1):

$$C = rD^* + q(K_1 + K_2) + w\left(D^{*\beta_1} A^{-\frac{1}{\beta_1}} K^{-\frac{\alpha_1}{\beta_1}} + D^{*\beta_2} E^{-\frac{1}{\beta_2}} K^{-\frac{\alpha_2}{\beta_2}}\right) \quad (1a)$$

The first order conditions for (1a) are:

$$\frac{\partial C}{\partial K_1} = q - w \frac{\alpha_1}{\beta_1} D^{*\beta_1} A^{-\frac{1}{\beta_1}} K^{-\frac{\alpha_1}{\beta_1}} - 1 \quad (2)$$

$$\frac{\partial C}{\partial K_2} = q - w \frac{\alpha_2}{\beta_2} D^{*\beta_2} A^{-\frac{1}{\beta_2}} K^{-\frac{\alpha_2}{\beta_2}} - 1 \quad (3)$$

(2) implies:

$$K_1 = \left[qD^{-\frac{1}{\beta_1}} A^{\frac{1}{\beta_1}} \frac{\beta_1}{w\alpha_1} \right]^{\frac{-1}{\frac{\alpha_1}{\beta_1} + 1}}$$

(3) implies:

$$K_2 = \left[aD^{-\frac{1}{\beta_2}} E^{\frac{1}{\beta_2}} \frac{\beta_2}{w\alpha_2} \right]^{\frac{-1}{\frac{\alpha_2}{\beta_2} + 1}}$$

Restating (1a):

$$C = rD^* + q \left[D^{\frac{1}{\alpha_1 + \beta_1}} \frac{-1}{q \frac{\alpha_1}{\beta_1} + 1} A^{\frac{-1}{\alpha_1 + \beta_1}} \frac{-1}{\frac{\beta_1}{w\alpha_1} \frac{\alpha_1}{\beta_1} + 1} + D^{\frac{1}{\alpha_2 + \beta_2}} \frac{-1}{q \frac{\alpha_2}{\beta_2} + 1} E^{\frac{-1}{\alpha_2 + \beta_2}} \frac{-1}{\frac{\beta_2}{w\alpha_2} \frac{\alpha_2}{\beta_2} + 1} \right] + w \left[\left(A^{-\frac{1}{\beta_1}} \left(q A^{\frac{1}{\beta_1}} \frac{\beta_1}{w\alpha_1} \right)^{\frac{-1}{\frac{\alpha_1}{\beta_1} + 1}} - \frac{\alpha_1}{\beta_1} D^{*\frac{-1}{\alpha_1 + \beta_1}} \right) + \left(E^{-\frac{1}{\beta_2}} \left(q E^{\frac{1}{\beta_2}} \frac{\beta_2}{w\alpha_2} \right)^{\frac{-1}{\frac{\alpha_2}{\beta_2} + 1}} - \frac{\alpha_2}{\beta_2} D^{*\frac{-1}{\alpha_2 + \beta_2}} \right) \right] \quad (1b)$$

Collecting terms:

$$\begin{aligned}
 C = rD^* + q \left(D^* \frac{1}{\alpha_1 + \beta_1} \phi_{qAw} + D^* \frac{1}{\alpha_2 + \beta_2} \phi_{qEw} \right) \\
 + w \left(D^* \frac{1}{\alpha_1 + \beta_1} \phi_{AAw} + D^* \frac{1}{\alpha_2 + \beta_2} \phi_{EEq} \right) \quad (1c)
 \end{aligned}$$

Chapter 3 discusses the implications of (1c) on the way in which cost aggregates are selected for empirical work.

APPENDIX C

AN ATTEMPT TO RESOLVE THE CONFLICT BETWEEN THE SIMPLE
AND VERTICALLY INTEGRATED MODELS

The model in Appendix B requires that labor and capital be separable by use. This is an unacceptable handicap to empirical work and it is proposed in this appendix to treat the S&L as if it were a simple firm rather than a vertically integrated one. Notice that this model differs from the one in Appendix A by making the interest price of deposits still depend upon the efforts of the firm to attract customers.

