AN ANALYSIS OF THE BEHAVIOR
COMMERCIAL BANKS

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STAFF PAPER SERIES No. 82-05

PHILIPPINE INSTITUTE FOR DEVELOPMENT STUDIES

DECEMBER 1982

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This is part of a larger study on "The Structure and Growt of the Philippine Financial Market and the Behavior of Its Majo Components", support of which comes from PIDS.

The paper has benefitted from the comments of Dr. Edita A. Tan, Dr. José Encarnación, Jr., Dr. Rolando A. Danao, Dr. Manue F. Montes and Dr. Eli M. Remolona. The author wishes to thank the Central Bank for the cooperation.

The views expressed in this study are those of the author and do not necessarily reflect those of the Institute.

ABSTRACT

This study has attempted to analyze the behavior of Philippine commercial banks. The recent contributions by various authors to the theory of the multiproduct firm provide the basis for analyzing bank behavior. In this framework, the bank is viewed as a producing unit rather than an investor. This approach recognizes the role of production technology in determining the optimal mix of outputs and inputs and size of bank operation.

Four competing models representing different production technologies were hypothesized. As revealed, the model that best describes bank behavior is that which does not allow differences in production structure among the years (i.e., 1977-1979) and assumes jointness in the production process and centralized decision-making. In other words, banks produce the different financial products (i.e., secured loans, unsecured loans, short-term loans, long-term loans, investments, demand deposits and other bank services) jointly and their choice of output mix depends on the input mix. Some information, like the marginal cost of producing each bank output, scale economies, demand for factor inputs, etc.,

which generally interest both bank managers and regulatory authorities were then obtained from the underlying production technology of banks.

Since banks are multiproduct firms, it is necessary to make a distinction between savings in costs derived from expanding the scale of operation (economies of scale) from those derived from producing different products in combination (economies of scope). The existence of scale economies encourages bigness, while the existence of scope economies encourages product diversification. Results showed that a majority of banks had either completely or nearly exhausted the economies of scale. Thus, a policy encouraging banks to expand further their size through internal capital build-up and/or merger is indeed a less desirable policy option. However, economies of scope were found to exist in the production of short- and long-term loans. In other words, it is cheaper to produce both types of loans in combination rather than separately. This may serve as an argument for encouraging banks to produce both short- and long-term loans without necessarily requiring them to increase their size. However, there is a need to lift policies biased towards short-term loans so that banks can fully enjoy the economies of scope.

Some results of this study can aid us in understanding the role of bank behavior and monetary policies in determining the supply of money. According to one simple model of money supply determination, the supply of money varies positively with policy controlled reserve base but inversely with banks' free reserves. Free reserves vary inversely with the prices of funds used by banks as inputs in the production process; thus, money supply, in turn, responds inversely to the prices of funds. In this study, however, the demand for borrowed funds and deposits deduced from the production technology of banks was found to be inelastic. This means that changing the prices of borrowed funds (including rediscount rates) and deposits will leave the quantity demanded of such factor inputs virtually unaffected. In this case, therefore, the rediscounting policies of the Central Bank will be left powerless to influence money supply movements.

The current deregulation of interest rates will likely make banks' demand for deposits and funds borrowed from the money market relatively more price elastic. In view of this, it is worthwhile to set the rediscount rates at levels competitive with money market rates to make the demand for these funds also price elastic. Thus, banks' free reserves, which partly determine movements of the supply of money, will be responsive to market forces, as expressed through the market rates of interest on loans, deposits and money market instruments, and on Central Bank's policy decisions, as expressed through movements on the rediscount rates. In this regard, it is suggested that the rediscounting facility of the Central Bank be used more as an instrument for controlling movements of the supply of money and less as an allocative instrument

Finally, the issue of using implicit or explicit pricing scheme on demand deposits was discussed. Currently, banks are using implicit pricing. It is, however, our view to use explicit pricing for reason of efficiency. The finding that banks realize a comfortable positive net implicit return on demand deposit accounts makes this shift in policy even more appropriate.

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INTRODUCTION

I.1 Rationale of the St

The commercial banking system is to date the most dominant force in the financial system of the Philippines. It shares about one-half of the total financial assets of the system and over three-fourths of those of the banking system.[1] Since its inception, the commercial banking system has tremendously grown in size and complexity, and its structure has been considerably altered as a result of changes in management decisions and regulatory policies.

Despite the important role played by Philippine commercial banks in the overall development process, no rigorous empirical analysis of their behavior has been done so far. This is quite unfortunate since knowledge of the behavior of commercial banks is essential in at least two respects.[2] First, commercial banks are among

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[1]See the Joint IMF/WB Mission Report, 1980.

[2]A growing number of economists have pointed out the importance of understanding bank behavior. For example, see Sealey (1980), Baltensperger (1980), Adar et al. (1975), Klein (1971), and Pesek (1970).

the most heavily regulated firms in the economy. The effectiveness of regulations depends to a large extent on the understanding of the behavioral characteristics of commercial banks. Second, it is now widely recognized that the role of intermediary decisions, particularly those of commercial banks, largely influences the money supply. This new view of money supply determination requires a better understanding of individual commercial bank behavior to comprehend fully money supply movements.

Recently, the regulatory authorities have introduced a number of policies which would significantly alter the banking environment.[3] Commercial banks would certainly respond (either favorably or unfavorably) to these new policies in terms of making major portfolio adjustments (i.e., changing the mix of assets and liabilities) and of altering the scale of operation to achieve their set objectives. Their response will be

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[3]The new policies refer to the financial reforms of 1980 embodied in Central Bank (CB) Circular Nos. 739 to 742 and to the deregulation of interest rates on loans and deposits incorporated in CB Circular No. 777.

significant since they are the most important portfolio managers in the entire financial sector. Within this context, understanding the behavior of commercial banks is even more important in order to determine the extent of and enhance the effectiveness of these new policies. This study is a step towards that direction. It attempts to investigate the behavior of individual commercial banks.

I.2 Statement of the Problem

Two general approaches to the study of bank behavior are discernible in economic literature. One focuses on the "financial" aspect of banking. This approach views banks as rational investors. It is mainly interested in determining the optimal mix of assets and liabilities which is solved using Markowitz's (1952) theory of portfolio selection.[4]

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[4]A number of studies on bank behavior have used this approach. For example, see Sharpe (1967), Lee and Leroy (1973), Hart and Jaffee (1974), Mingo and Wilkowitz (1977), Fortson and Dince (1977), Eatman and Sealey (1979), Booth and Dash (1979), and Buser (1980).

This approach is deemed inadequate because it cannot answer important questions, like optimal scale of bank operation, marginal costs of the different types of loans, etc., which are extremely important in making decisions. Sealey and Lindley (1979) attribute its inadequacy mainly to the omission of the production constraint under which banks operate.

The other approach focuses on the "real resource" aspects of banking. It treats banks like any other producing units. Borrowing from the neoclassical theory of the firm, a production function or cost function is specified to capture the behavior of banks. As such, the approach is mainly concerned with determining the optimal size of banks and related issues, such as the marginal cost of producing a bank output, the demand for the factor inputs, etc.[5]

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[5]Unlike the first approach, the second was rarely used in modelling bank behavior. Studies using the second approach can be found in Greenbaum (1967), Bell and Murphy (1968), Benston (1972), Mullineaux (1978), and Richard and Villanueva (1978). Admittedly, these studies did not pay attention at all to the elasticities of demand for the factor inputs as well as to the substitution elasticities among the factor inputs.

Studies using the second approach are not without inadequacies. Most models using the neoclassical theory of the firm assume that banks produce a single homogeneous product. Such models, therefore, are not capable of dealing with the important issues of asset or product diversification. Although some models recognize the fact that banks are multiproduct firms, severe *a priori* restrictions are oftentimes imposed on the structure of production.[6] It should, however, be noted that putting severe *a priori* restrictions to an otherwise unrestricted or less restricted production function can result in substantial errors in the estimation of scale economies, marginal costs, and in deriving other important information from the production function.[7]

Baltensperger (1980) observes that both approaches to the study of bank behavior have progressed independently of each other as if the "financial" and

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[6]An example of the highly restricted model is the Cobb-Douglas production function.

[7]This has been demonstrated for other industries in the U.S. by Christensen and Greene (1976), Brown *et al*. (1979), and Spady and Friedlaender (1980).

the "real resource aspects of banking can be separated. In the process of looking for that optimal mix of assets and liabilities, the bank makes use of real resources, such as labor, capital, etc. On the other hand, in determining the scale of operation the bank must also consider the diversity of its asset and liability holdings. It is clear then that decisions regarding the structure of assets and liabilities and scale are made jointly by banks. Thus, in analyzing bank behavior, the issues of determining the mix of assets and liabilities and scale have to be dealt with simultaneously. This is necessary because policies directly affecting the bank's decision regarding the use of real resources would affect decisions regarding the mix of assets and liabilities. Likewise, policies directly affecting the bank's decision concerning the mix of assets and liabilities would consequently force the bank to make changes in the use of real resources. This clearly requires an integrative approach to the study of bank behavior to predict more accurately the reactions of banks to certain policies.

This study attempts to simultaneously deal with the issues of determining the optimal mix of assets and liabilities and the scale of operation of individual banks. To achieve this, the theory of the multiproduct firm will be utilized.[8] In this framework, the bank is viewed as a multiproduct, multifactor entity. Furthermore, the role of the production technology in determining the optimal mix of assets and liabilities and the size of bank operation is given due importance. The specific objectives of this study are:

1) to determine the underlying production technology of the banking firm;

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[8]Despite early observations by many economists that the multiproduct firm is the rule rather than the exception in the modern capitalist economy, the rigorous development of the theory of the multiproduct firm is only very recent. This is mainly due to some conceptual problems, i.e., many of the concepts commonly used in a single-product firm cannot be readily applied to a multiproduct firm without further qualification, and to the difficulty in specifying a sensible and estimable functional form for a multiproduct technology. The first problem is studied more deeply by Lau (1972), McFadden (1978), Panzar and Willig (1975), Baumol (1977), and Laitinen (1980), while the second is sufficiently treated by Diewert (1971), Christensen et al. (1973), Lau (1974), and Hall (1973) who proposed different functional forms which can facilitate the analysis of the behavior of a multiproduct firm.

2) to provide estimates of the marginal costs of producing various bank outputs;

3) to verify the existence of economies of scale;

4) to examine the possibilities of product diversification or specialization; and

5) to provide estimates of the elasticities of the demand for factor inputs and elasticities of substitution among factor inputs.

Any attempt to use the theory of the multi-product firm to analyze bank behavior requires an appropriate classification of bank outputs and inputs. Thus, we will be confronted with the problem of determining which of the balance sheet items can be considered as bank outputs or inputs. This issue will also be pursued in this study as a corollary objective.

I.3 The Data Base

Of the thirty-two commercial banks in existence, twenty-seven private domestic banks were selected to compose the observations of this study. The Philippine National Bank (PNB), Bank of America, Chartered Bank, City Bank, and Hongkong and Shanghai Bank were deliberately excluded because their characteristics differ from those of the private domestic banks. PNB is an extraordinarily large government bank whose 1979 assets were approximately seven times greater than those of the biggest private domestic bank. Its operations are heavily influenced by the priorities set by the government. The four other banks are foreign branches of multinational banks. Their operations are inevitably influenced by the objectives of their mother banks.

The combined assets of the twenty-seven private stic banks comprised 60.6 percent of the total assets of the commercial banking system in 1979.

Since the paucity of the observations poses a great problem in estimating parameters, pooling of the cross-section observations for several years to increase the sample size was resorted to. The calendar years

1977 to 1979 were selected because the number of banks were the same during this period.

The data for this study were obtained mainly from published reports and from the unpublished periodic reports of individual banks to the Central Bank. The latter requires the individual banks to submit a statement of conditions (balance sheet) and to publish it in major daily newspapers on a quarterly basis. Income statement is reported to the Central Bank semi-annually. Banks are not required to publish the income statement in major daily newspapers. Nevertheless, they incorporate it in their annual reports which are distributed to their stockholders.

In reporting balance sheets and income statements, banks are required to follow strictly the Manual of Accounts for Commercial Banks approved and prescribed by the Monetary Board.[9] The said manual indicates and defines in greater detail the items to be reported by banks.

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[9]See CB Circular No. 522.

The degree of disaggregation of the data reported in the balance sheets differs from those contained in the income statements. Data from the former are highly disaggregative while those from the latter are quite aggregative. For instance, outstanding balances of savings and time deposits are classified separately in the balance sheets, but interest expenses on them are lumped together in the income statements. Since some of the detailed items are less relevant to this study, items in the financial statements were rearranged and reclassified to suit the framework of this study. (See Appendix A.1 and A.2).

In this study, loans are classified according to security and maturity. This classification is deemed important for both policy- and decision-making purposes.[10] The information regarding loans classified according to security and maturity were obtained from the subsidiary ledgers of individual banks. Unfortunately, cross-tabulations of loans by security and maturity could not be derived from the said reports.

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[10] There are other ways of classifying loans, such as by interest rate, by types of borrowers, etc. but these are less relevant to the objectives of this study. See Appendix A of the Manual of Accounts for Commercial Banks (1976).

I.4 Organization of the Study

Chapter II briefly describes the structure, growth, and performance of individual banks. The framework for analyzing bank behavior is presented in Chapter III. The application of the theory of the multiproduct firm to the banking firm, however, requires an appropriate classification of bank outputs and inputs. Chapter IV deals with this problem and also provides estimates of the net rates of return on the various elements of bank portfolio. The econometric model is presented in Chapter V. Chapter VI discusses the empirical results. Chapter VII summarizes the major findings and discusses some policy implications.

Chapter II

FINANCIAL STRUCTURE, GROWTH AND PERFORMANCE OF INDIVIDUAL COMMERCIAL BANKS

This chapter briefly describes the structure, growth and performance of individual commercial banks.[1] Table I ranks the twenty-seven commercial banks according to size of their total assets. The sizes of banks widely varied.[2] The biggest bank was at least eight times greater than the smallest bank.

During the period 1977 to 1979, the individual banks were generally characterized by a rapid growth of assets. Again, the average annual growth rates considerably differed among banks, ranging from 5.0 to 211.2 percent annually. This resulted in a constant change in the ranking of banks during this period.

To have a more meaningful analysis of the financial structure and growth of individual banks, the simple flow of funds analysis is utilized.

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[1]Patrick and Moreno (1980) also discussed in detail the performance of individual banks, but their emphasis differs from that of this study. See also Tan (1981).

[2]In subsequent discussions, the term "banks" refers to commercial banks unless otherwise stated.

Table I

RANKING OF PRIVATE DOMESTIC COMMERCIAL BANKS
ACCORDING TO ASSETS

	1977				1979		Average
ank-ng	Banks	Assets (₱M)	Banks	Assets (₱M)	Banks	Assets (₱M)	Annual Growth Rate 1977-1979 (%)
1	BPI	3,172.8	BPI	4,442.0	Allied	5,977.3	77.5
2	Metro	3,001.9	Metro	4,072.7	Metro	5,245.3	32.2
3	Far East	2,553.9	Allied	3,709.3	BPI	5,233.3	28.9
4	Rizal	2,514.6	UCPB	3,436.9	UCPB	3,940.8	32.9
5	PCIB	2,451.0	PCIB	3,236.4	Rizal	3,745.5	22.0
6	UCPB	2,274.7	Far East	3,202.3	PCIB	3,683.2	22.9
7	China	2,259.6	Rizal	3,092.3	Far East	3,490.8	17.2
8	Equitable	2,183.8	China	2,814.8	China	3,253.1	20.1
9	Pacific	2,070.1	Pacific	2,544.4	Pacific	3,216.2	24.7
0	Consolidated	2,060.4	Consolidated	2,524.2	Republic	2,852.2	211.2
1	Allied	1,912.9	Equitable	2,443.6	Manila Banking	2,829.5	31.7
2	IBAA	1,795.3	Manila Banking	2,206.9	Consolidated	2,750.0	15.7
3	Veterans	1,696.4	Commercial	1,984.9	Veterans	2,623.7	25.7
4	Commercial	1,689.3	Phil. Banking	1,952.6	Equitable	2,458.2	6.2
5	Manila Bank	1,633.3	Veterans	1,826.2	Traders	2,433.8	46.9
6	Phil. Banking	1,609.4	IBAA	1,814.4	Commercial	2,211.0	14.4
7	Prudential	1,443.9	Traders	1,801.8	Communication	2,057.5	42.3
8	Traders	1,134.9	Prudential	1,603.8	Prudential	2,028.0	18.8
9	ACB	1,055.0	Communication	1,410.3	IBAA	1,976.5	5.0
0	Communication	1,016.5	Security	1,369.4	Phil. Banking	1,953.7	10.7
1	Security	973.0	ACB	1,110.3	Security	1,447.8	23.2
2	City Trust	653.6	Interbank	976.3	ACB	1,234.6	8.2
3	Filman	633.8	City Trust	824.2	City Trust	1,165.7	20.7
4	Interbank	611.1	Republic	745.4	Interbank	1,156.1	39.1
5	Producers	481.1	Filman	709.7	Filman	1,000.9	26.5
6	Trust	444.3	Producers	682.1	Producers	898.4	36.8
7	Republic	310.8	Trust	561.1	Trust	669.7	22.8

urce: PNB, A Study of the Philippine Commercial Banking System, 1977-1979.

II.1 Sources of Funds

Banks can raise funds through various sources, such as deposits, borrowings from the Central Bank and money market and equity (stockholders' contribution). The composition of liabilities varied among banks (see Appendix B). This reflects differences in views on liability management among banks. These differences persisted throughout the period considered in this study.

As generally expected, deposits constituted the most important source of funds for all the banks. However, the crucial issue is the extent to which individual banks are successful in mobilizing savings. To gauge the extent, the ratio of deposits to equity is used as an indicator. This ratio gives an idea of how much deposits are generated per peso worth of equity. For want of a better term, this ratio will be called the "intermediation ratio".

The intermediation ratios vastly varied among banks, ranging from 1.18 to 9.68 in 1977, from 1.96 to 11.14 in 1978, and from 2.45 to 11.73 in 1979 (see Table II). Clearly, the intermediation ratio was

Table II

RATIO OF TOTAL DEPOSITS TO TOTAL NET WORTH

Banks	1977	1978	1979
Large Banks			
1	8.42	8.36	6.96
2	7.93	7.55	7.98
3	7.52	8.98	8.87
4	6.75	7.87	7.46
5	9.68	11.14	11.73
6	6.62	7.34	6.96
7	5.74	4.57	4.25
8	4.52	7.49	7.39
9	6.30	6.23	8.46
$\bar{X}$	7.05	7.73	7.78
s	1.53	1.81	1.98
C.V.	21.72	23.37	25.43
Medium Banks			
10	3.47	6.83	7.24
11	6.73	7.86	7.22
12	6.99	5.45	4.28
13	4.56	4.33	7.30
14	5.09	6.38	3.82
15	5.34	5.75	6.79
16	5.83	6.15	4.10
17	5.27	9.38	10.04
18	7.85	7.80	10.18
$\bar{X}$	5.68	6.60	6.78
s	1.34	1.51	2.37
C.V.	23.56	22.65	35.03
Small Banks			
19	3.61	4.47	4.04
20	3.66	3.39	2.45
21	1.18	1.96	2.60
22	1.72	2.28	6.19
23	2.48	3.09	2.63
24	1.63	2.07	4.85
25	4.01	4.15	5.15
26	2.39	2.89	2.84
27	3.77	3.72	4.42
$\bar{X}$	2.74	3.11	3.91
s	1.09	.90	1.35
C.V.	39.92	29.03	34.51

Source of Basic Data: PNB, A Study of the Philippine Commercial Banking System, 1977-1979.

positively correlated with bank size. This means that larger banks were more successful in mobilizing savings than smaller banks. In addition, the proportion of time deposits in the total financial resources of larger banks was relatively higher than that of smaller banks, indicating that the former have greater capacity to mobilize long-term funds, possibly of larger unit sizes, than the latter (see Appendix B).[3] It is to be noted that a good number of smaller banks have improved their intermediation ratios in recent years.

The relative smallness of the share of deposits in the total resources of smaller banks made them rely more heavily on borrowed funds. This definitely puts smaller banks in a more disadvantageous position compared to larger banks since borrowed funds are more expensive to raise than deposits. Another relativel more important source of funds for smaller banks was equity or stockholders' contribution.

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[3]Total Financial Resources ≡ Total Liabilities + Total Net Worth = Total Assets.

The individual banks achieved impressive growth rates in deposits during the period 1977 to 1979 (see Appendix C). This mainly accounted for the rapid growth in total assets of banks during the period. Interestingly, nondeposit funds consisting mainly of borrowings from the Central Bank and from the money market (see Appendix C) also grew tremendously in almost all banks.

Another notable feature is that larger banks continued to increase their assigned capital in 1979, whereas the smaller banks hardly showed any increase. This would definitely make large banks further increase in size because the growth of other liability items, particularly funds borrowed from the money market and the Central Bank, is also contingent upon the size of bank capital.[4]

Policy-makers and bankers are very interested in lengthening the maturities of banks' deposit

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[4]For instance, banks are allowed to use the rediscounting facility of CB provided that "Availment by any authorized financial intermediary shall not exceed ten percent (10%) of its net worth, net of valuation reserves, as of the end of the quarter, preceding the date of application" (Section 4 of CB Circular No. 749).

liabilities, i.e., the proportion of demand deposits which represent short-term deposit liabilities is expected to consistently decline while that of savings and time deposits which represent long-term deposit liabilities is expected to consistently increase over the years. This was in fact shown to be the case with the commercial banking system as a whole for the past few years.[5] At the micro level, the situation is quite different, however. In particular, eighteen banks experienced a lengthening of the maturities of their deposit liabilities in 1978. But this number was considerably reduced to only four in 1979. Thus, the finding that the maturity of deposit liabilities of the commercial banking system has been shifting from shorter to longer term needs to be qualified since only a few banks really followed such pattern consistently. Apparently, the changes in the composition of deposit liabilities of larger banks had significantly influenced the composition of liabilities of all banks taken

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[5]See the Joint IMF/WB Report (1980).

together. Indeed, the aggregate data missed important information on the characteristics of individual banks.

II.2 Uses of Funds

The funds raised by banks are used in four general ways, namely: cash in vault and deposits in other banks, loans, investments, and other assets. The distribution of individual bank resources according to uses for 1977-1979 is presented in Appendix D.

The loan portfolio of most banks comprised between 50 to 65 percent of their total assets. It appears that commercial banks were relatively more cautious in lending than other financial institutions, like rural banks and private development banks whose loan portfolio for the same period accounted for about 86 and 76 percent of their total assets, respectively. A sizeable proportion of bank resources was invested in government and private bonds and securities. For most banks, it comprised between 17 to 23 percent of their total assets.[6]

The growth rates of the different types of assets were remarkable and were in step with the impressive growth rates of deposits (see Appendix E). This is understandable since the latter are a major constraint of the former. The observed slight decline in the growth rates of the different asset items in 1979 can be mainly attributed to the moderate decline in the growth rates of deposit liabilities in that same year.

Loans are further classified according to security and maturity. In terms of security, loans may be categorized into the following: 1) unsecured loans, 2) loans secured by real estate, and 3) other secured loans.

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[6]This size is influenced to a certain degree by government policy, particularly P.D. 717 which requires banks to set aside 25 percent of their total loanable funds for agricultural loans. The funds may, however, be used for investment in government bonds subject to certain limitations.

Surprisingly, the proportion of unsecured loans to total loans was quite high for almost all banks (see Appendix F). There were sixteen banks in 1977 whose unsecured loans comprised more than 40 percent of their total loans, fifteen in 1978, and nineteen in 1979. This may be interpreted as a shift in the banks' interest from the collateral to the profitability of the proposed loan project. It may also reflect the growing importance of special bank-client relationship arising from the recent development of conglomerate organizations. In this case, the profitability of the proposed loan project may not be the overriding criterion but rather the relationship of individuals or firms with and their influence on bank management. These clients include bank officers and those who have established relationships with the bank. Indeed, the recent financial crisis had shown the magnitude of unsecured loans obtained by some individuals, notably bank directors, who have some special relationships with the banks.

Correlation analysis was done to verify whether a relationship exists between bank size and the percentage share of unsecured loans. The objective is to explore whether larger banks tend to hold higher (lower) percentage share of unsecured loans compared with smaller banks. The obtained Spearman correlation coefficients were not statistically significant (.31 for 1977; .17 for 1978; and -.21 for 1979), indicating the absence of such relationship.

The classification of loans according to maturity is very important especially to regulatory authorities who are concerned with the changes in the maturity structure of loans. In terms of maturity, loans may be grouped into: 1) demand loans, 2) short-term loans (one year or less), and 3) long-term loans (more than one year).

Most bank loans were of short-term maturity (see Appendix F). About three-fourths of the total loan portfolio of most banks consisted of short-term loans. There were, however, a good number of banks having a relatively higher proportion of their total loan portfolio in terms of long-term loans. Some of them were large banks, others small.

The joint IMF/WB Mission Report of 1980 provided several reasons why commercial banks preferred loans of shorter maturity. First, short-term lending is more profitable and less subject to the adverse effects of high inflation rates than long-term lending.[7] Second, the rediscount policy of the Central Bank is biased towards instruments with maturities of less than a year. Third, commercial banks have not traditionally involved their staff in the evaluation of project proposals.

II.3 Profit Rates of Banks

The profit rate or rate of return is one of the most important performance measures of banks.[8] Profit rate is defined as current operating income divided by total net worth or equity.

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[7]Accordingly, a greater proportion of these short-term loans was rolled over. Banks profit more from this practice owing to the service fee and other charges involved each time a loan is rolled-over. The joint IMF/WB Mission estimated that about 50 percent of loans booked as short-term are likely to be rolled-over for at least another year and 30 percent for 1-3 years. However, no estimate of the net rate of return on short-term loans was provided. Chapter IV discusses this issue in greater detail.

[8]See Rhoades (1979) for the discussion of several performance measures of banks.

Table III shows that the profit rates widely varied among banks ranging from -31.9 to 42.4 percent in 1977, from -17.8 to 35.8 percent in 1978, and from -28.0 to 27.5 percent in 1979. The data reveal a positive correlation between profit rates and bank size. This holds true for all the years considered in this study.

The profit rates of most banks fluctuated considerably from year to year as shown by the relatively higher values of the coefficients of variation. Interestingly, larger banks having relatively higher profit rates during the period experienced lesser variability in their profit rates, whereas smaller banks obtaining lower profit rates during the same period experienced greater variability in their profit rates. The relative stability in the profit rates of larger banks may be due to their well-diversified portfolio made possible by their ability to obtain at relatively lower cost greater amount and better quality of information about the market environment, the profitability of the proposed loan projects and the past performance and characteristics of prospective borrowers.

Table III

PROFIT RATES OF INDIVIDUAL BANKS, 1977-1979
(In Percent)

Banks	1977	1978	1979	Average	S.D.	C.V.
1	.68	- .51	2.10	.76	1.07	140.38
2	9.82	19.18	15.35	14.78	4.70	31.83
3	15.57	14.48	13.72	14.59	.93	6.37
4	22.73	25.10	23.71	23.85	1.19	4.99
5	12.52	8.30	19.29	13.37	4.53	33.86
6	20.58	19.68	12.14	17.47	3.78	21.66
7	21.68	19.52	17.94	19.71	1.88	9.52
8	23.31	22.72	17.54	21.19	3.17	14.98
9	19.96	18.41	12.73	17.03	3.81	22.35
10	-16.00	-6.83	-27.99	-16.94	10.61	62.64
11	17.20	22.73	17.77	19.23	3.04	15.82
12	15.44	11.31	8.63	11.79	3.43	29.10
13	6.21	12.05	17.18	11.81	5.49	46.98
14	20.29	22.44	18.88	20.54	1.79	8.73
15	23.63	18.26	7.21	16.37	8.37	51.14
16	12.31	12.77	4.77	9.97	4.51	45.19
17	15.53	18.60	18.24	17.46	1.68	9.61
18	9.15	19.98	13.98	14.37	5.42	37.76
19	12.70	16.22	15.83	14.92	1.93	12.93
20	11.30	13.58	15.36	13.41	2.04	15.18
21	17.23	19.08	14.73	17.01	2.18	12.83
22	-31.87	-17.75	23.41	-8.74	28.72	328.62
23	24.91	17.94	16.30	19.72	4.57	23.18
24	9.98	15.70	5.62	10.43	5.06	48.47
25	11.76	17.53	24.67	17.99	6.47	35.95
26	42.40	35.76	27.51	35.22	7.46	21.18
27	9.90	5.79	12.81	9.50	3.53	37.13

Source of Basic Data: Department of Economic Research, Central Bank of the Philippines, 1977-1979.

Chapter III

THEORETICAL FRAMEWORK

The recent contributions by various authors to the theory of the multiproduct firm provide the basis for analyzing the behavior of a banking firm.[1] In this framework, the bank is viewed as a producing unit rather than merely an investor. Like other producing units, the bank has its own production technology, and knowledge of this production technology is important in simultaneously determining the optimal output and input mix and the scale of a multiproduct banking firm.

A general characterization of the production technology of a banking firm is first presented. Then, specialized forms of the general production technology are discussed. The purpose is to test empirically which of these alternative characterizations best describes the behavior of a banking firm.

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[1]See Shephard (1970), Lau (1972), McFadden (1978), Panzar and Willig (1975), Baumol (1977), Laitinen and Theil (1978), and Laitinen (1980) for a detailed discussion of the theory of the multiproduct firm. A very limited number of applications of this theory to the banking firm can be found in Mullineaux (1978), Richard and Villanueva (1978), Miller (1979), and Humphrey (1981).

III.1 The Multiproduct Production Technology of the Bank

The banking firm produces several outputs (e.g., loans and investments) and provides various services to its customers (e.g., issuance of letters of credit, administration of trust funds).[2] The output levels must be related in some way to the amount of inputs used by the bank, such as deposit funds, labor, capital, etc. The bank's production technology relates the different combinations of outputs to the corresponding feasible combinations of inputs. This technology may be represented by the following transformation function,[3]

$$F(Q, X) = 0 \qquad (3.1)$$

where Q $(\equiv q_1, q_2, \ldots q_m)$ is an m-dimensional

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[2]See Appendix G for the authorized activities of commercial banks. In subsequent discussions, bank outputs and services shall be referred to as bank outputs.

[3]Lau (1972) also calls it the joint production function or production possibility frontier of the multiproduct firm.

vector of levels of bank outputs, and X ($\equiv x_1, x_2, \ldots, x_n$) is an n-dimensional vector of quantities of variable inputs.

The transformation function F gives an implicit association between Q and X. Following Lau (1972), F is assumed to have the following properties:

a) F is twice differentiable, convex and closed in Q and X in the nonnegative orthant;

b) F is strictly increasing in Q and strictly decreasing in X; in addition, it is assumed that

$$\lim_{q_i \to 0} \frac{\partial F}{\partial q_i} \to 0; \quad \lim_{x_j \to 0} \frac{\partial F}{\partial x_j} \to -\infty; \quad \text{and}$$

c) Q is finite if and only if X is finite.

It has been demonstrated by Shephard (1970), Uzawa (1962), Diewert (1971) and McFadden (1978) that if F obeys the properties a) to c), a unique multi-product joint cost function can be constructed from F, and it can be written as

$$C = C(Q, P) = \min P.X \qquad (3.2)$$

where $P \equiv (p_1, p_2, \ldots, p_n)$ is an n-dimensional vector of input prices. The minimum cost function (3.2) adheres to the following properties:

i) C is nondecreasing in P, i.e., if $P' \geq P$, then $C(Q, P') \geq C(Q, P)$. It says that increasing at least one of the input prices cannot lower the cost of producing Q. C is also a nondecreasing function of outputs and tends to infinity as outputs tend to infinity.

ii) C is homogeneous of degree one in P for every $Q > 0$, i.e., $C(Q, \lambda P) = \lambda C(Q, P)$. It means that multiplying all prices by λ cannot change the composition of the input bundle that minimizes cost. Therefore, cost must go up by the same factor λ.

iii) C is concave in P for every $Q > 0$; i.e., $C(Q, \lambda P + (1 - \lambda)P') \geq \lambda C(Q, P) + (1 - \lambda)C(Q, P')$ for $0 \leq \lambda \leq 1$. If the price of a factor rises, with all other prices held constant, costs will never go down but they will go up at a decreasing rate. The reason is that if other prices remain the same, this one factor becomes more expensive, and the cost minimizing firm will shift away from it to use other inputs.

iv) C is continuous as a function of P, for P is strictly positive.

C obeys the following Shephard's lemma:[4] Suppose $x_j^*(Q, P)$ denotes the firm's conditional factor demand for input j. If C is continuously differentiable at (Q, P) and each p_j is strictly positive, then

$$x_j^*(Q, P) = \frac{\partial C(Q, P)}{\partial p_j} \qquad (3.3)$$

Equation (3.3) tells that the optimal input bundle can be determined by taking the derivatives of the cost function with respect to the input prices.

Moreover, Hall (1973) pointed out that when F is differentiable in every Q, the following condition

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[4]See Varian (1978) for the proof.

also holds:

$$\frac{\partial C(Q, P)/\partial q_i}{\partial C(Q, P)\partial q_k} = \frac{\partial F(Q, X)/\partial q_i}{\partial F(Q, X)/\partial q_k} \qquad (3.4)$$

i.e., the ratio of the marginal costs of two goods equals the marginal transformation between them.

McFadden (1978) has shown that C and F are dual in the sense that either one can be derived from the other.[5] In other words, the duality between C and F ensures that they contain the same information about the technology of the firm. Thus, either function may be used equivalently to predict the firm's behavior.

This study chooses to start from a cost function rather than from a production function. This choice is dictated by the desire to approximate better the decision-making process done at the bank level. Past works usually assume banks to follow only the "asset-management" practice wherein loan commitments are adjusted

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[5]Proofs of the duality theorem are also given in Uzawa (1962), Shephard (1970) and Diewert (1971).

in response to changes in deposits, reserves and economic conditions of which banks have little control. Deposit funds, which are the most important factor inputs of banks, are regarded as completely exogenous to the bank. In this case, the production function can very well capture the decision-making process since it treats factor inputs as exogenous to the banking firm.

The introduction of the "liability management" technique to banking has changed the bank from a passive to an aggressive solicitor of funds.[6] This is brought about mainly by the interest ceilings imposed on deposits. Given the relatively low interest ceilings on deposits, a bank can attract new deposits by paying implicit interest on these deposits. This can be in the form of an extra cost incurred by the bank in providing a low cost or free additional services (such as overdraft privileges, advisory services, etc.) to its customers.

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[6]The "asset management" and "liability management" banking practices are sufficiently discussed in standard textbooks of money and banking. For example, see Havrilesky and Boorman (1978) and Horvitz (1979).

The implicit interest rate is said to vary directly with the size of deposits and inversely with the explicit rate of interest (Havrilesky and Boorman, 1978).

The adoption of the "liability management" approach by commercial banks also enables them to deal with the rapid development of the money market in the Philippines. When a bank needs funds to meet additional loan requirements and/or demand for more liquidity, it has now the option to issue deposit substitutes. It was pointed out earlier that the money market is a relatively important source of funds, especially for smaller banks which are less able in acquiring deposits.

This innovative banking technique maintains that a bank bases its loan commitments on the anticipated cost of attracting new deposits and nondeposit funds. Clearly, the level of deposits and nondeposit funds used to meet loan demands and liquidity needs is an endogenous decision, whereas the prices of such funds are exogenous to the bank. It, therefore, calls for the use of a cost function which could very well capture such decision-making process since it treats the level of inputs as endogenous and input prices as exogenous.

Without further restrictions, the transformation function given in (3.1) describes a production technology which is rather general in the sense that it "permits arbitrary kinds of interaction between total factor intensities and the trade-off between various types of outputs" (Hall, 1973; p. 880). If the production technology of the banking firm takes this form, it implies the following interesting behavioral characteristics of the banking firm: first, the marginal cost of each output depends on the level of any output; and second, the ratios of any two marginal costs are dependent on factor prices or factor intensities. The second implication means that the bank's choice of output mix depends on the allocation of its inputs. Hence, any change in the relative input prices will trigger a change in the combination of outputs.

While this general or unrestricted transformation function may reasonably describe the bank's behaviour, it is not necessary, in reality, for the multiproduct production technology of banks to take this form. It is possible that a simpler or restricted form of the transformation function would more appropriately describe the bank's behavior. A number of these restricted forms are quite popular in economic literature dealing with multiproduct technologies. Two forms will be discussed because of their relevance to our analysis of bank behavior.

III.2 Restricted Forms of the Transformation Function

One way of restricting the transformation function is to assume that the bank's multiproduct production technology is characterized by nonjointness in the production process.[7] In this framework, the multiproduct banking firm is seen to have separate production functions for each product.[8]

Hall (1973) defined a nonjoint production technology as:[9] A technology with a transformation function (3.1) is nonjoint if there exist m single product production functions, i.e.,

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[7]Also called output independence by Laitinen (1980).

[8]Examples can be found in Bell and Murphy (1968) and Sealey and Lindley (1977).

[9]See also Laitinen and Theil (1978).

$$q_i = q_i(x_1^i, x_2^i, \ldots, x_n^i), \quad i = 1, 2, \ldots, m \quad (3.5)$$

so that: (i) if (3.1) holds, i.e., if X can produce Q, there is a factor allocation

$$x_j^1 + x_j^2 + \ldots + x_j^m = x_j, \quad j = 1, 2, \ldots, n \quad (3.6)$$

such that (3.5) holds for each of the $q_i(.)$; and (ii) if (3.5) holds, then (3.1) holds for values of q_i in (3.5) and of x_j in (3.6).

By duality, each of the m single product production functions will have the corresponding minimum cost functions as follows:

$$C_i = C_i(q_i, P), \qquad i = 1, 2, \ldots, m \qquad (3.7)$$

Merging these m single product cost functions into one multiproduct cost function results in the following multiproduct nonjoint cost function,

$$C = C(Q, P) = \sum_{i=1}^{m} C_i(q_i, P) \qquad (3.8)$$

That is, for a multiproduct firm to have a nonjoint production technology, its total cost function should equal the sum of the cost functions of producing each product separately. The merging of the individual cost functions requires that there are no economies nor diseconomies in jointness; otherwise, $C(Q, P) < \sum_{i=1}^{m} C_i(q_i, P)$ if there are economies of jointness, or $C(Q, P) > \sum_{i=1}^{m} C_i(q_i, P)$ if there are diseconomies of jointness, and (3.8) does not hold anymore.

The implication of this restrictive form can be clearly seen in (3.8). The marginal cost of each output, $\partial C/\partial q_i$, is independent of the level of any other output. Consequently, the ratios of any two marginal costs are independent of the output mix. Moreover, a nonjoint production technology does not allow an output to be a specific substitute or complement of any other output (Laitinen, 1980).

Another way of restricting the general transformation is to assume the existence of a single variable that can represent all the outputs of a multiproduct firm.[10] This is equivalent to assuming the existence of the aggregate quantity measure Z, where

$$Z = h(Q) \tag{3.9}$$

and h is the quantity aggregator function which is a linearly homogeneous, concave and nondecreasing function. Given (3.9), the transformation function F can then be specialized to

$$F(Q, X) = G[h(Q), X] = 0 \tag{3.10}$$

The transformation function having the form of (3.10) is referred to as a separable transformation function or a transformation function with separability restriction.

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[10]The studies of Greenbaum (1967), Benston (1972), and Murray and White (1980) may serve as examples of this particular approach to the study of bank behavior. Although they recognize that banks are multiproduct firms, their analyses assumed one homogeneous bank output.

It is to be noted that a separable transformation function permits decentralization in decision-making or equivalently, a two-stage optimization process.[11] In the first stage, the banking firm optimizes the level of aggregate output Z (which may be called loanable funds) for given input levels, such as deposit funds, labor services, capital, etc., subject to the transformation function F. In the second stage, it optimizes the mix of components of the aggregate output subject to the quantity aggregator function h.

The imposition of separability on the transformation function implies that the cost function can be written as[12]

$$C = C[h(Q), P] \tag{3.11}$$

The restrictiveness of a separable transformation function can be immediately observed from (3.11).

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[11]See McFadden (1978) and Blackorby *et al.* (1977).

[12]See Hall (1973) for proof.

If the technology of a banking firm is separable, the ratios of any two marginal costs, i.e., $\frac{\partial C/\partial q_i}{\partial C/\partial q_k}$, are dependent only on the output mix but not on the factor prices or factor intensities. With this kind of production technology, the banking firm can choose its output mix independently of its input mix. Thus, no specific interaction between any particular output and any particular input can be expected.

This interesting implication is related to the issue of the independence of asset and liability management tackled in the literature on banking.[13] Klein (1971) pointed out that the original justification for interest rate regulation was that competition for deposits between banks would lead to "unsound" portfolio policies. A bank would prefer to hold high-yielding (and risky) earning assets if interest rates on its sources of funds are high. He proved this argument wrong by showing that in his model neither the cost of

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[13] See Baltensperger (1980) for a discussion of this issue.

deposits nor the size and structure of deposit liabilities can affect asset selection or the mix of outputs chosen by the bank. His model was partly motivated by Benston (1964) who had earlier shown some empirical evidence supporting the view of the independence of asset and liability management.

We have presented three alternative characterizations of the multiproduct production technology of the banking firm. The first describes a general or unrestricted form of the production technology, while the second and the third are special cases or restricted forms. As pointed out, each implies a particular pattern of bank behavior. It must, however, be recognized that the banking firm may take any of these forms, and it is the initial task of this study to determine which of the three forms best describes the actual behavior of commercial banks in the Philippines.

The usual practice of doing an empirical analysis of the behavior of any firm is to put <u>a priori</u> restrictions on the production technology.[14] This substantially

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[14]The Cobb-Douglas and the CES functions are the most popular restrictive models.

simplifies econometric work because there will be fewer parameters to be estimated. However, it requires some prior knowledge about the specific form of the production technology. In the absence of this prior knowledge, imposing a priori restrictions on the production technology becomes arbitrary, and it may lead to erroneous results. This study deviates from this usual practice by treating the two restrictive forms, i.e., the nonjoint and separable production processes, as testable hypotheses. The unrestricted form is considered as the maintained hypothesis.

