Cuevas, Carlos E.

INTERMEDIATION COSTS AND SCALE ECONOMIES OF BANKING UNDER FINANCIAL REGULATIONS IN HONDURAS

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INTERMEDIATION COSTS AND SCALE ECONOMIES OF BANKING UNDER FINANCIAL REGULATIONS IN HONDURAS

DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of The Ohio State University

By

Carlos E. Cuevas, B.S., M.S.

* * * * *

The Ohio State University

1984

Reading Committee:

Professor Douglas H. Graham
Professor Dale W Adams
Professor Francis E. Walker

Approved By

Adviser
Department of Agricultural Economics and Rural Sociology

To my wife, Sylvia, and my son, Carlos,
for their love, support, and understanding

ACKNOWLEDGMENTS

I wish to express my deepest appreciation to Professor Douglas Graham, my adviser and best friend during these four years at Ohio State. I learned from his example, and benefited from his guidance, encouragement, and support throughout this entire period. His insistence on comprehensiveness and completeness, and his thought-provoking questions and comments greatly contributed to the improvement of this dissertation. My family and I enjoyed the kind friendship of the Graham family during all these years. They made us feel respected and appreciated. Our sincere gratitude to all of them.

I am indebted to Professor Dale Adams, who was the man responsible for bringing me to Ohio State. I hope he does not regret it. He was a permanent source of insight and provided valuable criticism and advice during my work at OSU.

I wish to acknowledge the helpful advice of Professor Francis Walker during the course of this study. I also thank Professors Edward Kane and Warren Lee for their valuable comments and suggestions on my dissertation prospectus. Professor Kane's concepts in financial regulation had great influence on my thought and interests.

I wish to thank all faculty and staff of the Agricultural Finance group at the Department of Agricultural Economics for their support and friendship. Special thanks to Mrs. Barbara Lee for her sympathy and cooperation in so many "rush hours" experienced in the fulfillment of project duties. I also wish to acknowledge the support received from all department chairmen during this period, specially Professor David Boyne.

Text and tables of this dissertation were diligently processed by Ms. Jill Loar. Ms. Janice Christensen helped me with the graphs. Thanks to both of them for their careful work.

I am indebted to many people in Honduras. They not only facilitated my data gathering but also contributed to making my work there an excellent professional experience. I am specially grateful to the Office of Food and Agriculture of the USAID Mission in Tegucigalpa, to the Economic Studies Unit of BANADESA, and to the Economic Studies Division of Banco Atlántida.

Finally, my family and I wish to express our gratitude to our relatives and friends in Chile for their permanent encouragement and support. We are also specially grateful to all our friends in Columbus, who have made these years of our lives so enjoyable and rewarding. Sylvia, Carlos and I, we did it.

VITA

January 16, 1946 . . . . . Born - Santiago, Chile

1968 . . . . B.S., Agronomy (Ingeniero Agrónomo), Universidad de Chile, Santiago, Chile

1977 . . . . M.S., Agricultural Economics, Universidad Católica de Chile, Santiago, Chile

1969-1971. . . . . Staff member, Department of Technical Assistance and Credit, Instituto de Desarrollo Agropecuario, Puerto Montt, Chile

1971-1973. . . . . Head, Department of Livestock Development, Corporación de la Reforma Agraria, Santiago, Chile

1974-1975. . . . . Advisor, Cooperativa Rupanco Ltda., Osorno, Chile

1976-1980. . . . . Research Associate, Department of Agricultural Economics, Universidad Católica de Chile, Santiago, Chile

1980-1984. . . . . Research Associate, Department of Agricultural Economics and Rural Sociology, The Ohio State University, Columbus, Ohio

PUBLICATIONS

1. "Intermediation Costs in an Agricultural Development Bank: A Cost Function Approach to the Measurement of Scale Economies," ESO 1089, Ohio State University, February 1984.

2. "Coffee and Basic Grains: Review of Sectoral Performance, Pricing and Marketing Margins, and Recent Policy Changes". A Report to USAID-Honduras, January 1984 (co-author).

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4. "Level and Structure of IHCAFE Costs Associated with Coffee Loan Activities". A Report to USAID-Honduras, January 1984 (co-author).

5. "Loan Targeting and Financial Intermediation Costs in Honduras", ESO 1072, Ohio State University, December 1983. Presented at the ASSA Meetings 1983 (co-author).

6. "Agricultural Lending Costs in Honduras," (co-author) Chapter 8 in Adams, D., Graham, D., and Von Pischke, J. D. eds., Undermining Rural Development with Cheap Credit, Westview Press, Boulder, Colorado, forthcoming.

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FIELDS OF STUDY

Major Field: Agricultural Economics

Economic Theory. Professors Stephen A. McCafferty, Gene E. Mumy, and Edward J. Ray.

Econometrics and Quantitative Methods. Professors Richard G. Anderson, Leroy J. Hushak, Francis E. Walker, and D. Ransom Whitney.

Development Economics and International Trade. Professors Douglas H. Graham, Albert E. Keidel, Marie C. Thursby, and Thomas A. Wolf.

Agricultural Finance, and Money and Banking. Professors Dale W Adams, Douglas H. Graham, and Edward J. Kane.

TABLE OF CONTENTS

Chapter | Page

Chapter Page

LIST OF TABLES

Table		Page

Table | Page

LIST OF FIGURES

CHAPTER I

Introduction

Financial markets play a crucial role in resource allocation and distribution. The efficiency with which financial markets operate determines the magnitude of the contribution of this sector to economic development. The intrinsic nature of finance, however, makes it difficult to assess the efficiency of financial-market performance. Transaction costs of financial intermediation provide an analytical tool to evaluate this performance. Transaction costs are an appropriate measure of the degree of "friction" existing in the functioning of financial markets. The higher the transaction costs of financial intermediation, the less efficient the performance of financial markets, and the more constrained their contribution to development.

This study is a comprehensive analysis of the costs of financial intermediation in a small, less developed country, Honduras. The transaction costs of intermediation borne by lenders and borrowers are measured and analyzed with particular (though not exclusive) attention devoted to agricultural lenders and borrowers. Particular emphasis is placed on the cost structure and scale economies of financial institutions. The effects that financial market regulations have on the magnitude and the distribution of financial intermediation costs are also investigated.

This Introduction presents an overview of the issues involved, states the problem addressed and the objectives pursued. The organization of the study is set forth at the end of this chapter.

Overview

Over the last decade, much effort has been devoted to the clarification and understanding of the roles of money, capital, and finance in development. In less developed countries (LDCs), the contribution of money to development relies primarily on its role as a channel of resources from savers to investors [56]. This function has been the focus of many research efforts.

With the clarification of the contribution that finance makes to development and of the roles performed by financial intermediaries, concern has surfaced regarding the effects of economic policies on the financial sector. Since financial intermediaries channel claims on real resources between savers and investors, policies that affect the functioning and performance of the financial sector will have an impact on the allocation of real resources and on the distribution of income [1,32,57,74]. As a consequence of the non-neutrality of the incidence of financial policies, it is in the interest of different groups in society to attempt to influence the direction of these policies. Thus government intervention in financial markets tends to be ultimately decided by the relative strength of different political constituencies, constraining the economist's role to that of "sorting out" the likely consequences of alternative intervention schemes [52].

"To intervene or not to intervene" has been a question addressed by many researchers, both with respect to financial markets in general, and to credit allocation schemes in particular. Selective credit policies have been utilized extensively in developed countries and advocated for LDCs, on the assumption that market imperfections and fragmentation exist, and that there is a need to induce important shifts in economic relationships and technological change [57,77,86]. The results of these policies in LDCs have generated various controversies. These debates usually contrast the costs and effects of financial market regulation against alternative policy measures such as the establishment of specialized financial institutions that would presumedly perform the allocational and development-promoting roles attributed to selective credit controls [2,57,86].

Statement of the Problem

Financial intermediaries in LDCs are usually highly regulated. Controlled interest rates creating fragmented markets for loans and deposits are among the preferred regulations utilized by governmental authorities. At the same time, domestic central banks and international agencies impose various targeting and end-use requirements for funds lent to different sectors of the economy. Special credit projects and specialized lending institutions complete the typical financial scene in these countries [2,23]. Specialized lending institutions (development banks) have received special attention particularly from international funding agencies, that have seen them as a financial innovation capable of increasing internal and external finance to selected sectors such as agriculture [20,23,41,93].

A number of studies have analyzed several features of intervention schemes in rural financial markets, and their effects on resource allocation and income distribution.[1/] These studies suggest that very often the intended effects of regulations are rarely attained, and that many unintended and undesirable results occur. The diffused nature of financial activities and the limited development of institutional and informational systems in LDCs have made it difficult for advocates and detractors of governmental intervention in rural financial markets to provide strong empirical support for their views.

Financial intermediation is far from costless, and financial policies impinge upon these costs in several ways

1/ A collection of essays on this subject is forthcoming in Adams, Graham, and Von Pischke [5].

[1]. Financial intermediaries use the services of factors of production according to particular technologies, therefore resource costs are necessarily involved in the process. Moreover, the quantity and quality of resources as well as the technologies utilized are subject to changes. Financial policies in general, and regulatory policies in particular, create incentives for innovations and organizational adjustments in the financial sector. These innovations and adjustments are justified more often by their "productivity in regulatory avoidance" than by their cost-reducting effectiveness (Kane, [53]). In fact, many technological and organizational changes in the financial system may have increased intermediation costs instead of reducing them. However, few attempts have been made to evaluate these costs, estimate the effects of policies on their magnitude and the incidence of these costs among participants [79].

This study analyzes the costs of financial intermediation in a small, less-developed economy, Honduras, where most of the characteristics of the typical environment depicted above are present [36]. The chain that links savers with investors is conceived as a sequence - savings mobilization, lending, borrowing - that demand the use of real resources and therefore involve costs. It is hypothesized that both the magnitude of these costs as well as their relative incidence among lenders and borrowers are affected by the regulated environment. The characteristics and behavior of commercial banks and development banks will be contrasted, with the aim of providing additional insights into the behavior of specialized lending institutions, particularly those engaged in agricultural lending.

Objectives

The aims of this work are two-fold: first, to document and evaluate the costs involved in the process of financial intermediation. These include the costs incurred by lenders in mobilizing funds, the operational costs of on-lending these funds to clients, as well as the costs incurred by final borrowers securing loans from institutional sources. The second objective is to determine the impact of regulatory policies on the costs of financial intermediation. Interest-rate regulations and selective credit policies will receive special attention.

Specific objectives of the study are as follows:

1. To measure the average costs and the marginal costs of loans granted and deposits mobilized, as well as the overall intermediation costs for the National Agricultural Development Bank (BANADESA) and a large private bank in Honduras;
2. To assess the scale economies and scope economies of banking, and other related characteristics of the underlying technology of financial services provided by these institutions;

3. To estimate the impact of interest-rate policies and loan-targeting schemes on the intermediation costs of lenders;
4. To examine to what extent 2, and 3 above differ between a private commercial bank and a public-sector agricultural development bank;
5. To investigate the nature and magnitude of borrowing costs borne by agricultural borrowers in Honduras, specifically the non-interest transaction costs involved in obtaining a loan;
6. To ascertain the effects of the explicit interest rate charged by lenders, the loan size, and risk characteristics of the farmer-client on his non-interest transaction costs; and
7. To analyze the differences in borrowing costs (explicit and implicit) associated with different loan sources (i.e. the agricultural development bank vs. other lending institutions).

Organization of the Study

An overview of the Honduran financial system from 1960 to 1982 is presented in chapter 2. Policies and regulations that have affected financial deepening in the Honduran economy are reviewed and analyzed. Chapter 3 develops the theoretical framework for the study. The functions of financial intermediation, the theory of the banking firm, and theoretical elements of credit rationing models make up this conceptual framework. The methodology used to measure and evaluate the costs of intermediation for lenders and borrowers is presented in chapter 4. This includes econometric analysis of the lenders' cost functions and the transaction-costs of borrowing.

The principal results are presented in chapters 5 and 6. Chapter 5 sets forth the analysis of lenders' costs, the estimation of cost functions, and the estimated effects of regulations on financial intermediaries. The magnitudes of deposit-mobilization and lending costs are documented and discussed here for the agricultural development bank of Honduras and the largest private commercial bank in the country. Scale-economies and scope-economies are then estimated and contrasted between the two banks. Chapter 6 concentrates on the results obtained in the evaluation of the transaction costs of borrowing. The magnitude of these costs, and the factors affecting this magnitude and their incidence in the agricultural loan portfolio are discussed. Emphasis is placed on the trade-off that exists between implicit, non-interest transaction costs and the explicit interest rate. Finally, chapter 7 summarizes the major findings and outlines important policy implications and conclusions.

CHAPTER II

Background: The Financial Sector of Honduras

Honduras, with a population of about 4 million inhabitants and a size comparable to the state of Ohio, is one of the countries with the lowest income per capita in Latin America (US$ 660 in 1982).1/ Like many other countries in the area, Honduras is an open economy, with agricultural exports the basis of the country's foreign-exchange earnings.2/ Agriculture contributes roughly 30% of GDP and receives about one-fourth of the total credit of the banking system. Also, Honduras exhibits the main features of the financial structures of low income countries as pointed out by McKinnon [66]: (1) limited issuance of primary securities (bonds, stock) by individual economic units, and consequently a greater reliance on self-finance by these economic units, as compared to more developed countries; (2) most primary securities are acquired by financial intermediaries, rather than being purchased directly by savers; and (3) most claims on financial institutions held by the public are accounted for by the

1/ Selected indicators are presented in appendix A.

2/ A thorough description of the Honduran economy and financial markets is found in Graham *et al*. [36], specially chapters 1 and 2 [33].

liabilities of the monetary system, i.e, the central bank and deposit banks. Under these conditions, the major role in the intermediation of financial assets between savers and investors corresponds to the financial sector. These financial assets consist mainly of currency and deposits, i.e., claims on the central bank and the depository institutions comprising the financial system.

This chapter reviews the main features of the Honduran financial system, emphasizing developments in the 1970s and early 1980s.3/ The first section describes the historical evolution of the size and composition of the banking system. The moderate expansion and subsequent stagnation of the financial sector after 1976 stand out in the discussion presented in this section. Section 2.2 analyzes the development of the financial system of Honduras on the basis of the most commonly accepted indicators of financial deepening. A pattern of growth, stagnation, and decline of the financial sector emerges as a result of examining the behavior of the ratio of the sector's liabilities (M2) to the Gross National Product during the period 1970-1982. However, financial deepening in Honduras compares favorably to other Central American or other Latin American countries. Finally, the regulatory environment under which the Honduran financial

3/ Even though informal credit markets exist in Honduras, particularly in the rural areas (see Graham et al. [36]), in what follows the term financial sector is applied to the complex of institutions that comprise the Honduran "formal" financial system.

system has evolved is reviewed in sections 2.3 and 2.4. Interest-rate regulations, rediscount policies, and reserve requirements are emphasized as indicators of the degree of regulation and fragmentation of the financial system. These regulations provide various incentives for the financial institutions to engage in regulatory-avoidance behavior. Thus the costs of avoidance or adjustment to the changing regulatory environment should be considered in addition to the costs of complying with these financial-market regulations.

2.1. Size and Composition of the Financial System

The Honduran banking system is less than a century old. The first financial institutions, created in 1888, were comprised of two private banks authorized to issue paper currency subject to the supervision of the Ministry of Finance [97].[4/] These banks merged in 1889 to become the "Banco de Honduras", with official endorsement to engage in currency-emission. In 1912, "Banco Atlántida" and "Banco de Comercio" were created, the latter being acquired by the former in 1917. From this period until 1950 Banco de Honduras and Banco Atlántida were the only two banks with authority to issue paper money in the country. This authority was then transferred to the Central Bank, founded in 1950. At that time, only four financial institutions

4/ A comprehensive review of the history of the Honduran banking system until 1968 is found in Yu-Shan [97]. These initial paragraphs rely heavily upon this work.

were recognized, the two banks mentioned above with a total of seven offices, and two single-office savings banks. These offices were located in the two main cities of the country (Tegucigalpa and San Pedro Sula), and in port-towns along the northern coast, where banana operations were (and still are) concentrated.5/

The continuing evolution of the Honduran banking system in terms of the number of financial institutions and the number of offices, from 1950 through 1982, is summarized in appendix A, table 28. Financial institutions (not including the central bank) have been classified here between private commercial banks, public development banks, and other (private or public) financial institutions that comprise savings and loans associations and "financieras". The ratio between total population and the total number of offices of all financial institutions is presented in this table, to serve as a crude proxy for real growth of the (physical) size of the financial network.

Between 1950 and 1968 the system experienced a 9-fold expansion in the number of offices, with the creation of 6 new private commercial banks, and the formation of the first public financial institutions. Of the latter, the most important was the "Banco de Fomento" (currently the "Banco Nacional de Desarrollo Agrícola", BANADESA). With this

5/ In fact, Banco-Atlántida's main office was established in La Ceiba, then the most important port for banana exports.

expansion, the ratio of total population to the number of offices of financial institutions dropped from 160 thousand inhabitants per office in 1950 to roughly 28.2 thousand in 1968. The total number of offices of the financial system continued growing between 1968 and 1976, from 82 offices to 212, further reducing the population-to-institution ratio to 15.1 thousand inhabitants per office in 1976.

Overall, the financial system has experienced rather limited growth in terms of number of offices since 1976, becoming practically stagnant after 1980. The lowest ratio of population to number of offices was attained in 1980, 13.3 thousand inhabitants per office, before the failure of "Banco Financiera Hondureña" at the end of this year. Private banks accounted for most of this expansion in the second half of the 70's, showing an increase in the number of offices from 175 in 1976 to a peak of 218 in 1980. Only two new offices of development banks were created during this period, while the most striking growth in relative terms corresponds to other financial institutions. These institutions show a 3-fold increase in the number of offices between 1976 and 1980, thus accounting for one third of the overall increase in the size of the financial system between 1976 and 1980. The expansion of these other financial institutions finally terminates, as does the rest of the system, after 1980. The total number of offices has slightly decreased between 1980 and 1982. As a consequence the ratio of population to the number of offices in 1982 remains at the same level as in 1978.

As the foregoing discussion suggests, the expansion of private commercial banks have been the predominant source of growth within the financial institutions since its inception. Table 29 in appendix A provides further evidence of this dominance, both on the asset and the liability side of the system's balance sheet. Private commercial banks have accounted for more than 80 per cent of total lending since 1970, with the exception of 1978 (79%). These banks have also accounted for more than 86 per cent of total deposits mobilized in the system. The development banks' share of total lending in the 1970s and early 1980s has fluctuated between 8 per cent (1976) and 16.6 per cent (1980). However, the development banks' share in total lending in 1982 (11.7 percent) is only slightly larger than their share in 1970 (10.4%), and about half the level attained in 1965 (21.2%).

The role of development banks in deposit mobilization has been of little importance and stagnant, accounting for only 6 percent of total deposits mobilized in the system in the period 1970-1982, despite the fact that development banks are the "preferred" depository institution for public sector entities. Between 40 and 50 percent of public-sector deposits go to development banks. In turn, for these development banks as a group, reliance on public-sector deposits has increased from 6.4 percent of total deposits in 1970, to 47 percent of the deposit-portfolio in the early 1980s.6/ The increased role of other financial institutions in total deposit-mobilization observed in table 29 has occurred mainly at the expense of the savings-accounts balances of private commercial banks.7/ As a group, these other financial institutions accounted for an average of 8 percent of total deposit mobilization in recent years.

In summary, the Honduran financial system experienced sustained growth in the network of branches since 1950 until the mid 1970s. This expansion reduced to a moderate pace during the second half of the 1970s and came to a stop and remained stagnant after 1980. The private commercial banks dominated the system throughout the period. Therefore, the development of the financial sector discussed in the following section corresponds essentially to changes experienced in the private-bank area.

2.2. Development of the Financial Sector

In this section the ratio of the money stock (M2) to the Gross National Product (GNP) is utilized as an indicator of the degree of monetization or "financial deepening" [66,83]. This ratio also represents an alternative way of defining the size of the financial sector, in terms of its

6/ Figures computed from data reported in the Central Bank Statistical Bulletin [9].

7/ See Cuevas and Vogel [27].

total "output" instead of the physical size of the "plant" (i.e., branch network), considered in the preceding section. More importantly, the behavior of the ratio of M2-to-GNP is an indicator of the degree of financial repression; the more repressed the financial sector of an economy, the more constrained is the growth of the stock of financial assets relative to income [53].

The behavior of the ratio of M2-to-GNP in Honduras is contrasted against those of other countries in table 1. In this table, the money stock (M2) as a percent of GNP is presented for Honduras, row 1, other Central American countries, rows 2 through 4, other Latin American countries, rows 5 through 8. A textbook case of succesful financial reform and substantial growth of the financial system (South Korea) is included in row 9 of the same table, and two industrialized economies are included in rows 10 and 11 for comparative purposes. Ratios of M2-to-GNP are presented in this table for 1960, 1965, and for the period 1970-1982.

The degree of monetization of the Honduran economy, and all less-developed economies included in table 1 (rows 1 through 9) have always been below those of Japan and the United States(rows 10 and 11). In the early 80's, the ratios of M2 over GNP of the less-developed economies shown in table 1 were between 23% (Guatemala), and 41% (South Korea), whereas those of the United States were around 62%,

Table 1. Ratio of Money Stock (M2) to Gross National Product (GNP): Honduras and Other Selected Countries, 1960-1982

Country	Year, M2 as Percent of GNP															GNP per capita in 1982 (US$ 1982)[d]
	1960	1965	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	
1. Honduras	14.61	17.55	21.61	22.74	24.65	26.82	24.60	26.55	30.11	30.14	31.75	26.70	25.98	26.72	30.64	660.1
2. Guatemala	13.63	17.36	18.79	20.07	23.65	23.61	21.85	23.25	25.45	23.96	24.83	23.36	22.66	23.19	n.a.	1144.4
3. Nicaragua[a]	12.72	17.29	15.75	17.01	20.70	23.73	19.80	18.94	21.69	18.94	18.43	n.a.	n.a.	n.a.	n.a.	850.0
4. Costa Rica[b]	19.77	20.36	19.84	25.73	27.20	26.73	26.86	30.16	32.87	33.74	37.78	44.64	43.72	n.a.	n.a.	1032.1
5. Brazil	27.41	21.40	23.35	22.10	25.23	27.97	27.06	29.33	28.45	29.02	30.16	28.25	23.24	24.73	n.a.	1661.9
6. Mexico	19.14	23.69	25.99	26.97	28.52	28.53	25.65	25.75	27.30	28.92	32.97	34.23	34.11	37.57	38.93[c]	2231.6
7. Argentina	n.a.	n.a.	28.74	27.42	24.76	27.84	32.99	25.28	22.68	29.41	33.02	35.83	33.79	39.06	27.58	2554.6
8. Chile	n.a.	16.32	17.89	26.77	35.29	40.05	22.10	18.43	14.02	14.66	18.49	19.66	22.33	25.39	34.94	1331.2
9. South Korea	10.53	12.05	33.45	32.93	36.03	37.68	33.21	31.83	31.14	33.81	34.04	33.98	36.52	36.96	41.24	1652.8
10. Japan	66.66	79.18	93.05	104.65	114.13	111.25	105.61	111.54	114.26	116.19	141.71	145.29	147.62	154.60	160.37	9119.2
11. United States	61.66	66.43	63.25	66.14	67.91	64.93	63.35	66.03	67.72	67.06	64.17	61.94	61.95	60.76	63.77	13303.0

Source: International Monetary Fund [42]. M2 computed as money plus quasi-money (row 351 in Int'l. Fin. Statistics), plus deposits in other financial institutions (rows 44 and 45 of the same publication), except in the U.S. (domestic M2 definition is used).

a/ National Accounts figures not available for 1979-82
b/ Monetary figures not available 1981-82
c/ GDP used instead of GNP (not available)
d/ Or latest year available. Exchange-rate conversion may distort cross-country comparisons.

and Japan showed an impressive 154 percent average for these years. In this same period (1980-1982), Honduras shows a relatively high degree of monetization among the low-income countries included in table 1. Despite being the poorest country among this set, money stock as a proportion of GNP in Honduras was higher than in Guatemala and even higher on average than in Brazil and Chile with a per-capita income more than double the Honduran level. In other words, the degree of monetization of the Honduran economy and the relative size of this country's financial sector appear relatively higher than the country's overall development level would suggest.

Another interesting comparison between the countries included in table 1 refers to the evolution of the M2/GNP ratio over time. Overall, South Korea is the most striking case of financial development with a 4-fold increase in the ratio of M2-to-GNP between 1960 and 1982. A second group of countries showing a degree of monetization (ratio M2/GNP) in the early 80's more than double the level observed in 1960 includes Japan, Mexico, Chile, Costa Rica, and Honduras. Finally, the other countries included in table 1 have experienced little or only moderate growth in their levels of monetization during the 23-year period under analysis. In summary, both the recent level of the ratio of money stock to national income, as well as the behavior of this ratio over time, do not place Honduras among the most "financially repressed" economies of the countries included in table 1. In order to better assess the extent to which financial regulations may have affected financial growth in the Honduran economy, it is necessary to analyze changes in the ratio of money stock to GNP over time. Thus the remainder of this section will discuss the particular features of the evolution of the degree of monetization in Honduras.[8/]

The figures reported in table 1 for the ratio of M2-to-GNP for Honduras show three sub-periods in the development of the country's financial system. First, a period of sustained growth from 1960 to 1973, during which the M2/GNP ratio grew from less than 15% to almost 27%. Second, a period of fluctuation with a moderate-growth trend between 1974 and 1978, the year in which the ratio M2/GNP reaches its highest level in the time series (about 32%). The third sub-period, after 1978, shows a declining trend in the degree of monetization of the economy until 1981, and then a partial recovery in 1982. Despite this recovery, the level of the M2/GNP ratio in 1982 is similar to that existing in 1977, lower than the 1978-level, and far lower than the

8/ It is clear from table 1 that there are important differences in the growth paths followed by the M2/GNP ratios of different countries. However, a cross-country analysis of these different paths is beyond the scope of this chapter.

level that would have been reached in 1982 had the growing trend prevailing up to 1978 been maintained.[9]

Quarterly growth-rates estimated in a separate study [27] support the foregoing analysis by sub-periods. The growth-rate of the M2/GNP ratio for the period between 1970 and the first quarter of 1974 was almost 1% per quarter. Between the second quarter of 1974 and the end of 1978 this growth-rate was approximately 0.4% per quarter. Finally, for the period 1979-1981 the rate of growth of the ratio of M2-to-GNP was negative. During this period, the M2/GNP ratio was falling at an estimated rate of 1% per quarter. According to this same study, the trends for the ratio M2/GNP can be attributed mainly to the pattern followed by the interest-bearing components of the money stock, i.e., savings and time deposits. Currency and demand deposits as a whole remained at a fairly constant level, as a percent of GNP, between 1970 and 1982. Savings and time deposits on the other hand, which accounted for 50 to 56% of M2 in the 1970-1982 period, marked the growth-stagnation-decline pattern shown by the overall M2/GNP ratio during this period. This performance of interest-bearing deposits suggests a role for interest rates in the explanation of

9/ The ratio M2/GNP would have reached a level close to 34% in 1982, if the trend observed in the sub-period 1974-78 had been maintained after 1978. Had the average trend of the 1970-78 period been sustained, the 1982-level of the M2/GNP ratio would have reached approximately 37%. These projections are based on quarterly growth rates reported in Cuevas and Vogel [27].

financial growth. A discussion of this role is included in the following sections.

Many factors explain the pattern of financial development experienced in Honduras. Of particular interest is the explanation of the financial decline since 1978. It is not the purpose of this background chapter to engage in a discussion of all phenomena involved in the process of financial development.[10/] However, some of the main factors affecting this process are outlined below, emphasizing their relevance to the Honduran case.

2.3. Indirect Policy Impacts on Financial Deepening

Policies affecting the development of the financial system can be classified into two categories. The first set are those policies not specifically aimed at the financial sector, but that exercise a significant (indirect) effect on the performance of the system. Typical examples of these policy-effects are inflation that arise from fiscal deficits, and currency-overvaluation resulting from exchange-rate policies. The second set are those policies that are specifically designed to affect the operation of the financial sector, such as interest-rate regulations, reserve requirements, rediscount policies, and selective credit allocation policies. A brief discussion of the indirect policies follows. The second type of sector-specific policies is considered in more detail in the next section.

10/ A discussion of the factors affecting financial development in Honduras is found in Gonzalez-Vega [34].

Inflation affects the growth of the financial sector in several ways. It reduces the real size of the monetary system, will induce the public to substitute non-financial assets for monetary assets, will alter relative prices (specially over time), thus increasing the uncertainty of financial-market operations and shortening the term structure of loans and deposits. Inflation in Honduras arises mainly from a disproportionate expansion in domestic credit aimed at financing fiscal deficits, as documented in Gonzalez-Vega [34]. Important increases in the fiscal deficit during the 1970s were matched by a growing share of the public sector in total domestic credit during this period. As a consequence, the rate of inflation increased particularly in the second half of the 1970s and in the early 1980s.

At this point, it is important to consider the measurement of the rate of inflation in Honduras. This is normally reported in Honduras as the average rate of change of the consumer price index (CPI). A wholesale price index was not available in Honduras until 1982. Therefore the only other deflator available for comparative purposes is the implicit GDP deflator (ID) computed from national-accounts data. Even though the correlation between the two deflators is very high, the rates of change of the two indices show significant differences in some years.[11/]

11/ Cuevas and Vogel [27] estimated a correlation coefficient of 0.98 between the two indices for the period 1970-81.

Despite these differences, the two time series of inflation-rates show a similarly unstable and fluctuating behavior throughout the period 1970-1982. Likewise, in both cases an upward trend can be identified when the rates of inflation in each series are averaged over the same sub-periods reflecting the behavior of the M2/GNP ratio. First, in the sub-period 1970-1973 the average annual rate of inflation was 3.5% according to the CPI, or 3.2% if the changes in the implicit deflator are used to estimate the rate of inflation. The average calculated for the 1974-1978 sub-period jumps to 8% per year in the CPI-based series, whereas in the ID-based series this annual average is 9.9%. Finally, the upward trend in the inflation-rate continues during the period 1979-1982 according to the calculations based on the CPI, that give an average rate of 12.3% per year for this period. The average inflation-rate computed for this same period using the implicit GDP deflator remains at a moderate level (8.7%).

