

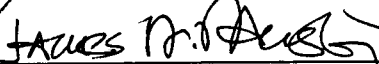
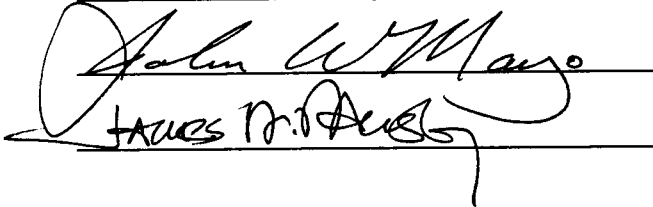
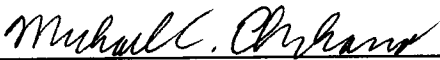
To the Graduate Council:

I am submitting herewith a dissertation written by Atul Kumar Saxena entitled "Cost Complementarities Among Banking and Nonbanking Activities of Bank Holding Companies and the Cost of Regulation." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Business Administration.



Harold A. Black, Major Professor

We have read this dissertation
and recommend its acceptance:



Accepted for the Council:



Associate Vice Chancellor
and Dean of the Graduate School

COST COMPLEMENTARITIES AMONG BANKING AND
NONBANKING ACTIVITIES OF BANK HOLDING COMPANIES
AND THE COST OF REGULATION

A Dissertation

Presented for the

Doctor of Philosophy

Degree

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Atul Kumar Saxena

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DEDICATION

This dissertation is dedicated to my parents

Mr. Naresh Chandra Saxena

and

Mrs. Pushpa Saxena

who have made several sacrifices for their
children to provide the best educational
opportunities and always given unselfish and
invaluable advice while keeping their woes to themselves.

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ABSTRACT

A multiproduct quadratic cost function (MQCF) is used to investigate the issue of jointness in production of banking and nonbanking activities of bank holding companies. Federal Deposit Insurance Corporation data are used for banking activities and the Federal Reserve's FRY-11AS tapes are used to obtain nonbanking data.

The two data sources are combined according to the highest bank holding company code to investigate whether cost complementarities exist between banking and nonbanking activities. Several alternative definitions for bank output are employed. Additionally, three nonbanking activities are defined as securities, insurance, and "other nonbanking activities."

The results show significant cost savings from the joint production of banking and nonbanking activities, with one exception. Importantly, the exception is the insurance business. There are significant diseconomies of scope between banking and insurance activities. Point estimates are also presented for product-specific economies of scale for banking and the three nonbanking activities.

Further, scale and scope economies results are presented after dividing the data into multi-bank holding companies and one-bank holding companies. The important result shows different conclusions regarding economies of scope between banking activities and securities suggesting structural differences between the organizational forms.

TABLE OF CONTENTS

CHAPTER	PAGE
I. INTRODUCTION	
Purpose of This Research	1
Relevance of This Research to Current Times . .	4
Motivation	8
Organization of the Dissertation	19
II. LITERATURE REVIEW	
Economies of Scale and Scope in Traditional Banking	
Early Studies on Bank Costs (up to 1970) .	24
Later Studies on Bank Costs (from 1970 to early 1980s)	27
Latest Literature on Bank Costs	30
Empirical Studies on BHCs' Nonbanking Costs . .	43
III. THE REGULATORY ENVIRONMENT OF BANKS AND BHCs	
The Evolution of Commercial Banking Industry Structure	
A Historical Perspective	45
Recent Trends	52
The Legal Environment of BHCs	53

IV. AN ANALYSIS OF NONBANKING ACTIVITIES OF BANK HOLDING COMPANIES

Data Description	59
Nonbanking Assets of BHCs in Each Category . .	64
Is the Nonbanking Business of BHCs Heavily Concentrated?	70
Nonbanking Profitability of Bank Holding Companies	72
Recapitulation	73

V. THEORETICAL FRAMEWORK OF THE EMPIRICAL TECHNIQUES

Some Theoretical Background

Scale/Scope Economies, Incremental Costs, and Subadditivity	76
Jointness in Production Function and Bank Costs	79
Detection of Jointness in Production Function	81
Production and Intermediation Approaches . . .	83
Definition and Measurement of Input (Prices) .	84
Definition and Measurement of Bank Output . . .	85
Specification of the Models	88
Scale and Scope Economies Among Banking Activities	90
Scale/Scope Economies Between Banking- Nonbanking Activities	93
Discussion of the Variables and their Coefficients	103

VI. EMPIRICAL RESULTS

Descriptive Statistics

Banking Activities 108

BHCs' Banking and Nonbanking Activities 110

Regression Results

Banking Activities 113

Banking and Nonbanking Activities . . . 119

VII. CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

Summary

Scale and Scope Economies for Banking
and Nonbanking Activities of BHCs . . . 127

Nonbanking Activities of BHCs 130

Conclusions Regarding the Scope of Economies Among Banking and Nonbanking Activities

Model 1: Outputs Defined as Total
Deposits and Loans 133

Model 2: Outputs Defined as Earning
Assets 133

Model 3: Outputs Defined as Revenue
Measures 134

Model 4: Outputs Defined as Banking
and Nonbanking Activities
(With Fixed Input Prices) . . . 135

Model 5: Outputs Defined as Banking and
Nonbanking Activities (With Input
Prices Interacting Linearly). . 135

MBHCs versus OBHCs	136
Directions for Future Research	137
BIBLIOGRAPHY	141
APPENDICES	
APPENDIX 1: Lists of Nonbanking Activities Permitted and Prohibited by Regulation	153
APPENDIX 2: Tables 1 - 20	156
VITA	176

LIST OF TABLES

TABLE	PAGE
1. Total Nonbanking Activities of Bank Holding Companies	156
2. Mean Nonbanking Activities of Bank Holding Companies	157
3. Concentration of BHCs' Nonbanking Assets . . .	158
4. Number of BHCs in Nonbanking Activities . . .	159
5. Percentage Breakdown of BHCs' Nonbanking Assets	160
6. Market Concentration of Total Nonbanking Assets	161
7. Nonbanking-to-Total BHC Assets Ratios	162
8. Return on Assets Ratios of Nonbank Subsidiaries	163
9. Return on Equity Ratios of Nonbank Subsidiaries	164
10. Descriptive Statistics: Banking Activities .	165
11. Group-wise Descriptive Statistics for Banking Activities	166
12. Descriptive Statistics: Banking and Nonbanking Data (1989)	167
13. Descriptive Statistics: Banking and Nonbanking Data (1990)	168
14. Regression Results for Model 1	169
15. Regression Results for Model 2	170
16. Regression Results for Model 3	171
17. Regression Results for Model 4	172

TABLE	PAGE
18. Regression Results for Model 5	173
19. Regression Results for Model 6A	174
20. Regression Results for Model 6B	175

CHAPTER 1

INTRODUCTION

1.1 Purpose of This Research

The topic of scale and scope economies in banking has long been debated. Even with the debate there seems to be little consensus among the participants. There is disagreement as to whether scale and scope economies exist in the banking industry, and if they do, whether such economies persist beyond a certain level of bank outputs.

Scale economies are often defined to be present when a k -fold proportionate increase in every input quantity yields a k' -fold increase in output, where $k' > k > 1$. Economies of scope refer to cost savings from the joint production of more than one product. Generally, economies of scope exist if it is cheaper for one firm to produce the industry's multiproduct output rather than several firms sharing the total production.¹

There are a number of issues that the researchers disagree on including the functional form of the cost equation, the data source, bank size and the definition of

¹Chapter 5 explains the concepts of economies of scale and scope. For a detailed discussion on these issues see Baumol, Panzar, and Willig (1988).

bank outputs and inputs. There are debates as to whether to use account-based data, such as the total number of accounts or total dollars outstanding in these accounts, whether to use operating costs or total costs (that include interest expense) as the dependent variable, and whether to include cost of loanable funds as an independent variable in the regressions.

This dissertation has two parts. In the first part the work of earlier researchers is synthesized. The synthesis uses total dollar volume of outputs, total costs as the dependent variable, cost of loanable funds as an independent variable, and a comprehensive data set that contains the population instead of just a sample of commercial banks.

The second part of the dissertation deals with the regulation of commercial banks and bank holding companies (BHCs).² Economies of scale/scope between banking and nonbanking activities are investigated in this part. While the first part is important and valuable, the second part makes this dissertation even more valuable as no study has as yet, looked at these issues. Historically, there has been an effort on the part of regulators to keep the traditional banking

²Henceforth, the terms bank and bank holding company are used interchangeably unless specifically mentioned.

activities of banks separated from the nonbanking activities.³ Their main argument for such a separation has revolved around two concerns. First is the "safety and soundness" concern, whereby the regulators want to minimize bank failures. Second is the fear of concentration of economic and financial power within the commercial banking industry [Sinkey (1992), pg. 17].

These issues are studied in some detail in the latter part of the dissertation. More specifically, however, the issue of jointness in production between banking and nonbanking activities is addressed. It is hypothesized that given freedom of entry into the nonbanking sector, commercial banks would choose to market nonbanking products only if it is profitable for them to do so.⁴

If economies of scope in production exist between banking and nonbanking activities without a simultaneous increase in

³In the banking literature traditional banking activities are referred to simply as banking activities whereas nonbanking activities have been referred to as commercial activities. [See Kaufman (1984), Kaufman (1987), Rosenblum and Pavel (1985), and Sinkey (1992)]. There is an ongoing debate whether or not to keep banking artificially separated from commerce.

⁴An exception to this line of argument would be for a bank to carry an unprofitable product in order to complete the portfolio of services. For instance, safe-deposit vaults (SDVs) have traditionally been unprofitable business for banks, yet they have carried the vaults in order to provide a complete array of services to customers. The example of SDVs is an exception to the profit-maximizing rule and hence, is ignored in the final analyses.

risk, then the only justification that regulators have in separating the two types of activities stems from the possibility of a reduced number of banking firms. This line of thought follows from the monopoly argument presented above and is an empirical question which will not be addressed here.

1.2 Relevance of This Research to Current Times

Because of deregulation and more importantly, because of technological and financial innovations, the structure of the financial services industry has changed significantly in the last 10-15 years [Kane (1981), Eisenbeis (1985), and Sinkey (1992)]. Therefore, this period has seen much interest among researchers and regulators regarding regulatory issues concerning financial institutions. The Depository Institutions Deregulation and Monetary Control Act (DIDMCA) of 1980 and the Garn-St Germain Depository Institutions Act of 1982 were passed and other provisions implemented.

These acts were written mainly to level the playing field for the commercial banks and other depository institutions and to meet the competition from nondepository institutions [Sinkey (1985)]. Thus, many observers believe that the single most important achievement of DIDMCA was the phase out of

Regulation Q that had imposed ceilings on the rate of interest that commercial banks and savings and loan associations could pay on deposits.

During the 1980s, the financial condition of the savings and loan (S&L) industry deteriorated and the number of bank failures increased. The bank failure rate during the decade of the 1980s was significantly greater than the rate during the entire period from 1934-1979 [Keeton (1990)]. Smaller banks (with assets less than 50 million dollars or loans and investments less than 250 thousand dollars) have traditionally had a higher failure rate than large banks (with loans and investments over 50 million dollars) [Keeton (1990)].

However, this gap narrowed during the 1980s. Whereas 36 percent of small banks failed during 1921-1929, only 2.2 percent failed during 1984-1989. On the other hand, close to zero percent of large banks failed during 1921-1929 while 0.6 percent failed during 1984-1989 [Keeton (1990)]. There are two cautions to be noted while interpreting Keeton's results. First the too-big-to-fail doctrine may have worked to artificially lower the actual number of large bank failures.

The too-big-to-fail (TBTF) doctrine refers to the reluctance on the part of regulators to let large banks fail.

If large banks face liquidity problems the discount window provides funds to keep them afloat. Occasionally, the FDIC arranges for another bank to assume the insured deposits of the problem bank which results in 100 percent deposit-insurance protection [Sinkey (1992)]. In the case of *de facto* failures that federal regulators (Federal Reserve/FDIC/OCC) refuse to close, a bailout through the FDIC is arranged (e.g., First Pennsylvania Bank of Philadelphia in 1980 and Continental Illinois Bank of Chicago in 1984). This practice of protecting large banks has established a public perception that big banks are too important to fail [Sinkey (1992)].⁵

The second note of caution arises due to size differential among banks because of the relatively long time difference. For instance, a bank with 50 million dollars in loans and investments may have qualified as a large bank in the 1920s but not in the 1960s, and certainly not in the 1980s

⁵Several recent studies look at the stock market reaction to banks declared insolvent and to regulators' decision to declare them as TBTF. Swary (1986) found significant response to the Continental Illinois crisis in terms of both negative abnormal returns and positive abnormal volume of trading. Wall and Peterson (1990) replicate the Swary study using daily data. Among other results, they report insignificant and positive (negative) returns to TBTF announcement for liability-managed (solvent) banks. Broadly speaking, their results do not support the FDIC's position that the failure of Continental would have precipitated a run on the major banks. Finally, O'Hara and Shaw (1990) find positive wealth effects accruing to TBTF banks, with corresponding negative effects to those not included in the FDIC's list of TBTF banks.

From Keeton's statistics it would seem logical that one of the reasons small banks merge to form bigger entities is to prevent failure (or, at least, to lessen the probability of failure). Some researchers have provided other motivations behind mergers [Rhoades (1986), Warshawsky (1987), and Shaffer (1991)]. In addition to the mergers of small banks there is a growth in the number of sizeable acquisitions in which the total deposits of the acquirer and the acquired banks each exceed one billion dollars. In 1981 there was just one sizable merger. By 1988 this number rose to twenty-one [Howe, Shelton, and Totonis (1989)].

No attempt is made in this dissertation to explore directly the reasons behind bank failures or bank mergers.⁶ However, several studies postulate that one of the reasons banks merge is to exploit economies of scale and scope.⁷ If two banks merge to exploit the possible economies of scale and/or scope, the resulting entity should be a healthier bank that faces a reduced possibility of failure.

To address the issues of economies of scale/scope and profitability, the underlying concept of the cost structure of

⁶See Sinkey (1979), for bank failure issues and Beatty, Santomero, and Smirlock (1987) and Srinivasan and Wall (1992) for bank merger reviews.

⁷See, for example, Shaffer (1991)

multiproduct banking firms must be understood. This requirement arises due to the fact that when studying these economies movements in total costs with respect to a change in one or several of the firm's outputs must be measured. Specifically, an investigation of economies of scope between pairs of products essentially implies studying total-cost behavior of the firm while varying its product mix.

1.3 Motivation

This research contributes to two strands of the banking literature. First, it addresses policy issues arising from the safety-and-soundness and the market concentration arguments made above. Some researchers believe that the numerous laws that have been enacted since the Great Depression have resulted in creating artificial barriers to market structure. Laws such as those restricting interstate banking and product market expansion have been specially criticized [Benston (1971); Eisenbeis (1985); Kaufman (1987); Sinkey (1992)].

These studies argue for letting free markets decide the banking structure and related issues. The main thrust of these articles is that due to the regulatory constraints on interest on deposits (until DIDMCA of 1980), product-line

diversification, and geographic market expansion, commercial banks are placed at a competitive disadvantage with respect to nonbanks. However, these studies do not specifically relate their arguments to cost savings of bank holding companies that carry nonbanking products along with traditional products.

The second strand of banking literature that is relevant to this dissertation deals with economies of scale and scope in banking. The studies falling in this category are concerned with the cost optimizing market structure of the commercial banking industry. Within this literature there is controversy. The controversy concerns the methodology and the data used. As far as methodology is concerned there are disagreements on the definition and measurement of outputs, inputs, and bank costs, and the specification of cost equation.

On the issue of data, the controversy revolves mainly around whether to use the Functional Cost Analysis (FCA) data or the Reports of Income and Condition (the call reports). Effectively, this controversy boils down to whether or not to include large banks in the analyses. Even among studies using the FCA data there are some that prefer to use a partition of the data [e.g., Benston, Hanweck, and Humphrey (1982) prefer to use only the large banks from the FCA data].

In the last two decades numerous studies have dealt directly or indirectly with the issue of bank cost structures (the second strand of relevant literature). While most studies in the 1970s regard banks as producing single outputs, some of the latest studies treat banks as multiproduct firms. However, there is disagreement over several other issues, such as what constitutes the inputs and outputs of a commercial bank.

Disagreement also exists over what is the better way of measuring outputs. Whether it is the number of accounts (of deposits and loans) or the total dollars outstanding in these accounts that is the better measure of outputs. Most of the early studies did not include interest paid on deposits (cost of loanable funds) as an independent (explanatory) variable contributing to total costs.⁸

Although most of these studies did not provide any reasonable explanation for excluding interest expense, it may be assumed that they were mainly concerned with studying operating costs in order to infer any production efficiencies. In the process these studies ignored the complete picture whereby the total intermediation process could be studied. The omission of interest expense may be significant since interest

⁸For example, Benston [(1965) and (1972)], Bell and Murphy (1968), Benston et al. (1982), and Gilligan and Smirlock (1984).

paid on deposits can constitute up to seventy percent of a bank's total costs [Lawrence (1986 and 1989) and Humphrey (1990)]. Hence, any bank cost study without interest expense is at best incomplete, and looks only at one part of the total cost picture.

However, the most controversial issue has been the specification of the cost function. Different results obtain depending upon how the model is specified. That is, use of the same data with alternative model specifications, such as Cobb-Douglas, translog, or simple quadratic specifications, yields different results. Several functional forms of the cost equation have been used in the banking cost literature, including the Cobb-Douglas function, the translog function, and the generalized translog function with a Box-Cox transformation.

In addition to the above disagreements, obtaining accurate and consistent data and making it compatible for an economies of scale and scope study is often very difficult. Most of the studies to date have used the Functional Cost Analysis (FCA) data. This data source is, however, inappropriate for several reasons. First, it is a compilation of figures sent in by member banks to the Federal Reserve

voluntarily. Benston et al. (1982) argue that the FCA data represents the most efficient banks. However, McNulty (1983) says that banks comprising the FCA data could also be banks that have high cost ratios. The fact remains that the FCA sample is not a randomly selected sample of banks.

Moreover, the FCA data represent a small fraction of all banks (roughly 300 out of 15,000 during the time frame for most studies). After collecting the data from banks the Federal Reserve Board uses its own judgment in standardizing the format in which the figures are compiled and presented. Thus, the FCA data source lacks the flexibility if one does not wish to use the data in the same form (ratios/aggregates).

Other than number of accounts, the FCA data can be re-created from the Federal Deposit Insurance Corporation (FDIC) data. This is possible because for most part the FCA data is an aggregation of, and/or ratio manipulation from, the raw numbers provided by banks on the reports of condition and income (Call reports). Thus in some sense the FCA data may be regarded as a subset of the FDIC data (with the caveat that FDIC data does not contain account-based numbers). For the purpose of this analysis it would be more useful to have the raw figures/data for each bank or bank holding company.

The last flaw of the FCA data is that it grossly underrepresents large banks. No bank with deposits over one billion dollars is represented in this data source, and very few of the banks included have deposits approaching one billion dollars. To the extent that the large banks are not represented, conclusions cannot be drawn with confidence about scale and scope economies in large commercial banks. Evanoff, Israilevich, and Merris (1990) argue that the FCA data excludes the very banks (those with deposits over one billion dollars) which are most likely to be involved in market expansion. Thus, no study has compared directly the performance of small banks with that of the largest ones.

One advantage of the FCA data over the FDIC data, however, is that the former contains account-based information. The FDIC does not require banks to report the number of accounts in their various deposits and loans categories. For a study that requires account-based information FCA data is the preferred data source. However, account-based information is not needed for this dissertation, hence, the FDIC data are used. As will be explained later, whenever total costs are used as the dependent variable and the cost of loanable funds as an independent variable, it is

advisable to use total dollar-volume, rather than number of accounts [Hunter and Timme (1989) and Lawrence (1989)].⁹

This research contributes to existing literature in the following ways. First, a data source is used that does not have a small bank selection bias. The data that are used are compiled by the Federal Deposit Insurance Corporation (FDIC) and provided on tapes by the National Technical Information Service (NTIS). By law, all insured banks are required to submit periodically their balance sheets and income statements (call reports) to the FDIC. Thus, this data source represents all FDIC-insured banks for each period, i.e., the entire population of banks rather than just a sample thereof.

Second, the cost of loanable funds, interest paid on deposits, is included as one of the explanatory variables in the regressions. Moreover, total interest expense is also included in total costs, which is the dependent variable for all the different regression models. As explained before, most early studies ignore this expense.

Third, a quadratic cost function is used that is better suited for economies of scale and scope study than alternative

⁹The use of total costs, total dollar-volume of outputs, and cost of loanable funds is referred to as the intermediation approach. The differences between this approach with the traditional production approach is explained in Chapter 5.

cost functions. The translog cost function has traditionally been the most popular model for estimating costs of multiproduct technologies. However, a well-known disadvantage of the log-quadratic output structure of the translog model is its inability to model cost behavior when any output is zero. As a result, the estimated translog cost function cannot be used to measure the costs of specialized production, as is required to estimate economies of scope or product-specific economies of scale.

Lawrence (1989) compares the performance of seven cost functions and concludes that the translog does the best job—even better than the generalized translog function with a Box-Cox transformation. The quadratic cost function is not one of the seven tested by Lawrence. Despite Lawrence's conclusion about the translog function and its popularity in contemporary literature for empirical estimation, it has been criticized by recent researchers [For example, Baumol, Panzar, and Willig (1988), Röller (1990A) and (1990B), and Pulley and Braunstein (1992)].