III.3 Information Derived from the Multiproduct Cost Function

Once the production technology that best describes the behavior of the bank is known, substantial economic insights -- such as scale economies, possibilities of product diversification or specialization, etc., -- which generally interest both managers and regulatory authorities can be obtained from it.

III.3.a Multiproduct Economies of Scale

Commercial banking in the Philippines has recently taken a new dimension with the introduction of Universal Banking.[15] The two objectives of the said financial reform are: 1) to increase the total flow of savings intermediated in the system, and 2) to increase the proportion made available to borrowers on medium- and long-term loans. With Universal Banking, the range of services offered by commercial banks has been broadened to include those exclusively rendered by investment houses. Moreover, larger banks are intensively promoted through the increase in the legal minimum capital requirements and the package of incentives.[16]

At the micro level, these two important policies are designed to achieve scale economies which presumably

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[15]To promote such approach, Batas Pambansa Bilang 61 to 67 amended the General Banking Act. Implementing guidelines are outlined in detail in CB Cir. Nos. 739 to 742. The basis for such reform can be found in the Joint IMF/WB Mission Report of 1980.

[16]A bank cannot enjoy the incentives accorded the universal bank unless its capital shall have reached ₱500M.

have been unexploited by having numerous and smaller banks. Thus, for a given interest rate structure, a larger scale of operation is expected to yield lower costs, a benefit to be shared with bank customers in terms of lower prices for bank services.

Whether economies of scale could be achieved from this new thrust is indeed difficult to ascertain empirically since the Philippines did not have prior experience with Universal Banking.[17] At present, however, commercial banks are already offering quite a number of services.[18] It would be interesting to know whether at present there are still economies to be exploited by banks by operating at a larger scale and providing traditional services simultaneously. This would certainly give us insights on the advantages and disadvantages of having larger banks offering a broader range of services.

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[17] Although the joint 1980 IMF/WB report claimed that economies of scale could arise from this new approach to commercial banking, no empirical support was given, however.

[18] Appendix G lists the traditional functions of commercial banks.

The important concept at issue is economies of scale. However, operational concepts like economies of scale, which are commonly used in a single-product firm, are not readily applicable to a multiproduct firm. More specifically, in analyzing a multiproduct firm a distinction should be made between savings in costs derived from expanding the scale of operation from those derived from expanding the number of different commodities produced. Indeed, the importance of distinguishing these two cannot be understated because the Universal Banking approach connotes bigness and, at the same time, diversity in financial products. nfortunately, this distinction was not properly noted in discussions on Universal Banking and in studies treating banks as multiproduct firms.

aumol (1977) and Panzar and Willig (1975) developed new operational concepts which can facilitate analysis on the behavior of the multiproduct firm. It is then necessary to review some concepts most relevant to our empirical analysis of the behavior of the banking firm.

<u>Definition I</u>: Strict Economies of Scale

The multiproduct production technology F (defined in [3.1]) exhibits economies of scale if for any initial input-output vector $(q_1, q_2, \ldots q_m, x_1, x_2, \ldots, x_n)$ and if for any $\lambda > 1$, there is a feasible input-output vector $(v_1 q_1, v_2 q_2, \ldots, v_m q_m, \lambda x_1, \lambda x_2, \ldots, \lambda x_n)$ where all $v_i \geq \lambda + \delta$, for $\delta > 0$.

The definition states that if all input quantities are increase by λ, each output should increased by at least $\lambda + \delta$.

In a single-product firm, economies of scale are commonly associated with declining average cost. The concept of declining average cost cannot be easily applied to the multiproduct firm for two reasons. First, the heterogeneity of products of the multiproduct firm makes it difficult to construct an unambiguous measure of aggregate output. Second, most bank inputs may be shared in producing several outputs together, and there is no way of allocating costs to derive the average cost for each product. Hence, it is impossible to define an average cost for a multiproduct firm. However, the relationship between cost and output scale of the multiproduct firm can still be established if all output quantities increase proportionately. That is, all output quantities are increased along a ray extending from the origin in output space while all input quantities are required to follow the least cost expansion path. Only then is it possible to associate economies of scale with declining ray average cost. We have the following additional definitions:

Definition II: Ray Average Cost (RAC)

$RAC = C(\gamma Q, P)/\gamma$, for $\gamma > 1$,
where γ is the measure of the scale of output along the ray through $Q(\equiv q_1, q_2, \ldots, q_m)$.

Definition III: Strictly Declining RAC

RAC is strictly declining if

$$\frac{C(\gamma Q, P)}{\gamma} < \frac{C(\alpha Q, P)}{\alpha}, \quad \text{for } \gamma > \alpha$$

where γ and α are measures of the scale of output along the ray through $Q(\ q_1, q_2, \ldots, q_m)$.

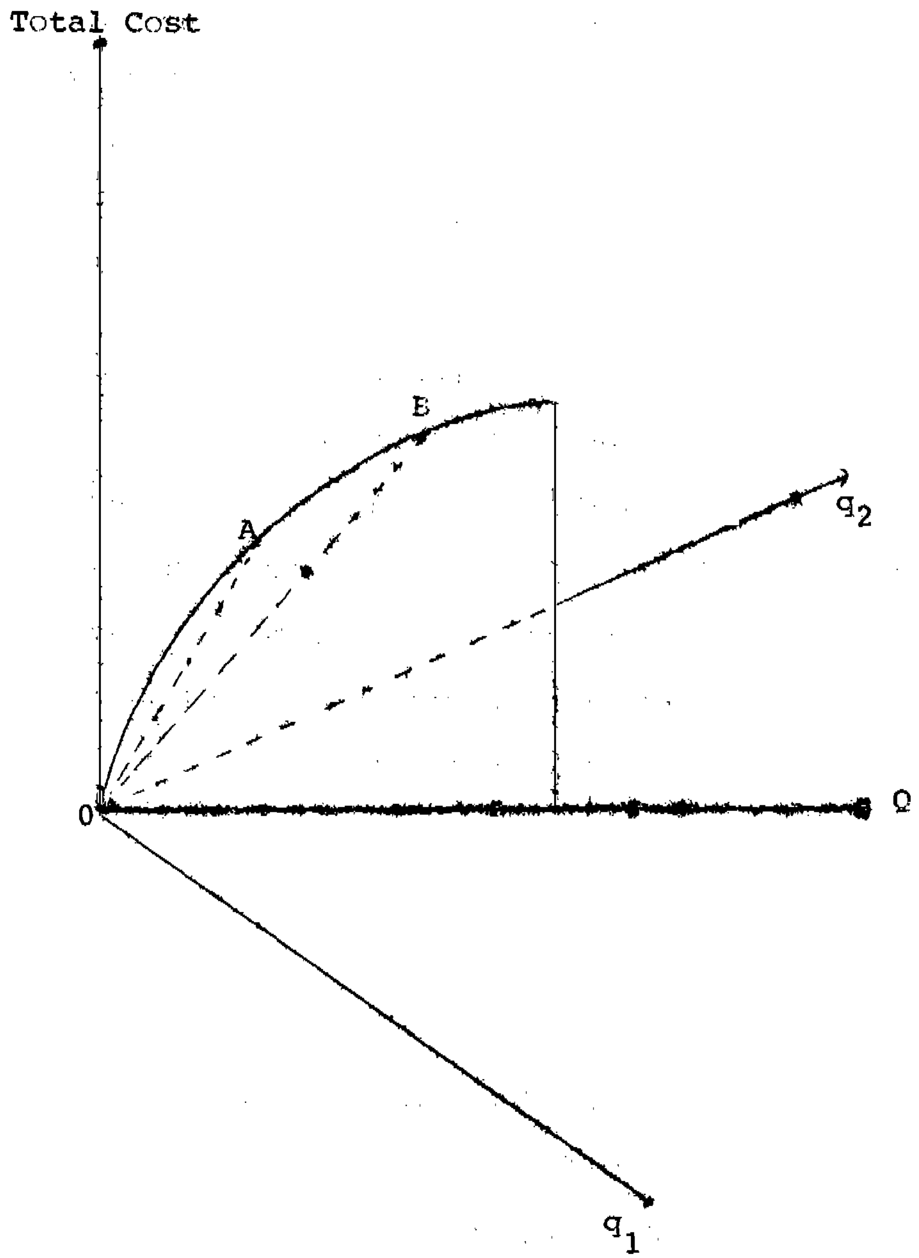
The concept of strictly declining RAC is clearly depicted in Figure I for a two-product case. The slope of the rays OA and OB is decreasing as one moves along the proportion ray OQ, showing that RAC is strictly declining. Thus, the multiproduct scale economies can be associated with a strictly declining RAC.

Having presented the concept of a strictly declining ray average cost, the problem of measuring multiproduct economies of scale from the cost function can be tackled. If the cost function can be represented by (3.2) satisfying the properties i) to iv), Panzar and Willig (1977) proposed to measure the degree of scale economies in the following manner:

$$\hat{S} = \frac{C(Q, P)}{\sum_{i=1}^{m} q_i \partial C/\partial q_i} \tag{3.12}$$

where $\partial C/\partial q_i$ is the marginal cost of the ith output. Under marginal cost pricing, the denominator of (3.12) also equals total revenues, and $\hat{S}$ now measures the extent of the discrepancy between total costs and total

Figure I



revenues. From (3.12), it can be said that the multiproduct production technology F exhibits economies, diseconomies, or constant returns to scale at (Q, X) if and only if $\hat{S} > 1$, $\hat{S} < 1$, or $\hat{S} = 1$, respectively.

III.3.b Economies of Scope

Economies of scale discussed above describe the technical gains derived from increases in output quantities. It cannot, however, be known from the measured economies of scale whether cost savings can be realized by producing two or more products together. For banks, it is very important to know whether offering more financial products would be more economical than offering only one. In other words, diversification is desirable if there are decreasing relative costs with further diversification. Otherwise, complete specialization would be more desirable. This brings us to the concept of economies of scope coined by Panzar and Willig (1975).

Definition IV: Economies of Scope

There are economies of scope over the joint production of goods

1, 2, ..., m if $C(q_1, q_2, \ldots, q_m, P) < C_1(q_1, P) + C_2(q_2, P) + \ldots + C_m(q_m, P)$, all $q_i > 0$, where $C(q_1, q_2, \ldots, q_m, P)$ is the firm's minimized cost of jointly producing goods 1, 2, ..., m, at given parametric input prices P.

Economies of scope exist if it is cheaper to produce different products in combination rather than separately. They arise from conditions in which inputs are shared or utilized jointly without complete congestion. The most popular example in banking, as pointed out by Adar et al. (1975), is in the use of information by different departments in extending different services to the same client. The wider the set of products over which the economies of scope extend, the larger the cost disadvantage of a firm offering fewer products. On the other hand, a firm producing several products together would experience some cost disadvantages if economies of scope are absent.

Baumol (1977) developed an econometrically testable form of economies of scope. This is described by a cost function which is transray convex. Formally:

<u>Definition V</u>: A cost function is transray convex along a hyperplane $\sum_{i=1}^{m} w_i q_i = h$, all $w_i > 0$, if given two distinct output vectors Q^a and Q^b on that hyperplane,

$$C[\lambda Q^a + (1-\lambda)Q^b] \leq C(Q^a) + (1-\lambda)C(Q^b)$$

for $0 < \lambda < 1$.

It means that the production cost of a weighted average combination of any pair of output vectors Q^a and Q^b is not greater than the weighted average of the costs of producing each separately. Thus, a sufficient condition for cost savings in the multiproduct case requires some degree of interproduct complementarity.[19]

To illustrate clearly the concept of transray convexity, consider Figures II and III. Apparently, the cost function in Figure II exhibits economies of scale. This emerges from the fact that the multiproduct

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[19]See Baumol (1977) and Baumol, Bailey and Willig (1979) for a more elaborate discussion on this concept.

Figure II

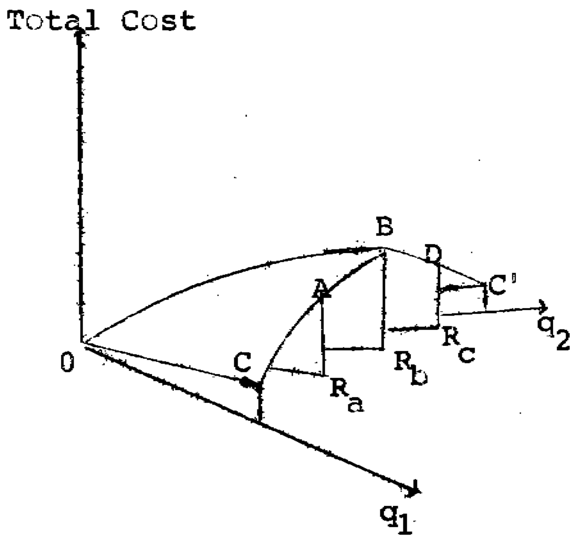
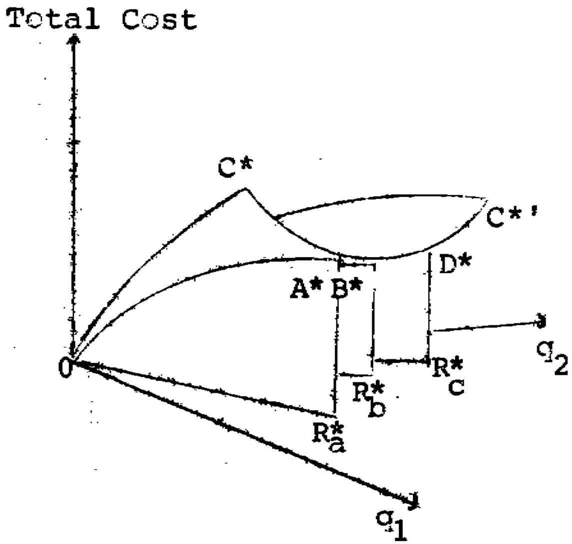


Figure III



joint cost function is concave with respect to the output plane q_1, q_2. The rays through the origin, represented by R_a, R_b and R_c, describe a cost function which has decreasing ray average costs. However, if we consider the cross-section CBDC' taken across these rays, we find that its lowest points reach q_1 and q_2. Despite the presence of scale economies, the cost surface favors the production of q_1 and q_2 in isolation since it increases production cost using common facilities. A decreasing ray average cost, therefore, is not a sufficient condition for a multiproduct firm to enjoy cost savings by producing several products together. A sufficient condition is that the production process should be characterized by interproduct complementarity as the scale of production increases.

Figure III bears out this last point. Ray average cost along R^*_a, R^*_b and R^*_c is strictly decreasing. Moreover, the cost surface OC*C*' exhibits interproduct complementarity in the production process since the transray cross-section C*A*B*D*C*' reaches its lowest point in the interior of the diagram where both products are produced together. To realize, therefore, cost savings in a multiproduct case, the unit cost of production must not only decrease because the output levels increase, but also because outputs are produced together rather than in isolation. That is, cost savings are favored in a multiproduct firm by a joint production process characterized by interproduct complementarity. This provides a reason for the bank to diversify rather than specialize in the production of one type of financial product.

To verify empirically whether the multiproduct cost function, $C(Q, P)$, exhibits transray convexity along the hyperplane $\sum_{i=1}^{m} w_i q_i = h$, the bordered principal minors of the following bordered Hessian

$$\begin{vmatrix} 0 & w_1 & w_2 \cdots & w_m \\ w_1 & C_{11} & C_{12} \cdots & C_{1m} \\ w_2 & C_{21} & C_{22} \cdots & C_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ w_m & C_{m1} & C_{m2} \cdots & C_{mm} \end{vmatrix} \qquad (3.13)$$

where $C_{ik} = \partial C / \partial q_k \partial q_i$, must be examined. The cost function is transray convex throughout h if and only if all the bordered principal minors are negative (Baumol *et al.*, 1981).

III.3.c Price Elasticities and Elasticities of Substitution

An important capability of any cost function is to provide quantitative measures of elasticities of substitution among inputs and price elasticities of demand for various inputs. Both are extremely important for micro policy and descriptive purposes, yet no study on bank behavior paid much attention to these aspects. Banks use deposits, borrowed funds, labor services and many others in producing loan outputs. The prices of these factors may be influenced by regulatory authorities to achieve certain monetary targets and/or check unwanted developments, such as the phenomenal growth of the money market at the expense of the development of the capital market. Relative prices of these factor inputs may also be influenced by regulatory authorities to increase the flow of funds intermediated by the system. All these could influence the bank's decision on the optimal level of output and input mix. However, the effectiveness of such regulations can be either strengthened or weakened depending on how banks respond to the regulatory environment. Their responses are in turn determined to a large extent by their behavioral characteristics, such as the degree of their responsiveness to changes in the prices of factor inputs and substitution possibilities among factor inputs.

The degree of responsiveness of the quantity demanded of a particular input to changes in the market price of the said input is indicated by the own-price elasticities. This is defined as

$$e_{jj} = \frac{\partial \ell n x_j}{\partial \ell n p_j} \tag{3.14}$$

The elasticities of substitution measure the extent inputs can be substituted for each other. Uzawa (1962) has shown that the elasticity of substitution (σ_{js}) between inputs j and s can be obtained using the following formula:

$$\sigma_{js} = \frac{C\ C_{js}}{C_j C_s} \tag{3.15}$$

where C_j and C_s represent the first derivative of the cost function with respect to the price of the jth and sth input, respectively, and C_{js} represents the second derivative of the cost function with respect to the relevant input price.

Allen (1956) has shown that the conventional demand elasticities can be related to the elasticities of substitution as follows:

$$e_{jj} = M_j \sigma_{jj} \tag{3.16}$$

where M_j represents the cost share of the jth input.

Chapter IV

OUTPUTS AND INPUTS OF COMMERCIAL BANKS

Bank outputs and inputs have to be identified before the theory of the multiproduct firm can be applied to the banking firm. The bank is an economic institution whose outputs are difficult to define. This difficulty is manifested in the works of various authors who used different variables (e.g., total assets, deposits, loans) to represent bank outputs. A number of economists pointed out that deposit liabilities and earning assets are the appropriate representations of bank outputs since they constitute a greater part of the services banks provide for both depositors and borrowers. In this connection, Benston (1965) and Bell and Murphy (1968) proposed to classify bank outputs according to the following relatively homogeneous services: demand deposits, time deposits, real estate loans, installment loans, business loans and securities.

Sealey and Lindley (1977), however, argued that only earning assets can be considered as bank outputs

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[1]See Appendix G for a complete list of bank services.

and that deposits are strictly bank inputs. Accordingly, the inclusion of deposit liabilities as bank outputs resulted from the failure of previous authors to distinguish between production in the technical sense and production in the economic sense.[2] In technical production, a firm combines inputs and through some transformation process generates other goods or services regardless of the standard of value used to measure the latter. Thus, Sealey and Lindley categorized the services technically produced by the commercial bank into: (1) administration of the payments mechanism for demand deposit customers; (2) intermediation services to depositors and borrowers; and (3) other services such as trust department activities, portfolio advisory services, etc.

On the other hand, production in the economic sense involves the firm's attempt to create a product which is more highly valued than its original inputs. All the technical outputs then are not necessarily economic outputs. For a bank, only economic outputs can be strictly considered as outputs.

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[2]These concepts are discussed in Frisch (1965).

> "Specifically, because of institutional arrangements and market conditions under which a financial firm operates, only those services associated with the acquisition of earning assets are products more highly valued in the market than the original inputs.
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> The services received by depositors of financial firms are more appropriately associated with the acquisition of economic inputs since these require the financial firms to incur positive costs without yielding direct revenue.' (Sealey and Lindley, 1977; p. 1253).

Definitely, banks incur positive costs on savings and time deposits since they do not collect any service charges from such accounts. This is true of U.S. and Philippine commercial banks. In a sense, therefore, both can be considered bank inputs. This conclusion, however, is not applicable in the case of demand deposits, since banks earn from service charges and penalties collected from such accounts. There is an overwhelming evidence that U.S. commercial banks indeed incur positive costs on demand deposits. For example, Hester and Zoellner (1966) and Ratti (1980) using statistical accounting technique to estimate net rates of return on the elements of bank portfolio obtained results indicating that banks realized negative rates of return on demand deposits. Studies using the Functional Cost

Analysis technique also showed the same results. These imply that the service charges collected by U.S. banks from depositors on demand deposit accounts are not sufficient to cover the cost of services. Thus, demand deposits can also be considered bank inputs.

Unfortunately, no study has ascertained whether Philippine commercial banks also incur positive costs on demand deposit accounts. It is then necessary to provide such information in order to properly delineate bank outputs and inputs.[3] The statistical revenue-cost accounting technique presented here is utilized for this purpose. Interestingly, the results do not only aid us in appropriately classifying bank outputs and inputs; they also give us information on the net rates of return on the elements of bank portfolio.[4]

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[3]As mentioned in Chapter I, this is a corollary objective of this study.

[4]A number of studies have pointed out in a more impressionistic manner the relative differences among net rates of return on the various elements of bank portfolio, for example, short- versus long-term loans, or secured versus unsecured loans, and also indicated their corresponding policy implications (see, for example, the Joint IMF/WB Report of 1980). However, no empirical study to date has shown estimates of the net rates of return on such assets.

IV.1 The Statistical Revenue-Cost Accounting Model[5]

Commercial banks incur costs for the use of funds and realize some returns on their assets. The statistical accounting technique allocates revenue and cost among the elements of bank portfolio. In the model, the gross revenue earned by banks is assumed to be a linear function of the elements of the portfolio That is,

$$Y_i = y_o + \sum_j y_j X_{ji} \qquad (4.1)$$

where Y_i = gross income of the ith bank,

y_o = the revenue not associated with any of the elements in the portfolio (balance sheets),

y_j = the gross rate of return on the jth element in the portfolio, and

X_{ji} = the book value of the jth element in the portfolio for the ith bank.

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[5]This model is based on Hester and Zoellner (1966). See also Bond (1971), Longbrake (1973, 1976) and Meyer and Kraft (1961).

Total cost is also written as a linear function of the elements of bank portfolio. Thus,

$$C_i = b_o + \sum_j b_j X_{ji} \qquad (4.2)$$

where C_i = the total current operating cost for the ith bank,

b_o = cost not associated with any of the elements in the portfolio, and

b_j = the rate of cost on the jth element in the portfolio.

Since we are interested in the net rates of return on the various elements of bank portfolio, we subtract (4.2) from (4.1). This gives

$$\bar{R}_i = \bar{r}_o + \sum_j \bar{r}_j X_{ji} \qquad (4.3)$$

where $\bar{R}_i = Y_i - C_i$ = net income for the ith bank,

$\bar{r}_j = y_j - b_j$ = net rates of return on the jth element in the portfolio, and

$\bar{r}_o = y_o - b_o$ = net fixed revenue that does not vary with any of the elements of the bank's portfolio.

Equation (4.3) provides estimates of net rates of return (cost) of assets (liabilities). It is expected that the coefficients of the asset items are nonnegative and those of the liability items are nonpositive.

The interpretation of the coefficients of equation (4.3) requires some clarifications. Hester and Pierce (1975) proposed to interpret the coefficients as the marginal return the average sample bank earns if it can substitute a dollar of asset or liability for a dollar of vault cash. Ratti (1980), on the other hand, argued that this interpretation is incorrect. He pointed out that under a balance sheet constraint a dollar increase in loans will indeed result in an increase in expected income but this will drain out reserves by an equal amount, thereby increasing the expected cost of short-term borrowing. Similarly, a dollar increase in deposits will raise the cost of servicing them but this will also reduce the expected cost of borrowing. Ratti then suggested that the coefficients should be interpreted as the marginal return or implicit rate of return of an asset or liability item adjusted by the marginal cost and probability of short-term borrowing. Ratti's interpretation seems more intuitive and, more importantly, it rests on solid theoretical ground of bank behavior which is lacking in the Hester-Pierce's interpretation. This study, therefore, adopts Ratti's interpretation of the coefficients of X_{ji}. In subsequent discussions, the coefficients shall be alternatively called marginal returns, implicit rates of return or net rates of return, keeping in mind Ratti's interpretation.

IV.2 Estimation Procedure

The dependent and independent variables included in the model are listed in Table IV. Three alternative measures of income are considered in this study. These are: 1) net current operating income; 2) net income before taxes; and 3) net income after tax.

Net current operating income is defined as total current operating income minus total current operating expenses. Net income before taxes is net current operating income plus recovery on charged-off assets, income from assets acquired, profit from assets sold/exchanged, reduction in allowances for probable

Table IV

LIST OF VARIABLES INCLUDED IN THE MODEL FOR RATES OF RETURN ON THE ELEMENTS OF BANK PORTFOLIO

Symbol	Variable Definition	Means	Standard Deviations
	A. Dependent Variables		
R^1	Net current operating income	.0154	.0162
R^2	Net income before taxes	.0152	.0146
R^3	Net income after taxes	.0130	.0131
	B. Independent Variables		
A_0	Reciprocal of total assets	.0008	.0006
A_1	Deposits with banks	.1008	.0450
A_2	Trading account securities	.0678	.0488
A_3	Investments in bonds	.1252	.0674
A_4	Unsecured loans	.2405	.1220
A_5	Loans secured by real estate	.1384	.0776
A_6	Other secured loans	.1329	.0823
A_7	Demand loans	.0667	.0499
A_8	Short-term loans	.3817	.1104
A_9	Long-term loans	.0621	.0567
A_{10}	Equity investments in allied undertakings	.0014	.0017
A_{11}	Bank's properties	.0311	.0143
A_{12}	Other assets	.0528	.0769
L_1	Demand deposits	.1264	.0396
L_2	Savings deposits	.2285	.0965
L_3	Time deposits	.1748	.0908
L_4	Bills payable	.2266	.1239
L_5	Marginal deposits	.0471	.0192
L_6	Other liabilities	.0702	.0366

losses, and miscellaneous income minus losses and charged-off on assets, loss from assets sold/exchanged, additions to allowance for probable losses, and other miscellaneous loss.[6]

Net income after taxes is calculated by deducting income taxes paid from net income before taxes.

These alternative measures of income are included to determine which has the most stable relationship to portfolio variables. It is well known that net income before taxes reflects the results of a number of non-recurring and non-operating transactions and other arbitrary accounting decisions, such as adjusting allowances for probable losses, writing off loans, etc. The same difficulties are also encountered when net income after taxes is used. In contrast, net current operating income is free of these difficulties. It is, therefore,

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[6]Thirty out of eighty-one observations have net income before taxes greater than net current operating income. Thisis mainly due to the fact that their reported recoveries on charged-off assets and profit from assets sold/exchanged exceed the losses and charged-off on assets and loss from assets sold/exchanged during the accounting period.

expected that the latter is likely to have the most stable relationship to portfolio variables.

Note that cash reserves, defined as cash on hand, checks and other cash items, are excluded from the model. The reason for their exclusion is that the balance sheet constraint should always be satisfied so that if there are any changes in any of the asset liability items, cash reserve should be adjusted accordingly.[7] This is required in order to be consistent with our interpretation of the coefficients.

Trading account securities are treated separately from investments in bonds. The former include government securities purchased, government and private securities purchased under resale agreements, government and private securities sold under repurchase agreements, government and private securities purchased under certificates of assignment/participation with recourse and commercial papers primarily held by banks for their trading activities. The latter consist of investments in private and government

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[7]It is, of course, implied here that banks are operating under the fractional reserve system.

bonds and other debt instruments carried by banks but are not for trading purposes. Most of these are treasury bills/notes and certificates of indebtedness issued by the government, its political subdivisions and instrumentalities and/or corporations owned and/or controlled by the government. These may form part of the bank's reserve against deposit liabilities.

Following Hester and Zoellner (1966), we deflate all variables in (4.3) by total assets.[8] The equation to be estimated is

$$R_i = a + r_o A_{oi} + \sum_j r_j X^*_{ji} + w_i \qquad (4.4)$$

where TA_i = total assets of the ith bank,

R_i = $\bar{R}_i/TA_i$,

A_{oi} = a scale variable given by the reciprocal of the total assets of the ith bank, i.e., $1/TA_i$,

X^*_{ji} = X_{ji}/TA_i,

r_o = coefficient of the scale variable,

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[8]See also Ratti (1980).

a = the constant term,

r_j = net rate of return on the jth element in the portfolio, and

w_i = the stochastic disturbance term.

To estimate the parameters of equation (4.4) using the combined cross-section and time-series data, we will use the error components model.[9] This model assumes that the regression error is composed of three independent components -- one associated with time, another with the cross-sectional units, and a third being an overall component variable both in the time and cross-sectional dimension. The choice of the error components model is determined by the need to have efficient estimators of the parameters. The latter are obtained by weighting the observations in inverse relationships to their variances.[10]

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[9]This model is discussed extensively in economic literature. For example, see Mundlak (1978), Wallace and Hussain (1969), Madalla (1971), Nerlove (1971a, 1971b), and Fuller and Battese (1974).

[10]The TSCSREG Procedure of the Statistical Analysis System (SAS) package is used to estimate the parameters of (4.4). It follows the algorithm suggested by Fuller and Battese (1974).

Two alternative models are tested, namely Model I and Model II. Both models have basically the same variables except that the former classifies loans according to securities, while the latter, according to maturities.

ince there are three alternative measures of income, three sub-models are considered under Models I and II. This raises the number of equations to be estimated to six.

Two options are considered for each equation. The first includes the intercept term while the second suppresses it. All intercept terms are, however, found to be statistically insignificant. Therefore, only the results of the second option are discussed.

IV.3 Estimated Net Rates of Return

The independent variables are first checked for possible multicollinearity problem. Such problem does not exist as may be gathered from the correlation matrix given in Appendix H.

Table V presents the results of the regression runs.[11] It should be recalled that the coefficients are interpreted as marginal return (alternatively, implicit rates of return, net spread, net rates of return) adjusted by the marginal cost and probability of short-term borrowing.

The coefficient of deposits with other banks (A_1) is statistically not different from zero. This holds true for all the six sub-models. It means that banks do not earn a positive net return on their deposits with other banks. It should be noted that banks generally keep this asset mainly to complement cash in vault as primary reserves and/or for check clearing purposes.

Another variable which consistently yields statistically insignificant relationship with bank income is trading account securities (A_2). Banks, however, regard this asset as relatively less important

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[11]The results of the first option which includes the intercept term are shown in Appendix I.

Table V

ESTIMATED NET RATES OF RETURN ON THE ELEMENTS OF BANK PORTFOLIO
(Using Fuller and Battese Method)

Independent Variables \ Dependent Variables	MODEL I			MODEL II		
	R^1	R^2	R^3	R^1	R^2	R^3
A_0	-9.5660	-3.0016	-4.1089	-[illegible].4316	-3.1355	-3.5458
	(-3.26)*	(-1.51)	(-1.92)***	(-2.81)*	(-1.18)	(-1.62)
A_1	.0333	.0286	.0259	.0376	.0304	.0275
	(1.37)	(1.16)	(1.17)	(1.51)	(1.21)	(1.22)
A_2	.0074	.0194	.0260	.0041	.0144	.0232
	(.34)	(.87)	(1.30)	(.19)	(.64)	(1.15)
A_3	.0585	.0645	.0745	.0753	.0765	.0829
	(2.10)**	(2.59)**	(3.49)*	(2.88)*	(3.13)*	(3.07)*
A_4	.0488	.0565	.0559			
	(3.50)*	(4.47)*	(5.28)*			
A_5	.0388	.0414	.0347			
	(2.18)**	(2.38)**	(2.291)**			
A_6	.0112	.0170	.0205			
	(.71)	(1.12)	(1.56)			
A_7				.0217	.0460	.0487
				(.87)	(1.98)***	(2.31)**
A_8				.0430	.0497	.0500
				(3.54)*	(4.26)*	(4.97)*
A_9				.0210	.0190	.0180
				(1.06)	(.99)	(1.07)
A_{10}	-.0684	.1591	-.0679	-.[illegible]4	-.0309	-.3045
	(-.08)	(.20)	(-.10)	(-.45)	(-.10)	(-.45)
A_{11}	-.0194	-.0634	-.0934	.0442	-.0010	-.0187
	(-.18)	(-.63)	(1.10)	(.41)	(-.01)	(-.23)
A_{12}	-.0158	-.0173	-.0111	-.0204	-.0226	-.0157
	(-.95)	(-1.05)	(-.76)	(-1.23)	(-1.37)	(-1.08)
L_1	.1048	.0930	.0574	.0853	.0762	.0406
	(3.39)*	(3.19)*	(2.29)**	(2.64)*	(2.48)**	(1.54)
L_2	-.0708	-.0642	-.0527	-.0704	-.0683	-.0610
	(-3.46)*	(-3.52)*	(-3.31)*	(-3.86)*	(-3.42)*	(-3.22)*
L_3	-.0289	-.0300	-.0232	-.0320	-.0345	-.0273
	(-1.68)***	(-1.79)***	(-1.58)	(-1.81)***	(-2.02)**	(-1.54)**
L_4	-.0151	-.0274	-.0240	-.0199	-.03345	-.0302
	(-1.07)	(-2.09)**	(-2.15)**	(-1.35)**	(-2.44)**	(-2.60)**
L_5	.0261	-.0244	-.0512	.0267	-.02276	-.0466
	(.37)	(.36)	(-.87)	(-.37)	(-.32)	(-.76)
L_6	.0413	.0306	.0223	.0444	.0358	.0275
	(1.37)	(1.00)	(.82)	(1.42)	(1.12)	(.97)
Variance Component for Cross Section	.00006067	.00003310	.00001846	.00005777	.00003461	.0000197
Variance Component for Time Series	.00000931	.00000635	.0000052	.00000962	.00005584	.0000042
Variance Component for Error	.00002366	.00003107	.00002878	.00002465	.00003137	.0000290
Transformed Reg. M.S.E.	.00003143	.00003784	.00003300	.00003337	.00039013	.0000338

Note: *Significant at .01 level. **Significant at .05 level. ***Significant at .10 l as may be seen from its average share to total assets.[12] Moreover, banks hold trading securities primarily to accommodate any temporary excess liquidity. Empirically, therefore, trading securities are not an important source of income.

Investments in bonds (A_3) yield a positive net rate of return as generally expected. The attractiveness of this asset lies in its fairly reasonable net rate of return of not less than 5 percent per annum, and it is relatively less risky compared with loans.[13] In addition, it may form part of total reserves, and may also serve as a substitute for agricultural loans as provided for by P.D. 717. The latter are generally regarded as high-risk, low-yielding types of asset.[14]

The estimated net rate of return on investments appears to be slightly higher if income is defined as

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[12]The thinness of trading securities held by banks indicates that banks are not actively trading securities.

[13]During the period of analysis, the unweighted average gross yields on CBCIs, Treasury Bills and DBP bonds were 11.28, 11.23, and 12.43 percent, respectively.

[14]See Villanueva and Saito (1978).

net income before taxes than when it is defined as net current operating income. The difference suggests the magnitude of capital gains realized by banks on bonds. Thus, the average capital gains on bonds is about .60 percent per annum under Model I, and about .12 percent per annum under Model II.

Both unsecured loans (A_4) and loans secured by real estate (A_5) give positive net rates of return. As expected, the former yield relatively higher marginal return than the latter. The difference in their net yields may be regarded as a premium for risk-taking since unsecured loans are riskier than loans secured by real estate.

Again, the estimated net rates of return on unsecured loans and loans secured by real estate are observed to be slightly higher if income is defined as net income before taxes than if it is defined as net current operating income. The difference suggests that banks made excessive write-offs on loans, particularly unsecured loans, in the previous years. Thus, during the period of analysis, the estimated net gain from recoveries on charged-off loans is .77 percent per annum for unsecured loans and .26 percent per annum for loans secured by real estate.

The coefficient of other secured loans (A_6) is relatively small and statistically not different from zero. This type of loan, therefore, does not significantly contribute to the bank's net income.

When bank loans are classified according to maturities, demand loans (A_7) and short-term loans (A_8) appear to be significantly correlated with bank income. They have approximately the same estimated net rates of return of about 5 percent per annum if bank income is defined either as net income before tax or as net income after tax. However, the coefficient of demand loans is not statistically significant if bank income is taken as net current operating income.

Table V discloses higher estimated net rates of return on demand and short-term loans if bank income is defined as net income before tax than when it is taken as net current operating income. Thus, the effect of arbitrary accounting decision, such as excessive write-offs on loans made by banks, is also reflected in Model II.

The relatively small and statistically insignificant coefficient of long-term loans (A_9) indicates that banks do not realize a positive return on this asset. Apparently, banks are not efficient producers of long-term loans. This explains in part why banks prefer loans of shorter maturity.

Of interest is the finding that the estimated net rates of return on loans (classified either according to securities or maturities) are considerably lower than those on investments in bonds. Since banks are primarily lenders, it is but natural to expect that the marginal return on loans will be higher than that on investments in bonds. This is further reinforced by the substantially higher gross yields (interest plus commissions, premiums, fees and other charges on loan transactions) on loans than on those on bonds and securities. The results seem to indicate that transaction costs significantly determine the relative net rates of return on investments in bonds and on loans. It is common knowledge that transaction costs of loans are higher than those on investments in bonds. Indeed, the magnitude of the difference between their net spreads makes investments in bonds far more lucrative than loans.

In general, results show that commercial banks in the Philippines would realize a net spread of 3.5 to 5.5 percent per annum on loans, depending on the type of loans and on the manner of defining bank income. Unfortunately, no study in the Philippines has provided estimates of net spread on loans with which our estimates may be compared. Recently, PNB has indicated that for an effective lending rate of 19.15 percent per annum, the ideal spread is 3.15 percent (Daily Express, 31 August 1981).[15] Although, our estimates are slightly higher than those of PNB, they are deemed plausible, however. PNB's lower estimate may be attributed to certain factors. One is that it is financing government high priority projects usually involving higher transaction costs. Another is that its effective lending rate is usually lower than that of ordinary private commercial banks.

Allegedly, the large spread between regulated deposits and loan rates allows banks to enjoy a substan-

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[15]The method used to arrive at this figure was not given, however. Presumably, PNB was using the standard accounting procedure commonly used by banks to arrive at the net spread. It was not also made clear whether this holds true for all types of loans.

tially comfortable profit margin.[16] To verify this, we compare our estimates of net rates of return on loans with those obtained by Ratti (1980) for a sample of U.S. banks believed to be operating under a more competitive market structure. Although Ratti's classification of loans differs from ours, a meaningful comparison can still be made. The results from Table VI seem to corroborate the said allegation. While U.S. banks earn a razor-thin rate of return on loans, Philippine commercial banks realize a much larger spread. Even PNB's ideal net spread may be considered high compared to what an average U.S. bank could obtain.

The other asset items mentioned in Table V do not significantly contribute to bank's income.

The results shown in Table V reveal that except for the third sub-model under Model II, the coefficient of demand deposits (L_1) is statistically significant and positive for all sub-models. This implies that banks realize a positive implicit return on such accounts.

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[16] See the ILO Report (1974).

Table VI

A COMPARISON OF THE ESTIMATED NET RATES OF RETURN OBTAINED BY U.S. AND PHILIPPINE COMMERCIAL BANKS ON DIFFERENT TYPES OF LOANS
(In Percent)

Ratti's Study[a]		This Study[b]	
Real estate loans	2.27	Unsecured loans	5.59
Commercial and Industrial loans	1.87	Loans secured by real estate	3.47
Loans to consumers	1.86	Demand loans	4.87
Loans to farmers	2.55	Short-term loans	5.30

Sources: [a]Table 1 of Ratti's study (1980).

[b]Table V of this study.

Note: The dependent variable is net income after tax.

This is indeed contrary to our *a priori* expectation and to the findings of similar studies done in the U.S.[17]

Before making any conclusion, it is necessary to check further our results. It is to be noted that total loans were subdivided into several categories. The latter were used as independent variables in the model. However, demand deposits may be highly correlated with total loans but not with the different types of loans. This may have a bearing on the results we obtained. That is, the use of the different types of loans may have made demand deposits represent total loans; hence the positive coefficient for demand deposits.

It is, therefore, hypothesized that demand deposits would yield a negative coefficient if total loans are used in the model instead of the different types of loans. This hypothesis was tested by estimating equation (4.4) again, but this time total loans appear as one of the independent variables instead of the different types of loans. As may be shown in Appendix J, a positive sign is

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[17] See Hester and Zoellner (1966) and Ratti (1980).

still obtained for the coefficient of demand deposits. This implies that the hypothesis stating that demand deposits would yield a negative coefficient if total loans are used instead of the different types of loans should be rejected.[18] Indeed, the findings clearly indicate that servicing demand deposit accounts is a relatively important net income earning activity of Philippine commerical banks.

An explanation regarding the positive net rate of return on demand deposits is in order. The costs commercial banks incur to attract depositors consist of explicit and implicit interest. The latter refers to the implicit resource costs (e. ., cost of capital, labor and materials) incurred in the process of servicing deposit accounts. At present, banks are prohibited by law to pay explicit interest on demand deposits. Nevertheless, they pay implicit interest on such accounts.

Banks may collect explicit service charges for demand deposit accounts. In addition, they usually

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[18] As shown in Appendix H, the correlation coefficient between total loans and demand deposits is very low. This reinforces our findings above.

require their customers to maintain a minimum balance of ₱500 on their demand deposits. The said minimum balance carries with it forgone earnings which bank deposits could have earned if they put their money on interest-earning assets. The forgone earnings are actually the price paid by depositors for the services rendered to them by banks. It may also be regarded as the implicit service charge collected by banks for servicing demand deposits.

Customers are heavily penalized if their outstanding current account is below ₱500 and/or if they issue checks without sufficient funds. Starting 2 May 1979, the monthly service charge on balance below the minimum is ₱5.00, while the penalty rate for issuing checks without sufficient funds is ₱25.00 per day for every ₱50,000. These may be considered explicit service charges banks collect from erring depositors. Total service charges then are the sum of implicit and explicit service charges.