In summary, the first period of rapid monetization of the Honduran economy (1970-1973) is associated with a low-inflation environment. The rather stagnant second period in terms of the growth of the M2/GNP ratio (1974-1978) coincides with an average inflation-rate significantly higher than the one existing in the first period. This relatively high-inflation scenario remains the same or worsens, depending on the deflator selected, during the period of financial decline after 1978.

The foregoing discussion suggests the existence of a relationship between the formation of inflationary pressures in the economy on the one hand, and the decline of financial-sector growth on the other hand. However, the inflationary process in Honduras is moderate as compared to other Latin American countries and inflationary expectations may not have developed in Honduras until after 1980. The tradition of a stable price level in Honduras matches the even more traditional stability of the exchange-rate. This rate has remained at the same level, 2 lempiras per dollar, for more than forty years. Furthermore, only in very recent years has a serious disequilibria appeared in the balance of payments inducing devaluation expectations, thus capital flight and currency substitution.[12/] These conditions may have contributed to the financial decline observed after 1978.

An overall assessment of the (indirect or unintended) effects of fiscal and foreign-exchange policies on the development of the financial sector of Honduras indicate that: (a) low-inflation and exchange-rate stability are associated with sustained growth of the financial system, and (b) the appearance of moderate inflation and currency-overvaluation seem to induce a decrease in the rate of growth and

12/ See Gonzalez-Vega [34].

eventually a contraction of the financial system. The incidence of sector-specific policies and their interactions with inflationary phenomena are the subject of the following section.

2.4. Financial-Sector Regulations and Financial Deepening

This section reviews the main financial regulations prevailing in Honduras during the period 1970-1982. Interest-rate regulations, rediscount policies, and reserve requirements are considered. Emphasis is placed on the likely effects of these policies on deposit-mobilization, and on the operation of financial intermediaries.

Interest-rate ceilings on deposits and loans have existed during most of the period 1970-1982. Interest-rates paid on time-deposits were freed in 1978, and the ceilings for rates paid on savings deposits were lifted in 1981. However, loan-rate ceilings have remained in effect throughout the entire period, thus imposing indirect ceilings on deposit-rates even after these were officially eliminated. Tables 30 and 31 in appendix A describe the evolution of interest-rate ceilings on deposits, table 30, and loans, table 31, both in nominal and real terms. As expected, fairly stable nominal administered rates with a fluctuating rate of inflation generate unstable and fluctuating real interest-rates, regardless of the deflator selected (the CPI, or the implicit GDP deflator, ID). In order to capture the existence of possible trends in real rates, it is useful to smooth these fluctuating rates by averaging them for different sub-periods. The discussion that follows relies upon these average real interest-rate ceilings.

In the first four years of the series, 1970-1973, deposit rate ceilings show, on average, low though positive levels, of less than 1% for savings deposits, and about 3.5% for time deposits. Despite an increase in the nominal ceiling for interest rates on savings deposits after 1973, the average real rate for these accounts in the period 1974-1978 is -2% using the inflation rate of the CPI, or -3.6% if the ID-based rate of inflation is utilized. The real rate on time deposits falls in this same period to a near-zero average according to the CPI based rate of inflation, or -1.3% according to the inflation-rate of the implicit deflator. The two years with explicit ceilings for interest rates on savings deposits after 1978 show high negative real rates with an average of -6.6% or -5.2% depending on the deflator chosen for the calculations. After the elimination of all ceilings in 1981, the nominal effective interest rates paid by banks, according to central-bank estimates for late 1981, imply negative real returns for depositors in savings accounts (-2.1%) and very low positive rates for holders of time deposits (2.8%). This reflects the indirect effects of the ceilings on lending rates on deposit-rates.

Ceilings on loan-rates cause financial-market fragmentation. Seven or more different levels of the lending-rate ceilings were in effect at the same time during the period under study. Among these, the maximum lending-rate (ranging from 16% to 19%) was usually allowed only for selected operations using own-resources mobilized from the public. The average lending-rate ceiling was normally well below this maximum rate, thus providing a permanent incentive to lenders to reclassify loans and reallocate funds internally in order to maximize the amounts lent at the maximum rate.

In real terms, lending-rate ceilings have been predominantly positive between 1970 and 1982. However, a declining trend is observed when comparing sub-period averages. The average maximum lending-rate ceiling in real terms was higher than 14% between 1970 and 1973. This average declined to 7.8% or 6%, depending on the deflator, for the period 1974-1978. After this year, the CPI deflator indicates a further decline to a 5.5%-average in the period 1979-1982, whereas the ID-based inflation rate gives an average of 9.1% in real terms for this same period. In general, lending-rate ceilings have implied positive though declining real rates, a situation that contrasts with the strongly negative real rates of interest characteristic of credit markets in other less-developed economies [2].

The different lending-rate ceilings pointed out above are closely associated with the rediscount policies of the central bank. These policies are represented in table 32 (appendix A), where the number of rediscount lines in different years is reported, along with the discount rates and associated lending rates of the main lines existing during the period. The number of discount rates associated with central-bank lines of credit grew from a total of 3 in 1973, to 9 different discount rates in 1982, varying according to the specific targets of the rediscount lines. This reflects increased fragmentation in the financial sector. Furthermore, the low discount rate is offset by upward pressures on the operational costs of financial institutions using rediscount funds. Additional accounting, monitoring, and reporting schemes have to be implemented by these institutions to comply with the requirements attached to the use of rediscount funds.

The increase in the number of rediscount lines indicated above is in a sense "consistent" with the interest-rate policies applied to deposits. As pointed out before, the real levels of the interest-rate ceilings on deposits provided a growing disincentive for depositors to hold financial savings. For the depository institutions this means increasing costs of mobilization, since they need to offer non-interest rewards to their depositors in order to at least maintain the existing levels of deposit balances. Under these circumstances, central-bank rediscount lines appear as a convenient source of low-cost funds, especially appealing to banks with difficulties in mobilizing deposits from the general public. There are however, trade-offs involved in the use of rediscount funds, as this study will show later. Use of these funds avoids the traditional costs associated with deposit-mobilization, but do represent a source of additional costs for banks due to the credit-allocation constraints (i.e., loan targeting) associated with rediscount lines, with the reporting and documentation requirements mentioned earlier.

The main lines of rediscount funds established lending-rate ceilings that imply a gross margin for loan administration between 4 and 7 percentage points. In order to estimate the gross spread or margin implicit in the structure of interest-rate ceilings, it is necessary to incorporate into the analysis the reserve requirements prevailing for Honduran financial institutions. Reserve requirements fluctuated between 25% and 30% for demand, savings, and time deposits in banking institutions during the period between 1970 and 1982. These requirements were lower for deposits in savings and loans associations, and higher for deposits denominated in foreign currency, thus adding to the fragmentation in financial markets.

Table 2 presents the estimated gross-spread or margin implicit in the interest-rate and reserve policies of the central bank during the period 1970-1982. First, the weighted average of deposit-rate ceilings adjusted by reserve requirements is included in column 1 of table 2.[13/] The average lending-rate ceiling, as well as the maximum lending-rate ceiling, are seen in columns 2 and 3. The implicit gross margin allowed for financial intermediaries by these financial regulations is estimated for the average lending-rate ceiling and then for the maximum level among these ceilings in the last two columns of table 2. It is clear from this table that the gross spread implicit in the central-bank's financial policy has systematically shrunk. If banks had lent all funds at the maximum lending rate, and paid the maximum allowed rate on deposits, their margins would have shown a decrease from a "generous" average spread of 11.1% in the earlier years of the period (1970-1973), to a narrow 5%-spread in the post-1978 period.

A more reasonable assumption is that banks have lent on average at rates between the maximum and the average ceilings. On the other hand, it is likely that these banks have paid interest-rates on deposits close to their ceiling levels, since these have been already sufficiently low in real terms to discourage depositors. Under these conditions, the implicit spread set by policy-makers for financial institutions lie between the margin computed using the average ceiling, column 4 in table 2, and the spread associated with the maximum lending-rate ceiling. This range

13/ The (low) interest-rate paid on the proportion of total reserves held in government bonds was not considered in the calculations. However, this represents a minor bias in the estimated average effective deposit-rate ceiling.

Table 2. Deposit-rate Ceilings Adjusted by Reserve Requirements, Lending-rate Ceilings, and Gross-spread Implicit in Interest-rate Regulations and Reserve Requirements, 1970-1982

Year	(1) Average Deposit-rate Ceiling Adjusted by Reserve Requirements[a/] %	(2) Average Lending-rate Ceiling %	(3) Maximum Lending-rate Ceiling %	Implicit Gross-spread: With Average Lending-rate (2) - (1) %	Implicit Gross-spread: With Maximum Lending-rate (3) - (1) %
1970	6.85	-	18	-	11.15
1971	6.85	-	18	-	11.15
1972	6.85	-	18	-	11.15
1973	7.22	12.0	18	4.78	10.78
1974	8.50	12.8	18	4.30	9.50
1975	9.40	12.1	16	2.70	6.60
1976	9.40	12.1	16	2.70	6.60
1977	9.40	12.1	16	2.70	6.60
1978	10.19	12.1	16	1.91	5.81
1979	11.93[b/]	12.0	16	0.07	4.07
1980	13.20[b/]	13.3	19	0.10	5.80
1981	14.00[c/]	14.3	19	0.30	5.00
1982	n.a.	15.0	19	-	-

Sources: Tables 31 and 32 in appendix A, and Central Bank (Superintendence) internal memoranda

a/ Weighted average of interest-rate ceilings on savings deposits and time deposits, adjusted by the reserve rate. Reserve rates: 25% in 1970-72, and 1975-77, 28% in 1973-74, 30% in 1978-82.

b/ Interest-rate ceilings on time deposits were lifted in Dec. 78. Averages for 1979 and 1980 are based on Central Bank (Superintendence) estimates of effective interest-rates paid on time deposits

c/ All interest-rate ceilings on deposits eliminated after May 1981. Average for 1981 based on Central Bank (Superintendence) estimates of effective interest-rates paid.

n.a.: not available.

results in an average implicit spread between 2.9% and 7% for the period 1974-1978. For the subsequent period, 1979-1982, the average margin implicit in the financial policy would fall between 0.16% and 5%. These margins implicit in the interest-rate and reserves policies are in general consistent with those indicated above for central-bank rediscount lines.

The foregoing discussion raises two important points. First, sector-specific regulatory policies affecting the financial system have resulted in low (usually negative) and unstable real deposit-rates, thus penalizing and discouraging savers. The downward trend observed in these real deposit-rate ceilings can be associated with the slow-down and decline in the growth of the Honduran financial sector discussed earlier. Second, these combined policies have caused decreasing spreads for financial intermediaries operating with own-resources mobilized from the general public. Regardless of the source of loan funds, these gross spreads implicit in interest-rate, reserve, and rediscount policies range from roughly zero up to 7% in the period after 1974. Therefore, if intermediation costs are in effect larger than the gross margins implicit in the regulatory setting then there will be strong incentives for the financial institutions to avoid these regulations in order to minimize operational losses. Financial institutions will allocate funds in their loan portfolio to maximize the use of high-interest lines of credit, and will try to pass-on transaction costs to other participants in the system, primarily to the ultimate borrowers. The level, structure, and behavior of these intermediation costs borne by lenders and borrowers are the subject of the following chapters.

CHAPTER III

Theoretical Framework

This chapter reviews the theoretical elements involved in the study of financial intermediation costs. First, the role of the financial system as a service sector that creates specialized commodities or services is discussed. The transaction costs involved in the provision of these financial commodities are emphasized. Second, the theory of the banking firm provides a basis for the analysis of lender's intermediation costs. The ways in which financial regulations affect the use of real resources by financial institutions are discussed in this section. Finally, the theoretical foundations of credit rationing constitute the framework for the study of borrowing transaction costs.

The working assumptions adopted are: (i) lenders are cost-minimizing firms that behave as price-takers in input markets; and (ii) lenders are able to exercise loan-rate differentiation through the non-interest component of the price vector associated with loan operations, passing on transaction costs to borrowers and substituting the discriminatory application of loan procedures among borrowers for explicit loan-rate differentiation.

There is no *a priori* reason to modify the foregoing assumptions for the case of development banks. As long as financial viability and institutional survival are objectives pursued by these specialized institutions, revenues and costs must be taken into account. Therefore, the only additional assumption that is required with respect to development banks is that the goals of financial viability and institutional survival are components of their objective function. Some literature on specialized lending institutions imply that the latter assumption may not be valid for publicly-owned institutions, given the political role that these entities allegedly perform [2,23,93]. However, it has also been argued that managers of these institutions must be concerned about costs and profitability, in order to improve their standing with higher-ranked government authorities concerned with fiscal deficits [34].

In general, development goals and political objectives predominate over profit considerations in public development banks [20,41]. However, these goals and objectives are attained through the selective provision of banking services (primarily loans) to specific groups, under special terms. Therefore, given these objectives, it is still in the interest of the bank's administration to minimize the costs of providing these services. This allows them to reach a larger set of target groups, and to service a broader scope of political interests than would be the case if cost considerations were neglected. In summary, even though long-term profit maximization conventionally defined is a questionable assumption for public development banks, cost minimization seems to be an appropriate framework for the analysis of these institutions.

3.1. The Functions of Financial Intermediaries and Transaction Costs

A financial system provides four services in an economy: (1) provision of a medium of exchange and a store of value, money; (2) financial intermediation, i.e., mobilizing funds from savers (surplus units) to investors (deficit units); (3) provision of a means of transforming and distributing risk across the economy; and (4) provision of a set of policy instruments that serve as stabilization tools. The provision of these services require the use of real resources, and therefore involve costs of production [65]. Benston and Smith [14] conceive financial intermediaries as producers of specialized financial commodities. These commodities are sold for prices that are expected to cover the direct costs and the opportunity costs of production.

Demand for financial commodities derive from the existence of transaction costs in performing transfers between individuals and over time. Benston and Smith summarize their discussion of the demand for financial commodities as follows:

> "...financial intermediaries meet consumers' demands for time-dated consumption by supplying units of generalized purchasing power that can be converted into goods or services at minimal transaction costs in the amounts and at the times demanded" [14, page 219]

Financial intermediaries allow borrowers the opportunity to acquire the services of real goods now in exchange for reduced consumption in the future. At the same time, financial intermediaries provide depositors with investment opportunities that match their preferences in terms of liquidity and maturity. In short, loans and deposits are among the commodities produced by financial intermediaries. Labor and capital goods are utilized in the production of financial commodities, primarily through resources devoted to documentation, information and monitoring activities. Financial intermediaries can achieve economies of scale and economies of diversification in performing these tasks. Furthermore there are economies enjoyed by consumers from the provision of several financial services by a single institution [14].

In summary, the existence of transaction costs in inter-temporal and intra-temporal transfers explains the existence of financial intermediaries. The provision of financial commodities such as loans and deposits by these intermediaries reduces overall transaction costs for society in performing these transfers. However, the transaction costs remaining in the process of financial intermediation are still significant. Their level and distribution among the participants in the process are affected by changes in technology, changes in consumer preferences and more importantly, by financial regulations.

Surplus units in the economy (depositors) incur search and information costs before selecting a depository institution. Once this selection is made, there are further costs associated with performing transactions, i.e., deposits, withdrawals, and transfers. The opportunity cost of time is likely to be the most important transaction cost for depositors. Transaction costs incurred by financial intermediaries may be classified into costs of mobilizing deposits and costs of lending. The former correspond to resources utilized in handling deposit accounts, documentation, record-keeping, and issuing statements. Costs of lending refer to costs associated with loan processing, monitoring, and loan recovery. Gathering information about potential borrowers, assessment of collateral and documentation are among these lending costs. Beyond these direct costs of intermediation, the return to the owners of financial intermediaries (i.e., profits) should be considered a part of the overall margin needed by these intermediaries to stay in business. Finally, borrowers incur transaction costs in negotiating, obtaining and repaying a loan.

The foregoing discussion can be summarized in the following set of simplified relationships:

(a) for savers, effective return = $d - c_s$

where, d is the interest rate paid on deposits,

c_s is the (per unit) non-interest transaction costs incurred by depositors;

(b) for borrowers, effective or total costs of borrowing = $i + c_b$

where, i is the interest rate charged on loans,

c_b is the (per unit) non-interest transaction costs of borrowing;

(c) for financial intermediaries,

$$d + c_m + c_l + b = i \qquad (3.1)$$

where, c_m is the (per unit) cost of mobilizing deposits,

c_l is the (per unit) operational costs of lending, and

b denotes per unit profits.

It is clear from the identity (3.1) that in the absence of regulations on interest rates any changes in the return to savers (d) or in the direct costs of intermediation (c_m, c_l), or in the opportunity cost of capital invested in financial intermediation (b) will be reflected in the interest rate paid by the ultimate borrower (i). Different types of financial regulations will affect different components of equation (3.1), or will directly affect the transaction costs borne by savers (c_s) and borrowers (c_b).

Regulations on financial intermediaries may be classified into four groups [14]: (1) licensing, (2) price controls, (3) credit allocation, and (4) supervision. A brief discussion of the first three groups follows. Supervision is closely related to credit allocation policies in terms of its effects on transaction costs, therefore it will not be treated separately here.

(1) Licensing, i.e., entry-restrictions or restrictions to branching, results in consumers of financial services (depositors and borrowers) bearing higher transaction costs than would be the case with free-entry or branching. The problem of scale is important here, particularly in small markets, thus branch expansion could be limited even in the absence of licensing restrictions, at the expense of high transaction costs for consumers in small communities.

(2) Price controls are probably the most important type of regulation. These take the form of ceilings imposed on rates paid on deposits and/or ceilings on lending rates. The former affect the ability of financial intermediaries to mobilize deposits, the latter constrain their ability to discriminate between borrowers of different risk or creditworthiness. As a result, the costs of mobilizing (c_m) will be adjusted to compensate depositors beyond the ceiling rate. At the same time, the costs of lending associated with high-risk customers cannot be fully reflected in the level of the explicit interest rate due to the

existence of lending-rate ceilings. Therefore, equation (3.1) tends to become an inequality:

$$\bar{d} + c_m + c_l + b > \bar{I} \tag{3.2}$$

where $\bar{d}$ and $\bar{I}$ denote administered ceilings on the deposit and the lending rate. In order to restore the original identity, either profits have to go down and eventually become operational losses, or a proportion of the costs of intermediation (c_m, c_l) must be transferred to other participants in the market.

Of these two possibilities, borrowers are more likely to have their transaction costs increased as a result of the interest-rate regulations. They will have to provide more information and documentation that otherwise would have been gathered by the intermediary, and follow additional and more complicated procedures. Borrowing transaction costs will increase, and "honest" borrowers will be discouraged by these increased costs. Investors with high yield-high risk alternatives, and "dishonest" borrowers determined to default will still be willing to bear the increased level of transaction costs. Thus a process of adverse selection may result from the imposition of lending-rate ceilings.

(3) Selective credit policies, or mandatory credit allocation, have been a popular form of policy intervention, particularly in low-income countries. Substitutability (fungibility) of credit both in lender portfolios as

well as in borrower funds tend to make these policies ineffective [86]. At the same time, these selective credit policies will impose additional transaction costs on the economy [14].

The foregoing discussion offers a conceptual framework for the following sections. These sections formulate the basic models for the analysis of the transaction costs of intermediation borne by financial intermediaries (section 3.2), and by borrowers (section 3.3). The models take into account the effects of two types of financial regulations: interest-rate controls, and selective credit policies. Specification and estimation procedures applied to these models are discussed in chapter 4.

3.2. Lender's Intermediation Costs

Several different approaches to modeling the behavior of financial intermediaries are found in the literature. Baltensperger [8] and Sealey [81] have surveyed the main developments and have attempted to integrate them in more comprehensive models at the cost of introducing further complexities.

Two main approaches discussed by Sealey [81] are the Markowitz-Tobin portfolio approach (e.g. Kane and Malkiel [55]) and the firm-theoretic models (e.g. Klein [58]). The latter present the advantages of allowing the explicit consideration of market conditions, resource costs involved in intermediary operations and deposit-rate setting behavior.

The portfolio-theory approach omits these aspects of banking behavior, however, it has the advantage over the firm-theoretic models of incorporating uncertainty and particularly non-linear risk preferences in intermediary behavior.

Since the main concern here is with the behavior of the resource costs involved in financial intermediation, the theory-of-the-firm approach will be followed. It will be assumed that the financial intermediary minimizes cost subject to the constraint of a function that relates the production of banking services to the use of productive factors and inputs. The model can be summarized as follows:

$$\text{minimize } C = \sum_{j=1}^{n} p_j X_j \quad \text{, cost equation,} \tag{3.3}$$

subject to

$$F(q_1,\ldots,q_m,X_1,\ldots,X_n) = 0, \text{ production function,} \tag{3.4}$$

where, C is operational costs of production

q_i is the quantity produced of the ith output, $i=1,\ldots,m$

X_j is the quantity of the jth input, $j=1,\ldots,n$

p_j is the price of the jth input, $j=1,\ldots,n$.

The solution of the system formed by equations (3.3), (3.4) and the first-order conditions for cost minimization yields a cost function that depends on the output levels and factor prices, p_i.

$$C = \Phi\ (q_1,\ldots,q_m,p_1,\ldots,p_n)\ . \tag{3.5}$$

This same approach underlies other empirical studies on banking costs and economies of scale in banking [15,16,17, 18,30,69].

In general, the production technology represented by the implicit form (3.4) is not known. However, the duality relationships between cost and production functions allow inferences about the production technology from the knowledge of the cost function [61,91]. Varian [91] has shown that an input-requirement set that approaches the true (unknown) technology can be defined given a cost function with input prices and output levels as arguments. This cost function will be the same as the cost function associated with the original technology, since it will include only economically efficient points of this production technology. Furthermore, if the original production technology is "well-behaved", i.e. continuous, monotonic, convex and closed in output and input levels, then the production technology derived from the cost function is the true technology.1/

The foregoing duality relationships allow the study of different properties of the underlying technology, starting with the cost function. Among these properties, economies of scale, economies of scope, elasticities of factor substitution and elasticities of factor demand are of particular importance. Their definitions and formulations will be considered in chapter 4.

1/ See Varian [91]. Lamberte [62] reviews many dual relationships of cost and production functions, and applies them to the analysis of banking costs.

Regulation-related variables are introduced in the cost function (3.5) by assuming that the total demand for every factor of production X_i, can be decomposed into two parts: (a) X_{i1}, which corresponds to the level of X_i consistent with an unregulated environment; and (b), X_{i2}, an additional quantity or a differential skill that is required by existing regulations. Examples of these are additional personnel or special mechanisms devised to provide customer services that compensate for deposit-rate ceilings, and teams hired and trained to deal with specific project funds and clientele. Also, additional accounting and record-keeping personnel become necessary to comply with the reporting requirements of special credit programs. Finally, in the case of public lending institutions there are usually expanded personnel costs of featherbedded employment within the institution and additional workload (i.e. costs) of the existing staff associated with servicing political-patronage clients.

The level of input j can then be written as

$$X_j = h_j(X_{j1}, X_{j2}) \ , \qquad (3.6)$$

where the magnitude of X_{j2}, the regulation-induced portion of X_j, is assumed to depend on the degree of regulation. At this stage, this relationship for the case of interest rate regulations can be formulated as follows:

$$X_{j2} = g_j(d_e - d) \qquad , \ g_j > 0 \ , \ d_e > d \ . \qquad (3.7)$$

where $(d_e - d)$ is the difference between an equilibrium deposit rate d_e and the statutory rate d. It is expected that the closer d is to d_e, the lower the level of X_{j2}, and therefore the lower the level of non-financial costs. In other words, assuming that d_e is approximately constant the existence of a trade-off between the explicit interest rate paid on mobilized funds and the operating costs of the financial intermediary is hypothesized. The fact that the equilibrium rate d_e is usually unobservable introduces a difficulty in the measurement of the difference $(d_e - d)$. In this respect, the assumption that d_e is constant makes the statutory rate d itself a good proxy for the differential since $\Delta(d_e - d) = -\Delta d$. This assumption is kept for the time being, postponing the discussion about the measurement of $(d_e - d)$ until the next chapter.

Interest-rate regulations are not the only variables to be included in the cost function. Many other indicators of, or proxies for, financial-market regulations can be utilized in the empirical assessment of the cost function (3.5). This study emphasizes the effects that interest-rate ceilings, and loan targeting have on the costs borne by financial intermediaries. Chapter 4 discussed the specifications of these effects in the cost function.

3.3. Credit Rationing, Implicit Pricing and Borrowing Costs

The literature on credit rationing has been abundant over the last two decades [6,45,46,47,48,49,87,88]. Fairly comprehensive reviews can be found in Baltensperger [7] and Gonzalez-Vega [31]. A credit-rationing framework is utilized in this section to introduce the relationship between the implicit interest charged in loan operations and the characteristics of these operations associated with borrower's riskiness and demand conditions.

Borrowers are seen by lenders as essentially non-homogeneous. Each borrower has a different demand function for loanable funds and, more importantly, different borrowers have different risk characteristics and therefore different probabilities of repaying their loans. Since lenders are concerned with the expected return on loans which is a decreasing function of risk, they will be interested in using various "screening devices" for their borrowers [88], of which the interest rate would be the most important.

Thus loan-rate differentiation is a necessary element of lenders' behavior if they are to maximize profits. Some literature on credit rationing has approached this issue by considering lenders as price-setting entities that optimize along the borrower's demand function [47,49], even though this price-discriminating behavior is not necessarily determined only by different demand elasticities. Different risk characteristics of customers, and, in this sense, different costs associated with the loan operation also play a role [7]. The price-setting analytical model set forth below closely follows those presented by Jaffee and Modigliani [47] and Jaffee and Russell [49], with some extensions relevant for the purposes of this study. The main implication of these modifications is that credit rationing will be exercised primarily through implicit-price adjustment, rather than through quantity restrictions.

It is assumed that lenders maximize the expected value of their profits, π, which in a loan operation are given by:

$$\pi = LR[P] - LC \ , \tag{3.8}$$

where,

LR is the size of the loan contract given by:

R, the interest-rate factor $R = 1 + r$, and L is the loan size, a point on the borrower's loan demand function faced by the lender. This function, $L = L(R,\overline{W})$, derives from a multi-period optimization in which the borrower behaves as price-taker and where $\overline{W}$ represents the individual's resource endowment that influences the potential size of his/her investment projects. It is assumed that $L' = \partial L/\partial R < 0$

$P = P\ (L,R)$ is the likelihood of repayment (the λ function in Jaffee and Russell, [49]) which is conditional on the value of a minimum cost of default Z accruing to borrowers, that determines the range of contract sizes over which default is observed.

$P\ (L,R) = 1 \quad \text{if } LR \leq Z \ ,$

$P(L,R) < 1$, $P'_L < 0$, $P'_R < 0$, for $LR > Z$2/.

where the prime denotes the partial derivative with respect to the variable that appears as a subscript.

C is the cost of funds for the lender which is assumed constant for simplicity (i.e. the marginal cost is equal to average cost).

Maximization of (3.8) with respect to the loan rate factor R gives the following equilibrium condition, stated in terms of the elasticities of the loan demand function (η) and of the likelihood function (ε) with respect to the loan rate factor:

$$RP\left[1 + \frac{1}{\eta}(1 + \varepsilon)\right] = C \; . \qquad (3.9)$$

In other words, the expected marginal revenue is set equal to the marginal cost, therefore the optimal loan rate is determined by:

$$R^* = C/P\left[1 + \frac{1}{\eta}(1 + \varepsilon)\right] \; . \qquad (3.10)$$

That is, the loan rate would be optimally set considering the probability of repayment (P), the borrower's demand elasticity (η) and the response of P to changes in R (ε). In general form, R (and thus r) will be a function of loan

2/ Note that $P'_R = \partial P/\partial R < 0$ does not ensure $dP/dR < 0$ since the latter is given by $dP/dR = P'_L L' + P'_R$ where the first term to the right of the equal sign is positive (since $L' < 0$) thus making the sign of dP/dR indetermined.

demand and the probability of repayment, together with the perceived response of those functions to variations in R.

Note that under certainty of repayment ($P=1$, $\varepsilon=0$) condition (3.9) reduces to the familiar result in monopolistic equilibrium:

$$R\ (1 + \frac{1}{\eta}) = C\ . \tag{3.11}$$

The two reasons for loan-rate differentiation are summarized in equation (3.10): first, as the likelihood of repayment, P, diminishes, i.e. ceteris paribus the loan becomes riskier, the interest-rate factor R (and therefore r) will go up. Second, customers with different demand elasticities will be charged (everything else constant) different rates. An additional element in (3.10) is the response of the probability of repayment to changes in R. However, its behavior will not be discussed at this stage, considering the simplifying assumptions made with respect to the P function.

Pure monopoly price setting is not a necessary condition for this loan-rate differentiation process. As asserted in Stiglitz and Weiss [88], many banks can compete by selecting prices (interest rates) that maximize their profits. However, the typical environment in which lenders perform their activities in LDCs is characterized by institutional arrangements that constrain price-setting or loan-rate differentiation. These restrictions are particulary strong in rural financial markets in LDCs where the targeting of credit to specified groups or end-use requirements for loan funds at concessionary (and controlled) interest rates prevail [2].

Under regulated conditions, facing constraints on loan rate differentiation, lenders will engage in "regulatory avoidance" or implicit-price setting (Kane, [54]). This involves establishing different procedures for credit allocation, monitoring and supervision that create both lender and borrower transactions costs (see [2,59]). This amounts to exercising price-setting through the non-interest component of the price vector. Lenders are substituting the discriminatory application of loan procedures among borrowers for explicit loan rate differentiation. Also, to the extent that different sources of funds (international donors, and government) allow lenders to charge slightly different loan rates, lenders will use their limited discretionary power on these rates to set their prices. This price-setting procedure forces different borrowers onto different "tracks," where the number and height of the obstacles to negotiate loans in each track (i.e., transaction costs) are controlled by the lending institutions, enabling them to ration-out unwanted (risky) clients and ration-in desired clients.

Furthermore, the lender can transfer the burden of transaction costs from himself to the borrower in the form of administrative charges, fees, documentation requirements and charges, and compensatory balances. Borrowers will experience a rise in their total borrowing costs equivalent to the implicit charges passed on by the lender. There is however, as Kane [52,54] points out, some degree of waste embodied in implicit pricing since this effort diverts economic resources from other uses. When this occurs the total borrower's costs will differ from the actual revenue or total price perceived by the lender by the amount of that "waste." This wedge is neglected in the following analysis assuming that borrower's costs reflect accurately the differential loan rates (inclusive of implicit charges) that lenders impose.