The translog cost function is unsuitable for cases involving zero output of one product (for a multiproduct firm). In addition, it also suffers from a robustness problem

arising due to the so-called flip-flop property [Röller (1990)]¹⁰. The quadratic form offers a simple measure of economies of scale and scope as well as marginal cost [Baumol et al. (1988), Mayo (1984B), and Friedlaender, Winston, and Wang (1983)].

Baumol et al. have argued that the multiproduct quadratic cost function (MQCF) is particularly attractive in the multiproduct setting since it permits an easy analysis of marginal costs and economies of scale and scope. Although the use of the quadratic approximation has been criticized for its inability to impose the homogeneity condition needed for cost minimization [Caves et al. 1980)], Braunstein and Pulley (1980) and Mayo (1984B) have developed procedures to deal with this problem.

Mayo (1984B) deals with the problem by using a multiplicative Cobb-Douglas variation of the simple quadratic function. The MQCF is defined as usual. However, he defines total costs as a Cobb-Douglas function of factor prices. Moreover, this Cobb-Douglas function in input prices interacts with the MQCF in outputs multiplicatively.

¹⁰Roller (1990a) has provided an example to show the flip-flop property of the translog function. He has further used data from the Bell System to confirm empirically his point.

Recently, Röllner [(1990A) and (1990B)] introduced a variant to the Mayo model. He replaces Mayo's Cobb-Douglas input price function with the CES version. Thus, Röllner advocates a nonlinear MQCF specification with factor prices defined as a CES-function and interacting with the quadratic output function multiplicatively. Both Mayo's and Röllner's models are estimated using nonlinear regression techniques¹¹.

Finally, the intermediation approach is used in which the total dollar amounts of deposits and loans are considered as bank outputs and not the number of accounts. The intermediation approach is appropriate when the interest on deposits is included as an explanatory variable. Hunter and Timme (1989) and Humphrey (1985)¹² regard this approach relevant when addressing long-term viability issues of banks. With all of the above improvements, the study on economies of scale and scope in traditional banking activities will be a significant contribution to the literature.

¹¹Pulley and Braunstein (1992) introduced the more sophisticated "composite cost function". This is basically a nonlinear specification which contains as special cases the more commonly used simple, linear, multiplicative, and separable quadratic specifications. The application of composite cost function to the data is left for future research.

¹²In Chapter 4 the appropriateness of the use of intermediation approach vis-a-vis the production approach is discussed in detail.

The second part of the dissertation is related to the regulation of banks and BHCs. This part contributes to the literature because to date no researcher has looked at the possibilities of economies of scale and scope between banking and nonbanking activities. Given recent technological and financial innovations, the barriers to interstate banking and product market expansion have been crumbling [Kane (1981) and (1984)]. Several researchers have raised concerns about the validity of the McFadden-Pepper Act of 1927 and the Glass-Steagall Act of 1934.¹³

There is evidence that banking firms that diversify into nonbanking activities earn economic profits from these activities [Rosenblum and Pavel (1985)]. However, various state and federal laws prohibit banks from freely engaging in these products. Hence, those banks that anticipate earning profits from, and are willing to market such products, are unable to do so due to the legal barriers. Thus, regulation can be seen as inflicting costs on those banks that prefer not to circumvent laws and market only traditional banking products.

¹³Several researchers have questioned the continued existence of these laws. [See Kane (1981), Eisenbeis (1983), Kaufman (1984), and Sinkey (1992)].

The above arguments beg an investigation into scale and scope economies between banking and nonbanking activities. If it can be shown empirically that economies of scope from the joint production of these activities is indeed possible, then a case could possibly be made for taking a closer look at some of the laws that have already been challenged in the past.

To sum up this section, the motivation for this research is two-fold. First, no researcher has looked at the possibility of economies of scope between banking and nonbanking activities of bank holding companies. Second, this research synthesizes the earlier studies on economies of scale and scope among banking activities. This synthesis, however, is an improvement over the earlier studies. Some of the important improvements have been mentioned above.

1.4 Organization of the Dissertation

The dissertation is organized as follows. Chapter 2 reviews the literature on economies of scale and scope in banking. This section is subdivided into three categories:

- Early studies (pre-1970s);
- Studies in the 1970s and early 1980s; and
- Most recent studies.

The main motivation behind dividing this part of literature review in three groups is as follows. Until the 1970s most of the studies were stand-alone or isolated pieces of research. Starting with the early 1970s the situation changed as researchers built upon and tried to improve existing literature. However, for most part, they continued to use the Cobb-Douglas functional form. Thus, the second group of studies are tied together as a group in their use of the Cobb-Douglas functional form, the FCA data, and operating costs.

It is not until the early 1980s that the more flexible functional forms are employed. These cost functions do not constrain results *a priori*, one way or the other. Essentially, researchers during the end of the second period experimented with the translog function and several modifications thereof. However, several studies during this period mixed the production and intermediation approach. That is, they used operating expenses and not total expenses while defining their output measures as number of accounts.

Humphrey (1985) introduced the concepts of intermediation and production approaches, although the study by Murray and White (1983) on Canadian credit unions had already adopted the

intermediation approach without introducing the term. Hunter and Timme (1989) and Lawrence (1989) were among the first to apply this approach to the commercial banking industry. Hence, in the third group, some of the latest studies that have used the intermediation approach together with the translog function are included.

After reviewing the literature on economies of scale and scope, the chapter reviews the literature on banks' nonbanking activities. The studies included for review in this section mainly comprise of summary articles that tell us how many BHCs were engaged in nonbanking activities and what the level of activities were in some of the important categories of these activities. Some articles also deal with the legislative aspects of banks' nonbanking activities.

Chapter 3 looks at the regulatory environment of banks and BHCs. Specifically, some of the important laws affecting deposit interest rates, geographic and product market expansion possibilities facing banks are reviewed.

Chapter 4 provides a detailed analysis of the nonbanking activities of BHCs. Profitability, capital ratios, asset size, and market concentration of nonbanking subsidiaries of BHCs are studied in this Chapter for the years 1986 thru 1990.

Chapter 5 provides a theoretical framework of the empirical techniques used in the research. The theoretical efforts in economies of scale and economies of scope are reviewed and the production and intermediation approaches explained. The models to be tested are specified after defining bank inputs and outputs. In the next section the data sources are discussed and finally the variables used in the regressions are explained.

Chapter 6 provides the important results from the empirical research. First some descriptive statistics on the variables are provided. Then regression results for economies of scale and scope are tabulated both for banking and nonbanking activities.

CHAPTER 2

LITERATURE REVIEW

2.1 Economies of Scale and Scope in Traditional Banking

Most of the evidence about the existence and the extent of scale and scope economies at depository institutions comes from the empirical estimation of statistical cost functions. Underlying the cost functions is the well-known economic principle that production costs depend on input prices and the level and composition of output. This functional relationship follows from the property of duality between the production and cost functions.

Duality theory indicates that every specification of a cost structure corresponds to a specification of a production structure. That is, total production/profit can be maximized subject to the budget constraint to arrive at the optimal input mix (the *primal* problem), or conversely, the *dual* problem can be solved whereby total costs are minimized subject to a production constraint.

It is more useful to estimate cost functions and their associated factor demand systems because it is simpler to specify important and econometrically testable hypotheses

concerning the structure of technology by using cost functions. Moreover, it is better to estimate a cost function because production functions are more likely to violate the assumption of independence of disturbances from independent variables [Spady and Friedlaender (1978)].

The usual procedure is first to define a set of outputs and inputs. The prices for the set of inputs are defined and calculated because it is the cost of inputs that influence total costs. Then a statistical function is selected to relate explicitly production costs to outputs and input prices. Once the statistical function is selected and specified, the parameters of the function are estimated using sample data.

The estimated parameters and sample data are then used to construct empirical measures of the various types of scale and scope economies. Having briefly stated the usual procedure followed by researchers, the important studies classified according to the three subdivisions as explained above now follow.

2.1.1 Early Studies on Bank Costs (up to 1970)

Benston (1965) and Bell and Murphy (1968) are early studies on bank costs. They argue that the primary services

provided by banks are in the form of funds, however, most of their operations consist of handling documents and dealing with people. Hence, banks' operating costs are primarily related to the number of documents handled and customers served rather than to the dollars deposited or loaned. Therefore, these researchers measure output in terms of the number of deposit and loan accounts.

They further divide commercial bank output into six services: demand deposits, time deposits, real estate loans, instalment loans, business loans, and securities. The direct costs of each are analyzed separately. Indirect costs are divided into administrative, business development, and occupancy costs. Separate cost functions are then estimated for each category of costs.

These studies use Federal Reserve's Functional Cost Analysis (FCA) data which allow them to provide estimates of individual bank services from which estimates of the marginal costs and economies of scale can be computed for use by regulators and managers. Benston's data include the 80 to 83 banks for years 1959, 1960, and 1961 that participated in the FCA program and fell under the jurisdiction of the Boston Federal Reserve Bank.

Bell and Murphy extend Benston's data set to include FCA participants in the Boston, New York, and Philadelphia Districts for the years 1963, 1964, and 1965. Thus, the two studies [Benston (1965) and Bell and Murphy (1968)] provide comparative estimates for six years of data.

The sample banks range in total assets from \$2.8 million to \$801 million and in number of demand deposit accounts from 900 to 57,000. Consistent and significant economies of scale are reported for demand deposits and real estate loans. Time deposits and instalment loans show significant scale economies for the years 1959 thru 1961 and insignificant economies from 1963 thru 1965. Other results are either not significant or have measurement problems [Benston (1972)].

Greenbaum (1967) uses bank's gross income as a proxy for the bank's output in the belief that the bank's services are worth what its customers are willing to pay [Benston (1972)]. Powers (1969) disagrees with Greenbaum and uses gross operating income as a measure of bank output. Both researchers, however, treat demand and time deposits as inputs and exclude them from the output measures.

Benston (1972) questions the wisdom of using revenue measures to proxy bank output the way Greenbaum and Powers

have done. He believes that "Gross income is a function of the elasticity of demands of individual banks face, the riskiness of assets, and the production cost of earning assets" [pg. 321].

Neither Greenbaum nor Powers adequately address these issues. For example, neither adjust the yields on assets for differences in risk among assets. Similarly, they do not adjust the yields for differences in production costs. The yields on large loans and securities is lower than the yields on small loans, *ceteris paribus* because the small loans cost a bank more, per dollar. Therefore, wholesale banks or those with few loans will appear to be more efficient than retail, consumer oriented banks.

2.1.2 Later Studies on Bank Costs (from 1970 to early 1980s)

Most of the early studies on economies of scale in financial institutions employ the Cobb-Douglas function. Benston (1965) and Bell and Murphy (1968), two of the studies mentioned in the preceding subsection, also use the Cobb-Douglas specification with the "production" approach.¹³

¹³The terms production and intermediation approach were not coined until the mid-1980s.

The use of the Cobb-Douglas function in the specification of bank production has some drawbacks. The most important drawback being the fact that it rules out *a priori* U-shaped long run average cost curves. At least for the range of bank outputs that are observed the cost curves do not rise. Thus, infinite economies of scale may have been implied when in reality they did not exist. Other studies that used Cobb-Douglas function also suggest economies of scale in banking and thrift industries.¹⁴

Infinite scale economies imply that banks should keep merging and that the regulators should adopt a liberal merger policy. This also implies that the banking and the thrift industries are characterized by natural monopoly. Hence, the most cost efficient market structure in both these industries is to have just one firm that serves the entire nation.

In practice we see quite the opposite picture. In reality there are over 12,000 commercial banks and several thousand thrift institutions existing in the United States. This implies that either the natural monopoly implications are

¹⁴Some of the studies that use Cobb-Douglas functional form to estimate bank costs have been discussed above; for example, Benston (1965) and Bell and Murphy (1968). McNulty (1981) and Benston (1970) are examples of studies that apply the Cobb-Douglas cost function to the savings and loan industry.

incorrect or that they (banks) are constrained by antitrust laws. The discrepancy between natural monopoly implications and the reality of several thousand banking firms led researchers to look for flaws in the methodology of the studies that yields these results. It was found that bank production is not well approximated by the Cobb-Douglas specification.

The transcendental logarithmic function (or the translog function) was found to be more flexible. It is flexible enough to yield both economies and diseconomies of scale at different output levels and to provide information on scope economies by incorporating interdependencies between products. This implies that the translog allows us a more realistic and accurate measure of economies of scale and economies of scope.

Another limitation of the studies in the second group is their use of an aggregate output measure which rules out the possibility of making any inferences about economies of scope. Even if it is assumed that there is no aggregation bias in the process of adding different categories of products, the use of an aggregate measure implies that the expense behavior of a firm on each of its products is uniform. As mentioned above, only economies of scale, but not economies of scope, can be

measured using aggregate outputs. If economies or diseconomies of scope exist between certain pairs of products, the measures of scale economies will be biased. The introduction of the translog cost function in the early 1980s greatly facilitated economies of scope studies.

2.1.3 The Latest Literature on Bank Costs

Benston, Hanweck, and Humphrey (1982) are the first to apply the translog version of the cost function to study economies of scale in the commercial banking industry. They use as a measure for defining bank outputs the *Divisia multilateral index*. This is roughly defined as the weighted average of the number of accounts of various outputs of the bank that are under consideration. Weights are based on the proportionate share of total operating costs attributable to each output. Benston *et al.* aggregated five outputs in this way. These outputs are demand deposits, time and savings deposits, real estate loans, installment loans, and business loans.

Their data come from the Federal Reserve's Functional Cost Analysis (FCA) program for 1975 thru 1978. For their analysis they exclude the largest banks within the FCA sample

due to underrepresentation. As mentioned above, the FCA data contain very few banks with deposits exceeding one billion dollars. Hence, these banks are eliminated from their data. Variables representing factor prices for wages and capital, in addition to homogeneity (dummy) variables for holding company affiliation and state branching status and average account size, are included in their model.

Benston, Hanweck, and Humphrey's empirical results demonstrate that there are diseconomies of scale for banks in the unit banking states. On the other hand, slight economies of scale were found for the branch banking states. Their estimates indicate that unit banks servicing larger accounts experience greater proportionate operating costs than their branch bank counterparts. Benston *et al.* explain this by saying that larger account customers demand more implicit service returns than do smaller customers and that monitoring costs are higher on larger loans.

Some of their other important findings are as follows. First, holding company affiliation does not affect operating costs. Second, the cost of adding a branch office increases as bank size increases and exceeds that of an additional unit bank for all sizes. Third, the bank average operating costs

tend to be either U-shaped or upward sloping for their three different measures of output. Finally, the optimum bank size (as far as cost efficiency is concerned) falls in the range of 10 - 25 million dollars in deposits.

Although the Benston, Hanweck, and Humphrey study is a significant improvement over existing literature there are some deficiencies. They use the FCA data which has several limitations. Some of the problems associated with the FCA data have been discussed earlier. The most important limitation is that their sample does not represent the largest banks (with deposits over one billion dollars).

Moreover, it is a small sample (between 747 to 852 banks) given that the total number of banks during the period exceeded 15,000. Additionally, their total-cost variable includes only about 72 percent of the operating costs. Typically, operating costs constitute only about 30 percent of total bank costs [Lawrence (1989) and Hunter and Timme (1989)]. Hence their regressions do not explain the relationship between total costs of banks and the choice variables.

Finally, they do not measure economies of scope in their study. Their Divisia index, although a better way of

aggregation (in comparison with the simple addition of outputs without proper weighing), is still an aggregation of outputs into a scalar. When a vector of actual outputs is replaced by a scalar index of composite production detection of economies of scope is precluded. Thus, their study only reports estimates of economies of scale, not economies of scope.

Most of the early studies view financial institutions as a series of separate Cobb-Douglas production processes.¹⁵ Although these studies explicitly recognize the multiproduct nature of the banking firm, they assert that "from a cost standpoint, all these functions or services may be regarded as different products..... Thus, a meaningful analysis of bank costs should consider each function separately" [Bell and Murphy (1968)].

Gilligan and Smirlock (1984) test this hypothesis against the proposition that bank production is, in fact, characterized by jointness. They employ an unrestricted multiproduct translog function where jointness is not ruled out *a priori*. They define bank outputs as total dollar volume of deposits and loans and estimate two equations, one each for the asset and liability sides of the balance sheet.

¹⁵For example, Bell and Murphy (1968) and Benston [(1965) and (1972)].

Their data are a time series of over 2700 unit state banks compiled by the Federal Reserve Bank of Kansas City. Specifically, they use the call reports data for these banks over the six year period 1973-1978. As mentioned above, all insured commercial banks are required to file these reports annually with the Federal Reserve.

Gilligan and Smirlock find that the structure of bank costs is characterized by jointness and reject the Cobb-Douglas specification. Their two other important findings are that economies of scale exist for (small) banks with deposits up to 25 million dollars and that there are overall economies of scope between the two categories of deposits (demand and time deposits) and the two categories of assets (loans and securities).

The shortcomings of this study are as follows. First, the authors use data pertaining to only unit banks from one Federal Reserve Bank district (Kansas City). Hence, it is an empirical question whether their results apply to branching states and across unit banks in other parts of the country. Second, their dependent variable is total operating costs, which exclude interest expense. Hence, their analysis does not consider total costs and ignores the complete picture.

Third, they mix the production and intermediation approaches because while using operating costs as the dependent variable they use total dollar volume in accounts (and not the number of accounts) to measure their outputs.¹⁶ Fourth, they assume input prices as constant during the entire period of their study (from 1973 to 1978) because their cost function is defined as

$$\begin{aligned} \ln C = & \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 (\ln x_1)^2 \\ & + \beta_4 (\ln x_2)^2 + \beta_5 \ln X_1 \ln X_2 \end{aligned} \quad [1]$$

where X_1 and X_2 are the outputs. Input price variables are not included as independent variables in the equation.

Lastly, they do not consider the possibility of economies of scope between assets and liabilities. That is, they ignore the possibility of economies of scope between deposits and loans as they do not run a regression in which both deposits and loans appear as independent variables.

Gilligan, Smirlock, and Marshall (1984) attempt to remove some of the shortcomings of the study by Gilligan and Smirlock

¹⁶ To be fair to them the distinction between the two approaches had not surfaced clearly in the literature at that time. No study has been found that used the distinction while specifying their bank cost models.

(1984). They use a complete translog model that includes deposits, loans, a wage rate, and a cost of capital (but not interest expense) as independent variables. They also use a dummy variable to differentiate between unit and branch banks. The outputs are measured in terms of the number of accounts outstanding in each output category.

The data for their study come from the Federal Reserve's FCA program for the year 1978. The original data set contains 767 banks. However, banks with deposits over one billion dollars (due to underrepresentation) and banks with missing values were discarded. Their final sample size was 714 banks.

Gilligan et al. find statistically significant cost complementarities between deposits and loans both for unit and branch banks. They also report statistically significant economies of scale for both categories of banks (unit and branch) with deposits up to 25 million dollars. For banks with deposits between \$25-\$50 million the scale economy measure is not statistically different from one. This implies that there are constant returns to scale for banks in this deposit range. Finally, they report product specific diseconomies of scale for both deposits and loans. These diseconomies, however, are statistically significant only for branch banks.

The study by Gilligan, Smirlock, and Marshall is an example of research (as far as empirical techniques are concerned) on scale and scope economies that follows the production approach. However, the study can be criticized on two counts. First, it contains all the shortcomings of any study following the production approach. The most severe limitation being that only a small fraction (30 percent or less) of total costs (i.e., only operating costs) are considered. Second, they use the Functional Cost Analysis data for their study. Hence, the study may have all the flaws that come with the FCA data as was discussed earlier.

Murray and White (1983) carry out a study that follows the intermediation approach. Their sample consists of 61 large computerized credit unions operating in British Columbia, Canada. The data pertain to the years 1976 - 1977. Their total-cost variable includes all labor and real capital expenses, as well as the interest and dividends paid to depositors and shareholders. They assume that economic output is best measured by the dollar value of earning assets.¹⁷

¹⁷Sealey and Lindley (1977) have argued that in order to study bank production it is meaningful to include only earning assets as outputs (e.g., the various categories of loans). This dissertation will be studying the entire intermediation process of banks and not just their production process.

They define three outputs of credit unions as mortgage lending, other loans, and security investments. Other assets and liabilities are assumed to be inputs to the production process. Additional variables are used to control for other distinguishing features which could affect credit union costs and otherwise bias one way or another their analysis of the production relationships. They use a system of equations that comprise the full cost system, which includes a translog cost function and the cost share equations for input prices.

They conclude that the Cobb-Douglas and the constant elasticity of substitution (CES)¹⁸ production functions are much more restrictive than the general translog specification. They find no evidence to support the imposition of homotheticity, unitary elasticity of substitution, or constant returns to scale conditions for the Canadian credit union production functions.

They find support for the existence of economies of scale for their sample. Moreover, they find strong evidence of cost complementarities between mortgage and other lending activities, but no significant cost complementarities between

¹⁸It can be shown that the Cobb-Douglas function is a special case of the more general CES production function [See Chiang (1984) pp. 428-430 for proof].

investment activities and lending. The implication is that large multiproduct credit unions are more cost efficient than small single-product ones. Therefore, regulation should not restrict growth of the small credit unions either through product diversification or through mergers.

As mentioned earlier, Murray and White's study is an example of the intermediation approach. They include interest expense in their total costs and their outputs are measured in terms of total dollar values of earning assets. As far as methodology is concerned, theirs is the most suitable for studying economies of scale and scope.

However, there are two weaknesses in this study. First, the study pertains to a small and specialized sample of credit unions (only large, computerized credit unions in the province of British Columbia). Thus, no conclusions can be drawn about small credit unions or those outside British Columbia.