Thus, the result showing a positive net rate of return on demand deposits indicates that total service charges exceed the cost of servicing such accounts.

As expected, the coefficient of savings deposits (L_2) is negative and statistically significant for all sub-models. The estimated net cost of savings deposits is between 5 to 7 percent per annum, depending on the measure of bank income used. This is more or less the same as the interest rate on savings deposits prevailing during the period under study.[19]

The estimated marginal costs of time deposits (L_3) and borrowed funds (L_4) are about 2 to 3 percent per annum. Interestingly, these estimates are approximately one-half of the estimated marginal cost of savings deposits. The relatively low estimated marginal costs of time deposits and borrowed funds may be attributed to certain factors. One is that larger unit sizes of these funds are usually contracted by banks, thereby reducing transaction costs.[20] Another is the lower turnover rates of these funds besides their more predictable with-

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[19] It should be noted that the interest rate on savings deposits was pegged at 6 percent per annum for quite a time. It was first raised to 7 percent per annum in September 1979, then to 9 percent per annum in December 1979 (cf. C.B. Circular Nos. 696 and 706). The ceiling was finally lifted in July 1981 (cf. C.B. Circular No. 777).

[20] The monetary authorities actually set the minimum size of time deposits at ₱100.00 and deposit substitutes at ₱50,000.00.

drawals since they have fixed maturity dates.[21] This reduces the cost of adjusting reserves to avoid the penalty of having deficits in reserves.[22] In contrast, savings deposits are usually of smaller unit sizes and have higher turnover rates. This increases both transaction costs and the marginal cost and probability of short-term borrowing.

Marginal deposits (L_5) and other liabilities (L_6) do not have any significant effect on bank income.

The three measures of income, namely current operating income (R^1), net income before tax (R^2) and net income after tax (R^3), appear to have equally stable relationships with the portfolio variables. This may be due to the fact that these three alternative measures of income are not significantly different from one another. ence, any one of these three measures of income may

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[21]Time deposits have a maturity of not less than 90 days, whereas deposit substitutes have usually a maturity of 30-60 days (see Joint IMF/CBP Banking Survey Commission, 1977).

[22]Recall the interpretation of the coefficients discussed in Section IV.1.

be used in estimating the implicit rates of return on the various elements of bank portfolio.

The statistical model for estimating the net rates of return on the various elements of bank portfolio appears to be generally plausible. However, caution should be made in using the results of the model as basis for making decisions. The obvious weakness of the model is that the estimates may suffer from the vagaries of statistical accounting analysis, especially if a very substantial proportion of joint costs which cannot be easily allocated to any particular bank activity exists. Nonetheless, the approach used in this study is deemed far superior to the ordinary cost accounting method.

Going back to the original purpose of this exercise, we note again that banks earn negative implicit returns on savings and time deposits. This is consistent with *a priori* expectations and the evidence provided by studies in the U.S. However, a rather unexpected result demonstrated in this study is that the Philippine commercial banks earn a positive implicit return on demand deposits. It, therefore, indicates that servicing demand deposit accounts is a direct income-earning endeavor of commercial banks.

In other words, banks successfully create this product which is more highly valued than the original input elements. By using the criteria set by Sealey and Lindley (1977), demand deposits, therefore, can be considered bank output in addition to the bank's earning assets and other income-earning services, such as trust department activities, issuance of letters of credit, etc.

Chapter V

ECONOMETRIC SPECIFICATION OF THE MULTIPRODUCT JOINT COST FUNCTION

The task of this chapter is threefold: (1) to present a functional form that permits the estimation of the multiproduct joint cost function; (2) to outline the procedure for estimating the parameters of the said function; and (3) to briefly discuss the variables included in the model.

V.1 The Specific Functional Form for the Multiproduct Joint Cost Function

In choosing a functional form for our multiproduct joint cost function (MJCF), there are three considerations: First, the functional form is "flexible", that is, it does not *a priori* constrain the various elasticities of substitution as the Cobb-Douglas and CES models do. Second, it is capable of providing a second-order approximation to an arbitrary twice differentiable function. Third, it can detect the presence or absence of the cost properties of the multiproduct firm, such as multiproduct scale economies and economies of scope.

Three flexible forms can possibly represent the MJCF. The first is the "hybrid Diewert" multiproduct cost function (HDMJCF) proposed by Hall (1973). It is expressed as

$$C = \sum_{i}^{m} \sum_{k}^{m} \sum_{j}^{n} \sum_{s}^{n} \alpha_{ikjs} (q_i q_k p_j p_s)^{\frac{1}{2}} \qquad (5.1)$$

The second is the quadratic multiproduct joint cost function (QMJCF) presented by Lau (1974). It is written as

$$\begin{aligned} C = {} & \alpha_o + \sum_{i=1}^{m} \alpha_i q_i + \sum_{j=1}^{n} \beta_j p_j \\ & + 1/2 \sum_{i=1}^{m} \sum_{k=1}^{m} \gamma_{ik} q_i q_k \qquad (5.2) \\ & + 1/2 \sum_{j=1}^{n} \sum_{s=1}^{n} \lambda_{js} p_j p_s \\ & + \sum_{i=1}^{m} \sum_{j=1}^{n} \theta_{ij} q_i p_j \end{aligned}$$

The third flexible form which is called the transcendental logarithmic (translog) multiproduct joint cost function (TMJCF) was suggested by Christensen et al. (1973). The TMJCF is written as

$$
\begin{aligned}
\ln C = \alpha_o &+ \sum_{i=1}^{m} \alpha_i \ln q_i + \sum_{j=1}^{n} \beta_j \ln p_j \\
&+ 1/2 \sum_{i=1}^{m} \sum_{k=1}^{m} \gamma_{ik} \ln q_i \ln q_k \\
&+ 1/2 \sum_{j=1}^{n} \sum_{s=1}^{n} \lambda_{js} \ln p_j \ln p_s \qquad (5.3) \\
&+ \sum_{i=1}^{m} \sum_{j=1}^{n} \theta_{ij} \ln q_i \ln p_j
\end{aligned}
$$

In reviewing the three flexible forms, Caves et al. (1980) pointed out that the QMJCF does not satisfy the regularity condition of linear homogeneity in factor prices. The condition is necessary to prove the existence of a duality relationship between the cost and transformation functions. While HDMJCF and TMJCF fulfill this regularity condition, the former has more parameters to be estimated than the latter. Thus, the

TMJCF appears to be more suitable for our purpose, but only if there are nonzero output observations in the sample.[1] Since none of the sample observations registered zero in any of the outputs, the TMJCF is chosen to represent the multiproduct joint cost function.

The TMJCF is required to meet the following symmetry conditions:

$$\text{i) } \gamma_{ik} = \gamma_{ki} \qquad \text{ii) } \lambda_{js} = \lambda_{sj} \tag{5.4}$$

In addition, every cost function should always exhibit linear homogeneity in input prices. The following parameter restrictions imposed on the TMJCF are necessary and sufficient for linear homogeneity in input prices:

$$\text{i) } \sum_{j=1}^{n} \beta_j = 1$$

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[1]If one of the q_i is zero, $\ln q_i = -\infty$, consequently $\ln C = -\infty$ and $C = 0$. That is, whenever the firm does not produce all of the various products and the output of at least one product is zero, then the translog cost function automatically yields zero costs. This, of course, contradicts common sense.

$$\text{ii)} \quad \sum_{j=1}^{n} \lambda_{js} = 0 \tag{5.5}$$

$$\text{iii)} \quad \sum_{j=1}^{n} \theta_{ij} = 0$$

The cost function which is dual to the transformation function obeys Shephard's lemma, i.e., a set of factor demand equations can be derived from the joint cost function. In our translog multiproduct joint cost function, the partial derivatives of (5.3) yield cost share equations of input j. This is written as

$$M_j = \frac{\partial \ln C}{\partial \ln p_j} = \beta_j + \sum_{s=1}^{n} \lambda_{js} \ln p_s + \sum_{i=1}^{m} \theta_{ij} \ln q_i \tag{5.6}$$

where M_j is the cost share (i.e., $p_j x_j / C$) of the jth input.

Since all the cost shares must add up to one, the following parameter restrictions are implied:

$$\text{i)} \quad \sum_{j=1}^{n} \beta_j = 1$$

$$\text{ii)} \quad \sum_{j=1}^{n} \lambda_{js} = 0 \qquad (5.7)$$

$$\text{iii)} \quad \sum_{j=1}^{n} \theta_{ij} = 0$$

Since these are exactly the same parameter restrictions when linear homogeneity in the input prices is imposed on the cost function, therefore, no new parameter restrictions are added to the cost share equations.

As earlier discussed, nonjointness and separability in outputs may be imposed on the production process. The imposition of nonjointness implies that the marginal cost of each output is independent of the level of any other output, i.e.,

$$\frac{\partial^2 C}{\partial q_i \partial q_k} = 0 , \quad i \neq k \qquad (5.8)$$

The TMJCF is then required to have the following parameter restrictions:

$$\gamma_{ik} = 0, \qquad i \neq k \qquad (5.9)$$

This reduces the number of parameters by (m)(m-1)/2.

A separable transformation function implies that the relative marginal costs are independent of input prices, or

$$\frac{\partial}{\partial \ln p_j}\left[\frac{(\partial \ln C/\partial \ln q_i)}{(\partial \ln C/\partial \ln q_k)}\right] = 0 \qquad (5.10)$$

Applying this condition to the translog joint cost function, we have:

$$\frac{\partial}{\partial \ln p_j}\left[\frac{(\alpha_i + \sum_{k=1}^{m} \gamma_{ik} \ln q_k + \sum_{j=1}^{n} \theta_{ij} \ln p_j)}{(\alpha_k + \sum_{i=1}^{m} \gamma_{ik} \ln q_i + \sum_{j=1}^{n} \theta_{kj} \ln p_j)}\right] \qquad (5.11)$$

Separability holds if

$$\theta_{ij} = 0, \quad \forall_{i,j} \qquad (5.12)$$

Since the imposition of linear homogeneity in the input prices leaves only $m(n-1)$ free θ_{ij}'s, the imposition of separability on the joint cost function further reduces the number of parameters by $m(n-1)$.

It should be recalled that this study uses a combination of time series and cross-section data. The estimation of (5.3) with pooled time series and cross-section data would not allow for differences in production structure among the years. Before we impose restrictions of nonjointness and separability on the structure of production, we should test first the hypothesis that the structure of production differs among the years considered in this study. Thus, we introduce dummy variables for 1978 and 1979 (i.e., $Y_1 = 1$ in 1978, zero otherwise; $Y_2 = 1$ in 1979, zero otherwise) which allow the production structure to be different from that of 1977. The dummy variables are allowed to interact with outputs and factor prices. The expanded cost function can then be written as:

$$\ln C = \alpha_o + \alpha_{y1} Y_1 + \alpha_{y2} Y_2 \tag{5.13}$$

$$+ \sum_{i=1}^{m} \alpha_i \ln q_i + \sum_{j=1}^{n} \beta_j \ln p_j$$

$$+ 1/2 \sum_{i=1}^{m} \sum_{k=1}^{m} \gamma_{ik} \ln q_i \ln q_k$$

$$+ 1/2 \sum_{j=1}^{n} \sum_{s=1}^{n} \lambda_{js} \ln p_j \ln p_s$$

$$+ \sum_{i=1}^{m} \sum_{j=1}^{n} \theta_{ij} \ln q_i \ln p_j$$

$$+ \sum_{i=1}^{m} \rho_{i1} \ln q_i Y_1 + \sum_{i=1}^{m} \rho_{i2} \ln q_i Y_2$$

$$+ \sum_{j=1}^{n} \delta_{j1} \ln p_j Y_1 + \sum_{j=1}^{n} \delta_{j2} \ln p_j Y_2$$

Since a cost function should exhibit linear homogeneity in factor prices, the following additional parameter restrictions are required:[2]

$$\text{iv)} \quad \sum_{j=1}^{n} \delta_{j1} = 0$$

$$\text{v)} \quad \sum_{j=1}^{n} \delta_{j2} = 0 \qquad (5.14)$$

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[2]See (5.5) for the first three sets of parameter restrictions.

The following are then the cost share equations implied in (5.13) by Shephard's lemma:

$$M_j = \beta_j + \sum_{s=1}^{n} \lambda_{js} \ln p_s + \sum_{i=1}^{m} \theta_{ij} \ln q_i + \delta_{1j} Y_1 + \delta_{2j} Y_2 \qquad (5.15)$$

V.2 Statistical Method

The cost function and the cost share equations are estimated jointly using the Zellner Efficient (ZEF) method.[3] Since the parameters appearing in the cost share equations also appear in the cost function, we can impose the restriction that they are equal.[4] The joint estimation of the cost function and the cost

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[3]This method is also called "Seemingly Unrelated Regressions" or SUR for short. See Zellner (1962).

[4]OLS may be applied to the cost function and to each of the cost share equations separately, and the results are consistent. However, these estimates in general will be inefficient because the fact that the parameters appearing in the cost function are the same as those appearing in the cost share equations has been ignored (see Lau, Lin and Yotopoulos, [1975]).

share equations has the effect of adding degrees of freedom without adding unrestricted parameters.

We specify an additive disturbance terms for each of the cost share equations and the cost function. Any deviations of the cost shares from logarithmic derivations of the translog cost function are assumed to result from random errors in cost minimizing behavior Following Zellner (1962), we assume correlated disturbances across equations. To implement the ZEF method, it is necessary to drop one of the cost share equations since only n-1 of said equations are linearly independent. However, this raises another problem, i.e., the estimato that are going to be obtained will not be invariant to the cost share equation that is going to be omitted.

Barten (1969) had shown that the maximum likelihood parameter estimates are independent of the omitte equation. This requires the use of Full Information

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[5]Since the cost shares add up to one, the sum of the disturbances across equations is zero at each observation. This implies that the disturbance covariance matrix is singular and non-diagonal, thus it is necessary to omit one of the cost share equations in order to implement the ZEF method.

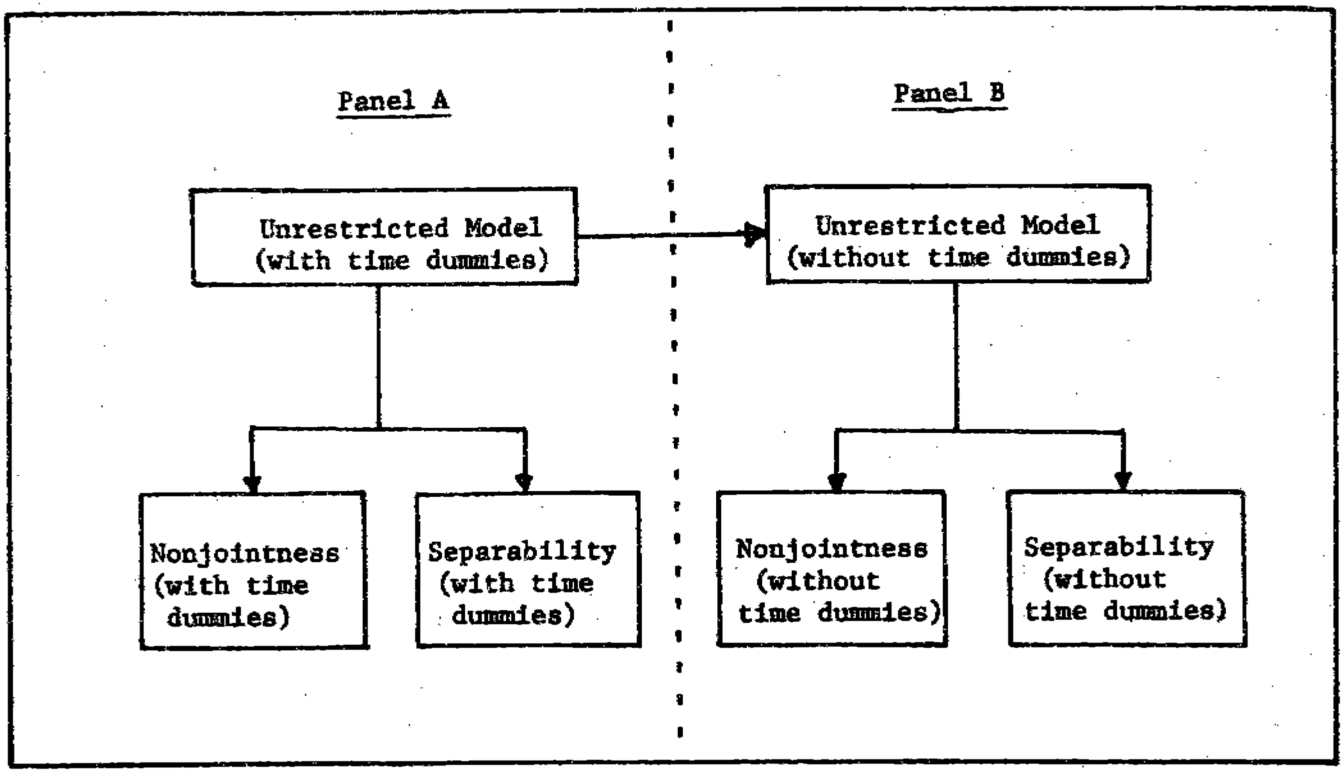
Maximum Likelihood (FIML) to obtain parameter estimates of the system of equations. Oberhofer and Kmenta (1974), however, had demonstrated that if one were to iterate the ZEF method until the estimated coefficients and residual covariance matrix converge, asymptotically equivalent estimators to maximum likelihood estimators can be obtained. Therefore, the iterative Zellner efficient estimators are also invariant to the omitted equation. This is the method employed in this study.

We will consider two alternative models for the cost function of banks, namely Alternative I and Alternative II. Both have practically the same variables except that the former classifies loans according security, while the latter, according to maturity.

In the empirical analysis to be presented in Chapter VI, we will first try to determine the underlying production technology of banks and then derive estimates of marginal costs, scale economies, etc., from the said technology. Figure IV outlines the test procedure for determining the underlying production technology. Panel A presents the three models -- the unrestricted model, a model with nonjoint production

Figure IV

TEST PROCEDURE



process, and a model with separable production process -- with time dummies. Panel B gives the same three models minus the time dummies.

The testing of hypotheses proceeds as follows: First, the null hypothesis stating that there are no differences in the structure of production among the years is tested, i.e., the unrestricted model without time dummies is tested against the unrestricted model with time dummies. If the null hypothesis is accepted, the succeeding tests of hypotheses will follow Panel B, i.e., the nonjoint and separable production processes will be tested separately against the unrestricted model without time dummies. If, however, the null hypothesis is rejected, the succeeding tests of hypotheses will follow Panel A.

The various hypotheses will be tested using the likelihood ratio statistic:

$$-2 \log \lambda = n(\log/\hat{\Omega}_r/ - \log/\hat{\Omega}_u/) \qquad (5.1)$$

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[6] Note that symmetry and homogeneity in input prices are imposed on all models.

where $/\hat{\Omega}_r/$ and $/\hat{\Omega}_u/$ are the determinants of the restricted and unrestricted estimates of the error variance-covariance matrix, respectively, and n is the total number of observations. $-2 \log \lambda$ follows a X^2 distribution with degrees of freedom equal to the number of independent restrictions imposed.

V.3 The Variables Included in the TMJCF

Table VII lists the variables included in the TMJCF. For the purpose of studying asset diversification, bank loans are classified by security and maturity. This gives us two alternative ways of defining bank outputs. Aside from the different types of loans, the other outputs considered are investments, demand deposits and other bank services. The latter are represented by the contingency accounts which include trust accounts and unused letters of credits. These are relatively important sources of bank income.

Banks use funds, labor and capital as factors of production. Ceilings are imposed on most of the prices of these factors, particularly interest rates

Table VII

LIST OF VARIABLES INCLUDED IN THE TMJCF

Notation	Definitior
	A. Dependent Variables
C	Total current operating costs
M_1	Cost share of savings and time deposits
M_2	Cost share of borrowed funds
M_3	Cost share of labor
M_4	Cost share of operating inputs
	B. Independent Variables
1) Bank Outputs	
	Alt. I
q_1	Unsecured loans
q_2	Secured loans
q_3	Investments
q_4	Demand deposits
q_5	Other bank services
	Alt. II
q_1	Short-term loans
q_2	Long-term loans
q_3	Investments
q_4	Demand deposits
q_5	Other bank services
2) Factor Pri	
P_1	Price of savings and time deposits
P_2	Price of borrowed funds
P_3	Price of labor services
P_4	Price of operating inputs
3) Time Dummies	
Y_1	1 for 1978, 0 otherwise
Y_2	1 for 1979, 0 otherwise

on deposits.[7] However, banks have ways of circumventing the price ceiling regulations. It is, therefore, necessary to use effective prices of the factors of production since they reflect approximately the true cost of using bank resources. The following derivations of the input prices generally follow the method used by Mullineaux (1978).

a) Price of Savings and Time Deposits (p_1)

In reality, the interest rate on savings deposits differs from that on time deposits. Ideally, therefore, the two rates should be considered as two distinct input prices. However, income statements reported by banks lump the two interest payments together, and there is no way of separating them. Given this limitation, the two types of deposits are treated as homogeneous commodities which can be represented by one price. Thus, the price of deposits is obtained by the following formula:

$$p_1 = \frac{\text{interest payments on deposits}}{\text{volume of savings and time deposits}} \quad (5.17)$$

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[7] Interest ceilings were still imposed during the period considered in this study.

b) Price of Borrowed Funds (p_2)

Borrowed funds consist of borrowings from the Central Bank and from the money market. The prices of these funds vary. In addition, there are different types of money market instruments whose prices also differ from each other. Unfortunately, the interest payments on them are lumped together in the reported bank income statements. They are, therefore, treated inevitably as one commodity represented by one price.

The price paid by banks on borrowed funds is simply computed in the following manner:

$$p_2 = \frac{\text{interest expenses on borrowed funds}}{\text{volume of bills payable}} \qquad (5.18)$$

c) Price of Labor Services (p_3)

The conventional method is applied to derive the price of labor services, that is,

$$p_3 = \frac{\text{expenses on compensation and benefits}}{\text{total number of employees}} \qquad (5.19)$$

d) Price of Operating Inputs (p_4)

The unit price of operating inputs is defined as

$$p_4 = \frac{\text{total current operating expenses less interest payments on savings and time deposits, interest payments on borrowed funds, compensation and fringe benefits}}{\text{total assets}} \qquad (5.20)$$

It should be noted that all data from the balance sheet items are average balances of four quarters. The average balances are preferred to the year-end data because the effect of window dressing usually done by banks at the end of the year is automatically discounted. Moreover, this is necessary especially if banks are experiencing seasonal variations and/or are rapidly growing during the period considered. This is clearly evident if we are to compute for the explicit interest rate on savings and time deposits defined in (5.17). In growing banks, the use of average savings and deposit balances will result in a higher effective interest rate for savings and time deposits than the use of year-end balances.

Chapter VI

EMPIRICAL FINDINGS

This chapter first attempts to determine the cost function that appropriately describes the underlying production technology of banks and then proceeds to derive important information from the said technology.

VI.1 The Underlying Production Technology of Banks

Two alternative cost functions which are basically similar in almost all aspects except in the manner of classifying loans are considered: Alternative I classifies loans according to **security**, while Alternative II classifies loans according to **maturity**. The test procedure outlined in the preceding chapter is applied to each alternative.

To test the various hypotheses mentioned in Chapter V, X^2 test statistics is utilized. The overall significance level of our series of tests is set at 5 percent. Table VIII summarizes the results of the tests.

Table VIII

TEST STATISTICS FOR THE DIFFERENT MODELS

Model	Type of Restriction	No. of Parameter Restrictions	Critical X^2 (5%)	Alternative I		Alternative II	
				X^2 Test Statistics	Hypothesis Outcome	X^2 Test Statistics	Hypothesis Outcome
A	Unrestricted Model with Time Dummies	-	-	-	-	-	-
B	Unrestricted Model without Time Dummies	18	28.87	11.78	Accept	9.05	Accept
C	With Nonjointness	10	18.31	22.37	Reject	169.91	Reject
D	With Separability	15	25.00	42.44	Reject	44.91	Reject

Note: Model B is tested against Model A which is the Unrestricted Model with Time Dummies, while Model C and Model D are tested against Model B.

First, we will test the hypothesis that there are no differences in the production structure of commercial banks among the years. That is, the unrestricted model without time dummies will be tested against the unrestricted model with time dummies. In the context of our TMJCF, this implies the testing of the null hypothesis:

$$\begin{aligned} &\text{i)} \quad \alpha_{y1} = \alpha_{y2} = 0 \\ &\text{ii)} \quad \rho_{i1} = \rho_{i2} = 0 \;, \quad \forall_i \qquad (6.1) \\ &\text{iii)} \quad \delta_{j1} = \delta_{j2} = 0 \;, \quad \forall_j \end{aligned}$$

The null hypothesis is accepted in Alternatives I and II, suggesting that the production structure of banks did not differ among the years (i.e., 1977-1979) considered in this study. This was expected since the three years considered are consecutive and too short to allow banks to alter their production technology. In subsequent tests, therefore, the unrestricted model without time dummies is considered as the maintained hypothesis against which restrictive models are tested.

The second hypothesis deals with the nonjointness in the production process. In the context of the TMJCF (equation [5.3]), the null hypothesis to be tested is

$$\gamma_{ik} = 0 , \quad \forall_{i,k} , \quad i \neq k \qquad (6.2)$$

The null hypothesis is rejected in both alternatives, implying that the production technology of banks is not characterized by nonjointness. In other words, no output-producing department of a bank can operate on its own as if it were an independent firm since its activities influence, and are also influenced by, the activities of the other departments. This finding raises serious doubts about the validity of applying simpler models, such as those proposed by Sealey and Lindley (1977) and Bell and Murphy (1968), to the Philippine case. Such models assume nonjointness in the production process without prior verification of its validity.

Finally, the hypothesis that bank's underlying production technology is characterized by separability in outputs will be tested. It means that we have to test the null hypothesis that

$$\theta_{ij} = 0 , \qquad \forall_{i,j} \tag{6.3}$$

Again, this hypothesis is strongly rejected in both alternatives, indicating that models of bank behavior which assume a single homogeneous output must be rejected.

If the technology is separable, the ratio of any two marginal costs or, under perfect competition, the ratio of any two output prices is dependent on the output mix but independent of factor prices or factor intensities. The result showing that separability is decisively rejected implies that the ratios of any two marginal costs are also sensitive to factor prices or factor intensities. Thus, a bank's optimization decision depends simultaneously on output and input mix. With this finding, it may be said that the practice of managing simultaneously both outputs and inputs stands out well in contrast to the practice of managing the outputs independently of the inputs. In other words, the decision-making process done at the bank level is still centralized.

The Cobb-Douglas is even more restrictive than any of the models tested since it requires that all second order parameters (γ_{ij}, λ_{js} θ_{ij}) be zero. Since the model with separability restriction, which is the most restrictive among the models considered, is rejected, the Cobb-Douglas form will most likely be rejected. This, therefore, seriously limits the claim of Richard and Villanueva (1978) that a Cobb-Douglas function is the underlying technology of the entire banking system.[1] Since they were analyzing only the rural and private development banks of the Philippines, their conclusions could not be extended to the commercial banks.

On the basis of the results, we may conclude that the unrestricted model which does not allow for differences in the structure of production during the period 1977-1979 is the model that best describes the production technology of banks. Such model describes a technology that is characterized by jointness in the

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[1]They were actually using a Cobb-Douglas profit function which is dual to the Cobb-Douglas production function.

production process and also allows simultaneous determination of output and input mix

Our analysis on bank behavior will proceed using the information contained in the unrestricted model. The parameter estimates of the unrestricted model without time dummies are shown in Table IX, while those of the other models are given in Appendix K.

VI.2 The Implied Marginal Costs of the TMJCF

To see the extent of the increase in costs due to a unit increase in the production of a particular output, the marginal costs may be computed. These can be obtained from the TMJCF. By differentiating (5.3) with respect to each product, the following cost elasticities are obtained:

$$\frac{\partial \ln C}{\partial \ln q_i} = \alpha_i + \sum_{i=1}^{m} \gamma_{ij} \ln q_i + \sum_{j=1}^{n} \theta_{ij} \ln p_j \qquad (6.4)$$

Table IX

ZEF PARAMETER ESTIMATES OF THE UNRESTRICTED TRANSLOG MULTIPRODUCT JOINT COST FUNCTION

Variables	Parameters	Alternative I Values	Alternative I t-Ratios	Alternative II Values	Alternative II t-Ratios
Constant	α_0	7.5761	7.57*	8.0365	5.69*
ln q1	α_1	-0.7221	-2.26**	-2.1317	-3.12*
ln q2	α_2	-1.2017	-5.14*	-0.2669	-1.41
ln q3	α_3	-0.0133	-0.78	-0.3088	-0.59
ln q4	α_4	1.5647	2.17**	1.3318	1.73***
ln q5	α_5	0.7717	2.26**	0.7476	1.99**
ln p1	β_1	-0.0108	-0.14	0.0853	0.90
ln p2	β_2	0.2467	2.57*	0.0941	0.82
ln p3	β_3	0.3106	7.62*	0.3777	8.52*
ln p4	β_4	0.5465	3.39*	0.4429	2.23**
$1/2\ (\ln q_1)^2$	γ_{11}	0.0156	0.11	-0.4547	-1.36
$\ln q_1 \ln q_2$	γ_{12}	-0.1879	-2.28**	-0.0880	-1.18
$\ln q_1 \ln q_3$	γ_{13}	0.0604	0.51	0.3930	2.29**
$\ln q_1 \ln q_4$	γ_{14}	0.2621	1.75***	0.4617	1.57
$\ln q_1 \ln q_5$	γ_{15}	0.0112	0.12	0.1583	1.00
$1/2\ (\ln q_2)^2$	γ_{22}	-0.2697	-3.68*	-0.0188	-1.03
$\ln q_2 \ln q_3$	γ_{23}	0.2470	3.28*	0.0818	1.65***
$\ln q_2 \ln q_4$	γ_{24}	0.3675	2.16**	-0.0265	-0.45
$\ln q_2 \ln q_5$	γ_{25}	0.2390	2.51**	0.1050	2.34**
$1/2\ (\ln q_3)^2$	γ_{33}	0.2839	4.12*	0.2506	4.34*
$\ln q_3 \ln q_4$	γ_{34}	-0.5576	-4.36*	-0.5949	-4.51*
$\ln q_3 \ln q_5$	γ_{35}	0.0021	0.02	-0.1132	-0.99
$1/2\ (\ln q_4)^2$	γ_{44}	0.0696	0.33	0.2146	1.00
$\ln q_4 \ln q_5$	γ_{45}	-0.3537	-2.91*	-0.2607	-2.01***

Table IX (Continued)

Variables	Parameters	Alternative I Values	Alternative I t-Ratios	Alternative II Values	Alternative II t-Ratios
$1/2\ (\ln q_5)^2$	$\gamma 55$	-0.0430	-0.41	-0.0139	-0.13
$1/2\ (\ln p_1)^2$	$\lambda 11$	0.2050	8.79*	0.2295	9.51*
$\ln p_1 \ln p_2$	$\lambda 12$	-0.0581	-2.40**	-0.0875	-3.54*
$\ln p_1 \ln p_3$	$\lambda 13$	-0.0220	-1.71***	-0.0121	-1.09
$\ln p_1 \ln p_4$	$\lambda 14$	-0.1249	-2.76*	-0.1299	-2.30*
$1/2\ (\ln p_2)^2$	$\lambda 22$	0.1025	3.12*	0.1388	4.22*
$\ln p_2 \ln p_3$	$\lambda 23$	-0.0021	-0.17	-0.0134	-1.18
$\ln p_2 \ln p_4$	$\lambda 24$	-0.0423	-0.71	-0.0379	-0.62
$1/2\ (\ln p_3)^2$	$\lambda 33$	0.0232	1.84***	0.0252	2.15**
$\ln p_3 \ln p_4$	$\lambda 34$	0.0009	0.04	0.0002	0.01
$1/2\ (\ln p_4)^2$	$\lambda 44$	0.1663	3.07*	0.1676	3.05*
$\ln q_1 \ln p_1$	$\theta 11$	-0.0797	-3.80*	-0.1063	-2.83*
$\ln q_2 \ln p_1$	$\theta 21$	0.0055	0.33	0.0134	1.43
$\ln q_3 \ln p_1$	$\theta 31$	0.0791	3.07*	0.0778	3.42*
$\ln q_4 \ln p_1$	$\theta 41$	0.0656	2.23**	0.1009	3.33*
$\ln q_5 \ln p_1$	$\theta 51$	-0.0261	-1.31	-0.0339	-1.56
$\ln q_1 \ln p_2$	$\theta 12$	0.1048	3.96*	0.1583	3.40*
$\ln q_2 \ln p_2$	$\theta 22$	0.0068	0.32	-0.0151	-1.39
$\ln q_3 \ln p_2$	$\theta 32$	-0.0614	-2.27**	-0.0627	-2.23**
$\ln q_4 \ln p_2$	$\theta 42$	-0.1231	-3.32*	-0.1656	-4.01*
$\ln q_5 \ln p_2$	$\theta 52$	0.0409	1.63	0.0473	1.75***
$\ln q_1 \ln p_3$	$\theta 13$	-0.0280	-2.03*	-0.0572	-3.52*
$\ln q_2 \ln p_3$	$\theta 23$	-0.0037	-0.46	0.0069	1.35***
$\ln q_3 \ln p_3$	$\theta 33$	-0.0088	-0.86	-0.0059	-0.61
$\ln q_4 \ln p_3$	$\theta 43$	0.0309	2.22**	0.0446	3.45*
$\ln q_5 \ln p_3$	$\theta 53$	-0.0078	-0.83	-0.0061	-0.65
$\ln q_1 \ln p_4$	$\theta 14$	0.0029	0.56	0.0053	0.06
$\ln q_2 \ln p_4$	$\theta 24$	-0.0086	-0.53	-0.0052	-0.25
$\ln q_3 \ln p_4$	$\theta 34$	-0.0089	-0.20	-0.0092	-0.20
$\ln q_4 \ln p_4$	$\theta 44$	0.0266	0.37	0.0200	0.28
$\ln q_5 \ln p_4$	$\theta 54$	-0.0070	-0.11	-0.0072	-0.14

Note: The parameter estimates refer to those of the unrestricted model without time dummies. *Significant at .01 level. **Significant at .05 level. ***Significant at .10 level.

The marginal cost for each output may be derived by multiplying (6.4) by C/q_i; we have

$$\frac{\partial C}{\partial q_i} = \left[\frac{\partial \ln C}{\partial \ln q_i}\right] \frac{C}{q_i} = \left[\alpha_i + \sum_{i=1}^{n} \gamma_{ij} \ln q_i + \sum_{j=1}^{n} \theta_{ij} \ln p_j\right] \frac{C}{q_i} \tag{6.5}$$

As may be seen from (6.5), the marginal cost for each product depends on the levels of all outputs and facto prices. Since the levels of all outputs and factor prices vary across observations, the marginal cost also differs from one observation to the other.

The marginal cost equations for the different bank outputs are presented in Table X-a and Table X-b for Alternatives I and II, respectively. They are evaluated at the observed levels of outputs and input prices, and the results are shown in Table XI-a and Table XI-b for Alternatives I and II, respectively. We notice some differences in the estimates of the marginal cost of investments, demand deposits and other bank services under the two alternatives; however, the

Table X-a

MARGINAL COST EQUATIONS, ALTERNATIVE I

$$MC_1 = [-.7221 + .0156 \ln q_1 - .1879 \ln q_2 + .0604 \ln q_3 + .2621 \ln q_4 + .0112 \ln q_5 - .0797 \ln p_1 + .1048 \ln p_2 - .0280 \ln p_3 + .0029 \ln p_4] \frac{C}{q_1}$$

$$MC_2 = [-1.9017 - .1879 \ln q_1 - .2697 \ln q_2 + .2470 \ln q_3 + .3675 \ln q_4 + .2390 \ln q_5 + .0055 \ln p_1 + .0068 \ln p_2 - .0037 \ln p_3 - .0086 \ln p_4] \frac{C}{q_2}$$

$$MC_3 = [-.3133 + .0604 \ln q_1 + .2470 \ln q_2 + .2859 \ln q_3 - .5576 \ln q_4 + .0021 \ln q_5 + .0791 \ln p_1 - .0614 \ln p_2 - .0088 \ln p_3 - .0089 \ln p_4] \frac{C}{q_3}$$

$$MC_4 = [1.5647 + .2621 \ln q_1 + .3675 \ln q_2 - .5576 \ln q_3 + .0696 \ln q_4 - .3537 \ln q_5 + .0656 \ln p_1 - .1231 \ln p_2 + .0309 \ln p_3 + .0266 \ln p_4] \frac{C}{q_4}$$

$$MC_5 = [.7717 + .0112 \ln q_1 + .2390 \ln q_2 + .0021 \ln q_3 - .3537 \ln q_4 - .0430 \ln q_5 - .0261 \ln p_1 + .0409 \ln p_2 - .0079 \ln p_3 - .0070 \ln p_4] \frac{C}{q_5}$$

Note: The bracketed terms are the cost elasticities with respect to q_1, q_2, q_3, q_4 and q_5, respectively.

Table X-b

MARGINAL COST EQUATIONS, ALTERNATIVE II

$$MC_1 = [-2.1317 - .4547 \ln q_1 - .0880 \ln q_2 + .3930 \ln q_3 + .4617 \ln q_4 + .1583 \ln q_5 - .1063 \ln p_1 + .1583 \ln p_2 - .0572 \ln p_3 + .0053 \ln p_4] \frac{C}{q_1}$$

$$MC_2 = [-.2669 - .0880 \ln q_1 - .0188 \ln q_2 + .0818 \ln q_3 - .0265 \ln q_4 + .1050 \ln q_5 + .0134 \ln p_1 - .0151 \ln p_2 + .0069 \ln p_3 - .0052 \ln p_4] \frac{C}{q_2}$$

$$MC_3 = [-.3088 + .3930 \ln q_1 + .0818 \ln q_2 + .2506 \ln q_3 - .5949 \ln q_4 - .1132 \ln q_5 + .0778 \ln p_1 - .0627 \ln p_2 - .0059 \ln p_3 - .0092 \ln p_4] \frac{C}{q_3}$$

$$MC_4 = [1.3318 + .4617 \ln q_1 - .0265 \ln q_2 - .5949 \ln q_3 + .2146 \ln q_4 - .2607 \ln q_5 + .1009 \ln p_1 - .1656 \ln p_2 + .0446 \ln p_3 + .0200 \ln p_4] \frac{C}{q_4}$$

$$MC_5 = [.7476 + .1583 \ln q_1 + .1050 \ln q_2 - .1132 \ln q_3 - .2607 \ln q_4 - .0139 \ln q_5 - .0339 \ln p_1 + .0473 \ln p_2 - .0061 \ln p_3 - .0072 \ln p_4] \frac{C}{q_5}$$

Note: The bracketed terms are the cost elasticities with respect to q_1, q_2, q_3, q_4 and q_5, respectively.

Table XI-a

ESTIMATED MARGINAL COSTS, ALTERNATIVE I

OBS.	MC_1	MC_2	MC_3	MC_4	MC_5
1	.082	.049	-	.274	.033
2	.053	.042	-	.280	.039
3	.065	.117	-	.311	.014
4	.018	.029	.074	.139	.025
5	.048	.257	.163	-	.016
6	.058	.332	.233	-	.013
7	.081	.067	.085	.158	.032
8	.106	.139	.092	.130	.008
9	.114	.154	.126	.192	.012
10	.073	.150	.079	.120	.021
11	.049	.152	.130	.109	.015
12	.064	.295	.135	-	.001
13	.014	-	.033	.342	.059
14	.025	-	-	.306	.018
15	.031	.018	.012	.318	.011
16	.127	.180	-	-	-
17	.106	.119	-	.103	-
18	.100	.131	-	.177	-
19	.105	.221	.028	-	-
20	.070	.173	-	.258	-
21	.073	.158	.005	.274	-
22	.044	.030	.075	.313	.062
23	.059	.072	.072	.207	.042
24	.057	.108	.080	.197	.026
25	.107	.137	.036	-	.010
26	.120	.153	.071	-	.012
27	.084	.111	.153	.139	.029
28	.212	.236	-	-	.027
29	.177	.312	-	-	-
30	.063	.096	-	.221	.026
31	.047	.096	.116	.147	.026
32	.024	.056	.160	.376	.036
33	.051	.094	.170	.185	.047
34	.001	-	.020	.122	.054
35	-	-	.311	.563	.085
36	-	-	.344	.239	.084
37	.006	.046	.212	.145	.055
38	-	.065	.208	.127	.041
39	-	.058	.284	.268	.066
40	.088	.177	.053	.021	.005

Table XI-a (Continued)

OBS.	MC_1	MC_2	MC_3	MC_4	MC_5
41	.081	.157	.099	.093	.010
42	.120	.251	.136	-	.010
43	.101	.038	.030	.355	.092
44	.093	.090	.098	.193	.057
45	.091	.114	.145	.175	.087
46	.028	-	.094	.568	.079
47	-	-	.235	.711	.113
48	.034	.077	.151	.332	.046
49	.098	.143	-	.050	-
50	.012	.025	.102	.286	.042
51	.005	.019	.242	.309	.068
52	.086	.122	.026	.200	.018
53	.123	.122	-	.152	-
54	.226	.266	-	-	-
55	-	-	.023	.401	.110
56	-	-	.076	.407	.141
57	-	-	.086	.494	.123
58	.095	10.374	-	-	-
59	.082	2.60	-	-	-
60	-	-	.098	.591	.070
61	-	.038	.096	.231	.094
62	-	.024	.120	.286	.114
63	-	.015	.162	.341	.118
64	-	-	-	2.122	3.459
65	-	-	-	1.866	.508
66	-	-	-	1.126	.039
67	.050	.115	.153	.089	.028
68	.042	.136	.172	.031	.015
69	.060	.221	.240	-	.012
70	.059	.075	-	.161	.012
71	.045	.096	.007	.181	.010
72	.008	.014	.159	.366	.071
73	-	-	.191	.274	.117
74	-	.039	.140	.179	.052
75	-	.019	.226	.399	.071
76	.132	.186	-	-	-
77	.159	.190	-	.005	-
78	.131	.322	.038	-	-
79	-	.001	.244	.077	.157
80	-	.055	.254	-	.123
81	-	.038	.220	.172	.108

Note: MC_1 = marginal cost of unsecured loans.
MC_2 = marginal cost of secured loans.
MC_3 = marginal cost of investments.
MC_4 = marginal cost of demand deposits.
MC_5 = marginal cost of other bank services.