In terms of the model developed above, the interest-rate factor R should now be interpreted in the broad sense of including explicit and implicit interest, i.e., the rate r will consist of an explicit rate (i) and an implicit element (τ) which result from expressing borrowing transaction costs per loan on a percent basis. It is precisely this component of the total price that will be affected by the variables involved in equation (8), i.e. borrower's riskiness and demand conditions, since the explicit rate is bounded by the existing regulations.

In summary, it is argued here that lenders in rural financial markets in LDCs are price-setters (of explicit and implicit interest charges) that take as given the profile of loan demand such as farm size, loan amount, enterprise type, and other characteristics of the borrower. Lenders then set explicit interest charges and, more importantly, establish differential administrative procedures that are in effect transformed into implicit charges (i.e., transaction costs for the borrower) according to these loan demand characteristics.

A general formulation that derives from the foregoing discussion is as follows:

$$T = T(B, i) , \tag{3.12}$$

where,

T is the borrowing (non-interest) transaction costs per loan

B is a vector of risk-related characteristics of the loan operation (loan size, firm size, and loan use).

i is the explicit interest rate that can be charged on loans by the lender.

The main concern here is to investigate the trade-off between explicit interest and transaction costs or implicit interest, passed-on or charged by lenders to borrowers. Also, it is important to examine the incidence of different characteristics of the loan operation on the level of transaction costs, as well as the interactions between these characteristics and the trade-off between explicit and implicit interest.

CHAPTER IV

Methodology

Econometric analyses of time-series and cross-sectional data are the methodological tools used in this study. This chapter reviews the specification and variable definition associated with the empirical estimation of the relationships formulated in the preceding section. The lender's cost function is reviewed first (section 4.1), followed by a discussion of the approach to be adopted for the borrower's cost analysis (section 4.2).

4.1. Lender's Cost Function

Lender's costs are composed of the opportunity cost of loanable funds, operational costs, and risk costs, usually measured as the losses due to default [64]. Since this study is concerned with resource costs involved in financial intermediation, the lender's administration or operational costs comprise the dependent variable in the cost function (3.5):

$$C = \Phi(q_1,\dots,q_m,p_1,\dots,p_n,\Gamma) \ , \qquad (4.1)$$

where Γ stands for a vector of regulatory indicators.

The (per unit) explicit costs of funds will enter the function as one of the proxies for the degree of regulation, i.e., one element of vector Γ. On the other hand, administrative or operational costs include the resource costs involved in routine loan-recovery activities, but they do not include the default rate or a related measure as an *ex ante* premium for risk. Accounting provisions for unrepaid loans should reflect this *ex ante* risk-premium, but that is not necessarily the case in regular accounting practices. The approach utilized here will not include these accounting provisions in the measurement of the dependent variable in the cost function. Instead, the delinquency rate will be considered as a variable that influences the allocation of real resources in the financial institution, and therefore affects loan administration costs (Lee and Baker [64]). In other words, the treatment of delinquency will focus on the effects that variations in the delinquency rate have on costs of financial intermediation.

Four issues will be discussed below in relation to the lender's cost function: (1) specification, (2) output definition, (3) proxies for regulation and (4) data and estimation.

4.1.1. Specification

The specification of a mathematical form for the cost function (4.1) takes into account certain conditions suggested by theoretical considerations [38,55,58], earlier empirical work [15,17,68,69], and the specific objectives of this study. These conditions refer to the shape of the average cost curves, and in general to the characteristics of the underlying technology, particularly economies of scale and factor-substitution. Also, allowing for interactions between the variables entering the function will help in testing different hypotheses with respect to their effect on intermediation costs.

Earlier studies in less-development countries (e.g. Gheen [16], Nyanin [43]) have provided very limited insights into the characteristics of the cost structure and underlying technology of these institutions, due to the choice of very restrictive functional forms for the cost function. In general, the use of Cobb-Douglas or CES specifications implies the adoption of highly restrictive assumptions about the technology utilized by financial intermediaries. Under these specifications, scale economies are forced to remain constant, regardless of the output level, therefore the corresponding average cost curves are either downward or upward sloping throughout the entire output domain. In other words, under these constrained functional forms, the existence of U-shaped average cost curves is ruled out *a priori*.

In this study, the cost-function specification will be flexible enough to allow some specific features of the underlying technology such as economies of scale and factor substitution to be tested. Furthermore, it is important to allow for interactions such as the effect of loan size on the marginal cost of lending, or the effect of deposit size on the marginal cost of mobilizing deposits.

The foregoing arguments call for the specification of a generalized form of the cost function. Within this class of mathematical functions, the trascendental logarithmic (translog) form has been utilized in a number of earlier banking cost and profit-function empirical studies [15,17,68,69,72], as well as in cost analyses of multiple-output, multiple-input firms [18,19,21,25,78]. The translog cost function is essentially a second-order approximation to an arbitrary cost function. It is quadratic in the logarithms of quantities and input prices, and linear in the parameters. This function has flexible properties with respect to the characteristics of the underlying technology discussed above, and allows multiple interactions between the variables in the model. Many assumptions imposed by other functional forms, such as homogeneity or unitary elasticity of factor-substitution, become testable hypotheses under the translog specification. The use of this functional form is particularly pertinent in multi-output production, as is the case of financial institutions producing at least two different outputs, loans and deposit services, in varying proportions.1/

In what follows, the specification of the implicit cost function (4.1) is developed for the two-output, two-input

1/ For a detailed characterization of the translog function see Binswanger [21], Christensen, Jorgenson, and Lau [25], and Ray [78].

case. The vector of regulatory indicators Γ is omitted for simplicity. The specific forms in which these indicators will enter the cost function are discussed in section 4.1.2 below.

For two outputs and two inputs, the translog function is written as follows:

$$\begin{aligned} \ln C = {} & \alpha_0 + \alpha_1 \ln q_1 + \alpha_2 \ln q_2 + \beta_1 \ln p_1 + \beta_2 \ln p_2 + \\ & + \frac{1}{2}\gamma_{11}(\ln q_1)^2 + \frac{1}{2}\gamma_{22}(\ln q_2)^2 + \gamma_{12}\ln q_1 \ln q_2 + \\ & + \frac{1}{2}\delta_{11}(\ln p_1)^2 + \frac{1}{2}\delta_{22}(\ln p_2)^2 + \delta_{12}\ln p_1 \ln p_2 + \\ & + \eta_{11}\ln q_1 \ln p_1 + \eta_{12}\ln q_1 \ln p_2 + \eta_{21}\ln q_2 \ln p_1 + \\ & + \eta_{22}\ln q_2 \ln p_2 , \end{aligned} \tag{4.2}$$

where, q_i = quantity of the ith output,

q_1 : loans, q_2 : deposits,

p_j = price of the jth input,

p_1 : salaries and wages,

p_2 : price of capital services.

The cost-share equations for the two factor inputs derive from equation (2) as:

$$S_j = \beta_j + \Sigma_h \delta_{jh} \ln p_h + \Sigma_i \eta_{ij} \ln q_i, \quad j,h = 1,2, \quad i = 1,2, \tag{4.3}$$

where S_j denotes the cost share of factor j,

$$S_j = \frac{p_j x_j}{C} = \frac{\partial \ln C}{\partial \ln p_j}.$$

Cost function (4.2) should be homogenous of degree one in input prices. This condition imposes a set of restrictions on the parameters of equation (4.2) that is also consistent with the requirement that the sum of the cost shares (4.3) must equal one:

$$\Sigma_j \beta_j = 1, \quad \Sigma_j \delta_{jh} = 0, \quad \Sigma \eta_{ij} = 0, \quad j,h = 1,2, \quad i = 1,2.$$

Several properties of the cost structure and the underlying production function can be investigated using the translog cost function defined in equation (4.3). These properties are summarized below.

Economies of Scale

Overall economies of scale, ES, are defined as the percentage change in cost when all outputs increase by a common factor. In equation (4.2), scale economies are measured as:

$$ES = \frac{\partial \ln C}{\partial \ln q_1} + \frac{\partial \ln C}{\partial \ln q_2},$$

i.e., $ES = \alpha_1 + \alpha_2 + \gamma_{11}\ln q_1 + \gamma_{22}\ln q_2 + \gamma_{12}(\ln q_1 + \ln q_2) +$

$$+ (\eta_{11} + \eta_{21}) \ln p_1 + (\eta_{12} + \eta_{22}) \ln p_2. \qquad (4.4)$$

Note that scale economies are a function of the output levels, q_1 and q_2, therefore the ES measure is not invariant to scale and is dependent on the output mix. If ES is less than 1, there are economies of scale since costs increase proportionately less than output. Values of ES equal to or greater than 1 imply constant returns or diseconomies of scale respectively. Partial economies of scale, ES_i, and marginal costs of each output, MC_i, can be computed from equation (4.2) as:

$$ES_i = \frac{\partial \ln C}{\partial \ln q_i} = \alpha_i + \gamma_{ii}\ln q_i + \gamma_{ik}\ln q_k + \Sigma_j \eta_{ij}\ln p_j \text{ , and}$$

$$MC_i = \frac{C}{q_i}\left(\frac{\partial \ln C}{\partial \ln q_i}\right) = \frac{C}{q_i}(\alpha_i + \gamma_{ii}\ln q_i + \gamma_{ik}\ln q_k + \\ + \Sigma_j \eta_{ij}\ln p_j) \quad i,k = 1,2 \ . \quad (4.5)$$

Equation (4.5) requires an important qualification. When there is joint production of two (or more) outputs, it is not possible to measure the cost of the ith output "because this cost is also attributable to other outputs" [61]. The production of loan and deposit services by a bank is not exactly analogous to the typical wool-and-mutton example of jointness in production. However, it can be argued that some degree of technological interdependence exists in the production of loans and deposit services. In some cases, this interdependence approaches the wool-mutton analogy when bank-client relationships are such that the provision of one of the services (e.g., a loan) is tied to the sale of the other (i.e., the opening of a deposit account). Furthermore, the case of financial intermediaries will also fit the definition of jointness that arises from the existence of fixed or quasi-fixed allocatable inputs in multi-output production [85]. Jointness in production, due either to technological interdependence or to the existence of binding constraints in the allocation of some inputs, invalidates the derivation of individual cost functions for each output from the multi-product form of the cost function [85].2/

In terms of equation (4.5), the foregoing considerations imply that the ratio (C/q_i) is not an appropriate measure of the average cost of producing output i, since total costs C are attributable to both outputs (q_1 and q_2). Furthermore, it is not possible to derive separate cost functions for each output for analytical purposes (e.g., finding optimum levels of production). In fact, all analytical results obtained for one output will be conditional upon the level of the other output. Therefore, the use of equation (4.5) is constrained here to two purposes: first, to assess the effects of different variables on the marginal costs of producing each output, by looking at the signs and levels of significance of the coefficients involved in the equation. Second, to make point-predictions of the level of marginal costs for each output, at given levels of all variables involved in the expression for marginal costs (4.5). This second purpose has yet to overcome the problem of "allocating" total costs between the two outputs, in order to estimate the value of the average-cost ratio that enters expression (4.5). A procedure to overcome this allocation problem is described below.

Even though exercises in cost allocation among outputs are feasible in financial institutions [26,37], the output-

2/ This limitation also applies to multi-output production and profit functions.

cost-shares resulting from these allocation studies are conditional upon the output levels at which they were performed. An expression for the share of each output in total marginal costs that takes this conditionality into account has been defined by Laitinen [61]:

$$g_i = \frac{q_i}{\rho} \frac{\partial C}{\partial q_i} \quad , \tag{4.6}$$

where, g_i is the share of the ith output in total marginal costs,

q_i is the quantity of output i,

ρ is Laitinen's definition of total or overall marginal costs,

$$\rho = \Sigma_i q_i \frac{\partial C}{\partial q_i} \quad , \tag{4.7}$$

$\partial C/\partial q_i$ is the individual marginal cost of output i.

Expression (4.6) can be easily transformed into:

$$g_i = \frac{\partial \ln C}{\partial \ln q_i} \Big/ \Sigma_i \frac{\partial \ln C}{\partial \ln q_i} = \frac{ES_i}{ES} \quad , \tag{4.8}$$

i.e., the share of the ith output in total marginal costs is equal to the ratio of the partial scale-economies measure associated with this output (ES_i) over the value of overall scale-economies (ES). It is evident from (4.8) and (4.5) that the output-cost-share g_i depends on both the scale of production and the output mix. However, it can be easily computed using the values of ES_i and ES resulting from the estimated cost function.3/ The expression (4.5) for

3/ See B.1 in appendix B.

marginal costs of production of output i can now be written as follows:

$$MC_i = \frac{C_i}{q_i}\,\frac{\partial \ln C}{\partial \ln q_i} = \frac{C_i}{q_i}\,(B_i + \gamma_{ii}\ln q_i + \gamma_{ik}\ln q_k), \quad i,k = 1,2 \qquad (4.9)$$

where,

$C_i = g_i C$, is the portion of total costs C attributed to output i, using the output-cost-share g_i. This cost share g_i is evaluated at the specific levels of both outputs and all other variables involved in the cost function,

$B_i = \alpha_i + \Sigma_i \eta_{ij} \ln p_j$.

Cost Complementarities (Economies of Scope)

Cost complementarities exist in multi-output production when the marginal cost of producing one output declines with increases in production of another output[4/]. In the case of a banking firm producing loan and deposit services, cost complementarities exist if the marg_nal costs of lending decrease as a result of increasing deposit activity, or vice versa. For example, an expansion of deposit services may reduce information costs in loan evaluation. In general, cost complementarity exist if:

$$\partial(MC_i) \,/\, \partial q_k = \frac{\partial^2 C}{\partial q_i \partial q_k} < 0 \ .$$

This condition can be expressed in terms of the logarithms of the variables as:

4/ Murray and White [69] refer to this relationship as "economies of scope". However, Benston, Berger, Hanweck and Humphrey [18] give a more strict definition for the concept of economies of scope. See also Panzar and Willig [73].

$$\frac{\partial^2 C}{\partial q_i \partial q_k} = \frac{C}{q_i q_k} \left(\frac{\partial^2 \ln C}{\partial \ln q_i \partial \ln q_k} + \frac{\partial \ln C}{\partial \ln q_i} \frac{\partial \ln C}{\partial \ln q_k} \right) < 0 \,. \quad (4.10)$$

Since C, q_i, q_k are all positive, the sign of this second derivative is determined by the expression in parenthesis. Murray and White [69] indicate that in terms of the parameters of the cost function, a necessary condition for the existence of cost complementarity between loans and deposits is:

$$\gamma_{12} + \alpha_1 \alpha_2 < 0 \quad (4.11)$$

Elasticity of Substitution and Elasticities of Input Demand

The flexibility of resource allocation in the banking firm, as well as the responsiveness of management to price signals, can be assessed through the magnitudes of the elasticity of factor-substitution and the price-elasticities of factor demand. Uzawa [89] has shown that the Allen partial elasticity of substitution between factors of production, σ_{jh}, can be written in terms of the (dual) cost function as:

$$\sigma_{jh} = \left(\frac{\partial^2 \ln C}{\partial p_j \partial p_k} \Big/ \frac{\partial \ln C}{\partial p_j} \frac{\partial \ln C}{\partial p_h} \right) + 1 \,. \quad (4.12)$$

This expression can be transformed and expressed in terms of the parameters of the translog cost function (4.2) and the factor shares (S_j), so that the Allen partial elasticities of substitution can be computed as:5/

5/ See B.2 in appendix B for details on the transformation of equation (4.12) into (4.13).

$$\sigma_{jh} = (\delta_{jh} + S_j S_h)/S_j S_h \ , \ \sigma_{jj} = (\delta_{jj} + S_j(S_j - 1))/S_j^2 \ ,$$
$$j,h = 1,2 \ . \tag{4.13}$$

In addition, the price elasticities of demand for inputs, e_{jh}, can be obtained using the estimated values of σ_{ij} and the factor shares (see Binswanger [21]).

$$e_{jj} = \sigma_{jj} S_j \ , \quad e_{jh} = \sigma_{jh} S_h \ , \quad j,h = 1,2 \tag{4.14}$$

It is clear from (4.13) that if all $\delta_{jh} = 0$, then the elasticities of substitution are independent of factor prices, and equal to one for $j \neq h$.

4.1.2. Output Definition

It has been shown that the estimation of cost functions is particularly sensitive to the definition of output of banking institutions [15,17,18]. However, the difficulties associated with this definition have induced some researchers to avoid the cost-function approach for the analysis of banking behavior and concentrate their efforts on alternative approaches, such as profit-function analysis [68].

The use of the (dollar) value of loans and deposits as a measure of a bank's output has been criticized on the basis that this definition amounts to the use of a total sales concept instead of a value-added concept to measure firm output [15,30]. A preferred conceptual approach states that banks essentially produce services in the form of deposits and loan accounts [8,15,30].

A number of studies have used the number of loans as the definition of output [30,71]. Gheen [30] has argued that loan accounts can be considered a homogeneous measure since lending operations tend to be standardized. However, there are a number of attributes of each particular account that may create sharp differences in their administrative costs. Among these characteristics of loan accounts, loan size can reflect the degree of riskiness involved in the loan operation and therefore should be another variable entering the cost function. Whether loan risk increases or decreases with loan size is a controversial issue. "Everything else constant" it could be expected that the riskiness of a loan increases with the loan size. A larger loan-size implies a higher leverage on the borrower's wealth thus reducing the borrower's expected ability to repay. Therefore, if lenders perceive large loans as riskier ventures they will tend to require additional information, more evaluation, and closer supervision, as compared to smaller loans.

Additional requirements will create further loan-administration costs associated with loans of large amounts. It is hypothesized here that the marginal cost of a loan is an increasing function of loan size. However, it can be expected that the increase in costs is less than proportional to the increase in loan size. Therefore, on a per unit of money basis the marginal cost of lending will be a decreasing function of the loan size.

As for deposit accounts, their size can play a discriminatory role, similar to that assumed for loan size in the preceding discussion, though through different mechanisms. Large deposit accounts may be associated with "preferred" customers who receive special or additional services, i.e., involve higher costs for the financial intermediary. Also, large accounts may be associated with numerous transactions, thus making them more costly to service as compared to less active accounts. Furthermore, the risk of withdrawal becomes higher as the size of deposit-balances increase. It is thus expected that the marginal cost of handling deposit-accounts increases as the deposit-size increases. However, as in the case of loans, the marginal cost per lempira mobilized in deposits is expected to decrease with deposit-size.

Summarizing, two measures of output are used in the estimation of the cost function (4.2), (a) the number of loans and deposits, and (b) the value of loans and deposits. Loan-size and deposit-size variables are included in the model to account for the heterogeneity of loans and deposit transactions. These variables are included in the cost function (4.2) in interactive form with the output levels:

$$\theta_1 \ln q_1 \ln LS + \theta_2 \ln q_2 \ln DS, \tag{4.15}$$

where, LS is the average loan size,

DS is the average size of deposit-balances.

In this way, scale-economies indicators and the marginal costs of production become dependent upon the average size of loans and deposits.

An alternative to the foregoing two-output definition of the production of banking services is the use of an index of bank output that combines the number of loans and deposits with different weights. It has been argued that the use of an index gives a more comprehensive view of the overall "bank productive efficiency" [17], particularly when dealing with scale-economies questions. It must be pointed out however, that the interpretation of other results obtained in the estimation of a cost function, such as marginal costs of loans or deposits, becomes less clear when the firm's output is measured through an index that combines loans and deposits. A discussion of these indices is found in Benston, Hanweck, and Humphrey [15,17]. These authors have found that the use of a Divisia index, instead of a simple sum of loans and deposits, generates differences in the estimates of economies of scale and the optimum size of banking institutions, even though these differences are admittedly not substantial [15]. A Divisia index corresponds to the sum of the number of loans and deposit-accounts adjusted (weighted) by the quantity shares and unit costs of each type of account [17].

As will be discussed later (section 4.1.4), a problem in implementing this index-number approach in the case of the Honduran banks, is the absence of a data-reporting system such as the FCA in the United States. While quantity shares by type of account could be computed with individual banks' data, unit costs by type of account are not recorded by Honduran financial institutions. Here the approach will be to use a simple sum of loans and deposits as a crude measure of aggregate output. This simple sum is equivalent to a Divisia index when quantity shares and unit costs are the same across all observations. The results obtained with this single-output definition will be contrasted against those associated with the two-output approach, in terms of the magnitudes and significance of the estimates of scale economies.

4.1.3. Proxies for Regulation

Interest-Rate Ceilings

The statutory deposit rate is one of the variables that will represent the degree of repression on interest rates. As stated before (section 3.1), the statutory deposit rate d would be a good proxy for the difference between an unobserved equilibrium rate d_e, and the level of d itself, under the assumption that d_e is constant. However, while this assumption may be valid for the d_e rate in real terms, it cannot be maintained when nominal rates are considered in an inflationary environment. A constant equilibrium rate in real terms results in a fluctuating nominal equilibrium rate that varies with the rate of inflation. As a result, the inflation rate can be utilized as a proxy-variable that will capture the variation of the equilibrium nominal rate d_e. The difference $(d - d_e)$ will then be measured as the difference between the statutory deposit rate d and the rate of inflation, i.e., the ex-post real deposit rate $(d-\dot{p})$, where $\dot{p}$ denotes the rate of inflation. As discussed before, restrictions on the level of the deposit rate create costs of regulation-avoidance in order to compete for deposit mobilization. Therefore, an increase in the real deposit-rate should induce the substitution of explicit interest for implicit premia to depositors, thus decreasing the administrative costs of mobilizing deposits.

Interest-rate regulations include ceilings on lending rates. These constraints on the interest rates that can be charged on loans generate costs of implementing loan procedures that allow lenders to discriminate among borrowers. The higher the ceiling on the lending rate, the more flexible and less constrained are these lending operations. Again, explicit interest charges can take the place of implicit charges, and lenders' costs can be reduced through the adoption of less-complicated loan procedures. This effect will not only reduce lenders' costs but, as will be argued later, will also benefit borrowers since transaction costs associated with borrowing will be reduced as well. The ex-post real lending rate $(\ell-\dot{p})$ computed using the interest-rate ceiling ℓ and the rate of inflation $\dot{p}$, will be specified in the cost function as another indicator of interest-rate regulations, along with the real deposit rate defined above. The relevant expression that will be included in the cost function (4.2) can be written as:

$$\lambda_1(d-\dot{p}) + \lambda_2(\ell-\dot{p}) \tag{4.16}$$

where, d, $\dot{p}$, and ℓ have been defined above. The foregoing discussion about the effects of interest-rate regulations indicates that the signs of λ_1 and λ_2 should be negative.

Loan Targeting and Special Credit Projects

The most important financial intermediary dealing with targeted funds and special credit projects in Honduras throughout the period considered in this study (1971-1982) has been the National Agricultural Development Bank (BANADESA). Only recently have some private banks participated in externally-funded projects sponsored by the World Bank, and to a lesser extent by the U.S. Agency for International Development (USAID). Therefore, the analysis of the effects of loan-targeting on intermediation costs will concentrate on the development bank. A separate study has reported and analyzed the lending costs associated with different sources of funds in both the development bank and a private commercial bank dealing with agriculture [26]. The findings of this cross-sectional comparative study will be referred to when discussing the results obtained in the econometric analysis of targeting in the development-bank case.

The effects of targeted funds and special credit projects on intermediation costs were discussed in section 3.1. These programs have a direct effect on lenders' costs due to the additional accounting and record-keeping personnel and materials necessary to comply with the reporting requirements of these programs. Typical sources of targeted funds in Honduras are the central bank, and donor agencies. Central-bank funds correspond mainly to crop-specific lines of credit designed to provide short-term financing to small and medium-size farms. Foreign funds usually come in the form of special projects targeted to specific activities, and tend to include a larger proportion of long-term loans. In what follows, the term "external funds" will be used to refer to both central-bank and foreign funds. The other, non-targeted, source of funds for BANADESA are demand, savings and time deposits from public-sector institutions, and from the public at large.

It is further hypothesized that the effect of targeted funds on costs in the development bank includes a "ratchet" effect. That is, the increased level of costs growing out of a new credit project contracted by the bank does not decline to the previously existing cost level once the loan funds have been disbursed to the ultimate borrowers. Additional resources are employed or purchased at the beginning of the project in order to comply with the project's targeting requirements, but these resources are not laid-off or sold once the funds are disbursed. The cost function will thus incorporate a set of variables that capture the effect of targeted funds under this "ratchet" effect hypothesis. Three indicator variables (S_i, i=1,2,3) are defined to account for the effect of the three different sources of funds: deposits, central bank, and foreign funds. In order to capture the influence of targeted funds under the "ratchet" effect hypothesis, S_i's are defined so that $S_i > 0$ if the value of funds coming from source i has increased over the level observed in the previous year, otherwise $S_i = 0$. Specifically, the value of S_i in year t (S_{it}) will follow a three-point distribution, such that:

$$S_{it} = 0, \text{ if } \Delta_{it} \leq 0$$

$$S_{it} = 1, \text{ if } 0 < \Delta_{it} \leq (1/2)\ \Delta_{itm}$$

$$S_{it} = 2, \text{ if } (1/2)\ \Delta_{itm} < \Delta_{it} \leq \Delta_{itm},$$

where, Δ_{it} stands for the difference between the amount of funds coming from source i in year t, and the amount of these funds in year t-1,

Δ_{itm} is the maximum value of this difference observed over the period covered by the data (1971-1982).

A combined variable, S_{23} is similarly defined to account for the effect of all external funds combined (central-bank and foreign funds together). The "ratchet effect" hypothesis implies that a positive sign is expected in the coefficients of the S_i variables that capture the effects of targeted funds, i.e., central-bank and foreign funds. The estimation will consider the possibility that these effects may be lagged, particularly for foreign-donor funds, since this source of funding is often in the form of special projects with delayed period of disbursement and expenditures. Consequently, external funds combined, and foreign funds alone are also specified with a one-year lag, to capture the lagged effect increases in these sources of funds are likely to have on costs.

Summarizing, the set of indicator variables that will enter the cost function to address the issue of loan-targeting can be written as:

$$\omega_1 S_1 + \omega_2 S_2 + \omega_3 S_3 \quad , \tag{4.17}$$

or alternatively:

$$\omega_1 S_1 + \omega_{23} S_{23} \quad ,$$

where, S_i's have been defined above and ω_i's are the corresponding parameters.

The variables S_2 and S_{23} are also included with a one-year lag in various regressions.

4.1.4. Delinquency and Default

The treatment of delinquency will focus on the effects that variations in the delinquency rate are likely to have on loan-administration costs. These cost-increasing effects of delinquency are due to the allocation of additional resources to loan recovery, and costs associated with legal procedures to handle loans in default. Special departments or task-forces are often created, or existing units reinforced with additional personnel and resources to deal with delinquency.

A likely second-round effect of increases in loan delinquency on the costs of financial institutions emerges from the tightening of lending procedures. Banks tend to become more cautious in loan-approval, and upgrade their loan-evaluation departments in the presence of a growing delinquent portfolio. This second-round effect of delinquency is likely to operate with a lag, whereas the allocation of additional resources to loan recovery discussed above may be an almost contemporaneous reaction to increasing delinquency.

An important consideration in the treatment of delinquency and default is the classification of delinquent balances by age. Banks usually will not take actions on balances until they are 30 days overdue, nor will they actively pursue loans more than 4-years delinquent. Therefore, the age classification of delinquent balances should be taken into account in defining the variables that account for the effects of delinquency on administrative costs. Delinquent balances between 90 days and 4 years overdue will be considered here as "active delinquency". The expression included in the cost function to capture the effects of delinquency can be written as follows:

$$\pi_1 DR + \pi_2 DA \qquad (4.18)$$

where, DR is the delinquency rate computed as the ratio of total overdue balances over total loans outstanding,

DA is the proportion of total delinquent balances that is more than 90 days and less than 4 years overdue.

Both DR and DA will be also included with a one-year lag to test for the second-round effects of delinquency. In all cases, cost-increasing effects of delinquency should be reflected in positive signs of the estimated parameters involved in expression (4.18).

4.1.5. Data and Estimation

The estimation of the cost function will draw upon two separate data sets. The first data base corresponds to 28 branches of the National Agricultural Development Bank (BANADESA) over the 12-year period 1971 through 1982. This bank is referred as the "development bank". The second data set was obtained from the largest private commercial bank of the country (Banco Atlántida), that will be referred to as the "private bank". This bank has a network of over 50 agencies and offices throughout the country, that is organized into 16 main branches with independent accounting records. The same 12-year period (1971-82) is covered by this data set. Data were gathered through the Economic Studies departments of both banks, and in many cases directly from the branches. Financial-sector and national-income variables were recorded from Central Bank publications.

All variables have been expressed in real terms (lempiras of 1966) using the country's implicit GDP deflator. Exceptions are the number of loans, the number of deposit accounts, and several dummy or categorical variables already defined in previous sections. Variable definitions are briefly outlined below.

(a) Costs. Total non-financial operating expenses, net of depreciation and provisions for bad debt. The sources of these data in both banks were the revenue-expenditure statements of the branches, produced by the accounting divisions.

(b) Outputs. Alternative definitions of output utilized here are: (i) the number of loans, and the number of deposit accounts (as separate outputs), (ii) the value of loans, and the total amount of deposit balances at year-end (also as separate outputs), and (iii) an index of aggregate bank output computed as the sum of loans plus deposits.[6/] Information on the number of loans was not available from the private bank, excepting the last two years of the series. Therefore, the definition of output in this case was constrained to those stated in value terms.

(c) Factor Prices. Two factors are considered here: labor, and capital goods. The price of labor services (p_1) is measured as total personnel costs including benefits and social security payments divided by the total number of employees. A unit price of capital services (p_2) is proxied

6/ See section 4.1.2 for a discussion of these definitions.

by the ratio of depreciation _plus_ rents paid over the total value of loans _plus_ deposit balances. This proxy was found positively (and significantly) correlated with the implicit deflator of gross domestic capital formation in the national accounts. _A posteriori_ support for this proxy selection is the fact that the factor-price homogeneity condition is met in most (unrestricted) estimations of the cost function.

(d) Loan Size and Deposit Size. These variables are included in the model to account for the heterogeneity of loans and deposit accounts (see section 4.1.2). Loan size is computed as the ratio of total value of loans over the total number of loans. Deposit size is calculated as the ratio of total deposit balances at year-end over the total number of deposit accounts. Since the number of loans was not available in the case of the private bank, loan size could not be computed for this bank.