$$Q = D^* = M^* \quad Q = f(K,L) = \alpha K^\beta L^\phi$$

$$C = rK + wL + iD$$

K = capital required to produce Q

L = labor required to produce Q

r = price of capital

i = interest rate on savings deposits $i = g(K,L)$

w = price of labor

$$\Pi = rK + wL + iD + \lambda(Q - \alpha K^\beta L^\phi) \quad (1)$$

First order conditions:

$$\frac{\partial \Pi}{\partial K} = r + g_k D - \lambda \alpha \beta K^{\beta-1} L^\phi \quad (2)$$

$$\frac{\partial \Pi}{\partial L} = w + g_1 D - \lambda \alpha \phi K^\beta L^{\phi-1} \quad (3)$$

They imply:

$$K = L \frac{\beta(w + g_1 D)}{\phi(r + g_k D)} \quad L = K \frac{\phi(r + g_k D)}{\beta(w + g_1 D)}$$

$$C = r \left(L \frac{\beta(w + g_1 D)}{\phi(r + g_k D)} \right) + wL + iD \quad (4)$$

$$L = (C - iD) \left[w + \frac{r\beta(w + g_1 D)}{\phi(r + g_k D)} \right]^{-1} \quad (4a)$$

$$C = rK + w \left(k \frac{\phi(r + g_k D)}{\beta(w + g_1 D)} \right) + iD \quad (5)$$

$$K = (C - iD) \left[r + \frac{w\phi(r + g_k D)}{\beta(w + g_1 D)} \right]^{-1} \quad (5a)$$

Substituting (4a) and 5a) into the production function:

$$Q = (C - iD)^{\beta+\phi} \left[w + \frac{r\beta(w + g_1 D)}{\phi(r + g_k D)} \right]^{-\phi} \left[r + \frac{w\phi(r + g_k D)}{\beta(w + g_1 D)} \right]^{-\beta} \quad (6)$$

$$C^* = C - iD = Q \left[w + \frac{r\beta(w + g_1 D)}{\phi(r + g_k D)} \right]^{\frac{\phi}{\beta+\phi}} \left[r + \frac{w\phi(r + g_k D)}{\beta(w + g_1 D)} \right]^{\frac{\beta}{\beta+\phi}} \quad (6a)$$

Where C^* = "operating expenses."

APPENDIX D
AGGREGATION BIAS

The purpose of this appendix is to demonstrate how to adjust for aggregation errors in variables. For example, let us say that x_1 is the mortgage holdings of a firm, x_2 the construction loans it has outstanding, and y the sum of x_1 and x_2 . y represents the total assets of the firm.

The variable z can be defined as:

$$z = \frac{x_2}{x_1 + x_2} .$$

If the correct weighting in terms of cost of production should be y^* , where $y^* = x_1 + (1+\sigma)x_2$, then $y^* = y + \sigma x_2 = y(1 + \sigma z)$. The σ represents the premium or discount that should have been included in the construction of y . If y is used instead of y^* in our logarithmic equation, then we have, in effect, left out $\ln(1+\sigma z)$.

Following the Griliches and Ringstadt, who formulated the above problem, we will estimate the value of σ by including z in the equation.¹

¹See Griliches, Ziv, and V. Ringstad, *Economies of Scale and the Form of the Production Function*, North Holland, 1971, p. 28.

APPENDIX E

TABLES E-1 - E-5

Table E-1

Regression Results for the Cost of Savings Deposits Equation,
Using the Full Sample (1878 firms). The Data are from 1975.

| Variable | Coefficient | t-statistic |
|---|-------------|-------------------|
| Constant | 5.821 | 137.930 |
| Ratio: advertising expenses to total interest expenses | 0.003 | 0.014 |
| Dummy: interest paid from date of deposit to date of with- drawal; one=yes, zero=no | 0.146 | 5.652 |
| Dummy: deposits made by tenth of month get full month inter- est; one=yes, zero=no | 0.111 | 5.871 |
| Dummy: was a giveaway program in operation during past year; one=yes, zero=no | -0.059 | -3.500 |
| Dummy: was interest compounded more often than daily; one= yes, zero=no | 0.133 | 2.788 |
| Dummy: was interest compounded daily; one=yes, zero=no | 0.132 | 3.338 |
| Dummy: was interest compounded monthly; one=yes, zero=no | 0.010 | 0.105 |
| Dummy: was interest compounded quarterly; one=yes, zero=no | 0.104 | 2.634 |
| Herfindahl index: savings deposit concentration within each association's SMSA | 0.007 | 0.029 |
| R ² (corrected); 0.042 | | F(9,1868): 10.053 |
| Standard error of the estimate: 0.353 | | |
| Mean of the dependent variable: 6.080 | | |
| Residual sum of squares: 232.750 | | |