Table XI-b

ESTIMATED MARGINAL COSTS, ALTERNATIVE II

OBS.	MC_1	MC_2	MC_3	MC_4	MC_5
1	.047	-	.066	.371	.086
2	.066	.182	-	.374	-
3	.086	1.578	-	.514	-
4	.018	.091	.085	.183	.023
5	.091	.869	.156	-	.010
6	.124	.797	.209	-	.011
7	.079	.011	.074	-	.024
8	.151	.044	.068	.104	.007
9	.152	.062	.084	.172	.022
10	.103	.111	.080	.142	.021
11	.089	.392	.093	.178	.004
12	.129	.608	.106	-	-
13	-	-	.093	.406	.074
14	-	-	.024	.446	.042
15	-	-	.190	.603	.076
16	.169	.767	-	.071	-
17	.131	.771	-	.163	-
18	.129	.398	-	.236	-
19	.165	.102	.023	-	-
20	.072	.060	-	.362	-
21	.081	.040	.029	.330	.023
22	.079	1.471	-	.362	-
23	.114	6.559	-	.277	-
24	.080	.124	.083	.229	-
25	.148	.068	.009	-	.009
26	.151	.200	.017	.013	.001
27	.109	.096	.100	.147	.025
28	.293	.402	-	-	-
29	.250	.797	-	.088	-
30	.082	.315	-	.393	.018
31	.083	.046	.098	.079	.047
32	.049	.022	.125	.238	.060
33	.124	.037	.125	-	.061
34	-	-	.037	.161	.036
35	-	.090	.308	.460	.072
36	-	.145	.357	.100	.079
37	.055	.058	.155	.089	.051
38	.055	.092	.141	.149	.035
39	.048	.082	.221	.294	.056
40	.126	.229	.018	.066	.003
41	.113	.139	.073	.109	.016
42	.191	.153	.103	-	.021

Table XI-b (Continued)

OBS.	MC_1	MC_2	MC_3	MC_4	MC_5
43	.071	-	.035	.340	.077
44	.118	.014	.084	.148	.043
45	.148	.023	.151	.034	.067
46	.021	-	.106	.441	.116
47	-	-	.248	.553	.128
48	.069	.031	.129	.268	.058
49	.119	.086	-	.092	-
50	.024	.128	.067	.322	.029
51	.025	.032	.238	.127	.071
52	.089	.045	-	.148	.047
53	.141	.034	-	.168	.015
54	.240	.258	-	.009	-
55	-	-	.061	.374	.112
56	-	-	.079	.384	.094
57	-	-	.111	.389	.129
58	.006	12.642	.005	.570	-
59	-	-	.012	.629	.035
60	-	-	.088	.710	.038
61	.052	.031	.063	.303	.008
62	.026	-	.112	.337	.036
63	.026	-	.167	.271	.087
64	-	-	-	2.435	2.730
65	-	-	-	2.173	.300
66	-	-	-	1.176	.085
67	.089	.084	.128	.046	.035
68	.094	.188	.096	.072	.016
69	.151	.404	.133	-	.010
70	.051	-	-	.211	.031
71	.046	.034	.016	.226	.031
72	.022	.009	.151	.304	.068
73	-	.020	.176	.178	.087
74	.040	.046	.097	.172	.045
75	.045	.013	.182	.147	.077
76	.176	.022	-	-	-
77	.212	-	.008	-	-
78	.232	.159	.032	-	-
79	-	.094	.231	-	.095
80	.043	.131	.223	-	.072
81	.042	.052	.205	-	.076

Note: MC_1 = marginal cost of short-term loans.
MC_2 = marginal cost of long-term loans.
MC_3 = marginal cost of investments.
MC_4 = marginal cost of demand deposits.
MC_5 = marginal cost of other bank services.

said differences are not very perceptible. Note that the estimated marginal costs are not well-behaved for certain levels of bank outputs.[2] Thus, we exclude them from Table XI-a and Table XI-b.

The marginal cost gives the annual additional cost brought about by increasing one particular bank output by P1M. Some discernible patterns can be observed from Tables XI-a and XI-b. Among the financial products considered, demand deposits appear to be the most costly to produce. This may be due to the complex processes involved in producing this particular bank output. Every check has to be verified several times before it is cleared. Bookkeeping entries are going to be made and financial reports are going to be prepared and sent out to depositors. In addition, ancillary banking services, such as receiving payments for large firms, giving advice, etc., are performed by banks in favor of demand depositors. All these involve the use of bank resources, such as bookkeepers' time, tellers'

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[2] This problem is also encountered in other studies using the translog model. For example, see Caves et al. (1979, 1981) and Brown et al. (1979).

time, machine time, etc., which could eventually raise the cost of servicing demand deposit accounts. It is to be noted that in 2 May 1979, banks raised both the minimum balance for demand deposits from ₱200 to ₱500 and the penalty for holding demand deposit balances below the minimum from ₱3.00 to ₱5.00 per month. This move in effect increased the implicit price of servicing demand deposit accounts, possibly to compensate for its increasing production cost. This may indicate that banks correctly perceived the increasing difficulty encountered in producing this bank output.

The estimated marginal cost of producing other bank services is observably low. It is less than .10 in most cases. This is true regardless of the alternatives (I or II) considered.

A much clearer picture is obtained if we analyze the behavior of the marginal cost curves throughout the relevant range of output. We, therefore, plot the relationship between one output and its corresponding marginal cost while other outputs and all factor inputs are held constant at their sample means. The curves represent the marginal costs for an average bank.

The marginal cost curves of the five bank outputs under Alternative I are shown in Figures V-a to V-e, respectively. Some interesting patterns are discernible. The marginal cost curves of unsecured loans, secured loans, demand deposits and other bank services are declining. This means that the additional cost of producing an extra unit of these outputs becomes smaller at higher levels. However, the marginal cost curves of secured loans, demand deposits and other bank services become flat over a certain range, indicating that after some output level, the bank will no longer realize additional cost savings by expanding the volume of these outputs.

The graphs also reveal differences in the height and rate of decline of the marginal costs. In terms of height, unsecured loans have the lowest declining marginal cost curve, while demand deposits have the highest.

Note that the marginal cost curve of unsecured loans is lower compared with that of secured loans. The difference may be attributed to the fact that those who were able to obtain unsecured loans are mostly bank

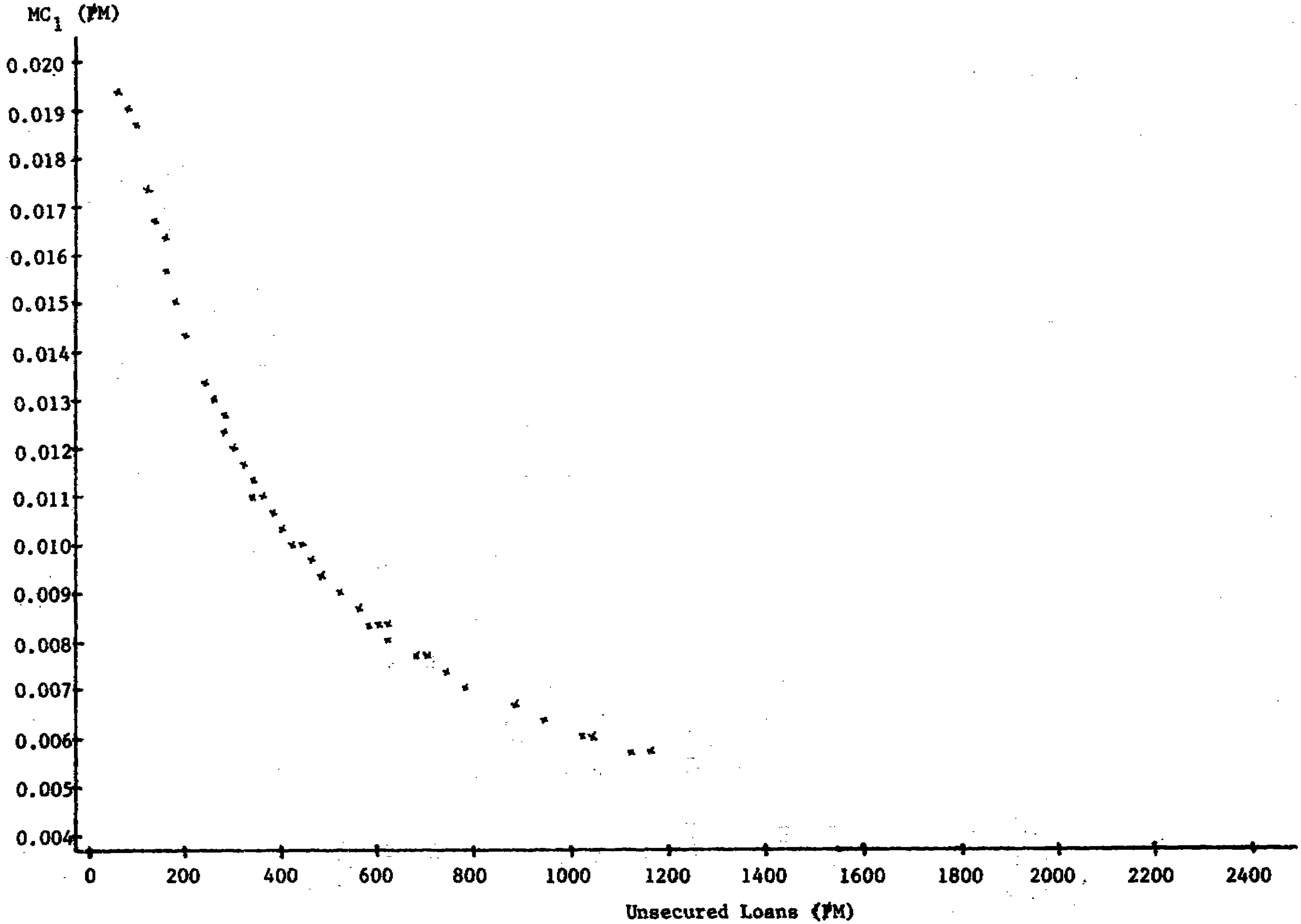

Figure V-a: Marginal Cost Curve of Unsecured Loans, Alternative I

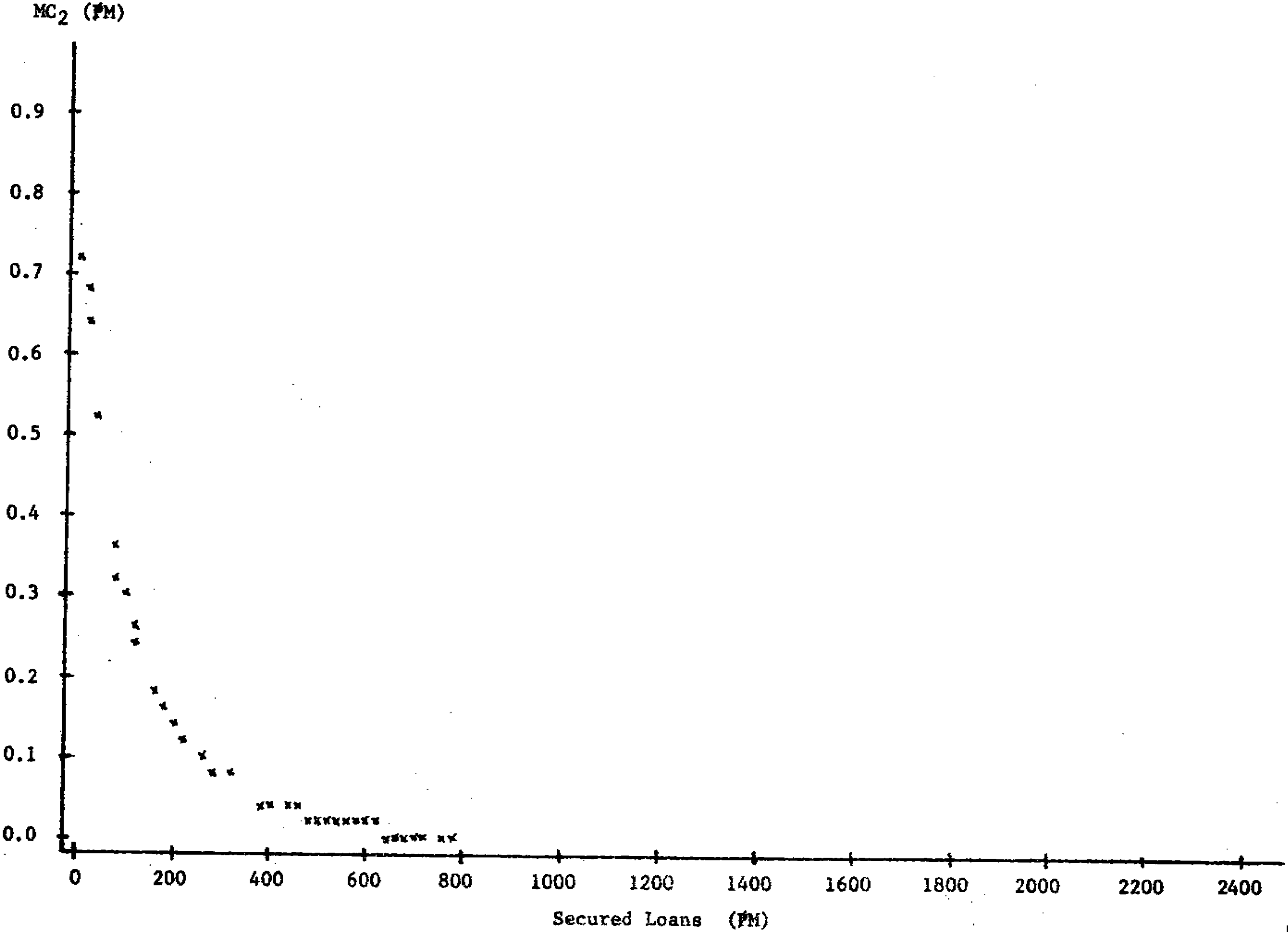

Figure V-b: Marginal Cost Curve of Secured Loans, Alternative I

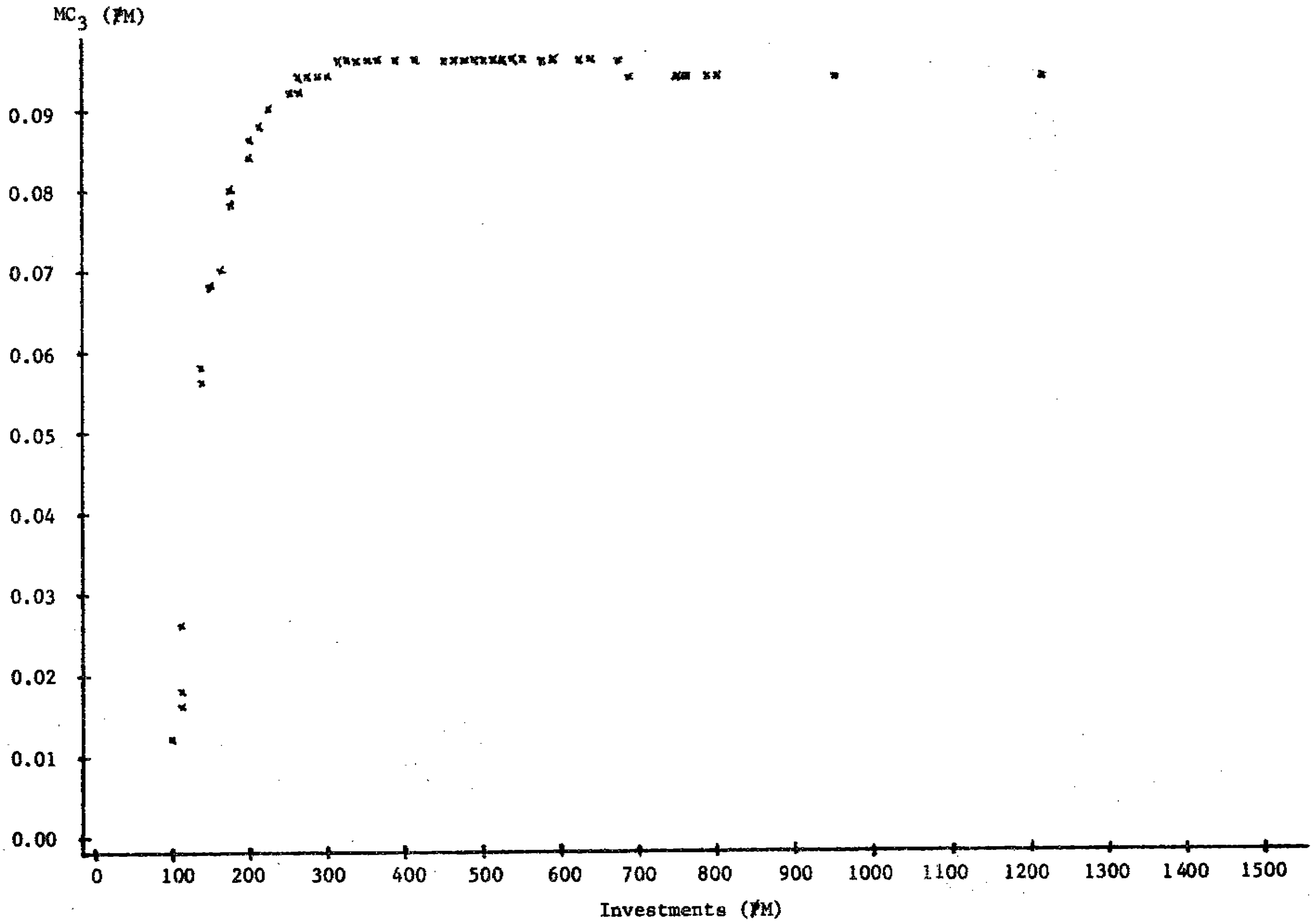

Figure V-c: Marginal Cost Curve of Investments, Alternative I

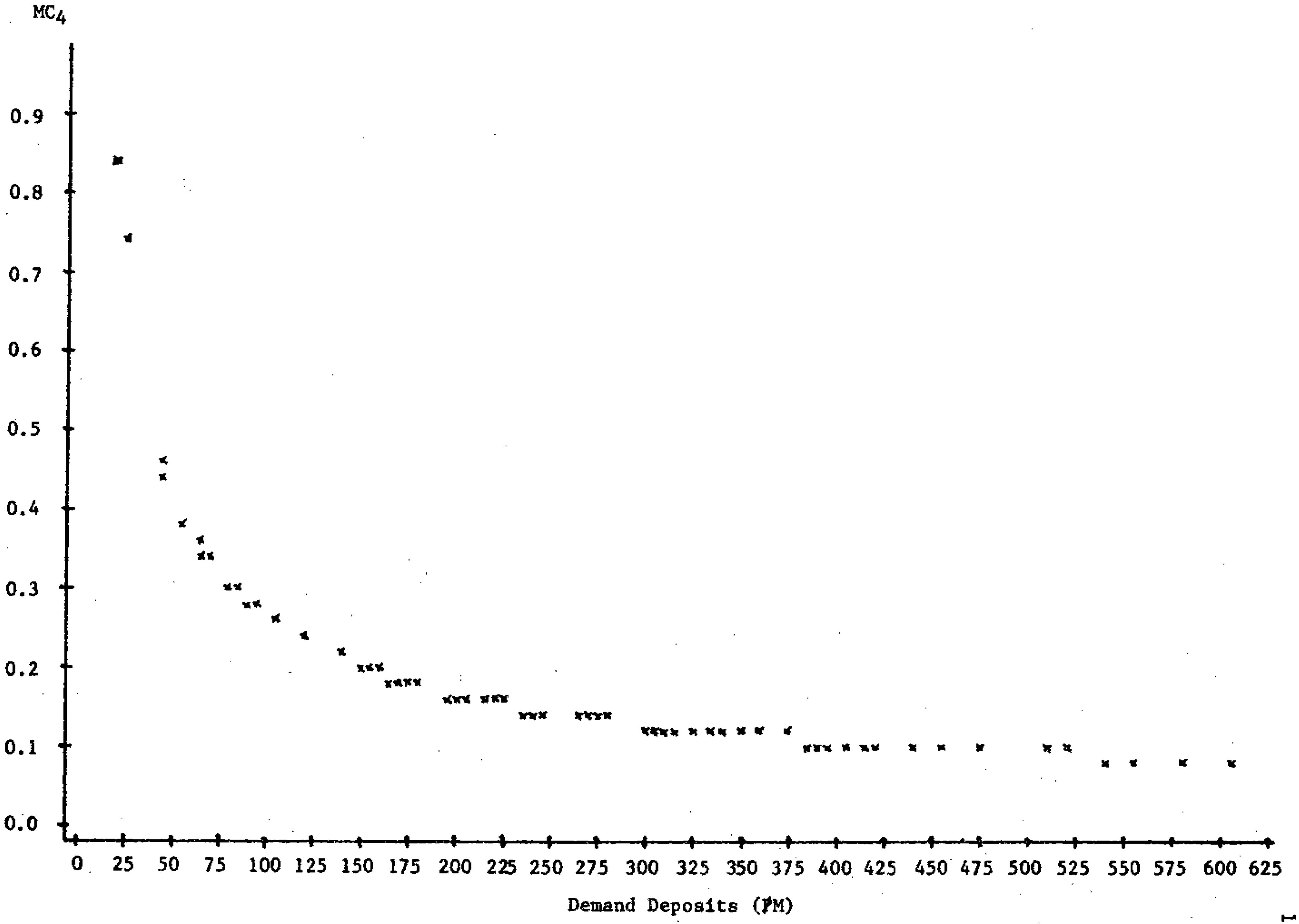

Figure V-d: Marginal Cost Curve of Demand Deposits, Alternative I

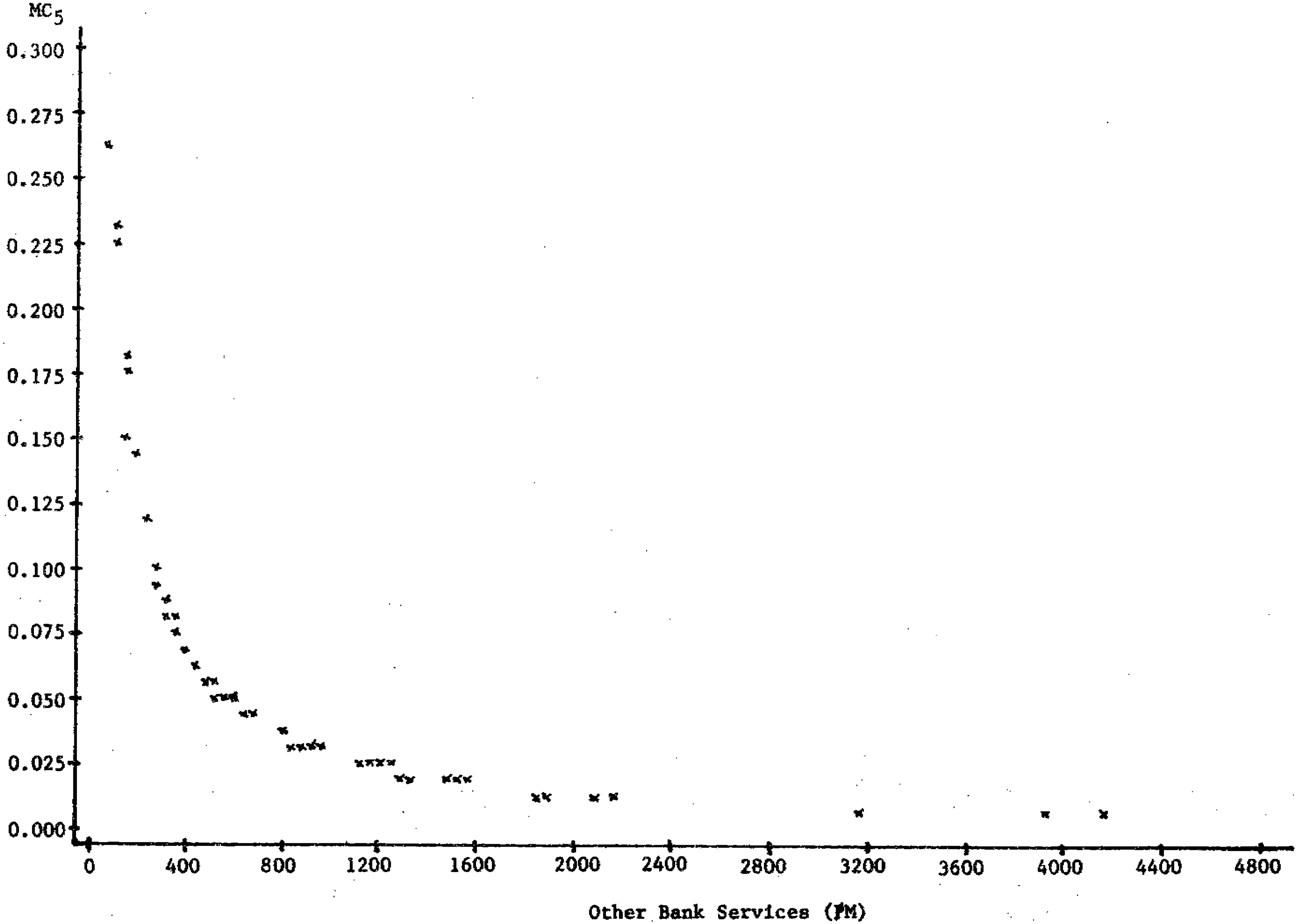

Figure V-e: Marginal Cost Curve of Other Bank Services, Alternative I officers and established customers of the bank whose loan applications involve lower processing cost on the part of the bank.

In contrast, the marginal cost curve of investments increases at a faster rate and eventually flattens out at the ₱300M output level. The increasing marginal cost curve implies that the additional cost of producing an extra unit of this output increases at higher output level.

Figures VI-a to VI-e present the marginal cost curves of bank outputs under Alternative II. The marginal cost curves of short-term loans, long-term loans and other bank services decline at a diminishing rate throughout their respective relevant range of outputs. The declining marginal cost curve of long-term loans deserves attention because it indicates that if banks are to increase the volume of long-term loans, they will most likely incur lower additional cost of producing an extra unit of this output.

Similar with results under Alternative II, the marginal cost curve of investments is sloping upwards. Unexpectedly, however, the marginal cost curve of

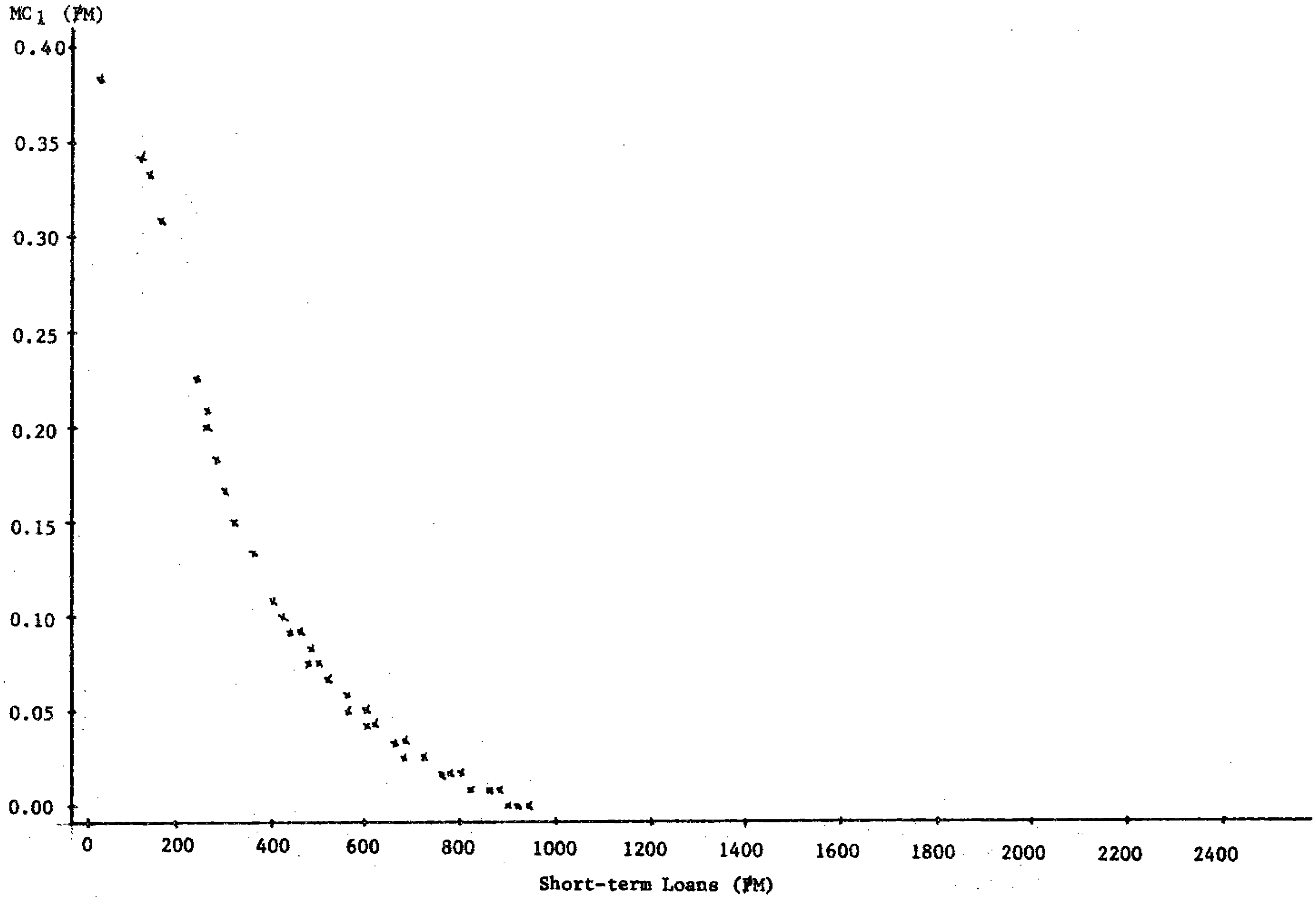

Figure VI-a: Marginal Cost Curve of Short-Term Loans, Alternative II

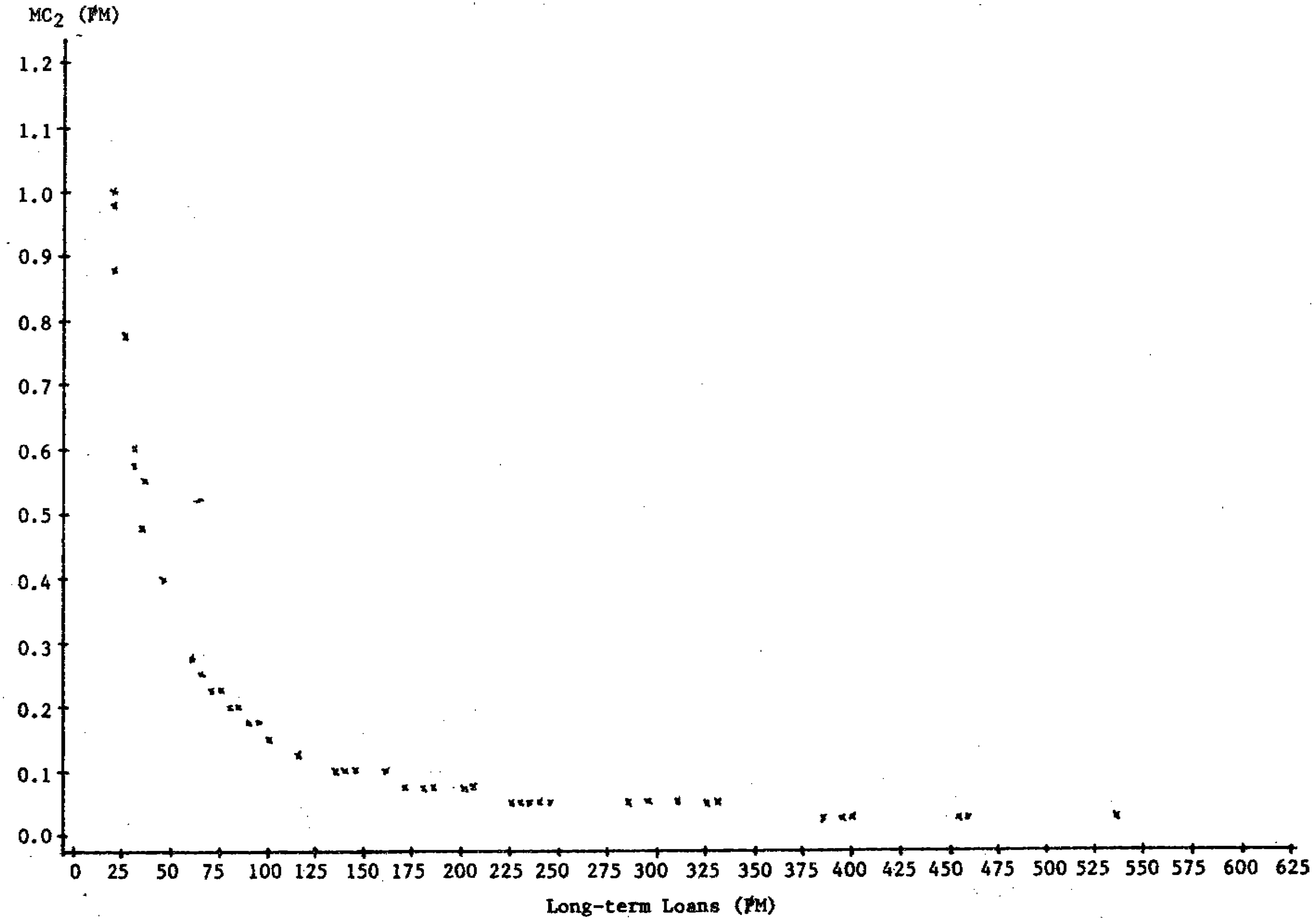

Figure VI-b: Marginal Cost Curve of Long-Term Loans, Alternative II

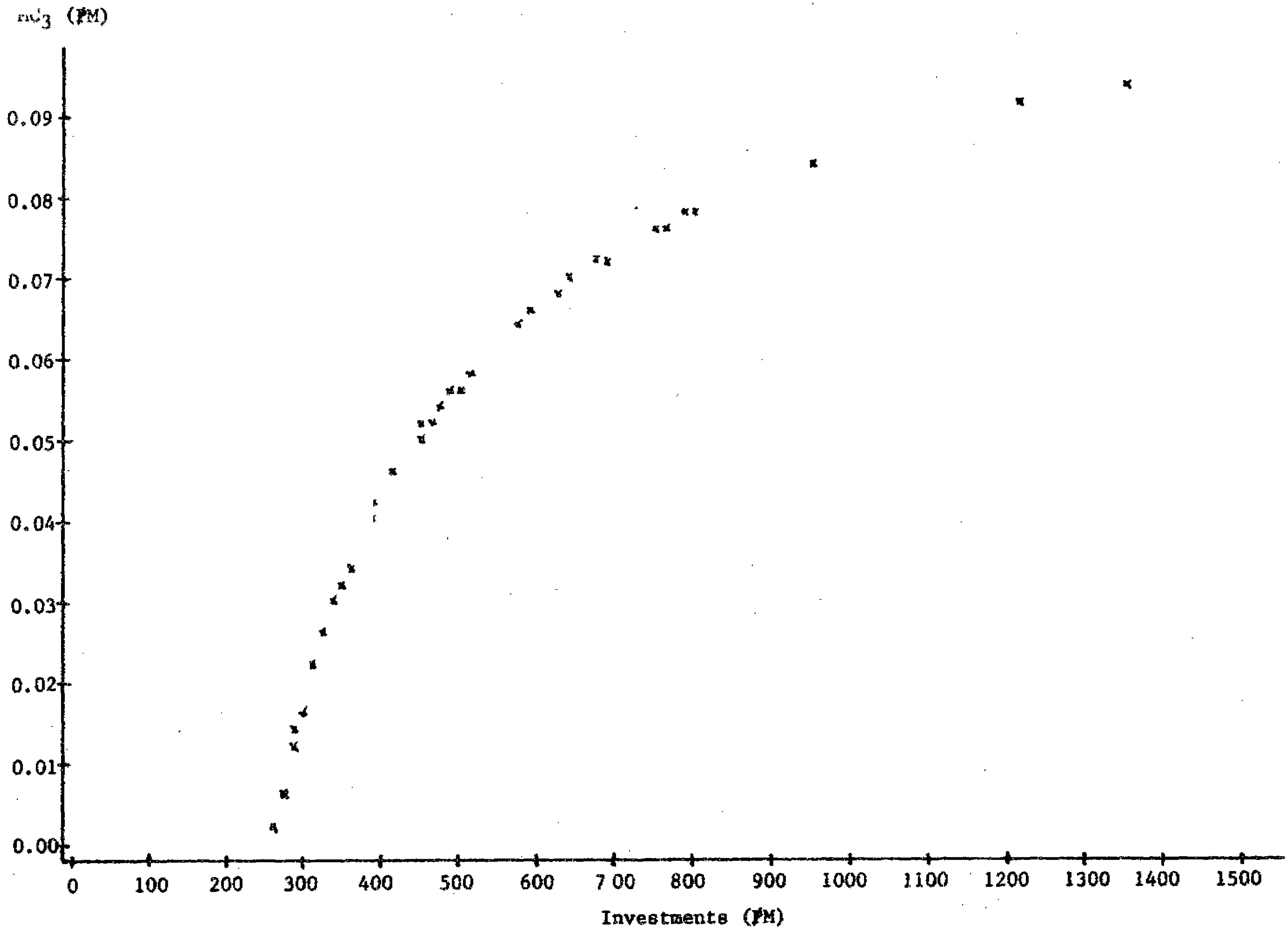

Figure VI-c: Marginal Cost Curve of Investments, Alternative II

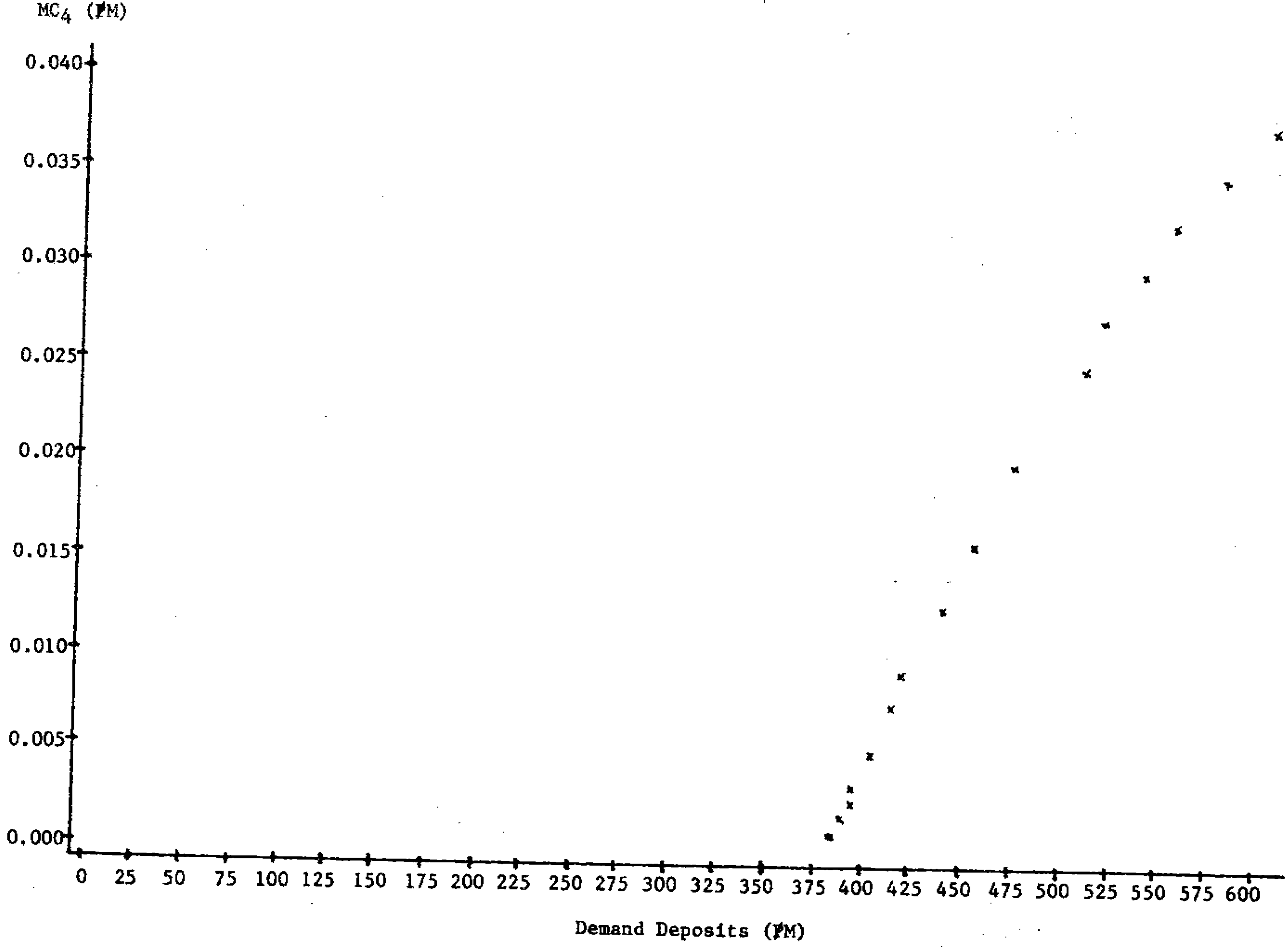

Figure VI-d: Marginal Cost Curve of Demand Deposits, Alternative II

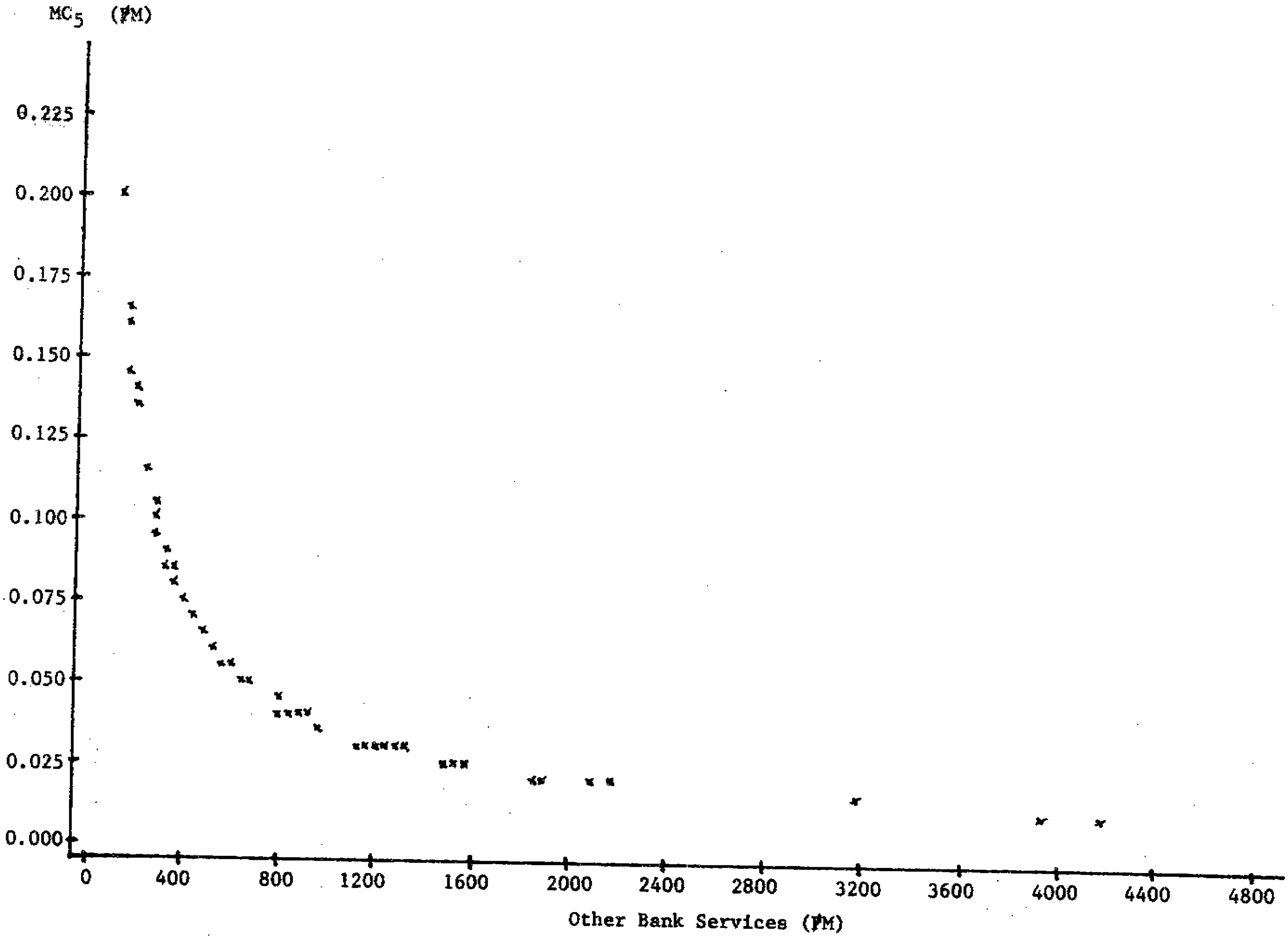

Figure V-e: Marginal Cost Curve of Other Bank Services, Alternative II demand deposits under Alternative II is rising. It is inconsistent with the result derived earlier for the same bank output under Alternative I. The said result may have been influenced by the distribution of loans between short- and long-term. As noted in Chapter II, short-term loans comprised at least three-fourths of the total loan portfolio of most banks. This share may be sufficient to make short-term loans represent total loans. If this were the case, the result we obtained may be regarded as a reflection of that special bank-client relationship. It is common knowledge that banks' clients are not merely borrowers but most often they are also depositors. Thus, it would be worthwhile for banks to maintain good loan relationship with borrowers, especially business firms, since it assures them of a reliable source of deposits and a steady inflow of funds. In order to cultivate this relationship and, in part, to compensate their clients for holding large non-interest bearing demand deposit balances, banks provide for free or at a very minimal fee many technical and financial services, such as payroll processing, account collection services, trusteeships, and other advisory services, to their regular clients. All these could increase the cost of servicing demand deposit accounts.