Secondly, we do not know whether commercial banks face the same cost structure as credit unions. The opportunity set of activities that could have been performed by Canadian credit unions in the period studied were similar to those of U.S. savings and loan associations. Hence, there is a distinct possibility that inferences about scale and scope economies in

the Canadian credit union industry are more applicable to U.S. thrifts than to U.S. banks. However, this is an empirical question not addressed here.

The primary emphasis of Hunter and Timme (1986) is to study the impact of technical change on bank production. They define technical change as an increase in the level of maximum or efficient output from a given set of inputs over time. Such an increase may occur due to factors like experience, increased knowledge, new innovations, and better production techniques.

Their data consist of 91 bank holding companies for the years 1972 thru 1982 obtained from the Bank Compustat file. The median size of total assets for the sample banks is \$1.67 billion in 1972 and \$4.85 billion in 1982. They use the translog function to estimate bank costs. The general form of bank's aggregate cost function is defined as

$$C = f(Q, P, B, H, T) \quad [2]$$

where Q is the aggregated bank output, P is a vector of input prices, B is the number of banking offices, and T is time. The time variable, T , is used as an index of the level of bank

technology. The authors assume that technology is a continuously growing function of time.

For their sample banks Hunter and Timme find that "bank production processes were subject to significant technical advancement" (pg. 160). They report a downward shift in banks' total cost curves during the eleven year period. For example, while total costs for a \$20 billion (output) bank were about \$190 million in 1976, these costs dropped to about \$150 million in 1982. They further conclude that banks with more offices have realized less technical change and banks with higher levels of output have realized more technical change.

The Hunter and Timme study breaks new ground in that technical change is explicitly measured, as is its impact on scale economies. However, it has some of the weaknesses mentioned in the reviews of the earlier papers. For example, their sample consists of the largest banks only. Most of their conclusions are based on their dependent variable being total operating costs.

When they include interest expense, they find neither scale economies nor diseconomies. In contrast, Benston et al. (1982) found that interest costs reduced observed operating cost diseconomies of scale for large banks. Finally, they use

an aggregated measure of bank output which precludes any inferences about economies of scope.

Hunter, Timme, and Yang (1990) employ the minflex Laurent function to examine cost subadditivity for 311 of the 400 largest U.S. commercial banks. Their data come from the 1986 call reports and the sample banks have assets ranging from approximately one billion dollar to \$78 billion. Moreover, they define deposits alternately as inputs and outputs.

Treating deposits as outputs they do not find significant scale economies or cost subadditivity for their sample banks. When they fit the translog model on the same data for comparison with the minflex Laurent function, they do not find significant differences between the two functional forms. Moreover, for the largest banks (with assets over \$10 billion), the results are invariant with respect to specifying deposits as outputs or inputs. For the small banks in their sample they find mild scale economies and cost subadditivity when deposits were treated as inputs.¹⁹

¹⁹In an earlier study, Hunter and Timme (1989) use the same data and the expansion-path subadditivity index, a la Berger et al. (1987) to conclude that "large banks do not necessarily incur lower costs by engaging in multiproduct production" (pg. 2). This index measures the percentage difference in the total costs of a single firm producing a set of products compared with the costs incurred by a pair of firms producing the same set of products.

2.2 Empirical Studies on BHCs' Nonbanking Costs

The debate over removing the regulatory barriers between banks and nonbanks has now been going on for years.²⁰ Despite the debate, there is no published study that investigates the issue of cost complementarities between banking and nonbanking activities of bank holding companies. As a matter of fact, the most important contribution of this research is to fill this void in the banking literature.

The main reason for the absence of research on the cost structure of bank holding companies' nonbanking subsidiaries is the difficulty in obtaining relevant data. Until 1986 there were no publicly available sources for these data. However, the Federal Reserve started requiring BHCs to furnish certain data pertaining to their nonbanking subsidiaries from 1986.

Two studies by Liang and Savage [(1990A) and (1990B)] are the only studies that have analyzed these data for the years 1986 through 1988. These studies provide important insights on issues such as firm sizes, market concentration, profitability analysis, riskiness, and trend analysis of BHCs' nonbanking activities. Both studies, however, do not address the important issues of scale and scope economies. Moreover, the

²⁰Papers written on this topic include Rosenblum and Pavel (1985), Kaufman (1985), Peterson (1985), Corrigan (1987), and Sinkey (1992).

studies are basically restricted to the analysis of nonbanking subsidiaries only.

Chapter 4 replicates and synthesizes the two studies by Liang and Savage. It updates them from 1986 through 1990. The conclusions that can be drawn from this synthesis and update are discussed in Chapter 4. Some of these findings are instrumental in the subsequent part of this research. For example, it is found that certain activities that are performed by BHCs' nonbanking subsidiaries are actually traditional banking activities.²¹ Moreover, the analysis shows that over the five year period from 1986 to 1990 BHCs' assets in these subsidiaries have declined. Before analyzing the trends in the nonbanking sector, however, in Chapter 3 the regulatory environment of banks and bank holding companies is discussed.

²¹These activities include commercial finance, mortgage banking, consumer finance, other depository institutions, and small business financing.

CHAPTER 3

THE REGULATORY ENVIRONMENT OF BANKS AND BHCs

3.1 The Evolution of Commercial Banking Industry Structure

3.1.1 A Historical Perspective

Modern banking originally developed as an adjunct of private commercial firms. In the United States, however, it is the policy of the federal government to keep banks separate from other forms of commerce. Recent developments suggest that the policy may not long be sustained. In order to study the evolution of the banking industry, it is useful to understand why activity restrictions were originally imposed.

This history provides the explanation of why the liberalization of activity restrictions has expanded rather than reduced government supervision and regulation.²² It also explains the related roles of separation and antitrust in the competitive private market system.

Modern commercial banking in the United States is frequently traced to the 17th-century English goldsmiths. In addition to their traditional work (that of making gold and

²²For an excellent discussion of the historical development of the various aspects of commercial banking up to the early 1960s see Carson (1963) and Friedman and Schwartz (1963).

silver ornaments and jewelry) they also carried on the banking activities. The common law did not preclude goldsmiths from accepting deposits, extending credit, issuing promissory notes, and dealing in bills of exchange. There was, then, neither a government-imposed nor a market-determined separation between banking and commerce at this time.

According to Shull (1983), separation was initiated, for all practical purposes, with the establishment of the Bank of England in 1694. The charter gave bank the permission to exercise certain specified (banking) powers while refraining from dealing or trading in the buying or selling of any goods, wares, or merchandise. This prohibition on dealing in merchandise can be identified as the origin of the policy to separate banking and commerce [Shull (1983)].

The prohibition on dealing in merchandise was seemingly aimed at complaints by merchants. Shull thinks it plausible that merchants would have considered the goldsmiths to be not only their bankers, but also serious competitors, with certain advantages derived from the nature of their business. In this case, to have the government establish a bank would have been taken as a far greater threat. The goldsmiths may well have encouraged the merchants' concern about a government-sponsored

bank. It was alleged that the bank would become a monopoly and monopolize all the money in the country and "subject all trade to usurious exactions."

The idea developed, after the middle of the 18th century that bank assets should be comparably more liquid than liabilities. That is, the average maturity of assets should be less than that of liabilities to have the capability to meet liability demands at all times. Adam Smith (1977) articulated the "real bills" theory in *The Wealth of Nations*.

The real bills doctrine contends that currency issued only on loans to carry goods (as opposed to loans to purchase fixed capital or, worst of all, to speculate in stocks or property) would vary with the volume of transactions and would not affect the price level [Carson (1963) pg. 21]. In the economists' jargon of the 1920s, the money stock would be "neutral." In addition to being safe and uniform, a good currency should be elastic. When properly elastic, notes expand and contract with the needs of trade.

During the same period, a number of land-bank experiments had shown difficulty of borrowing short and lending long. Thus, the Bank of Massachusetts, chartered in 1784, was limited in the amount of land which it could own. Later banks,

including the First Bank of the United States, were limited to owning their bank premises. All of these examples supported the separation imposed by the early U.S. banking charters. The policy, then, of keeping commercial banks from engaging in other forms of commerce was established with the earliest bank charters in the U.S. "Competitive" and "solvency" reasons for separating banking from commerce developed independently.

However, from the point of view of government policy they are closely related through the underlying government-bank relationship. A chartered bank was intended to be "an institution resembling the goldsmiths' banks but without the hazard of bankruptcy" [Shull (1983)]. The intention required government involvement and created the fear both of monopolization and of mismanagement, and both supported activity restrictions.

The policy of separation can be traced from bank charters to restrictions in general banking laws that sometimes included explicit prohibitions. Moreover, this policy (of separation) frequently specified "banking powers" so as to constrain chartered banks to a relatively few financial

activities.²² Banks sometimes found ways to circumvent these restrictions.²³ Furthermore, nonbanking firms sometimes found it possible to circumvent the regulatory barrier to entry and offer close substitutes for seemingly unique "banking" services.²⁴ Over time, the policy of separation has ebbed and flowed, however, it has been reaffirmed periodically on several occasions in the 20th century.²⁵

The periodic reaffirmation of separation is one indication that chartered commercial banks are still viewed as private establishments employed as public agents. However, the nature of their perceived public agency has changed considerably over the years. Banks are no longer a unique source of funds for the government. They continue, however, to

²²The National Banking Act was interpreted by the courts to mean that, as a general rule, national banks could not engage directly in any business enterprise and could not purchase or deal in the stock of corporations [Shull (1983) pp.270].

²³In the early 1900s, national banks found it possible to deal in securities by establishing state-chartered security affiliates owned pro rata by the stockholders of the banks and controlled by the same boards of directors.

²⁴Trust companies, in the late 19th century, entered banking by offering deposits. They were generally less restricted than national banks and frequently permitted to invest directly in corporate stock.

²⁵Modern legislation limiting commercial bank activities includes the Glass-Steagall Act of 1933, which prohibits banks from affiliating with "security firms"; the Bank Holding Company Act of 1956, which restricted bank affiliations with other nonbanking companies; and amendment to the Bank Holding Company Act in 1970, which established a net public benefits test for expansion into related activities.

be the principal source of the money supply, repositories for the liquid wealth of a large proportion of the population, and the institutional mechanism through which monetary policy is transmitted. The money supply, liquid wealth, and monetary policy are affected with a public interest; and banks have required support and been subjected to regulation comparable to that required by their original public agency.

From the historical perspective one might conclude that the separation between banking and commerce was a protection against whatever advantages the Bank might obtain in the future. Advantages such as entry barriers, lower tax rates, government deposits at below-market interest rates, *ad hoc* government assistance in difficult circumstances, and a general understanding that the government had an interest in keeping Bank viable.

It is the continued government affiliation that underlies the more proximate reasons typically given for separation. If banks were to give up their protected sanctuary, perhaps, the whole question would be reconsidered. Historically, then, the issue of separation is not merely dependent upon whether banks have market power, but more so on the relationship between government and banks.

If banks are special they need to be protected from failing with the help of the safety-net that includes subsidized federal deposit insurance, participation in the electronic payment system, and borrowing at the discount window. In this scenario an argument can be made for a continued separation between banking and commerce, because otherwise the safety-net will have to cover the nonbanking subsidiaries of BHCs as well. On the other hand, if banks are not special, then there is no obvious reason to treat banks differently than other private firms.

To sum up this section, the original purpose of separation was to keep the government-sponsored bank from constraining opportunities for private merchants through monopolization of other lines of commerce. Government support and protection of the valuable institution it had chartered followed its establishment. Subsequent experience and developing banking theory supported separation on liquidity and solvency grounds. Nevertheless, both bases for separation derived from the underlying government-bank relationship. Activity restrictions imposed for liquidity and solvency reasons reflected the same government interest in bank stability that raised concerns about monopolization.

3.1.2 Recent Trends

The policy of separation was reaffirmed by the Glass-Steagall Act of 1933 and the Bank Holding Company Act of 1956 and its 1970 amendment. However, this separation is more artificial than real because the firewalls between banking and commerce have been greatly eroded due to technological and financial innovations [Kane (1981) and (1984)]. Nonbanking firms have found ways to innovate banking services and banks have expanded into new lines of commerce.

Currently, the elimination of the restrictions on bank activities is viewed by some as consistent with other types of deregulation aimed at making banking more competitive. The intensification of competition in banking markets over the last decade has also tended to negate the argument that banks have monopoly power that could be transferred to nonbanking markets, and that the antitrust laws would be ineffective in preventing such transfers.

Current laws in the United States prohibit commercial firms from owning banks and banks are prohibited from owning commercial firms. In general, banks are not allowed to engage in nonbanking activities, and a bank holding company can own only five percent of the voting shares of any nonbank

commercial corporation without regulatory approval [Mester (1992)].

Mester argues that the Bank Holding Company Act of 1956 was intended to inhibit interstate banking rather than corporate ownership of banks. The one-bank holding company (OBHC) loophole allowed a nonbank corporation owning one bank to enter any business except securities. The OBHC loophole was partially closed by the 1970 amendment to the 1956 BHC Act, however, it was not until 1987 when it was sealed completely. In 1987 the bank was redefined as any institution with FDIC deposit insurance or any institution that accepts demand deposits and makes commercial loans.

3.2 The Legal Environment of Bank Holding Companies

According to the 1970 amendment of the Bank Holding Company Act (1956) a commercial bank is defined as an institution that both "accepts deposits that the depositor has a legal right to withdraw on demand and engages in the business of making commercial loans." The Competitive Equality Banking Act (CEBA) of 1987 redefined bank as any institution whose deposits were insured by the Federal Deposit Insurance Corporation (FDIC). However, if a firm engages in only one of

the above two activities (that is, either demand deposits or commercial loans) it is usually referred to as a nonbank bank.

Nonbank banks are not as heavily regulated as are commercial banks. This is due to the fact that the federal safety net via the FDIC does not extend to include nonbanking activities. In an attempt to level the playing field in the financial services industry, CEBA banned further establishment of nonbank banks. The 160 or so existing ones, however, were grandfathered [Sinkey (1992)].

A bank holding company is an institution that owns controlling interest in one or more banks. Currently, controlling interest in a bank is presumed to exist if a holding company owns 25 percent or more of the bank's voting stock. The Glass-Steagall Act prohibited Fed member-banks and their affiliates, such as subsidiaries of the same holding company, from underwriting securities.

Except for securities underwriting, however, federal legislation on other nonbanking activities has been less specific. Consequently, nonbanking activities as diverse as leasing operations, data processing, and the sale of money orders and travelers' checks have been authorized by the Federal Reserve as being "closely related" to banking

activities, whereby BHC subsidiaries could undertake them (see Appendix). Therefore, holding company gives banking organizations a way to engage in nonbanking activities without directly involving the bank subsidiary, and, presumably, without exposing the deposit insurance funds to additional risk [Gardner and Mills (1991)].

Section 3(d) of the Bank Holding Company Act, the Douglas Amendment, prohibits the Federal Reserve Board from approving an application by a BHC to acquire any bank located outside of the BHC's home state. The only exception is if such an acquisition is "specifically authorized by the state laws of the State in which [the] bank is located, by language to this effect and not merely by implication" [Gardner and Mills (1991)].

The idea that bank and nonbank subsidiaries from the same bank holding company can be operated without affecting one another is called corporate separateness. Under Federal Reserve's Regulation Y, the Board may allow bank holding companies to form or acquire nonbank subsidiaries if these nonbank subsidiaries are "so closely related to banking or managing or controlling banks as to be a proper incident thereto." Appendix 1 contains a list of nonbanking activities

permitted and denied to BHCs as of January 1989 [adapted from King, Tschinkel, and Whitehead (1989)].

Appendix 1 shows that there are several nonbanking activities permitted by regulation that can be performed by commercial banks. Indeed, banks carry out these activities in their usual course of business. Activities such as consumer finance, credit card business, mortgage finance, commercial finance, and performing trust services are all examples of activities that are both, traditional and nonbanking activities.

While the permitted activities are assumed to be closely related to banking, certain activities, such as insurance premium funding, real estate syndication, and real estate brokerage are assumed not to be closely related to banking. Hence, these activities are precluded from BHCs' opportunity set. In between these two groups (permitted and precluded activities) there is a set of activities that banks can undertake after prior permission from the Federal Reserve. These include, offering negotiable order of withdrawal (NOW) accounts, printing and selling checks, and offering cash management services.

The classification of nonbanking activities into the three categories as above indicates the Federal Reserve's intention of keeping banking separate from commerce. As mentioned earlier in this chapter, the underlying government-bank relationship is responsible for the original motivation for such a separation. However, technological and financial innovations make it very difficult for the Federal Reserve to transform its intentions into practice. As highlighted by several researchers, including Kane (1981), banks develop innovative means to circumvent laws that are very restrictive. One such innovation was the bank holding company (BHC) form of organization.

In the last several decades, commercial banks turned to the BHC form of organization. This trend accelerated during the 1980s. Thus, whereas only 177 applications to form bank holding companies were approved by regulators in 1977, by 1988 the number of applications approved had increased to 400. As of year-end 1988, 6,474 bank holding companies existed, compared to 1,948 as of 1977, a compound annual growth rate of 11.5 percent.

More importantly, however, these bank holding companies controlled over 90 percent of assets in insured commercial

banks [Gardner and Mills (1991)]. At year-end 1987, 6,503 bank holding companies controlled 9,316 banks and 41,362 bank branches, for a total of 50,678 banking offices (85 percent of total banking offices) [Sinkey (1992)].

The growth in the number and size of bank holding companies can be generally attributed to three factors: tax incentives, geographic restrictions regarding branch banking, and product line diversification restrictions. Thus, BHC movement can be viewed as a regulation-induced innovation designed to circumvent geographic and product market restrictions and reap potential tax benefits [Sinkey (1992)].

According to Eisenbeis (1983), tax considerations were the single most important factor in the initial formation of bank holding companies. Since then, however, tax benefits have been greatly eroded via changes in the tax law. Hence, the other two incentives may be the forces that continue to encourage the formation of bank holding companies.

CHAPTER 4

AN ANALYSIS OF NONBANKING ACTIVITIES OF BANK HOLDING COMPANIES

While much research and literature exist on traditional banking activities, fewer papers deal with nonbanking activities. The second part of the dissertation employs nonbanking data, hence, it is important to understand the nature of the nonbanking businesses of bank holding companies. The following questions arise: What is the market structure of the nonbanking sector? What are the more profitable nonbanking activities for BHCs? What is the trend in terms of the market concentration, the total number of firms engaged in nonbanking activities, and the popularity of individual activities? This chapter provides one set of answers to these questions.

4.1 Data Description

Two data sources are used in this research. The first source is the FDIC bank tapes for the years 1989 and 1990. The data include 13,954 observations for 1989 and 13,543 observations for 1990. Some observations are eliminated from these data. These eliminated observations include trust

companies without deposits, domestic branches of foreign banks, banks with missing data and outliers.²⁶

Essentially, the banks that remain in the data include the following:

[a]. National banks that are members of the Federal Reserve and supervised by the Comptroller of Currency;

[b]. State banks that are members of, and supervised by the Federal Reserve; and

[c]. State banks that are not members of the Federal Reserve and are supervised by the Federal Deposit Insurance Corporation.

The data for BHCs' nonbanking activities are derived from the Federal Reserve's FRY-11AS tapes (the second data source). Starting in 1986, bank holding companies with consolidated

²⁶Also excluded from the sample are "non-check (industrial)" state banks (not members of the Federal Reserve System), mutual savings bank, state incorporated commercial and industrial banks, and non-banks such as agencies and New York Investment Corporations. The outliers consist of 61 observations (for 1989 and 1990 combined). These include banks with cost of loanable funds exceeding 0.25 or below 0.04 and banks with cost of physical capital exceeding 0.5 or below 0.001.

assets greater than \$1 billion or assets greater than \$150 million and significant holdings of nonbanking assets were required to file a new set of reports.

There are three reports that BHCs must file. "Combined Financial Statements of Nonbanking Subsidiaries of BHCs" on form FRY-11Q is filed on a quarterly basis. "Annual Report of Selected Financial Data for Nonbanking Subsidiaries of BHCs" is reported on form FRY-11I. The "Combined Financial Statements of Nonbanking Subsidiaries of BHCs, by Type of Nonbanking Subsidiary" on form FRY-11AS is filed annually.

The FRY-11Q report, compiled on a quarterly basis, consists of consolidated balance sheet and income statement figures for all nonbanking subsidiaries of bank holding companies. A subsidiary in this context is a company in which the parent BHC controls more than 50 percent of voting stock. The FRY-11I report provides financial data for selected nonbanking activities.

The FRY-11AS report, which is filed annually, contains the same information as described for FRY-11Q, except that it is classified according to eleven nonbanking activities.²⁷

²⁷The eleven activities are commercial finance, mortgage banking, consumer finance, securities brokerage, other depository institutions, leasing, data processing, insurance underwriting, small business investment company, insurance agency, and other nonbanking activities. The

For the purpose of reporting under the FRY-11 system, BHCs have to classify all their subsidiaries into one of these eleven categories. Thus, first a BHC has to decide what is the main activity of each of its subsidiaries, then consolidate all of its subsidiaries according to the eleven categories. If a BHC has more than one subsidiary in any nonbanking activity, then data from all the subsidiaries in this category have to be consolidated as a single entry.