Table E-2

Regression Results for the Unconstrained (Translog) Cost Function
Using the Full Sample, the Branching Sample, and the Unit
Sample. t-statistics are in parentheses and the
Data are from 1975.

| Variable ^a | Coefficient and t-statistic | | |
|--|-----------------------------|--------------------|--------------------|
| | Full Sample | Branch Sample | Unit Sample |
| Constant | 4.251 (0.899) | -3.093 (-0.471) | 2.123 (0.259) |
| Total Assets | 0.446 (2.621) | 0.995 (4.115) | -0.017 (-0.039) |
| (Total Assets) ² | 0.022 (8.759) | 0.021 (5.045) | 0.056 (6.822) |
| Wage rate | 0.391 (0.155) | 1.892 (0.630) | 2.485 (0.531) |
| Interest rate | -5.439 (-1.553) | -2.282 (-0.491) | -2.114 (-0.350) |
| Wage rate * interest rate | 1.674 (1.653) | 1.041 (0.874) | 1.753 (0.939) |
| (Wage rate) ² | -0.879 (-1.896) | -0.568 (-1.174) | -1.861 (-1.938) |
| (Interest rate) ² | 0.581 (0.850) | 0.627 (0.752) | -0.077 (-0.064) |
| Total assets * wage rate | -0.050 (-1.023) | -0.170 (-2.558) | 0.028 (0.217) |
| Total assets * interest rate | 0.025 (0.338) | -0.158 (-1.583) | -0.141 (-0.750) |
| Ratio: loans serviced <u>by</u> others to total assets | -0.020 (-0.406) | -0.143 (-2.845) | 0.164 (1.453) |
| Ratio: loans serviced <u>for</u> others to total assets | 0.303 (10.758) | 0.275 (9.353) | 0.353 (6.129) |
| Ratio: "bad" loans to total assets | 4.477 (8.400) | 4.175 (7.962) | 6.002 (4.674) |
| Ratio: "other" loans to total assets | 1.524 (7.585) | 1.330 (5.953) | 1.428 (3.819) |
| Ratio: borrowed funds to total assets | 0.499 (3.813) | 0.536 (3.904) | 0.394 (1.495) |

^aAll variables are in natural logarithms except the ratio, Herfindahl index, and dummy variables.

Table E-2 (continued)

| Variable | Coefficient and t-statistic | | |
|--|-----------------------------|----------------------|--------------------|
| | Full Sample | Branch Sample | Unit Sample |
| Ratio: interest paid on accounts earning at or below passbook rate to total payments | -0.112 (10.124) | 2.465 (2.336) | -1.663 (-1.055) |
| Herfindahl index: SMSA savings deposit concentration | 0.164 (1.112) | 0.051 (0.290) | 0.277 (1.135) |
| Ratio: service corporation investment to total assets | 5.170 (4.358) | 5.704 (4.861) | 4.618 (1.669) |
| Herfindahl index: firm's dispersion of deposits among its offices | -0.00002 (-6.684) | -0.00001 (-3.820) | - |
| Dummy: stock organization equals one, zero otherwise | 0.120 (10.201) | 0.066 (5.338) | 0.215 (8.814) |
| Dummy: federal charter equals one, zero otherwise | 0.023 (2.172) | 0.016 (1.412) | 0.010 (0.487) |
| R^2 (corrected) | 0.964 | 0.960 | 0.912 |
| F statistic | 2517.194 | 1443.084 | 369.465 |
| Standard error of estimate | 0.219 | 0.188 | 0.249 |
| Mean of dependent variable | 6.395 | 6.932 | 5.435 |
| Residual sum of squares | 89.252 | 41.905 | 40.575 |

Table E-3

Regression Results for the Homothetic Cost Function Using the Full Sample, the Branching Sample, and the Unit Sample. t-statistics are in Parentheses and the Data are from 1975.