The shapes of the marginal cost curves of the different bank outputs are indeed important bases for making decisions because they give an idea regarding the specific types of bank products that could be expanded. For instance, the results support the move of regulatory authorities to encourage banks to increase the volume of their long-term loans since cost advantages are realized if they are produced at a larger scale. In addition, the policy granting non-commercial banks to accept demand deposits would heighten competition and eventually force commercial banks to employ cost efficient methods to produce this bank output.

It cannot be known from the information developed so far whether individual banks have successfully maximized profit or not. Maximum profit depends on operating revenue as well as costs. As an initial step for obtaining a maximum profit, the first-order conditic for profit maximization must be satisfied; that is, the marginal revenue (MR) derived from each output must equal the marginal cost (MC) of producing the said output. Clearly, information regarding the marginal revenue of each output is also required so that we can examine the question of profit maximization. In the following, we first estimate the total revenue function and then derive from it the marginal revenues of the different bank outputs.

The total revenue of the ℓth bank is expressed as a function of its outputs:

$$RE^{\ell} = f(q_i^{\ell}) \tag{6.6}$$

where RE^{ℓ} = gross revenue or income of the the ℓth bank, and

q_i^{ℓ} = quantity of the ith output for the ℓth bank (see Table VII for the definition of bank outputs).

Two equations are specified for the revenue function. These are the quadratic and the logarithmic forms. As was done in Chapter IV, the error components model is used to estimate the parameters of those equations. The logarithmic form is found to perform better than the quadratic form, hence only the results of the former are presented in Table XII. Under Alternative I, all coefficients are statistically significant at 5 percent level, while under Alternative II, only

Table XII

PARAMETER ESTIMATES OF THE REVENUE FUNCTION
(Using Fuller and Battese Method)

Independent Variables	Model I	Model II
Unsecured loans ($\ln q_1$)	.211 (4.05)*	
Secured loans ($\ln q_2$)	.160 (4.24)*	
Short-term loans ($\ln q_1$)		.478 (7.08)*
Long-term loans ($\ln q_2$)		.068 (3.35)*
Investments ($\ln q_3$)	.204 (4.35)*	.119 (2.81)*
Demand deposits ($\ln q_4$)	.169 (2.41)**	.125 (2.04)**
Other bank services ($\ln q_5$)	.139 (2.88)*	.060 (1.37)
Variance component for cross section	.01658	.01010
Variance component for time series	.00369	.00487
Variance component for error	.01938	.01826
Transformed Reg. M.S.E.	.02300	.01927

Note: The intercept is suppressed. t-ratios in parentheses.
* Significant at .01 level.
** Significant at .05 level.

the coefficient of other bank services fails to pass the test. As expected, all coefficients have positive signs.

Since the logarithmic form is used, the coefficients shown in Table XII may be interpreted as revenue elasticities. Each of them gives the degree of responsiveness of total revenue to a change in the level of a particular output, <u>ceteris paribus</u>.

Interesting insights may be obtained from the estimated revenue elasticities. For instance, a 100 percent increase in unsecured loans will increase total revenue by 21 percent, whereas a similar percentage increase in secured loans will increase total revenue by only 16 percent, <u>ceteris paribus</u>. Total revenue will increase by 48 percent if short-term loans were increased by 100 percent, but it will increase by a mere 7 percent if long-term loans were increased by a similar percentage, <u>ceteris paribus</u>.

The marginal revenue for each output may be derived by multiplying the coefficients given in Table XII by RE^{ℓ}/q_i^{ℓ}. The results are shown in Tables XIII-a and XIII-b for Alternatives I and II, respectively.

Table XIII-a

ESTIMATED MARGINAL REVENUES OF DIFFERENT BANK OUTPUTS, ALTERNATIVE I

OBS.	MR_1	MR_2	MR_3	MR_4	MR_5
1	.066	.146	.111	.137	.085
2	.099	.079	.125	.118	.046
3	.099	.110	.208	.151	.034
4	.056	.091	.116	.186	.040
5	.0578	.112	.096	.239	.028
6	.063	.100	.105	.270	.022
7	.130	.030	.097	.097	.047
8	.134	.047	.101	.115	.055
9	.137	.050	.154	.141	.046
10	.087	.087	.111	.157	.055
11	.085	.074	.124	.172	.035
12	.077	.097	.103	.191	.028
13	.050	.100	.123	.151	.044
14	.053	.126	.164	.142	.038
15	.046	.216	.161	.200	.053
16	.121	.067	.089	.093	.034
17	.104	.053	.098	.082	.045
18	.086	.062	.110	.096	.056
19	.077	.075	.055	.093	.049
20	.061	.094	.189	.109	.044
21	.069	.084	.174	.132	.047
22	.085	.055	.121	.132	.072
23	.095	.060	.104	.133	.068
24	.069	.077	.100	.141	.066
25	.108	.052	.077	.100	.034
26	.142	.051	.096	.121	.031
27	.134	.043	.135	.145	.033
28	.178	.107	.058	.092	.049
29	.212	.108	.115	.094	.020
30	.169	.062	.162	.100	.020
31	.085	.068	.122	.160	.033
32	.088	.066	.191	.186	.034
33	.109	.065	.139	.191	.041
34	.040	.093	.031	.091	.066
35	.072	.059	.120	.310	.027
36	.069	.080	.108	.375	.026
37	.146	.040	.126	.178	.025
38	.168	.040	.134	.174	.024
39	.220	.044	.178	.223	.035
40	.074	.064	.101	.116	.029

Table XIII-a (Continued)

OBS.	MR_1	MR_2	MR_3	MR_4	MR_5
41	.073	.059	.126	.136	.031
42	.090	.072	.123	.171	.032
43	.188	.047	.160	.123	.092
44	.142	.050	.142	.105	.132
45	.106	.058	.083	.158	.082
46	.103	.065	.192	.158	.066
47	.112	.053	.187	.187	.064
48	.104	.058	.136	.151	.044
49	.076	.076	.076	.075	.047
50	.089	.060	.134	.159	.035
51	.129	.078	.205	.363	.055
52	.143	.058	.207	.143	.025
53	.180	.042	.218	.094	.022
54	.133	.032	.101	.065	.008
55	.075	.066	.118	.127	.074
56	.128	.051	.115	.151	.077
57	.096	.055	.138	.155	.071
58	.042	4.149	.096	.185	.064
59	.044	1.452	.181	.177	.044
60	.068	.100	.183	.195	.053
61	.232	.046	.100	.132	.070
62	.230	.037	.095	.133	.077
63	.139	.034	.096	.146	.064
64	1.661	.097	.235	.125	.429
65	.270	.226	.264	.177	.193
66	.146	.026	1.587	.121	.026
67	.084	.060	.131	.172	.029
68	.107	.051	.132	.163	.019
69	.116	.059	.123	.215	.013
70	.070	.090	.104	.100	.042
71	.077	.092	.120	.122	.040
72	.092	.044	.119	.148	.040
73	.145	.044	.092	.200	.046
74	.158	.042	.122	.154	.030
75	.105	.042	.140	.870	.040
76	.084	.086	.049	.062	.052
77	.101	.095	.045	.084	.216
78	.100	.100	.050	.134	.052
79	.169	.048	.062	.310	.051
80	.238	.054	.073	.286	.046
81	.138	.043	.073	.227	.049

Note: MR_1 = marginal revenue of unsecured loans.
MR_2 = marginal revenue of secured loans.
MR_3 = marginal revenue of investments.
MR_4 = marginal revenue of demand deposits.
MR_5 = marginal revenue of other bank services.

Table XIII-b

ESTIMATED MARGINAL REVENUES OF DIFFERENT BANK OUTPUTS, ALTERNATIVE II

OBS.	MR_1	MR_2	MR_3	MR_4	MR_5
1	.119	.322	.065	.102	.037
2	.118	.680	.073	.087	.020
3	.135	1.737	.121	.112	.015
4	.090	.343	.068	.138	.017
5	.097	.502	.056	.177	.012
6	.101	.327	.061	.200	.009
7	.080	.062	.056	.072	.020
8	.122	.065	.059	.085	.024
9	.125	.076	.090	.105	.020
10	.122	.199	.065	.116	.024
11	.108	.331	.072	.127	.015
12	.115	.324	.060	.141	.012
13	.087	.222	.072	.112	.019
14	.095	.311	.095	.105	.016
15	.095	.279	.094	.148	.023
16	.118	.672	.052	.069	.015
17	.096	1.171	.057	.060	.019
18	.096	.922	.064	.071	.024
19	.110	.124	.032	.069	.021
20	.096	.403	.110	.080	.019
21	.104	.182	.101	.098	.020
22	.089	.257	.071	.098	.031
23	.098	7.830	.060	.099	.029
24	.096	.387	.058	.105	.028
25	.116	.109	.045	.074	.015
26	.114	.161	.056	.089	.013
27	.103	.101	.078	.107	.014
28	.191	.387	.034	.068	.021
29	.207	.417	.067	.070	.009
30	.133	.293	.095	.074	.009
31	.129	.060	.071	.119	.014
32	.148	.043	.112	.138	.015
33	.166	.047	.081	.142	.018
34	.071	1.104	.018	.068	.028
35	.092	.152	.070	.229	.011
36	.106	.120	.063	.278	.012
37	.109	.065	.074	.132	.011
38	.108	.087	.078	.129	.010
39	.122	.106	.104	.165	.015
40	.095	.215	.059	.086	.013

Table XIII-b (Continued)

OBS.	MR_1	MR_2	MR_3	MR_4	MR_5
41	.093	.149	.073	.101	.014
42	.122	.106	.072	.127	.014
43	.122	.106	.094	.091	.040
44	.124	.085	.061	.097	.028
45	.126	.072	.048	.117	.035
46	.149	.053	.112	.117	.028
47	.132	.052	.109	.139	.027
48	.128	.065	.080	.112	.019
49	.102	.352	.045	.056	.020
50	.100	.266	.078	.117	.015
51	.164	.399	.119	.269	.024
52	.147	.069	.121	.106	.011
53	.141	.042	.127	.069	.009
54	.086	.024	.059	.048	.003
55	.103	.257	.069	.094	.032
56	.107	.195	.067	.112	.033
57	.124	.080	.080	.115	.031
58	.094	.152	.056	.137	.028
59	.099	1.241	.105	.131	.019
60	.102	1.098	.107	.144	.023
61	.114	.329	.057	.098	.030
62	.099	.180	.055	.098	.033
63	.094	.121	.056	.108	.027
64	.371	.137	.137	.093	.185
65	.337	.918	.154	.131	.083
66	.084	.348	.926	.090	.011
67	.112	.078	.071	.027	.012
68	.107	.108	.077	.121	.008
69	.118	.142	.072	.159	.006
70	.110	.147	.061	.074	.018
71	.123	.114	.070	.090	.018
72	.096	.068	.069	.110	.017
73	.112	.086	.054	.148	.019
74	.112	.077	.071	.114	.013
75	.137	.053	.082	.138	.017
76	.127	.113	.029	.046	.022
77	.147	.131	.026	.062	.093
78	.146	.075	.029	.099	.022
79	.129	.075	.036	.229	.022
80	.158	.081	.042	.211	.020
81	.127	.060	.042	.168	.021

Note: MR_1 = marginal revenue of short-term loans.
MR_2 = marginal revenue of long-term loans.
MR_3 = marginal revenue of investments.
MR_4 = marginal revenue of demand deposits.
MR_5 = marginal revenue of other bank services.

To verify whether banks have attained the maximum profit, we compute the ratio of marginal cost to the marginal revenue of each output. A ratio of one or very close to one for all outputs indicates that banks have attained the maximum profit.[3]

The computed ratios of the marginal cost to marginal revenue given in Tables XIV-a and XIV-b clearly suggest that banks have not attained the maximum profit.

We offer two alternative explanations for obtaining such results. First, that banks have not attained the maximum profit does not necessarily imply that they are not trying to maximize profit. They may be maximizing profit **but** failed to do so because of some constraints in their operation. As is well known, the banking industry is highly regulated. For instance, banks are required to keep reserves against deposits and deposit substitutes, and their risk assets are not allowed to exceed ten times their net worth. Another regulation which amounts to dictating banks to

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[3]The first-order condition for profit maximization is $MR_i = MC_i$, or $MC_i/MR_i = 1$, $\forall_i$ for each observation.

Table XIV-a

RATIOS OF MARGINAL COST TO MARGINAL REVENUE, ALTERNATIVE I

OBS.	$\frac{MC_1}{MR_1}$	$\frac{MC_2}{MR_2}$	$\frac{MC_3}{MR_3}$	$\frac{MC_4}{MR_4}$	$\frac{MC_5}{MR_5}$
1	1.248	.335	-	1.994	.387
2	.536	.529	-	2.373	.848
3	.659	1.059	-	2.062	.412
4	.284	.318	.638	.746	.625
5	.831	2.305	1.701	-	.572
6	.919	3.317	2.218	-	.605
7	.622	2.264	.877	1.629	.684
8	.791	2.958	.919	1.130	.144
9	.832	3.080	.820	1.359	.260
10	.839	1.720	.712	.764	.379
11	.578	2.046	1.046	.636	.423
12	.820	3.029	1.317	-	.035
13	.140	-	.268	2.259	1.335
14	.474	-	-	2.160	.474
15	.668	.083	.074	1.594	.208
16	1.051	2.695	-	-	-
17	1.022	2.245	-	1.259	-
18	1.167	2.130	-	1.853	-
19	1.364	2.954	.510	-	-
20	1.148	1.840	-	2.367	-
21	1.053	1.892	.029	2.074	-
22	.518	.545	.618	2.364	.858
23	.622	1.194	.696	1.554	.621
24	.828	1.403	.803	1.394	.393
25	.993	2.610	.470	-	.292
26	.848	2.994	.589	-	.387
27	.627	2.600	1.13	.959	.879
28	1.189	2.208	-	-	.552
29	.834	2.880	-	-	-
30	.373	1.551	-	2.214	.781
31	.555	1.408	.95	.919	.791
32	.274	.847	.83	2.023	1.059
33	.467	1.446	1.22	.969	1.155
34	.025	-	.65	1.335	.817
35	-	-	2.60	1.821	3.200
36	-	-	3.173	.637	3.307
37	.041	1.144	1.681	.812	2.165
38	-	1.628	1.554	.731	1.745
39	-	1.309	1.591	1.201	1.896
40	1.189	2.747	.523	.181	.171

Table XIV-a (Continued)

OBS.	$\frac{MC_1}{MR_1}$	$\frac{MC_2}{MR_2}$	$\frac{MC_3}{MR_3}$	$\frac{MC_4}{MR_4}$	$\frac{MC_5}{MR_5}$
41	.112	2.661	.788	.684	.319
42	.328	3.476	1.109	-	.308
43	.537	.814	.187	2.883	.997
44	.654	1.782	.932	1.467	.868
45	.859	1.954	1.747	1.108	1.061
46	.271	-	.490	3.595	1.204
47	-	-	1.257	3.796	1.771
48	.325	1.339	1.106	2.194	1.041
49	.281	1.874	-	.663	-
50	.134	.418	.758	1.803	1.192
51	.039	.244	1.182	.851	1.243
52	.600	2.103	.125	1.396	.724
53	.685	2.936	-	1.622	-
54	1.702	-	-	-	-
55	-	-	.195	3.163	1.495
56	-	-	.661	2.701	1.836
57	-	-	.623	3.187	1.732
58	2.274	2.500	-	-	-
59	1.854	1.790	-	-	-
60	-	-	1.868	3.031	1.321
61	-	.828	.982	1.745	1.339
62	-	.645	1.266	2.153	1.473
63	-	.439	1.683	2.341	1.852
64	-	-	-	16.962	8.059
65	-	-	-	10.548	2.632
66	-	-	-	9.298	2.632
67	.593	1.907	1.264	.517	.969
68	.394	2.653	1.303	.190	.789
69	.515	3.738	1.947	-	.923
70	.845	.833	-	1.602	.284
71	.584	1.043	.058	1.484	.252
72	.087	.315	1.325	2.473	1.775
73	-	-	2.076	1.370	2.623
74	-	.928	1.148	1.162	1.733
75	-	.452	1.612	2.134	1.775
76	1.571	2.161	-	-	-
77	1.574	2.005	-	.059	-
78	1.365	3.220	1.321	-	-
79	-	.021	3.923	.248	3.078
80	-	1.018	3.494	-	2.676
81	-	.878	3.018	.758	2.218

Table XIV-b
RATIOS OF MARGINAL COST TO MARGINAL
REVENUE, ALTERNATIVE II

OBS.	$\frac{MC_1}{MR_1}$	$\frac{MC_2}{MR_2}$	$\frac{MC_3}{MR_3}$	$\frac{MC_4}{MR_4}$	$\frac{MC_5}{MR_5}$
1	.396	-	1.017	3.637	2.324
2	.559	.268	-	4.279	-
3	.638	.908	-	4.604	-
4	.200	.264	1.256	1.326	1.337
5	.942	1.730	2.801	-	.833
6	1.228	2.435	3.411	-	1.188
7	.981	.177	1.310	2.117	1.192
8	1.235	.679	1.154	1.224	.293
9	1.214	.816	.938	1.644	1.106
10	.844	.557	1.238	1.224	.881
11	.824	1.184	1.283	1.403	.262
12	1.126	1.876	1.761	-	-
13	-	-	1.294	3.625	3.887
14	-	-	.251	4.255	2.577
15	-	-	2.023	4.084	3.333
16	1.429	1.141	-	1.033	-
17	1.362	.658	-	2.692	-
18	1.347	.432	-	3.341	-
19	1.495	.821	.719	-	-
20	.752	.149	-	4.498	-
21	1.287	.220	3.491	3.374	1.128
22	.888	5.724	-	3.695	-
23	1.162	.838	-	2.809	-
24	.832	.320	1.429	2.189	-
25	1.280	.626	.201	-	.608
26	1.302	1.835	.380	.146	.075
27	1.059	.951	1.274	1.370	1.748
28	1.535	1.038	-	-	-
29	1.207	1.909	-	1.263	-
30	.618	1.075	-	5.318	2.062
31	.641	.773	1.378	.666	3.321
32	.331	.517	1.121	1.730	4.044
33	.747	.780	1.543	-	3.481
34	-	-	2.062	2.380	1.265
35	-	.593	4.419	2.009	6.294
36	-	1.210	5.646	.360	6.639
37	.504	.892	2.106	.674	4.658
38	.509	1.058	1.808	1.157	3.452
39	.395	.774	2.123	1.780	3.736
40	1.322	1.064	.305	.770	.238

Table XIV-b (Continued)

OBS.	$\frac{MC_1}{MR_1}$	$\frac{MC_2}{MR_2}$	$\frac{MC_3}{MR_3}$	$\frac{MC_4}{MR_4}$	$\frac{MC_5}{MR_5}$
41	1.217	.935	.997	1.083	1.185
42	1.560	1.449	1.440	-	1.504
43	.580	-	.374	3.734	1.937
44	.950	.165	1.370	1.520	1.519
45	1.172	.321	3.126	.291	1.896
46	.141	-	.948	3.675	4.099
47	-	-	2.254	3.950	4.654
48	.531	.477	1.612	2.393	2.900
49	1.161	.244	-	1.643	-
50	.240	2.078	.838	2.683	1.450
51	.152	.808	1.983	.473	3.008
52	.605	.643	-	1.396	4.392
53	1.000	.810	-	2.421	1.613
54	2.791	10.772	-	.188	-
55	-	-	.887	3.979	3.534
56	-	-	1.179	3.444	2.848
57	-	-	1.382	3.383	4.161
58	.064	-	-	.089	4.161
59	-	-	.114	4.802	1.823
60	-	-	.800	4.920	1.667
61	.456	.094	1.105	3.093	.265
62	.260	-	2.025	3.428	1.081
63	.277	-	2.982	.509	3.175
64	-	-	-	26.300	14.770
65	-	-	-	16.600	3.609
66	-	-	-	13.125	7.456
67	.798	1.071	1.803	.362	2.812
68	1.138	1.743	.800	.595	1.975
69	1.258	2.845	1.847	-	1.667
70	.464	-	-	.353	1.703
71	.373	.298	.229	2.513	1.550
72	.230	.132	2.179	2.773	3.953
73	-	.233	3.288	1.201	4.528
74	.359	.599	1.366	1.509	3.462
75	.328	.243	2.220	1.063	4.466
76	1.386	.194	-	-	-
77	1.444	-	.304	-	-
78	1.587	2.134	1.092	-	-
79	-	1.254	6.364	-	4.318
80	.272	1.617	5.259	-	3.637
81	.330	.864	4.821	-	3.619

allocate their resources is the requirement to set aside 25 percent of their total loanable funds for agricultural loans. Indeed, these regulations place severe restrictions on the input and output mix that banks may acquire. It should be mentioned at this point that our parameter estimates of the cost and revenue functions using existing data have implicitly incorporated those constraints. We may, therefore, say that banks are not completely free to determine their output and input mix to attain the maximum profit.

An alternative explanation of the results is that banks may not be aiming at all for a maximum profit. Under the classical framework of profit maximization, this behavior is deemed irrational. However, it is possible that banks follow an altogether different set of decision rules which govern the behavior we observed. This is plausible considering the character of banking firms. It is common knowledge that a bank is pursuing a number of objectives. Some of these objectives, like satisfying the legal reserve requirements and the minimum net worth to risk assets ratio, are dictated by regulatory authorities while others, like maintaining a certain level of excess reserves and satisfactory profit rate, are determined by management. Of course, it is not necessary for a bank to achieve all the perceived objectives simultaneously. Instead, it orders them according to importance and defines a satisfactory level for each of them. Lower-order (i.e., more important) objectives are satisfied before higher-order (i.e., less important) objectives, and higher-order objectives are not achieved at the expense of lower-order objectives. Once the satisfactory level is attained, the lower-order objectives become constraints of the next objective in the hierarchy.

In brief, we are suggesting that the behavior of banks may be explained by the L*-ordering.[4] In this framework, it is then understandable that we obtained results showing that banks have not attained the maximum profit simply because they do not aim for a maximum profit. Rather, they might be merely intereste in maintaining a satisfactory rate of profit. The evidence shown in Table III (cf. Chapter II) seems to

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[4]See Encarnación (1964a, 1964b) for a detailed exposition of the L*-ordering.

suggest that the impressive profit rates realized by most banks were already satisfactory. This allowed them, therefore, to pursue other objectives.

Closely related to our findings is the following observation made by Licaros, the former Governor of the Central Bank: "The average Filipino banker is in the banking business not for banking profits; he uses his bank for allied purposes."[5] Again, this suggests that banks are not maximizing profit. However, implied in the statement is, of course, the fulfillment of a satisfactory rate of profit, for no bank can afford to be totally unconcerned with profits. The reason, of course, is obvious. Depositors, especially large ones, who prefer to maintain their deposits with profitable banks for reason of security would shy away from banks whose profit rates fall below the perceived satisfactory level. Thus, banks have to maintain a satisfactory rate of profit to gain the confidence of depositors. Otherwise, they will be deprived of an important source of funds which may be channelled to their affiliated companies.

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[5] Far Eastern Economic Review (1978), quoted in Patrick and Moreno (1980).

Although we do not have information regarding the ordering of the objectives banks try to achieve, nevertheless, it may be safe to say that those objectives imposed by regulatory authorities and the objective of achieving a satisfactory rate of profit are likely to be considered as lower-order.[6] While the acceptable minimum value for some of the objectives may be known only to the individual banks, others are known publicly. This is true particularly of those imposed by regulatory authorities. For instance, the legal reserves must not fall below 20 percent of the outstanding deposits and deposit substitutes, and the net worth must not be less than 10 percent of the total risk assets; otherwise, banks will be heavily penalized.[7]

The lower-order objectives are most probably uniform among banks. However, we may find diversity in the objectives as we go to the higher-order ones. This could be attributed to a host of factors, one of which is the kind of organizational structure adopted

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[6] Havrilesky and Boorman (1978) suggest the following ordering: legal reserves, operating cash reserves and protective liquid assets, customer loans, and open market instruments.

[7] The penalty ranges from paying huge fines to suspension of the authority to operate.

by banks. As is well known, most commercial banks in the Philippines are managed by the owners themselves. This gives management a wider array of choices regarding the objective that will be ultimately maximized. We may mention two possible objectives. One is to maximize certain expense items, such as staff expenditures, managerial emoluments and discretionary profits, subject to certain basic constraints.[8] Another is to maximize (or to minimize interest payments on) unsecured loan accommodations to directors, officers, stockholders and their related interests (DOSRI). Indeed, this last point prodded the Central Bank to enact rules governing DOSRI accounts.[9] With these rules, we might think this

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[8]See Williamson (1963) for the exposition and application of the expense-preference model.

[9]The Central Bank has set a ceiling on the total outstanding direct credit accommodations to each of the bank's directors, officers or stockholders to an amount equivalent to his outstanding deposits and book value of his paid-in capital contribution in the lending bank; provided, however, that unsecured credit accommodations to each of the bank's directors, officers or stockholders shall not exceed 30 percent of his total credit accommodations.

objective to be one of the lower-order objectives. However, Patrick and Moreno (1980) seem to think otherwise. They point out that some banks violated the rules governing DOSRI accounts without being noticed by the monetary authorities.

VI.3 Estimated Scale Economies

This section will attempt to provide estimates of the degree of scale economies based on the concept of ray average cost (RAC). In the context of our TMJCF, the measure of economies of scale given in (3.13) may be expressed as

$$\hat{S} = \frac{C}{\sum_{i=1}^{m} q_i \left(\frac{\partial \ln C}{\partial \ln q_i}\right) \frac{C}{q_i}} \qquad (6.7)$$

or

$$\hat{S} = \frac{1}{\sum_{i=1}^{m} \partial \ln C/\partial \ln q_i} \qquad (6.8)$$

where $\sum_{i=1}^{m} \ln C/\partial \ln q_i$ denotes the sum of the cost elasticities. A more convenient way of estimating scale economies is provided by Christensen and Greene (1976) who define scale economies as one minus the sum of the cost elasticities along an output ray, or

$$S = 1 - \sum_{i=1}^{m} \partial \ln C / \partial \ln q_i \qquad (6.9)$$

This provides a valid test for economies of scale directly from the estimated parameters of the TMJCF. In terms of (6.9), the following propositions hold:

a) $S > 0$ if there are economies of scale;

b) $S < 0$ if there are diseconomies of scale; and

c) $S = 0$ if there are constant returns to scale.

If (6.9) were multiplied by 100, the result would indicate the percentage difference between the total cost and total revenue, assuming that all outputs are priced at their respective marginal costs.

The equations used to estimate scale economies are given in Table XV-a and Table XV-b for Alternatives I and II, respectively. Note that the scale economies depend on the levels of all outputs and input prices. Thus, the scale economies implied by our TMJCF may vary across observations. This is an artifact of our

Table XV-a

EQUATION FOR SCALE ECONOMIES, ALTERNATIVE I

$$
\begin{aligned}
S = 1 & - [-.7221 + .0156 \ln q_1 - .1879 \ln q_2 + .0604 \ln q_3 + .2621 \ln q_4 + .0112 \ln q_5 \\
& \quad -.0797 \ln p_1 + .1048 \ln p_2 - .0280 \ln p_3 + .0029 \ln p_4] \\
& - [-1.9017 - .1879 \ln q_1 - .2697 \ln q_2 + .2470 \ln q_3 + .3675 \ln q_4 + .2390 \ln q_5 \\
& \quad + .0055 \ln p_1 + .0068 \ln p_2 - .0037 \ln p_3 - .0086 \ln p_4] \\
& - [-.3133 + .0604 \ln q_1 + .2470 \ln q_2 + .2859 \ln q_3 - .5576 \ln q_4 + .0021 \ln q_5 \\
& \quad + .0791 \ln p_1 - .0614 \ln p_2 - .0088 \ln p_3 - .0089 \ln p_4] \\
& - [1.5647 + .2621 \ln q_1 + .3675 \ln q_2 - .5576 \ln q_3 + .0696 \ln q_4 - .3537 \ln q_5 \\
& \quad + .0656 \ln p_1 - .1231 \ln p_2 + .0309 \ln p_3 + .0266 \ln p_4] \\
& - [.7717 + .0112 \ln q_1 + .2390 \ln q_2 + .0021 \ln q_3 - .3537 \ln q_4 - .0430 \ln q_5 \\
& \quad - .0261 \ln p_1 + .0409 \ln p_2 - .0079 \ln p_3 - .0070 \ln p_4]
\end{aligned}
$$

Note: The bracketed terms are the cost elasticities with respect to q_1, q_2, q_3, q_4 and q_5, respectively.

Table XV-b

EQUATION FOR SCALE ECONOMIES, ALTERNATIVE II

$$
\begin{aligned}
S = 1 &- [-2.1317 - .4547 \ln q_1 - .0880 \ln q_2 + .3930 \ln q_3 + .4617 \ln q_4 + .1583 \ln q_5 \\
&\quad - .1063 \ln p_1 + .1583 \ln p_2 - .0572 \ln p_3 + .0053 \ln p_4] \\
&- [-.2669 - .0880 \ln q_1 - .0188 \ln q_2 + .0818 \ln q_3 - .0265 \ln q_4 + .1050 \ln q_5 \\
&\quad + .0134 \ln p_1 - .0151 \ln p_2 + .0069 \ln p_3 - .0052 \ln p_4] \\
&- [-.3088 + .3930 \ln q_1 + .0818 \ln q_2 + .2506 \ln q_3 - .5949 \ln q_4 - .1132 \ln q_5 \\
&\quad + .0778 \ln p_1 - .0627 \ln p_2 - .0059 \ln p_3 - .0092 \ln p_4] \\
&- [1.3318 + .4617 \ln q_1 - .0265 \ln q_2 - .5949 \ln q_3 + .2146 \ln q_4 - .2607 \ln q_5 \\
&\quad + .1009 \ln p_1 - .1656 \ln p_2 + .0446 \ln p_3 + .0200 \ln p_4] \\
&- [.7476 + .1583 \ln q_1 + .1050 \ln q_2 - .1132 \ln q_3 - .2607 \ln q_4 - .0139 \ln q_5 \\
&\quad - .0339 \ln p_1 + .0473 \ln p_2 - .0061 \ln p_3 - .0072 \ln p_4]
\end{aligned}
$$

Note: The bracketed terms are the cost elasticities with respect to q_1, q_2, q_3, q_4 and q_5, respectively.

unrestricted translog model which permits the estimation of scale economies for each observation using the observed levels of bank outputs and factor prices.[10]

Table XVI presents the estimated scale economies for individual banks in each year. Their asset-size group, i.e., whether they are large, medium or small banks, is also indicated.

The estimated scale economies appear to be quite sensitive to the manner of classifying bank loans. Sixteen cases are observed to have inconsistent signs, i.e., they have positive (negative) values under Alternative I but have negative (positive) values under Alternative II. However, the inconsistency is not very alarming since most of the observations having negative values under one alternative obtained positive values very close to zero under the other alternative.

As may be gleaned from Table XVI, a greater number of banks were operating in the region of

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[10]For a production structure that is restricted to be homogeneous in outputs, the scale economies are not allowed to vary with the levels of outputs. For example, in the Cobb-Douglas framework wherein all second-order parameters (γ_{ik}, λ_{js}, θ_{ij}) are assumed to be zero, scale economies are defined as $S = 1 - \sum_i \alpha_i$.

Table XVI

ESTIMATED SCALE ECONOMIES

Alternative I				Alternative II			
Banks	1977	1978	1979	Banks	1977	1978	1979
1)	.331(S)	.299(S)	.354(S)	1)	.137(S)	.310(S)	.342(S)
2)	.070(M)	-.011(L)	-.129(L)	2)	-.028(M)	-.125(L)	-.212(L)
3)	.777(L)	-.216(L)	-.247(L)	3)	-.193(L)	-.115(L)	-.157(L)
4)	.009(L)	-.064(L)	-.019(L)	4)	-.012(L)	-.055(L)	-.069(L)
5)	.361(S)	.415(S	.398(S)	5)	.175(S)	.187(S)	-.010(S)
6)	.224(M)	.082(M)	.002(M)	6)	.288(M)	.197(M)	.087(M)
7)	.072(M)	.106(M)	-.021(M)	7)	.064(M)	.016(M)	-.076(M)
8)	-.127(L)	-.093(M)	-.085(M)	8)	.059(L)	.117(M)	-.089(M)
9)	.052(L)	-.004(L)	-.190(L)	9)	.115(L)	.057(L)	-.120(L)
10)	.690(S)	.827(S)	.541(S)	10)	.682(S)	.800(S)	.543(S)
11)	.042(M)	-.042(M)	-.070(S)	11)	.068(M)	.032(M)	.046(S)
12)	.499(S)	.049(S)	.012(S)	12)	.284(S)	.021(S)	-.057(S)
13)	-.041(M)	-.051(M)	-.132(M)	13)	.022(M)	-.002(M)	-.084(M)
14)	.017(L)	-.138(L)	-.143(L)	14)	.018(L)	-.124(L)	-.119(L)
15)	-.102(L)	-.124(L)	-.241(L)	15)	-.033(L)	-.042(L)	-.153(L)
16)	-.026(M)	.151(M)	.066(S)	16)	.043(M)	-.066(M)	-.007(S)
17)	.302(S)	.076(S)	-.198(M)	17)	.287(S)	.096(S)	-.138(M)
18)	.010(L)	.068(L)	.168(L)	18)	.160(L)	.173(L)	.206(L)
19)	.274(S)	.162(S)	.106(S)	19)	.237(S)	.199(S)	.143(S)
20)	1.723(S)	1.330(S)	.201(S)	20)	.406(S)	.260(S)	.143(S)
21)	.027(M)	-.105(M)	-.233(M)	21)	.085(M)	-.057(M)	-.151(M)
22)	.993(S)	.912(S)	-.058(S)	22)	.900(S)	.828(S)	-.037(S)
23)	-.076(L)	-.052(L)	.056(L)	23)	-.050(L)	-.013(L)	-.020(L)
24)	.355(S)	.270(S)	-.075(S)	24)	.259(S)	.191(S)	-.026(S)
25)	-.008(M)	.030(M)	-.213(M)	25)	.047(M)	.084(M)	-.035(M)
26)	.378(L)	.012(L)	.067(L)	26)	.372(L)	.052(L)	.065(L)
27)	-.187(M)	-.081(M)	-.244(M)	27)	-.107(M)	-.007(M)	-.121(M)

Note: S = small bank.

M = medium bank.

L = large bank.

positive scale economies in 1977, regardless of the alternatives (I or II) considered. The degree of scale economies was remarkably high especially for small banking firms in that year. The presence of scale economies must have been correctly perceived by banks since almost all achieved a faster growth rate in size during the succeeding years, presumably to exploit the scale economies.[11] Thus, the subsequent years saw the degree of scale economies consistently declining for practically all banks. Specifically, sixteen banks under Alternative I and nineteen under Alternative II were already operating at the region of negative scale economies in 1979, indicating that cost disadvantages will most likely be experienced if they further expand all output levels proportionately. As expected, most of those already experiencing diseconomies of scale are large and medium banks. Note also that a number of banks obtained positive scale economies of .10 or less. The results suggest that only a few banks would stand to benefit from increases in their scale of operation.

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[11]The remarkable growth of the size of individual banks was discussed in Chapter II.

VI.4 Economies of Scope

In the previous section, an attempt was made to determine whether individual banks can still realiz some cost savings by expanding the scale of production i.e., increasing all outputs proportionately along a ray in an output space. Using a multiproduct joint cost function, the existence of economies of scale was tested directly. Since banks are multiproduct firms, it is equally important to find out whether cost savings can be realized by producing one or more products. In effect, we will determine whether it is better for banks to specialize or to diversify. This involves testing the presence or absence of economies of scope.

The existence of economies of scope may be inferred from the banks' production process characterized by interproduct complementarity or transray convexity. To determine whether the cost function is characterized by interproduct complementarity or transray convexity, we have to examine the bordered principal minors of the following bordered Hessian

$$|\bar{H}| = \begin{vmatrix} 0 & w_1 & w_2 & w_3 & w_4 & w_5 \\ w_1 & C_{11} & C_{21} & C_{31} & C_{41} & C_{51} \\ w_2 & C_{12} & C_{22} & C_{32} & C_{42} & C_{52} \\ w_3 & C_{13} & C_{23} & C_{33} & C_{43} & C_{53} \\ w_4 & C_{14} & C_{24} & C_{34} & C_{44} & C_{54} \\ w_5 & C_{15} & C_{25} & C_{35} & C_{45} & C_{55} \end{vmatrix} \qquad (6.10)$$

where $C_{ik} = \partial^2 C/\partial q_i \partial q_k$ (i, k = 1, 2, 3, 4, 5). Under the framework of marginal cost pricing, $w_i = \partial C/\partial q_i$; hence, the Hessian is bordered by the marginal costs. The relevant bordered principal minors are

$$|\bar{H}_2| = \begin{vmatrix} 0 & w_1 & w_2 \\ w_1 & C_{11} & C_{21} \\ w_2 & C_{12} & C_{22} \end{vmatrix} \qquad (6.11)$$

$$|\bar{H}_3| = \begin{vmatrix} 0 & w_1 & w_2 & w_3 \\ w_1 & C_{11} & C_{21} & C_{31} \\ w_2 & C_{12} & C_{22} & C_{32} \\ w_3 & C_{13} & C_{23} & C_{33} \end{vmatrix} \qquad (6.12)$$

$$|\bar{H}_4| = \begin{vmatrix} 0 & w_1 & w_2 & w_3 & w_4 \\ w_1 & C_{11} & C_{21} & C_{31} & C_{41} \\ w_2 & C_{12} & C_{22} & C_{32} & C_{42} \\ w_3 & C_{13} & C_{23} & C_{33} & C_{43} \\ w_4 & C_{14} & C_{24} & C_{34} & C_{44} \end{vmatrix} \qquad (6.13)$$

$$|\bar{H}_5| = |\bar{H}|$$

The last is the full bordered Hessian itself.