(e) Real deposit-rate and real lending-rate. Two approaches were used to compute the nominal deposit rate (d). First, it was calculated as the arithmetic mean of all deposit-rate ceilings established by the central bank. This average deposit-rate will be denoted d_c. Second, the implicit rate paid on deposits by each bank was computed as the ratio of total interest payments over total deposit balances. This second variable is denoted d_p, and can be interpreted as the bank's average cost of funds under regulated conditions. In both cases, the real deposit-rate is obtained by substracting the inflation rate $\dot{p}$ from the nominal deposit rate. The real lending rate is proxied substracting the inflation rate from the overall ceiling established for the nominal interest rate on loans, ℓ. The rate of inflation is calculated as the 12-month variation in the implicit GDP deflator.

(f) Delinquency rate. Only the development bank provided information on delinquency. The ratio of overdue balances over total loans outstanding was computed as a measure of the delinquency rate. The age-classification of delinquent balances in the development bank does not break down balances more than 1 year overdue. Therefore, the variable that accounts for "active delinquency" (DA in expression 4.18) is redefined to include all delinquent balances over 90 days overdue.

Estimation of the translog cost function (4.2) was undertaken independently for the two banks, both as a single equation (by OLS), and as a cost system with the cost-share equations (4.3). Since cost shares must add to 1, one of these equations is redundant and therefore is dropped from the system. The remaining equations in the system, the cost function and the labor-share equation, are seemingly unrelated and the estimation of this two-equation system utilizes a generalized-least-squares procedure. Joint estimation of the cost system should improve the efficiency of the parameter estimates [21,69,70]. However, Benston, Hanweck and Humphrey [17] argue that these gains in efficiency are relatively small and undertake their estimations using OLS on the cost function above. As will be shown later, aside from efficiency gains, there may be important differences in the magnitude of the estimated parameters resulting from different estimation procedures. As a consequence, the scale-economies measure (and other parameters) will differ depending on the estimation technique.

4.2. Borrower's Costs

The methodological issues involved in the empirical assessment of the general model set forth in section 3.3 are discussed here. This model was formulated in general form as:

$$T = T(B, i) , \tag{4.19}$$

where,

- T is the borrowing (non-interest) transaction costs per loan
- B is a vector of risk-related characteristics of the loan operation (loan size, firm size, loan use, etc.)
- i is the explicit interest rate that can be charged on loans by the lender.

The definition of transaction costs that will be used as the dependent variable in this general model is outlined below. The elements involved in a trade-off equation between transaction costs and explicit interest rate are then briefly discussed. This discussion includes the selection of proxies for loan risk, and the specification of a mathematical form for the general expression (4.19) above. Since this section of the empirical work focuses on agricultural loan operations, the expressions farmers, clients, and borrowers will be used interchangeably.

4.2.1. Transaction Costs

Transaction costs are defined here as all those non-interest explicit and implicit expenses incurred by the borrower in the process of obtaining a loan. These costs occur at different stages in the sequence of procedures established by the lending institution, i.e., application and documentation, approval, and disbursement. Explicit expenses refer basically to the following:

(a) Cost of transportation, lodging and meals when travelling to the office of the institution granting the loan, or to other places with the purpose of obtaining related documents;

(b) Fees, taxes or other charges associated with the issuing of documents, registration of guarantees or collateral, contracts and the like; and,

(c) Other explicit charges imposed by the lending institution in the process of handling the loan application.

The implicit transaction costs directly related to borrowing correspond to the value of the time foregone by clients in negotiating and securing their loans.

When transaction costs per loan, T, are expressed as a percent of the loan amount, we obtain the implicit element (τ) involved in the interest-rate factor discussed in section 3.3.

4.2.2. A Trade-off Equation between Transaction Costs and the Interest Rate

The general model defined by expression (4.19) corresponds essentially to a trade-off equation between transaction costs of borrowing and the explicit interest rate. In this equation, the risk-related elements of vector B will play the role of shift and/or interaction variables. Likewise, the model will account for behavioral or managerial differences between loan sources (development bank, private banks, credit unions) that may affect both the level of borrowing-transaction costs and the magnitude of the trade-off between these and the explicit interest rate charged on the loan.

Characteristics of the Loan Operation

The components of vector B in the model refer primarily to variables associated with the risks of lending from the point of view of the lender. Key elements underlying these risks can be summarized as follows:

(a) Firm size. This factor is related to the client's wealth and loan-repayment capacity. *Ceteris paribus*, a wealthier client represents a larger debt capacity and a better ability to repay. Therefore, as the size of the firm increases, transaction costs of borrowing should decrease.

In the case of agricultural loans, a logical proxy for firm size is the area of the farm. However, the heterogeneous nature of land quality in Honduras might affect the validity of this variable as a proxy for size. Other size measures available in the data will be specified as alternatives to farm area. These other proxies for size include the number of hired laborers, total labor costs, cultivated cropland, and the value of collateral declared by the borrower.

(b) Loan amount. The relationship between this characteristic and the level of risk has been discussed before (see section 4.1.2.). It is expected that, everything else constant, the riskiness of a loan increases with loan size, thus creating additional transaction costs for both the lender and the borrower. At this point, it is important to distinguish between transaction costs per loan and transaction costs per lempira. If transaction costs per loan increase in exactly the same proportion in which the loan amount increases, transaction costs per lempira will remain constant. The hypothesis set forth here is that as loan size increases, transaction costs per loan increase at a decreasing rate; therefore the magnitude of transaction costs per lempira borrowed will decrease as the loan amount increases.

(c) Loan use. This feature refers to enterprise-type characteristics associated with different levels of production risks, marketing risks and built-in collateral. The end-use of the loan may be considered relevant by the lender in any of the following cases. First, if the lender is not aware of diversion and fungibility, and/or believes that loan-monitoring will guarantee that loan funds are devoted to the stated end-use. Second, if the stated end-use is known to be the single most important activity of the borrower. Third, if the activity allegedly being financed with the loan is developed under a three-party marketing-repayment agreement between the borrower, the lender, and a marketing firm. If none of these conditions is present, loan-use in general should not be a factor in the lender's assessment of loan risk. The discussion that follows assumes that some consideration is given to the stated end-use of loans in evaluating the risks of lending.

The most important end-uses of agricultural loans are represented by a set of dummy variables in the model set forth below. Among these end-uses, basic grains may be considered one of the riskiest activities in Honduran agriculture. This consideration is due to the crops' exposure to weather-related phenomena (droughts in the south, floods in the north) that frequently reduce yields and profitability. Furthermore, despite government efforts to raise farm-level prices these have not improved significantly for producers, due in part to increasing marketing margins and imperfect marketing structures.7/ This adds uncertainty of marketing to the production risks mentioned above, thus making basic grains possibly a less-preferred lending activity. It follows from this reasoning that loans for basic grains will carry higher transaction costs than loans for other uses.

Transaction costs (and risks) associated with loans to export-crops can be expected to be lower-than-average. These crops, such as sugar, tobacco, cotton, and others, are grown under marketing-repayment schemes agreed upon between processing firms, banks and producers. These agreements minimize marketing risks and in many cases eliminate default risks for the lender. Furthermore, the processing/marketing agent usually provides technical assistance that reduces production risks through the adoption of improved inputs and practices. Finally, the behavior of transaction costs in the case of livestock activities in Honduras is more difficult to predict. On the one hand, tropical diseases, inefficient cattle-raising techniques, and poor animal-health resources make livestock a rather unreliable source

7/ See Pollard, Graham, and Cuevas [75].

of income for farmers. Furthermore, dairy products have controlled prices at retail, and beef markets have been subject to depressed price conditions for several years. These production and marketing conditions mean that livestock should be seen as a "bad risk" by lenders. However, livestock (as well as machinery) is a typical end-use with built-in collateral, since the animals purchased can be made a part of the loan guarantee. This particular feature makes the expected response of lenders to these loans ambiguous, and therefore the expected sign of the differential transaction costs associated with these loans is also ambiguous.

Specification

The trade-off equation between transaction costs and interest rate can now be written more explicitly as:

$$T = f(A, L, i, D, U) \tag{4.20}$$

where,

A is the area of the farm,

L is the loan amount,

i is the explicit interest rate charged on the loan

D is a set of dummy variables representing different loan sources for the borrower,

U is a set of dummy variables accounting for different end-uses of loans.

Most previous studies on borrowing transaction costs have been descriptive in the presentation and treatment of their results [3,40]. Therefore, these studies do not provide a priori elements to select a specific mathematical form for the trade-off equation (4.20). In other cases, the market of loanable funds has been modeled as a supply-demand system specifying linear forms for the equations involved but neglecting transaction costs [44]. The issue of simultaneity requires particular attention, and is discussed below.

Even under the price-setting framework set forth in section 3.3, the loan-amount variable L on the right-hand side of equation (4.1) may be considered endogenous rather than pre-determined. This loan amount would be a point on the borrower's loan-demand function outlined in section 3.3, which, together with the trade-off equation (4.20), would conprise a two-equation system with T and L as endogenous variables. The system will be recursive if it is assumed that borrowers neglect transaction costs when making borrowing decisions, i.e., the loan demand is a function of the explicit interest rate, and the individual's resource endowment,

$$L = h(i,W) \tag{4.21}$$

where,

i is the explicit interest rate,

W represents the borrower's resource endowment that influences the potential size of his investment projects,

$L'_i < 0$, $L'_W > 0$.

If on the other hand it is assumed that borrowers do consider transaction costs as part of the loan price, the system should be specified in a simultaneous-equations model. In this case the loan-demand function can be written as:

$$L = g(i,T,W) \tag{4.22}$$

where,

$L'_i < 0,\ L'_T < 0,\ L'_W > 0.$

As will be explained in the following section, the data base utilized to analyze borrower's transaction costs do not include information to measure the borrower's resource endowment. Therefore the estimation of a system of equations with T and L as endogenous variables is not attempted in this study. The empirical approach undertaken here estimates the single equation (4.20), recognizing the shortcomings involved if the "true" model is the one that considers the loan amount L as endogenous. Under the hypothesis that loan demand does not depend on transaction costs, as in equation (4.21), the problem of estimating the single equation (4.20) would be multicollinearity, with no bias in the parameter estimates. However, if the true model involves a loan-demand function such as (4.22) where the loan amount depends on the magnitude of transaction costs, then the trade-off equation (4.20) includes a variable (i.e., loan amount) that is correlated with the error term. In this case, the single-equation estimation of (4.20) would yield biased and inconsistent estimates of the parameters in the model. It can be shown that the bias is negative for the coefficient associated with the loan-amount variable, and positive in the case of the interest-rate variable (see appendix B, section B.3). As will be clear in chapter 6, these potential biases do not affect the essence of the conclusions derived from the results obtained in the estimation of the transaction-costs function (4.20). The mathematical form of this function is specified below.

The trade-off equation between transaction costs and interest rate is specified as a generalized power function [28], in log-linear form:

$$\ln T = a_0 + a_1 \ln A + a_2 \ln L + a_3 \ln(i) + b_1 D_1 + b_2 D_2 + c_1 U_1 + c_2 U_2 + c_3 U_3 \qquad (4.23)$$

where,

T is the borrowing (non-interest) transaction costs per loan,

A is the area of the farm,

L is the loan amount,

i is the explicit interest rate that can be charged on the loan by the lender,

D_1 and D_2 are dummy variables that account for deviations of T in private banks and credit unions with respect to the development bank, that is used as the base or level of reference,

$D_1=1$ if the lender is a private bank,

$D_1=0$ otherwise,

$D_2=1$ if the lender is a credit union,

$D_2=0$ otherwise,

U_1, U_2, and U_3 are dummy variables defined to capture the effects on transaction costs of different loan-uses: basic grains, export crops, and livestock, as deviations with respect to a miscellaneous end-use category conformed by all other end-uses in agriculture (land purchases, trade, vegetable crops, and others),

$U_1=1$ if the stated end-use of the loan is basic grains,

$U_1=0$ otherwise,

$U_2=1$ if the stated end-use of the loan is export crops,

$U_2=0$ otherwise,

$U_3=1$ if the stated end-use of the loan is livestock,

$U_3=0$ otherwise.

The generalized power function was chosen in order to obtain direct estimates of the elasticities of transaction costs with respect to the explanatory variables. Also, this functional form guarantees that transaction costs will be zero if there is no loan operation (L=0), and that predicted values will be non-negative.

From the discussion about the characteristics of loan operations and their relationship with risk, it follows that the expected signs of the partial derivatives in equation (4.23) are:

(a) Area of the farm, A, proxy for borrower's wealth,

$\partial \ln T/\partial \ln A=a_1 < 0$,

as borrower's wealth increase transaction costs of borrowing decrease.

(b) Loan amount, L

$0 < \partial \ln T/\partial \ln L=a_2 < 1$, as the loan amount increases, transaction costs per loan increase but at a decreasing rate. If this holds then $\partial ln\tau/\partial lnL=(a_2-1) < 0$, i.e., transaction costs per lempira ($\tau=T/L$) are a decreasing function of loan amount. Note that, from the definition of elasticity, the slope of the transaction costs (per loan) curve can be written as:

$$\partial T/\partial L=a_2(T/L)=a_2\tau,\ 0 < a_2\tau < 1.$$

Since in general the ratio of transaction costs to loan amount (transaction costs per lempira borrowed) is less than 1, the slope of the transaction costs per loan curve will be positive but less than 1. The value of this slope will decrease as loan amount increases.

In turn, the slope of the transaction costs per lempira curve can be written as:

$$\partial ln\tau/\partial lnL=(a_2-1)(\tau/L)=(a_2-1)(T/L^2),\ < 0.$$

In other words, the absolute value of the slope of this function is inversely related to the loan amount. This downward sloping curve will be very steep for small loans, and relatively flat for large loans.

(c) Interest rate, i

$$\partial lnT/\partial lni=a_3 < 0,$$

transaction costs (implicit interest) and the (explicit) interest rate charged on loans are substitutes. In other words, a trade-off exists between transaction costs and the interest rate. Note that under this functional form, the elasticity of transaction costs per lempira with respect to the interest rate is also a_3,

$$\partial \ln\tau/\partial \ln i = a_3 < 0.$$

Therefore, the absolute change in transaction costs per lempira induced by a one-unit change in the explicit interest rate is given by

$$\partial\tau/\partial i = (\partial \ln\tau/\partial \ln i)(\tau/i) = a_3(T/iL), < 0.$$

In short, the absolute magnitude of the change in transaction costs due to a change in the interest rate is directly proportional to the ratio of transaction costs over interest costs (T/iL). Also, the response of τ to a change in the interest rate is inversely proportional (in absolute value) to the level of the explicit interest rate, and to the loan amount. This trade-off between transaction costs and interest rate will be discussed further below.

(d) Loan sources, D_1, D_2

The hypothesis that in general the loan source (type of lender) is a factor in determining the level of transaction costs can be tested under the joint null hypothesis $b_1=0, b_2=0$. It is expected that this hypothesis will be rejected, i.e., that loan source is a significant factor in the transaction-costs function.

Since private banks may be expected to be more efficient in "passing-on" intermediation costs to the borrowers, it is anticipated that

$$\partial \ln T/\partial D_1 = b_1 > 0.$$

In other words, it is expected that transaction costs of borrowing from private banks will be higher than those associated with development-bank loans, which serve as level of reference in equation (4.24).

Also, given that loan procedures are in general less complicated in credit unions it can be expected that borrowing from these institutions will imply lower transaction costs, i.e.,

$\partial \ln T/\partial D_2=b_2 < 0.$

(e) Loan uses, U_1, U_2, U_3

The significance of end-use as a determinant of the level of transaction costs can be analyzed testing the joint null hypothesis $c_1=0$, $c_2=0$, $c_3=0$. The conditions under which end-use would matter in the determination of loan procedures and transaction costs have been discussed before. This discussion does not lead to any specific expectation about the result of the joint test indicated above. As regards the signs of the parameters associated with specific end-uses, the discussion in the preceding section suggests that

$\partial \ln T/\partial U_1=c_1 > 0$, for basic grains,

$\partial \ln T/\partial U_2=c_2 < 0$, for export crops, and

$\partial \ln T/\partial U_3=c_3 \gtrless 0$, for livestock.

The specification of the transaction-costs equation (4.23) determines that the magnitude of the elasticity of transaction costs with respect to changes in the explicit interest rate will be a constant parameter ($\partial \ln T/\partial \ln i = a_3$). However, it can be expected that this elasticity will be affected by other variables in the model. Specifically, lenders may react differently to changes in the interest rate when dealing with very small loans or very small firm sizes. In these cases, the loan procedures that create borrower's transaction costs tend to be more rigid, therefore the magnitude of the trade-off or substitution between transaction costs (implicit interest) and the explicit interest rate may be smaller than average, in absolute terms. Also, the response of different lenders to changes in the interest rate may differ due to different institutional structures, overall flexibility of loan procedures, and managerial goals and capabilities. These considerations suggest the inclusion of interaction effects in equation (4.23), in order to account for the effect of very small loan sizes, firm sizes, and different lenders, on the elasticity of transaction costs with respect to the interest rate. The term $a_3\ln(i)$ in equation (4.23) is then substituted by the following expression:

$$a_{30}\ln(i) + a_{31}S\ln(i) + a_{32}D_1\ln(i) + a_{33}D_2\ln(i) + a_{34}F\ln(i) \tag{4.24}$$

where,

S is a dummy variable for loan-size category,

S=1 if the loan amount is less than or equal to L.2,000,

S=0 otherwise,

F is a dummy variable for farm-size category,

$F=1$ if the area of the farm is less than or equal to 20 hectares,

$F=0$ otherwise,

i, the interest rate, and the dummy variables for loan source D_1, D_2 have been defined before.

With this change in specification, the trade-off between transaction costs and the interest rate in elasticity form is given by

$$\partial \ln T/\partial \ln i = a_{30} + a_{31}S + a_{32}D_1 + a_{33}D_2 + a_{34}F. \qquad (4.25)$$

It is expected that in all cases the sign of the elasticity will be negative, i.e., $\partial \ln T/\partial \ln i < 0$. The interaction variables now included in expression (4.25) will only affect the magnitude of this elasticity. The discussion above is consistent with expected signs of the coefficients in (4.25) as follows:

$a_{31} > 0$, $a_{34} > 0$

i.e., the absolute value of the elasticity is reduced when dealing with very small loans or very small farm sizes.

$a_{32} < 0$, $a_{33} \gtrless 0$,

Private banks will be more responsive to changes in the interest rate, due to a greater flexibility of procedures and better managerial abilities. Even though loan procedures are less complicated and fairly flexible in credit unions, their management is not likely to respond actively to changes in the economic environment, therefore the expected sign of a_{33} is ambiguous.

Finally, a_{30} is also expected to be negative. This is the value of the elasticity in the case of loans larger than L.2,000 (S=0), granted by the development bank ($D_1 = D_2 = 0$) to borrowers with farms of more than 20 hectares (F = 0).

4.2.3. Data and Estimation

The estimation of the borrower's transaction-costs function (4.23) in its original form, and with the modifications introduced by expression (4.24), will draw upon field-level data obtained in a survey undertaken in July-August 1981. This survey included some 200 observations of farmer-clients of the development bank (BANADESA), private banks, and credit unions. The interviews were conducted in four important agricultural regions of Honduras, by an unusually competent survey team under the author's supervision. The survey questionnaire was designed to measure the costs incurred by borrowers when applying for and obtaining loans from institutional sources. These costs include the costs of transportation, lodging and meals incurred in trips to the office of the institution or other places, with purposes related to the loan application or to its disbursement. Fees, taxes or other charges associated with the issuance of documents, registration of guarantees, and contracts, were also documented, as well as miscellaneous charges imposed by the lending institution. The time spent by the farmer in negotiating and securing the loan was also recorded, in order to compute an imputed cost that is added to the other (explicit) costs of borrowing, to obtain the total borrower's transaction costs.

The explicit interest rate paid on the loan, the loan amount, farm size, hired labor, and end-use of the loan are among the variables documented in the survey. However, the emphasis on measuring transaction costs of borrowing and other related variables constrained the measurement of different components of the resource endowment available to the farmer. This restriction makes it difficult to attempt the specification and estimation of a loan-demand function that completes the system of equations referred to in section 4.2.2 above. Instead, a single-equation approach will be used to estimate the transaction-costs function (4.23), and its extended version with expression (4.24). The econometric problems that might affect this estimation procedure have been discussed above (see section 4.2.2).

Chapter V

Lender's Intermediation Costs

This chapter first reviews the estimates of the cost functions for the development bank and the private bank obtained (section 5.1). This overview addresses the methodological issues of output definition, functional form, and estimation procedure in terms of their effects on the overall statistical performance of the cost-function estimates. This section also provides estimates of the average and marginal costs of lending, as well as the average and marginal costs of mobilizing deposits, for the two banks under study. Second, the results obtained for the measures of economies of scale, economies of scope, and factor substitution are presented and contrasted between the two banks (section 5.2). Section 5.3 deals with the effects of interest-rate regulations on intermediation costs in the two institutions. Then, section 5.4 presents and discusses the effects of loan-targeting and special credit projects on portfolio composition and costs of the development bank. The results obtained for the effects of delinquency on this bank's costs are reviewed and discussed in the final section.

5.1. Overview of Results

This section is organized in three parts: the first and second parts report the separate results of the cost-function estimates of each bank. The methodological issues and problems associated with the estimation are also discussed. Estimates of average costs and marginal costs are obtained using the functional specifications and estimation procedures that are judged best among the different alternatives considered. The results for the two banks are summarized and contrasted in the final part of this section, emphasizing their economic interpretation and policy implications.

5.1.1. The Cost Function of the Development Bank

The results obtained from the estimation of the bank's cost function, with different output definitions and two functional forms, are summarized in table 3. Detailed results of the estimated equations referred to in table 3 are reported in appendix C, tables 33 and 34. These results correspond to the (unrestricted) single-equation estimation of different model specifications.[1/] The issue of system estimation versus single-equation estimation will be considered later.

Three general results are clear from the observation of table 3. First, the output definition that considers loans

1/ Factor-price homogeneity restrictions were not significant when imposed on any of the equations.

and deposits as separate outputs performs better in terms of statistical results than the equations including the single-output definition (loans *plus* deposits). Comparison of rows (1) and (3) in each column of table 3 indicates that the R-square values for the equations with the two-output definition are consistently higher than those obtained with the single-output (aggregate) specification. Second, output defined in value terms (value of loans, deposit balances) provides a better statistical fit than estimations using number of loans and number of deposit accounts. This is evident from the comparison of columns (1) and (2) against columns (3) and (4) in table 3. All R-square values reported in the two right-hand columns of this table (value of loans, deposit balances) are higher than those shown in the first two columns (number of loans, number of deposit accounts), regardless of the functional form utilized in the estimation of the cost function. Third, the translog specification performs statistically better than the Cobb-Douglas form, under all different output definitions. This result is clear from the comparisons of column (1) *versus* column (2), and column (3) against column (4) in table 3. The R-square values associated with the translog form are significantly higher than those obtained with the Cobb-Douglas specification. The F-ratios reported in table 3 indicate that these differences are statistically significant at the 1% level in all cases.

Table 3. Development Bank: Summary of R-square Values from the Estimation of the Cost Function, Under Different Output Definitions and Functional Forms

Output Definition: Number of Loans and Deposit Accounts *versus* Value of Loans and Deposit Balances Functional Form: Cobb-Douglas *versus* Translog				
	(1)	(2)	(3)	(4)
Output Definition: Two-Output *versus* Single-Output	Number of Loans, Number of Deposit Accounts		Value of Loans, Deposit Balances	
	Cobb-Douglas	Translog	Cobb-Douglas	Translog
Two-output: loans, q_1, and deposits, q_2				
(1) R^2	0.7567	0.7922	0.8208	0.8598
(2) F-test of functional form[a/]	--	2.47*	--	7.60*
Single-output: loans *plus* deposits ($Q = q_1 + q_2$)				
(3) R^2	0.7325	0.7650	0.7946	0.8167
(4) F-test of functional form	--	3.45*	--	5.08*

Source: Tables 33 and 34 in appendix C.

a/ $F = [SSE_C - SSE_T)/(k_T - k_C)]/(SSE_T/N-k_T)$, where SSE = error sum of squares,
k = number of estimated parameters,
C denotes Cobb Douglas form,
T denotes Translog form.

* : significant at 0.01 level.

Overall, the "best" specification for the cost function of the development bank is the translog form that includes output as two separate variables expressed in value terms, value of loans and deposit balances (column 4 in table 3, and table 33 in appendix C). The remainder of this section will concentrate on the results obtained with the two-output specifications, both in terms of numbers of accounts and in value terms. The implications of using the sum of loans plus deposits as a measure of aggregate output will be discussed in section 5.2, in reference to the value of the scale-economies parameter.

Single-Equation and System Estimation

Tables 4 and 5 present the results obtained for the cost function using single-equation estimation (OLS) and system estimation (GLS). Table 4 reports the results for the cost function using numbers of loans and deposit-accounts as bank outputs, whereas table 5 deals with outputs defined as value of loans and deposit balances. It is clear in both tables that system estimation improves overall goodness-of-fit of the estimations, and specially the statistical significance of individual coefficients. Significance of individual coefficients appears weak in the case of single-equation estimation due to multicollinearity. The additional degrees of freedom gained through the adoption of the system approach provide a solution for this low level of statistical significance.

Table 4. Development Bank: Estimated Parameters of the Cost Function. Output Defined as Number of Loans (q_1) and Number of Deposit Accounts (q_2). Single Equation *versus* System Estimation.[a/]

	(1) Single Equation (OLS)		(2) System of Equations (GLS)	
Parameter (Variable)	Estimate	t-ratio	Estimate	t-ratio (asymptotic)
α_0 (intercept)	9.3081	2.382*	9.0209	4.005*
α_1 ($\ln q_1$, no. of loans)	-0.6827	-1.222	0.0274	0.080
α_2 ($\ln q_2$, no. of deposit accounts)	-0.6293	-0.486	-1.5806	-2.238†
β_1 ($\ln p_1$, price of labor)	0.6978	1.077	0.8020	8.073*
β_2 ($\ln p_2$, price of capital)	0.3021	0.466	0.1980	1.994†
γ_{11} $(\ln q_1)^2$	-0.0931	-1.748°	0.0620	1.845°
γ_{22} $(\ln q_2)^2$	-0.0700	-0.255	0.3796	2.547*
γ_{12} $(\ln q_1 \ln q_2)$	0.1973	1.618°	0.0365	0.481
δ_{11} $(\ln p_1)^2$	-0.0111	-0.149	0.1007	13.686*
δ_{22} $(\ln p_2)^2$	-0.0111	-0.149	0.1007	13.686*
δ_{12} $(\ln p_1 \ln p_2)$	0.0111	0.149	-0.1007	-13.686*
η_{11} $(\ln q_1 \ln p_1)$	0.0257	0.561	-0.0604	-7.482*
η_{12} $(\ln q_1 \ln p_2)$	-0.0257	-0.561	0.0604	7.482*
η_{21} $(\ln q_2 \ln p_1)$	0.0499	0.366	-0.0730	-4.004*
η_{22} $(\ln q_2 \ln p_2)$	-0.0499	-0.366	0.0730	4.004*
R^2	0.7749	---	0.7898[b/]	---
F-value	57.37*		38.64*	
Weighted R^2 (system)			0.4238	

a/ Factor-price homogeneity restrictions imposed on all estimated equations. Cross-equations restrictions imposed on system estimation. N=160. DFS=306. Significance levels: *, .01; †, .05; °, .10.

b/ R^2 of labor-share equation: 0.2775, F-ratio = 14.79.

Table 5. Development Bank: Estimated Parameters of the Cost Function. Output Defined as Value of Loans (q_1) and Deposit Balances (q_2). Single Equation *versus* System Estimation.[a/]

	(1) Single Equation (OLS)		(2) System of Equations (GLS)	
Parameter (Variable)	Estimate	t-ratio	Estimate	t-ratio (asymptotic)
α_0 (intercept)	5.3210	9.817*	4.7545	14.219*
α_1 ($\ln q_1$, value of loans)	0.1439	1.153	0.3434	4.890*
α_2 ($\ln q_2$, deposit balances)	0.0163	0.101	-0.1037	-1.188
β_1 ($\ln p_1$, price of labor)	0.5439	3.399*	0.5776	14.385*
β_2 ($\ln p_2$, price of capital)	0.4561	2.851*	0.4224	10.518*
γ_{11} $(\ln q_1)^2$	0.0931	3.388*	0.1351	10.502*
γ_{22} $(\ln q_2)^2$	-0.0429	-1.211	0.0967	4.756*
γ_{12} $(\ln q_1 \ln q_2)$	-0.0063	-0.257	-0.0113	-0.723
δ_{11} $(\ln p_1)^2$	0.0003	0.007	0.1022	13.729*
δ_{22} $(\ln p_2)^2$	0.0003	0.007	0.1022	13.729*
δ_{12} $(\ln p_1 \ln p_2)$	-0.0003	-0.007	-0.1022	-13.729*
η_{11} $(\ln q_1 \ln p_1)$	-0.0426	-1.255	-0.0954	-14.914*
η_{12} $(\ln q_1 \ln p_2)$	0.0426	1.255	0.0954	14.914*
η_{21} $(\ln q_2 \ln p_1)$	0.0922	2.786*	-0.0169	-2.029†
η_{22} $(\ln q_2 \ln p_2)$	-0.0922	-2.786*	0.0169	2.029†
R^2	0.8491	---	0.8586[b/]	---
F-value	173.86*		117.51*	
Weighted R^2 (system)			0.7331	

a/ Factor-price homogeneity restrictions imposed on all estimated equations. Cross-equations restrictions imposed on system estimation. N=288. DFS=562. Significance levels: *, .01; †, .05.

b/ R^2 of labor-share equation: 0.2886, F-ratio = 28.50.

The cost system that specifies loans and deposits in value terms (table 5) again presents a better fit (weighted R-square) than the cost-system with output defined in terms of number of loans and deposit accounts (table 4). In both cases the R-square obtained for the labor-share equation is rather low, a result that affects the overall weighted R-square obtained for the system. However, the gains in efficiency of the estimation attained through the use of a system approach are clear. Almost all individual coefficients are statistically significant and in general their magnitudes differ from those obtained under the single-equation approach. As a consequence, scale-economy measures and other related results obtained using the estimated parameters of the cost-system will differ from those derived from single-equation results. These differences will be discussed later in section 5.2. Before considering the expressions for the marginal costs of the two outputs, it is useful to take into account the effects of loan size and deposit size on the estimation of the cost function.

Effects of Loan Size and Deposit Size

The results of the cost-system estimations including loan-size and deposit-size effects are presented in table 6.[2/] In this table, model 1 describes the estimated coefficients of the function that utilizes the number of loans

2/ Results of the single-equation estimation are included for reference in table 35, appendix C.