| Variable ^a | Coefficient and t-statistic | | |
|---|-----------------------------|--------------------|--------------------|
| | Full Sample | Branch Sample | Unit Sample |
| Constant | 4.793 (1.0405) | 5.437 (0.962) | 3.048 (0.383) |
| Total assets | 0.418 (7.882) | 0.453 (4.918) | -0.225 (-1.463) |
| (Total assets) ² | 0.022 (8.744) | 0.020 (5.007) | 0.055 (6.933) |
| Wage rate | -0.009 (-0.004) | -0.965 (-0.341) | 2.990 (0.644) |
| Interest rate | -5.527 (-1.580) | -5.978 (-1.369) | -2.496 (-0.415) |
| Wage rate * interest rate | 1.745 (1.737) | 1.613 (1.371) | 1.527 (0.833) |
| (Wage rate) ² | -0.967 (-2.116) | -0.595 (-1.233) | -1.802 (-1.966) |
| (Interest rate) ² | 0.647 (0.964) | 0.925 (1.117) | -0.243 (-0.205) |
| Total assets * wage rate | - | - | - |
| Total assets * interest rate | - | - | - |
| Ratio: loans serviced <u>by</u> others to total assets | -0.024 (-0.483) | -0.151 (-2.997) | 0.163 (1.447) |
| Ratio: loans serviced <u>for</u> others to total assets | 0.303 (10.762) | 0.273 (9.268) | 0.354 (6.160) |
| Ratio: "bad" loans to total assets | 4.474 (8.407) | 4.133 (7.866) | 5.965 (4.653) |
| Ratio: "other" loans to total assets | 1.527 (7.634) | 1.328 (5.931) | 1.413 (3.811) |
| Ratio: borrowed funds to total assets | 0.490 (3.761) | 0.518 (3.771) | 0.394 (1.501) |

^aAll variables are in natural logarithms except the ratio, Herfindahl index, and dummy variables.

Table E-3 (continued)

| Variable | Coefficient and t-statistic | | |
|--|-----------------------------|----------------------|--------------------|
| | Full Sample | Branch Sample | Unit Sample |
| Ratio: interest paid on accounts earning at or below passbook rate to total payments | -0.044 (-0.049) | 2.301 (2.185) | -1.658 (-1.053) |
| Herfindahl index: SMSA savings deposit concentration | 0.163 (1.101) | 0.053 (0.300) | 0.282 (1.158) |
| Ratio: service corporation investment to total assets | 5.248 (4.433) | 5.631 (4.794) | 4.426 (1.608) |
| Herfindahl index: firm's dispersion of deposits among its offices | -0.00002 (-6.750) | -0.00001 (-4.097) | - |
| Dummy: stock organization equals one, zero otherwise | 0.120 (10.209) | 0.066 (5.406) | 0.216 (8.895) |
| Dummy: federal charter equals one, zero otherwise | 0.023 (2.121) | 0.017 1.505 | 0.011 (0.530) |
| R^2 (corrected) | 0.964 | 0.960 | 0.912 |
| F statistic | 2797.726 | 1595.284 | 413.702 |
| Standard error of estimate | 0.219 | 0.189 | 0.249 |
| Mean of dependent variable | 6.395 | 6.932 | 5.435 |
| Residual sum of squares | 89.318 | 42.179 | 40.619 |

Table E-4

Regression Results for the Homogeneous Cost Function Using the Full Sample, the Branching Sample, and the Unit Sample. t-statistics are in Parentheses and the Data are from 1975.

| Variable ^a | Coefficient and t-statistic | | |
|---|-----------------------------|--------------------|--------------------|
| | Full Sample | Branch Sample | Unit Sample |
| Constant | 3.627 (0.772) | 4.417 (0.774) | 0.637 (0.077) |
| Total assets | 0.880 (144.180) | 0.913 (125.340) | 0.837 (73.797) |
| Total assets) ² | - | - | - |
| Wage rate | -0.268 (-0.105) | -1.306 (-0.457) | 1.331 (0.277) |
| Interest rate | -6.528 (-1.831) | -7.400 (-1.681) | -3.964 (-0.637) |
| Wage rate * interest rate | 1.938 (1.892) | 1.970 (1.660) | 2.248 (1.187) |
| (Wage rate) ² | -0.999 (-2.142) | -0.697 (-1.432) | -1.662 (-1.751) |
| (Interest rate) ² | 0.823 (1.203) | 1.166 (1.396) | -0.161 (-0.132) |
| Total assets * wage rate | - | - | - |
| Total assets * interest rate | - | - | - |
| Ratio: loans serviced <u>by</u> others to total assets | 0.008 (0.160) | -0.153 (-3.023) | 0.250 (2.159) |
| Ratio: loans serviced <u>for</u> others to total assets | 0.295 (10.289) | 0.275 (9.244) | 0.333 (5.601) |
| Ratio: "bad" loans to total assets | 4.501 (8.291) | 4.235 (7.986) | 6.398 (4.827) |
| Ratio: "other" loans to total assets | 1.631 (7.986) | 1.393 (6.169) | 1.320 (3.439) |
| Ratio: borrowed funds to total assets | 0.499 (3.754) | 0.549 (3.962) | 0.386 (1.420) |

^aAll variables are in natural logarithms except the ratio, Herfindahl index, and dummy variables.