For transray convexity to hold, the border principal minors must all be negative. The obtain bordered principal minors for all observations are presented in Table XVII. Note that $/\bar{H}_5/$ is not shown anymore since the information given by $/\bar{H}_2/$, $/\bar{H}_3/$ and $/\bar{H}_4/$ will already allow us to draw some conclusion regarding the property of our cost function.

It can be observed from Table XVII that the signs of the bordered principal minors of almost all observations do not satisfy the requirement of a transray convex cost function. This is true of Alternatives I and II. The results imply that overall economies of scope are absent. That is, banks

Table XVII

SIGNS OF THE BORDERED PRINCIPAL MINORS

OBS.	Alternative I $\lvert\bar{H}_2\rvert$	Alternative I $\lvert\bar{H}_3\rvert$	Alternative I $\lvert\bar{H}_4\rvert$	Alternative II $\lvert\bar{H}_2\rvert$	Alternative II $\lvert\bar{H}_3\rvert$	Alternative II $\lvert\bar{H}_4\rvert$
1	+	+	-	+	+	-
2	+	+	-	-	+	-
3	+	+	-	-	+	-
4	+	-	-	-	+	-
5	+	-	-	+	-	-
6	+	-	-	+	-	-
7	+	-	-	+	+	-
8	+	-	-	-	+	-
9	+	-	-	-	+	+
10	+	-	-	+	-	-
11	+	-	-	+	-	-
12	+	-	-	+	-	-
13	+	+	+	-	+	-
14	+	+	+	-	+	-
15	+	+	-	+	-	-
16	+	+	-	-	+	-
17	+	+	-	-	+	-
18	+	+	-	-	+	-
19	+	-	-	-	+	+
20	+	+	-	+	-	-
21	+	+	-	+	-	-
22	+	-	-	-	+	-
23	+	-	-	-	+	-
24	+	-	-	-	+	-
25	+	-	-	-	+	-
26	+	-	-	+	-	-
27	+	-	-	+	-	-
28	+	+	+	-	+	-
29	+	+	+	-	+	-
30	-	-	-	+	-	-
31	+	-	-	+	-	-
32	-	+	+	+	+	-
33	+	-	-	+	-	-
34	-	+	-	-	+	-
35	-	-	-	-	+	+
36	-	+	+	-	+	-
37	-	+	+	-	+	-
38	-	+	+	+	-	-
39	+	+	+	+	-	-
40	+	-	-	-	+	-

Table XVII (Continued)

OBS.	Alternative I $\lvert\bar{H}_2\rvert$	Alternative I $\lvert\bar{H}_3\rvert$	Alternative I $\lvert\bar{H}_4\rvert$	Alternative II $\lvert\bar{H}_2\rvert$	Alternative II $\lvert\bar{H}_3\rvert$	Alternative II $\lvert\bar{H}_4\rvert$
41	+	-	-	-	+	-
42	+	-	-	-	+	-
43	+	+	-	+	-	-
44	+	-	-	-	+	-
45	+	-	-	-	+	-
46	+	+	+	-	+	-
47	-	+	+	-	+	-
48	-	+	+	-	+	-
49	+	+	-	+	-	-
50	-	+	+	-	+	-
51	-	+	+	-	+	-
52	+	+	-	-	+	-
53	+	+	-	-	+	+
54	+	+	-	-	+	-
55	-	-	-	+	-	-
56	-	-	-	+	-	-
57	-	-	-	-	+	-
58	-	-	-	-	+	-
59	+	+	+	-	+	-
60	-	-	+	-	+	-
61	+	+	+	-	+	+
62	+	+	-	-	+	+
63	+	+	+	+	-	-
64	-	-	+	-	+	+
65	-	-	-	-	+	+
66	-	-	-	+	-	-
67	+	-	-	+	-	-
68	+	-	-	+	-	-
69	+	-	-	+	-	-
70	+	+	-	-	+	-
71	+	+	-	-	+	-
72	-	+	+	-	+	-
73	+	+	+	+	-	-
74	+	+	+	+	-	-
75	+	+	+	+	-	-
76	+	+	+	-	+	-
77	+	+	-	-	+	-
78	+	-	-	-	+	-
79	+	+	+	+	-	-
80	+	+	+	-	+	+
81	+	+	+	-	+	+

will not realize any cost savings by producing all the outputs together. Apparently, no input is shareable in producing all the financial products together

Although, interproduct complementarity or transray convexity does not exist if all products are considered together, however, it may exist for subsets or pairs of products. In this regard, it is also important to investigate the presence/absence of interproduct complementarity for pairs of products. To accomplish this, we examine the curvature of the isocost curve for pairs of products. The curvature of the isocost curve may be examined using the approach suggested by Brown et al. (1979). We take the second differential of the ith output with respect to the kth output holding total cost, factor prices and the remaining outputs fixed, i.e.,

$$\left.\frac{d^2 q_i}{dq_k^2}\right|_* = -[(C_i^2 C_{kk} - 2C_{kk} - 2C_{ik}C_i C_k^2 C_{ii})/C_i^3] \quad (6.15)$$

$$*dC = dq_{i-2} = dp_j = 0$$

where $C_i = \partial C/\partial q_i$; $C_k = \partial C/\partial q_k$; $C_{ii} = \partial^2 C/\partial q_i^2$;

$C_{kk} = \partial^2 C/\partial q_k^2$; and $C_{ik} = \frac{\partial^2 C}{\partial q_i \partial q_k}$. A positive sign indicates convexity of the isocost curve, i.e., there are gains to further specialization, while a negative sign indicates the existence of interproduct complementarity for the pairs of products considered, i.e., there is a decreasing relative cost to the joint production.

Tables XVIII-a and XVIII-b summarize the results describing the presence or absence of interproduct complementarity for pairs of outputs under Alternatives I and II, respectively. The findings reveal that interproduct complementarity does not exist for all pairs of products. This, of course, conforms to our earlier finding when we considered all financial products together. However, a closer look at the results would show that interproduct complementarity exists for certain pairs of products.

Under Alternative I, almost all observations yield results indicating that secured and unsecured loans are complements. In our framework, it means that banks can realize some cost savings if these two financial products are produced together. The distribution of loans according to security presented in Chapter II

Table XVIII-a

PRESENCE (-)/ABSENCE (+) OF INTERPRODUCT COMPLEMENTARITY FOR PAIRS OF PRODUCTS, ALTERNATIVE I

OBS.	q_1q_2	q_1q_3	q_1q_4	q_1q_5	q_2q_3	q_2q_4	q_2q_5	q_3q_4	q_3q_5	q_4q_5
1	-	+	-	-	+	-	-	+	+	-
2	-	+	-	-	+	-	-	-	-	-
3	-	+	-	-	+	-	-	+	+	-
4	-	-	-	-	-	-	-	-	-	-
5	-	-	+	-	-	+	-	+	-	-
6	-	-	+	-	-	+	-	+	-	+
7	-	+	-	-	+	-	-	-	-	-
8	-	+	-	-	+	-	-	-	-	-
9	-	+	-	-	+	-	-	-	-	-
10	-	+	+	-	+	+	-	+	-	-
11	-	-	+	-	-	+	-	+	-	-
12	-	-	+	-	-	+	-	+	-	-
13	-	+	-	-	-	+	+	-	-	-
14	-	+	-	-	-	+	+	+	+	-
15	-	+	-	-	+	-	-	-	-	-
16	-	+	+	-	+	+	-	+	-	+
17	-	+	-	-	+	-	-	+	+	-
18	-	+	-	-	+	-	-	-	-	-
19	-	+	+	-	+	+	-	+	-	+
20	-	+	-	-	+	-	-	+	+	-
21	-	+	-	-	+	-	-	-	-	-
22	-	+	-	-	+	-	-	-	-	-
23	-	+	-	-	+	-	-	-	-	-
24	-	+	-	-	+	-	-	-	-	-
25	-	+	+	-	+	+	-	+	-	-
26	-	+	+	-	+	+	-	+	-	-
27	-	-	-	-	-	-	-	-	-	-
28	-	+	+	-	+	+	-	-	+	+
29	-	+	+	-	+	+	-	-	+	+
30	-	+	-	-	+	-	-	+	+	-

Table XVIII-a (Continued)

OBS.	q_1q_2	q_1q_3	q_1q_4	q_1q_5	q_2q_3	q_2q_4	q_2q_5	q_3q_4	q_3q_5	q_4q_5
31	–	+	–	–	+	–	–	–	–	–
32	–	+	–	–	–	–	–	–	–	–
33	–	–	–	–	–	–	–	–	–	–
34	+	–	+	+	+	+	+	–	–	–
35	–	+	+	+	+	+	+	–	–	–
36	+	+	–	+	–	–	+	+	–	–
37	+	+	–	+	–	+	–	+	–	–
38	+	+	–	+	–	+	–	+	–	–
39	+	+	+	+	+	–	–	–	–	–
40	–	+	+	–	+	+	–	+	–	–
41	–	+	+	–	+	+	–	+	–	–
42	–	+	+	–	+	+	–	+	–	–
43	–	+	–	–	+	–	–	–	–	–
44	–	+	–	–	–	–	–	–	–	–
45	–	–	–	–	+	–	–	–	–	–
46	–	+	–	–	+	–	–	–	–	–
47	+	+	+	+	+	+	+	–	–	–
48	–	+	–	–	+	–	–	–	–	–
49	–	+	+	–	+	+	–	–	–	–
50	–	+	–	–	+	–	–	–	–	–
51	–	–	–	–	–	–	–	–	–	–
52	–	+	–	–	+	–	–	–	–	–
53	–	+	–	–	+	–	–	+	+	–
54	–	+	+	–	+	+	–	–	+	+
55	–	–	+	+	–	+	+	–	–	–
56	–	–	+	+	–	+	+	–	–	–
57	–	–	+	+	–	+	+	–	–	–
58	–	+	+	+	–	–	–	–	–	–
59	–	+	+	+	–	–	–	–	–	–
60	+	–	+	+	–	+	+	–	–	–
61	+	–	+	+	+	–	–	–	–	–
62	+	+	+	+	–	–	–	–	–	–
63	+	+	+	+	–	–	–	–	–	–
64	–	+	+	–	–	+	+	–	+	+
65	–	–	+	+	+	–	–	+	+	+

Table XVIII-a (Continued)

OBS.	q_1q_2	q_1q_3	q_1q_4	q_1q_5	q_2q_3	q_2q_4	q_2q_5	q_3q_4	q_3q_5	q_4q_5
66	-	-	+	+	-	+	+	-	-	-
67	-	-	+	-	-	+	-	+	-	+
68	-	-	+	-	-	+	-	+	-	+
69	-	-	+	-	-	+	-	+	-	+
70	-	+	-	-	+	-	-	+	+	-
71	-	+	-	-	+	-	-	-	-	-
72	-	-	-	-	-	-	-	-	-	-
73	+	+	+	+	+	+	-	-	-	-
74	+	+	+	+	-	-	-	-	-	-
75	+	+	+	+	-	-	-	-	-	-
76	-	+	+	-	+	+	-	-	+	+
77	-	+	+	-	+	+	-	-	+	+
78	-	+	+	-	+	+	-	+	-	+
79	+	+	-	+	-	+	-	+	-	+
80	+	+	-	+	-	+	-	+	-	+
81	+	+	-	+	-	+	-	+	-	-

Note: q_1 = unsecured loans
q_2 = secured loans
q_3 = investments
q_4 = demand deposits
q_5 = other bank services

Table XVIII- b

PRESENCE (-)/ABSENCE (+) OF INTERPRODUCT COMPLEMENTARITY FOR PAIRS OF PRODUCTS, ALTERNATIVE II

OBS.	q_1q_2	q_1q_3	q_1q_4	q_1q_5	q_2q_3	q_2q_4	q_2q_5	q_3q_4	q_3q_5	q_4q_5
1	+	+	-	-	-	+	+	-	-	-
2	-	+	-	-	+	-	-	+	+	-
3	-	+	-	+	-	+	-	+	-	+
4	-	-	-	-	-	-	-	-	-	-
5	-	-	+	-	-	+	-	+	-	+
6	-	-	+	-	-	+	-	+	-	+
7	-	+	-	-	+	-	-	-	-	-
8	-	+	+	-	+	+	-	+	-	-
9	-	+	+	-	+	+	-	+	-	-
10	-	+	+	-	+	+	-	+	-	-
11	-	+	+	-	+	+	-	+	-	-
12	-	-	+	-	-	+	-	+	-	+
13	-	-	+	+	-	+	+	-	-	-
14	+	-	+	+	+	-	-	-	-	-
15	+	+	+	+	+	+	+	-	-	-
16	-	+	+	+	-	+	+	-	-	-
17	-	+	-	+	+	-	+	+	-	+
18	-	+	-	+	+	-	+	+	-	+
19	-	+	+	+	+	+	+	+	+	-
20	-	+	-	-	+	-	-	+	+	-
21	-	+	-	-	+	-	-	-	-	-
22	-	+	-	+	-	+	-	+	-	+
23	-	+	-	+	-	+	-	+	-	+
24	-	+	+	-	+	-	-	-	-	-
25	-	+	+	-	+	+	-	+	-	-
26	-	+	+	-	+	+	-	+	-	+
27	-	+	+	-	+	+	-	+	-	-
28	-	+	+	+	+	+	+	-	-	-
29	-	+	+	+	+	+	+	-	-	+
30	-	+	-	-	+	-	-	+	+	-

Table XVIII-b (Continued)

OBS.	q_1q_2	q_1q_3	q_1q_4	q_1q_5	q_2q_3	q_2q_4	q_2q_5	q_3q_4	q_3q_5	q_4q_5
31	-	+	+	-	+	+	-	+	-	-
32	-	+	+	-	+	+	-	+	-	-
33	-	-	+	-	-	+	-	+	-	+
34	-	+	+	+	+	+	+	-	-	-
35	+	+	+	+	+	-	-	-	-	-
36	+	+	-	+	+	+	-	+	-	+
37	-	-	+	-	-	+	-	+	-	-
38	-	-	+	-	-	+	-	+	-	-
39	-	-	+	-	-	+	-	+	-	-
40	-	+	+	-	+	+	-	+	-	-
41	-	+	+	-	+	+	-	+	-	-
42	-	+	+	-	+	+	-	+	-	+
43	+	+	-	-	-	+	+	-	-	-
44	-	+	+	-	+	+	-	+	-	-
45	-	-	+	-	-	+	-	+	-	-
46	+	+	-	-	-	+	+	-	-	-
47	+	+	+	+	+	+	+	-	-	-
48	-	+	-	-	+	-	-	-	-	-
49	-	+	+	+	+	+	+	-	-	+
50	-	+	-	-	+	-	-	-	-	-
51	-	-	+	-	-	+	-	+	-	-
52	-	+	+	-	+	+	-	-	+	-
53	-	+	-	-	+	-	-	+	+	-
54	-	+	+	-	+	+	-	-	+	+
55	-	-	+	+	-	+	+	-	-	-
56	-	+	+	+	+	+	+	-	-	-
57	-	+	+	+	+	+	+	-	-	-
58	-	+	-	+	-	+	-	-	+	+
59	+	-	+	+	-	+	+	-	-	-
60	+	-	+	+	+	-	-	-	-	-
61	-	+	-	-	+	-	-	-	-	-
62	-	+	-	-	-	-	-	-	-	-
63	-	-	-	-	-	-	-	-	-	-
64	+	+	-	-	+	-	+	-	+	+

Table XVIII-b (Continued)

OBS.	q_1q_2	q_1q_3	q_1q_4	q_1q_5	q_2q_3	q_2q_4	q_2q_5	q_3q_4	q_3q_5	q_4q_5
66	-	-	+	+	-	+	+	-	-	-
67	-	-	+	-	-	+	-	+	-	+
68	-	+	+	-	+	+	-	+	-	-
69	-	-	+	-	-	+	-	+	+	+
70	-	+	-	-	+	-	-	+	-	-
71	-	+	-	-	+	-	-	-	-	-
72	-	-	-	-	-	-	-	-	-	-
73	-	+	-	+	-	+	-	+	-	-
74	-	+	+	-	+	+	-	+	-	-
75	-	-	+	-	-	+	-	+	-	-
76	-	+	+	+	+	+	+	-	-	-
77	+	+	+	+	-	-	-	+	+	-
78	-	+	+	+	+	+	+	+	+	-
79	+	+	-	+	-	+	-	+	-	+
80	-	-	+	-	-	+	-	+	-	+
81	-	-	+	-	-	+	-	+	-	+

Note: q_1 = short-term loans; q_2 = long-term loans; q_3 = investments; q_4 = demand deposits; q_5 = other bank services seems to suggest that banks are trying to exploit economies of scope.

Interproduct complementarity also exists between other bank services and the other four financial products, namely unsecured loans, secured loans, investments and demand deposits. It is possible that some bank inputs are shareable between these financial products. For example, the cost incurred in issuing letters of credits to bank clients may be shared with the lending activities of banks, or the issuance of demand deposits, especially if the said services are rendered to the same clients. Information cost, which is a significant part of the processing costs incurred by banks in rendering services to clients, is certainly lower in this case.

The result seems to suggest that other bank services are a relatively important financial product for banks. Interestingly, the production of such financial product is one of the characteristics that distinguish commercial banks from other types of banking institutions.

Most cases show that there are cost disadvantages to the joint production of loans (both secured and unsecured) and investments. Although this finding implies that banks should concentrate in the production of loans (which are their primary products), nevertheless, the acquisition of bonds and securities is an unavoidable activity for banks due to certain legal constraints, such as the requirement to hold sufficient reserves for deposits and deposit substitutes. Admittedly, bonds and securities are the most lucrative form of reserves and a more attractive substitute for agricultural loans. This may compensate for the extra cost incurred in producing this bank output together with loans

The results regarding the joint production of loans (both secured and unsecured) and demand deposits are rather ambiguous. About half of the total observations examined show results suggesting the existence of inter-product complementarity between these financial products, while the other half yield opposite results.

As regards investments and demand deposits, a majority of the cases indicate the presence of inter-product complementarity between these two financial products.

Under Alternative II, almost all cases point to the presence of interproduct complementarity between short- and long-term loans. In other words, there are cost advantages to the joint production of both types of loans. Recall that both types of loans have declining marginal cost curves, hence, banks will realize substantial cost savings if they produce short- and long-term loans together at larger scales. In contrast, banks specializing in the production of either short or long-term loans will be placed in a more disadvantageous position compared with other banks producing both types of loans. It seems that the result does not lend support to the contention that banks should specialize in producing short-term loans.

The other results are consistent with those obtained under Alternative I. Specifically, other bank services can be produced jointly with the other four financial products at less cost. The joint production of loans (short- and long-term) and investments would bring about cost disadvantages to most banks. Some savings in cost can be realized by producing investments and demand deposits together. However, the results regarding the joint production of loans (short- and long-term) and demand deposits slightly differ in the two alternatives. Under Alternative II, we observe more cases showing the absence of inter-product complementarity. This result seems to reinforce our casual observation that resources used in producing demand deposits are not completely shareable with the production of loans.

The preceding exercise was aimed at detecting the presence or absence of economies of scope, i.e., whether it is cheaper to produce the outputs in combination rather than separately. The approach followed was to examine the property of our cost function, i.e., whether it is characterized by transray convexity or not. The use of the unrestricted translog cost function permits us to investigate the presence of transray convexity for all output levels considered.

In general, results seem to indicate that banks have some economies of scope to be exploited. In particular, they point to the desirability of having a diversified loan portfolio.

VI.5 Own-Price Elasticities and Elasticities of Substitution

The own-price elasticities and elasticities of substitution are, respectively, calculated in the translog framework in the following manner:[12]

$$e_{jj} = \frac{\lambda_{jj} + \hat{M}_j^2 - \hat{M}_j}{\hat{M}_j}, \quad j = 1, 2, 3, 4 \qquad (6.16)$$

$$\sigma_{js} = \frac{\lambda_{js} + \hat{M}_j\hat{M}_s}{\hat{M}_j\hat{M}_s}, \quad j \neq s \qquad (6.17)$$

where λ_{jj} and λ_{js} are the parameter estimates of the TMJCF and $\hat{M}_j$'s, the predicted cost shares. The owner-price elasticities and elasticities of substitution for the four factor inputs are evaluated for the average firm. The equations used to estimate the own-price elasticities and the input-substitution elasticities are presented in Tables XIX-a and XIX-b for Alternatives I and II, respectively. The results are shown

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[12] See Berndt and Wood (

Table XIX-a

ESTIMATING EQUATIONS FOR THE OWN PRICE ELASTICITIES AND THE INPUT-SUBSTITUTION ELASTICITIES, ALTERNATIVE I

$$e_{11} = \frac{.2050 + \bar{M}_1^2 - \bar{M}_1}{\bar{M}_1}$$

$$\sigma_{12} = \frac{-.0581 + \bar{M}_1 \bar{M}_2}{\bar{M}_1 \bar{M}_2} \qquad e_{22} = \frac{.1025 + \bar{M}_2^2 - \bar{M}_2}{\bar{M}_2}$$

$$\sigma_{13} = \frac{-.0220 + \bar{M}_1 \bar{M}_3}{\bar{M}_1 \bar{M}_3} \qquad \sigma_{23} = \frac{-.0021 + \bar{M}_2 \bar{M}_3}{\bar{M}_2 \bar{M}_3} \qquad e_{33} = \frac{.0232 + \bar{M}_3^2 - \bar{M}_3}{\bar{M}_3}$$

$$\sigma_{14} = \frac{-.1249 + \bar{M}_1 \bar{M}_4}{\bar{M}_1 \bar{M}_4} \qquad \sigma_{24} = \frac{-.0423 + \bar{M}_2 \bar{M}_4}{\bar{M}_2 \bar{M}_4} \qquad \sigma_{34} = \frac{.0009 + \bar{M}_3 \bar{M}_4}{\bar{M}_3 \bar{M}_4} \qquad e_{44} = \frac{.1663 + \bar{M}_4^2 - \bar{M}_4}{\bar{M}_4}$$

Note: The parameters are obtained from Table IX. $\bar{M}_1$, $\bar{M}_2$, $\bar{M}_3$ and $\bar{M}_4$ are the sample means of the predicted cost shares ($\bar{M}_1$ = .3252; $\bar{M}_2$ = .2467; $\bar{M}_3$ = .1636; and $\bar{M}_4$ = .2635)

Table XIX-b

ESTIMATING EQUATIONS FOR THE OWN-PRICE ELASTICITIES AND THE INPUT-SUBSTITUTION ELASTICITIES, ALTERNATIVE II

$$e_{11} = \frac{.2295 + \bar{M}_1^2 - \bar{M}_1}{\bar{M}_1}$$

$$\sigma_{12} = \frac{-.0875 + \bar{M}_1\bar{M}_2}{M_1M_2} \qquad e_{22} = \frac{.1388 + \bar{M}_2^2 - \bar{M}_2}{\bar{M}_2}$$

$$\sigma_{13} = \frac{-.0121 + \bar{M}_1\bar{M}_3}{\bar{M}_1\bar{M}_3} \qquad \sigma_{23} = \frac{-.0134 + \bar{M}_2\bar{M}_3}{\bar{M}_2\bar{M}_3} \qquad e_{33} = \frac{.0252 + \bar{M}_3^2 - \bar{M}_3}{\bar{M}_3}$$

$$\sigma_{14} = \frac{-.1299 + \bar{M}_1\bar{M}_4}{\bar{M}_1\bar{M}_4} \qquad \sigma_{24} = \frac{-.038 + M_2M_4}{\bar{M}_2\bar{M}_4} \qquad \sigma_{34} = \frac{.0002 + \bar{M}_3\bar{M}_4}{\bar{M}_3\bar{M}_4} \qquad e_{44} = \frac{.1676 + \bar{M}_4^2 - \bar{M}_4}{\bar{M}_4}$$

Note: The parameters are obtained from Table IX. $\bar{M}_1$, $\bar{M}_2$, $\bar{M}_3$ and $\bar{M}_4$ are the sample means of the predicted cost shares, e.e., ($\bar{M}_1 = .3271$; $\bar{M}_2 = .2454$; $\bar{M}_3 = .1650$; and $\bar{M}_4 = .2626$).

in Tables XX-a and XX-b for Alternatives I and II, respectively.

The diagonal elements of the matrix are the estimated own-price elasticities. Under Alternative I, the signs of the estimated own-price elasticities for the four factor inputs conform to *a priori* expectation. That is, an increase in the price of a factor input leads to a reduction in the quantity demanded of the said factor input, *ceteris paribus*. Under Alternative II, the TMJCF yields a positive own-price elasticity of the demand for deposits, violating the requirements of our cost-minimization model.[13] Nevertheless, the estimated own-price elasticity of the demand for deposits is close to zero and also, not statistically significant, making the violation of the regularity conditions of no practical significance.

Note that the estimated own-price elasticities of the demand for the other three factor inputs under

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[13]The own-price elasticities should be nonpositive so that the input demand curves will be downward sloping. Mild violation of the regularity conditions is not, however, uncommon in empirical studies using duality theory. For example, see Quizon (1980) and Caves *et al.* (1981).

Table XX-a

OWN-PRICE ELASTICITIES ON THE DIAGONAL AND INPUT-SUBSTITUTION ELASTICITIES ON THE OFF-DIAGONAL, ALTERNATIVE I

(t-values in parentheses)

	P_1	P_2	P_3	P_4
P_1	-.0444 (-.51)	.2758 (.05)	.8933 (1.78)**	-.4435 (-.51)
P_2	.2758 (.05)	-.3378 (-2.48)**	.9484 (1.41)	.3474 (.28)
P_3	.8933 (1.78)***	.9484 (1.41)	-.6944 (-9.04)*	1.0202 (6.98)*
P_4	-.4435 (-.51)	.3474 (.28)	1.0202 (6.98)*	-.1054 (-.44)

Note: P_1 = price of (savings and time) deposits.

P_2 = price of borrowed funds.

P_3 = price of labor services.

P_4 = price of operating inputs.

* Significant at .01 level.

** Significant at .05 level.

*** Significant at .10 level.

Table XX-b

OWN-PRICE ELASTICITIES ON THE DIAGONAL AND INPUT-SUBSTITUTION ELASTICITIES ON THE OFF-DIAGONAL, ALTERNATIVE II

(t-values in parentheses)

	P_1	P_2	P_3	P_4
P_1	.0287 (.29)	-.0900 (.01)	.7756 (1.85)**	-.5123 (-.56)
P_2	-.0900 (.01)	-.1890 (-1.24)	.6687 (.60)	.4106 (.43)
P_3	.7756 (1.85)***	.6687 (.60)	-.6823 (-9.57)*	1.0051 (7.19)*
P_4	-.5123 (-.56)	.4106 (.43)	1.0051 (7.19)*	-.0992 (-.97)

Note: P_1 = price of (savings and time) deposits.

P_2 = price of borrowed funds.

P_3 = price of labor services.

P_4 = price of operating inputs.

* Significant at .01 level.

** Significant at .05 level.

*** Significant at .10 level.

Alternatives I and II are fairly close to each other. This means that these estimates are less sensitive to the manner of classifying bank loans.

The own-price elasticity coefficients of the factor inputs are substantially less than one, indicating inelasticity of the demand for the said factor inputs. The observed inelasticity of the demand for deposits may serve as an indicator of the banks' active role in the intermediation process. On the other hand, the inelasticity of the demand for borrowed funds reflects the banks' strong reliance on the money market and Central Bank as important sources of funds.

In certain cases, the inelasticity of the demand for the factor inputs may be ascribed to the situation wherein the prices of the said factor inputs are established toward the lower end of the respective demand curves. This explanation is plausible, especially with the case of deposits and borrowed funds. During the period of analysis, the prices of these factor inputs were regulated by monetary authorities.[14]

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[14]It should be recalled that we were not able to separate money market borrowings from Central Bank borrowings. Ceilings are imposed on interest rates on money market instruments, while generous rediscount rates are offered by the Central Bank especially on preferred areas.

It is, of course, common knowldege that in most cases the regulated prices of these resources were considerably lower than their free market prices.

The inelasticity of the demand for the factor inputs may also be attributed to the unavailability of substitutes for these factor inputs or to the weak substitution possibilities among the factor inputs. It is worthwhile to examine this problem.

The Allen-Uzawa partial elasticities of substitution are shown as off-diagonal elements of the matrix in Table XX-a for Alternative I and Table XX-b for Alternative II. It should be recalled that a positive elasticity of substitution implies that factors are substitutes, while negative elasticity of substitution indicates that factors are complements.

The computed elasticities of substitution under Alternatives I and II are fairly close to each other, except that inconsistent signs are obtained for the coefficient of the elasticity of substitution between deposits and borrowed funds.

It is commonly expected that deposits and borrowed funds can substitute each other since the scarcity of funds from one source will most likely induce banks to draw funds correspondingly from the other source in order to produce the same output level. However, the results do not support this a priori expectation. Instead, we find a lack of substitution between deposits and borrowed funds. In fact, these factor inputs are shown to be complements under Alternative II, although the result is not statistically significant. Thus, it may be concluded that from the point of view of commercial banks, borrowed funds (i.e., borrowings from the money market and the Central Bank) cannot substitute for deposits (savings and time deposits), or vice-versa. This may be due to the existing regulations setting limits to borrowings by banks. For instance, borrowings from the Central Bank are limited to 50 percent of the bank's net worth under the general rediscounting facility and 10 percent under the special rediscounting facility.[15] Likewise, the maximum amount banks can borrow from the money market needs approval from the Central Bank.

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[15]The list of eligible papers included in the special rediscounting facility is constantly updated by the Central Bank to respond to the changing economic environments and programs of the government.

Approval is granted only to banks which comply with the Central Bank regulations (e.g., the minimum net worth to risk assets ratio) and show satisfactory performance. Thus, these regulations constrain banks' choices of the mix of borrowed funds and deposits, especially if the maximum allowable level for borrowed funds is already attained.[16]

Indeed, the absence of substitution possibilities between borrowed funds and deposits leaves banks very little flexibility in managing their liabilities. With changes in the relative prices of these factor inputs, banks would certainly meet some difficulties in fashioning out an optimal input mix without affecting their output levels.

Deposits and labor services appear to be substitutes for each other. The estimated elasticity of substitution for these two factor inputs is still less than one but statistically significant under the two alternatives. Deposits are, however, shown to be a complement

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[16]Patrick and Moreno (1980) have indicated that banks tend to exhaust their CB credit accommodations. This is, of course, understandable considering the fact that CB funds are relatively cheap.

to operating inputs. Thus, except for labor, there is hardly any other factor input that can substitute for deposits. This merely highlights the uniqueness of this factor input in the production process of banks

The substitution elasticity coefficient of borrowed funds and labor is positive, indicating that they are substitutes. However, it is statistically not different from zero. The same may be said with the substitution elasticity coefficient of borrowed funds and operating inputs. Again, banks will have less flexibility in using borrowed funds since such factor input cannot substitute for or be substituted by the other factor inputs.

The estimated elasticity of substitution between labor and operating inputs is very close to one and is statistically significant at the 5 percent level in both Alternatives I and II, suggesting that said factor inputs are substitutes for each other. This is, of course, in accord with our expectations. A bank, for example, may reduce the number of tellers if electronic machines are used. Also, the number of bookkeepers may be reduced if accounts are computerized. Changes in the relative prices of these factor inputs will motivate banks to substitute the input whose price is relatively cheaper for the input whose price is relatively more expensive to produce the same level of output.

In sum, it may be said that the production technology presently adopted by banks is, in general, characterized by some rigidities in the sense that the own-price elasticities and the input-substitution elasticities are very low. Such results may be attributed to the existing regulations that effectively constrain banks' operations. For example, interest ceilings are imposed on deposits and money market instruments. In addition, there are ceilings on the amount banks can borrow from the Central Bank and money market. It is to be noted that the parameter estimates of our cost function have implicitly incorporated these regulatory constraints. As demonstrated by Diewert (1974), the own-price elasticities and input-substitution elasticities are usually lower when the cost function is subject to constraints than when it is unconstrained.[17]

[17] This is based on Le Chatelier's principle first introduced into economics by Samuelson (1947).

Therefore, it is not surprising to obtain results showing very low own-price elasticities and input-substitution elasticities since the estimated cost function is subject to a number of regulatory constraints.

In less regulated industries, the own-price elasticities and input-substitution elasticities are expected to be fairly large. The findings of Sicat (1963) and Miguel (1975) seem to support this *a priori* expectation. In their studies, the estimated elasticities of substitution between capital and labor in less regulated industries, like food manufacturing, beverages, tobacco products, furnitures and fixtures, etc., were quite high and statistically significant (see Table XXI).

Table XXI

ESTIMATED ELASTICITIES OF SUBSTITUTION FOR SELECTED INDUSTRIES
(Using the CES Production Function)

(1) Industry	(2) Miguel's Study	(3) Sicat's Study
Food manufacturing	1.534	1.366
Beverages	1.[illegible]47	1.111
Tobacco products	2.008	1.571
Furnitures and fixtures	1.[illegible]57	1.247
Leather and leather products	1.268	1.578
Rubber products	1.849	1.[illegible]88

Sources: Column 2 - Miguel (1975)
Column 3 - Sicat (1963)

Note: Miguel (1975) used time series data (1956-1969), while Sicat (1963) used cross-section data. The figures in Sicat's study are averages for the years 1956-1959.

Chapter VII

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

VII.1 Summary and Conclusions

This study has attempted to analyze the behavior of commercial banks which chalk up two-thirds of the total financial resources of the banking system. A better understanding of bank behavior is important in at least two respects. One is that banks are among the most heavily regulated firms in the economy, and the effectiveness of regulations depends to a large extent on the behavioral characteristics of commercial banks. The other is that the new view of money supply determination requires sufficient knowledge of individual bank behavior to comprehend fully money supply movements.

In modelling bank behavior, two peculiar characteristics of a banking firm were considered: (1) a bank, like any ordinary firm, is a producing unit, not merely an investor; and (2) a bank is a multiproduct, multifactor firm. Utilizing the duality relationship between cost and production functions, a multiproduct joint cost function was postulated to capture the behavior of banks. It is capable of treating the problem of determining simultaneously the optimal input and output mix and the scale of operation of banks. The analysis was facilitated by the use of recently formulated microeconomic concepts -- such as declining ray average cost and economies of scope -- which describe important properties of multiproduct firms.

In this study, four specific models were considered, namely: (1) the unrestricted model that allows differences in the structure of production among the years; (2) the unrestricted model that does not allow differences in the structure of production among the years; (3) the model that assumes nonjointness in the production process; and (4) the model that assumes separability in outputs.

The specific functional form chosen for econometric work was the transcendental logarithmic multiproduct joint cost function (TMJCF). It is a flexible functional form, parsimonious in parameters compared with other flexible forms, and capable of detecting important cost properties of the multiproduct firm, like scale and scope economies.

Any attempt to use the theory of the multiproduct firm to analyze the behavior of a bank requires an appropriate classification of bank outputs and inputs. A statistical accounting model was constructed for the purpose of obtaining estimates of **net rates** of return on the elements of bank portfolio. The results gave us some basis for determining which of the elements of bank portfolio can be considered as bank outputs or inputs.

Twenty-seven private domestic commercial banks were selected to compose the observations of this study. The period 1977 to 1979 was chosen as the reference period. The study used two alternative ways of classifying bank loans, namely: (1) Alternative I which classifies loans according to security; and (2) Alternative II which classifies loans according to maturity.

Certain findings important to both bank managers and policy-makers have emerged from our empirical work. These are briefly reviewed below.

During the period 1977 to 1979, commercial banks experienced a rapid growth in size. The growth was phenomenal among smaller banks which tried to acquire a more competitive position. Larger banks, however, still maintained their competitive edge. A greater proportion of their deposits were of long-term maturity. Moreover, they were found to be more efficient than smaller banks in mobilizing savings.

As expected, bank loans were mostly of short-term maturity. About 80 percent of the loan portfolio of most banks were for one year or less. Interestingly, unsecured loans comprised about 40 percent of the total loan portfolio of most banks. This may be interpreted as a shift in the interest of banks away from the collateral to the profitability of the proposed loan project. However, it must also be pointed out that this facility is most likely offered to highly favored firms having long established relationship with the bank and also, to influential individuals, like bank officers. In this case, profitability of the proposed loan project may not be the overriding criterion but rather the relationship of individuals or firms with and their influence on management.

In making decisions on the composition of bank portfolio, it is important that banks have some idea regarding the profitability of the various elements of their loan portfolio. Thus, we also estimated the net rates of return on the elements of bank portfolio. Unsecured loans and loans secured by real estate were observed to be more profitable than other secured loans (loans secured by chattel mortgage and by assignment of deposits). The estimated net rate of return on unsecured loans is about 5 percent per annum while that on loans secured by real estate is approximately 4 percent per annum. The difference may be attributed to the varying degree of risk involved in the two types of loans.

Demand and short-term loans were found to be fairly profitable. The estimated net rate of return on these loans is about 5 percent per annum. The results also confirm the general expectation that long-term loans are unprofitable.

Surprisingly, the estimated net rate of return on investments was observed to be relatively higher than that on the different types of loans. Indeed, this makes investments relatively more attractive than loans because aside from yielding a higher net rate of return, they are also less risky and can form part of total required reserves.

A comparison of the estimated net spread or net rate of return on loans realized by Philippine commercial banks with that by U.S. banks was made (cf. Section IV.3), and the result confirms that regulated lending and deposit rates only allowed domestic banks to enjoy a much larger net spread on loans.

While it was expected that bank liabilities would yield negative rates of return, this study found that demand deposits give a positive rate of return, whereas other liabilities yield negative rates. This suggests that servicing demand deposits is a direct income-earning endeavor of commercial banks. In this regard, it is then appropriate to consider demand deposits as bank output rather than as a mere input in the production process.

In this study, bank outputs are composed of loans (Alternative I: secured and unsecured loans; Alternative II: short- and long-term loans), investments, demand deposits and other bank services. Bank inputs include savings and time deposits, borrowed funds, labor services, and operating inputs. The result of the first hypothesis testing revealed that the production structure of banks dids not differ among the years (i.e., 1977-1979) considered in this study. Thus, in subsequent tests, the unrestricted model that does not allow differences in production structure among the years was treated as the maintained hypothesis against which restrictive models were tested. The results of the subsequent tests of hypotheses suggest that restrictive models, i.e., those assuming nonjointness in the production process and separability in outputs, must be rejected. Therefore, the unrestricted model is considered the model that can best describe the production structure of banks. Such model describes a production process wherein different products are produced jointly by banks (in contrast to the model that assumes separate production processes for the different bank products). Furthermore, said model assumes that banks determine simultaneously the optimal output and input mix (in contrast to the model that assumes that the output mix is determined independently of the input mix).

Substantial economic insights can be drawn from the fitted translog multiproduct joint cost function. One is the implied marginal cost of producing each bank output. The study has shown that the estimated marginal cost of producing an extra unit (₱1M) of a particular bank output considerably varies from bank to bank. This may reflect the varying efficiency of individual banks in producing the same output.

The relationship between the marginal cost and a specific bank output was plotted with the curves representing the marginal cost curves of an average bank (cf. Settion VI.2). The marginal cost curves of unsecured loans, secured loans, short-term loans, long-term loans, and other bank services were observed to be decreasing as the scale of production of the said outputs is increased. These marginal cost curves eventually flatten beyond certain levels of output. Special attention should be given to the marginal cost curve of long-term loans since it suggests some cost advantages in increasing the volume of the said output. On the other hand, the marginal cost curve of investments tends to increase with an increase in output level.

Inconsistent results were obtained with regard to the behavior of the marginal cost curve of demand deposits. That is, Alternative I exhibited a declining marginal cost curve for demand deposits while Alternative II showed an increasing marginal cost curve. The inconsistent results may be attributed to the distribution of loans among the different categories of loans. As noted in Chapter II, loans of most banks were fairly distributed between secured and unsecured loans but were concentrated in the shorter end. Short-term loans might have represented total loans, and in this case, therefore, the result obtained under Alternative II may be considered as a reflection of that special bank-client relationship. Since banks' borrowers are, in most cases, also their depositors, it is to the advantage of banks to maintain good loan relationship with borrowers in order to assure themselves of a reliable source of deposits. To cultivate this relationship and, in part, to compensate their clients for holding large non-interest bearing demand deposit balances, banks provide for free or at a very minimal fee many technical and financial services to their clients. The cost varies directly with the size of demand deposit balances since more services are usually offered to those who have larger demand deposit balances.

An interesting finding revealed in this study is that banks have failed to achieve the maximum profit.[1] Two alternative explanations were offered for obtaining such result. The first alternative argues that banks still adhere to the profit maximization assumption. However, they failed in their effort to maximize profit due to some regulatory constraints, such as the reserve requirements, the minimum risk assets to net worth ratio, the requirement to set aside 25 percent of their total loanable funds for agricultural loans, etc., which they have to comply with in order to continue operation. It should be noted that the parameter estimates of our cost and revenue functions have implicitly incorporated such regulatory constraints. In effect, those regulations

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[1]That is, we found that in all cases $MR_i \neq MC_i$, for all i (=1, 2, 3, 4, 5) where i refers to the ith bank output (cf. Section VI.2).

place severe restrictions on the input and output mix which banks may acquire to maximize profit.