For example, suppose that a BHC has four securities brokerage subsidiaries and two securities underwriting subsidiaries. For the purpose of reporting, data from the four securities brokerage subsidiaries would be consolidated as one item and data from the two securities would be consolidated as another item. Furthermore, the Federal Reserve has defined only one category, namely securities brokerage and securities underwriting (column g of FRY-11AS), under which all securities related business is to be reported. Hence, for reporting purpose, the two items that were consolidated earlier will have to be further added together. In this manner, several nonbanking activities are reduced to the

last is a catch-all category that includes, but is not limited to, businesses such as trust services, courier services, management consulting, traveling services (e.g., travelers' checks), foreign exchange services, and so on.

eleven defined above. Data from the FRY-11AS tapes are used as they match with the annualized data from the FDIC tapes.

The traditional banking data for banks comprising BHCs are consolidated from the FDIC tapes by BHC-code. This code is common to both data sources. For example, in 1989 there are 48 banks on the FDIC tapes with the BHC-code of 8514. The data from these 48 banks are consolidated as one observation. The FRY-11AS tapes contain an observation with the same name and the same BHC-code.

Data from the two sources were thus consolidated for each bank holding company. The variables that were so consolidated include total costs, total loans, cost of loanable funds, cost of employee wages and benefits, and cost of physical capital. To this compiled data were added the nonbanking data from the FRY-11AS tapes to arrive at the final data that were used in this dissertation. Descriptive statistics for the sample banks and BHCs are discussed in Chapter 6.

The data used in this research pertain to years 1989 and 1990. However, in order to address the issues raised at the beginning of this chapter, information regarding BHCs' nonbanking activities for prior years is needed. For the purpose of comparison with prior years 1986 thru 1988

information from Liang and Savage (1990A and 1990B) is used.²⁸ There are 303, 298, 284, 283, and 294 bank holding companies for the years 1986, 1987, 1988, 1989, and 1990, respectively, that filed the FRY-11 reports.

The data for the years 1986 thru 1990 provide an opportunity to draw some broad conclusions. Specifically, the general trend, or a lack thereof, in the nonbanking businesses of BHCs, their respective sizes, market concentration, profitability, and capital ratios are studied. The next section contains some of the more important findings.

4.2 Nonbanking Assets of BHCs in Each Category

Table 1* gives a breakdown of total nonbanking assets according to the eleven categories specified by the Federal Reserve. Historically, the largest nonbanking category in terms of total assets has been the "other nonbanking" category. Assets in the other nonbanking subsidiaries have fluctuated over time. After a slight fall in 1988 they rose by 9.8 percent in 1989 but fell by 25.3 percent in 1990.

²⁸Since the data used by Liang and Savage [(1990A) and (1990B)] are not available for this research, for the sake of comparisons numbers are directly taken out of the two papers.

*All tables may be found in Appendix 2.

On the other hand, insurance agencies and small business investment companies have held the fewest assets (roughly about a half million dollars), though, in 1990 the latter category showed almost a three-fold increase. One interesting observation, however, is that total nonbanking assets in all categories combined have fallen sharply from 1987. Although they rose by 5.9 percent in 1988, they fell by 12.1 percent in 1989 and again by 10.5 percent in 1990. Overall, total nonbanking assets held by BHCs fell by 21.4 percent from 1988-90.

The figures for mean assets in Table 2 show a large distribution across the different nonbanking activities. "Other depository institutions" have, on average, held most nonbanking assets per firm. For instance, in 1989 the average subsidiary within this group held \$2,304.9 million in assets. But within this category the average size of firms has fluctuated over time. The average firm size increased by 54.33 percent from 1987 to 1989, but from 1989 to 1990 it dropped by 67.54 percent.

Despite this drop, mean assets in this category continue to be the largest among all nonbanking activities in 1990. On the other end of the spectrum, insurance agencies are smallest in terms of mean assets ranging between 4.6-8.7 million

dollars. The average size of small business investment (SBI) subsidiary, though small in absolute terms, more than doubled from 1987 to 1990.

Table 3 shows that the five largest BHCs in each category hold at least 50 percent of their total assets in that category. This is true for all the years 1987 through 1990. Thus, the nonbanking sector is heavily concentrated. More specifically, the securities brokerage and "other depository institutions" categories have the greatest concentration. Leasing subsidiaries show the least concentration.

The total number of BHCs engaged in nonbanking activities has stayed fairly stable over the last five years. There are 303, 298, 284, 283, and 294 BHCs which filed the FRY-11AS reports with the Federal Reserve for the years 1986 through 1990 respectively.²⁹ However, Table 4 shows that except for two categories [those of other depositories (ODP) and small business (SBI)], the number of BHCs engaging in nonbanking activities has diminished.

The number of insurance underwriting (INU) subsidiaries has remained stable during the period of study. BHC subsidiaries under the other nonbanking (ONB) and insurance

²⁹The numbers of BHCs filing FRY-11AS reports for the years 1986, 1987, and 1988 are taken from Liang-Savage [(1990A) and (1990B)].

underwriting (INU) categories are the only groups that have retained over 100 firms from 1987 to 1990. The other relatively popular nonbanking activities are mortgage banking, securities brokerage, leasing, and data processing. The fewest nonbanking subsidiaries of BHCs can be found under other depository institutions (ODP) category, ranging from eight to thirty-seven.

Table 5 gives the percentages of total assets for each activity. Thus, in 1987 commercial finance subsidiaries of BHCs held 17.1 percent of total nonbanking assets. In 1987 mortgage banking subsidiaries held 14.9 percent of total nonbanking assets, commercial finance subsidiaries held 17.1 percent, and so on.

Subsidiaries in the "other nonbanking" category have always held the largest share. Otherwise, commercial finance, mortgage banking, and consumer finance subsidiaries have generally been three of the largest categories in terms of percentage of total assets from 1987 through 1990. Insurance subsidiaries (both agencies and underwriting firms) and small business investment companies have been the most insignificant part of the nonbanking sector, on average, each holding less than one percent of total nonbanking assets.

As mentioned in the previous paragraph, the majority of the nonbanking assets are held by subsidiaries that are engaged in commercial finance, mortgage banking, consumer finance, and other depository institutions. Ironically, these activities are the ones that are really not nonbanking activities, rather traditional banking activities. Table 5 presents the percentage change in asset ownership over time for each of the eleven nonbanking activities. Three of the four activities that can be performed by banks themselves, show the most decline from 1987 to 1990. Indeed this is an interesting finding as this decline may indicate that historically, regulatory restrictions have been binding on BHCs. The reasoning behind this conclusion is presented in the following paragraphs.

Why would a commercial bank or a bank holding company want to operate a nonbank subsidiary in commercial finance, mortgage banking, or consumer finance when these activities can be performed by the banks themselves? One answer to this question is that banks or BHCs do so in order to circumvent the strict interstate and product-line expansion restrictions. Some researchers provide another answer to this question [see Sinkey (1992)]. These researchers argue that due to less

regulatory burdens, these activities are more profitable when conducted in a BHC as opposed to a bank. Whether the second argument is true or not is examined empirically later on in section 4.4.

Indeed, several researchers support the first reasoning behind the innovation of the BHC organizational form [e.g., Jessee and Seelig (1977) and Sinkey (1992)]. Thus, a banking firm headquartered in one state had to form a holding company and acquire or incorporate a nonbank subsidiary if it wanted to go across state border even if it were interested in one of the traditional banking activities (such as commercial or consumer finance and/or mortgage banking).

However, over the last several years, several states have liberalized the interstate banking restrictions. This implies that the activities in question can now be performed within the commercial bank itself or by one of its branches. The need for establishing a BHC for avoiding interstate restrictions has thus been reduced. Nevertheless, the differences in the regulatory costs imposed on the holding company versus the bank may continue to promote the holding company form of organization.

In percentage terms, there have been significant increases in four nonbanking activities, namely small business investment (200%), other depository institutions (84.6%), insurance underwriting (77.8%) and data processing and information (30%). In dollar figures, however, only one of these, "other depository institutions," contains any significant amount of assets. Generally speaking, total BHC assets in nonbanking activities have declined over time. Out of the eleven activities that are reported by BHCs, Table 1 shows that seven activities experienced a decline in their assets whereas only four experienced an increase from 1986 to 1990.

4.3 Is the Nonbanking Business of BHCs Heavily Concentrated?

Tables 1 through 5 show that the nonbanking sector is heavily concentrated with the five largest firms in each of the eleven categories of nonbanking activities holding over 50 percent of that category's assets. Tables 6 and 7 put banking and nonbanking activities in proper perspective by comparing the assets of banking and nonbanking subsidiaries, as well as

the parent holding companies. This table is constructed using data from 263 BHCs for 1989 and 271 BHCs for 1990.³⁰

As can be seen in Table 6, the 25 largest firms hold approximately 90 percent of all nonbanking assets. From 1987 through 1989 the percentage grew from 89.6 percent to 93.1 percent before falling to 91.3 percent in 1990. This trend, i.e., the numbers rising from 1987 through 1989 and falling in 1990, is true for all other partitions of the sample. In general, it is concluded that the BHCs' nonbanking businesses are highly concentrated. The concentration grew over the years 1987-89 before declining slightly in 1990. The average assets held by BHCs' nonbanking subsidiaries show a similar trend. That is, for all columns in Table 7, average nonbanking assets increase from 1987 through 1989 before falling for the year 1990. However, the numbers increase substantially from 1988 to 1989. For instance, nonbank assets held by the largest five firms rose by 25.4 percent in 1989. The average BHC assets, on the other hand, decline from the year 1989 after increasing from 1987 to 1988.

³⁰20 FRY-11AS observations for 1989 and 23 FRY-11AS observations for 1990 could not be matched with their corresponding holding company code from the FDIC data.

The bottom panel shows nonbanking assets relative to BHC assets. Only the top 50 or so BHCs hold over ten percent of their assets in their nonbanking subsidiaries. Otherwise, nonbanking assets constitute a relatively small fraction of BHC assets. For most BHCs nonbanking activities constitute roughly between six and nine percent of total assets.

To summarize, the nonbanking activities of bank holding are heavily concentrated among the top 5-10 BHCs. This concentration has held steady over the period 1987-90. The average BHC assets have declined from 1988 to 1990 resulting in an increase in the ratio of nonbanking to BHC assets. This increase, however, is more significant for the largest firms. For the 100 largest firms, as well as for the full sample, this increase has been relatively small.

4.4 Nonbank Profitability of Bank Holding Companies

Tables 8 and 9 show the median profit ratios for the different nonbanking subsidiaries from 1986 through 1990. First, consider the income-to-assets [or the return on assets (ROA)] measure. It is evident from Table 8 that the real nonbanking activities, such as the two insurance categories and securities brokerage categories have traditionally been

the most profitable. Those activities that can be undertaken by banks themselves (the traditional banking activities) have been among the least profitable.

The ROE (income-to-equity) ratios tell the same story in Table 9. Data processing, insurance agency, insurance underwriting, and the securities brokerage categories have relatively healthy ROE figures. The two profit ratios may help explain as to why banks want to enter the insurance and securities brokerage businesses.

4.5 Recapitulation

In this section, the nonbanking activities of bank holding companies are studied for the years 1989 and 1990. This study is necessary to assess the market structure and profitability attached to individual nonbanking activities. Data are obtained from a relatively new set of reports, FRY-11AS. These data are combined with that from the FDIC data to obtain financial information for the banking activities of consolidated bank holding companies.

Two previous studies by Liang and Savage (1990A and 1990B) are used to obtain corresponding figures for the years 1986 through 1988. Several financial ratios are calculated and

the general state of the nonbanking subsidiaries studied vis-a-vis banking subsidiaries as well as consolidated BHC.

Some of the important conclusions are as follows. Throughout the five year period 1986-1990, the nonbanking sector was extremely concentrated. The five to ten largest firms in each of the eleven nonbanking categories held about 90 percent of that category's total assets. However, nonbanking assets for most bank holding companies ranged from 6.3 to eight percent of total BHC assets. Total nonbanking assets as well as total number of firms engaged in nonbanking activities declined over this time period.

The most significant decline was in those activities that can be performed by commercial banks. These activities include commercial, consumer, and mortgage financing. The decline in these activities may be due to the liberalization of interstate banking restrictions. Because of banks' abilities to expand across state borders they do not have to resort to operations of these activities via nonbanking subsidiaries.

Researchers such as Sinkey (1992) and Eisenbeis (1983) have suggested that firms resorted to the BHC form in order to circumvent regulation and for bigger profits. Since over the years these laws have become less binding banks are able to

perform some of the activities themselves instead of having to establish a nonbanking subsidiary.

The return on assets for nonbanking subsidiaries show a significant decrease from 1987 to 1990. However, it stabilized over the last three years of this analysis. Since 1988, ROAs of nonbanking subsidiaries have aligned themselves with commercial banks' and BHCs' return on assets. The return on equity for nonbanking firms are significantly less than banks' and BHCs'.³¹

Within the eleven nonbanking activities, insurance and securities brokerage continue to outperform the rest in profitability. This may partly explain why commercial banks want to enter these businesses. On average, nonbanking activities appear to be more profitable than traditional banking activities for BHCs.³² However, nonbanking activities, on average, have more problem loans in terms of net charge-off rates, past-due rates, and nonaccrual rates.

³¹The data show that this was due to the extremely low capitalization levels of commercial banks.

³²However, data show that nonbanking activities, on average, have more problem loans in terms of net charge-off rates, past-due rates, and nonaccrual rates.

CHAPTER 5

THEORETICAL FRAMEWORK OF THE EMPIRICAL TECHNIQUES

5.1 Some Theoretical Background

5.1.1 Scale/Scope Economies, Incremental Costs, and Subadditivity

The last decade has seen the publication of several journal articles on the topic of multiproduct firm costs. Some of these are banking papers while others represent other industries. These papers build on the work of Panzar and Willig [(1977) and (1978)] and Baumol (1977).

For a single output producing industry the cost minimizing number of firms can be determined by studying the average cost curve. The same measure cannot be applied for a multiple output producing industry. In the latter case it is not clear as to what is the measure of output that should be used to divide total costs to arrive at the average cost. Thus, economies of scale is neither a necessary nor a sufficient condition for cost complementarity in a multiproduct industry.

The way out of this problem is through the concept of ray average cost defined as:

$$\text{RAC} = C(ky)/k \quad [3]$$

where y is a vector of firm outputs and k is a constant scalar. Ray average costs are said to be declining (increasing) as:

$$C(k_1y)/k_1 < (>) C(k_2y)/k_2, \quad \text{for } k_1 > k_2 \quad [4]$$

However, the concept of RAC can be applied to a multiproduct scenario only if it can be assumed that the firm's outputs all change proportionally. In reality, such occurrence seldom occurs. More often, firms would want to change the outputs of their product-mix according to the profitability attached with each product. That is, products that yield a higher risk adjusted return will be produced more abundantly than those that yield a lower return, *ceteris paribus*.

This enables the introduction of the concept of incremental cost (IC). IC due to the production of product-1 (say) can be defined as the firm's total cost with the given vector of outputs, minus what that total cost would be if production of product-1 were discontinued, all other output

quantities remaining unchanged. That is, the incremental cost of producing q_1 units of product-1 is given as

$$IC(q_1) = C(q_1 + q_2 + \dots + q_n) - C(q_2 + q_3 + \dots + q_n) \quad [5]$$

However, it is extremely difficult, if not impossible, to calculate the IC of any product because it is never produced in isolation, nor is it completely omitted by a multiproduct firm such as, a commercial bank.

The concepts of economies of scope, subadditivity (of cost functions), and natural monopoly are all interrelated. If the inequality,

$$C(q) < C(q_1) + C(q_2) + \dots + C(q_n) \quad [6]$$

holds for any possible disaggregation of an output vector q , then $C(\cdot)$ is said to be subadditive in q and the market is a natural monopoly in q .

In the multiproduct framework, economies of scale (or falling average costs) are neither necessary nor sufficient for natural monopoly. In general, cost complementarity in any form, when combined with economies of scale will guarantee

subadditivity of a multiproduct cost function. In other words, economies of scope exist if a multiproduct industry output is more cheaply produced by one (multiproduct) firm than by many firms, each producing a certain partition of the industry output vector [Panzar and Willig (1977) and (1978)]. Thus, if a cost function is characterized by economies of scope or subadditivity, then multiproduct industry structure can be supported on efficiency grounds [Mayo (1984A)].

5.1.2 Jointness in Production Function and Bank Costs

Most of the early studies view financial institutions as a series of separate Cobb-Douglas production processes. Although these studies explicitly recognize the multiproduct nature of the banking firm, they assert that "from a cost standpoint, all these functions or services may be regarded as different products Thus, a meaningful analysis of bank costs should consider each function separately" [Bell and Murphy (1968)].

This argument led many studies to estimate separate cost functions for individual bank activities or to use arbitrary aggregation functions to transform the multiproduct outputs to scalar indexes of outputs. This way of specifying cost

function(s), i.e., the use of Cobb-Douglas and an aggregated output measure rules out cost complementarities and U-shaped cost curves *a priori*.

Mainly because of the last drawback, some researchers started working with more flexible functional forms. According to Caves, Christensen, and Tretheway (1980) "to be attractive for empirical applications a flexible form for the MCF (multiproduct cost function) should be linearly homogeneous in input prices for all possible price and output levels; be parsimonious in parameters; and contain the value zero in the permissible domain of output quantities."

Baumol et al. (1982), in their "Desiderata for multiproduct cost functions," have added some more desirable attributes for a cost function. Let $C(y,w)$ represent a cost function, then to qualify as a proper cost function it must be non-negative and non-decreasing, concave, and linearly homogeneous in the input prices, w . Further, $C(y,w)$ must be non-decreasing in its outputs, y .

Secondly, the functional form should not, in itself, prejudice the presence or absence of any of the cost properties that play an important role in the analysis. This is an error found in most of the early studies on banking costs that use

the Cobb-Douglas cost function. Baumol et al. call this property "substantive flexibility".

5.1.3 Detection of Jointness in Production Functions

One approach to determining jointness would be to calculate 'pseudo' single product production functions for each output and compare the sum of the costs of these single output cost functions to the total costs associated with the joint production [Willig (1979)]. This, however, requires knowledge of what the cost function would be for each output produced in isolation.

Some researchers [e.g., Caves et al. (1980)] have tried to get around this problem by using a generalized translog function with a Box-Cox transformation, which permits zero output levels while maintaining the basic functional form. Such a technique still yields unreliable estimates at zero output levels if there are no actual output levels near zero. This is the case with the banking firm. Any inferences about scope economies using the Box-Cox transformation, therefore, will be unreliable.³³

³³Another potential problem with a Box-Cox transformation in such an analysis is that the number of parameters to be estimated increases significantly [Friedlaender, Winston, and Wang (1983)]. This conflicts with the requirement that cost functions should be parsimonious in number

An alternative to this problem is the test of jointness as used by some recent studies [e.g., Murray and White (1983), Gilligan and Smirlock (1984), Gilligan et al. (1984), and Lawrence (1989)]. In these studies the test of jointness involves comparison of the explanatory power of an unrestricted multiproduct cost function to one where non-jointness is imposed in estimation.

The translog cost function represents a flexible form for a multiproduct firm that permits detection of jointness. With two outputs and constant input prices, the translog function can be written as:

$$\begin{aligned} \ln C = & \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 (\ln x_1)^2 \\ & + \beta_4 (\ln x_2)^2 + \beta_5 \ln X_1 \ln X_2 \end{aligned} \quad [7]$$

where the X_i 's represent the two outputs (for example, the dollar amounts of loans and deposits outstanding). The translog form also permits a direct test of whether or not bank costs are characterized by a Cobb-Douglas production function. It requires

$$\beta_3 = \beta_4 = \beta_5 = 0 \quad [8]$$

of parameters to be estimated [Caves, Christensen, and Tretheway (1980) and Baumol, Panzar, and Willig (1988)].

5.2 Production and Intermediation Approaches

Two basic approaches tend to be used in empirical studies of bank production: the production approach and the intermediation approach [Humphrey (1985), Lawrence (1989), and Hunter and Timme (1989)]. According to the production approach, a bank's inputs include labor and physical capital. Bank output is measured by the number of accounts held at the bank. Costs under this approach include all of the operating expenses. Because interest paid on deposits and borrowed funds is not an operating expense, it is not included in total costs.

In the intermediation approach output is measured by the total dollar amount of the various products that the bank offers. Total costs include both operating expense and interest expense. The latter approach is generally accepted as more relevant for addressing questions related to the long-run competitiveness of banks [Humphrey (1985) and Hunter and Timme (1989)].

Studies that use the production approach in examining bank costs generally rely on the data collected by the Federal Reserve's FCA program. But as mentioned earlier this data source has its drawbacks, such as not representing banks with

over one billion dollars in deposits and not being a randomly selected sample. The weaknesses with the FCA data undermine the production approach since the FCA program is the only reliable source for account-based data on large samples of banks. Because in this dissertation the intermediation approach is adopted, account-based data is not required.

Data from the FDIC Call and Income tapes and the FRY-11AS tapes are used. The benefits from the FDIC tapes have been mentioned earlier. Like the FDIC tapes, the FRY-11AS tapes contain microeconomic data on all the bank holding companies consolidated by their nonbanking subsidiaries. The basic form of the relationship that is estimated in this study is:

$$\text{Total Costs} = f(\text{Banking and Nonbanking Outputs, Cost of Loanable Funds, Cost of Wages, Cost of Physical Capital})^{34} \quad [9]$$

5.3 Definition and Measurement of Input (Prices)

Traditionally, researchers assume that bank production employs two inputs, labor and capital. Hence, most studies use

³⁴Dividends are excluded as an explanatory variable for two reasons. First, they constitute a very small fraction of total costs. More importantly the inclusion of another explanatory variable would violate the desiderata of cost functions [Baumol, Panzar, and Willig (1988) and Caves, Christensen, and Tretheway (1980)]. The increased number of parameters to be estimated would complicate further the quadratic models that are specified.

the average employee wage and the cost of capital as input prices. However, when dealing with total costs, and not operating costs, the cost of loanable funds or interest rate must be included in total costs.