Table 6. Development Bank: Estimated Parameters of the Cost Function, Including Loan-Size and Deposit-Size Effects. System Estimation with Two Output Definitions[a/]

	Model (output definition)			
	(1) Number of Loans (q_1), Number of Deposit Accounts (q_2)		(2) Value of Loans (q_1), Deposit Balances (q_2)	
Parameter (Variable)	Estimate	t-ratio (asymptotic)	Estimate	t-ratio (asymptotic)
α_0 (intercept)	1.6131	0.941	6.0005	11.489*
α_1 ($\ln q_1$, loans)	-0.3023	-1.117	0.5814	5.787*
α_2 ($\ln q_2$, deposits)	0.4123	0.769	-0.6449	-3.203*
β_1 ($\ln p_1$, price of labor)	0.6710	6.793	0.5585	10.192*
β_2 ($\ln p_2$, price of capital)	0.3290	3.331*	0.4415	8.056*
γ_{11} $(\ln q_1)^2$	0.1116	4.046*	0.1463	8.835*
γ_{22} $(\ln q_2)^2$	0.0027	0.023	0.2619	4.799*
γ_{12} ($\ln q_1 \ln q_2$)	-0.0226	-0.365	-0.0646	-2.693*
δ_{11} $(\ln p_1)^2$	0.0479	5.564*	0.0756	8.041*
δ_{22} $(\ln p_2)^2$	0.0479	5.564*	0.0756	8.041*
δ_{12} ($\ln p_1 \ln p_2$)	-0.0479	-5.564*	-0.0756	-8.041*
η_{11} ($\ln q_1 \ln p_1$)	-0.0445	-5.513*	-0.0766	-9.542*
η_{12} ($\ln q_1 \ln p_2$)	0.0445	5.513*	0.0766	9.542*
η_{21} ($\ln q_2 \ln p_1$)	-0.0356	-1.932†	-0.0103	-0.858
η_{22} ($\ln q_2 \ln p_2$)	0.0356	1.932†	0.0103	0.858
θ_1 ($\ln q_1 \ln LS$, loan-size interaction)	0.0858	19.505*	-0.0091	-2.332†
θ_2 ($\ln q_2 \ln DS$, deposit-size interaction)	0.0527	9.786*	-0.0180	-1.950†
R^2	0.8955[b/]	---	0.8858[b/]	---
F-value	76.03		68.86	
Weighted R^2 (system)	0.7848		0.8168	

a/ Factor-price homogeneity and cross-equations restrictions imposed on estimation. DFS=304.
Significance levels: *, .01; †, .05.

b/ R^2 of labor-share equation: Model (1) = 0.2775 (F = 14.79)
Model (2) = 0.3116 (F = 17.42)

and the number of deposit-accounts as the measure of the bank's outputs. The results that correspond to the definition of outputs in value terms (value of loans, deposit balances) are presented as model 2 in table 6. Both models show satisfactory results from a statistical point of view. In general, model 2 (with output in value terms) performs better than model 1, considering the values of the weighted R-square and the statistical significance of individual coefficients, therefore this model will be preferred later for prediction purposes. The most interesting contrast between the two models corresponds precisely to the estimated coefficients of the loan-size and deposit-size interactions. Both coefficients show positive signs in the function that specifies outputs in terms of numbers of loans and deposit-accounts, whereas these signs are negative when the cost function is specified using the value of loans and deposit balances as output definition. This contrast can be understood more clearly recalling the expressions for the marginal costs of each output, previously developed in section 4.1.

Marginal costs of lending:

$$MC_1 = (C_1/q_1)(B_1 + \gamma_{11}\ln q_1 + \gamma_{12}\ln q_2 + \theta_1 \ln LS) \quad , \quad (5.1)$$

marginal costs of mobilizing deposits:

$$MC_2 = (C_2/q_2)(B_2 + \gamma_{22}\ln q \ + \gamma_{12}\ln q_1 + \theta_2 \ln DS) \quad , \quad (5.2)$$

where, MC_i is the marginal cost of the ith output, i=1,2,

C_i/q_i is the point-estimate of the average cost of the ith output, at given levels of q_i and all other variables in the model (see section 4.1.1),

$B_i = \alpha_i + \Sigma_j \eta_{ij} \ln p_j$, j=1,2

q_1: loans, q_2: deposits,

p_1: price of labor, p_2: price of capital,

LS : loan size, DS : deposit size.

Consider first the marginal cost of lending. Results of model 1 in table 6 show the following signs for the coefficients of the variable affecting the marginal cost <u>per loan</u>: $\hat{\gamma}_{11} > 0$, $\hat{\gamma}_{12} < 0$, $\hat{\theta}_1 > 0$. These signs indicate that the marginal cost <u>per loan</u> is an increasing function of the total number of loans ($\hat{\gamma}_{11} > 0$), is reduced by increases in the total number of deposit accounts ($\hat{\gamma}_{12} < 0$),[3/] and increases with increases in loan size ($\hat{\gamma}_1 > 0$). In short, the marginal cost of a loan is an increasing function of loan size. Now, the signs of the parameter-estimates of model 2 reported in table 6, associated with the marginal costs of lending <u>per lempira lent</u> are: $\hat{\gamma}_{11} > 0$, $\hat{\gamma}_{12} < 0$, $\hat{\theta}_1 < 0$. Therefore, the marginal cost of lending <u>per lempira lent</u> increases with the total amount lent ($\hat{\gamma}_{11} > 0$), benefits from economies of joint production ($\hat{\gamma}_{12} < 0$), and decreases when the loan-size increases $\hat{\theta}_1 < 0$), i.e.,

3/ This coefficient is not significantly different from zero, i.e., the estimated economies of joint production are not too strong when output is defined as numbers of loans and deposit-accounts.

marginal costs of lending per lempira lent are a decreasing function of the loan size.

The results obtained for the costs of mobilizing deposits are qualitatively very similar to those discussed above for the marginal cost of lending. The marginal cost of mobilizing deposits per account (coefficients from model 1 in table 6) tends to increase with the number of accounts ($\hat{\gamma}_{22} > 0$), decreases with increases in the number of loans being jointly produced ($\hat{\gamma}_{12} < 0$), and increases as the deposit-size increases ($\hat{\theta}_2 > 0$). It has to be pointed out that the estimates for both the scale effect ($\hat{\gamma}_{22}$) and the effect of joint production ($\hat{\gamma}_{12}$) are not significantly different from zero. These results suggest that the main determinant of the marginal cost of deposits per account is the average deposit-size. However, in the case of the marginal cost of mobilizing deposits per lempira mobilized (model 2 in table 6) all relevant coefficients are statistically significant. These estimated parameters indicate a clear cost-increasing effect of scale ($\hat{\gamma}_{22} > 0$), a significant cost-saving effect due to joint production of loan services ($\hat{\gamma}_{12} < 0$), and a cost-decreasing effect of deposit size ($\hat{\theta}_2 < 0$).

Summarizing, marginal costs of lending are positively associated with the total volume of lending operations, and benefit from the joint production of deposit services. The marginal cost per loan increases with increases in the loan size, whereas the marginal cost per lempira lent decreases as the loan-size increases. Marginal costs of mobilizing deposits are an increasing function of total deposit activity, and enjoy cost-economies due to joint production of loans. The marginal cost per deposit-account increases as the average deposit-balance increases, whereas the marginal cost per lempira mobilized decreases as the average deposit-size increases.

Point estimation of average costs and marginal costs on a per-lempira basis utilizes the results of model 2 in table 6. This point estimation is obtained evaluating model 2 at the geometric means of all variables involved.[4/] The resulting estimates are the following:[5/]

Share of lending costs in total costs :	71.1%
Share of deposit-mobilization costs in total costs:	28.9%
Costs of lending	
Average cost per lempira lent:	L.0.1002, or 10.02%
Marginal cost per lempira lent:	L.0.0764, or 7.64%
Costs of mobilizing deposits	
Average cost per lempira mobilized	L.0.0878, or 8.78%
Marginal cost per lempira mobilized:	L.0.0272, or 2.72%
Total average costs of intermediation for the bank, per lempira	L.0.1880, or 18.80%

4/ The procedure to allocate total estimated costs among loans and deposits was described in section 4.1.

5/ Figures in lempiras are lempiras of 1966. 1 Lempira = 0.5 US$.

<u>Total marginal costs of intermediation for the bank, per lempira</u> L.0.1036, or 10.36%

The estimated costs of lending reported above are consistent with those reported by Cuevas and Graham [26] in a cross-sectional study of this development bank undertaken in 1982. This study found average costs of lending of 8.4%, using a sample with larger average amounts of funds lent and mobilized, and a loan size almost twice as large as the sample means used here to evaluate the results of the cost function. Other estimates of loan-administration costs in agricultural lending institutions range between 3 and 14 percentage points [71,79,96]. The results presented here confirm the existence of significant costs associated with lending in development banks. These costs are well above the administrative margins allowed for in special credit projects usually channeled through these financial institutions. Projects sponsored by international donors usually contemplate a 4%-margin for loan-administration, whereas the average spread of central-bank rediscount lines lies between 4% and 7% (see chapter 2). Therefore, the development bank will assume operational losses when engaging in credit programs of this nature.

There are no comparable estimates for the costs of mobilizing deposits in agricultural development banks in the available literature. The results reported here indicate that these costs are far from being negligible. However, the relationship between the estimated values of average cost and marginal cost of mobilizing deposits indicates that there are important unexploited economies of scale involved in deposit-mobilization for this bank. These economies of expansion are also observed for lending activities, but in this case they appear less important than in the case of deposit-mobilization. This contrast in the effect of output expansion will be discussed at greater length in section 5.2.

5.1.2. The Cost Function of the Private Bank

The lack of data on number of loans limited the estimation of the cost function in the case of the private bank to output specifications in value terms (value of loans, deposit balances). At the same time, the loan-size variable could not be computed thus limiting the analysis of size effects to those associated with the average size of deposit balances.

As was the case in the development bank, the translog form is in general a better specification for the private bank's cost function than the Cobb-Douglas form. However, the differences are not as striking as those found in the development-bank case. Table 7 summarizes the R-square values obtained in different specifications, and the corresponding tests contrasting the two functional forms. Detailed results of these equations are presented in table 36, appendix C. The R-square figures reported in table 7

Table 7. Private Bank: Summary of R-Square Values Obtained in the Estimation of the Cost Function, Under Different Specifications

Deposit-size Interaction	Model (Functional form) (1) Cobb-Douglas	(2) Translog
(1) No Interaction in the Specification		
R-square	0.9699	0.9758
F-test of functional form[a]	--	4.11*
(2) Interaction Included in the Specification		
R-square	0.9701	0.9769
F-test of functional form	--	5.09*
t-test of deposit-size interaction	-1.204	-2.856*

Source: table 36, appendix C.

a/ $F = [(SSE_C - SSE_T)/10]/(SSE_T/N-14)$,
where SSE = error sum of squares,
C denotes Cobb-Douglas form,
T denotes Translog form.

* : significant at 0.01 level

indicate excellent goodness of fit in all specifications. The translog form shows a significantly better fit than the Cobb-Douglas, even though the actual magnitude of the difference in R-squares is very small. The variable that captures the effect of deposit size does not show a coefficient significantly different from zero in the Cobb-Douglas form. It is statistically significant under the translog specification.

The gains in efficiency due to the adoption of a system-estimation procedure for the translog functional form were not very important in the private bank. As can be seen in table 8, all individual coefficients maintained their signs and approximate magnitude when comparing the results of the single equation estimation (model 1) against the parameter estimates obtained with the cost-system approach (model 2). All but one of the t-ratios for individual coefficients showed a moderate increase in absolute value in the cost-system estimation as compared to the single-equation results. However, the coefficients of only two explanatory variables went from below significant to a significant level (η_{21} and η_{22}). This is in sharp contrast to the effects of the estimation procedure on the significance of individual coefficients found in the development bank, where most individual coefficients showed drastic changes in their levels of statistical significance as a result of the adoption of the cost-system approach.

Table 8. Private Bank: Estimated Parameters of the Cost Function, Single Equation _versus_ System Estimation.[a/]

Parameter (Variable)	(1) Single Equation (OLS) Estimate	t-ratio	(2) System of Equations (GLS) Estimate	t-ratio (asymptotic)
α_0 (intercept)	-4.0332	-1.665°	-4.0121	-1.728°
α_1 ($\ln q_1$, loans)	-0.7159	-2.029†	-0.8772	-2.595*
α_2 ($\ln q_2$, deposits)	1.4888	2.938*	1.5261	3.139*
β_1 ($\ln p_1$, price of labor)	1.5403	2.780*	1.6593	3.126*
β_2 ($\ln p_2$, price of capital)	-0.5403	-0.975	-0.6593	-1.242
γ_{11} $(\ln q_1)^2$	0.0097	0.236	0.0160	0.404
γ_{22} $(\ln q_2)^2$	-0.0584	-0.785	-0.0232	-0.325
γ_{12} $(\ln q_1 \ln q_2)$	0.1154	1.262	0.0928	1.060
δ_{11} $(\ln p_1)^2$	-0.0481	-0.633	-0.0572	-0.785
δ_{22} $(\ln p_2)^2$	-0.0481	-0.633	-0.0572	-0.785
δ_{12} $(\ln p_1 \ln p_2)$	0.0481	0.633	0.0572	0.785
η_{11} $(\ln q_1 \ln p_1)$	0.0323	0.697	0.0596	1.343
η_{12} $(\ln q_1 \ln p_2)$	-0.0323	-0.697	-0.0596	-1.343
η_{21} $(\ln q_2 \ln p_1)$	-0.0825	-1.331	-0.1146	-1.928†
η_{22} $(\ln q_2 \ln p_2)$	0.0825	1.331	0.1146	1.928†
R^2	0.9734	---	0.9758[b/]	---
F-value	733.04*		503.31*	
Weighted R^2 (system)	---		0.9536	

a/ Factor-price homogeneity restrictions imposed on estimation.
N=190. DFS=365.
Significance levels: *, .01; †, .05; °, .10.

b/ R^2 of labor-share equation: 0.3590, F-ratio = 25.90.

In summary, the statistical improvement observed in the estimation of the cost function for the development bank, from Cobb-Douglas to translog form, then from single-equation to system estimation is also present in the estimation of the private bank's cost function. In the latter case however, the degree of improvement is less important than in the former, and more importantly, very few individual coefficients show statistical significance. This may be a consequence of widespread multicollinearity between the variables in the cost function. In fact, the correlation coefficients between several of these variables were extremely high (see table 37, appendix C).

This result implies that, in the case of the private bank, all independent variables in the cost function tend to "move together" over time and across branches. Increases in lending are accompanied by proportional movements in deposit-mobilization, and branches with large loan-portfolios also carry large deposit-portfolios. In addition, it is likely that in the private bank salaries and wages vary proportionally to overall activity. Also, with all variables in real terms, variations over time tend to be reduced, that makes possible that essentially non-linear relationships (e.g., between a variable and its square) approach linear relationships, thus creating the multicollinearity problem. In contrast, the development bank will typically experience unbalanced expansions in outputs.

Given its reliance on external sources of funds, lending can be expanded over time, or across branches following regionally-targeted programs, without proportional changes in deposit mobilization. Also, these changes will tend to be more abrupt in the development bank, thus even the deflated values of the variables will show more variation than in the private bank. These characteristics of the development bank's operations tend to break collinearity patterns in the data, and facilitate the obtention of statistically significant coefficients for individual variables, using the appropriate estimation procedures.

With multicollinearity in the data, sample variances of individual coefficients will tend to be very large, therefore t-ratios will be in general small and will thus appear not significantly different from zero [43,70]. On the other hand, the high values of the R-square and the F-ratio for the overall function reject the null hypothesis that all individual coefficients are zero. This typical pattern of multicollinearity - high R-square and overall significance, and poor significance of individual coefficients - implies that the set of explanatory variables explains very well the behavior of the dependent variable, but their individual effects cannot be distinguished. In the case of the private bank, the additional degrees of freedom obtained with the adoption of a system-estimation approach are not sufficient to overcome this degree of multicollinearity.[6/] This characteristic of the data poses a problem whenever the interpretation of results relies upon values of estimated coefficients with low levels of significance. Therefore, the discussion that follows should be taken with a word of caution.

As pointed out before, the inclusion of the deposit-size effect in interactive form with total deposit balances gave significant estimates in the translog specification. Table 9 shows the results of both single-equation and system estimation of the cost function including deposit-size interactions. In both cases the sign of the estimated parameter is negative, meaning that intermediation costs in general will decrease, *ceteris paribus*, with increases in the average size of deposit balances. Specifically, marginal costs of mobilizing deposits per lempira mobilized are a decreasing function of deposit size. The expressions for the marginal costs of lending and of mobilizing deposits in the private bank can be written as follows:

marginal cost of lending:

$$MC_1 = (C_1/q_1)(B_1 + \gamma_{11}\ln q_1 + \gamma_{12}\ln q_2) , \qquad (5.3)$$

6/ Dropping the two largest branches from the data set did not improve the significance of individual coefficients. Simplifying the model to the Cobb-Douglas form reduces but does not eliminate the collinearity problem, and has the disadvantage of restricting the parallel analysis of the two banks.

Table 9. Private Bank: Estimated Parameters of the Cost Function, Including Deposit-Size Effects. Single Equation *versus* System Estimation.[a]

	(1) Single Equation (OLS)		(2) System of Equations (GLS)	
Parameter (Variable)	Estimate	t-ratio	Estimate	t-ratio (asymptotic)
α_0 (intercept)	-3.1379	-1.307	-3.0242	-1.324
α_1 ($\ln q_1$, loans)	-0.5526	-1.572	-0.7300	-2.184†
α_2 ($\ln q_2$, deposits)	1.3148	2.621*	1.3405	2.805*
β_1 ($\ln p_1$, price of labor)	1.4563	2.673*	1.5913	3.071*
β_2 ($\ln p_2$, price of capital)	-0.4563	-0.837	-0.5913	-1.141
γ_{11} $(\ln q_1)^2$	0.0040	0.098	0.0110	0.284
γ_{22} $(\ln q_2)^2$	-0.0567	-0.777	-0.0142	-0.205
γ_{12} $(\ln q_1 \ln q_2)$	0.1384	1.535	0.1134	1.323
δ_{11} $(\ln p_1)^2$	-0.0404	-0.542	-0.0508	-0.715
δ_{22} $(\ln p_2)^2$	-0.0404	-0.542	-0.0508	-0.715
δ_{12} $(\ln p_1 \ln p_2)$	0.0404	0.542	0.0508	0.715
η_{11} $(\ln q_1 \ln p_1)$	0.0064	0.138	0.0366	0.829
η_{12} $(\ln q_1 \ln p_2)$	-0.0064	-0.138	-0.0366	-0.829
η_{21} $(\ln q_2 \ln p_1)$	-0.0538	-0.872	-0.0894	-1.522
η_{22} $(\ln q_2 \ln p_2)$	0.0538	0.872	0.0894	1.522
θ_2 ($\ln q_2 \ln DS$, deposit-size interaction)	-0.0227	-2.768*	-0.0247	-3.169*
R^2	0.9745	---	0.9769[b]	---
F-value	684.92*		489.52*	
Weighted R^2 (system)	---		0.9562	

a/ Factor-price homogeneity restrictions imposed on estimation. N=190. DFS = 365. Significance levels: *, .01; †, .05.

b/ R^2 of labor-share equation: 0.3590, F-ratio = 25.90.

marginal cost of mobilizing deposits:

$$MC_2 = (C_2/q_2)(B_2 + \gamma_{22}\ln q_2 + \gamma_{12}\ln q_1 + \theta_2 \ln DS) \quad , \quad (5.4)$$

where, MC_i is the marginal cost of the ith output, i=1,2,

C_i/q_i is the point-estimate of the average cost of the ith output, at given levels of q_i and all other variables in the model (see section 4.1.1 for details),

$B_i = \alpha_i + \Sigma_j \eta_{ij} \ln p_j \quad , \quad j=1,2$

q_1: loans, q_2: deposits,

p_1: price of labor, p_2: price of capital,

DS : deposit size.

The estimated coefficients reported in table 9 show the following signs: $\hat{\gamma}_{11} > 0$, $\hat{\gamma}_{22} < 0$, $\hat{\gamma}_{12} > 0$, $\hat{\theta}_2 < 0$. However, with the exception of $\hat{\theta}_2$ none of these coefficients is statistically different from zero at the commonly accepted levels of significance. Therefore, the individual effects of scale ($\hat{\gamma}_{11}$, $\hat{\gamma}_{22}$) and of joint production ($\hat{\gamma}_{12}$) will not be given particular emphasis in this analysis. The interpretation of the effect of deposit size on the marginal cost of deposit-mobilization (i.e., the sign of $\hat{\theta}_2$) has been pointed out above.

It is interesting to highlight here the relationships between the average-cost and marginal-cost levels for each of the bank's outputs. In general, marginal costs are greater than average costs when the firm is operating on the upward-sloping portion of its average cost curve. This means that the output level is beyond the overall minimum-cost level, and that further output expansions will be always cost-increasing. The reverse is true if marginal costs lie below average costs at a specific level of output. Marginal costs will be greater than (above) average costs or less than (below) average costs depending on the magnitude of the second term in parentheses on the right-hand side of equations (5.3) and (5.4). The evaluation of this term at the geometric means of the variables involved for the marginal cost of lending gives a value less than one, i.e., the marginal cost of lending is lower than the corresponding average costs. In other words, the bank is operating on the downward-sloping section of a hypothetical average cost curve for lending activities. On the other hand, the evaluation of the corresponding expression in equation (5.4) for the marginal cost of mobilizing deposits gives a value greater than one meaning that the marginal cost of mobilizing deposits at the geometric means of the variables in the model is greater than the corresponding average costs. This result indicates that the bank is operating on the upward sloping section of a hypothetical average cost curve for deposit-mobilization. Further discussion of this contrast between the bank's cost position with respect to each output is presented in section 5.2.

Evaluating the results of the cost-system estimation in table 9 (model 2) at the geometric means of all the variables in the model, the following point-estimates were obtained for the private bank:

Share of lending costs in total costs:		28.3%
Share of deposit-mobilization costs in total costs:		71.7%
<u>Costs of lending</u>:		
Average costs per lempira lent:	L.0.0339, or	3.39%
Marginal cost per lempira lent:	L.0.0169, or	1.69%
<u>Costs of mobilizing deposits</u>:		
Average cost per lempira mobilized:	L.0.0533, or	5.33%
Marginal cost per lempira mobilized:	L.0.0671, or	6.71%
<u>Total average costs of intermediation for the bank, per lempira</u>:	L.0.0872, or	8.72%
<u>Total marginal costs of intermediation for the bank, per lempira</u>:	L.0.0840, or	8.40%

These results show several similarities with those reported for this bank in Cuevas and Graham [26]. The shares of lending and deposit activities in total costs are quite similar to those obtained in this cross-sectional study. Average costs of lending reported above are somewhat higher than those found in Cuevas and Graham, but this difference may be reflecting differences in average loan-size between the two samples that are not accounted for in the cost-function model estimated here.

Some general conclusions and several interesting contrasts emerge from the analysis of the results obtained for the development bank and the private bank. A review of these general conclusions and contrasts is presented below, notwithstanding more thorough discussions of some of these findings in subsequent sections.

5.1.3. General Findings and Contrasts, A Summary

A summary of some of the results presented in previous sections is shown in table 10 to facilitate the analysis and discussion of these results. Rows 1 and 2 of table 10 indicate the distribution of total intermediation costs in each bank between lending costs (row 1), and costs of mobilizing deposits (row 2). Rows 3 and 4 show the average and marginal costs of lending on a per-lempira basis, while rows 5 and 6 report the corresponding average and marginal costs figures for the costs of deposit mobilization. Finally, overall intermediation costs (lending costs plus deposit-mobilization costs) are reported in rows 7 and 8 of table 10.

The first important contrast between the two banks is shown in rows 1 and 2 of table 10. Over 70% of the development-bank's costs of intermediation correspond to lending activities, whereas only 29% of its costs are attributed to the administration of deposit accounts. The opposite is true for the private bank, where only 28% of the costs are associated with lending, while 72% of the bank's total intermediation costs are related to deposit mobilization. This acute contrast reflects the development-bank's greater reliance on foreign funds and special rediscount lines from the central bank, as compared to the private bank

Table 10. Lender's Intermediation Costs: Lending Costs and Costs of Mobilizing Deposits. Summary of Findings for the Development Bank and the Private Bank.

Cost Concept	Development Bank (%)	Private Bank (%)
1. Share of Lending Costs in Total Intermediation Costs	71.1	28.3
2. Share of Deposit-Mobilization Costs in Total Intermediation Costs	28.9	71.7
Costs of Lending		
3. Average Costs	10.02	3.39
4. Marginal Costs	7.64	1.69
Costs of Mobilizing Deposits		
5. Average Costs	8.78	5.33
6. Marginal Costs	2.72	6.71
Overall Lender's Intermediation Costs[a/]		
7. Average Costs	18.80	8.72
8. Marginal Costs	10.36	8.40

Source: Results of cost-system estimations, table 6 (model 2) and table 9 (model 2), evaluated at geometric means of the variable in the models.

a/ Lending Costs + Costs of Deposit Mobilization which relies more heavily upon financial resources mobilized from the general public.

Over the period under analysis (1971-1982), an average of 51% of the loan-portfolio of the development bank was funded through foreign funds or central-bank rediscount lines. Furthermore, these external (non-deposit) sources of funds have grown in relative importance with respect to the loan-portfolio from a 44%-average in the period 1971-1974 to a 57%-average in the period 1979-1982. Consequently, the proportion of the total value of new loans funded through deposit mobilization decreased from an average of 56% in the period 1971-1974, to a 43%-average in the last four years of the series. On the other hand, the private bank has relied primarily upon deposits mobilized from the general public to finance its loan portfolio. This bank's access to rediscount lines at the central bank has been limited, and only recently has it engaged in foreign-funded special credit projects. In 1981, a representative year according to bank officials, 91% of the loan portfolio was funded with own deposits, almost 7% came from central-bank rediscount funds, and a little over 1% from foreign funds (primarily World Bank projects). This sharp contrast in the composition of the banks' liabilities has a counterpart in the allocation of real resources in each bank, that is reflected in the participation of lending and deposit activities in total intermediation costs.

Costs of lending show a second striking contrast between the two banks. The estimated average costs of lending are 10% for the development bank, three times as high as those estimated for the private bank (3.39%). The marginal costs of lending are 4.5 times larger in the development bank (7.6%) than in the private bank (1.7%). This is again reflecting the differences in the sources of funds with which the banks operate. The greater reliance on external funds by the development bank implies the acceptance of loan-targets imposed by foreign donors, international lenders, and/or the government. These targets typically imply servicing a more risky and numerous clientele, and a high incidence of relatively small loans. Also, targeted funds are accompanied by monitoring, supervision, and reporting requirements that force the institution to maintain a more centralized operation, and a heavier incidence of supervisory and record-keeping resources, than would be the case in the absence of these targeting requirements.

It is important to note that the cost estimates reported in table 10 do not include provisions for bad debts, thus representing a lower-bound estimate for the operational spread that these institutions would require in order not to suffer operational losses. In this sense, the results obtained for the development bank are particularly striking, especially when comparing these results with the margins contemplated in credit projects funded by external agencies or the central bank. These funding sources usually allow only 3 to 4 percentage points to cover the administrative costs associated with the on-lending of their funds. Thus, to operate with these special lines of credit the development bank experiences an operational loss of over 6%, assuming that all loans are fully repaid.

The foregoing results highlight the existence of a policy inconsistency, in the sense that external donors and/or the government impose on the development bank costly loan-targets without appropriate support to service these target-groups. The costs of servicing a more risky, more numerous, and more costly clientele, for which the institution is reimbursed only at a margin of 3 or 4 percentage points, seriously compromise the financial viability of the institution. It is interesting to note that the usual 3-4% margin is closer to the average lending costs observed in efficient private commercial banks like the one under study here, than to the average lending costs observed in the development bank. However, as it has been documented elsewhere [26], the average cost of lending for the private bank increases substantially when dealing with foreign-funded credit projects. The average cost of agricultural loans made by the private bank with World Bank funds has been estimated at 8.4% ignoring default risks [26], a figure that exceeds by far the 4%-spread allowed in these credit projects for loan-administration costs.

The average costs of mobilizing deposits are also higher in the development bank as compared to the private bank (row 5 in table 10). However, marginal costs of deposit-mobilization show the opposite pattern, they are lower in the development bank than in the private bank (row 6 in table 10). Note also that the private bank has gone beyond the minimum average cost level in its deposit activity, since the marginal costs of deposit-mobilization appears higher than the corresponding average cost. These differences in costs between the two banks are explained by the contrasts in their scale of operations, and to some extent by differences in the composition of their deposit-clientele. A brief discussion of these differences follows.

Taking the geometric means of the relevant variables in the two banks for the overall period 1971-1982, the ratio between the administrative costs of the private bank and those of the development bank is 1.4 to 1, the ratio of their loan portfolios is 2 to 1, and the ratio between their deposit portfolios is 6.8 to 1. In short, the private bank has extended its deposit-mobilization activity relatively more than its lending activity. Moreover, this bank has reached a point of decreasing returns to further expansions of the deposit-mobilization activity, unless this expansion relies upon increasingly large average deposit-balances (see discussion on the effects of deposit-size on the bank's costs in section 5.1.2 above). At the other extreme, the development bank is operating on the steep-downward-sloping section of a hypothetical average-cost curve for deposit-mobilization, considering the large difference between average costs and marginal costs observed in table 10. Another factor that contributes to the low marginal costs of mobilizing deposits in the development bank is the incidence of deposits from public-sector institutions that, in general, should imply lower handling costs on a per-lempira basis. As indicated in chapter 2, the incidence of these deposits is larger in the liability portfolio of the development bank than in the private bank, due to regulations that force public institutions to deposit a majority of their cash-flow or surplus funds in the development bank. Yet, the main explanation for the behavior of deposit-mobilization costs in the development bank is overcapacity, since the large difference between average costs and marginal costs should be attributed primarily to under-utilized fixed or quasi-fixed resources in the structure of the bank.