In a case wherein the existing regulations do not pose as effective constraints of profit maximization, it is still possible to observe individual banks failing to equate marginal revenue to marginal cost. This may happen if banks find it more advantageous to operate like a cartel and can enforce collusive behavior among themselves. The cartel in this case may be maximizing industry profit. Once the optimal output for the industry is determined, the cartel distributes the market among its members. However, the allocation of market shares may not be governed by the marginal changes in cost and revenues of each member but rather by the bargaining ability of member banks.[2] In other words, banks individually may not be maximizing profit but together as a cartel they may well be. This may be the best alternative in order to prevent or reduce losses due to excessive advertising, price wars and other costly activities

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[2]Size and/or importance of member banks to the cartel may serve as leverage in bargaining.

which each bank is likely to undertake in the absence of collusive arrangements.

The other explanation offered was that banks may not be trying to maximize profit at all. That is, they may be following another set of decision rules instead of the standard profit maximization. This is plausible considering the fact that banks usually pursue a number of objectives, some of which are dictated by regulatory authorities, while others are determined by management. However, instead of trying to achieve all objectives simultaneously, banks presumably order them according to importance and specify a satisfactory level for each of them. Lower-order (i.e., more important) objectives are satisfied before higher-order (i.e., less important) objectives, and higher-order objectives are not achieved at the expense of lower-order objectives. Once the satisfactory level is achieved, the lower-order objectives become constraints of the next objective in the hierarchy. In brief, we are suggesting that the behavior of banks **may** be explained by the L^*-ordering. In this framework, we can then understand why we obtained results showing that banks **failed to achieve** the maximum profit simply because they were not aiming for a maximum profit. Rather, they might be merely interested in achieving a satisfactory rate of profit.

The existence and degree of overall economies of scale were also examined. The results showed that substantial economies of scale remained unexploited by most banks in 1977 and 1978. However, in 1979 some banks were already operating in the region of negative scale economies. A handful of banks were also found to have nearly exhausted their scale economies.

The overall scale economies give an idea regarding the cost savings or cost disadvantages that can be derived by expanding the level of all outputs proportionately along a ray in the output space. However, they do not give us some indication regarding cost savings or cost disadvantages that can be realized by producing several outputs together. This is properly captured by the concept of economies of scope.

Thus, the study went on further to investigate whether cost savings can be realized by producing several products together. The findings disclosed that banks are likely to experience cost disadvantages if they produce the five financial products together. However, results pointed to the desirability of producing certain subsets of the financial products. In particular, cost savings would be realized if banks diversify their loan portfolio, i.e., they produce both secured and unsecured loans, and short- and long-term loans. Thus, banks have still some economies of scope to be exploited.

Another piece of worthwhile information deduced from the fitted cost function is the derived demand for the bank's factor inputs. This has been left unattended by past studies on bank behavior. The results of this study revealed that the demand for the factor inputs is inelastic and that weaker substitution possibilities exist among the four factor inputs. We take special note of the absence of substitution possibilities between deposits (savings and time) and borrowed funds which appears contrary to our *a priori* expectation. Indeed, the results suggest that the production technology adopted by banks is, in general, characterized by some rigidities in the use of factor inputs.

We have attributed such results to the existing regulations that effectively constrain banks' operations. For example, interest ceilings are imposed on deposits and money market instruments. In addition, there are ceilings on the amount banks can borrow from the Central Bank and money market. It should be noted that the parameter estimates of our cost function using existing data have implicitly incorporated these regulatory constraints. According to Le Chatelier's principle -- first introduced into economics by Samuelson (1947) and applied to profit functions by Diewert (1974) -- the own-price elasticities and input-substitution elasticities are lower when the cost function is subject to constraints than when it is unconstrained. Thus, it is not surprising to obtain results showing inelastic demand for and weaker substitution possibilities among the factor inputs since our estimated cost function is subject to some regulatory constraints. In less regulated industries, like food manufacturing, beverages, tobacco products, furnitures and fixtures, etc., Sicat (1963) and Miguel (1975) found fairly high substitution possibilities between capital and labor.

Indeed, the kind of production technology presently adopted by banks under the existing regulatory environment gives them little flexibility to manage their liabilities, in particular, and to fashion out an optimal input mix, in general. Whenever there are changes in the input prices, we expect banks to meet tremendous difficulties in adjusting the allocation of their resources without considerably affecting the scale of their operation.

VII.2 Policy Implications

It is worthwhile to discuss some specific policy implications that may be drawn.

The recent financial reforms embody a set of policies designed both to achieve a least cost banking industry structure and to increase the proportion of long-term loans. The success of these reforms is, to a large extent, contingent upon two factors. One is that there are still economies of scale that can be exploited by banks; the other is that there is some kind of complementarity between short- and long-term loans. The presence of both factors are extremely important if banks are to increase their scale of operation and produce both types of loans at the lowest cost possible.

As mentioned earlier, there is some kind of complementarity between short- and long-term loans. In other words, it **would be cheaper to produce both** types of loans in combination rather than separately. This **may** serve as a strong argument for encouraging banks to produce both types of loans rather than letting them specialize in the production of short-term loans. The current move of the Central Bank to lift policies biased against long-term loans (e.g., rediscounting policies) is deemed appropriate. It **could** motivate banks to increase the proportion of long-term loans in their total loan portfolio.

In addition, the marginal cost curves of short- and long-term loans were observed to be declining, suggesting the cost advantages realized if both were produced at larger scales. It seems that amalgamation of banks for the purpose of producing short- and long-term loans is an attractive policy option. However, a word of caution is in order. As noted earlier, a majority of banks had either completely or nearly exhausted the economies of scale. Further expansion through merger is indeed less desirable for these banks. Hence, the effectiveness of such policy will likely be very limited.

In reducing the cost of banking services, too much attention is usually paid to the exploitation of scale economies or to scale-related technical change. However, cost reduction may also be effected by banks through technical changes unrelated to increases in scale (i.e., shifting the marginal cost curve downward). This may be in the form of new ways of organizing resources, new packaging of services, flexible organizational setup, efficient methods of credit evaluation and monitoring system, etc. A more competitive atmosphere conducive to the adoption of innovative banking techniques is indeed desirable. The deregulation of interest rates is certainly a big step towards this direction. Inefficient banking firms which will remain passive to this new environment may be allowed to close shop or be absorbed by other banks rather than be protected.

The results of this study can also aid us in understanding the role of bank behavior and monetary policies in determining the supply of money. In this regard, we recall the simple model of money supply determination developed by Teigen (1970). His model pays attention to the role of bank behavior in determining the supply of money. Accordingly, banks will tend to issue more liabilities to raise funds and decrease their excess reserves when the return from lending rises relative to the cost of making loans.

Teigen's model can be summarized by the following equation:

$$M = k \left[R^* - R^f(i_s, r_j) \right]$$

This means that the supply of money, M (=currency in circulation plus demand deposits), is a multiple, k, of the difference between the policy controlled reserve base, R^* (which reflects the money market operations of the Central Bank), and the banks' free reserves, R^f. Free reserves vary inversely with the lending rates, i.e., $\partial R^f/\partial i_s < 0$ (where i_s are lending rates) but positively with the borrowing rates, i.e., $\partial R^f/\partial r_j > 0$

(where r_j are borrowing rates, such as rediscount rates, money market rates and deposit rates).

The supply of money changes directly with R^* and i_s but inversely with r_j. Let us focus our attention to the last relationship since this is one of the issues addressed to in this study. An increase in one of the r_j's decreases the quantity demanded of that specific type of funds, which in turn results in a decrease in M, <u>ceteris paribus</u>. Conversely, a decrease in one of the r_j's increases the quantity demanded of that specific type of funds, which in turn results in an increase in M, <u>ceteris paribus</u>.

In this study, however, the derived demand for borrowed funds (i.e., Central Bank and money market borrowings) and deposits were found to be inelastic. In other words, changing the cost of borrowed and deposit funds, i.e., changing r_j's (including the rediscount rates) would leave the quantity demanded of such funds virtually unaffected. In this case, therefore, the Central Bank can influence the movements of money supply only through its money market operations. Its rediscounting policies would then be left powerless to influence the movements of money supply.

There is, however, a need to qualify this result. The observed inelastic demand for borrowed funds and deposits may be attributed to the setting of interest ceilings, in the case of deposits and money market instruments, and of giving generous rediscount rates, in the case of borrowings from the Central Bank. As is well known, the regulated prices of these resources are usually lower than their free market prices, and inelastic demand usually obtains if the price of any resource is established toward the lower end of the demand curve. Therefore, any small changes in the prices of these resources will hardly affect banks' demand for such resources.

The current deregulation of interest rates may make banks' demand for deposits and funds borrowed from the money market relatively more price elastic. In view of this, it is worthwhile to set the rediscount rates at levels competitive with money market rates to make the demand for these funds also price elastic. Thus, banks' free reserves, which partly determine movements of the supply of money, will be responsive to market forces, as expressed through the market rates of interest on loans, deposits and money market instruments, and on Central Bank's policy decisions, as expressed through movements on the rediscount rates. In this regard, it is suggested that the rediscounting facility of the Central Bank should be used more as an instrument for controlling movements of the supply of money and less as an allocative instrument.

The relatively higher net rate of return realized by banks on investments in bonds and securities (which are mostly government bonds and securities) has at least two policy implications. One is that it indicates the feasibility of developing the secondary market for government securities. The other policy implication is rather disturbing. The earnings realized by banks from these assets would increase the ability of banks to expand credit, and since government securities can form part of total required reserves, the increased earnings from such assets might have reduced the effective reserve requirement ratio.[3] This, in a sense, is expansionary.

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[3]There is strong evidence that from 1960 to 1974, between 29 to 53 percent of the total required reserves of commercial banks were covered by government securities. See Manalo (1979).

Thus, to successfully develop the secondary market for government securities and also, to enhance the effectiveness of monetary policy, it would be worthwhile to lower the share of government securities in the total reserve requirements of banks below that which is currently allowed by the regulatory authorities.

Finally, the issue of using an implicit rather than an explicit pricing scheme on demand deposit accounts also deserves the attention of policy-makers. The implicit service charges collected by banks on demand deposit accounts and the implicit interest payments made by them on the same accounts may be valued differently by banks and depositors whereas the explicit price for the service and the explicit interest payments on said accounts are valued equally by both. Clearly, explicit pricing provides correct market signals to both banks and depositors, while implicit pricing may give wrong signals. Thus, greater efficiency may be realized by explicit pricing on demand deposit accounts. Because of this consideration, it is deemed more appropriate to use an explicit pricing scheme. The finding that banks realize a comfortable positive net implicit return on demand deposit accounts makes this shift in policy even more appropriate. However, this issue merits more thorough examination to ascertain the quantitative effects that removal of the prohibition will have on individual banks, the financial system and the public and also, to determine the explicit interest that banks have to pay on demand deposits.

There are already strong indications that an explicit pricing scheme will eventually be utilized in the near future. The introduction of the automatic transfer service (ATS) from savings to checking accounts, a facility offered by banks that gives opportunities to depositors to hold minimal balances on non-interest earning demand deposits and more on interest-earning savings deposits, and the recent policy of granting commercial banks the authority to offer negotiable order of withdrawal (NOW) accounts, which are interest-bearing checking accounts, are steps towards this direction. The development of these instruments can be hastened by embarking vigorous advertising campaigns. As information spreads about the availability of these financial instruments, depositors will probably exert considerable effort in determining whether to put some or all of their funds on NOW accounts, savings deposits, or time deposits.

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Appendix A.1

ASSETS AND LIABILITIES

A. Assets

1. Cash, Checks and Other Cash Items
2. Due from the Central Bank and Other Banks
3. Trading Securities
4. Investments in Bonds and Other Debt Instruments
5. Loans (Alternative Classifications)

   a. <u>By Securities</u>

      5.1 Unsecured Loans
      5.2 Loans Secured By Real Estate
      5.3 Other Secured Loans

   b. <u>By Maturities</u>

      5.1 Demand Loans
      5.2 Short-term Loans (one year or less)
      5.3 Long-term Loans (more than one year)

6. Equity Investments in Allied Undertakings/Affiliates
7. Bank Premises, Furniture, Fixtures and Equipment and Other Properties
8. Other Assets

B. Liabilities and Capital Accounts

1. Liabilities

   1.1 Demand Deposits
   1.2 Savings Deposits
   1.3 Time Certificates of Deposits
   1.4 Bills Payable
   1.5 Marginal Deposits
   1.6 Other Liabilities

2. Capital Accounts

   2.1 Assigned Capital
   2.2 Surplus
   2.3 Undivided Profits

C. Contingency Accounts

Appendix A.2

INCOME STATEMENT

1. Current Operating Income

2. Less: Current Operating Cost

   2.1 Interest on Savings and Time Deposits

   2.2 Interest on Borrowed Funds

   2.3 Compensation/Fringe Benefits

   2.4 Other Operating Expenses

3. Net Current Operating Income

4. Net Income Before Tax

5. Net Income After Tax

NOTES TO APPENDIX B

The twenty-seven banks are grouped into three asset-size groups. Each group consists of nine banks. The composition of each bank group is determined by the ranking of banks according to size of assets. The first nine large asset-size banks belong to the first bank group; the second nine large asset-size banks compose the second bank group; and the last nine small asset-size banks constitute the third bank group. They will be referred to as large, medium and small banks, respectively.

The ranking of banks within each bank group kept on changing during the period 1977 to 1979. However, there was hardly any change in the composition of the three bank groups, except that in 1978 two banks interchanged each other's bank group -- one formerly belonging to large bank group and the other formerly belonging to the medium bank group -- and that in 1979 two formerly small asset-size banks took the place of two formerly medium asset-size banks.

Appendix B.1

COMPOSITION OF LIABILITIES OF INDIVIDUAL BANKS, 1977
(In Percent)

Banks	Demand Deposits	Savings Deposits	Time Deposits	Other Deposits	Deposit Substitutes	Other Bills Payable	Other Liabi-lities	Assigned Capital	Surplus	Undivided Profits
Large Banks										
1	16.38	29.60	22.58	1.97	2.73	1.90	13.66	7.88	3.31	0.00
2	13.14	18.57	17.71	.05	25.01	3.56	11.01	6.37	4.20	.38
3.	14.70	25.18	20.52	.29	10.51	.82	17.40	4.58	5.99	-
4	15.94	18.49	22.06	.70	17.53	7.24	9.39	2.84	4.69	1.11
5	14.17	35.96	8.22	2.84	8.47	2.73	21.29	5.50	.52	.31
6	15.66	26.54	10.24	-	24.29	4.30	11.20	5.72	1.90	.15
7	20.73	29.19	14.08	1.54	10.70	1.31	13.76	6.89	.21	1.61
8	12.44	13.33	27.23	1.26	21.96	7.83	9.12	3.13	1.83	1.88
9	34.94	7.74	39.57	.86	.80	1.54	4.69	4.44	2.54	2.89
X̄	17.57	22.73	20.25	1.06	13.56	3.47	12.39	5.26	2.80	.93
s	6.94	8.89	9.49	.95	9.06	2.56	4.88	1.68	1.93	1.02
C.V.	39.50	39.12	46.86	89.61	66.80	73.72	39.34	31.91	68.83	109.81
Medium Banks										
10	9.98	15.16	14.70	.24	10.12	27.86	10.39	10.46	-	1.09
11	22.14	29.76	9.36	.93	10.56	8.93	9.08	4.90	3.64	.72
12	22.44	44.95	16.10	.86	10.60	.66	14.28	6.80	.69	4.58
13	11.61	18.38	11.58	.94	30.24	5.83	12.25	6.57	.69	2.03
14	11.41	22.43	20.55	3.50	9.54	9.70	11.49	7.40	1.90	2.08
15	12.75	14.47	15.75	3.12	17.86	16.86	10.55	6.37	2.27	-
16	11.66	34.15	13.41	1.83	7.20	9.35	11.94	6.93	2.56	.98
17	8.93	22.89	26.50	.54	16.29	1.00	12.68	10.26	.56	.34
18	3.45	12.14	6.02	51.75	-	3.23	14.06	5.90	1.77	1.68
X̄	12.71	23.81	14.89	7.08	12.49	9.27	11.86	7.29	1.56	1.50
s	6.07	10.72	6.04	16.79	8.40	8.62	1.71	1.88	1.17	1.36
C.V.	47.79	45.02	40.55	237.18	67.22	92.99	14.38	25.79	74.74	90.61

Appendix B.1 (Continued)

Banks	Demand Deposits	Savings Deposits	Time Deposits	Other Deposits	Deposit Substitutes	Other Bills Payable	Other Liabi-lities	Assigned Capital	Surplus	Undivided Profits
Small banks										
19	13.44	16.62	14.64	.91	25.04	4.07	13.19	9.90	1.00	1.19
20	10.79	13.20	16.57	1.26	25.12	4.74	10.82	14.64	.66	2.20
21	15.29	15.79	15.24	2.35	19.11	3.50	16.57	11.36	.57	.22
22	8.18	4.63	4.30	.62	13.14	46.56	11.70	7.22	.13	3.52
23	11.46	14.46	12.76	.08	27.14	4.87	13.61	11.80	.17	3.65
24	16.45	24.06	7.86	.74	9.39	4.61	8.35	22.51	1.82	4.21
25	12.39	10.43	6.90	.33	16.13	12.74	15.69	21.80	-	3.58
26	5.63	46.78	14.48	14.48	2.19	-	12.07	39.64	4.18	-25.42
27	17.31	25.74	11.79	.67	14.62	4.06	11.24	10.79	1.58	2.20
X	12.33	19.08	11.62	2.38	16.88	9.46	12.58	16.63	1.12	2.60
s	3.82	12.21	4.28	4.58	8.19	14.31	2.52	10.09	1.31	1.39
C.V.	31.03	64.00	36.81	1.92	48.52	151.21	20.04	60.65	116.62	53.44

Source: PNB, A Study of the Philippine Commercial Banking System, 1977.

Appendix B.2

COMPOSITION OF LIABILITIES OF INDIVIDUAL BANKS, 1978
(In Percent)

Banks	Demand Deposits	Savings Deposits	Time Deposits	Other Deposits	Deposit Substitutes	Other Bills Payable	Other Liabi-lities	Assigned Capital	Surplus	Undivided Profits
Large Banks										
1	6.82	19.52	19.79	.38	12.27	23.96	9.79	5.39	.56	1.51
2	12.99	25.17	27.80	1.60	7.30	4.67	11.44	5.63	3.39	-
3	12.09	19.99	14.47	.27	20.22	11.64	11.08	6.14	3.76	.35
4	12.28	16.97	29.00	.75	19.60	4.57	8.79	2.50	4.51	1.03
5	13.65	30.31	17.21	3.06	6.54	6.68	16.78	4.17	.61	.98
6	13.84	27.41	11.88	-	15.59	14.11	10.42	4.66	1.94	.14
7	16.63	35.70	12.26	1.61	5.94	7.72	12.78	5.79	.24	1.34
8	9.78	13.01	25.17	1.11	20.94	14.49	9.00	3.26	1.49	1.75
9	17.12	8.27	53.28	.86	2.56	4.57	3.82	6.76	.02	2.74
$\bar{X}$	12.80	21.82	23.43	1.07	12.33	10.27	10.43	4.92	1.84	1.09
s	3.12	8.66	12.92	.93	7.03	6.50	3.47	1.40	1.67	.87
C.V.	24.83	39.22	55.13	86.97	56.99	63.26	33.22	28.37	91.11	79.54
Medium Banks										
10	19.35	32.28	10.63	1.07	8.20	7.01	12.19	5.64	2.70	.93
11	15.92	35.09	18.79	.65	7.15	2.46	10.99	4.55	1.98	2.42
12	13.06	23.01	23.41	.29	11.68	1.65	15.94	6.55	4.20	.21
13	11.98	21.82	13.57	1.04	20.86	6.10	13.45	9.25	-	1.93
14	9.18	23.65	21.08	3.27	9.72	8.80	15.37	6.59	1.09	1.27
15	11.43	14.38	17.21	5.58	15.23	19.28	10.78	5.89	2.22	-
16	13.07	36.60	17.09	1.06	6.42	1.59	12.99	8.11	1.92	1.02
17	8.41	39.60	19.46	3.90	2.46	1.72	16.35	6.47	.57	.63
18	3.70	7.60	7.00	53.62	-	6.85	11.94	5.48	3.13	.62
$\bar{X}$	11.79	26.00	16.47	7.61	9.08	6.16	13.33	6.50	1.98	1.00
s	4.49	10.75	5.21	17.31	6.34	5.64	2.10	1.42	1.30	.78
C.V.	38.09	41.35	31.61	227.48	69.83	91.61	15.78	21.83	65.72	77.72

Appendix B.2 (Continued)

Banks	Demand Deposits	Savings Deposits	Time Deposits	Other Deposits	Deposit Substitutes	Other Bills Payable	Other Liabi-lities	Assigned Capital	Surplus	Undivided Profits
Small Banks										
19	16.72	19.73	7.94	1.03	2.21	9.44	10.82	9.85	1.13	1.22
20	6.65	15.34	20.78	2.08	15.20	14.44	10.01	11.61	.52	3.37
21	15.81	17.66	18.57	1.97	15.12	4.80	13.06	14.09	-1.30	.21
22	6.09	5.93	11.21	.49	15.11	39.09	10.60	10.25	.07	1.16
23	8.97	14.68	17.05	.12	31.99	2.16	11.83	8.51	.21	4.47
24	12.65	28.69	12.98	1.14	6.02	1.32	12.90	17.82	2.01	4.46
25	11.82	17.45	9.22	.31	8.05	22.44	10.88	16.08	-	3.75
26	4.19	28.25	8.18	1.45	2.36	28.67	14.50	13.51	-	-1.11
27	13.45	23.72	14.30	.40	22.35	4.59	9.59	7.67	1.12	2.82
X̄	10.71	19.05	13.36	1.00	13.16	14.11	11.58	12.15	.42	2.26
s	4.46	7.15	4.68	.72	9.78	13.28	1.62	3.46	.94	1.98
C.V.	41.51	37.55	34.99	.72	74.30	94.15	13.99	28.46	2.24	87.54

Source: PNB, A Study of the Philippine Commercial Banking System, 1978.

Appendix B.3

COMPOSITION OF LIABILITIES OF INDIVIDUAL BANKS, 1979
(In Percent)

Banks	Demand Deposits	Savings Deposits	Time Deposits	Other Deposits	Deposit Substitutes	Other Bills Payable	Other Liabi-lities	Assigned Capital	Surplus	Undivided Profits
Large Banks										
1	7.31	20.96	26.15	2.26	13.86	14.23	8.53	5.23	.29	1.19
2	12.01	22.50	28.18	1.40	5.26	9.68	12.29	5.73	2.94	-
3	11.05	15.78	14.93	2.90	19.01	14.49	11.33	6.38	3.76	.37
4	11.48	17.26	26.81	1.35	16.30	9.67	8.95	4.30	3.10	.78
5	11.28	28.53	21.25	3.77	9.38	8.80	11.46	3.81	.10	1.62
6	11.20	22.64	8.33	1.80	33.02	9.01	10.16	4.36	.89	.40
7	17.25	22.34	26.52	1.07	5.19	4.49	14.64	5.18	.30	2.19
8	7.83	14.37	23.69	1.99	25.06	11.74	9.33	3.77	.15	2.08
9	11.37	9.93	45.87	1.38	3.92	7.76	9.91	7.24	.25	2.36
$\bar{X}$	11.20	19.37	24.64	1.99	14.56	9.99	10.73	5.11	1.31	1.22
s	2.83	5.56	10.29	.87	9.93	3.14	1.92	1.19	1.50	.88
C.V.	25.24	28.70	41.75	43.79	68.20	31.40	17.92	23.21	1.15	72.20
Medium Banks										
10	19.79	31.60	9.85	1.00	10.02	10.46	8.69	5.75	1.85	1.00
11	14.91	30.79	15.94	3.78	5.50	8.14	11.88	5.57	2.29	1.21
12	13.36	23.10	17.28	.22	10.20	5.80	17.43	6.51	5.85	.26
13	6.97	17.46	28.64	2.80	12.66	14.18	9.64	5.91	.69	1.05
14	9.13	13.58	18.27	3.42	31.54	3.66	12.74	9.72	.16	.92
15.	11.03	30.95	18.77	.72	10.09	4.96	14.35	6.42	2.29	.36
16	6.64	12.18	4.65	.52	.06	52.41	20.18	5.30	-	.06
17	8.63	45.18	11.86	2.54	5.25	7.63	12.11	4.79	.88	1.13
18	2.89	6.53	4.96	63.00	-	5.18	9.85	3.81	2.85	.94
$\bar{X}$	10.15	23.49	14.47	8.67	9.48	12.49	12.99	5.98	1.87	.77
s	5.28	12.22	7.57	20.42	9.42	15.31	3.79	1.63	1.80	.42
C.V.	52.04	52.05	52.34	235.59	99.39	122.59	29.18	27.29	96.14	55.06

Appendix B.3 (Continued)

Bank	Demand Deposits	Savings Deposits	Time Deposits	Other Deposits	Deposit Substitutes	Other Bills Payable	Other Liabi-lities	Assigned Capital	Surplus	Undivided Profits
Small Banks										
19	16.19	19.12	6.09	5.80	19.32	11.59	8.86	.99	.83	10.68
20	8.66	10.13	17.64	.40	26.94	13.68	9.61	8.21	.38	4.37
21	12.51	14.95	15.34	1.37	16.92	17.56	12.78	9.99	-	-
22	11.23	22.82	23.62	1.10	9.30	5.54	14.27	6.07	4.06	1.98
23	5.64	9.53	12.16	.27	23.04	30.65	8.20	8.67	1.03	.81
24	13.62	18.17	17.75	.30	11.06	19.67	8.29	6.24	2.24	-
25	13.69	32.63	7.51	.87	5.46	.91	10.92	14.93	2.75	5.30
26	11.55	17.00	11.28	-	11.49	18.22	13.29	12.77	1.11	2.65
27	12.47	22.71	10.68	.86	23.19	7.21	11.31	8.98	.07	2.51
$\bar{X}$	11.73	18.56	13.56	1.22	16.30	13.88	11.11	9.41	1.40	2.05
s	3.07	7.09	5.55	1.77	7.35	8.91	2.13	2.87	1.36	1.87
C.V	26.15	38.18	40.92	145.38	45.11	64.19	19.18	30.46	96.80	91.19

Source: PNB, A Study of the Philippine Commercial Banking System, 1979.

Appendix C.

GROWTH RATES OF EACH LIABILITY ITEM OF INDIVIDUAL BANKS, 1978
(In Percent)

Banks	Demand Deposits	Savings Deposits	Time Deposits	Other Deposits	Deposit Substitutes	Other Bills Payable	Other Liabi-lities	Assigned Capital	Surplus	Undivided Profits
Large Banks										
1	32.[illegible]	149.8	161.0	204.3	135.1	66.8	82.7	-	-	-169.7
2	11.0	19.1	72.4	13.9	274.8	244.9	17.3	-	43.5	-
3	14.6	34.1	1.8	590.9	.7	307.3	25.4	20.0	11.6	16.5
4	-3.4	15.1	64.8	33.9	40.1	-20.9	17.4	10.2	20.5	16.2
5	30.8	14.4	184.1	46.1	4.8	231.6	7.0	3.0	61.3	333.7
6	8.6	26.9	42.6	39.4	-21.1	303.5	14.3	.2	25.4	19.4
7	6.0	61.5	15.0	93.9	-26.7	680.3	22.6	10.9	51.9	10.4
8	-3.4	20.1	13.7	-15.4	17.3	127.7	21.4	28.1	-.2	14.8
9	-25.9	61.5	103.5	51.8	382.4	347.9	23.2	130.3	-99.1	43.2
$\bar{x}$	7.87	44.72	73.21	117.64	89.71	254.37	25.69	22.52	12.77	31.61
s	16.95	40.95	61.43	177.36	137.70	189.43	20.02	39.21	44.59	122.14
C.V.	215.38	91.58	83.90	150.76	153.49	74.46	81.06	174.09	349.21	386.39
Medium Banks										
10	2.7	27.4	33.5	35.7	-8.7	-7.8	53788	35.4	-12.7	52.9
11	6.0	16.6	74.3	11.6	.9	453.6	15.0	.1	331.0	-20.9
12	-.6	2.2	27.7	10.9	24.3	127.0	2.5	60.0	-21.5	2450.0
13	4.3	20.7	18.4	12.5	-30.3	5.8	10.9	42.2	-100.0	-3.8
14	8.6	42.5	38.6	26.3	37.6	22.5	80.7	20.3	-22.3	-17.6
15	8.7	20.6	32.6	112.5	3.5	38.7	23.9	12.2	18.6	-
16	24.5	19.0	41.6	671.4	-.9	81.1	20.9	30.0	-16.8	15.6
17	49.6	174.6	16.6	51.8	-76.0	171.1	1047.2	-	59.4	189.7
18	15.2	-32.6	24.4	11.6	-46.4	128.3	-8.6	-	90.3	-60.0
$\bar{x}$	13.22	32.22	34.19	104.92	-10.67	113.67	138.92	22.24	36.22	289.54
s	14.64	53.04	16.27	202.63	33.19	133.59	322.19	20.11	116.03	766.76
C.V.	110.76	166.86	47.59	193.13	-311.10	117.53	231.92	90.45	320.37	264.82

Appendix C.1 (Continued)

Banks	Demand Deposits	Savings Deposits	Time Deposits	Other Deposits	Deposit Substitutes	Other Bills Payable	Other Liabi-lities	Assigned Capital	Surplus	Undivided Profits
Small Banks										
19	31.0	25.0	-42.9	18.8	-7.0	144.3	13.7	4.8	17.9	7.1
20	-22.3	46.5	58.2	108.5	-23.7	283.8	16.7	-	-	93.1
21	15.8	25.2	36.4	-6.0	-11.4	53.6	11.7	38.9	-355.6	7.1
22	19.0	104.6	316.[illegible]	26.3	83.7	34.1	44.8	127.0	-12.5	-47.4
23	8.6	40.8	85.4	37.9	63.5	-38.4	20.7	-	76.5	70.1
24	-2.9	50.6	108.6	31.2	-18.9	-63.9	95.2	-	39.5	33.7
25	35.2	137.1	89.5	-35.[illegible]	-29.3	149.8	-1.7	4.6	-	48.8
26	78.3	44.[illegible]	35.6	8.5	158.8	-	-188.3	-18.3	-100.0	89.5
27	9.4	29.7	70.7	1052.4	115.0	59.0	20.0	-	-	80.4
$\bar{x}$	19.12	56.03	84.17	138.0	36.74	69.16	66.38	17.44	20.65	42.49
s	26.49	36.54	91.9	325.36	66.07	102.14	75.4	41.21	41.25	44.31
C.V.	138.58	65.21	109.19	235.77	179.83	147.69	113.59	42.32	199.77	104.29

Source: PNB, <u>A Study of the Philippine Commercial Banking System</u>, 1978.

Appendix C.2

GROWTH RATES OF EACH LIABILITY ITEM OF INDIVIDUAL BANKS, 1979
(In Percent)

Banks	Demand Deposits	Savings Deposits	Time Deposits	Other Deposits	Deposit Substitutes	Other Bills Payable	Other Liabi- lities	Assigned Capital	Surplus	Undivided Profits
Large Banks										
1	72.6	73.0	112.9	864.3	82.1	-4.3	40.4	56.3	-17.3	26.4
2	8.9	5.3	19.4	3.1	-15.1	144.1	26.0	20.0	2.2	-
3	5.6	-8.7	19.2	1142.1	8.7	44.0	18.2	20.0	15.5	20.2
4	1.9	10.9	.3	95.0	-9.3	130.6	11.0	87.5	-24.3	-17.6
5	6.4	21.2	59.0	58.9	84.7	69.8	-12.1	17.0	-80.0	113.0
6	2.3	4.4	11.4	-	167.7	-19.3	23.2	18.3	-42.2	245.9
7	18.0	-28.9	146.2	24.0	-[illegible].5	-33.8	30.4	1.9	38.9	85.5
8	-3.0	33.8	14.0	116.0	44.0	-1.3	25.5	40.0	-87.6	43.5
9	-23.8	37.7	1.3	83.1	76.3	94.5	197.6	22.8	1900.0	-1.3
$\bar{x}$	9.88	16.53	42.69	265.27	48.84	47.09	40.09	31.6	189.3	57.29
s	24.61	27.79	49.75	401.63	56.57	62.47	57.38	24.51	606.07	77.86
C.V.	249.13	168.15	116.53	151.4	115.36	132.69	143.13	77.56	320.17	135.60
Medium Banks										
10	13.9	9.0	3.2	4.2	36.1	66.3	-20.5	13.5	-23.7	18.5
11	2.0	-4.4	7.8	537.4	-16.3	261.3	17.7	33.2	25.8	-45.9
12	2.9	1.0	-25.7	-23.9	-12.1	253.[illegible]	10.0	-	39.9	23.5
13	-2.7	5.4	74.3	10.0	67.1	106.7	-19.6	15.0	-19.1	6.1
14	48.5	34.5	56.3	4041.2	43.9	146.[illegible]	7.0	66.7	6.7	-70.0
15	6.7	6.5	38.9	13.5	98.7	294.1	39.6	-	50.0	-55.2
16	324.4	65.0	117.4	36.1	-90.3	599.5	432.5	50.2	-	120.5
17	38.6	54.1	17.7	12.1	187.6	501.3	-	-	109.6	143.4
18	12.4	23.0	2.3	68.8	-	8.6	18.5	-	30.5	116.7
$\bar{x}$	49.63	21.72	32.44	522.15	34.97	248.03	59.47	19.04	24.53	28.68
s	98.49	23.23	41.58	1254.92	74.70	185.76	134.00	23.41	38.55	76.22
C.V.	198.47	106.97	78.01	240.34	213.63	74.71	225.33	118.92	157.17	265.78

Appendix C.2 (Continued)

Banks	Demand Deposits	Savings Deposits	Time Deposits	Other Deposits	Deposit Substitutes	Other Bills Payable	Other Liabi-lities	Assigned Capital	Surplus	Undivided Profits
<u>Small Banks</u>										
19	7.6	7.7	-14.7	528.1	-2.9	35.3	16.3	-	2.4	-23.7
20	84.1	-6.6	20.0	-73.1	150.6	34.0	35.8	-	2.3	83.1
21	11.6	19.4	16.5	2.1	57.9	415.5	38.0	-	-	-
22	2.1	13.9	89.8	14.8	-51.4	-1.1	15.3	-28.5	-	12.0
23	9.6	90.3	28.5	35.4	80.6	-7.2	-8.4	.1	1600.0	-16.8
24	19.3	26.4	3.2	-91.6	-27.4	55.3	-23.0	6.0	1.2	-
25	29.2	35.7	30.9	-9.3	8.3	-17.6	1.0	-	62.8	42.0
26	28.8	28.3	61.0	-	88.0	6.9	60.9	4.0	-	-7.0
27	-2.0	1.2	21.9	125.4	9.7	66.2	24.3	23.4	-93.5	-5.7
$\bar{x}$	21.14	24.03	28.44	59.09	34.88	65.25	17.88	.066	175.02	9.32
s	24.49	26.07	29.00	175.91	60.48	126.74	24.22	12.61	505.19	31.55
C.V.	115.83	110.99	102.00	297.69	175.40	203.59	73.32	1893.89	288.65	338.52

Appendix D.1

COMPOSITION OF ASSETS OF INDIVIDUAL BANKS, 1977
(Percent of Total Assets)

Banks	Cash and Other Cash Items	Due from CB and Other Banks	Loans	Investments	Other Assets
Large Banks					
1	3.20	7.48	55.54	18.63	15.15
2	.74	6.32	64.67	22.42	5.85
3	3.27	11.53	58.87	18.52	7.80
4	4.48	18.38	52.11	19.09	5.94
5	5.08	9.79	52.52	17.51	15.09
6	3.70	5.42	65.61	16.88	8.39
7	5.06	6.07	63.17	12.42	13.29
8	3.08	6.29	65.12	17.45	8.06
9	1.98	6.88	31.56	53.32	6.26
$\bar{X}$	3.40	8.68	56.57	21.80	9.54
s	1.42	4.14	10.79	12.10	3.88
C.V.	41.72	47.62	19.08	55.50	40.65
Medium Banks					
10	2.51	8.46	63.10	19.84	6.08
11	3.11	10.66	55.30	23.81	7.19
12	5.15	16.52	57.33	11.28	9.72
13	1.35	13.84	58.77	17.52	8.52
14	4.12	5.86	61.77	21.39	6.85
15	4.19	14.76	58.45	12.60	9.99
16	3.33	12.82	57.31	20.58	5.96
17	3.35	11.93	52.52	23.04	9.16
18	1.74	8.11	53.27	31.66	5.22
$\bar{X}$	3.21	11.44	57.54	20.19	7.63
s	1.21	3.47	3.53	6.01	1.76
C.V.	37.74	30.35	6.14	30.26	23.10
Small Banks					
19	4.35	8.05	59.40	18.01	10.19
20	2.06	3.11	71.53	16.89	6.41
21	6.69	6.20	42.68	23.37	21.06
22	1.73	10.05	59.32	19.02	9.88
23	3.07	6.36	67.79	16.31	4.48
24	2.18	8.58	67.30	17.08	4.86
25	3.12	8.21	53.86	21.72	13.10
26	4.89	7.69	48.39	3.76	35.26
27	7.38	13.00	54.57	17.80	7.25
$\bar{X}$	3.94	7.58	58.54	17.11	12.50
s	2.04	2.82	9.78	5.53	9.94
C.V.	51.86	37.15	16.71	32.30	79.57

Source: PNB, *A Study of the Philippine Commercial Banking System, 1977.*

Appendix D.2

COMPOSITION OF ASSETS OF INDIVIDUAL BANKS, 1978
(Percent of Total Assets)

Banks	Cash and Other Cash Items	Due from CB and Other Banks	Loans	Investments	Other Assets
Large Banks					
1	1.40	11.85	59.50	21.79	5.46
2	2.79	14.79	49.84	19.82	12.72
3	1.26	6.02	68.21	18.83	5.68
4	2.72	18.69	57.70	14.85	6.05
5	4.35	14.00	56.26	15.63	9.75
6	3.42	7.09	56.79	23.13	9.57
7	4.42	15.09	58.03	10.80	11.66
8	2.41	22.00	55.06	13.14	7.39
9	1.75	9.75	33.72	47.49	7.29
$\bar{X}$	2.72	13.25	55.01	20.61	8.42
s	1.17	5.21	9.32	10.86	2.67
C.V.	42.95	39.29	16.95	52.71	31.67
Medium Banks					
10	2.97	14.07	57.91	18.32	6.73
11	3.30	15.11	62.18	10.86	8.55
12	1.49	10.52	59.00	20.60	8.38
13	1.20	7.07	64.69	17.21	9.83
14	3.34	6.66	70.22	13.60	6.18
15	5.54	18.41	56.72	10.79	8.54
16	3.37	6.83	61.19	22.16	6.44
17	3.92	14.42	52.99	21.00	7.67
18	1.70	12.02	54.14	25.25	6.89
$\bar{X}$	2.98	11.68	59.89	17.75	7.69
s	1.36	4.21	5.39	5.10	1.22
C.V.	45.70	36.04	8.99	28.73	15.87
Small Banks					
19	5.12	8.45	60.45	13.29	12.68
20	1.31	5.17	71.82	14.54	7.17
21	6.21	11.15	50.87	10.40	21.38
22	4.15	5.03	60.64	21.63	8.55
23	1.38	5.65	69.21	18.00	5.75
24	2.80	10.09	61.59	21.96	3.56
25	3.52	5.81	65.56	12.71	12.40
26	2.79	10.85	65.24	2.71	18.41
27	5.95	11.95	56.15	19.27	6.67
$\bar{X}$	3.69	8.24	62.39	14.95	10.73
s	1.81	2.85	6.45	6.13	6.01
C.V.	49.15	34.56	10.34	40.99	56.03

Source: PNB, A Study of the Philippine Commercial Banking System, 1978.

Appendix D.3

COMPOSITION OF ASSETS OF INDIVIDUAL BANKS, 1979
(Percent of Total Assets)

Banks	Cash and Other Cash Items	Due from CB and Other Banks	Loans	Investments	Other Assets
Large Banks					
1	2.28	20.06	52.85	18.13	6.67
2	2.49	20.01	49.34	13.15	15.02
3	1.17	5.20	59.56	27.07	7.01
4	2.44	17.75	58.71	14.91	6.19
5	6.05	17.16	48.65	19.15	8.99
6	2.97	7.59	49.62	31.07	8.76
7	2.76	9.47	61.27	15.70	9.80
8	1.83	17.85	49.59	24.31	6.41
9	3.81	8.05	46.36	33.84	7.94
$\bar{X}$	2.87	13.68	52.88	22.04	8.53
s	1.40	5.97	5.52	7.36	2.74
C.V.	48.82	43.64	10.43	33.40	32.12
Medium Banks					
10	2.53	11.13	57.17	20.78	8.38
11	3.88	11.21	57.86	16.48	10.56
12	2.64	9.36	53.85	22.74	11.41
13	1.97	14.17	62.00	15.66	6.21
14	3.13	3.75	61.78	25.98	5.36
15	3.07	7.14	62.42	21.49	5.88
16	1.84	7.40	83.16	.79	6.82
17	3.07	14.83	56.99	17.31	7.80
18	1.88	11.43	51.90	28.73	6.06
$\bar{X}$	2.67	10.05	60.79	18.88	7.61
s	69.09	3.53	9.14	8.05	2.14
C.V.	25.90	35.17	15.04	42.64	28.19
Small Banks					
19	6.97	6.46	59.95	13.86	12.76
20	1.60	9.74	62.71	20.25	5.69
21	5.84	11.86	54.54	9.46	18.30
22	1.35	8.98	61.81	18.80	9.07
23	4.28	3.18	61.14	22.67	8.73
24	3.79	11.60	59.02	14.87	10.72
25	2.88	13.30	63.52	15.16	5.14
26	4.34	7.49	58.09	18.44	11.63
27	5.25	14.60	51.22	19.34	9.60
$\bar{X}$	4.03	9.69	59.11	14.98	10.18
s	1.87	3.60	4.01	6.11	3.94
C.V.	46.41	37.15	6.79	40.77	38.70

Source: PNB, A Study of the Philippine Commercial Banking System, 1979.