Moreover, cost of loanable funds must be used as an additional input price explanatory variable- unless it is assumed that this variable is constant across firms. Because the intermediation approach with total costs is followed here and no assumption made about cost of loanable funds being constant, there are three input price variables:

- [i]. Cost of Loanable Funds (I) = total interest expense divided by total (year-ending) interest bearing deposits;
- [ii]. Cost of Wages (W) = total salary expense plus employee benefits divided by the number of full-time equivalent employees; and
- [iii]. Cost of Physical Capital (R) = total rental costs and other fixed costs divided by total (year-ending) deposits (to normalize for the wide variation in this category of costs across banks of various sizes).

5.4 Definition and Measurement of Bank Output

Deciding on the proper indicator of bank output is a common problem. Some studies have used account-based data where they have considered the number of accounts outstanding

(e.g., of loans and deposits) as the measure of bank output.³⁵ Alternatively, one could use the dollar volume of the defined outputs. This requires the researcher to consider carefully which bank assets and liabilities to include in the definition of output because results can be sensitive to the definition of output [Hunter and Timme (1989)].

Ideally, each bank product should be treated as a distinct output. However, beyond a certain point the analysis becomes intractable as the number of outputs is increased [Hunter and Timme (1989)]. Problems arise due to the excessive number of parameters to be estimated, especially if a quadratic or a translog model is specified.³⁶ Choices have to be made with respect to the number and types of outputs to include in the analysis.

For most purposes, the value-added criterion presented by Berger, Hanweck, and Humphrey (1987) is sufficient. According to them, for a product to be considered part of a bank's output, consumers must value the product more highly in the form produced by the bank than if they were to generate the same output themselves. An example would be demand deposit

³⁵Benston (1965), Bell and Murphy (1968), and Benston (1972).

³⁶The problems encountered due to both the nature of the data being analyzed and the form of the cost function that is to be fit statistically are detailed in Clark (1988).

accounts. Consumers value the safety and convenience provided by bank checking accounts more highly than transacting in cash alone and thus are willing to pay for this service.

For the first part of the dissertation three alternative definitions (models) of bank outputs are used. Since the intermediation approach is followed, these outputs are measured as the total dollars outstanding in the accounts of each category. For the first model, in accordance with most of the recent literature it is assumed that banks produce two products- deposits and loans.

For Model 2, outputs are defined as earning assets. Specifically, these assets are real estate loans, agricultural loans, commercial and industrial (C&I) loans, and consumer loans. For Model 3, two revenue measures are used to proxy bank outputs. These are total interest and noninterest income.

As mentioned earlier, the second part of the dissertation tests for economies of scale and scope between banking and nonbanking activities. Here three additional outputs are defined and measured:

- [i]. Securities Brokerage = total assets for all securities brokerage and securities underwriting subsidiaries of BHCs;

[ii]. Insurance = total assets for all insurance agency or brokerage and insurance underwriting subsidiaries of BHCs; and

[iii]. Other Nonbanking Activities = total assets under the remaining categories of nonbanking subsidiaries as reported by BHCs in FRY-11AS reports.³⁷

5.5 Specification of the Models

When estimating cost functions empirically, it is important that no *a priori* restrictions be imposed concerning the underlying production process. Care must be taken particularly with respect to the assumptions of homotheticity or elasticities of factor substitution. Some of the conventional functional forms such as the Cobb-Douglas or the Constant Elasticity of Substitution (CES) form assume separable or homothetic technologies and impose constant elasticities of factor substitution. For this reason these functional forms may not be suitable for economies of scale and scope studies [Friedlaender, Winston, and Wang (1983)].

³⁷Other nonbanking activities include (a) trust services; (b) provision of general economic and financial information and advice; (c) sponsorship, organization, or control of a closed-end investment company; (d) investment to promote community welfare; (e) courier services; (f) management consulting; (g) sale of money orders, travelers' checks, or savings bonds; (h) personal property and real estate services; (i) foreign exchange services; and (j) futures commission merchant services [Liang and Savage (1990A)].

Although the translog approximation has frequently been used in estimating bank cost functions, the existence of a large number of zero outputs, especially nonbanking outputs, presents a substantial problem. One could use a Box-Cox transformation of a generalized translog model to circumvent the problem of zero values. From an empirical standpoint, however, the apparent advantages of the generalized translog form in multiproduct studies may be illusory [Pulley and Braunstein (1992)].

Results obtained by Caves et al. (1980) using railroad data, as well as applications in telecommunications [Evans and Heckman (1983)] and banking [Lawrence (1989)], find that there are robustness problems associated with this functional form. Lawrence (1989) shows that the simple translog does a better job than the Box-Cox transformation. Moreover, such a transformation increases the number of parameters to be estimated. As mentioned earlier, this violates one of the basic requirements of an ideal cost function.

In this dissertation, the simple multiproduct quadratic approximation and variations thereof are used which represent a second-order Taylor series expansion. Ordinary least square regressions are run to test for cost complementarities among

BHC products. The first three models are used to make inferences about scale and scope economies in traditional banking activities. Alternative specifications of the simple MQCF are used depending upon the respective definitions of bank outputs. The subsequent model specifications pertain to scale and scope economies among banking and nonbanking activities of BHCs.

5.5.1 Scale and Scope Economies Among Banking Activities:

Cost Function Specification for Model 1

Bank output is defined as total deposits and total loans. The general cost function for Model 1 is

$$\begin{aligned} TC = & \beta_0 + \beta_1 D + \beta_2 L + \beta_3 D^*D + \beta_4 L^*L + \beta_5 D^*L \\ & + \beta_6 Y1 + \beta_7 Y2 + \beta_8 Y3 + \epsilon \end{aligned} \quad [10]$$

where,

TC = total costs (including interest expense),

D = total deposits,

L = total loans,

D*D = squared term for total deposits,

L*L = squared term for total loans,

$D*L$ = interaction term between deposits and loans,
 y_1 = cost of loanable funds,
 y_2 = cost of employees' wages and benefits,
 y_3 = normalized expenses on rental/other fixed costs,
 ε = error term that is assumed to be well behaved.

Cost Function Specification for Model 2

Bank output is defined as earning assets (real estate loans, agricultural loans, C&I loans, and consumer loans). The general cost function for Model 2 is

$$\begin{aligned}
 TC = & \beta_0 + \beta_1 RE + \beta_2 AG + \beta_3 CI + \beta_4 CN + \beta_5 (RE)^2 + \beta_6 (AG)^2 \\
 & + \beta_7 (CI)^2 + \beta_8 (CN)^2 + \beta_9 RE*AG + \beta_{10} RE*CI + \beta_{11} RE*CN + \beta_{12} AG*CI \\
 & + \beta_{13} AG*CN + \beta_{14} CI*CN + \beta_{15} y_1 + \beta_{16} y_2 + \beta_{17} y_3 + \varepsilon \quad [11]
 \end{aligned}$$

where,

TC = total costs (including interest expense),
 RE = total real estate loans,
 AG = total agricultural loans,
 CI = total commercial and industrial (C&I) loans,
 CN = total consumer loans,
 $(RE)^2$ = squared term for RE,

$(AG)^2$ = squared term for AG,

$(CI)^2$ = squared term for CI,

$(CN)^2$ = squared term for CN,

RE*AG = interaction term between RE and AG,

RE*CI = interaction term between RE and CI,

RE*CN = interaction term between RE and CN,

AG*CI = interaction term between AG and CI,

AG*CN = interaction term between AG and CN,

CI*CN = interaction term between CI and CN,

y1, y2, y3, and ϵ have the same definition as in equation 10.

Cost Function Specification for Model 3

Bank output is defined as revenue measures (interest and noninterest incomes).

The general cost function for Model 3 is

$$\begin{aligned}
 TC = & \beta_0 + \beta_1 I + \beta_2 NI + \beta_3 I^2 + \beta_4 (NI)^2 + \beta_5 I * NI \\
 & + \beta_6 y1 + \beta_7 y2 + \beta_8 y3 + \epsilon
 \end{aligned}
 \tag{12}$$

where,

I = total interest income,

NI = total noninterest income,

I_2 = squared term for interest income (I),

$(NI)^2$ = squared term for noninterest income (NI),

$I*NI$ = interaction term between I and NI,

y_1, y_2, y_3 , and ϵ have the same definition as in equation 10.

5.5.2 Scale/Scope Economies Between Banking-Nonbanking Activities:

Cost Function Specification for Model 4 (Fixed Input Prices)

The second part of the dissertation tests for jointness in production among banking and nonbanking activities. Scale and scope economies are measured for the traditional loans (banking activities), securities, insurance, and other nonbanking activities. Model 4 assumes constant input prices and has the following general form:

$$TC = f(BK, SEC, INS, ONBA) \quad [13]$$

where,

BK = total bank loans (banking activities),³⁸

SEC = securities business,

³⁸Banking activities (BK) include total loans from the FDIC tapes plus five categories of loans from the FRY-11AS tapes. The five categories are commercial finance, mortgage banking, other depository institutions, small business, and consumer finance.

INS = insurance business,

ONBA = other nonbanking activities

BK variable represents banking activities data for which are collected from both the FDIC and FRY-11AS tapes. ONBA is measured by adding securities (SEC) and insurance (INS) businesses and then subtracting the result from total nonbanking assets (NBA).

The simple quadratic equation specified for this model is

$$\begin{aligned} TC = & \beta_0 + \beta_1 BK + \beta_2 SEC + \beta_3 INS + \beta_4 ONBA + \beta_5 (BK)^2 + \beta_6 (SEC)^2 \\ & + \beta_7 (INS)^2 + \beta_8 (ONBA)^2 + \beta_9 BK*SEC + \beta_{10} BK*INS + \beta_{11} BK*ONBA \\ & + \beta_{12} SEC*INS + \beta_{13} SEC*ONBA + \beta_{14} INS*ONBA + \epsilon \end{aligned} \quad [14]$$

The additional variables (not defined above) are

$(BK)^2$ = squared term for banking activities,

$(SEC)^2$ = squared term for securities business,

$(INS)^2$ = squared term for insurance business,

$(ONBA)^2$ = squared term for other nonbanking business,

$BK*SEC$ = interaction term between loans and securities,

$BK*INS$ = interaction term between loans and insurance,

$BK*ONBA$ = interaction term between loans and other nonbanking activities,

SEC*INS = interaction term between securities and insurance,

SEC*ONBA = interaction term between securities and other nonbanking activities,

INS*ONBA = interaction term between insurance and other nonbanking activities.

Cost Function Specification for Model 5 (Linear Input Prices)

In Model 4 the possibility of differential factor prices has not been explicitly incorporated. Such an omission might typically be justified in statistical cost estimation on the assumption that input prices do not vary across cross-sectional observations [Mayo (1984B)]. However, different factor prices across firms in the banking-nonbanking industry should be considered a distinct possibility.

Where input prices vary across observations, it is necessary to account for this variation in the cost function. The simplest way to account for factor price variation is to allow such prices to enter the model linearly, as is done in this model. The specification of Model 4 is repeated in Model 5 while relaxing the assumption of fixed input prices. It is assumed that total costs for a BHC is a linear function of input prices. The cost equation for Model 5 is

$$\begin{aligned}
TC = & \beta_0 + \beta_1 BK + \beta_2 SEC + \beta_3 INS + \beta_4 ONBA + \beta_5 (BK)^2 + \beta_6 (SEC)^2 \\
& + \beta_7 (INS)^2 + \beta_8 (ONBA)^2 + \beta_9 BK*SEC + \beta_{10} BK*INS + \beta_{11} BK*ONBA \\
& + \beta_{12} SEC*INS + \beta_{13} SEC*ONBA + \beta_{14} INS*ONBA + \beta_{15} Y1 + \beta_{16} Y2 \\
& + \beta_{17} Y3 + \epsilon
\end{aligned}
\tag{15}$$

All of the output variables have the same definition as in the previous model. In addition, the input prices, $y1$, $y2$, and $y3$ enter the cost function linearly.

Difference in Cost Structure Between One-Bank Holding Companies versus Multi-Bank Holding Companies:

Model 5 is estimated again after segregating the data into one-bank and multi-bank holding companies. Table 16 contains results for the cross-sectional ordinary least square regression using Model 6A (the MBHC sample consisting of 370 observations). Table 17 presents results for Model 6B pertaining to the OBHC sample that comprises of 170 observations. The results are discussed in Chapter 6.

**5.5.3 Cost Complementarities Between Banking And Nonbanking Activities With Multiplicative Input Prices
[Left for Future Research]**

The addition of factor prices into the quadratic model in a linear fashion permits an examination of whether the results

in the earlier models were driven by cross-sectional differences in factor prices. However, while the simplicity of the linear form of input prices is appealing, it sacrifices a desirable attribute of theoretical and empirical cost functions. Namely, linear homogeneity of the cost function with respect to factor prices is sacrificed.

In order to remedy this characteristic strict input-output separability and linear homogeneity of input prices can be imposed. This can be done by writing the multiproduct quadratic cost function as:

$$\begin{aligned} TC = & [\beta_0 + \beta_1 BK + \beta_2 SEC + \beta_3 INS + \beta_4 ONBA + \beta_5 (BK)^2 + \beta_6 (SEC)^2 \\ & + \beta_7 (INS)^2 + \beta_8 (ONBA)^2 + \beta_9 BK*SEC + \beta_{10} BK*INS + \beta_{11} BK*ONBA \\ & + \beta_{12} SEC*INS + \beta_{13} SEC*ONBA + \beta_{14} INS*ONBA] * f(y1, y2, y3) \quad [16] \end{aligned}$$

In the above specification $f(y1, y2, y3)$ is a function of the three input price variables defined above. This function is interacting multiplicatively with the four-output quadratic function. Moreover, $f(y1, y2, y3)$ itself can take any functional form, such as linear, quadratic, Cobb-Douglas, and CES.

In contemporary cost literature some of these variations of the simple MQCF have already been considered. For example,

Mayo (1984B) specifies his $f(.)$ as a Cobb-Douglas function. He applies this variation of the MQCF to the public utilities industry. Röller [(1990A) and (1990B)] uses the CES representation for the input-price function. He develops what he refers to as the CES-Quadratic cost function and applies it to the telecommunications industry. It should be noted, however, that no researcher has applied the MQCF with these variations to study the relationship between banking-nonbanking activities of bank holding companies.

While all of the above variations to the simple MQCF add sophistication and accuracy to the estimation of cost function, recently Pulley and Braunstein (1992) introduced a much more general form of the MQCF. They call it the "composite cost function" as it nests within itself, as special cases, most of the MQCF functional forms discussed above.

The models used by Mayo (1984B), Röller [(1990A) and (1990B)], and Pulley and Braunstein (1992) are theoretically more appealing and empirically more accurate than the simple- and the linear input-prices versions of the MQCF. However, the estimation (computer programming) and the interpretation of these more sophisticated versions are somewhat more complex.

Because the factor prices enter the cost function multiplicatively rather than additively, the models must be estimated using nonlinear least squares. Moreover, the parameter estimates of output variables will vary with different levels of input prices.

The composite cost function in its most general form can be written as

$$\begin{aligned}
 TC^{(x)} = & \{ [\beta_{q0} + \sum \beta_i q_i + 1/2 \sum \sum \beta_{ij} q_i q_j + \sum \sum \beta_{ik} q_i \ln w_k] \\
 & * \exp[\beta_{k0} + \sum \beta_k \ln w_k + 1/2 \sum \sum \beta_{kl} \ln w_k \ln w_l \\
 & + \sum \sum \beta_{ik} q_i \ln w_k] \}^{(x)} + \epsilon
 \end{aligned}
 \quad [17]$$

Two special cases of the composite cost function correspond to $x=1$ and $x=0$. When $x=1$, equation 1 becomes

$$\begin{aligned}
 TC = & [\beta_{q0} + \sum \beta_i q_i + 1/2 \sum \sum \beta_{ij} q_i q_j + \sum \sum \beta_{ik} q_i \ln w_k] \\
 & * \exp[\beta_{k0} + \sum \beta_k \ln w_k + 1/2 \sum \sum \beta_{kl} \ln w_k \ln w_l \\
 & + \sum \sum \beta_{ik} q_i \ln w_k] + \epsilon
 \end{aligned}
 \quad [18]$$

When $x=0$, equation 1 reduces to

$$\begin{aligned} \ln(\text{TC}) = & \ln[\beta_{q0} + \sum \beta_i q_i + 1/2 \sum \sum \beta_{ij} q_i q_j + \sum \sum \beta_{ik} q_i \ln w_k] \\ & + \beta_{k0} + \sum \beta_k \ln w_k + 1/2 \sum \sum \beta_{kl} \ln w_k \ln w_l \\ & + \sum \sum \beta_{ik} q_i \ln w_k + \varepsilon \end{aligned} \quad [19]$$

Advantages of the Composite Cost Function in Empirical Research:

The disadvantages from the use of the earliest cost functions, such as the Cobb-Douglas function, have been recorded in several earlier papers [Christensen and Greene (1976), Benston et al. (1982), Gilligan et al. (1984), and Lawrence (1989)]. Over the last decade researchers have used the translog and the generalized translog functions to estimate economies of scale and scope. Recently, however, several disadvantages of both the translog models have been noticed in the literature [Baumol et al. (1988), Rölller (1990A) and (1990B), and Pulley and Braunstein (1992)]. The most important drawbacks in the translog models have been discussed above.

In the multiproduct setting, recent researchers have advocated the use of the MQCF. However, some quadratic specifications, such as Mayo (1984B) and Rölller (1990A and

1990B) have been criticized by Pulley and Braunstein (1992) as being somewhat restrictive. They claim that the multiplicative forms of the MQCF, such as Rölller's CES-Quadratic function, have the disadvantage of imposing strong separability between outputs and inputs. Their argument requires separability to be framed as a testable hypothesis rather than imposed *a priori*.

To avoid the imposition of the separability restriction and to develop a model that is as general as possible, they include price and output interaction terms in both the output and input-price structures of the composite specifications.³⁹ The composite function is linearly homogeneous in factor prices which makes it attractive for applied/empirical studies. On the other hand, because it is basically a quadratic function it does not suffer from the limitations of the translog.

Diewert (1974) defines a flexible functional form as one with sufficient free parameters to provide a second-order approximation to an arbitrary twice differentiable, linearly-homogeneous cost function. The composite function specified by equation 2 above (with one set of interaction terms) has the

³⁹Despite the inclusion of the interaction terms between outputs and input-prices at two places in their composite cost function, Pulley and Braunstein anticipate that only one set of interaction terms will be estimated in practice (pg. 224).

same parameters as the translog cost function- a flexible form, and requires the same parameter restrictions for symmetry and linear homogeneity, it follows that the composite model is flexible as well [Pulley and Braunstein (1992)].

To sum up this section, the composite cost function is appealing since it combines a quadratic output structure and is desirable for examining multiproduct properties such as, economies of scope and product-specific economies of scale, with an input price structure that is linearly homogeneous. The ability to model cost behavior in the range of zero outputs gives it an edge over the translog functional forms. Next, it does not impose *a priori*, the separability condition. Hence, it improves upon the quadratic forms used by Mayo and Röller. Finally, it nests within itself various other quadratic and log-quadratic specifications. Thus, it is indeed a more general form of the MQCFs. However, the application of the composite cost function to banking-nonbanking outputs is not pursued in this research.

5.6 Discussion of the Variables and Their Coefficients

The Dependent Variable:

The dependent variable in all of the models is total costs. Total costs not only include the total operating expense but also total interest expense. As mentioned before, most earlier studies used total operating expenses as their dependent variable. However, operating costs typically comprise about 30 percent of total costs. Thus, defining the dependent variable as total costs facilitates the study of the total intermediation process, rather than studying only the production process. In other words, by including the 100 percent of total costs, the whole picture of the cost structure can be studied.

About 70 percent of total costs are typically attributed to interest expense. Most of the remaining 30 percent of total costs are made up of salaries and employee benefits, rental and other fixed expenditures such as those on furniture and fixtures, and dividend payments to the stockholders.

The Independent Variables:

In all of the models that are specified in this dissertation there are four general categories of explanatory

variables. These are the intercept, the linear terms, the quadratic terms, and the interaction terms. In order to explain the interpretation of the coefficients of independent variables the following simple specification of the MQCF is used with two products y_1 and y_2 :⁴⁰

$$TC(y_1, y_2) = \beta_0 + \beta_1 y_1 + \beta_2 y_2 + \beta_3 y_1^2 + \beta_4 y_2^2 + \beta_5 y_1 y_2 \quad [20]$$

Equation 20 represents a single intercept specification, where the intercept term, β_0 , represents total fixed costs associated with the production of both outputs y_1 and y_2 .⁴¹ One shortcoming equation 20 is that fixed costs related to both outputs are captured in the single, constant parameter.

In reality, fixed costs will vary with the set of outputs selected for production. Mayo (1984B) uses dummy variables to capture product-specific fixed costs in his flexible fixed costs quadratic (FFCQ) model. Essentially, the FFCQ is an disaggregation of the single constant into $n+1$ constants in the case of a n -product firm. The FFCQ model estimated by Mayo can be written as

⁴⁰This section borrows from Panzar (1989).