Table E-4 (continued)

| Variable | Coefficient and t-statistic | | |
|--|-----------------------------|----------------------|--------------------|
| | Full Sample | Branch Sample | Unit Sample |
| Ratio: interest paid on accounts earning at or below passbook rate to total payments | -0.474 (-0.519) | 2.585 (2.434) | -3.051 (-1.888) |
| Herfindahl index: SMSA savings deposit concentration | 0.172 (1.140) | 0.037 (0.210) | 0.259 (1.025) |
| Ratio: service corporation investment to total assets | 5.154 (4.269) | 5.564 (4.689) | 4.403 (1.545) |
| Herfindahl index: firm's dispersion of deposits among its offices | -0.00002 (-8.324) | -0.00001 (-4.265) | - |
| Dummy: stock organization equals one, zero otherwise | 0.127 (10.630) | 0.071 (5.716) | 0.228 (9.056) |
| Dummy: federal charter equals one, zero otherwise | 0.030 (2.767) | 0.019 (1.623) | 0.018 (0.859) |
| R^2 (corrected) | 0.963 | 0.959 | 0.906 |
| F statistic | 2842.483 | 1654.077 | 407.371 |
| Standard error of estimate | 0.224 | 0.191 | 0.258 |
| Mean of dependent variable | 6.395 | 6.932 | 5.435 |
| Residual sum of squares | 92.992 | 43.071 | 43.595 |

Table E-5

Regression Results for the Unconstrained (Translog) Cost Function with the Assumption of Unit Elasticities of Substitution Between Inputs, Using the Full Sample, the Branching Sample, and the Unit Sample. t-statistics are in Parentheses and the Data are from 1975.

| Variable ^a | Coefficient and t-statistic | | |
|---|-----------------------------|--------------------|--------------------|
| | Full Sample | Branch Sample | Unit Sample |
| Constant | -0.134 (-0.078) | -7.016 (-2.790) | 1.890 (0.483) |
| Total assets | 0.431 (2.567) | 1.012 (4.217) | -0.042 (-0.098) |
| (Total assets) ² | 0.022 (8.818) | 0.021 (5.199) | 0.058 (7.041) |
| Wage rate | 0.971 (1.863) | 2.275 (3.088) | 0.843 (0.689) |
| Interest rate | -1.012 (-1.328) | 1.601 (1.455) | -0.332 (-0.189) |
| Wage rate * interest rate | - | - | - |
| (Wage rate) ² | - | - | - |
| (Interest rate) ² | - | - | - |
| Total assets * wage rate | -0.068 (-1.396) | -0.188 (-2.875) | -0.053 (-0.419) |
| Total assets * interest rate | 0.045 (0.619) | -0.160 (-1.613) | -0.087 (-0.467) |
| Ratio: loans serviced <u>by</u> others to total assets | -0.028 (-0.555) | -0.147 (-2.942) | 0.160 (1.398) |
| Ratio: loans serviced <u>for</u> others to total assets | 0.306 (10.855) | 0.277 (9.416) | 0.357 (6.111) |
| Ratio: "bad" loans to total assets | 4.519 (8.510) | 4.184 (7.989) | N/A |
| Ratio: "other" loans to total assets | 1.469 (7.358) | 1.286 (5.824) | 1.486 (3.933) |
| Ratio: borrowed funds to total assets | 0.514 (3.937) | 0.539 (3.933) | 0.504 (1.889) |

^aAll variables are in natural logarithms except the ratio, Herfindahl index, and dummy variables.