Overall, intermediation costs are higher in the development bank than in the private bank (rows 7 and 8 in table 10). However, this difference is more important in terms of the total average costs of operation than it is in terms of the marginal costs of intermediation. The relationship between the levels of average costs and marginal costs in the development bank reflects under-utilization of existing resources, whereas the private bank appears very close to its minimum-cost level of activity (marginal cost almost equals average cost). Marginal costs of intermediation in the development bank are only two percentage points higher than in the private bank, according to the estimates reported in table 10. This result indicates that the differences in efficiency are not too substantial between the two banks. However, an important implication is that marginal-cost pricing would imply large operational losses for the development bank, whereas in the case of the private bank it would represent an almost break-even situation. From a policy-making point of view, if operational margins were administered so that the development bank could cover its marginal costs of intermediation, this bank would still experience substantial losses, since its average costs exceed by far its marginal costs. Under such a policy however, the private bank would earn a profit since its average costs are lower than the marginal costs of the development bank.

5.2. Economies of Scale, Cost Complementarities, and Factor Substitution

Economies of Scale

The importance of output definition, functional form, and the procedure utilized to estimate the parameters of the cost function, in terms of the resulting scale-economies indicators, is discussed based on the results presented in tables 11 and 12. Table 11 summarizes the scale-economies estimates obtained for the development bank, under different output definitions, functional forms, and estimation procedures. Table 12 presents a similar breakdown of results for the private bank, although using only one output definition (value of loans, deposit balances).

As pointed out in the previous section, the best estimates of the development bank's cost function are obtained using the translog functional form and a system-estimation procedure. It is therefore pertinent to judge the different estimates of economies of scale against those obtained with this specification using the value of loans and deposit balances as output definition (panel 4, columns 4 and 5 in table 11). These are considered the best overall estimates of the development-bank's cost function.

Table 11 shows that the results of all single-equation estimations (columns 1 through 3) tend to underestimate the value of the scale-economies measure of the bank, as compared to the estimates obtained under a cost-system approach

Table 11. Development Bank: Scale-Economies Estimates (ES), Under Different Output Definitions, Functional Forms, and Estimation Procedures. Tests of Null Hypothesis ES=1, and R-squares of Underlying Estimated Equations.

	Estimation Procedure, Functional Form				
	Single-Equation (OLS)			System Estimation (GLS)[a/]	
Output Definition	Cobb-Douglas (1)	Translog (2)	Translog with Loan-Size and Deposit-Size Effects (3)	Translog (4)	Translog with Loan-Size and Deposit-Size Effects (5)
1. Single Output, Number of Loans + Number of Deposit Accounts					
Economies of Scale (ES)	0.48	0.47	0.84	—	—
F-test for Ho: ES=1	45.65*	41.70*	3.97*		
R-square of equation	0.73	0.77	0.85		
2. Single Output, Value of Loans + Deposit Balances					
Economies of Scale (ES)	0.64	0.58	0.75	—	—
F-test for Ho: ES=1	58.67*	65.14*	12.17*		
R-square of equation	0.79	0.82	0.86		
3. Two-Output, Number of Loans, Number of Deposit Accounts					
Economies of Scale (ES)	0.61	0.53	0.80	1.34	1.11
F-test for Ho: ES=1	20.14*	21.55*	7.04*	17.28*	4.62†
R-square of equation	0.76	0.79	0.89	0.79 (0.42)	0.89 (0.78)
4. Two-Output, Value of Loans, Deposit Balances					
Economies of Scale (ES)	0.65	0.71	0.79	1.08	1.07
F-test for Ho: ES=1	47.30*	34.95*	7.83*	8.67*	2.88
R-square of equation	0.82	0.86	0.88	0.86 (0.73)	0.89 (0.82)

Source: Tables 4, 5, and 6 in the text, tables 33 and 34 in appendix C.
a/ Weighted R-squares of the system indicated in parenthesis.
* : Null hypothesis (ES=1) rejected, at .01 level of significance
† : Null hypothesis (ES=1) rejected, at .05 level of significance

(columns 4 and 5). Among the estimated values obtained with a single-equation procedure, the models that do not include loan-size and deposit-size effects (columns 1 and 2) generate lower values of the economies-of-scale parameters than models incorporating these variables (column 3). There are no substantial differences in the resulting estimates of scale-economies due to "pure" differences in functional form (column 1 *versus* column 2), or across different output definitions. An exception is the case of the single-output definition in terms of number of loans plus deposit accounts (panel 1, columns 1 and 2), that generates very low estimates of scale economies.

In general, all single-equation estimations give values of economies of scale significantly less than one, whereas the most preferred estimates do not differ significantly from one (panel 4, column 5), or tend to be significantly greater than one (panel 4, column 4). Confidence intervals with 95% confidence limits calculated with these more reliable estimates give the following boundaries for the scale-economies (ES) parameter of the development bank:

$1.027 \leq ES \leq 1.135$, panel 4, column 4 in table 11,
point-estimate: $ES = 1.08$.

$0.989 \leq ES \leq 1.156$, panel 4, column 5 in table 11,
point-estimate: $ES = 1.07$.

In contrast with the foregoing results, the functional form appears to be very important in determining the estimated level of scale-economies in the private bank (table 12). Values of this parameter estimated with a translog form are twice as large as those obtained with a Cobb-Douglas specification, with little or no effect attributable to the inclusion of the deposit-size variable. Despite these large variations in the results due to the choice of functional form, all but one of the estimated scale-economies measures shown in table 12 are not significantly different from one. This is due to the widespread multicollinearity existing in the data utilized to estimate the private bank's cost function, whose effects were discussed in the previous section. One of the consequences of this multicollinearity problem is the presence of large variances of the individual coefficients. The economies-of-scale estimate is a linear combination of these coefficients, therefore its associated standard error will tend to be large, since this is obtained as a combination of the variances of the individual coefficients. As a consequence, a 95% confidence interval for the scale-economies parameter of the private bank results in a very large interval ($0.31 \leqq ES \leqq 2.88$). Therefore, these results obtained for the private bank should be considered with caution.

Summarizing, in the two banks the results obtained with the preferred estimation approaches generate estimates of economies of scale that are not significantly different from

Table 12. Private Bank: Scale-Economies Estimates (ES), Under Different Functional Forms, and Estimation Procedures. Tests of Null Hypothesis ES=1, and R-squares of Underlying Estimated Equations.

Estimation Procedure	Functional Form: Cobb-Douglas (1)	Cobb-Douglas with Deposit-Size Effect (2)	Translog (3)	Translog with Deposit-Size Effect (4)
1. Single-Equation				
Economies of Scale (ES)	0.95	0.96	1.73	1.86
F-test for Ho: ES=1	6.17*	3.85	1.12	1.61
R-square of equation	0.97	0.97	0.98	0.98
2. Cost-System				
Economies of Scale (ES)	--	--	1.59	1.76
F-test for Ho: ES=1			0.82	1.39
R-square of equation			0.98	0.98
(weighted R-square of system)			(0.95)	(0.96)

Source: Tables 8 and 9 in the text, table 36 in appendix C.

* : significant at 0.01 level

one. The important contrast however, is that in the development bank the point estimate of economies of scale is close to one (1.07), whereas in the private bank this point estimate is considerably greater than one (1.59). In the former case, a 10%-increase in the production of both outputs (loans and deposits) will generate a 10.7%-increase in total administrative costs of the development bank. In the private bank, the same 10%-increase in both outputs will create an increase in total administrative costs of 15.9%. It is important to note however, that the values of scale-economies reported in tables 11 and 12 are not fixed. Instead, these values are a function of the scale of operations and of the output mix. In this respect, it is useful to recall equation (4.4) for the value of the economies of scale (ES):

$$ES = A + \gamma_{11}\ln q_1 + \gamma_{22}\ln q_2 + \gamma_{12}(\ln q_1 + \ln q_2) \quad (5.5)$$

where, A summarizes all parameters and variables in (4.4) that do not involve output quantities,

q_1: loans, q_2: deposits.

According to results presented in the previous section for the development bank (table 5), the scale-economies measure for this bank tends to increase (i.e., to turn into diseconomies) as output increases, since both $\hat{\gamma}_{11}$ and $\hat{\gamma}_{22}$ are positive. There is, however, an offsetting effect due to joint production of loans and deposits, since $\hat{\gamma}_{12}$ is negative. A similar analysis cannot be done for the private bank, since none of the coefficients involved is significantly different from zero in this case (see tables 8 or 9 in the previous section). A more direct way of portraying the effects of scale and output-mix on the values of economies-of-scale measures is computing these values for branches of different sizes in each bank. This exercise is summarized in table 13, that shows the values of partial economies of scale (percentage change in costs with a 1% change in <u>one</u> output), and overall economies of scale (change in costs as a result of a change in the production of <u>both</u> outputs), for the two banks. Different (real-life) branch-size cases have been selected in both banks, in order to assess the main similarities and contrasts between banks and branch-sizes. Partial and overall economies of scale computed at the sample means of each bank are also reported in table 13.

A first contrast between the two banks is found in the values of the overall scale-economies indicators (rows 3 and 6 in table 13). The magnitudes of the estimated indicators for the two branch-sizes of the development bank denote the existence of a U-shaped overall average-cost "curve" (indeed a cost-surface), with the small branch lying on the downward sloping portion of this "curve", and the large branch located on the upward sloping section of this surface. The results obtained for the private bank however, indicate that

Table 13. Estimated Values of Partial and Overall Economies of Scale (ES), at the Sample Means and at Different Branch-Sizes. Development Bank and Private Bank

Bank, Economies-of-Scale Measure (ES)	Level of Evaluation		
	Sample Mean (1)	"Small" Branch Case (2)	"Large" Branch Case (3)
Development Bank[a]			
Partial ES ($\partial \ln C/\partial \ln q_i$)			
(1) ES_1, Loans	0.77	0.66	1.14
(2) ES_2, Deposits	0.31	0.30	0.40
(3) Overall ES ($\Sigma_i \partial \ln C/\partial \ln q_i$)	1.08	0.96	1.54
Private Bank[b]			
Partial ES ($\partial \ln C/\partial \ln q_i$)			
(4) ES_1, Loans	0.39	0.22	0.67
(5) ES_2, Deposits	1.20	1.05	1.42
(6) Overall ES ($\Sigma_i \partial \ln C/\partial \ln q_i$)	1.59	1.27	2.09

a/ Computed from table 5 (model 2). Branch-size cases selected on the basis of loan activity, 1982.

b/ Computed from table 8 (model 2). Branch-size cases selected on the basis of loan and deposit activity, 1982.

even the small branch would be experiencing "diseconomies" associated with overall output expansion. A representation of the private bank's average cost would be a surface with positive slopes for all movements that imply proportional expansions of both outputs.

The expression "overall expansion" needs to be underlined in the foregoing discussion since, as is evident from table 13, there exist substantial differences in the separate cost-effects of the expansion of different outputs. Furthermore, these differential effects of output expansions vary across banks. For the development bank, there exist substantial economies of scale to the expansion of deposit-mobilization activities. The partial scale-economies value of 0.31 computed at the sample mean (row 2, column 1 in table 13) indicates that a 10%-increase in deposit balances mobilized by the bank generates only a 3.1%-increase in administrative costs. On the other hand, the lending activities of this development bank are approaching constant returns-to-scale for the average-branch case[7], and display diseconomies of scale in branches with large amounts of funds lent (row 1, column 3). The opposite pattern is observed for the private bank in table 13. This bank's lending is the activity that shows cost-advantages as compared to deposit mobilization. In all cases, an expansion in the private bank's lending of 10% would generate

7/ i.e., a hypothetical branch that could be described by the sample means of all variables.

small-to-moderate increases in administrative costs, depending on the branch size (2.2% in the small branch, to 6.7% in the large branch). In contrast, the same expansion in the private bank's deposit-mobilization activity would create a cost increase between 10.5% (small branch) and 14.2% (large branch).

The general conclusion of the foregoing analysis is that the two banks could benefit from "economies of scale" by engaging in unbalanced output-expansion. In brief, each bank should expand relatively more the activity with the lowest value of the partial scale-economies measure, i.e., the output whose expansion generates the smallest cost increase. Expansion strategies for the development bank should emphasize deposit mobilization over lending activities. On the other hand, the private bank's expansion strategies should be biased towards lending operations. With deposit-mobilization expanding at a slower pace than lending, the overall (weighted) economies-of-scale indicator for this bank should approach unity.

Cost Complementarities (Economies of Scope), and Elasticities of Factor Substitution and Factor Demand

Several parameters associated with the underlying technology of production are derived from the estimated parameters of the cost function. The relationships that allow the derivation of these results were discussed in section 4.1. Table 14 reports these results for the two banks under study. The necessary condition for the existence of cost-complementarities indicated by Murray and White [69] is met in the two banks (row 1 in the table). In addition to the satisfaction of this necessary condition for cost complementarity, no further conclusions can be derived from the numerical values reported in table 14, row 1, since there are no specific units associated with these estimated parameters. Notwithstanding this limitation, these results indicate that, for the two banks, joint production of loans and deposits offers cost-advantages as compared to specialized single-output activity. This argues against the widespread "development" strategy of creating specialized lending institutions with no deposit-mobilization functions. Without necessarily altering their initial goals and objectives, these institutions would be better off in terms of costs and financial liability with the provision of multiple services to their clientele.

The elasticity of substitution between labor and capital, σ_{12}, computed using the estimated parameters of the cost function and reported in table 14 (row 2) appear relatively low for the development bank, even though there are no appropriate points of reference in the literature revised. The result obtained for the private bank ($\hat{\sigma}_{12}$=1.24) is almost twice as high as the value reported for the development bank ($\hat{\sigma}_{12}$=0.63). For comparison, the values reported by Murray and White [69] for British Columbia

Table 14. Cost Complementarities in Production (Economies of Scope), Elasticities of Factor Substitution, and Price-Elasticities of Demand for Factors of Production, Derived from Cost-Function Estimates. Development Bank and Private Bank.

Estimated Parameters	Development Bank[a/]	Private Bank[b/]
1. Cost Complementarities, $(\hat{\gamma}_{12} + \hat{\alpha}_1\hat{\alpha}_2)$	-0.4393	-0.8651
2. Elasticity of Factor-Substitution between Labor and Capital, $\hat{\sigma}_{12}$	0.6328	1.2419
3. Price-Elasticities of Demand for Factors of Production, $\hat{e}_{ij}$		
$\hat{e}_{11}$ (demand for labor, price of labor)	-0.4493	-0.8693
$\hat{e}_{12}$ (demand for labor, price of capital)	0.4493	0.8693
$\hat{e}_{22}$ (demand for capital, price of capital)	-0.1835	-0.3726
$\hat{e}_{21}$ (demand for capital, price of labor)	0.1835	0.3726

a/ Computed from cost-system estimates, table 6, model 2.

b/ Computed from cost-system estimates, table 9, model 2.

credit unions ($\hat{\sigma}_{12}$=1.74) are even higher than the elasticity of substitution found here for the private bank. However, their results imply price-elasticities of demand for factors of production of a magnitude similar to those calculated here in the case of the private bank.

In general, the private bank shows a higher value of the elasticity of substitution between factors of production, and factor demands more price-elastic than the development bank. These results denote a greater flexibility of the private bank in the allocation of productive resources, and a larger response to factor-market signals, as compared to the development bank. As expected, in both cases the demand for labor services shows a higher price-elasticity than the demand for services of capital goods. Overall, the results presented in table 14 reflect a more rigid structure of operations in the development bank, and a less important role of market signals in this bank's resource allocation, as compared to the private bank. As will be discussed later at greater length, the management of a development bank operates in an environment subject to pressures and constraints that at times induces decisions independent of market considerations.

5.3. Interest-Rate Regulations and Lenders' Intermediation Costs

In this section, the effects of interest-rate regulations on the banks' administrative costs are analyzed, including in each bank's function the real deposit-rate and the real lending-rate as proxies for the interest-rate restrictions imposed on financial intermediaries. It is useful to recall here the expression that includes these two proxy-variables:

$$\lambda_1(d - \dot{p}) + \lambda_2(\ell - \dot{p}) \tag{5.6}$$

where, d is the nominal deposit-rate,

ℓ is the nominal ceiling on the lending rate,

$\dot{p}$ is the inflation rate.

As indicated before, the nominal deposit-rate is calculated in two alternative ways. First, the deposit rate is calculated as the arithmetic mean of all deposit-rate ceilings established by the central bank. This average ceiling is denoted as d_c. Second, the implicit rate of interest paid on deposits by each bank is computed dividing total interest payments over total deposit balances. This implicit nominal deposit-rate is denoted d_p and is considered a proxy for the institution's cost of funds under the existing conditions of regulation. In both cases, the real deposit-rate is obtained by substracting the rate of inflation $\dot{p}$ from the nominal deposit-rate. The real lending-rate ceiling is computed as the difference between the overall maximum ceiling on the nominal lending-rate, ℓ, and the inflation rate $\dot{p}$. The rate of inflation is calculated as the 12-month variation in the country's implicit GDP deflator.

Selected statistics for the foregoing nominal and real rates are presented in appendix C (table 38), along with correlation coefficients for different pairs of these variables. An average nominal deposit-rate ceiling for the entire period 1971-1982 of 6.6% is associated with an average nominal implicit deposit-rate (cost of funds) of 3.6% and 3.7% respectively for the development bank and the private bank. The average nominal rates paid by these banks on interest-bearing accounts over the same period were 5.6% in the development bank, and 5.4% in the private bank. These rates are still below the average overall ceiling, reflecting the large proportion of the deposit portfolios accounted for by savings accounts in both banks. As it has been documented before (appendix A, table 30), savings accounts have been subject to lower interest-rate ceilings than time-deposits and other instruments. In real terms, the average deposit-rate ceiling in the period under study was -2.51%, while the average real implicit-rates paid on interest-bearing deposits were -2.52% in the development bank, and -2.71% in the private bank. The average real cost of funds for the two banks was -4.73% and -4.13% respectively. Finally, the average nominal lending-rate ceiling over this period was 17.2%, implying an average real lending-rate ceiling of 9.08%.

A brief exercise with the average figures reported above, and the average intermediation costs discussed in the preceding section is undertaken here. The average implicit cost of funds adjusted by reserve requirements is 5.1% and 5.3% for the development bank and the private bank respectively. Assuming that all lending was done over the period at the maximum ceiling (17.2%), those cost of funds imply gross-spreads of 12.1% for the development bank, and 11.9% for the private bank. Therefore, under this rather optimistic assumption for the effective lending rate, the private bank would result with a (positive) net spread of 3.2%, whereas the development bank would have suffered net losses of 6.7%. Note that for the latter, the alternative of engaging in foreign-funded projects with a 4% allowance for administrative costs is not a profitable option, since the average lending cost reported in section 5.1 implies average losses of 6% in these operations. The main difference however, is that the economies of scale to the expansion of deposit-mobilization in the development bank can sharply reduce the operational losses indicated here. In contrast, cost-saving possibilities under external financing are far more limited, since these depend only on the reduced scale-economies associated with lending.

It is important to note in table 38 (appendix C) the estimated correlations between implicit deposit-rates paid by the banks and the deposit-rate ceilings established by the monetary authorities. Nominal implicit rates (cost of funds) showed near zero correlation with the average deposit-rate ceiling in the development bank. For the private bank this correlation was also very low, although statistically different from zero. Despite this weak relationships between the nominal rates, real implicit deposit-rates were highly correlated (in both banks) with real deposit-rate ceilings. This result is a consequence of the fact that the correlation between two real rates includes as an element the perfect correlation of the inflation rate with itself. This same reason underlies the high values of the correlation coefficients between all real rates (see table 38). This correlation has to be considered when interpreting the results of the cost-function estimations that include real deposit and real lending rates.

Table 15 summarizes the results obtained in the estimation of the effects of interest-rate regulations on bank's non-financial costs. For the two banks (panels A and B), rows 1, 2, and 3 indicate the estimated coefficients obtained including in the cost function the real deposit-rate (rows 1 and 2), _or_ the real lending-rate ceiling (row 3). The two definitions of real deposit-rate have been included in different estimated equations. The estimated parameters for the real deposit-rate ceiling are reported in column 1, while those associated with the real implicit deposit-rate are presented in column 2. Rows 4 and 5 of the

Table 15. Effects of Interest-Rate Regulations on Lenders' Intermediation Costs: Estimated Parameters of the Real-Deposit Rate, and the Real Lending-Rate in Different Equations. Cost-system Estimates for the Development Bank and the Private Bank.[a/]

Bank (model)	Parameter, Variable: λ_1, $(d_c - \dot{p})$: real deposit-rate ceiling — Estimate (asymptotic t-ratio)	λ_1', $(d_p - \dot{p})$: real implicit rate paid on deposits — Estimate (asymptotic t-ratio)	λ_2, $(\ell - \dot{p})$: real lending-rate ceiling — Estimate (asymptotic t-ratio)	Weighted R-square of the cost-system	F-test of Joint Null Hypothesis: $\lambda_1 = 0, \lambda_2 = 0$	t-test of Null Hypothesis: $\lambda_1 + \lambda_2 = 0$
	(1)	(2)	(3)	(4)	(5)	(6)
A. Development bank						
(1)	-0.0383 (-8.48)*	--	--	0.78	--	--
(2)	--	-0.0195 (-6.06)*	--	0.70	--	--
(3)	--	--	-0.0263 (-9.71)*	0.78	--	--
(4)	--	0.0143 (2.46)†	-0.0403 (-6.91)*	0.73	31.75*	-6.85*
(5)	0.0345 (4.33)*	--	-0.0584 (-10.32)*	0.83	68.93*	-4.84*

Table 15, continued

Bank (model)	Parameter, Variable: λ_1, $(d_c - \dot{p})$: real deposit-rate ceiling — Estimate (asymptotic t-ratio)	λ_1', $(d_p - \dot{p})$: real implicit rate paid on deposits — Estimate (asymptotic t-ratio)	λ_2, $(\ell - \dot{p})$: real lending-rate ceiling — Estimate (asymptotic t-ratio)	Weighted R-square of the cost-system	F-test of Joint Null Hypothesis: $\lambda_1 = 0, \lambda_2 = 0$	t-test of Null Hypothesis: $\lambda_1 + \lambda_2 = 0$
	(1)	(2)	(3)	(4)	(5)	(6)
B. Private bank						
(1)	-0.0214 (-5.58)*	--	--	0.97	--	--
(2)	--	0.0041 (1.20)	--	0.95	--	--
(3)	--	--	-0.0008 (-0.26)	0.95	--	--
(4)	--	0.0571 (5.53)*	-0.0495 (-5.33)*	0.96	15.36*	2.34†
(5)	-0.0153 (-1.80)	--	-0.0052 (-0.81)	0.97	15.16*	-4.97*

a/ Other parameters of the cost function not reported. See basic specifications in table 5 (development bank) and table 8 (private bank).

* : significant at 0.01 level
† : significant at 0.05 level

two panels in table 15 show the estimated parameters obtained when the real deposit-rate and the real lending-rate ceiling are specified in the cost function.

In general, the results presented in table 15 indicate that there is an inverse relationship between the levels of real interest-rates and the costs of financial intermediation. Increases in the levels of the real deposit-rate or the real lending-rate will generate reductions in total intermediation costs of the banks. On the other hand, interest-rate restrictions that reduce the levels of the real deposit or lending rates will have cost-increasing effects on the financial intermediaries.

For the development bank, panel A in table 15, the real deposit-rate under its two definitions, and the real lending-rate ceiling show negative and statistically significant coefficients when included in separate regressions (rows 1 through 3). The sign of the real deposit-rate becomes positive when this variable is included together with the real lending rate (rows 4 and 5), a result that is probably a consequence of the high correlation between these real rates. Despite this difficulty, it is pertinent and revealing to test for the effect of a simultaneous change in both the real deposit-rate and the real lending-rate ceiling, i.e., a change that policy-makers could claim is "spread-neutral". These tests for the combined effect of changes in the two rates ($\lambda_1 + \lambda_2$) indicate that the net effect on the development bank's costs will be of opposite sign and significantly different from zero (see column 6). For example, using the results reported in row 5 of panel A, the net effect of a one-point increase in both the real deposit-rate ceiling and the real lending-rate ceiling would be a reduction of 2.4% in total intermediation costs of the bank[8/] ($\hat{\lambda}_1 + \hat{\lambda}_2 = -0.024$, t-ratio = -4.84). Note that the sign and magnitude of the combined effects of simultaneous changes in deposit and lending rates ($\hat{\lambda}_1 + \hat{\lambda}_2$) is not too different from the individual effects of each of these variables when included in separate equations (rows 1, 2, and 3). Therefore, it is possible to conclude that changes in the real deposit-rate ceiling and the real lending-rate ceiling will bring about changes in total intermediation costs of the development bank in the opposite direction of 2 to 3% per unit of change in the real interest-rate ceilings.

The results obtained for the private bank (panel B in table 15) are similar to the findings discussed above for the development bank. In the private bank, the estimated parameters for the real deposit-rate ceilings show negative signs and are statistically significant in the two equations including this variable (rows 1 and 5, column 1). The variable that represents the implicit cost of funds in real terms (column 2) shows an unstable pattern of effects. This estimated coefficient is not significantly different from

8/ i.e., approximately 0.35 million lempiras in 1982.

zero when this real implicit deposit-rate is the only proxy for interest-rate regulations in the model (row 2). However, this coefficient appears positive and significant when this variable is specified together with the real lending-rate ceiling (row 4). Again, the instability of this coefficient may be reflecting the collinearity between all rates in real terms. The test performed for the combined effect of simultaneous changes in the real deposit-rate ceiling and the real lending-rate ceiling (row 5, column 6) indicates that this combined effect has a negative sign and is significantly different from zero ($\hat{\lambda}_1 + \hat{\lambda}_2 = -0.0205$, t-ratio = -4.97). This result is similar to that obtained in the same test performed for the development bank. A simultaneous increase in both the real deposit-rate ceiling and the real lending-rate ceiling of one percentage point will generate a 2.05%-decrease in total intermediation costs of the private bank.[9/]

The general conclusion that derives from the foregoing analysis is that interest-rate regulations are an important determinant of non-financial intermediation costs in the financial institutions under study. According to these results, interest-rate restrictions that translate into reductions in the real ceilings imposed on deposit and lending rates generate significant cost increases to the

9/ i.e., about 0.8 million lempiras in 1982.

financial intermediaries. It is important to note that the cost increases borne by lenders estimated in this section are only a lower-bound estimate of the total cost-effects of interest-rate restrictions. Part of these total cost-effects are passed-on by the financial intermediaries primarily to borrowers, under the form of transaction costs associated with loan procedures established by lenders. Transaction costs of borrowing are the subject of chapter 6.

5.4. Loan-Targeting, Portfolio Composition and Lenders' Intermediation Costs

This section discusses the effects of loan-targeting on the intermediation costs of the development bank. The mechanisms through which targeted funds create additional costs for the financial intermediaries, as well as the methodological approach adopted for this analysis, have been described in previous chapters. Targeted funds are identified as funds obtained from central-bank rediscount lines, or from foreign donors. The term "external funds" is utilized here to refer to both central-bank and foreign funds combined. Non-targeted funds are demand, savings, and time deposits captured from public institutions and from the general public. First, a brief analysis of the relationships betweeen the sources of funds and portfolio composition is presented. Second, the results of the estimated cost function including variables that capture the effects of targeting are analyzed.

Sources of Funds and Portfolio Composition

The shares of different sources of funds in the development-bank's portfolio of new loans for the period 1971-1982 are presented in appendix C, table 39. The proportion of the total value of new loans funded through deposit mobilization decreased from an average of 56% in the period 1971-1974 to an average of 43% in the last four years. Consequently, external funds (central-bank and foreign funds combined) increased their share in loan amounts from a 44%-average in the first four years to a 57%-average for the period 1979-1982. Foreign funds were predominant among external sources during the first half of the period under analysis, while gradually decreasing in importance within this group after 1975. Central-bank funds became the most important component among external funds in the second half of the period.

The share of deposits in the number of loans decreased drastically from an average of over 40% in the first four years of the period to a remarkably small 5%-average in the last four years, reflecting the re-allocation of these funds to increasingly larger-sized loans. The relationship between the average size of loans granted out of deposits and the average size of loans funded by external sources grew from about 3:1 in the early 70's to over 7:1 in the early 80's (see table 39).

The increased share of external sources of funds both in the number of loans and in the value of loans would suggest that agriculture as a whole, and specially small farmers, have increased their share in the development-bank's portfolio of new loans. The loan-size figures presented in table 39 and the shares of agricultural loans in the bank's portfolio shown in table 40 allow an examination of the degree to which loan targeting has been effective in modifying the composition of the loan portfolio.

Data on loans by farm size are not available for the period under discussion here, therefore the average loan sizes are used as a reasonable proxy. These figures indicate that the average loan size serviced by external funds has not changed substantially over the period 1971-1982. This, in turn, suggests that the share of small loans in the portfolio has not experienced significant variations in this period. On the other hand, the share of loans to agriculture (crops + livestock) in the development bank's portfolio by the early 80's was at the same level of the early 70's, about 70% of the total value of new loans. The highest shares are observed in 1977-1978, when agricultural loans accounted for over 90% of the portfolio. Within agriculture, crop loans have in general increased their share, while the share of loans to livestock has decreased steadily since 1972.

In short, the increasing share of external funds, through the period under analysis, has not been associated with an increased share of agricultural loans in the portfolio. The peak years of 1977-1978 may be better explained by real-sector phenomena such as the "coffee boom" rather than by an increased proportion of the bank's loan funds being supplied by external sources under targeting arrangements. These findings are reinforced by the results of the correlation analysis between the shares of sources of funds in the portfolio and the share of agricultural loans.

<u>None</u> of the sources of funds showed a statistically significant correlation with total agricultural loans. The correlation coefficients between external funds (combined or separate) and agricultural loans were not statistically different from zero, either taking the shares in the number of loans or the shares in the value of new loans. Significant coefficients were found only when correlating the shares of different sources of funds with the shares of the components of total agricultural loans, i.e., crops and livestock. Table 41 in appendix C summarizes these results, showing the specialization of external funds in terms of the activities financed, central-bank funds primarily financing crop enterprises and foreign funds focusing on livestock activities.

Table 42 in appendix C presents the correlation coefficients between the shares of the different sources of funds in the portfolio of new loans. There is a high negative correlation between central-bank funds and foreign funds, showing that these external sources have been substituting for each other during the period under analysis. Central-bank funds have been also compensating for the decline in importance of deposits as a source of funds, as denoted by the negative correlation between these two sources.

These findings may be summarized as follows: (a) the growing share of external sources of funds (largely directed towards agriculture) has not been reflected in a significant change in the relative role of agricultural loans in the portfolio. The fungibility of finance is at work here, with external funds substituting for own-deposit funds that have been transferred from agricultural to non-agricultural loans. (b) The increased share of external funds may have induced the re-allocation of non-targeted funds to increasingly larger-sized loans in the non-agricultural sector. This cost-saving adjustment compensates for the increasing costs of handling a growing proportion of external funds in the "targeted" portion of the loan portfolio.