⁴¹The "single intercept equation" terminology, though intuitive, is borrowed from Panzar (1989).

$$\begin{aligned}
 TC(Y_1, Y_2) = & \beta_0 + \beta_{0Y_1} + \beta_{0Y_2} + \beta_1 Y_1 + \beta_2 Y_2 \\
 & + \beta_3 Y_1^2 + \beta_4 Y_2^2 + \beta_5 Y_1 Y_2
 \end{aligned}
 \tag{21}$$

Thus, the constant term β_0 of equation 4 is now broken down into three separate terms β_0 , β_{0Y_1} , and β_{0Y_2} . Panzar (1989) objects to this specification for the constant term and advocates an alternative. He agrees, rather encourages, in principle to the use of dummy variables to measure fixed costs associated with each output. However, he suggests a slightly different disaggregation than Mayo's. He recommends that instead of having the β_0 , β_{0Y_1} , and β_{0Y_2} terms, one should have β_0 , β_{0Y_1} , and $\beta_{0Y_{1+2}}$, where $\beta_{0Y_{1+2}}$ represents fixed costs of a firm that produces both goods y_1 and y_2 . His complete equation would look like the following

$$\begin{aligned}
 TC(Y_1, Y_2) = & \beta_0 + \beta_{0Y_1} + \beta_{0Y_{1+2}} + \beta_1 Y_1 + \beta_2 Y_2 \\
 & + \beta_3 Y_1^2 + \beta_4 Y_2^2 + \beta_5 Y_1 Y_2
 \end{aligned}
 \tag{22}$$

The distinction between Mayo's and Panzar's way of capturing the fixed costs is subtle and Panzar's reasoning is not readily apparent. Specially for studies on scale and scope economies any difference arising due to the alternative

specification of fixed costs are likely not to be significant. In any case, due to the presence of several output variables, single intercept models are employed in this research.

The next set of variables are the linear variables (y_1 and y_2) that measure their respective direct effects on total costs (TC). A positive sign on β_1 (β_2) represents that total cost is an increasing function of y_1 (y_2). A negative sign, on the other hand, represents that total cost is a decreasing function of that variable. Because here it is assumed that all the outputs are produced from real inputs with non-negative prices, it is expected that coefficients on all the linear output variables will be positive.

The estimated coefficients of the quadratic output terms provide insight into product-specific returns to scale. If β_3 (β_4) is positive, in the single intercept case, it ensures that there are globally decreasing y_1 - (y_2 -) specific returns to scale or a possibility of diseconomies of scale [Panzar (1989)]. Conversely, a negative sign indicates product-specific economies of scale.

The coefficients β_3 and β_4 measure the rate of change of total cost that is specific to an increase in outputs y_1 and y_2 respectively. It is assumed that all other variables are

held constant when the results are so interpreted. For example, the interpretation of β_3 can be taken as follows. Holding the production of y_2 constant and treating input prices as given, how do total costs behave when the production of y_1 is changed? The sign of β_3 will provide the answer.

Total costs will always rise with an increase in production of y_1 because non-negative input prices are considered here. However, if total costs increase at a decreasing (increasing) rate, the case when β_3 is negative (positive), it is an example of product-specific economies (diseconomies) of scale. If total costs rise in proportion to the increase in production, then it is the case of product-specific constant returns to scale.

Finally, the interaction term measures the rate of change of total cost due to the joint-production of the two products. The coefficient of this variable indicates whether there are any economies of scope between the two products. A positive (negative) sign on β_5 indicates transray concavity (convexity) of the cost function, which in turn implies diseconomies (economies) of scope from the joint production of y_1 and y_2 .

CHAPTER 6

EMPIRICAL RESULTS

6.1 Descriptive Statistics

6.1.1 Banking Activities

Two data sources for 1989 and 1990 are used in this research, the FDIC tapes for banking data and the FRY-11AS tapes for the nonbanking data. Data from the two sources are then consolidated for each bank holding company for each year. Data from the two years are further pooled for cross-sectional regressions. After a series of elimination 25,021 observations remain for the final (consolidated and pooled) sample. The elimination process is explained in Chapter 4.

Table 10 gives some descriptive statistics for the FDIC bank sample. For all bank outputs, or proxies thereof, the median values are far less than their mean counterparts. For example, mean total deposits for the 23,981 banks during 1989-90 are approximately \$180 million. However, the median total deposits are only \$41 million. Commercial and industrial loans have a mean value of roughly \$161 million, whereas the median value is \$26 million. This indicates the predominance of small sized banks in the sample. The mean values are inflated due to

the presence of some very large money center and superregional banks.

The mean and median input prices in the Table 10 are very close to each other. For example, the mean cost of loanable funds is \$0.068 per dollar, or 6.8 percent. The median value for this variable is 6.7 percent. This may or may not imply that both money center and small rural banks, on average, pay the same price for their borrowed funds. In order to further investigate this issue the sample is divided into three arbitrary groups based on deposit size as follows:

Group 1: Banks with deposits of \$100 million or less;

Group 2: Banks with deposits between \$100-\$500 million;

Group 3: Banks with deposits over \$500 million.

The descriptive statistics for selected banking variables, by bank size, are presented in Table 11.

The division of the data into subgroups suggests that there are indeed differences among them. Whereas the first two groups are similar to each other, the group consisting of the

500⁴² or so largest banks behaves differently. It seems that the largest banks, with deposits in excess of \$500 million, pay a higher price per dollar of deposits for each of the three inputs considered in this analysis.

The group 3 banks, for example, pay 60-basis points more for their loanable funds than the smallest banks and 50-basis points more than the medium-sized banks. Similarly, they pay, on average, \$3,000 per annum more to their employees in salaries and benefits than the other two group banks. Finally, their cost of physical capital per dollar of deposit is slightly higher than the two smaller group banks. One explanation for this price differential is since most of the largest banks are located in large metropolitan cities they pay a higher salary and benefits to their employees and pay a higher cost of physical capital.

6.1.2 BHCs' Banking and Nonbanking Activities

Tables 12 and 13 present the descriptive statistics for the consolidated banking and nonbanking activities of bank holding companies for 1989 and 1990 respectively. For 1989

⁴²Although there are about one thousand observations in group 3, because data for 1989 and 1990 are pooled there are roughly 500 banks in each year in this group.

there were 235 matches by bank holding company codes between the FDIC- and FRY-11AS tapes. These observations have no missing items on either tapes. The numbers for the banking activities (BK) variable were obtained by summing total loans [earning assets, as suggested by Sealey and Lindley (1977)] across all bank subsidiaries and five other subsidiary-categories of BHCs.⁴³

The rationale for including these subsidiaries in the traditional banking activities despite their appearance on the FRY-11AS (nonbanking) tapes has already been explained above. Briefly, however, the rationale is that these five activities are legally permissible and are being currently undertaken by the banking subsidiaries also.

As in Table 10, the numbers from Table 12 show significant differences between the mean and median values for all BHC outputs. The mean banking activities have more than twice the median values. The mean value for insurance business is \$10.59 million whereas the median value is only \$282,000. However, the most significant difference is in BHCs' securities activities. The majority of the sample firms do not

⁴³Data for these five categories were collected from the FRY-11AS tapes. These activities are commercial finance, mortgage banking, consumer finance, other depository institutions, and small business financing.

engage in securities business as the median value is zero.⁴⁴ The ones that do participate, however, hold large portfolios of these assets.

Banking activities dominate the other activities of bank holding companies. Among the nonbanking activities, however, the category of other nonbanking activities (ONBA) has the highest average assets. Insurance business, which comprises insurance agencies and insurance underwriting subsidiaries, are the smallest category among the four BHC outputs studied here. The descriptive statistics on the input price variables in Table 12 are comparable to those in Table 10. The mean and median values for all the three input prices are close to each other.

For the year 1990 there were 241 observations that had a clear match between the FDIC- and the FRY-11AS-tapes by BHC-codes. The descriptive statistics are presented in Table 13 which shows the same overall trend as Table 12. The only significant difference from Table 12 is that the median insurance business figure drops to zero. This implies that as

⁴⁴Table 4 shows that in 1989 only 74 BHCs were engaged in securities activities and 184 BHCs engaged in insurance related activities.

in the case of securities, the majority of the BHCs in the sample for 1990 do not participate in insurance business.⁴⁵

6.2 Regression Results

6.2.1 Banking Activities

6.2.1.1 Model 1:

Table 14 presents the results of the ordinary least square (OLS) regressions for Model 1. In this model two bank outputs are defined as total deposits and total loans. Based on the discussion in section 5.6 above, the regression results suggest that there are significant product-specific diseconomies of scale for both these products. The economic interpretation of this finding is that beyond a certain point it becomes cost ineffective to increase production of either product. Thus, for deposits, beyond a certain point banks have to pay a higher rate of interest to lure more depositors. Similarly, for loans, beyond a certain point banks have to charge a lower interest to lure additional borrowers.

The statistically significant and negative sign on the coefficient of the interaction term ($D \cdot L$) suggests that there

⁴⁵Table 4 shows that in 1990 there were only 72 BHCs engaged in securities activities and 178 BHCs engaged in insurance related activities.

are strong cost complementarities between deposits and loans activities of banks. This indicates that the joint production of deposits and loans by banks is more cost efficient than the production of these products in isolation. As mentioned earlier, the cost savings from joint production may come from sharing one or more of the capital intensive facilities, such as building, computer network, and skills of highly paid employees.

Overall, the model appears to be well specified with an R^2 of 0.9508. All of the estimated parameters are statistically significant at the 0.01-level. The coefficients of the input price variables all have positive signs. This indicates, as expected, that total costs are an increasing function of the inputs. In other words, all the three inputs are normal goods.

6.2.1.2 Model 2:

Table 15 presents the regression results for Model 2, where bank outputs are defined as earning assets. According to Sealey and Lindley (1977) total deposits are not a bank output. Some part of total deposits are actually inputs. They advocate defining bank outputs in terms of earning assets.

Thus, in Model 2, there are four bank outputs defined as, real estate loans, agricultural loans, commercial and industrial (C&I) loans, and consumer loans. The input price variables continue to be as defined in Model 1.

The statistically significant and positive coefficient on the quadratic real estate variable indicates product-specific diseconomies of scale. However, all the other three output variables show significant product-specific economies of scale. This suggests that there are cost savings from specializing in any one of the three activities- agricultural, C&I, and consumer loans. One possible source of cost savings in these three categories could be the learning curve or the skill level, for example, of loan officers. Once they have mastered the loan sanctioning process, these officers can generate substantial income to banks at relatively low marginal costs.

The pair-wise interaction terms among the four output variables provide some interesting insights into the issue of scope economies or diseconomies. There are significant economies of scope between real estate and agricultural loans, and real estate and consumer loans. Economies of scope between real estate and agricultural loans are possible due to sharing

of the bank officers' expertise/knowledge in the areas of valuation of land, building, and other properties. The result of scope economies between real estate and consumer loans is not readily apparent. It is possible that the home-builders also go for their personal loans to the same bank from where they received mortgage loans. Thus, the bank derives some cost benefits from the joint production of these two outputs.

There are significant diseconomies of scope between agricultural and C&I loans, agricultural and consumer loans, and C&I and consumer loans, when all taken pair-wise. C&I loans are usually processed and sanctioned at large banks located mainly in relatively large urban centers. Moreover, C&I loans, by definition, are oriented towards commercial and industrial units and are therefore, of high dollar denominations. There appears to be little expertise or knowledge derived from C&I loans that can be shared/utilized in the sanctioning of either agricultural loans, that are predominant in rural settings, or consumer loans that usually have much smaller denominations than C&I loans.

Similarly, the skills gained from agricultural loans cannot be readily transferred to the area of consumer loans. Hence, there are no obvious benefits from the joint production

of these two categories of loans. The interaction term between real estate and C&I loans is statistically insignificant. The other variable that is insignificant to total costs is cost of wages and employee benefits. The two other input price variables have the anticipated positive sign and are statistically significant at the 0.01-level.

The model appears to be well specified with a R^2 of 0.9673 and some strong results are obtained. All but one of the eighteen parameters to be estimated are statistically significant at the 0.01-level. The coefficient for y_2 is significant at the 0.05-level.

6.2.1.3 Model 3:

In Model 3 bank outputs are proxied by two revenue measures- interest and noninterest incomes. These revenues are generated by selling several products that are jointly produced by commercial banks. By definition interest revenues are generated from outputs that earn interest, such as all categories of loans and investment in securities. Noninterest revenues are generated from fees and handling/service charges on such activities as trust services, safe-deposit vaults, cashier's checks, and money transfers.

Table 16 presents the regression results for Model 3. When bank outputs are defined in terms of revenues it is not possible to make inferences about scale and scope economies for specific products or specific pairs of products. Only general conclusions are possible from such output specification.

Thus, the statistically significant and positive coefficient of the quadratic interest income term, (Interest Income)², indicates that there are product-specific decreasing returns to scale from products that generate interest income. By the same token, there are product-specific increasing returns to scale from products that generate noninterest income. The "products," however, are not clearly defined. For some banks these products may include the whole list of activities performed by banks, whereas for the others the list may be rather short.

Similar to the interpretation of the quadratic terms, the interaction term, (I)*(NI) only conveys a very broad conclusion. Table 16 shows a statistically significant and negative coefficient for this variable. This suggests that there are cost savings from the joint production of outputs that provide interest and noninterest income.

The costs of loanable funds (y_1) and physical capital (y_3) have coefficients that are positive and statistically significant. Cost of wages and employee benefits (y_2) is statistically insignificant to total costs. There are 23,970 observations that are used in the OLS regression for Model 3. This may be partly responsible for the extremely high R^2 value (0.9951) in addition to the fact that the explanatory variables have done a fine job of defining the relationship between total costs and bank outputs (measured by revenues).

6.2.2 Banking and Nonbanking Activities (Second Part of Dissertation)

6.2.2.1 Model 4:

In this model scale and scope economies are investigated between banking and nonbanking activities of bank holding companies. Data from all bank subsidiaries of the multi-bank holding companies (MBHC) are consolidated as single observations, each corresponding to a certain BHC-code. Thus, data for this part of the dissertation have fewer observations than for the first part. However, similar to the first part, data for the years 1989 and 1990 are pooled together for the purpose of OLS regressions.

As a result of the pooling there are 255 BHCs that are common to both years. Since there are a total of 283 observations for the year 1989 and 294 observations for 1990, this implies that 28 BHCs that were present in 1989 do not exist in 1990 data. Similarly, there are 39 new BHCs that are new additions to the FRY-11 system.

Table 17 presents the regression results for Model 4. In this model four BHC outputs are defined as total banking activities, securities activities, insurance business, and other nonbanking activities. The banking activities consist only of earning assets, hence, BHC deposits are excluded. Five items (commercial finance, mortgage banking, consumer finance, other depositories, and small business finance) from the FRY-11AS tapes are added to total loans of FDIC tapes.

Model 4 assumes that input prices are constant across the cross-section of the sample BHCs, hence they are not included in the cost equation. The equation specified for Model 4 is:

$$\begin{aligned}
 TC = & \beta_0 + \beta_1 BK + \beta_2 SEC + \beta_3 INS + \beta_4 ONBA + \beta_5 (BK)^2 + \beta_6 (SEC)^2 \\
 & + \beta_7 (INS)^2 + \beta_8 (ONBA)^2 + \beta_9 BK*SEC + \beta_{10} BK*INS + \beta_{11} BK*ONBA \\
 & + \beta_{12} SEC*INS + \beta_{13} SEC*ONBA + \beta_{14} INS*ONBA + \epsilon \quad [22]
 \end{aligned}$$

The explanation of each variable is provided in Chapter 5.

Overall, the model appears to be well specified with a high R^2 (0.9553) and strong results. Twelve of the fifteen parameters to be estimated are statistically significant at the 0.01-level. The quadratic terms pertaining to banking activities $[(BK)^2]$ and insurance business $[(INS)^2]$ are significantly different than zero and are negative. This implies that there are increasing returns to scale specific to banking activities and insurance business. There are, however, decreasing returns to scale that are specific to securities activities (SEC) and other nonbanking activities (ONBA) because the signs of the coefficients of these activities are negative and significant.

The more interesting issue for this dissertation is the investigation of cost complementarities between banking and nonbanking activities. The interaction terms provide some insight on this issue. The interaction term between banking and securities activities $[(BK)*(SEC)]$ is negative but statistically insignificant. This implies that cost savings from the joint production of these two activities are not statistically different from zero.

There are significant diseconomies of scope, however, between BHCs' banking activities and their insurance business.

Thus, it is more costly for a BHC to participate in the traditional banking activities and insurance business simultaneously. Hence, banks' demand for letting them enter insurance business does not stem from scope cost efficiency arguments.

On the other hand, there are significant economies of scope between the banking (BK) and other nonbanking activities (ONBA). Generally speaking, banks can save significantly from the joint production of banking and other nonbanking activities. It remains to be seen which of these ONBAs provides most cost savings.⁴⁶ It may be the case that all of the ONBAs show jointness in production with the traditional banking activities, otherwise there may be one or two of ONBAs that actually provide diseconomies while the remaining ONBAs provide economies of scope. The last few questions/issues are beyond the scope of this dissertation and are left for future research.

Table 17 further shows that there are statistically significant diseconomies of scope between securities and

⁴⁶As mentioned earlier, other nonbanking activities in this research not only include the activities aggregated by the Federal Reserve but also include activities that are not part of banking activities (BK) variable, securities, and insurance activities. Refer to footnote -- and Appendix for exact definition of ONBA.

insurance activities. The interaction terms between securities and ONBA, and insurance and ONBA, on the other hand, are negative and significant at the 0.01-level. This indicates strong economies of scope between these two pairs of products.

6.2.2.2 Model 5:

This model is the same as Model 4 except that the assumption of fixed input prices is dropped. Moreover, in this model it is assumed that total BHC costs are a linear function of input prices. Accordingly, in this model the multiproduct quadratic cost function (MQCF) is specified as

$$\begin{aligned}
 TC = & \beta_0 + \beta_1 BK + \beta_2 SEC + \beta_3 INS + \beta_4 ONBA + \beta_5 (BK)^2 + \beta_6 (SEC)^2 \\
 & + \beta_7 (INS)^2 + \beta_8 (ONBA)^2 + \beta_9 BK*SEC + \beta_{10} BK*INS + \beta_{11} BK*ONBA \\
 & + \beta_{12} SEC*INS + \beta_{13} SEC*ONBA + \beta_{14} INS*ONBA + \beta_{15} Y1 + \beta_{16} Y2 \\
 & + \beta_{17} Y3 + \varepsilon
 \end{aligned}
 \tag{23}$$

The explanation of each variable is provided in Chapter 5.

When the three input price variables are included in the MQCF in a linear fashion all the results of Model 4 reported in Table 17 still hold. The results for Model 5, however, are stronger than those of Model 4. Indeed, as reported in Table

18, out of the eighteen parameters to be estimated sixteen are statistically significant. Furthermore, of the sixteen parameters that are significant fifteen are significant at the 0.01-level, one being significant at the 0.05-level. The R^2 value is also slightly higher than that in the previous model.

Banking activities and insurance business continue to show product-specific economies of scale, while securities and other nonbanking activities continue to show product-specific diseconomies. The most significant difference between Models 4 and 5 is the fact that the latter demonstrates statistically significant cost complementarities between banking and securities activities. The other interaction terms have the same signs and significance levels as in the previous model.

6.2.2.3 Influence Diagnostics

Belsley, Kuh, and Welsch (1980) proposed a statistical test to measure the influence of each observation on the estimated coefficients when using OLS regressions. Influential observations are those that, according to various criteria, appear to have large influence on the parameter estimates. In order to investigate whether there are any influential observations in the data this test is performed. A few

observations are influential when measured according to one or two of the several prescribed criteria. However, no observation is influential according to all of the criteria suggested by Belsley *et al.* OLS regressions are estimated after dropping the influential observations. However, no significant differences from the original results are observed.

6.2.2.4 Models 6A and 6B: Multi-Bank Holding Companies versus One Bank Holding Companies

OLS regressions are estimated again after segregating the data according to multi-bank holding companies (MBHCs) and one-bank holding companies (OBHCs). Table 19 presents the results for the 374 MBHCs sample. Three of the four linear terms are positive and significant at the 0.01-level.

The positive coefficients on the quadratic insurance, securities and other nonbanking activities terms suggest that, absent participation in any other activity, product specific diseconomies for these activities prevail for this sample of BHCs. The statistical insignificance of the insurance coefficient, however, indicates that the hypothesis of a "flat" region of product specific insurance activity costs

cannot be rejected. The negative and significant coefficient on the quadratic banking term, however, indicates the presence of ray cost economies for this activity.

Turning to the interaction terms, significant economies of scope exist between BK and ONBA, and BK and SEC activities. The interaction term between BK and INS, though negative, is insignificant.

Table 20 contains the regression results for the OBHC sample (Model 6B). Although the R^2 value of 0.9746 is higher than that for model 6A, fewer of the coefficients attain statistical significance. Two major differences between MBHC and OBHC samples, however, are noteworthy. First, the interaction term between banking and securities activities for the OBHC sample is positive and significant at the 0.01-level. Thus, whereas for the MBHC sample this variable exhibited significant economies of scope, for the OBHC sample it shows diseconomies. Second, the banking activities for OBHCs exhibit significant product-specific diseconomies of scope. Hence, one might conclude that there are some inherent differences between OBHCs and MBHCs in the manner they carry out their banking and securities businesses.

CHAPTER 7

CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

7.1 Summary

In this dissertation the cost structure of banking industry treating banks as multi-output producing firms is investigated. Although several earlier studies address this issue, they all have certain flaws. This dissertation attempts to overcome most of these flaws. In addition to the econometric limitations, all of the earlier studies failed to address some issues that are economically and politically important. One such issue is that of jointness in production of banking and nonbanking activities. This issue is an essential part of the dissertation.