Table E-5 (Continued)

| Variable | Coefficient and t-statistic | | |
|--|-----------------------------|----------------------|--------------------|
| | Full Sample | Branch Sample | Unit Sample |
| Ratio: interest paid on accounts earning at or below passbook rate to total payments | -0.238 (-0.263) | 2.307 (2.203) | -1.157 (-0.727) |
| Herfindahl index: SMSA savings deposit concentration | 0.155 (1.047) | 0.044 (0.253) | 0.255 (1.022) |
| Ratio: service corporation investment to total assets | 5.334 (4.498) | 5.860 (5.013) | 6.750 (2.430) |
| Herfindahl index: firm's dispersion of deposits among its offices | -0.00002 (-6.719) | -0.00001 (-3.877) | - |
| Dummy: stock organization equals one, zero otherwise | 0.118 (10.087) | 0.065 (5.320) | 0.213 (8.658) |
| Dummy: federal charter equals one, zero otherwise | 0.024 (2.198) | 0.016 (1.406) | 0.008 (0.400) |
| R^2 (corrected) | 0.964 | 0.960 | 0.909 |
| F statistic | 2952.936 | 1698.004 | 448.484 |
| Standard error of estimate | 0.220 | 0.188 | 0.254 |
| Mean of dependent variable | 6.395 | 6.932 | 5.435 |
| Residual sum of squares | 89.638 | 42.001 | 42.418 |

VITA

Born during the wee hours of August 22, 1947, the author was (or so he has been told) the loudest baby in the hospital. He has been graduating and collecting degrees ever since. He graduated from J.E.B. Stuart High School in 1965. He passed his comprehensive exams and graduated from the University of Virginia in 1969, majoring in social anthropology and minoring in economics. Along the way he has worked as a summer camp counselor, a supervisor in a reform school, and even sold encyclopedias for a day. He received his Masters in economics in 1974 from VPI & SU and this dissertation represents the final requirement for his Ph.D. in economics from the same university. His fields were industrial organization and public choice. After completing the course work for his Doctorate, he took a one year visiting scholars appointment with the Federal Home Loan Bank Board.

The author is six feet two and has eyes of blue, brown hair, and skin that is fair. Right now, June of 1978, he is seeking work as a research economist and writing several papers.



A STUDY OF REGULATORY GOALS AND CONTROLS:
FIRM SIZE IN THE SAVINGS AND LOAN INDUSTRY

by

Jay M. Atkinson

(ABSTRACT)

The regulatory agencies of the Savings and Loan industry have a decisive role to play in determining the evolutionary path of the industry's structure because they control the most important avenues of growth for associations. Office siting, branching, the entry of new firms, and merging are all subject to their approval. Under current policies there is a pronounced trend toward large firms and, as the powers of the regulators are more preventive than curative, now is the time to decide whether such firms should be permitted to grow or not, while there are adequate numbers of large firms for analysis but not so many as to render the issue moot.

Previous workers have mostly concentrated on the efficiency of the firm. This study also focused on size efficiency, but several other potential justifications of large size firms were considered as well, such as size versus firm safety and size versus mortgage market efficiency.

To improve the descriptive powers of the cost function, a series of functional forms were estimated to determine what were the effects of imposing the restrictions of the most commonly used forms of cost

function on the elasticity of substitution, the output elasticities, and the elasticity of size--the sum of the output elasticities. The data were a 1975 sample of 1,878 firms, comprising about half the industry. Our results indicated that economies of scale are not as easily demonstrated as others have concluded. Such economies turn out to be crucially dependent on the way in which they are specified. An examination of the likely biases of each functional form suggests that only relatively small firms (under \$50 million in assets) would have lower costs with growth.

Our safety analysis showed that the ratio of net worth to liabilities declines as firm size increases while the ratio of "doubtful" loans to assets increases. Nor did large firms have higher rates of return than small firms. Large associations also seem to be more aggressive in seeking strategies that surmount regulatory safeguards. In an industry of such firms the regulators may have to intervene in more situations than they would have to otherwise.

The advent of more large firms might bring about improvements in the efficiency of the mortgage market. Large firms use the secondary mortgage market and the money made available by the FHLB System to a much greater extent than do small associations. This suggests that an increase in their share of the industry may support an expansion of the secondary mortgage market and an increase in the use of advances. The latter is particularly important to regulators if they continue their plans to use advances as a counter-cyclical tool. Our examination

of portfolios indicated, however, that large firms are not complete substitutes for the smaller firms in that the large firms tend to make fewer of the specialized types of loans for mobile homes, home improvements, and the like.