Appendix E.1

GROWTH RATES OF EACH ASSET ITEM OF INDIVIDUAL BANKS, 1978
(In Percent)

Banks	Cash and Other Cash Items	Due from CB and Other Banks	Loans	Investments	Other Assets
Large Banks					
1	8.32	134.2	82.8	112.9	73.96
2	21.95	130.4	25.6	49.3	17.55
3	113.86	28.5	31.4	4.6	20.88
4	-23.86	17.5	38.8	-2.5	27.60
5	16.19	67.4	45.3	21.1	-12.34
6	13.43	41.6	6.4	68.4	40.26
7	15.50	131.7	21.3	14.8	15.87
8	-3.87	220.4	4.0	-7.4	12.67
9	33.04	96.0	61.4	34.6	75.98
$\bar{X}$	21.62	96.41	35.22	32.87	30.27
s	38.19	65.08	25.42	38.85	28.91
C.V.	176.66	67.51	72.17	118.22	95.52
Medium Banks					
10	12.17	45.4	23.2	-9.6	9.97
11	-21.58	4.1	32.9	17.9	7.84
12	-48.95	-9.2	12.1	24.5	20.13
13	-10.29	-45.0	11.2	-.7	16.60
14	9.66	35.4	53.6	-14.1	21.80
15	60.30	53.3	17.7	3.9	3.67
16	12.47	-29.8	18.6	19.6	20.12
17	86.05	90.6	60.2	44.7	32.88
18	5.06	49.9	9.4	-14.1	42.15
$\bar{X}$	11.65	21.63	26.54	8.01	19.46
s	40.63	44.24	18.69	20.10	12.16
C.V.	348.65	204.49	70.42	250.85	62.50
Small Banks					
19	23.96	15.2	7.1	-22.3	30.98
20	-20.00	58.0	26.6	8.5	41.05
21	4.01	50.8	33.5	-50.2	13.63
22	282.08	24.4	63.3	81.8	38.24
23	-37.50	3.5	37.6	53.1	78.24
24	61.86	51.3	15.6	62.3	-7.41
25	60.00	16.7	72.6	-17.0	34.29
26	36.84	160.1	223.3	72.6	25.18
27	13.51	23.7	44.8	52.4	23.09
$\bar{X}$	47.20	44.86	58.27	25.69	30.81
s	94.13	47.14	65.32	47.04	23.10
C.V.	199.45	105.10	112.10	183.11	74.98

Source: PNB, A Study of the Philippine Commercial Banking System, 1978.

Appendix E.2

GROWTH RATES OF EACH ASSET ITEM OF INDIVIDUAL BANKS, 1979
(In Percent)

Banks	Cash and Other Cash Items	Due from CB and Other Banks	Loans	Investments	Other Assets
Large Banks					
1	161.61	171.7	43.2	34.1	96.94
2	5.33	50.8	16.6	-22.0	39.03
3	7.32	1.1	0.9	66.1	42.62
4	-2.41	2.8	10.9	9.5	11.51
5	78.91	62.8	11.4	57.8	18.76
6	9.77	27.0	10.4	69.8	15.65
7	-28.93	-28.7	20.2	7.60	-4.32
8	-7.92	-2.3	9.1	124.1	5.08
9	150.33	18.3	57.7	-18.3	24.78
$\bar{X}$	41.56	33.72	20.04	44.12	27.78
s	71.14	58.81	18.38	47.84	29.95
C.V.	171.18	174.41	91.71	108.43	107.81
Medium Banks					
10	-5.08	-10.7	10.0	26.4	38.80
11	28.36	-10.7	1.4	65.3	34.55
12	77.53	.5	-8.2	11.0	36.98
13	-24.39	106.8	13.2	47.5	28.91
14	230.26	42.7	30.2	110.6	35.88
15	14.97	26.5	29.0	22.7	15.49
16	152.40	159.1	387.7	11.4	41.69
17	5.66	31.8	45.3	11.3	37.41
18	58.84	39.4	37.7	63.5	26.31
$\bar{X}$	59.84	42.82	60.70	41.08	32.89
s	83.05	56.50	123.86	33.89	8.09
C.V.	138.78	131.93	204.04	82.51	24.59
Small Banks					
19	51.14	10.0	10.3	15.9	11.93
20	73.15	147.8	23.5	97.1	12.18
21	32.43	43.8	51.2	28.3	20.76
22	22.02	36.1	4.1	19.0	.45
23	22.22	-3.7	19.4	24.1	20.84
24	-31.61	-11.2	4.1	37.9	25.62
25	22.93	49.9	23.1	-17.6	72.00
26	62.50	67.1	16.7	91.1	23.52
27	-6.75	17.2	-3.6	6.1	52.08
$\bar{X}$	27.56	39.66	16.53	33.54	26.60
s	32.86	48.00	16.03	37.72	22.06
C.V.	119.22	121.01	96.94	112.43	82.96

Source: PNB, A Study of the Philippine Commercial Banking System, 1979

Appendix F.1

DISTRIBUTION OF LOANS BY SECURITY AND MATURITY, 1977
(In Percent)

Banks	By Securities: Unsecured Loans	By Securities: Secured by Real Estate	By Securities: Other Secured Loans	By Maturities: Demand Loans	By Maturities: Short-Term Loans	By Maturities: Long-Term Loans
Large Banks						
1	28.91	49.98	21.11	7.57	75.73	16.70
2	54.50	30.57	14.93	17.84	74.40	7.75
3	35.60	15.48	48.92	9.97	80.02	10.00
4	44.98	40.73	14.29	29.85	69.89	.27
5	16.32	66.05	17.63	8.38	80.30	11.31
6	55.91	27.10	16.99	3.01	81.45	15.54
7	35.05	54.24	10.71	5.54	67.15	27.31
8	53.42	15.78	30.81	5.87	88.19	5.94
9	51.18	24.03	24.78	6.90	75.90	17.20
$\bar{X}$	41.76	36.00	22.24	10.55	77.00	12.45
s	18.05	14.16	11.68	8.34	6.35	7.83
C.V.	43.22	39.32	52.52	79.07	8.24	62.93
Medium Banks						
10	50.26	23.28	26.46	.89	97.76	1.35
11	41.28	21.50	37.21	2.64	65.74	31.61
12	65.76	6.81	27.43	4.97	90.28	4.75
13	29.30	33.84	36.86	10.52	74.40	15.08
14	50.48	20.41	29.11	24.87	48.20	26.94
15	24.90	65.52	9.59	10.26	69.62	23.11
16	19.97	42.89	37.14	6.82	88.51	4.67
17	25.84	28.18	45.98	16.15	62.80	21.05
18	54.76	16.48	28.76	13.01	74.37	12.62
$\bar{X}$	40.28	28.77	30.95	10.01	74.63	15.69
s	15.98	17.18	10.22	9.32	15.47	10.72
C.V.	39.66	59.73	33.02	93.09	20.73	68.36
Small Banks						
19	73.01	8.14	18.85	48.05	43.58	8.37
20	99.11	.26	.63	.07	99.93	0.00
21	74.79	11.80	13.42	12.59	83.14	4.26
22	62.14	24.68	13.18	14.13	77.27	8.60
23	71.04	9.48	19.48	32.02	67.13	.86
24	36.52	45.03	18.45	.64	94.67	4.70
25	37.55	44.45	17.99	13.80	80.23	5.97
26	6.98	77.21	15.81	.46	70.23	29.30
27	53.49	33.86	12.65	9.28	87.14	3.59
$\bar{X}$	57.18	28.32	14.50	14.56	78.15	7.29
s	30.40	25.13	5.83	16.05	16.72	8.75
C.V.	53.16	88.72	40.22	110.25	21.40	120.00

Source of Basic Data: Department of Economic Research, Central Bank of the Philippines, 1977.

Appendix F.2

DISTRIBUTION OF LOANS BY SECURITY AND MATURITY, 1978
(In Percent)

Banks	By Securities			By Maturities		
	Unsecured Loans	Secured by Real Estate	Other Secured Loans	Demand Loans	Short-Term Loans	Long-Term Loans
Large Banks						
1	30.67	37.62	31.71	13.81	66.57	19.61
2	46.88	17.16	35.96	2.73	86.76	10.49
3	50.65	40.18	9.17	24.18	72.25	3.56
4	23.63	39.32	37.05	6.45	59.79	33.76
5	54.92	31.21	13.87	6.65	78.51	14.84
6	69.58	11.04	19.37	4.16	92.66	3.18
7	31.60	15.81	52.59	17.75	72.84	9.41
8	33.24	42.84	23.92	7.61	79.48	12.92
9	36.99	25.63	37.28	14.99	78.50	6.51
X̄	42.02	28.98	29.00	10.93	76.38	12.70
s	14.59	11.99	13.64	7.15	9.96	9.51
C.V.	34.71	41.38	47.02	65.47	13.03	74.93
Medium Banks						
10	41.72	22.86	35.42	2.17	69.43	28.40
11	24.90	65.52	9.59	10.26	75.93	13.81
12	49.18	18.80	32.02	.83	97.68	1.49
13	45.82	39.00	15.20	30.10	69.60	.30
14	42.67	19.27	38.06	21.86	43.90	34.24
15	66.92	21.55	11.53	9.16	80.97	1.87
16	25.62	34.28	40.10	31.74	52.19	16.07
17	17.80	31.48	50.72	12.86	76.44	10.71
18	19.09	30.99	49.91	9.52	74.72	15.77
X̄	37.08	31.53	31.39	14.28	71.21	13.63
s	16.36	14.60	15.75	11.22	15.70	11.86
C.V.	44.12	46.32	50.18	78.59	22.04	87.02
Small Banks						
19	54.81	6.89	38.30	28.68	65.10	6.22
20	47.99	41.22	10.79	6.50	88.94	4.56
21	28.79	40.75	30.46	3.36	89.83	6.82
22	45.04	24.53	30.43	5.67	93.45	.88
23	64.44	20.63	14.93	33.20	55.50	11.29
24	4.17	83.33	12.50	.69	98.61	.69
25	37.40	39.26	23.34	8.18	82.76	9.06
26	96.81	1.44	1.75	.93	95.65	3.42
27	73.85	19.52	6.63	36.76	60.24	3.01
X̄	50.37	30.84	18.79	13.77	81.12	5.11
s	26.76	24.35	12.40	14.67	16.42	3.59
C.V.	53.13	78.94	65.98	106.52	20.25	70.26

Source of Basic Data: Department of Economic Research, Central Bank of the Philippines, 1978.

Appendix F.3

DISTRIBUTION OF LOANS BY SECURITY AND MATURITY, 1979
(In Percent)

Banks	By Securities			By Maturities		
	Unsecured Loans	Secured by Real Estate	Other Secured Loans	Demand Loans	Short-Term Loans	Long-Term Loans
Large Banks						
1	55.17	13.37	31.46	7.37	75.40	17.23
2	69.18	19.56	11.25	15.10	80.01	4.89
3	51.90	44.80	23.30	4.57	75.95	19.48
4	40.33	39.10	20.57	11.07	66.74	22.19
5	61.18	10.21	28.61	10.85	84.21	4.94
6	32.34	17.97	49.69	12.36	75.40	12.24
7	33.84	38.90	27.26	17.52	63.79	18.68
8	19.83	34.13	46.04	7.35	57.75	34.90
9	42.35	33.98	23.67	10.05	86.60	3.35
$\bar{X}$	45.12	28.00	26.87	10.69	73.98	15.32
s	15.59	12.75	14.84	4.02	9.54	10.20
C.V.	34.55	45.52	55.23	37.57	12.89	66.56
Medium Banks						
10	63.16	30.23	6.61	37.16	59.63	3.20
11	46.70	43.38	9.92	4.44	88.44	7.12
12	56.53	13.96	29.51	3.77	94.36	1.88
13	58.72	16.07	25.20	10.78	79.36	9.87
14	22.93	24.37	52.70	7.01	81.54	11.45
15	50.38	39.84	9.78	3.90	71.34	24.76
16	34.40	57.62	7.98	19.38	53.24	27.38
17	40.34	18.32	41.34	9.82	55.08	35.10
18	36.33	29.86	33.81	21.41	51.13	27.46
$\bar{X}$	45.50	30.41	24.09	13.07	70.46	16.47
s	13.12	14.39	16.63	11.11	16.28	12.25
C.V.	28.83	47.33	69.01	84.97	23.11	74.39
Small Banks						
19	88.22	6.26	5.52	30.48	65.79	3.74
20	46.41	20.70	32.90	20.60	44.07	35.33
21	60.14	17.70	22.16	11.48	87.23	1.29
22	65.97	8.52	25.50	3.44	54.29	42.27
23	30.14	31.74	38.12	24.80	50.86	24.34
24	52.98	18.14	28.88	.14	97.38	2.48
25	49.10	23.34	27.57	1.13	75.79	23.08
26	56.50	5.52	37.90	11.38	73.84	14.78
27	26.73	37.35	35.92	2.22	90.41	7.37
$\bar{X}$	52.91	18.81	18.17	11.74	71.07	17.19
s	18.52	11.05	10.21	11.22	18.72	14.98
C.V.	35.00	58.75	36.09	95.56	26.34	87.18

Source of Basic Data: Department of Economic Research, Central Bank of the Philippines, 1979.

Appendix G

AUTHORIZED ACTIVITIES OF VARIOUS FINANCIAL ENTITIES BASED ON THE AMENDED BANKING LAWS

Authorized Activities	Expanded Commercial Banks (Unibank)	Commercial Banks (KB)		Thrift Banks			Rural Banks	Investment Houses (IH)
		Domestic	Foreign	Savings & Mortgage Banks	Private Development Banks	Savings & Loan Association		
A. Commercial Banking Services								
1. Accept deposits	1	1	1	1	1	1	1	*a/
2. Issued LC's and accept drafts	1	1	1	1b/	1b/	1b/	*	*c/
3. Discounting of promissory notes and commercial papers	1	1	1	11	11	11	11	1
4. Foreign exchange transactions	1	1	1	*	*	*	*	1
5. Lend money against security	1	1	1	1	1	1	1	1
B. Nationwide Branching Operations	1	1	1	1	1	1	1	1
C. Equity Investment in Allied Undertakings d/	1	1	1	1	1	1	1	1
D. Equity Investment in Non-Allied Undertakings	1	*	*	*	*	*	*	1
E. Trust Operation	1	11	11	11	11	11	11	1

Appendix G (Continued)

Authorized Activities	Commercial Banks (Unibank)	(KB) Domestic	(KB) Foreign	Thrift Banks: Savings & Mortgage Banks	Thrift Banks: Private Development Banks	Thrift Banks: Savings & Loan Association	Rural Banks	Investment Houses (IH
F. Issued Real Estate and Chattel Mortgage, Buy and Sell Them for Its Own Account, Accept/Receive in Payment or as Amortization of Loan	1	1	1	1	1	1	1	1
G. Direct Borrowing with Central Bank	1	1	1	1	1	1	1	1 e/
II. Activities of an Investment House								
1. Securities underwriting	1	*	*	*	*	*	*	1
2. Syndication Activities	1	*	*	*	*	*	*	1
3. Business development and project implementation	1	1	1	1	1	1	1	1
4. Financial Consultancy and investment adviser-Trust Operation	1	1	1	1	1	1	11	1
5. Portfolio management-Trust Operation	1	1	1	1	1	1	11	1
6. Mergers and consolidation	1	1	1	1	1	1	1	1

Appendix G (Continued)

Authorized Activities	Expanded Commercial Banks (Unibank)	Commercial Banks (KB) Domestic	Foreign	Thrift Banks Savings & Mortgage Banks	Private Development Banks	Savings & Loan Associations	Rural Banks	Investment Houses (IH)
7. Research and studies	1	1	1	1	1	1	1	1
8. Acquire, own, hold, or lease real and/or personal property	1	1	1	1	1	1	1	1
9. Pension, profit sharing pension benefit funds-Trust Operation	1	1	1	1	1	1	11	1
10. Money Market Operation	1	1	1	*f/	*f/	*f/	*	1

1 - Authorized Activities. 11 - Authorized but subject to Monetary Board Approval. * - Not authorized/prohibited.

a/ IH's are not yet allowed to accept deposits. However, certificates of time deposits for commercial banks and thrift banks have been put on equal footing against money market instruments of investment houses by subjecting them both to the same tax rate of 20 percent.

b/ Limited only to domestic LCs and drafts.

c/ This may be allowed for IHs that finance imported equipment but not for raw material requirements.

d/ Includes warehousing companies, leasing companies, storage companies, safe deposit box companies, companies engaged in the management of mutual funds banks, and such other similar activities as the Monetary Board may declared as appropriate.

e/ As decreed in PD 1685 amending PD 1309 allowing the CB to grant portions of its foreign loans to financial institutions other than banks.

f/ Full blown money market operation which includes deposit substitutes requires quasi-banking license which presently is closed.

Source: Table I of PDCP, "Universal Banking in the Philippines," Philippine Business Review, Vol. 13 (Fourth Quarter, 1980).

Appendix H

CORRELATION MATRIX FOR THE VARIABLES INCLUDED IN THE MODEL FOR NET RATES OF RETURN ON THE ELEMENTS OF BANK PORTFOLIO

	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11
A0	1.00000	-0.30049	0.07383	-0.21724	0.15477	-0.28032	-0.24970	-0.117720	-0.12707	-0.30549	-0.39343	0.35233
	0.0000	0.0064	0.5124	0.0514	0.1677	0.0113	0.0246	0.2974	0.2583	0.0055	0.0003	0.0013
A1	-0.30049	1.00000	0.04507	-0.04209	-0.24837	0.13594	0.08975	-0.07334	-0.10943	0.18220	0.16592	-0.18932
	0.0064	0.0000	0.6895	0.7091	0.0254	0.2263	0.4255	0.5153	0.3308	0.1035	0.1388	0.0905
A2	0.07383	0.04507	1.00000	-0.25371	0.14078	-0.30014	0.14034	0.03045	0.05584	-0.21594	-0.04777	-0.15761
	0.5124	0.6895	0.0000	0.0223	0.2100	0.0065	0.2114	0.7873	0.6205	0.0528	0.6719	0.1600
A3	-0.21724	-0.04209	-0.25371	1.00000	0.01309	0.31048	-0.22457	-0.04570	0.03651	0.13740	0.08657	0.02770
	0.0514	0.7091	0.0223	0.0000	0.9077	0.0048	0.0439	0.6854	0.7462	0.2213	0.4422	0.8061
A4	0.15477	-0.24837	0.14078	0.01309	1.00000	-0.35381	-0.12422	0.28936	0.62048	-0.17922	-0.08766	0.21235
	0.1677	0.0254	0.2100	0.9077	0.0000	0.0012	0.2692	0.0088	0.0001	0.1094	0.4365	0.0570
A5	-0.28032	0.13594	-0.30014	0.31048	-0.35381	1.00000	-0.08445	-0.00211	0.09423	0.36278	0.19593	-0.37092
	0.0113	0.2263	0.0065	0.0048	0.0012	0.0000	0.4535	0.9851	0.4027	0.0009	0.0796	0.0007
A6	-0.24970	0.08975	0.14034	-0.22457	-0.12422	-0.08445	1.00000	0.00151	0.26804	0.19705	0.16342	-0.31662
	0.0246	0.4255	0.2114	0.0439	0.2692	0.4535	0.0000	0.9893	0.0156	0.0779	0.1449	0.0040
A7	-0.11720	-0.07334	0.03045	-0.04570	0.28936	-0.00211	0.00151	1.00000	-0.13936	0.05666	-0.08998	-0.31666
	0.2974	0.5153	0.7873	0.6854	0.0088	0.9851	0.9893	0.0000	0.2147	0.6154	0.4244	0.0040
A8	-0.12707	-0.10943	0.05584	0.03651	0.62048	0.09423	0.26804	-0.13936	1.00000	-0.11868	0.24810	-0.06215
	0.2533	0.3308	0.6205	0.7462	0.0001	0.4027	0.0156	0.2147	0.0000	0.2913	0.0255	0.5815
A9	-0.30549	0.18220	-0.21594	0.13740	-0.17922	0.36278	0.19705	0.05666	-0.11868	1.00000	0.01004	-0.12275
	0.0055	0.1035	0.0528	0.2213	0.1094	0.0009	0.0779	0.6154	0.2913	0.0000	0.9291	0.2749
A10	-0.39343	0.16592	-0.04777	0.08657	-0.08766	0.19593	0.16342	-0.08998	0.24810	0.01004	1.00000	-0.14206
	0.0003	0.1388	0.6719	0.4422	0.4365	0.0796	0.1449	0.4244	0.0255	0.9291	0.0000	0.2058
A11	0.35233	-0.18932	-0.15761	0.02770	0.21235	-0.37092	-0.31662	-0.31666	-0.06215	-0.12275	-0.14206	1.00000
	0.0013	0.0905	0.1600	0.8061	0.0570	0.0007	0.0040	0.0040	0.5815	0.2749	0.2058	0.0000
A12	0.37115	-0.26996	-0.20922	-0.38555	-0.48417	-0.27742	-0.23790	-0.17929	-0.67032	-0.27889	-0.22800	0.23946
	0.0006	0.0148	0.0609	0.0004	0.0001	0.0122	0.0325	0.1093	0.0001	0.0117	0.0406	0.0313
A13	-0.28426	-0.04340	-0.02099	0.03381	0.58823	0.26580	0.34631	0.30542	0.79643	0.28248	0.17252	-0.29270
	0.0101	0.7004	0.8525	0.7644	0.0001	0.0165	0.0015	0.0056	0.0001	0.0106	0.1235	0.0080
A14	-0.31960	0.03646	0.16516	-0.32127	0.07435	-0.03147	0.16405	0.05276	0.19162	0.27074	0.22697	-0.25550
	0.0036	0.7466	0.1406	0.0035	0.5095	0.7803	0.1433	0.6399	0.0866	0.0145	0.0416	0.0213

	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11
L1	-0.14785 0.1818	-0.04746 0.6740	0.10830 0.3359	0.24534 0.0273	0.05106 0.6508	0.13990 0.2129	-0.07397 0.5116	-0.13908 0.2156	0.19177 0.0863	-0.03245 0.7737	-0.07112 0.5281	0.10167 0.3665
L2	-0.04412 0.6957	0.37420 0.0006	-0.22312 0.0453	0.00875 0.9382	-0.35243 0.0013	0.41541 0.0001	-0.01750 0.8768	-0.15744 0.1604	-0.09973 0.3757	0.14580 0.1940	0.23637 0.0336	0.07633 0.4982
L3	-0.35223 0.0013	0.18165 0.1046	-0.14409 0.1994	0.55483 0.0001	-0.20901 0.0611	0.16336 0.1451	-0.11011 0.3278	-0.09035 0.4225	-0.15335 0.1717	0.17736 0.1132	0.20203 0.0705	-0.09609 0.3935
L4	0.05109 0.6506	-0.30581 0.0055	0.20728 0.0633	-0.35970 0.0010	0.33931 0.0019	-0.40411 0.0002	0.22504 0.0434	0.24545 0.0272	0.14778 0.1880	-0.13080 0.2445	-0.20840 0.0619	-0.12712 0.2581
L5	0.12072 0.2830	0.03718 0.7418	-0.10943 0.3308	-0.07370 0.5132	0.23451 0.0351	-.07089 0.5294	-0.04382 0.6977	0.13954 0.2141	0.22810 0.0406	-0.15724 0.1609	0.06653 0.5511	0.05150 0.6430
L6	-0.07772 0.4904	-0.01201 0.9152	0.05372 0.6339	-0.10940 0.3310	-0.21693 0.0517	0.05619 0.6183	0.10446 0.3534	0.09153 0.4164	-0.16755 0.1349	0.22193 0.0465	0.17359 0.1212	-0.16374 0.1441

	A12	A13	A14	L1	L2	L3	L4	L5	L6
A0	0.37115 0.0006	-0.28426 0.0101	-0.31960 0.0036	-0.14785 0.1878	-0.04412 0.6957	-0.35223 0.0013	0.05109 0.6506	0.12072 0.2830	-0.07772 0.4904
A1	-0.26996 0.0148	-0.04340 0.7004	0.03646 0.7466	-0.04746 0.6740	0.37420 0.0006	0.18165 0.1046	-0.30581 0.0055	0.03718 0.7418	-0.01201 0.9152
A2	-0.20922 0.0609	-0.02099 0.8525	0.16516 0.1406	0.10830 0.3359	-0.22312 0.0453	-0.14409 0.1994	0.20728 0.0633	-0.10943 0.3308	0.05372 0.6339
A3	-0.38555 0.0004	0.03381 0.7644	-0.32127 0.0035	0.24534 0.0273	0.00875 0.9382	0.55483 0.0001	-0.35970 0.0010	-0.07370 0.5132	-0.10940 0.3310
A4	-0.48417 0.0001	0.58823 0.0001	0.07435 0.5095	0.05106 0.6508	-0.35243 0.0013	-0.20901 0.0611	0.33931 0.0019	0.23451 0.0351	-0.21693 0.0517
A5	-0.27742 0.0122	0.26580 0.0165	-0.03147 0.7803	0.13990 0.2129	0.41541 0.0001	0.16336 0.1451	-0.40411 0.0002	0.07089 0.5294	0.05619 0.6183
A6	-0.23790 0.0325	0.34631 0.0015	0.16405 0.1433	-0.07397 0.5116	-0.01750 0.8768	-0.11011 0.3278	0.22504 0.0434	-0.04382 0.6977	0.10446 0.3534

A7

A8

A9

A10

A11

A12

A13

A14

L1

L2

L3

L4

L5

L6

Appendix I

ESTIMATED NET RATES OF RETURN ON THE ELEMENTS OF BANK PORTFOLIO
(Fuller and Battese Method Estimates)

	ALTERNATIVE I						ALTERNATIVE II					
	R1		R2		R3		R1		R2		R3	
Variables	Coefficients	t-Ratios	Coefficients	t-Ratios	Coefficients	t-Ratios	Coefficients	t-Ratios	Coefficients	t-Ratios	Coefficients	t-Ratios
Intercept	0.0222	1.28	0.0308	1.22	0.0160	1.06	0.0210	1.15	0.0141	0.78	0.0085	0.54
A_0	-10.5121	-3.49*	-5.9374	-1.84***	-5.0538	-2.18**	-9.3785	-3.02*	-3.9019	-1.38	-4.0420	-1.69***
A_1	0.0155	0.55	0.0117	0.41	0.0130	0.52	0.0213	0.74	0.0198	0.65	0.0206	0.79
A_2	-0.0036	0.16	0.0087	0.37	0.0177	0.82	-0.0061	-0.26	0.0074	0.31	0.0190	0.89
A_3	0.0472	1.64***	0.0546	2.10**	0.0672	3.00*	0.0659	2.41**	0.0702	2.73*	0.0791	3.58*
A_4	0.0441	3.07*	0.0522	4.01*	0.0526	4.78*						
A_5	0.0354	1.98**	0.0368	2.07**	0.0305	1.96**						
A_6	0.0047	0.28	0.0111	0.70	0.0161	1.17						
A_7							0.0101	0.37	0.0385	1.46	0.0444	1.95***
A_8							0.0376	2.90*	0.0468	3.64*	0.0477	4.36*
A_9							0.0183	0.92	0.0169	0.87	0.0167	0.98
A_{10}	-0.3073	-0.36	-0.0095	-0.01	-0.1763	-0.26	-0.6691	-0.75	-0.2362	-0.28	-0.3834	-0.55
A_{11}	-0.0248	-0.22	-0.0983	-0.90	-0.1122	-1.30	0.0005	0.01	-0.0222	-0.22	-0.0291	-0.35
A_{12}	-0.0304	-1.52	-0.0320	-1.56	-0.0220	-1.22	-0.0345	-1.67***	-0.0325	-1.56	-0.0217	-1.18
L_1	0.0770	2.04**	0.0690	1.95***	0.0396	1.31	0.0596	1.51	0.0599	1.62	0.0313	0.99
L_2	-0.0807	-3.98*	-0.0750	-3.72*	-0.0613	-3.44*	-0.0793	-4.01*	-0.0754	-3.76*	-0.0656	-3.68*
L_3	-0.0422	-2.11**	-0.0425	-2.16**	-0.0328	-1.91**	-0.0441	-2.15**	-0.0428	-2.13**	-0.0324	-1.84***
L_4	-0.0323	-1.66***	-0.0440	-2.34**	-0.0369	-2.24**	-0.0353	-1.78***	-0.0441	-2.28**	-0.0367	-2.18**
L_5	0.0201	0.28	-0.0326	-0.48	-0.0589	-0.99	0.0237	0.33	-0.0256	-0.36	-0.0488	-0.79
L_6	0.0400	1.50	0.0840	1.10	0.0246	0.90	0.0489	1.56	0.0386	1.20	0.0290	1.01

Note: See Table IV for the definition of these variables; *significant at .01 level; **significant at .05 level; ***significant at .10 level.

Appendix J

ESTIMATED NET RATES OF RETURN ON THE ELEMENTS OF BANK PORTFOLIO

Independent Variables	R^1	R^2	R^3
A_0	-5.892	-1.366	-2.194
	(-2.03)**	(-.52)	(-1.01)
A_1	.049	.037	.031
	(1.91)***	(1.46)	(1.38)
A_2	.013	.027	.036
	(.54)	(1.11)	(1.65)***
A_3	.095	.093	.095
	(3.28)*	(3.43)*	(4.13)*
A_{10}	.226	.451	.237
	(.27)	(.58)	(.37)
A_{11}	-.062	-.072	-.060
	(-.61)	(-.80)	(-.83)
A_{12}	.005	.001	.002
	(.29)	(.05)	(.12)
A_{13}	.053	.053	.052
	(3.11)*	(3.23)*	(3.72)*
L_1	.079	.076	.042
	(2.18)**	(2.25)**	(1.48)
L_2	-.072	-.071	-.064
	(-4.14)*	(-4.15)*	(-4.26)*
L_3	-.046	-.044	-.036
	(-2.15)**	(-2.15)**	(-2.01)**
L_4	-.024	-.033	-.029
	(-1.39)	(-1.95)***	(-2.02)**
L_5	-.042	-.057	-.074
	(-.61)	(-.87)	(-1.33)
L_6	-.028	-.027	-.033
	(-.72)	(-.72)	(-1.02)
Variance Component for Cross-Section	.000042	.000024	.000013
Variance Component for Time Series	.000009	.000006	.000005
Variance Component for Error	.000027	.000033	.000030
Transformed Reg. M.S.E.	.000038	.000043	.000036

Note: A_{13} is total loans. The other variables are defined in Table IV.

*Significant at .01 level.

**Significant at .05 level.

***Significant at .10 level.

Appendix K

ZEF PARAMETER ESTIMATES OF THE TMJCF: ALTERNATIVE MODELS

Variables	Para-meters	ALTERNATIVE I: Model A Values	Model A t-Ratios	Model C Values	Model C t-Ratios	Model D Values	Model D t-Ratios	ALTERNATIVE II: Model A Values	Model A t-Ratios	Model C Values	Model C t-Ratios	Model D Values	Model D t-Ratios
Constant	α	0.3173	0.07	7.9943	8.30*	7.3172	7.73*	6.0827	3.05*	9.2658	9.06*	8.0350	5.75*
Y1	$\alpha y1$	1.7662	1.95***					0.1977	0.32				
Y2	$\alpha y2$	1.5464	1.06					0.4516	0.58				
$\ell nq1$	$\alpha 1$	-0.8918	-0.95	-0.1974	-0.86	-0.6185	-2.12**	-1.9716	-2.35**	-1.2153	-2.38**	-2.0035	-2.45*
$\ell nq2$	$\alpha 2$	-4.6229	-4.45*	-0.1249	-1.21	-2.1261	-6.05*	-0.4082	-1.47	0.0397	1.12	-0.3774	-2.03**
$\ell nq3$	$\alpha 3$	-0.2109	-0.18	-0.8912	-2.95	-0.2609	-0.68	0.1858	0.24	-0.6752	-2.35**	-0.3775	-0.74
$\ell nq4$	$\alpha 4$	5.5539	3.81*	0.3360	0.59	1.7616	2.56*	2.1687	2.15**	0.3794	0.76	1.2323	1.61
$\ell nq5$	$\alpha 5$	1.0142	0.89	0.0498	0.16	0.7653	2.34**	0.1113	0.18	0.2972	1.11	0.8310	2.24**
$\ell np1$	β	0.1656	1.01	-0.0743	-0.84	0.1670	6.35*	0.0634	0.64	0.1293	1.43	0.1692	6.45*
$\ell np2$	$\beta 2$	-0.0217	-0.10	0.2310	2.34**	0.1864	5.91*	0.1094	0.89	0.0315	0.29	0.1812	5.78*
$\ell np3$	$\beta 3$	0.3530	4.38*	0.3043	7.01*	0.1700	8.46*	0.3853	7.97*	0.3917	9.28*	0.1732	8.69*
$1/2\ (\ell nq_1)^2$	$\gamma 11$	0.1664	0.92	0.0442	1.10	-0.0042	-0.03	-0.0975	-0.22	0.2250	2.71*	-0.6707	-2.03**
$\ell nq_1 \ell nq_2$	$\gamma 12$	-0.0960	-0.88			-0.2066	-2.63*	-0.[illegible]1				-0.0525	-0.71
$\ell nq_1 \ell nq_3$	$\gamma 13$	-0.0194	-0.12			0.0742	0.66	0.2449	1.06			0.5113	3.03*
$\ell nq_1 \ell nq_4$	$\gamma 14$	0.0208	0.10			0.2578	1.80**	0.0739	0.18			0.5942	2.05**
$\ell nq_1 \ell nq_5$	$\gamma 15$	0.0444	0.34			0.0266	0.30	0.2255	0.95			0.1348	0.86
$1/2\ (\ell nq_2)^2$	$\gamma 22$	-0.2290	-2.27**	0.0701	3.11*	-0.3119	-4.43*	-0.0203	-0.83	0.0087	0.85	-0.0254	-1.41
$\ell nq_2 \ell nq_3$	$\gamma 23$	0.1503	1.18			0.2803	3.95*	0.0766	1.24			0.0620	1.26
$\ell nq_2 \ell nq_4$	$\gamma 24$	0.2773	1.18			0.4534	2.78*	0.0360	-0.45			-0.0305	-0.52
$\ell nq_2 \ell nq_5$	$\gamma 25$	0.3457	2.85*			0.2338	2.57*	0.1143	1.96			0.1104	2.49**
$1/2\ (\ell nq_3)^2$	$\gamma 33$	0.3403	3.53*	0.1915	3.35*	0.2854	4.34*	0.2495	3.25*	0.1510	2.76*	0.2170	3.82*
$\ell nq_3 \ell nq_4$	$\gamma 34$	-0.6190	-3.88*			-0.6370	-5.29*	-0.5984	-3.57*			-0.6909	-5.40*
$\ell nq_3 \ell nq_5$	$\gamma 35$	0.0685	0.49			0.0185	0.18	-0.0496	-0.32			-0.1015	-0.89
$1/2\ (\ell nq_4)^2$	$\gamma 44$	0.3487	1.29	-0.3010	-0.28	0.0007	0.00	0.4928	1.74***	-0.0220	-0.23	0.1258	0.59
$\ell nq_4 \ell nq_5$	$\gamma 45$	-0.4152	-2.50**			-0.3500	-3.03*	-0.2230	-1.24			-0.2382	-1.85***
$1/2\ (\ell nq_5)^2$	$\gamma 55$	-0.1027	-0.67	0.0117	0.24	-0.0657	-0.67	-0.0748	-0.45	0.0250	-0.59	-0.0327	-0.31
$1/2\ (\ell np_1)^2$	$\lambda 11$	0.1968	7.91*	0.2086	6.29*	0.1544	6.78*	0.2205	8.39*	0.2293	9.73*	0.1490	6.56*
$\ell np_1 \ell nP_2$	$\lambda 12$	-0.0411	-1.60	-0.0541	-2.31**	-0.0046	-0.20	-0.0708	-2.64*	-0.0934	-3.80*	-0.0012	-0.05
$\ell np_1 \ell np_3$	$\lambda 13$	-0.0289	-2.35**	-0.0193	-1.36	-0.0075	-0.62	-0.0172	-1.44	-0.0046	-0.43	-0.0042	-0.35

Appendix K (Continued)

Variables	Parameters	ALTERNATIVE I Model A Values	Model A t-Ratios	Model C Values	Model C t-Ratios	Model D Values	Model D t-Ratios	ALTERNATIVE II Model A Values	Model A t-Ratios	Model C Values	Model C t-Ratios	Model D Values	Model D t-Ratios
$1/2(\ell np_2)^2$	$\lambda 22$	0.0790	2.19**	0.0794	2.16	0.0399	1.28	0.1177	3.19*	0.1555	4.85*	0.0397	1.27
$\ell np_2 \ell np_3$	$\lambda 23$	-0.0002	-0.02	-0.0049	-0.38	0.0021	0.16	-0.0140	-1.09	-0.0248	-2.36**	-0.0021	-0.16
$1/2(\ell np_3)^2$	$\lambda 33$	0.0294	2.05**	0.0330	2.48	0.0030	0.22	0.0313	2.35**	0.0289	2.67*	0.0028	0.28
$\ell nq_1 \ell np_1$	$\theta 11$	-0.0829	-3.78*	-0.0797	-3.88			-0.1020	-2.57*	-0.1159	-3.24*		
$\ell nq_2 \ell np_1$	$\theta 21$	0.0055	0.31	0.0045	0.26			0.0140	1.52	0.0143	1.70***		
$\ell nq_3 \ell np_1$	$\theta 31$	0.0872	3.87*	0.0870	9.18*			0.0816	3.40*	0.0876	4.07*		
$\ell nq_4 \ell np_1$	$\theta 41$	0.0609	1.99**	0.0572	1.98**			0.0965	3.03*	0.0894	3.06*		
$\ell nq_5 \ell np_1$	$\theta 51$	-0.0296	-1.43	-0.0176	-0.91			-0.0414	-1.80***	-0.0291	-1.40		
$\ell nq_1 \ell np_2$	$\theta 12$	0.1082	3.89*	0.1005	3.89*			0.1509	3.06*	0.1723	3.90*		
$\ell nq_2 \ell np_2$	$\theta 22$	0.0057	0.25	0.0007	0.04			-0.0161	-1.40	-0.0161	-1.54		
$\ell nq_3 \ell np_2$	$\theta 32$	-0.0680	-2.39**	-0.0683	-2.59*			-0.0644	-2.17**	-0.0767	-2.89*		
$\ell nq_4 \ell np_2$	$\theta 42$	-0.1140	-2.94*	-0.1040	-2.97*			-0.1574	-3.97	-0.1533	-4.25*		
$\ell nq_5 \ell np_2$	$\theta 52$	0.0419	1.60	0.0482	1.98**			0.0539	1.89***	0.0424	1.64		
$\ell nq_1 \ell np_3$	$\theta 13$	-0.0279	-2.61*	-0.0271	-2.81*			-0.0547	-3.13*	-0.0618	-3.99*		
$\ell nq_2 \ell np_3$	$\theta 23$	-0.0026	-0.30	-0.0056	-0.69			0.0072	1.79***	0.0069	1.91***		
$\ell nq_3 \ell nP_3$	$\theta 33$	-0.0116	-1.04	-0.0094	-0.94			-0.0087	-0.82	-0.0023	-0.25		
$\ell nq_4 \ell np_3$	$\theta 43$	0.0282	1.89**	0.0304	2.25**			0.0426	3.07*	0.0457	3.70*		
$\ell nq_5 \ell np_3$	$\theta 53$	-0.0046	-0.45	-0.0051	-0.56			-0.0041	-0.40	-0.0062	-0.69		
$\ell nq_1 Y_1$	$\rho 11$	-0.0097	-0.07					-0.1653	-0.67				
$\ell nq_2 Y_1$	$\rho 21$	-0.0772	-0.62					-0.0142	-0.32				
$\ell nq_3 Y_1$	$\rho 31$	0.0850	0.53					0.2442	1.44				
$\ell nq_4 Y_1$	$\rho 41$	0.1102	0.69					0.0520	0.33				
$\ell nq_5 Y_1$	$\rho 51$	-0.1696	-1.55					-0.1029	-0.87				
$\ell nq_1 Y_2$	$\rho 12$	-0.1636	-0.95					-0.2397	-0.80				
$\ell nq_2 Y_2$	$\rho 22$	-0.2399	-1.43					-0.0334	-0.63				
$\ell nq_3 Y_2$	$\rho 32$	0.1808	1.16					0.1400	0.81				
$\ell nq_4 Y_2$	$\rho 42$	0.3122	1.60					0.2100	1.10				
$\ell nq_5 Y_2$	$\rho 52$	-0.1310	-1.04					-0.0927	-0.71				
$\ell np_1 Y_1$	$\delta 11$	0.0475	1.78***					0.0403	1.42				
$\ell np_2 Y_1$	$\delta 21$	-0.0542	-1.60					-0.0449	-1.29				
$\ell np_3 Y_1$	$\delta 31$	-0.0038	-0.29					-0.0053	-0.42				
$\ell np_1 Y_2$	$\delta 12$	0.0424	1.50					0.0303	1.02				
$\ell np_2 Y_2$	$\delta 22$	-0.0418	-1.16					-0.0263	-0.71				
$\ell np_3 Y_2$	$\delta 32$	-0.0095	-0.66					-0.0127	-0.94				

Note: Model A - Unrestricted Model with time dummies; Model C - A Model that imposes nonjointness in the proudction process; Model D - A Model that imposes separability between Inputs and Outputs. *Significatn at .01 level; **Significant at.05