7.1.1 Scale and Scope Economies for Banking and Nonbanking Activities of BHCs

The dissertation has two parts. In the first part, economies of scale and scope are measured for traditional banking activities. In the second part, the economies are measured for banking and nonbanking activities. No published study has addressed this important issue. In addition, modern

econometric techniques and a more comprehensive data are used. Several researchers advocate the use of the multiproduct quadratic cost function (MQCF) over the traditional translog function. Several variations of MQCF are applied in this research. Furthermore, the intermediation approach, that is regarded as more relevant when addressing issues of long-term viability of firms, is adopted.

7.1.1.1 Several Alternative Definitions of Outputs and the Inclusion of Interest Expense in Total Costs

The dependent variable employed in the dissertation is total costs which includes interest and noninterest expenses. It is assumed that banks have three inputs, loanable funds, salary and benefits, and physical capital. Most earlier studies ignore loanable funds as an input and interest expense as part of total costs despite the fact that interest expense can contribute up to 70% of total banking costs.

Several alternative definitions of traditional bank outputs are used to compare the results of the dissertation with those of the earlier studies:

- [i]. Total deposits and loans
- [ii]. Earning assets (four loan categories; real estate,

agriculture, commercial & industrial, and consumer),

[iii]. Revenue measures (interest and noninterest income)

In the second part of the dissertation, three nonbanking outputs are defined: insurance, securities, and other nonbanking activities.

7.1.1.2 Use of The Multiproduct Quadratic Cost Function

Despite the use of the translog cost function in contemporary literature it suffers from several defects. The most important limitations are discussed above. Recent researchers advocate the use of the multiproduct quadratic cost function for the estimation of economies of scope. In this dissertation several specifications of the basic quadratic function are employed.

Specification 1: MQCF with fixed input prices.

Specification 2: MQCF with input prices entering linearly.

Specification 3: MQCF with input prices entering multiplicatively.

Specification 4: The "composite quadratic" function.

The empirical application of specifications 3 and 4 to BHC data, however, is left for future research.

7.1.1.3 Data Sources

Two data sources are used. For the traditional banking activities, the FDIC bank tapes that include the population of U.S. banks for years 1989 and 1990 are utilized. For the nonbanking activities, the FRY-11AS tapes for 1989 and 1990 are employed. The second data source is relatively new and unexploited as the Federal Reserve only started requiring BHCs to file these data in 1986.

7.1.2 Nonbanking Activities of Bank Holding Companies

Total nonbanking assets of bank holding companies have declined significantly over the last several years. From 1988 to 1990 they fell by 21.4 percent from roughly \$210 billion to \$165 billion. The nonbanking activities showing the sharpest decline are commercial finance, mortgage banking, consumer finance, and other nonbanking activities.

In terms of mean asset size the category of other depository institutions (ODP) is the largest. As explained earlier, this category includes depositories acquired by bank holding companies at the behest of the FDIC or other Federal agencies. Because of the increased number of failing thrifts and commercial banks during the 1980s BHCs acquired many of

these depositories. This might explain the large numbers for BHCs' ODP category. BHCs' insurance business subsidiaries, on average, have the least assets. Overall, however, the majority of nonbanking assets are held by subsidiaries that are engaged in commercial finance (CMF), mortgage banking (MTB), consumer finance (CSF), and other depository institutions (ODP). Three of these categories, excluding ODP show most decline in their assets.

In general, all of the nonbanking subsidiaries face very concentrated markets. The securities and ODP subsidiaries in particular, are the most heavily concentrated among the eleven nonbanking activities. From 1987 through 1990 the 25 largest firms have held about 90 percent of the assets of the entire nonbanking market. The largest number of firms are in the other nonbanking (ONB) activities, although insurance undertaking (INU), mortgage banking (MTB), leasing (LSG), securities brokerage (SCB), and data processing (DPI) are some of the other popular nonbanking activities.

As to the profitability of nonbanking subsidiaries over the years 1986 through 1990, in terms of their return on assets (ROAs) and return on equities (ROEs), some interesting trends are observed. Specifically, three of the activities

that can be performed by commercial banks without the formation of nonbanking subsidiaries show a decline in profitability from 1986 to 1990.

These are the same activities that BHCs are exiting. Hence, one might conclude that the BHCs are leaving commercial finance, mortgage banking, and consumer finance because these can be more profitably performed from within their banking subsidiaries. Another explanation could be that the regulatory restrictions on interstate and product-line expansion of commercial banks are no longer binding on them. In other words, commercial banks do not have to establish a nonbanking subsidiary to perform these activities, rather they can perform them within their banking subsidiaries.

7.2 Conclusions Regarding the Scope of Economies Among Banking and Nonbanking Activities

Several interesting features emerge from the estimations of the simple multiproduct quadratic cost function (MQCF) and MQCF-with-input-prices models.⁴⁷ First, the models perform very well overall, with high F-statistics and R^2 values.

⁴⁷Subsequent empirical analysis will report the results of estimations of the modified MQCFs developed by Röller (1990) and Pulley and Braunstein (1992).

Second, the specific coefficients and the levels of significance they achieve are noteworthy. The quadratic terms provide mixed evidence on the linearity of cost increases in particular outputs.

7.2.1 Model 1: Outputs Defined as Total Deposits and Loans

When bank outputs are defined as total deposits and total loans the ordinary least square regressions exhibit statistically significant cost complementarities between the two outputs. The linear terms are significant and positive and the quadratic terms reflect significant diseconomies of scale specific to deposits and loans. The input price variables are also positive and significant.

7.2.2 Model 2: Outputs Defined as Earning Assets

When four loan categories are defined as bank outputs (earning assets) some interesting results are obtained. Real estate loans show product-specific diseconomies of scale, whereas agricultural, C&I, and consumer loans, all exhibit statistically significant economies of scale specific to these products. Hence, it is cost effective for banks to specialize in any of the last three activities. The cost diseconomies

associated with real estate loans must be studied over a longer period of time, however, because it could be just a sign of a sluggish, or indeed bad economic times for the real estate industry over the period studied here.

In terms of inter-product cost complementarities real estate business goes well with agricultural and consumer loans. The interaction term between real estate and C&I loans, though negative, is statistically insignificant. The other interaction terms all indicate pair-wise significant scope diseconomies among agricultural, C&I, and consumer loans.

7.2.3 Model 3: Outputs Defined as Revenue Measures

In this model two revenue measures, interest and noninterest incomes, are defined as bank outputs. The results indicate significant diseconomies of scale specific to the products that provide interest income to banks. Examples of these activities include investments in securities and the various loan activities. On the other hand, significant product-specific economies of scale obtain from activities providing noninterest income. Noninterest income for banks comes, perhaps, from fees on trust services, securities brokerage, and cashier's checks.

7.2.4 Model 4: Outputs Defined as Banking and Nonbanking Activities (With Fixed Input Prices)

In this model four BHC outputs are defined, including one banking and three nonbanking activities. Banking activities (BK) comprise of total earning assets in traditional loan activities. The three nonbanking activities being securities brokerage (SCB), insurance (INS), and other nonbanking activities (ONBA).

In model four it is assumed that input prices remain constant across the cross-section of the data. OLS results suggest product-specific economies of scale for banking and securities activities and diseconomies of scale for securities and other nonbanking activities. The results further show statistically significant economies (diseconomies) of scope between banking and ONBA (INS) activities. The interaction term $(BK) * (SEC)$ though negative is insignificant. The R^2 value for this model is 0.9553 indicating a good fit.

7.2.5 Model 5: Outputs Defined as Banking and Nonbanking Activities (With Input Prices Interacting Linearly)

When input prices are allowed to enter the MQCF in a linear fashion almost all of the results of the previous model

(Model 4) prevail. All four quadratic terms retain the same sign and significance levels leading to the same conclusions as above. Moreover, the three interaction terms between banking (BK) and nonbanking activities retain the same signs. However, the one significant difference is that the interaction term $(BK) \cdot (SEC)$ is now statistically significant at the 0.01-level. Thus, results of this model suggest significant economies of scope between banking and securities $(BK \cdot SEC)$ and banking and other nonbanking activities $(BK \cdot ONBA)$. On the other hand, there are significant diseconomies of scope between banking and insurance business.

7.3 MBHCs versus OBHCs

There appear to be two main differences between one-bank holding companies and multi-bank holding companies. First, MBHCs (OBHCs) exhibit significant economies (diseconomies) of scope between banking and securities activities. The second difference is that MBHCs show significant scale economies specific to their banking activities. OBHCs, on the other hand, show significant diseconomies of scale. Further research is needed to investigate the possible sources of these differences between the functioning of OBHCs and MBHCs.

7.4 Directions for Future Research

Based upon the research undertaken in this dissertation several interesting topics can be pursued by researchers. These topics provide insights into meaningful issues for both regulators and bankers. Some of the important topics are listed below in no particular order of importance or feasibility.

Selecting the Right Product-Mix

We know that there are certain combinations of banking and nonbanking activities that provide cost savings from their joint production. It would be interesting to the regulators and bankers to know how do banks choose what activities to undertake. What are the factors influencing the decision-making processes of banks to arrive at the product-mix given that inter-product cost complementarities exist between certain combinations of banking-nonbanking activities?

Predicting Takeover Targets

From the FRY-11AS data it is known that 28 firms merged out of existence during 1990. Current literature mentions certain banking characteristics that make these firms prime

candidates for takeovers. As an extension of this issue, nonbanking activities may be added to the logistic framework to develop a profile of such firms, perhaps predicting takeover targets.

Finite Mixture Estimation of Multiproduct Cost Function

All of the models used in this research are based on the same fundamental assumption as made by most earlier studies. Implicitly, it is assumed that all bank holding companies in the dataset use the same technology. Hence, they all face the same long-run cost function. In other words, the long-run average cost curves for the sample firms are identical. This premise underlies all studies on the topic of economies of scale and scope in the banking literature.

Recently, Beard, Caudill, and Gropper (1991) advanced a finite mixture estimation technique for multiproduct cost functions. This technique provides estimates of the proportions of firms using the various technologies, facilitates comparisons across technologies, and preserves the traditional interpretation of the coefficients derived from cost estimation. It would be interesting to apply this technique to banking and nonbanking activities of BHCs.

Why Are BHCs Leaving Certain Nonbanking Activities?

Rationalize why bank holding companies are gradually leaving certain nonbanking activities. FRY-11AS data shows that over the course of five years (from 1986 - 1990) the amounts of assets held and the number of subsidiaries owned by bank holding companies in commercial finance, mortgage banking, and consumer finance have declined.

Is Insurance Business Really Profitable For BHCs?

Why is insurance business attracting more bank holding companies? Is it economic efficiency or gaining market share that is driving this move?

What is the Difference in the *Modus Operandi* of BHCs' Securities and Banking Activities?

Why do multi-bank holding companies and one-bank holding companies behave differently towards securities (SEC) activities and traditional banking activities (BK)? This dissertation shows significant economies of scope between (SEC)*(BK) for MBHCs and significant diseconomies of scope for OBHCs. Similarly, the results show significant product-

specific economies of scale for banking activities for MBHCs and significant diseconomies of scale OBHCs.

How do C&I Loans Affect a Bank's Real Estate Business?

Why does the inclusion of commercial and industrial loans change the sign on the quadratic real estate loan variable $[(RE)^2]$ and the interaction term between real estate and consumer loans $[(RE)*(CONS)]$?

The investigation of these questions will add to the body of knowledge in this important area of research. The findings would be interesting not only to the academicians but also to regulators and practitioners.

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APPENDICES

Appendix 1

Nonbanking Activities Permitted by Regulation

(As of January 1989)

1. Making, acquiring, or servicing loans such as would be made by the following companies:
 - consumer finance
 - credit card
 - mortgage
 - commercial finance
 - factoring
2. Operating an industrial or Morris Plan bank or other industrial loan company
3. Performing trust company or fiduciary activities
4. Investment or financial advising
5. Full payout leasing of personal or real property
6. Investments in community welfare projects
7. Data processing services
8. Acting as insurance agent or broker primarily in connection with credit extensions
9. Underwriting credit life, accident, and health insurance
10. Courier services
11. Management consulting to depository institutions
12. Issuance and sale at retail of money orders, U.S. savings bonds, and travelers' checks
13. Real estate and personal property appraisal
14. Arranging commercial real estate equity financing
15. Securities brokerage

Appendix 1 (continued)

16. Underwriting and dealing in U.S. obligations and money market instruments
17. Foreign exchange advisory and transactional services
18. Futures commission merchant
19. Investment advice on financial futures and options on futures
20. Consumer financial counseling
21. Tax planning and preparation
22. Check-guaranty services
23. Operating a collection agency
24. Operating a credit bureau

Nonbanking Activities Permitted by Order of Federal Reserve

(Only a few examples are included here. The interested reader is referred to King *et al.* (1989) for the complete list)

1. Operating a savings and loan type business in Rhode Island
2. Operating certain state stock savings bank
3. Offering NOW accounts
4. Employee benefits consultant
5. Student loan servicing activities
6. Printing and selling checks
7. Cash management services and corporate bond trading
8. Provision of financial office services
9. Consulting and management services to insolvent thrifts

Prohibited Nonbanking Activities (Appendix 1 continued)

1. Insurance premium funding
2. Underwriting life insurance not related to credit extension
3. Real estate brokerage
4. Land investment or real estate development
5. Real estate syndication
6. Management consulting
7. Property management services
8. Operating a travel agency
9. Contract data entry services
10. Underwriting property and casualty insurance
11. Dealing in platinum and palladium
12. Engaging in pit arbitrage
13. Public credit ratings on bonds, preferred stock, and commercial paper
14. Acting as a specialist in French franc options on the Philadelphia Stock Exchange
15. Selling title insurance
16. Sale of certain thrift notes
17. Oil and gas activities
18. Timber brokerage activities
19. Sale of level-term credit life insurance
20. Acceptance of deposit accounts linked to credit card accounts
21. Selling auto club memberships

APPENDIX-2**TABLE-1****Total Nonbanking Activities of Bank Holding Companies**

Total nonbanking assets held by BHCs, by type of activity*.
(Millions of dollars)

	1987	1988	1989	1990
CMF	33,869.5	37,128.3	25,293.8	22,476.1
MTB	29,555.8	27,470.8	29,262.4	20,927.8
CSF	25,151.9	24,043.7	22,094.8	15,782.0
SCB	20,989.3	32,320.9	13,737.9	17,242.1
ODP	17,921.7	19,697.2	18,439.5	27,684.8
LSG	9,006.6	9,156.7	9,278.0	8,827.8
DPI	2,029.2	1,838.0	1,945.5	2,136.1
INU	1,755.8	1,678.4	2,229.6	2,607.3
SBI	595.2	650.6	493.1	1,500.0
INB	475.6	340.0	619.8	311.5
ONB	56,865.6	55,524.7	60,959.6	45,509.4
Total	198,216.2	209,849.3	184,354.0	165,004.9

Notes:

1. CMF=commercial finance; MTB=mortgage banking; CSF=consumer finance; SCB=securities brokerage; ODP=other depository institutions; LSG=leasing; DPI=data processing; INU=insurance underwriting; SBI=small business investment company; INB=insurance business; and ONB=other nonbanking activities.

2. The figures for 1987-1988 are from Liang and Savage (1990A and 1990B); data for 1989-90 come from the FDIC- and FRY-11AS tapes.

3. Sample size for years 1987, 1988, 1989, and 1990 respectively are 298, 284, 283, and 294 firms.

* Total assets for 1986 not reported in Liang-Savage (1990A or 1990B)

TABLE-2**Mean Nonbanking Activities of Bank Holding Companies**

Mean nonbanking assets held by BHCs, by type of activity.
(Millions of dollars)

	Mean Nonbanking Assets*		
	1987	1989	1990
CMF	513.2	477.2	499.5
MTB	259.3	295.6	237.8
CSF	465.8	460.3	350.7
SCB	212.0	185.6	239.5
ODP	1,493.5	2,304.9	748.2
LSG	91.0	106.6	98.1
DPI	23.1	24.6	28.9
INU	16.0	19.7	23.7
SBI	20.5	19.0	44.1
INB	5.7	8.7	4.6
ONB	291.6	322.5	248.7

Notes:

1. CMF=commercial finance; MTB=mortgage banking; CSF=consumer finance; SCB=securities brokerage; ODP=other depository institutions; LSG=leasing; DPI=data processing; INU=insurance underwriting; SBI=small business investment company; INB=insurance business; and ONB=other nonbanking activities.

2. The figures for 1987-1988 are from Liang and Savage (1990A and 1990B); data for 1989 and 1990 come from the FDIC- and FRY-11AS tapes.

3. Sample size for years 1987, 1988, 1989, and 1990 respectively are 298, 284, 283, and 294 firms.

* Mean assets for 1986 and 1988 not reported in Liang-Savage(1990A or B)

TABLE-3**Concentration of BHCs' Nonbanking Assets**

Concentration of nonbanking assets held by BHCs, by type of activity.

	Percent Held by the Five Largest Firms*			
	1987	1988	1989	1990
CMF	68.7	63.6	66.5	73.9
MTB	78.2	75.1	72.5	74.8
CSF	62.9	63.7	67.9	80.6
SCB	95.3	86.1	90.9	91.0
ODP	98.9	95.0	99.4	79.6
LSG	50.4	51.5	50.7	58.5
DPI	70.3	68.9	70.3	69.8
INU	64.5	68.9	66.6	67.1
SBI	77.3	79.8	80.4	87.9
INB	68.1	61.2	76.4	58.5
ONB	74.9	71.0	78.8	80.8

Notes:

1. CMF=commercial finance; MTB=mortgage banking; CSF=consumer finance; SCB=securities brokerage; ODP=other depository institutions; LSG=leasing; DPI=data processing; INU=insurance underwriting; SBI=small business investment company; INB=insurance business; and ONB=other nonbanking activities.

2. The figures for 1987-1988 are from Liang and Savage (1990A and 1990B); data for 1989 and 1990 come from the FDIC- and FRY-11AS tapes.

3. Sample size for years 1987, 1988, 1989, and 1990 respectively are 298, 284, 283, and 294 firms.

* Figures for 1986 not reported in Liang-Savage (1990A or 1990B)

TABLE-4**Number of BHCs in Nonbanking Activities**

The number of firms engaged in each nonbanking activity*

	1987	1988	1989	1990
CMF	66	58	53	45
MTB	114	110	99	88
CSF	54	51	48	45
SCB	99	83	74	72
ODP	12	14	8	37
LSG	99	96	87	90
DPI	88	88	79	74
INU	110	111	113	110
SBI	29	26	26	34
INB	84	75	71	68
ONB	195	183	189	183

Notes:

1. CMF=commercial finance; MTB=mortgage banking; CSF=consumer finance; SCB=securities brokerage; ODP=other depository institutions; LSG=leasing; DPI=data processing; INU=insurance underwriting; SBI=small business investment company; INB=insurance business; and ONB=other nonbanking activities.

2. The figures for 1987-1988 are from Liang and Savage (1990A and 1990B); data for 1989 and 1990 come from the FDIC- and FRY-11AS tapes.

3. Sample size for years 1987, 1988, 1989, and 1990 respectively are 298, 284, 283, and 294 firms.

* Numbers for 1986 not reported in Liang-Savage (1990A or 1990B)

TABLE-5**Percentage Breakdown of BHCs' Nonbanking Assets**

Percentage breakdown of nonbanking assets held by BHCs

	% of Total Nonbanking Assets*				Percentage Change From 1987 to 1990
	1987	1988	1989	1990	
CMF	17.1	17.7	13.7	13.6	-20.5
MTB	14.9	13.1	15.9	12.7	-14.8
CSF	12.7	11.4	12.0	9.6	-24.4
SCB	10.6	15.4	7.5	10.4	-1.9
ODP	9.1	9.3	10.0	16.8	+84.6
LSG	4.5	4.4	5.0	5.3	+17.8
DPI	1.0	0.9	1.0	1.3	+30.0
INU	0.9	0.8	1.2	1.6	+77.8
SBI	0.3	0.3	0.3	0.9	+200.0
INB	0.2	0.2	0.3	0.2	0
ONB	28.7	26.5	33.1	27.6	-4.2

Notes:

1. CMF=commercial finance; MTB=mortgage banking; CSF=consumer finance; SCB=securities brokerage; ODP=other depository institutions; LSG=leasing; DPI=data processing; INU=insurance underwriting; SBI=small business investment company; INB=insurance business; and ONB=other nonbanking activities.

2. The figures for 1987-1988 are from Liang and Savage (1990A and 1990B); data for 1989 and 1990 come from the FDIC- and FRY-11AS tapes.

3. Sample size for years 1987, 1988, 1989, and 1990 respectively are 298, 284, 283, and 294 firms.

* Numbers for 1986 not reported in Liang-Savage (1990A or 1990B)

TABLE-6**Market Concentration of Total Nonbanking Assets**

Concentration of nonbanking activities in BHCs (year-end figures)

	1987	1988	1989	1990
<u>Percent of NBAs held by</u>				
5 Largest Firms	59.2	57.2	71.5	69.8
10 Largest Firms	74.6	73.4	82.0	80.9
25 Largest Firms	89.6	90.6	93.1	91.3
50 Largest Firms	95.8	96.9	97.4	96.4
100 Largest Firms	99.1	99.5	99.5	99.3

Notes:

1. NBAs = Nonbanking assets;

2. The figures for 1986-88 are from Liang and Savage (1990A and 1990B); data for 1989 and 1990 come from the FDIC- and FRY-11AS tapes.