<u>Effects of Loan-Targeting on the Costs of the Development Bank</u>

The cost-function estimates including expression (4.17) to capture the effects of different sources of funds on intermediation costs are presented in table 16. Model 1 in this table includes the indicator variable for non-targeted funds (own-deposits, S_1), and the lagged combined effect of external funds (central bank and foreign funds). Model 2 also includes the non-targeted-funds variable, but separates the effect of (current-year) central bank funds from those of foreign funds with a one-year lag.

The estimated coefficients for the variable that captures the effects of increases in the amount of non-targeted funds (S_1, deposits) are not statistically different from zero, with very low asymptotic t-ratios in both models. Targeted funds show significant cost-increasing effects, whether they are included as a combined variable (column 1), or as separate effects (column 2). Given the typical features of central-bank and foreign-funded projects, model 2 is a more appropriate representation of these targeting schemes than model 1. The results of model 2 indicate that increases in central-bank funds will have a contemporaneous cost-increasing effect on the development bank ($\hat{\omega}_2 > 0$), given the short-term nature of the targeted programs funded through rediscount lines of the central bank. On the other hand, additional funds originated in foreign sources, usually targeted to medium-to-long-term activities with extended periods of disbursement, will exercise a cost-increasing effect with a one-year lag ($\hat{\omega}_3 > 0$ for $S_{3(t-1)}$).

The definition of the variables that account for the effects of different sources of funds does not allow a

Table 16. Effects of Loan-Targeting on the Intermediation Costs of the Development Bank: Estimated Coefficients for Different Sources of Funds.[a]

Source of Funds, Parameter	Estimated Coefficients in Different Models[b] (1)	(2)
Non-targeted funds		
ω_1, deposits (S_1)	0.0056 (0.31)	0.0145 (0.76)
Targeted funds		
ω_2, central bank (S_2)		0.1129 (4.20)*
ω_{23}, lagged central bank and foreign ($S_{23(t-1)}$)	0.0756 (2.81)*	
ω_3, lagged foreign funds ($S_{3(t-1)}$)		0.0525 (1.94)†
Weighted R-square of the cost system	0.73	0.74
F-test of Joint Null Hypothesis: $\omega_i = 0$, all i	3.13†	5.30*

a/ Cost-system estimation, other parameters of the cost function not reported. See basic specification of the cost function in table 5.

b/ Asymptotic t-ratios in parenthesis.

* : significant at 0.01 level
† : significant at 0.05 level

direct interpretation of the magnitudes of the estimated coefficients. However, comparisons of effects across variables are valid. The cost-increasing effects of central bank funds appear twice as high as those associated with lagged foreign funds. However, the null hypothesis that these two coefficients are equal to each other can be rejected only at the 0.10 level (i.e., accepting a 10%-probability of error).

In summary, these results support the hypothesis that there is a lagged, "ratchet"-type effect of targeted funds on the intermediation costs of the development bank. Overall intermediation costs are increased as a result of additional funding received from external sources. This effect is more significant in the case of rediscount lines of credit coming from the central bank than in the case of foreign-funded projects. On the other hand, greater reliance on deposits as a source of loan-funds will not affect overall intermediation costs of the development bank.

5.5. Loan Delinquency and Intermediation Costs in the Development Bank

Delinquency is a common characteristic of the loan portfolio of most development banks. Therefore it is pertinent to investigate the degree to which the delinquent portfolio in the development bank has contributed to the lending costs of the bank, above and beyond the costs considered up to this point.

This section presents a brief discussion of the delinquency record in the development bank, emphasizing the biases in the measurement of delinquency rates. At the same time, the results of the estimated cost function are analyzed including different indicators of delinquency. The estimated effects that delinquency has on bank's costs are interpreted as an indication of managerial response to this problem. The mechanisms of response were discussed in chapter 4.

Delinquency Records and Measurement Problems

Composition of the loan portfolio according to loan delinquency status is summarized in table 17. In this table, loans that have been rescheduled or refinanced are classified separate from non-delinquent balances, in order to provide a more complete description of the "health" of the loan portfolio. Table 17 shows that the loan portfolio has (apparently) deteriorated over time. Delinquent balances alone accounted for an average of 21% of the value of the loan portfolio during the period 1970-1974. Their relative importance grew to an average of 32% in the period 1975-1978, and subsequently to almost 39%, on average, in the period 1979-1982. If rescheduled and refinanced loans are added to delinquent balances, this broader definition of the delinquent loan portfolio goes from 34% of total loans outstanding in the first period indicated above, to 45% in

Table 17. Delinquent Balances and Refinanced Loans as a Proportion of Total Loans Outstanding in the Development Bank, 1970-1982

	Percent of Total Loans Outstanding		
	(1)	(2)	(3)
Year	Delinquent Balances[a/] %	Rescheduled and Refinanced Loans %	Non-Delinquent Balances %
1970	21.4	11.2	67.4
1971	24.9	11.5	63.6
1972	18.0	13.8	68.2
1973	18.1	15.5	66.4
1974	22.7	14.2	63.1
1975	25.9	13.4	60.7
1976	32.3	12.3	55.4
1977	35.5	11.6	52.9
1978	33.7	13.1	53.2
1979	31.9	12.6	55.5
1980	41.3	8.9	49.8
1981	36.9	11.5	51.6
1982	43.8	5.9	50.3

Source: 1970-1980, Graham *et al.* [36], Chapter V.
1981, 1982, computed from BANADESA records

a/ Loans one day or more overdue

the second period, reaching an average of 48% of the loan portfolio in the last 4-year period (1979-1982).

The foregoing descriptive record of delinquency for the bank requires some qualifications that arise from the definition of delinquency utilized in the bank, and the method for the calculation of delinquency rates. As indicated in chapter 4, delinquency rates are computed as the ratio of delinquent balances over total loans outstanding (i.e., column 1 in table 17). The bank defines a loan as delinquent or overdue only when all installments have become past-due. Therefore, overdue installments on long-term loans are not included as delinquent balances until the last repayment becomes overdue. However, the total amount of the same loan is included in the figure of total loans outstanding, i.e., in the denominator of the ratio that defines the delinquency rate.

This procedure to measure delinquency implies that these delinquency rates are underestimated as compared to a ratio of overdue balances to balances due. At the same time, the magnitude of this bias depends on the share of long term loans in the portfolio. The higher the share of these loans and the longer the term structure, the more underestimated is the delinquency rate. During the period under analysis (1970-1982), the share of long-term loans in the overall portfolio has decreased consistently, from an average of 42% for the years 1970-1974, to 32% on average during the period 1975-1978, and even further to about 20% in the last four years of the series.[10] This decreasing share of long-term loans is clearly related to the decreasing proportion of foreign funds among the bank's sources of funds, reported in the preceding section. Foreign-funded programs, typically targeted to long-term projects, have the property of "disguising" delinquency when the corresponding indicators are computed as described above.

These variations in the term structure of the loan portfolio and their implications for the measurement of delinquency have to be taken into account in the analysis of the figures reported in table 17. First, all delinquency rates reported in the table are underestimating the "true" delinquency rates that would result from calculating a ratio of overdue balances to balances due. Second, the pattern of growing delinquency may be misleading, since the degree of underestimation is more serious in the earlier years of the series, due to the higher share of long-term loans in the portfolio at that time. It can be asserted that "true" delinquency has not grown as the rates reported in table 17 suggest. Whether the actual delinquency rate has grown at a different rate, has remained stable, or has decreased, cannot be ascertained with the information available.

An alternative way of looking at the delinquency problem considers the "age" of delinquent balances. If old

10/ See Graham *et al.* [36], chapter V. This report discusses other features of the delinquent portfolio of the development bank, that are omitted here.

delinquent balances become more important in the delinquent portfolio, then the overall probability of repayment is decreasing. This situation indicates that loan recovery efforts are non-existent or ineffective, and loan-guarantees are nonexistent or not enforced. Table 18 sets forth the age composition of the delinquent portfolio of the development bank for the period under analysis. The shares of delinquent balances of different ages reported in this table indicate that the delinquent portfolio has become increasingly older throughout the period. Even though the proportion of delinquent loans more than 90 days overdue has remained fairly stable, around 80 or 90%, the proportion of balances with more than one year overdue shows a growing trend. On average, loans more than one year overdue accounted for 40% of the delinquent portfolio during the period 1970-1974, decreasing to 32% in the subsequent 4-year period (1975-1978), and then increasing to an average of 52% in the period 1979-1982. The results reported below will indicate that loan-recovery initiatives have existed in the bank, as a response to growing delinquency, but the figures discussed above suggest that these efforts have been in general ineffective.

Effects of Delinquency on Intermediation Costs

The estimated cost function of the bank reported in table 19 includes as explanatory variables the delinquency

Table 18. Composition of Delinquent Balances by Age in the Development Bank, 1972-1982

	Percent of Total Delinquent Balances			
		More than 90-days Overdue		
Year	Less than 90-days overdue (1) %	Total over 90 days overdue (2) %	More than 90 days but less than 1 year (3) %	More than 1 year overdue (4) %
1972	12.6	87.4	33.7	53.7
1973	7.7	92.3	53.3	39.0
1974	25.0	75.0	45.9	29.1
1975	15.0	85.0	59.8	25.2
1976	14.5	85.5	72.8	12.7
1977	9.5	90.5	63.5	27.0
1978	8.5	91.5	29.5	62.0
1979	7.4	92.6	46.1	46.5
1980	22.4	77.6	28.1	49.4
1981	17.5	82.5	31.5	51.0
1982	15.4	84.6	26.0	62.6

Source: BANADESA, Economic Studies

rate (DR), and the proportion of delinquent balances more than 90 days overdue (DA). The hypotheses formulated in chapter 4 stated that increases in delinquency will have cost-increasing effects due to the allocation of additional resources to loan recovery activities, and to the tightening of loan procedures. This latter effect is likely to operate with a lag, whereas the intensification of loan recovery is expected to be the first response of the bank's management to upward trends in delinquency.

The delinquency rates and proportion of "old" loans in the delinquent portfolio were calculated for all branches over the 1971-1982 period and included in the cost-function. Model (1) in table 19 includes these two variables, model (2) considers the current and lagged effect of the delinquency rate, and model (3) specifies the lagged values of the delinquency rate, and the lagged share of loans more than 90 days overdue. In general, the results presented in table 19 indicate that there is a cost-increasing effect of delinquency on the operations of the development bank. In all three models, the joint F-test for the inclusion of the delinquency-related variables is significant, indicating that these variables can be considered relevant in the specification of the cost-function. The current-year level of the delinquency rate shows a positive and significant coefficient in the models in which the variable is included

Table 19. Effects of Delinquency on the Intermediation Costs of the Development Bank: Estimated Coefficients for Current and Lagged Effects[a/]

Parameter, variable	Estimated Coefficients in Different Models[b/] (1)	(2)	(3)
Current Effects			
π_{10}, Overall delinquency rate (DR)	0.3567 (3.61)*	0.4419 (3.28)*	
π_{20}, Proportion of delinquency over 90 days-overdue (DA)	0.0798 (0.81)		
Lagged Effects			
π_{11}, DR (t-1)		-0.0642 (-0.45)	0.1995 (1.82)°
π_{21}, DA (t-1)			0.1642 (1.67)°
Weighted R-square of the cost system	0.75	0.75	0.77
F-test of joint null hypothesis: $\pi_i = 0$, all i	5.59*	6.33*	2.92†

a/ Cost-system estimation, other parameters of the cost function not reported. See basic specification of the cost function in table 5.

b/ Asymptotic t-ratio in parenthesis

* : significant at 0.01 level
† : significant at 0.05 level
° : significant at 0.10 level

included (models 1 and 2). However, the estimated coefficient for the current level of the variable that accounts for the "age" of delinquency is not significantly different from zero (see model 1 in table 5.17). The lagged value of the delinquency rate does not show a significant coefficient when it is included together with its current-year value (model 2), whereas its estimated coefficient is positive and significant in model 3. In this model, the lagged values of the two variables show positive and significant coefficents. Furthermore, the weighted R-square obtained for this model is the highest among the models specified in table 19.

In the three models reported in table 19, the sum of the coefficients of the two variables included fluctuates between 0.36 and 0.43, indicating that an increase in loan-delinquency of one percentage point would generate an increase in costs of about 0.4%. The results of model 3 suggest that aging plays a role in this cost-increasing effect, and that the response to increased delinquency occurs with a lag. In short, additional resources are devoted to loan-recovery and/or to loan-evaluation and monitoring, once an increase in the level of delinquency has been detected. However, there appears to be a delay in this response and, more importantly, these efforts have not been succesful in improving the "health" of the loan-portfolio of the bank. High levels of delinquency, and increasingly older delinquent balances continue to characterize the loan portfolio of the development bank.

CHAPTER VI

Transaction Costs and Borrowing Costs

This chapter presents first a brief overview of the results obtained from the field-survey on borrowing costs described in the methodology chapter. Second, the results of the econometric analysis of the trade-off model for borrower's transaction costs and the interest rate are presented and discussed. This section emphasizes the main factors affecting both the level of transaction costs and the magnitude of the trade-off between these costs and the explicit interest rate charged on loans.

6.1. Overview of Survey Results

A total of 198 interviews of farmer-clients of financial institutions were conducted in July-August 1981, throughout four main agricultural regions of Honduras. The general characteristics of the sample are summarized in appendix D, tables 43 through 46. Approximately one-half of the total sample of farm borrowers had loans less than 5,000 lempiras (i.e. $2,500 at the current exchange rate of two lempiras equal to one dollar). The average loan size however was close to 23,000 lempiras indicating a clear asymmetry or skewness in the overall distribution of loans.

Although the distribution of the clientele for each loan source overlaps to some extent, each can be clearly identified with respect to the predominant scope of their operations in terms of loan and farm size. Rural credit unions in Honduras are the classic small-farmer loan source with most loans below 2,000 lempiras on farms typically less than 20 hectares. At the other extreme are the farmer-clients of the private commercial banks with the larger proportion of their loans over 25,000 lempiras on farms generally above 100 hectares. The National Agricultural Development Bank (BANADESA) activity falls in between with a majority of its loan operations between 1,000 and 10,000 lempiras on farms largely between 10 and 100 hectares.

The pattern of association between loan size and farm size is fairly similar across different loan sources. Small loans tend to be directed to smaller farms and large loans appear concentrated in larger farm sizes. However, this relationship is not as strong as might have been expected, a correlation coefficient between loan size and farm size estimated for the overall sample was close to 0.5. Tables 44 through 46 in appendix D explain this finding by the presence of relatively large loans made to small farms by private banks, and relatively small loans being granted to some large farms by credit unions. BANADESA appears to be the source of loans for which the observed association between farm size and loan size more closely fits the expected pattern. It must be recalled that this expected positive relationship is based on the assumption that farm size is a good indicator of farmer's wealth and therefore creditworthiness. However, this may not necessarily be the case in Honduras, given the heterogeneity of land quality observed across regions and within regions.

6.1.1. Overall Sample Results

Borrowing transaction costs were defined (section 4.2) as all those non-interest explicit and implicit expenses incurred by the borrower in the process of obtaining a loan. Explicit expenses refer basically to the following: (a) Cost of transportation, lodging and meals when travelling to the office of the institution granting the loan, or to other places with the purpose of obtaining related documents. (b) Fees, taxes or other charges associated with the issuing of documents, registration of guarantees or collateral, contracts and the like. (c) Explicit charges imposed by the lending institutions in the process of handling the application.

Implicit transaction costs directly related to borrowing correspond to the value of the time forgone by the farmer attributable to negotiating and securing a loan. The minimum wage rate (5 lempiras per day) was imputed as a lower-bound estimate of the opportunity cost of time diverted from farming operations. In many cases a higher value could have been imputed to farmer's time, but using a lower limit has the advantage of obtaining a measure of transaction costs that represents a lower boundary as well. Total borrowing costs are computed as the sum of the explicit interest rate charged on the loan <u>plus</u> the transaction costs expressed on a per lempira basis.

A summary of the results obtained for the total sample of individual farmers is presented in Table 20. As pointed out before, the distribution of loan amounts approved is asymmetric, concentrated around small loan sizes. Likewise, the amounts actually disbursed as well as the different measures of transaction costs show a similar skewness. This common characteristic of the distribution of the variables involved in the analyses makes more appropriate the use of the median values as a basis for the presentation of descriptive results, since these should reflect more accurately (than the arithmetic mean) the central or typical values of the different variables.

It is interesting to note in table 20 the relationship between the amount actually disbursed in credit operations and the amount originally approved. The proportion disbursed (76 percent, taking the aggregate figures, or 66 percent considering the ratio of the two median values) is rather low considering the period of the year in which the survey was carried on. As of August, the first growing season ("primera") is precisely coming to its end, i.e,

Table 20. Mean and Median Values of Transaction Costs and Total Borrowing Costs (Per Loan and Per Lempira) for Total Sample of Borrowers

	Mean Value	Median Value
1. Amount of Loan Approved, L.	22,930.1	5,289.5
2. Amount Disbursed, L.	17,414.8	3,500
3. Ratio Disbursed/Approved	0.76	0.66[a]
4. Transaction Costs		
(i) per loan (Lps.)	226.88	57.75
(ii) per Lempira (%)		
Approved	2.50	1.26
Disbursed	3.54	1.82
5. Interest Rate (%)	13.54	13.00
6. Total Borrowing Costs, per Lempira (%)		
(i) Approved	15.95	15.25
(ii) Disbursed	16.98	16.11

a/ Ratio of the two median values.

Source: Survey results.

loans granted for that reason should be completely disbursed. The low proportion of long-term loans in the sample corresponded mainly to operations in 1980, implying that all loans were also disbursed. In sum, the observed ratio disbursed/approved should not be attributed to biases in the data collection. Rather, it may be an indication of either or both of the following phenomena:

-- First, the influence (guidance, counseling or outright dominance) of the bank official or agent in the determination of the amount of the loan to be applied for (an element of "supply-led finance"). The client then follows the official's "advice" when filling out the loan application, but will request disbursements according to his own idea of the level of indebtedness he is willing to undertake. The reasons for this being lower (on average) than the amount approved leads to the second explanation.

-- Secondly, even though agricultural credit in the country may appear as "cheap money" for farmers, a less than 100 percent disbursement rate would be counter-evidence for that assertion. This apparent contradiction suggests that credit conditions may not be as "cheap" when compared with the investment alternatives available to farmers, and that they do not have (in general) efficient ways to divert agricultural loans to other more profitable uses. Either the financial system is not well developed at the rural level, or loan monitoring and supervision is active enough to prevent credit diversion. It is likely that both arguments are valid in the case under analysis.

The tables included in this section present transaction costs per lempira both as a percent of the amount approved and as a percent of the amount disbursed. The former is interpreted as the implicit interest that the lending institution "intended" to charge whereas the latter corresponds to the actual cost incurred by the borrower.

The aggregate results for the sample as a whole reported in table 20, indicate that the various elements of borrower transaction costs added roughly three percentage points to the average explicit interest rate of 13 percent. This represents almost one quarter of the interest rate. The incidence of these borrowing costs by loan and farm size in the sample, and the differences observed between different institutional lenders are briefly discussed in the following sections.

6.1.2. Different Loan Sizes

The behavior of transaction costs and total borrowing costs, by loan size category is shown in table 21. Several consistent patterns can be observed in this table. The cost of obtaining a loan increases systematically with the size of loan (excepting for only one "drop" in the 15,000 to 25,000 lempira category). Notwithstanding this behavior, transaction costs per lempira borrowed decrease consistently

Table 21. Components of Total Borrowing Costs, by Loan Size[a/]

Loan Size Category (Lps.)	Transaction Costs: Per Loan (Lps.)	Transaction Costs: Per Lempira (%) Approved	Transaction Costs: Per Lempira (%) Disbursed	Interest Rate (%)	Total Borrowing Costs Per Lempira (%) Approved	Total Borrowing Costs Per Lempira (%) Disbursed
Less than 1,000	30.75	5.87	6.0	13	18.92	19.23
1,001 - 2,000	42.0	2.86	4.33	13	16.07	17.73
2,001 - 5,000	44.88	1.18	1.52	13	14.88	15.77
5,001 - 10,000	53.0	0.77	1.13	13	14.03	14.94
10,001 - 15,000	86.75	0.81	1.12	13	14.56	14.87
15,001 - 25,000	42.75	0.20	0.44	13.5	13.89	14.35
25,001 - 50,000	131.50	0.40	0.95	14	14.40	15.71
50,001 - 100,000	322.50	0.42	0.63	13	13.17	13.63
More than 100,000	1,414.50	0.83	1.01	11	12.09	12.36

a/ All values are median values. Therefore, the median values of total borrowing costs are not necessarily the sum of the median values of the separate transaction costs per lempira plus the median value of the interest rate, as they would be if mean values had been used.

Source: Survey results.

as the loan size increases. In other words, the increase in transaction costs per loan occurs at a slower rate than that of the loan size itself. Note that there appears to be a trade-off between the explicit interest rate and implicit charges (transaction costs) such that the behavior of total borrowing costs follows an almost perfectly decreasing order, from smaller loans to larger loans.

What appears as a very uniform treatment of all loans, if only the levels of explicit interest rates are considered, turns out to be a consistently negative relationship between borrowing costs and loan size. This result indicates the presence of rationing mechanisms exercised by lending institutions against small loans, due to their relatively high costs of handling and monitoring as well as the eventual higher default risk associated with these loans.

6.1.3. Different Farm Sizes

As pointed out before, the association between loan size and farm size was found significant but relatively low. However, table 22 shows that the behavior of transaction costs and total borrowing costs observed with respect to loan size are also apparent and consistent when contrasting the measures obtained for different farm-size categories. Transaction costs per loan increase as farm size increases, the reverse pattern is observed for transaction costs per lempira and for overall borrowing costs. These results suggest that the farm size of the borrowing unit is being

Table 22. Components of Total Borrowing Costs, by Farm Size[a/]

Farm Size Category (Has.)	Transaction Costs Per Loan (Lps.)	Transaction Costs Per Lempira (%) Approved	Transaction Costs Per Lempira (%) Disbursed	Interest Rate (%)	Total Borrowing Costs Per Lempira (%) Approved	Total Borrowing Costs Per Lempira (%) Disbursed
Less than 5	31.75	2.97	4.31	13	16.0	17.33
5.1 - 10	40.0	2.39	4.68	13	15.07	17.14
10.1 - 20	53.5	1.65	2.68	13	16.20	17.67
20.1 - 50	56.25	1.00	1.74	13	14.64	15.52
50.1 - 100	75.0	0.84	1.97	13	14.84	15.64
100.1 - 200	133.75	1.23	1.68	13.5	16.52	17.52
More than 200	149.25	0.41	0.60	13	13.82	14.02

a/ All values are median values. Therefore, the median values of total borrowing costs are not necessarily the sum of the median values of the separate transaction costs per lempira plus the median value of the interest rate, as they would be if mean values had been used.

Source: Survey results.

considered by banks as an indicator (although imperfect) of creditworthiness, tending to charge implicit risk-premia through transaction costs to smaller-farm operations.

6.1.4. Different Lenders

The borrowing costs associated with different institutional sources of loans are presented in table 23, broken down by the two basic components of borrowing costs: transaction (non-interest) costs, and the interest rate.

The lowest transaction costs per loan correspond to those granted by credit unions, where obtaining a loan would typically cost a farmer less than 18 lempiras. This figure rises to 60 lempiras in the case of BANADESA, and even higher for private banks, 136 lempiras. Private banks become the least expensive source of credit when transaction costs are expressed on a per lempira basis, as well as when total borrowing costs are considered. This is a direct result of the differences in loan size distribution between the sources set forth before. Overall borrowing costs in BANADESA and credit unions amount to a similar figure, although transaction costs per lempira appear higher in the case of BANADESA.

Summarizing the results of this and preceding sections, it has been found that:

(a) transaction costs <u>per loan</u>

-- are positively related to loan size,

Table 23. Borrowing Costs Associated with Different Institutional Sources of Credit[a/]

Source	Transaction Costs Per Loan (Lps.)	Transaction Costs Per Lempira (%) Approved	Transaction Costs Per Lempira (%) Disbursed	Interest Rate (%)	Total Borrowing Costs Per Lempira (%) Approved	Total Borrowing Costs Per Lempira (%) Disbursed
BANADESA	60	1.71	2.69	13	15.30	16.57
Private Banks	136	0.70	1.01	13	13.54	14.11
Credit Unions	17.75	1.43	1.62	12	16.11	16.52

a/ All values are median values. Therefore, the median values of total borrowing costs are not necessarily the sum of the median values of the separate transaction costs per lempira *plus* the median value of the interest rate, as they would be if mean values had been used.

Source: Survey results.

-- are positively related to farm size,

-- differ sharply between sources of credit.

(b) transaction costs per lempira

-- are negatively related to loan size,

-- are negatively related to farm size,

-- vary considerably between lending institutions.

(c) lending institutions tend to substitute implicit charges (that translate into transaction costs) for explicit interest, due to the limited discretionary power they have to determine these rates.

The econometric analysis presented in the following section will assess the statistical significance of some of the foregoing results.

6.2. The Transaction-Costs Function

This section presents the results obtained in the estimation of the transaction-cost function specified in chapter 4. Throughout this section, the functional form specified as equation (4.23) is referred to as the "basic model". The function that allows for interactions in the trade-off between transaction costs and interest rate is labeled "extended model". After the overall results of these two versions are presented and discussed, section 6.2.1 will focus on the specific findings for the relationships between transaction costs and loan amount. Section 6.2.2 concentrates on the results obtained for the trade-off between transaction costs and interest rate, and the factors that affect its magnitude.

The extended version of the transaction-costs function can be written as:

$$\ln T = a_0 + a_1 \ln A + a_2 \ln L + a_{30} \ln(i) + a_{31} S \ln(i) + a_{32} D_1 \ln(i) + a_{33} D_2 \ln(i) + a_{34} F \ln(i) + b_1 D_1 + b_2 D_2 + c_1 U_1 + c_2 U_2 + c_3 U_3 \qquad (6.1)$$

where,

T is the borrowing (non-interest) transaction costs per loan,

A is the area of the farm,

L is the loan amount,

i is the explicit interest rate that can be charged on the loan by the lender,

S is a dummy variable for loan-size category,

$S=1$ if the loan amount is less than or equal to L. 2,000,

$S=0$ otherwise,

D_1 and D_2 are dummy variables that account for deviations of T in private banks with respect to the development bank, that is used as the base or level of reference,

$D_1=1$ if the lender is a private bank,

$D_1=0$ otherwise,

$D_2=1$ if the lender is a credit union,

$D_2=0$ otherwise,

F is a dummy variable for farm-size category,

$F=1$ if the area of the farm is less than or equal to 20 hectares,

$F=0$ otherwise,

U_1, U_2, and U_3 are dummy variables defined to capture the effects on transaction costs of different loan-uses: basic grains, export crops, and livestock, as deviations with respect to a miscellaneous end-use category conformed by all other end-uses in agriculture (land purchases, trade, vegetable crops, and others),

U_1=1 if the stated end-use of the loan is basic grains,

U_1=0 otherwise,

U_2=1 if the stated end-use of the loan is export crops,

U_2=0 otherwise,

U_3=1 if the stated end-use of the loan is livestock,

U_3=0 otherwise.

Therefore, the basic model (4.23) is equivalent to the extended model (6.1) with zero restrictions on the parameters a_{31}, a_{32}, a_{33}, and a_{34}.

The results of the OLS estimation of the basic model and the extended version are presented in table 24. The extended model (column 2 in table 24) has been simplified dropping the interactions of farm size and credit unions with the interest-rate variable, which did not add statistical significance to the overall function. The F-statistic computed to contrast the extended model including these two interactions and the simplified one presented in table 24 has a value of 0.14, therefore the hypothesis that the two additional coefficients are equal to zero is not rejected. Moreover, neither one of the coefficients for these two interaction variables was significantly different from zero.

Table 24. Estimated Coefficients of the Transaction-Costs Function, Under Different Model Specifications. Dependent Variable : lnT.

Parameter (Independent Variable)	(1) Basic model Estimate	(1) Basic model t-ratio	(2) Extended model Estimate	(2) Extended model t-ratio
a_0 (intercept)	3.4225	3.397*	1.9183	1.745°
a_1 (lnA, area of the farm)	0.0001	0.002	0.0448	0.605
a_2 (lnL, loan amount)	0.3388	3.844*	0.4461	4.027*
a_{30} (lni, interest rate)	-0.9237	-3.782*	-0.8425	-3.390*
a_{31} (Slni, small loans x interest rate)			0.2874	2.833*
a_{32} (D_1lni, private banks x interest rate)			-2.1141	-2.536*
b_1 (D_1, private banks)	0.5879	2.201†	6.1259	2.690*
b_2 (D_2, credit unions)	-0.8329	-3.113*	-0.7997	-3.126*
c_1 (U_1, basic-grains loans)	0.3607	1.357	0.2980	1.176
c_2 (U_2, export-crops loans)	-0.3394	-1.085	-0.2943	-0.987
c_3 (U_3, livestock loans)	0.4925	0.329	0.3844	1.204
R-square	0.4652	--	0.5207	--
F-value	18.81*		18.58*	

OLS estimation, N=182. S, D_1, D_2, U_1, U_2, and U_3 are dummy variables.
Levels of significance: *, 0.01; †, 0.05; °, 0.10.

In general, the results shown in table 24 are satisfactory from the statistical point of view. R-square values are fairly high considering that the sample consists of a set of cross-sectional observations. Most individual coefficients are significantly different from zero and show the expected signs, according to the discussion presented in section 4.2. The results corresponding to the different factors entering the estimated equations are outlined below.

(a) Area of the farm, A

An exception to the significance of individual coefficients is the farm-area variable (A). The parameter-estimate is not significantly different from zero in any of the estimated models. This result may be reflecting the fact that farm size does not constitute a good proxy for farmer's wealth in the Honduran case, given the heterogeneity of land quality across and within different areas of the country. Two other proxies for farmer's wealth or firm size were substituted for farm area in different regressions with the results outlined below.