3. Sample size for years 1987, 1988, 1989, and 1990 respectively are 298, 284, 263, and 271 BHCs (20 firms for 1989 and 23 firms for 1990 could not be matched with the FDIC data).

TABLE-7**Nonbanking-to-Total BHC Assets Ratios**

Nonbanking-to-total assets for bank holding companies
(Dollar figures in millions)

		1987	1988	1989	1990
<u>Average NBAs held by (\$)</u>					
5	Largest Firms	17,379	18,760	23,521	21,001
10	Largest Firms	10,954	12,038	13,485	12,165
25	Largest Firms	5,262	5,943	6,125	5,493
50	Largest Firms	2,814	3,177	3,205	2,899
100	Largest Firms	1,455	1,631	1,637	1,493
	All Firms	493	577	626	555
<u>%-Ratio of NBA-to-BHC assets</u>					
5	Largest Firms	16.6	17.6	29.1	29.7
10	Largest Firms	16.9	17.8	22.0	20.2
25	Largest Firms	11.4	12.4	14.5	13.7
50	Largest Firms	9.4	10.2	12.0	11.0
100	Largest Firms	7.7	8.2	9.5	9.3
	All Firms	6.3	6.9	8.0	7.6

Notes:

1. NBAs = Nonbanking assets;

2. The figures for 1986-88 are from Liang and Savage (1990A and 1990B); data for 1989 and 1990 come from the FDIC- and FRY-11AS tapes.

3. Sample size for years 1987, 1988, 1989, and 1990 respectively are 298, 284, 263, and 271 BHCs (20 firms for 1989 and 23 firms for 1990 could not be matched with the FDIC data).

TABLE-8**Return on Assets Ratios of Nonbank Subsidiaries**

Median income-to-asset ratios (ROAs) of nonbank subsidiaries,
1986-1990:

(Percent-ratios)

	Income-to-Assets				
	1986	1987	1988	1989	1990
CMF	0.67	0.81	0.93	1.36	0.38
MTB	1.32	0.04	0.92	0.20	1.11
CSF	2.19	1.24	0.70	1.45	1.40
SCB	10.49	19.03	0.00	5.67	7.01
ODP	0.72	0.75	0.43	0.43	0.16
LSG	1.44	0.82	1.38	1.38	1.05
DPI	3.56	3.51	2.21	2.28	4.44
INU	8.93	7.38	7.20	7.94	7.57
SBI	0.00	-2.30	2.61	-.32	0.68
INB	7.94	12.07	8.85	9.54	10.01
ONB	1.35	0.98	0.90	1.51	2.10

Notes:

1. CMF=commercial finance; MTB=mortgage banking; CSF=consumer finance; SCB=securities brokerage; ODP=other depository instns; LSG=leasing; DPI=data processing; INU=insurance underwriting; SBI=small business investment company; INB=insurance business; and ONB=other nonbanking activities.

2. The figures for 1986-88 are from Liang and Savage (1990A and 1990B); data for 1989 and 1990 come from the FDIC- and FRY-11AS tapes.

3. Sample size for years 1986, 1987, 1988, 1989, and 1990 respectively are 303, 298, 284, 283, and 294 firms.

TABLE-9**Return on Equity Ratios of Nonbank Subsidiaries**

Median income-to-equity ratios (ROEs) of nonbank subsidiaries, 1986-1990:

(Percent-ratios)

Income-to-Equity					
	1986	1987	1988	1989	1990
CMF	6.05	8.00	10.94	15.27	4.52
MTB	14.90	2.04	2.93	2.65	6.08
CSF	16.29	14.73	8.61	11.56	12.80
SCB	15.97	19.03	0.0	9.42	10.48
ODP	10.16	6.42	3.80	3.80	2.06
LSG	9.30	6.05	7.10	9.14	4.78
DPI	15.52	9.74	11.70	8.69	10.35
INU	18.60	14.48	13.70	14.85	14.66
SBI	0.20	-2.71	3.68	0.33	0.68
INB	20.00	22.69	20.40	19.99	20.16
ONB	7.40	5.49	6.0	5.14	6.53

Notes:

1. CMF=commercial finance; MTB=mortgage banking; CSF=consumer finance; SCB=securities brokerage; ODP=other depository instns; LSG=leasing; DPI=data processing; INU=insurance underwriting; SBI=small business investment company; INB=insurance business; and ONB=other nonbanking activities.

2. The figures for 1986-88 are from Liang and Savage (1990A and 1990B); data for 1989 and 1990 come from the FDIC- and FRY-11AS tapes.

3. Sample size for years 1986, 1987, 1988, 1989, and 1990 respectively are 303, 298, 284, 283, and 294 firms.

TABLE-10**Descriptive Statistics: Banking Activities**

Descriptive statistics on the pooled data for banking activities (1989-90)

(All numbers except y1 and y3 are in thousands of dollars; y1 and y3 are ratios)

Name of Variable	# Observations	Mean	Median
Total Costs (TC)	23,981	21,612	3,863
Total Deposits (D)	23,981	179,928	41,299
Total Loans (L)	23,552	70,494	22,583
Real Estate Loans (RE)	23,917	60,087	11,158
Agriculture Loans (AG)	17,782	3,513	1,439
Commercial & Ind'l (CI)	23,757	39,857	3,983
Consumer Loans (CN)	23,511	18,122	3,813
Interest Income (I)	23,981	22,178	4,232
Noninterest Income (NI)	23,970	3,480	288
Cost of Loanable Funds(y1)*	23,981	0.068	0.067
Cost of Wages & Benefits(y2)	23,981	27,459	26,250
Cost of Physical Capital(y3)	23,981	0.005	0.005

*y1 = total interest expense/total interest bearing deposits

y2 = total salaries & employee benefits/# full-time equivalent employees

y3 = total rental and other fixed costs/total deposits

TABLE-11**Group-wise Descriptive Statistics for Banking Activities**

Descriptive statistics on selected data for banking activities (1989-90), by deposit-size groups:

(All numbers except y1 and y3 are in thousands of dollars; y1 and y3 are ratios)

Var Name	Group 1		Group 2		Group 3	
	# Obs.	Mean	# Obs.	Mean	# Obs.	Mean
TC	18,806	3,533	4,171	19,013	1,004	371,052
D	18,806	36,949	4,171	194,447	1,004	2,797,764
L	18,774	21,831	4,103	131,206	675	1,054,904
y1	18,806	0.067	4,171	0.068	1,004	0.073
y2	18,806	27,344	4,171	27,242	1,004	30,512
y3	18,806	0.005	4,171	0.005	1,004	0.006

Note:

1. Group 1 contains banks with deposits \$100 million or less;
Group 2 contains banks with deposits between \$100-\$500 million;
Group 3 contains banks with deposits over \$500 million.
2. TC=Total costs;
D =Total deposits;
L =Total loans;
y1=total interest expense/total interest bearing deposits;
y2=salaries & employee benefits/# full-time equivalent employees;
y3=total rental and other fixed costs/total deposits.

TABLE-12**Descriptive Statistics: Banking and Nonbanking Data (1989)**

Descriptive statistics on the data for bank holding companies' banking and nonbanking activities (1989):

(All numbers except y1 and y3 are in thousands of dollars; y1 and y3 are ratios)

Name of Variable	# Observations	Mean	Median
Total Costs (TC)	235	864,238	193,105
Banking Activities [#]	235	2,057,058	873,817
Securities Activities (SEC)	235	33,706	0
Insurance Business (INS)	235	10,591	282
Other Nonbanking Activities (ONBA)	235	252,262	2,909
Cost of Loanable Funds (y1) [*]	235	0.070	0.069
Cost of Wages & Benefits (y2)	235	26,977	26,060
Cost of Physical Capital (y3)	235	0.006	0.005

[#]Banking activities include total loans from the FDIC data plus five activities from the FRY-11AS tapes. The five activities are commercial finance, mortgage banking, consumer finance, other depository institutions, and small business.

^{*}y1 = total interest expense/total interest bearing deposits

y2 = total salaries and employee benefits/# full-time equivalent employees

y3 = total rental and other fixed costs/total deposits

TABLE-13**Descriptive Statistics: Banking and Nonbanking Data (1990)**

Descriptive statistics on the data for bank holding companies' banking and nonbanking activities (1990):

(All numbers except y1 and y3 are in thousands of dollars; y1 and y3 are ratios)

Name of Variable	# Observations	Mean	Median
Total Costs (TC)	241	656,975	154,873
Banking Activities [#]	241	1,851,028	816,955
Securities Activities (SEC)	241	43,070	0
Insurance Business (INS)	241	10,314	0
Other Nonbanking Activities (ONBA)	241	196,534	2,116
Cost of Loanable Funds (y1) [*]	241	0.069	0.069
Cost of Wages & Benefits (y2)	241	26,625	25,747
Cost of Physical Capital (y3)	241	0.006	0.005

[#]Banking activities include total loans from the FDIC tapes plus five activities from the FRY-11AS tapes. The five activities are commercial finance, mortgage banking, consumer finance, other depository institutions, and small business.

^{*}y1 = total interest expense/total interest bearing deposits

y2 = total salaries and employee benefits/# full-time equivalent employees

y3 = total rental and other fixed costs/total deposits

TABLE-14**Regression Results for Model 1**

Regression results for Model 1 (outputs: total deposits and loans):

$$TC = \beta_0 + \beta_1 D + \beta_2 L + \beta_3 D^2 + \beta_4 L^2 + \beta_5 D \cdot L + \beta_6 Y1 + \beta_7 Y2 + \beta_8 Y3 + \varepsilon$$

Variable Name	Parameter Estimate	t-statistics
Deposits	0.027*	24.761
Loans	0.103*	77.258
(Deposits) ²	2.1E-8*	35.664
(Loans) ²	2.6E-8*	70.687
(Deposits)*(Loans)	-4.9E-8*	-49.256
Cost of Funds (y1)	73173*	9.129
Cost of Wages (y2)	52.40*	6.664
Cost of Physical Capital (y3)	192375*	10.161
Intercept	-7163.9*	-12.465
R ²	0.9508	
Number of Observations	23,552	

Note:

* indicates significant at the 0.01-level

TABLE-15**Regression Results for Model 2**

Regression results for Model 2 (outputs defined as earning assets):

$$TC = \beta_0 + \beta_1 RE + \beta_2 AG + \beta_3 CI + \beta_4 CN + \beta_5 (RE)^2 + \beta_6 (AG)^2 + \beta_7 (CI)^2 + \beta_8 (CN)^2 + \beta_9 RE*AG \\ + \beta_{10} RE*CI + \beta_{11} RE*CN + \beta_{12} AG*CI + \beta_{13} AG*CN + \beta_{14} CI*CN + \beta_{15} Y1 + \beta_{16} Y2 + \beta_{17} Y3 + \epsilon$$

Variable Name	Parameter Estimate	t-statistics
Real Estate (RE)	0.094*	63.503
Agriculture (AG)	0.275*	27.910
Comm. & Ind.(CI)	0.217*	81.307
Consumer (CN)	0.163*	65.019
(Real Estate) ²	1.2E-7*	27.318
(Agriculture) ²	-1.0E-5*	-31.402
(Comm.& Ind.) ²	-2.2E-7*	-21.657
(Consumer) ²	-7.6E-8*	-10.260
(RE)*(AG)	-2.5E-6*	-20.239
(RE)*(CI)	-2.6E-9	-0.254
(RE)*(CN)	-2.0E-7*	-19.615
(AG)*(CI)	4.6E-6*	24.717
(AG)*(CN)	1.8E-6*	19.615
(CI)*(CN)	1.9E-7*	10.294
Cost of Funds (y1)	64295*	10.564
Cost of Wages (y2)	9.979**	1.789
Cost of Physical Capital (y3)	146362*	9.646
Intercept	-4869*	-11.124
R ²	0.9722	
Number of Observations	17,440	

*indicates significant at the 0.01-level; **significant at the 0.05-level.

TABLE-16**Regression Results for Model 3**

Regression results for Model 3 (outputs defined as bank revenues):

$$TC = \beta_0 + \beta_1 I + \beta_2 NI + \beta_3 I^2 + \beta_4 (NI)^2 + \beta_5 I * NI + \beta_6 Y1 + \beta_7 Y2 + \beta_8 Y3 + \varepsilon$$

Variable Name	Parameter Estimate	t-statistics
Interest Income (I)	0.878*	402.306
Noninterest Income (NI)	0.743*	66.451
(Interest Income) ²	2.8E-8*	18.330
(Nonint. Income) ²	-2.6E-7*	-14.761
(I)*(NI)	-1.1E-7*	-12.792
Cost of Funds (y1)	185144*	18.705
Cost of Wages (y2)	-12.748	-1.170
Cost of Physical Capital (y3)	178899*	6.797
Intercept	-13463*	-19.067
R ²	0.9951	
Number of Observations	23,970	

* indicates significant at the 0.01-level

TABLE-17**Regression Results for Model 4**

Results of pooled cross-sectional regression for BHCs' banking and nonbanking activities (1989-90):

Model 4: Assumes fixed input prices

$$TC = \beta_0 + \beta_1 BK + \beta_2 SEC + \beta_3 INS + \beta_4 ONBA + \beta_5 (BK)^2 + \beta_6 (SEC)^2 + \beta_7 (INS)^2 + \beta_8 (ONBA)^2 \\ + \beta_9 BK*SEC + \beta_{10} BK*INS + \beta_{11} BK*ONBA + \beta_{12} SEC*INS + \beta_{13} SEC*ONBA + \beta_{14} INS*ONBA + \epsilon$$

Variable Name	Parameter Estimate	t-statistics
Banking Activities (BK)	0.272*	9.082
Securities Activities (SEC)	-0.441	-0.231
Insurance Business (INS)	14.451*	3.614
Other Nonbanking Activities (ONBA)	2.718*	11.873
(BK) ²	-2.1E-8*	-4.224
(SEC) ²	1.1E-5*	6.888
(INS) ²	-5.9E-5*	-3.561
(ONBA) ²	2.8E-6*	11.500
(BK)*(SEC)	-9.1E-7	-1.453
(BK)*(INS)	2.2E-6*	5.025
(BK)*(ONBA)	-3.1E-7*	-4.836
(SEC)*(INS)	0.0004*	8.414
(SEC)*(ONBA)	-1.2E-5*	-6.759
(INS)*(ONBA)	-9.2E-5*	-9.750
Intercept	-14601	-0.371
R ²	0.9553	
Number of Observations	476	

* indicates significant at the 0.01-level

TABLE-18**Regression Results for Model 5**

Pooled regression for BHCs' banking and nonbanking activities:

Model 5: Assumes total costs are a linear function of input prices

$$TC = \beta_0 + \beta_1 BK + \beta_2 SEC + \beta_3 INS + \beta_4 ONBA + \beta_5 (BK)^2 + \beta_6 (SEC)^2 + \beta_7 (INS)^2 + \beta_8 (ONBA)^2 + \beta_9 BK \cdot SEC \\ + \beta_{10} BK \cdot INS + \beta_{11} BK \cdot ONBA + \beta_{12} SEC \cdot INS + \beta_{13} SEC \cdot ONBA + \beta_{14} INS \cdot ONBA + \beta_{15} y_1 + \beta_{16} y_2 + \beta_{17} y_3 + \varepsilon$$

Variable Name	Parameter Estimate	t-statistics
Banking Activities (BK)	0.282*	9.985
Securities Activities (SEC)	0.348	0.198
Insurance Business (INS)	11.569*	3.082
Other Nonbanking Activities (ONBA)	2.661*	12.447
(BK) ²	-2.0E-8*	-4.410
(SEC) ²	1.0E-5*	6.896
(INS) ²	-4.6E-5*	-2.993
(ONBA) ²	2.7E-6*	11.651
(BK) * (SEC)	-1.3E-6**	-2.211
(BK) * (INS)	2.1E-6*	5.167
(BK) * (ONBA)	-3.0E-7*	-4.989
(SEC) * (INS)	0.0004*	8.668
(SEC) * (ONBA)	-1.1E-5*	-6.329
(INS) * (ONBA)	-8.8E-5*	-10.001
Cost of Funds (y1)	19405714*	4.729
Cost of Wages (y2)	27479*	5.047
Cost of Physical Capital (y3)	4593627	0.368
Intercept	-2128409*	-7.438
R ²	0.9613	
Number of Observations	476	

*indicates significant at the 0.01-level; **significant at the 0.05-level.

TABLE-19**Regression Results for Model 6A**

Model 6A: Regression results for multi-bank holding companies (MBHCs)

$$TC = \beta_0 + \beta_1 BK + \beta_2 SEC + \beta_3 INS + \beta_4 ONBA + \beta_5 (BK)^2 + \beta_6 (SEC)^2 + \beta_7 (INS)^2 + \beta_8 (ONBA)^2 + \beta_9 BK \cdot SEC \\ + \beta_{10} BK \cdot INS + \beta_{11} BK \cdot ONBA + \beta_{12} SEC \cdot INS + \beta_{13} SEC \cdot ONBA + \beta_{14} INS \cdot ONBA + \beta_{15} Y1 + \beta_{16} Y2 + \beta_{17} Y3 + \epsilon$$

Variable Name	Parameter Estimate	t-statistics
Banking Activities (BK)	0.262*	7.560
Securities Activities (SEC)	-0.217	-0.110
Insurance Business (INS)	19.482*	2.913
Other Nonbkg. Acts. (ONBA)	2.598*	10.760
(BK) ²	-1.2E-8**	-1.738
(SEC) ²	1.0E-5*	6.520
(INS) ²	1.2E-5	0.285
(ONBA) ²	2.8E-6*	10.595
(BK) * (SEC)	-1.1E-6**	-1.611
(BK) * (INS)	-1.4E-6	-0.639
(BK) * (ONBA)	-3.4E-7*	-4.877
(SEC) * (INS)	0.00042*	7.475
(SEC) * (ONBA)	-1.2E-5*	-5.940
(INS) * (ONBA)	-8.3E-5*	-8.146
Cost of Funds (y1)	24886390*	4.628
Cost of Wages (y2)	35432*	5.139
Cost of Physical Capital (y3)	-8963758	-0.528
Intercept	-2604172*	-7.237
R ²	0.9639	
Number of Observations	374	

* indicates significant at the 0.01-level; ** indicates significant at the 0.10-level.

TABLE-20**Regression Results for Model 6B**

Model 6B: Regression results for one-bank holding companies (OBHCs)

$$TC = \beta_0 + \beta_1 BK + \beta_2 SEC + \beta_3 INS + \beta_4 ONBA + \beta_5 (BK)^2 + \beta_6 (SEC)^2 + \beta_7 (INS)^2 + \beta_8 (ONBA)^2 + \beta_9 BK \cdot SEC \\ + \beta_{10} BK \cdot INS + \beta_{11} BK \cdot ONBA + \beta_{12} SEC \cdot INS + \beta_{13} SEC \cdot ONBA + \beta_{14} INS \cdot ONBA + \beta_{15} y_1 + \beta_{16} y_2 + \beta_{17} y_3 + \varepsilon$$

Variable Name	Parameter Estimate	t-statistics
Banking Activities (BK)	0.117*	10.180
Securities Activities (SEC)	-110.54*	-2.619
Insurance Business (INS)	-2.557	-0.403
Other Nonbanking Activities (ONBA)	-0.527**	-2.251
(BK) ²	2.2E-8**	2.176
(SEC) ²	0.034**	2.091
(INS) ²	-1.7E-6	-0.931
(ONBA) ²	9.0E-6*	2.945
(BK) * (SEC)	0.0004*	6.750
(BK) * (INS)	1.7E-5	0.359
(BK) * (ONBA)	-4.7E-7**	-2.111
(SEC) * (INS)	0.0063	0.486
(SEC) * (ONBA)	-0.0034	-1.389
(INS) * (ONBA)	0.0005	0.154
Cost of Funds (y1)	383270	1.234
Cost of Wages (y2)	229.264	0.534
Cost of Physical Capital (y3)	1999589**	2.291
Intercept	-37612	-1.470
R ²	0.9746	
Number of Observations	102	

*indicates significant at the 0.01-level; **significant at the 0.05-level.

VITA

Atul Kumar Saxena was born in Basti, in the state of Uttar Pradesh, India on October 8, 1957. He attended elementary schools at the Sacred Heart Convent, Mathura, and Colvin Taluqdar's, Lucknow. He passed the Indian School Certificate Examination (ISCE) from St. Joseph's High School, Allahabad, in 1975. He passed the U.P. Board's Intermediate Examination from the Government Intermediate College, Allahabad, in 1976. He went to M.M.H. Degree College, Ghaziabad to receive the degree of Bachelor of Science in Mathematics, Physics, and Chemistry in August 1978. The same month he joined the University of Delhi and in April 1980 received the Master of Art degree in History.

He worked as a Management Trainee at Punjab National Bank from February 18, 1980 to January 15, 1981. On January 16, 1981 he joined Bank of India as a Probationary Officer at Jullunder and at the end of his first year got confirmed in the bank. He was transferred to another branch of Bank of India in Lucknow, where he worked as the Assistant Manager (Credit) from June 1982 to September 1983. From September 1983 to August 1986 he worked at Bank of India's Regional Office at Ghaziabad.

In August 1986 he came to attend the University of Georgia, Athens and received the Master of Business Administration degree in Management in June 1988. He joined the University of Tennessee, Knoxville in August 1989 and received the Doctor of Philosophy degree in Business Administration with a major in Finance and a minor in Industrial Organization in August 1993.

He will join the faculty at the Stetson School of Business and Economics, Mercer University, Macon, from September 1993.