First, the ratio of the value of the loan guarantee to the loan amount was used instead of area of the farm. The regressions estimated using this ratio showed lower R-square values than those obtained in the equations including farm area (see table 47, column 1, in appendix D). The individual coefficient of the ratio loan-guarantee/loan-amount was also non-significant. The values and significance of the other coefficients in the model were similar to those obtained with the model including farm area, presented in table 24. Another proxy for wealth was total labor costs. The results obtained using this variable were essentially the same as those reported for the models using farm area as proxy for firm size (see table 47, columns 2 and 3). Overall statistical significance and values of the estimated coefficients were very similar between these two alternative models. In view of these similarities, it was decided to keep farm area as the proxy for firm size, on the basis that this variable is more easily available for simulation purposes using the estimated equations.

(b) Loan amount, L

The results obtained for the relationship between transaction costs and loan amount were as expected in terms of sign and magnitude of the estimated coefficients. In all equations the estimated parameter for this variable was significantly greater than zero and less than one. The t-ratios for the null hypothesis that the parameter is zero ranged between 3.8 and 5.4 across different equations (see tables 24, and 47 in appendix D). On the other hand, t-ratios for the null hypothesis that the parameter is equal to one ranged between -4.7 and -7.6. In all cases the null hypothesis can be rejected at the 0.01 level of significance. The 99%-confidence intervals for the parameter

a_2 (loan amount) computed with the results presented in table 24 are the following:

basic model (column 1 in table 24), $0.1082 \leqq a_2 \leqq 0.5694$,

extended model (column 2 in table 24), $0.1564 \leqq a_2 \leqq 0.7358$.

These results indicate that transaction costs per loan are an increasing function of the amount of the loan. However, the elasticity of transaction costs per loan with respect to changes in the loan amount is less than one. Therefore, transaction costs per loan increase as loan size increases, at a decreasing rate.

The implicit values for the elasticity of transaction costs per lempira (τ) with respect to the loan amount are -0.6612 in the basic model, and -0.5539 in the extended version. Thus transaction costs per lempira are a decreasing function of the loan amount. As discussed in section 4.2, this result implies that the absolute value of the slope of the transaction-costs per lempira curve with respect to loan amount will decrease as the loan amount increases. These relationships between transaction costs and loan amount will be discussed with more detail in section 6.2.1. In this section these results will be laid out in graphs that emphasize the role of the interest rate and the loan source as shift parameters in the relationship between transaction costs and loan amount.

(c) Interest rate, i

The results obtained for the effect of this variable on transaction costs are also significant and stable across different specifications. The coefficient associated with the direct effect of the interest rate, a_{30}, is significantly less than zero and not significantly different from -1 in all estimated equations.[1/] These results indicate that there exists a trade-off between transaction costs of borrowing and the explicit interest rate charged on loans, such that a one-percent increase in the interest rate will bring about a one-percent decrease in borrowing transaction costs.

The foregoing results must be qualified when the interactions with the dummy variables for small loans (S) and private banks (D_1) are considered. These two interactions showed significant coefficients when included in the estimated equations (see table 24, column 2, also table 47, column 3). As indicated before, the interactions of farm size and credit unions with the interest-rate variable were not significant and were dropped from the extended model in order to simplify the equation and its analysis.

The positive sign shown by the interaction between interest rate and small loans (a_{31}) indicates that in these cases the magnitude of the trade-off becomes smaller in

1/ t-ratios for the null hypothesis a_{30} = 0 range between -3.3 and -3.8 (Ho rejected); t=ratios for the null hypothesis a_{30} = -1 show values between 0.22 and 0.74 (Ho not rejected).

absolute terms, than in the case of medium-size or larger loans.[2/] In other words, there is less substitution between implicit interest (transaction costs) and explicit interest for loans of very small amounts (less than 2,000 lempiras). The coefficient associated with the interaction between the interest rate and the dummy variable for private banks (a_{32}) is negative and significant. Thus the magnitude of the trade-off between transaction costs and the interest rate is larger when the lender is a private bank. This is a result of greater flexibility of loan procedures in these banks, and more prompt response of their management to changes in the economic environment, than is the case in the development bank and in the credit unions. This trade-off between transaction costs and interest rate is analyzed with further detail in section 6.2.2. In this section, the values and statistical significance of the estimated elasticities between transaction costs and interest rate for different combinations of loan sources and loan sizes will be presented and discussed.

(d) Loan sources, D_1, D_2

The results presented in table 24 and the tests of significance shown in table 25 indicate that loan source is a relevant factor in determining the level of transaction costs. The values of the F-statistics reported in table 25 reject the joint null hypothesis $b_1=0$, $b_2=0$, in both the

2/ Recall that $\partial \ln\tau/\partial \ln i = a_{30} + a_{31}S + a_{32}D_1, < 0$.

Table 25. Tests of Significance of the Effects of Loan Source and Loan-Use on Borrowers' Transaction Costs. Values of the F-Statistics for Joint Null Hypotheses, under Different Model Specifications.

Factor, Null Hypothesis	Basic Model[a/] F-value	Basic Model[a/] Significance	Extended Model[a/] F-value	Extended Model[a/] Significance
Loan Source, H: $b_1 = b_2 = 0$	8.51	0.01	6.35	0.01
End-Use H: $c_1 = c_2 = c_3 = 0$	3.70	0.01	2.69	0.05

a/ See Table 24 for detailed results of these models.

basic model and the extended model. The coefficient associated with the dummy variable for private banks (b_1) shows a positive sign and is significantly different from zero (see table 24). This result reflects the greater ability of private banks to pass-on transaction costs to borrowers. Therefore, for any given loan amount, borrowing from private banks entails higher transaction costs than borrowing from other institutional sources.

The results presented in table 24 show that credit unions are the least expensive source of funding for farm borrowers, at given loan sizes and interest rates. The coefficient of D_2, the dummy variable for credit-union loans, is negative and significantly different from zero, denoting lower transaction costs associated with borrowing from these financial institutions. This result is explained by the existence of less complicated loan procedures in credit unions, where loans are usually approved on the basis of personal knowledge of the applicant, thus requiring little time and documentation.

(e) Loan uses, U_1, U_2, U_3

The results obtained for end-use of loans as a factor determining the level of transaction costs are less clear than the findings discussed above for the effects of loan sources. In the case of loan use, the joint null hypothesis that the effects of different loan uses are non-significant ($c_1=c_2=c_3=0$) is also rejected by the values of the F-statistics reported in table 25. However, individual coefficients are in general not significantly different from zero, though their signs and magnitudes are very stable across different specifications (see table 24, and table 47 in appendix D). The sign of the coefficient associated with basic grains (c_1) is positive as expected, indicating that these loans bear higher transaction costs than the miscellaneous end-uses that play the role of reference level in the estimated equations. As discussed in section 4.2, this may be a result of a higher level of loan-risk that can be associated with basic-grains farming.

Export crops appear to be seen by lenders as low-risk ventures, thus requiring less information, documents and monitoring. It was pointed out in section 4.2 that these crops are usually grown under marketing-repayment agreements between producers, banks, and processing/marketing firms. These schemes reduce production and marketing risks, and minimize the risk of default from the lender's viewpoint. The negative sign observed for c_2, the coefficient associated with export-crop loans, is consistent with the foregoing discussion. Finally, livestock loans show a positive though non-significant coefficient associated with the corresponding dummy variable for this end-use (U_3). This result suggests that for lenders the perceived riskiness of this activity prevails over the fact that livestock can be used as built-in collateral in these loan operations.

6.2.1. Transaction Costs and Loan Size

This section draws upon the results of the basic model reported in table 24 for a presentation of the estimated relationship between transaction costs and the loan amount. The use of the basic-model results in this section, instead of the results of the extended version, makes the graphic presentation less complicated without affecting the essence of the relationship under analysis. The results obtained with the extended version are utilized extensively in the following section, to discuss the nature of the trade-off between transaction costs and the explicit interest rate.

To analyze the relationship between transaction costs and loan amount it is convenient to summarize the results of the basic model as follows:

$$T = 30.6459\ A^{0.0001}L^{0.3388}i^{-0.9237}e^{\Sigma_j b_j D_j + \Sigma_k c_k U_k} \qquad (6.2)$$

where, T is transaction costs per loan,

A is area of the farm,

L is the loan amount,

i is the explicit interest rate,

D_j are dummy variables for loan source, j=1,2,

U_k are dummy variables for end-uses, k=1,2,3.

Equation (6.2) is evaluated at the geometric mean of area of the farm (35 hectares), and written for each loan source disregarding the effects of different loan uses to simplify the exposition (i.e., setting all c_k=0):

(a) Development bank (D_1=0, D_2=0),

$$T = 30.6568\ L^{0.3388}i^{-0.9237} \qquad (6.3)$$

(b) Private banks (D_1=1, D_2=0),

$$T = 55.1895\ L^{0.3388}i^{-0.9237} \qquad (6.4)$$

(c) Credit unions (D_1=0, D_2=1),

$$T = 13.3292\ L^{0.3388}i^{-0.9237} \qquad (6.5)$$

Note that in these equations the interest-rate variable plays the role of a shift parameter for the relationship between transaction costs and loan size. Evaluating equations (6.3) through (6.5) at the geometric mean of interest rate in the sample (13%), the corresponding functions become:

$$T = 2.3680\ L^{0.3388}, \text{ for the development bank,} \qquad (6.6)$$

$$T = 5.1631\ L^{0.3388}, \text{ for private banks, and} \tag{6.7}$$

$$T = 1.2470\ L^{0.3388}, \text{ for credit unions.} \tag{6.8}$$

These equations are portrayed in figure 1 to show the effect of different loan sources on the relationship between transaction costs and loan size. As pointed out in the previous section, private banks impose the highest transaction costs per loan for any given loan amount. Credit unions are the least expensive source of funding at given loan sizes and interest rates, and the development bank falls in between the two extremes. The typical (median) value of the loan amount for each lender is indicated in figure 1 by points C (credit unions), D (development bank), and P (private banks), along the loan-size axis. The predicted values of transaction costs per loan corresponding to each typical value of loan size can be read on the curve corresponding to each loan source.

It is interesting to analyze the importance of loan source in the transaction-costs/loan-amount relationship looking at the corresponding value of transaction costs per lempira (τ) in each case. Equations (6.6) through (6.8) can be easily transformed into the following:

$$\tau = 2.8680\ L^{-0.6612}, \text{ for the development bank,}$$

$$\tau = 5.1631\ L^{-0.6612}, \text{ for private banks, and}$$

$$\tau = 1.2470\ L^{-0.6612}, \text{ for credit unions.}$$

These curves are presented in figure 2. In general, transaction costs per lempira borrowed are a decreasing

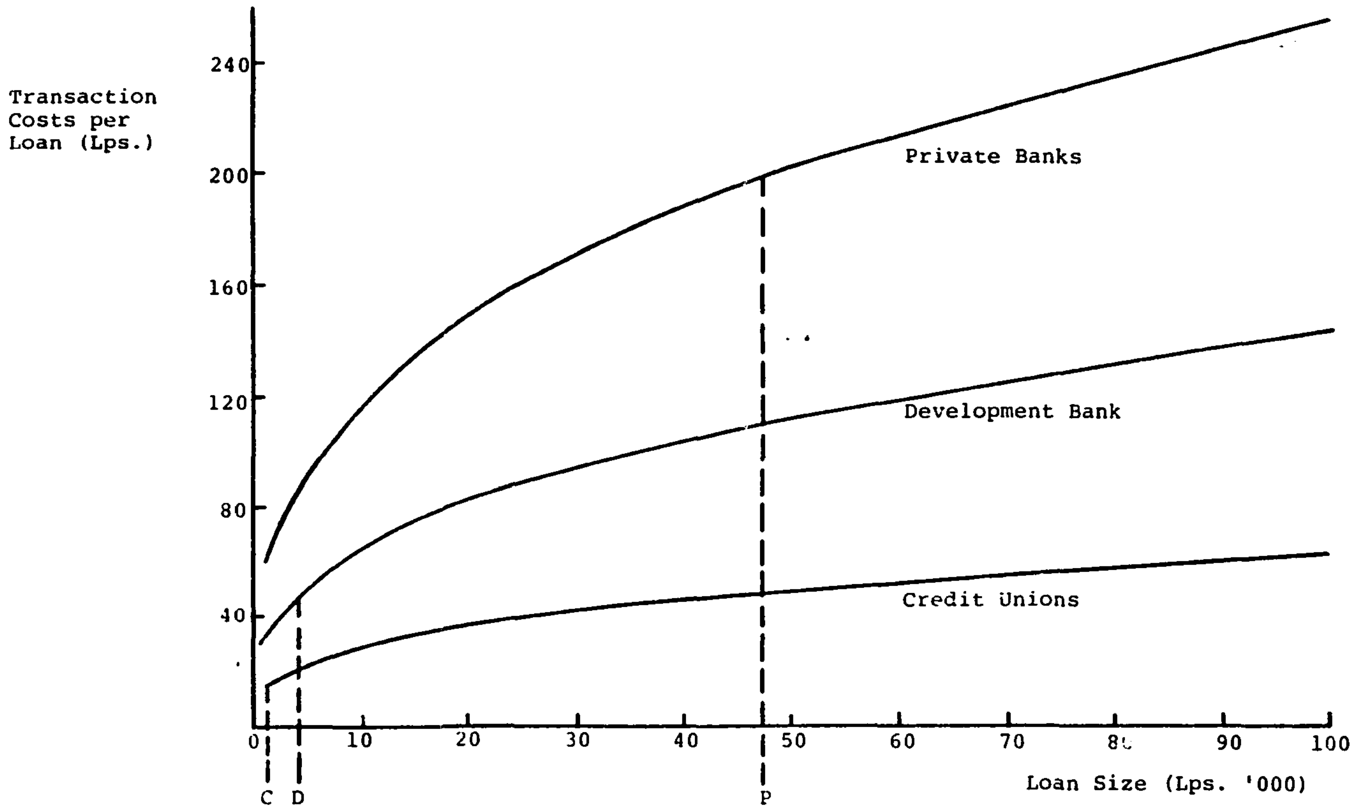

Figure 1. Transaction Costs per Loan by Loan Size, for Different Loan Sources

function of loan size. Curves are very steep for small loan amounts, becoming increasingly flatter as the loan size increases. For any given loan size, transaction costs per lempira are higher in private banks than in the development bank, where these costs are in turn higher than in credit unions. However, it is important to note again points C, D, and P in figure 2, and read the corresponding level of transaction costs per lempira on the vertical axis. For these most typical loan amounts (median values) private banks are the least-costly source of credit (0.42%) followed by credit unions (0.93%) and the development bank (1.19%). In general, given the domain of loan amounts with which different lenders operate (see table 43 in appendix D) the relevant range of transaction costs for each will lie on different sections of their corresponding curves. For credit unions the typical range is close to the vertical axis, on the steepest part of the curve, whereas for private banks the relevant range falls on the rather flat portion of the corresponding curve. A good proportion of the relevant range of transaction costs in the case of the development bank is on the steep section of the curve, although this bank's range of loan amounts implies a wider variety of slopes, as compared to the other two cases.

An important feature in the relationship between transaction costs and loan amount is the role of the explicit interest rate charged on loans. As pointed out before, the

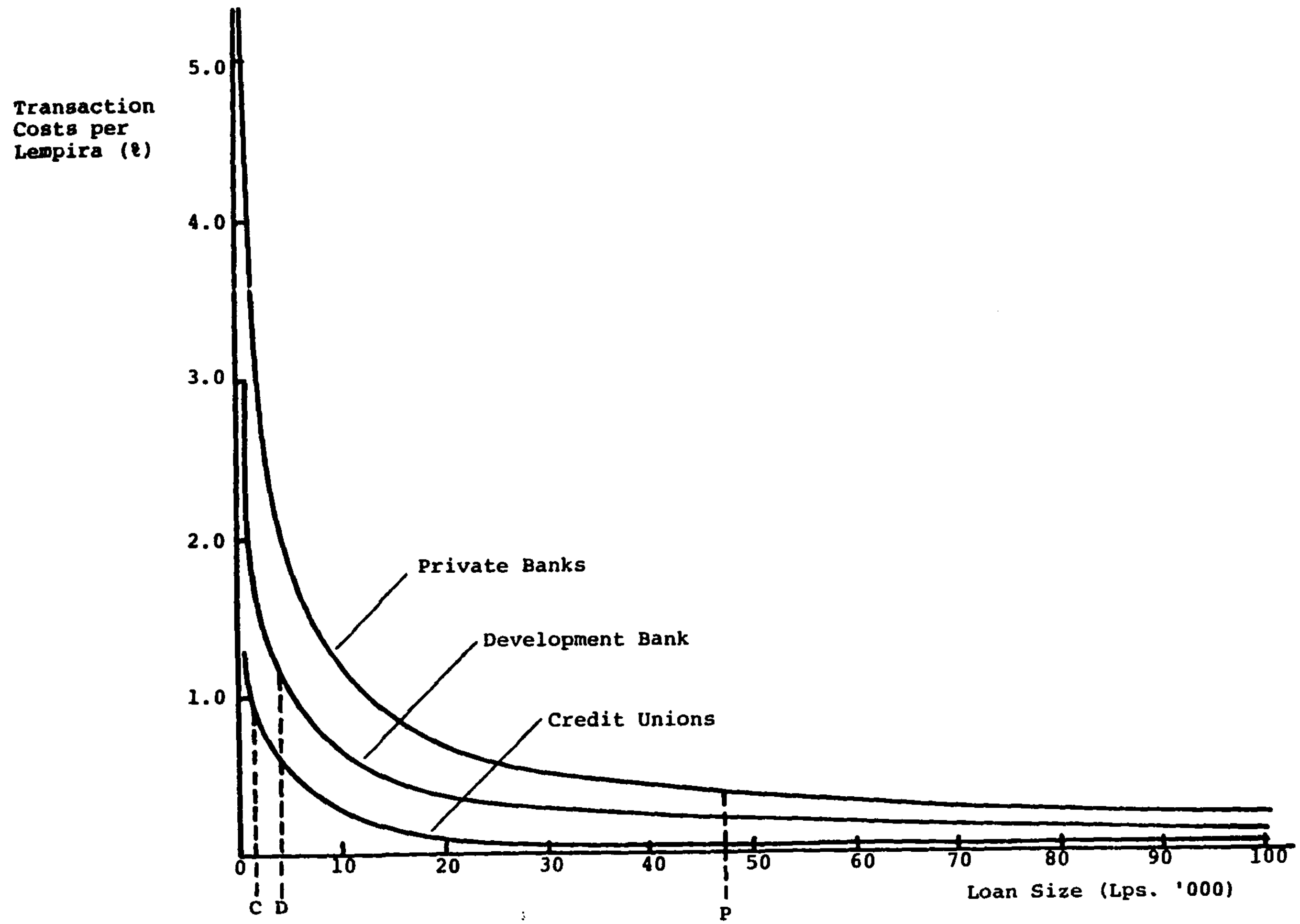

Figure 2. Transaction Costs per Lempira by Loan Size, for Different Loan Sources

interest-rate variable works as a shift parameter in the relationship between transaction costs and loan amount. Figure 3 shows the curves corresponding to the development bank at two different levels of the interest rate, 10% and 20%. The curves corresponding to private banks and credit unions are omitted to avoid unnecessary complication of the presentation. It can be seen in figure 3 that for any given loan size, transaction costs are reduced by an increase in the interest rate. In other words, the curve that relates transaction costs per lempira and loan amount shifts downward with an increase in the explicit interest rate. Furthermore, it is evident from figure 3 that the vertical magnitude of the shift is larger for small loans than for large loans. This implies that the decline in transaction costs due to an increase in the interest rate will be more important for small loans than for large loan amounts. For example, the shift portrayed in figure 3 associated with an increase in the interest rate from 10% to 20% represents a decrease in transaction costs per lempira of 1.2 percentage points for a loan of 2,000 lempiras. This reduction amounts to only 0.24 percentage points in the case of a loan of 20,000 lempiras.

In the following secticn, the foregoing results will be broken down and qualified to consider the interactions of loan size and loan source with the elasticity of transaction

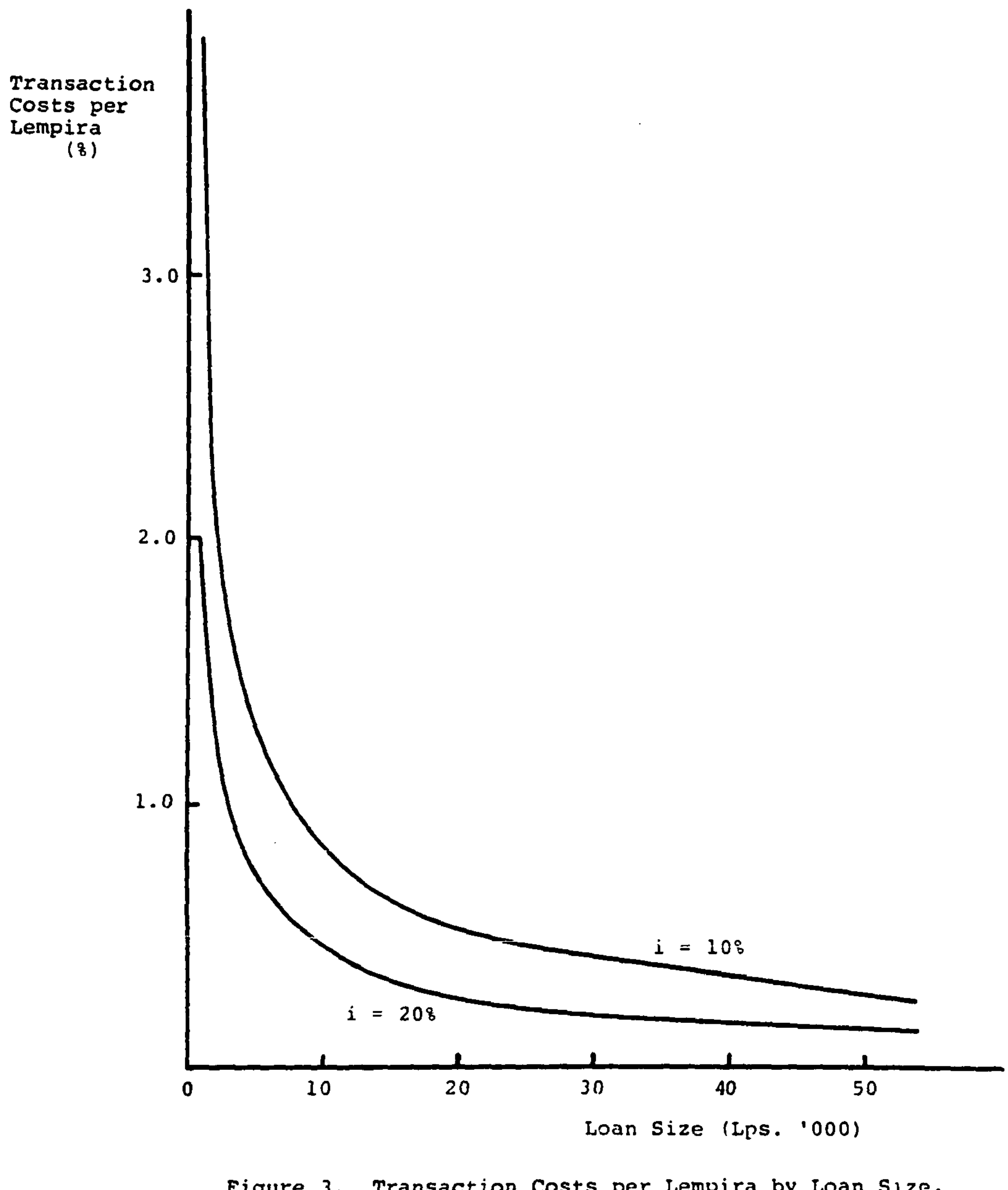

Figure 3. Transaction Costs per Lempira by Loan Size, for Different Levels of the Interest Rate (i)

costs with respect to the interest rate. These modifications will affect the magnitude of the trade-off between transaction costs and the interest rate, rather than the general direction of the effects under discussion here. Therefore, it is still valid and useful to represent the trade-off suggested by the analysis of figure 3 as a relationship between transaction costs per lempira and the interest rate. In this case, shown in figure 4, the loan amount is the variable that acts as a shift parameter. The curves drawn in figure 4 correspond to two different levels of loan amount, 2,000 and 20,000 lempiras.

Figure 4 shows that for any given interest rate, transaction costs are higher for small loans than for large loans. However, figure 4 also shows that a change in the interest rate will induce a larger compensating change in the opposite direction in the level of transaction costs per lempira for small loans than for larger-sized loans. This differential effect can be seen in figure 4 by looking at the different slopes of the curves, at a point such as i_0. The steepest slope corresponds to the curve associated with the smallest loan-size. It follows from this result that an increase in the explicit interest rate will have a progressive result, since it will reduce transaction costs more for small loans than for large loans. On the other hand, a reduction in the interest rate will increase transaction costs in a larger magnitude for small loans than for

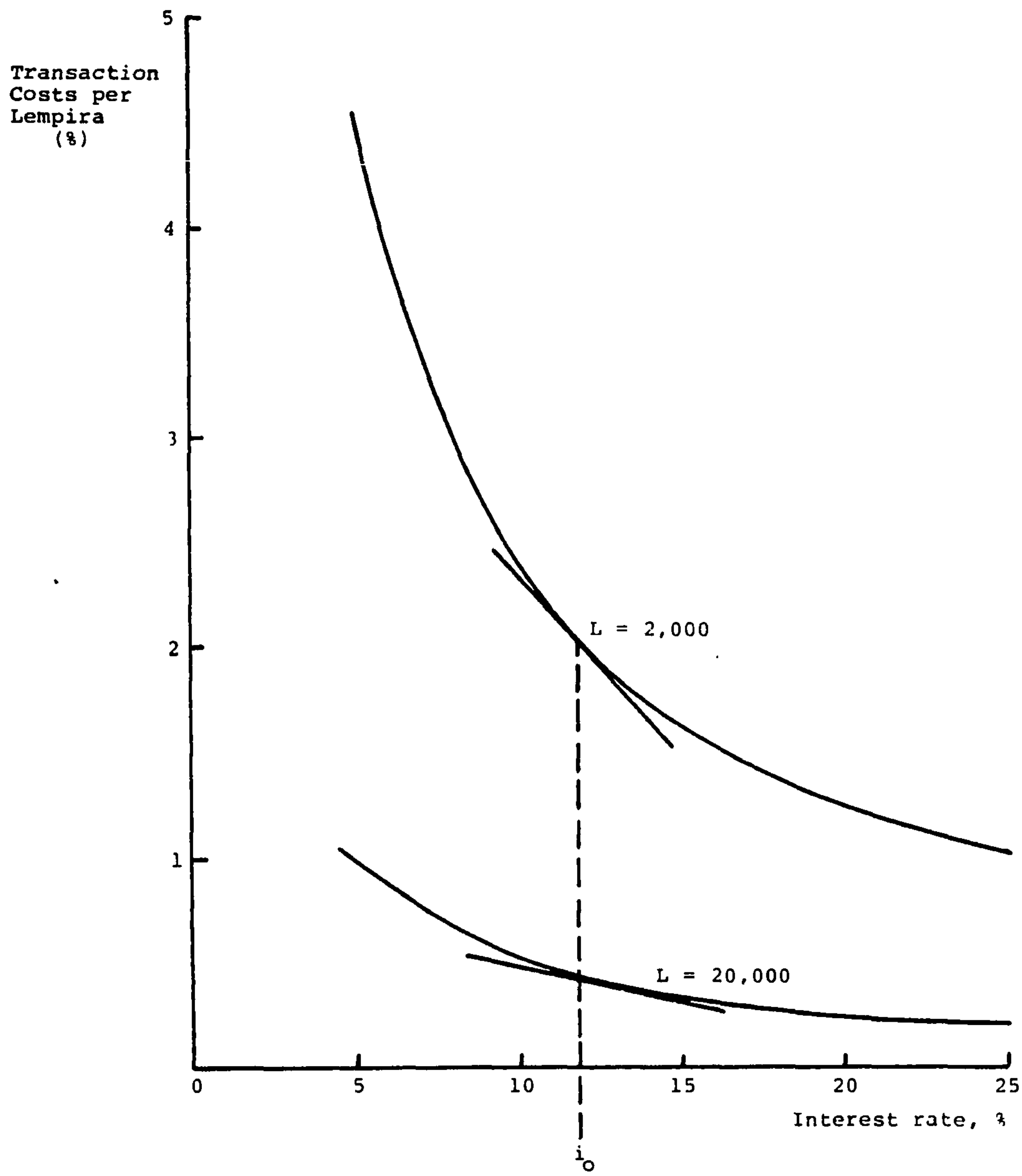

Figure 4. Trade-off Between Transaction Costs per Lempira and the Interest Rate, for Different Loan Sizes (L)

in the case of large loans. In this sense, policies that reduce interest rates will have regressive distributive consequences. Under more strict interest-rate restrictions, lenders substitute implicit charges (transaction costs) for explicit interest in such a way that transaction costs of borrowing increase more for small-loan operations than for large loans.

6.2.2. Trade-Off between Transaction Costs and the Interest Rate

This section utilizes the results of the transaction-costs function that includes interaction variables, to account for the effects of loan size and loan source on the elasticity of transaction costs with respect to the interest rate. The result of this extended version were presented in table 24, column 2. It is useful to recall here the expression for the elasticity between transaction costs and interest rate, including the effects of small-loan operations and of private banks as the loan source with a significantly different behavior:[3/]

$$\partial \ln\tau / \partial \ln i = a_{30} + a_{31}S + a_{32}D_1 \qquad (6.9)$$

where,

$\partial \ln\tau / \partial \ln i$ is the elasticity between transaction costs per lempira (τ) and interest rate (i)

3/ Overall results and statistical significance of individual interactions were discussed in the first part of section 6.2. Interactive effects of credit unions on the trade-off between τ and i were not significant, therefore these institutions are excluded from the analysis presented here.

S is a dummy variable for loan-size category

$S = 1$ if the loan amount is less than or equal to L.2,000,

$S = 0$ otherwise,

D_1 is a dummy variable for loan source,

$D_1 = 1$ if the lender is a private bank,

$D_1 = 0$ otherwise.

Expression (6.9) and the definitions of the variables involved imply that the elasticity of τ with respect to the interest rate will vary according to the loan source and to the loan-size category. These elasticities can be written for the different combinations of loan source and loan size as follows:

(a) development bank ($D_1=0$),

small loans ($S=1$), $\partial \ln\tau/\partial \ln i = a_{30} + a_{31}$,

large loans ($S=0$), $\partial \ln\tau/\partial \ln i = a_{30}$,

(b) private banks ($D_1=1$),

small loans ($S=1$), $\partial \ln\tau/\partial \ln i = a_{30} + a_{31} + a_{32}$,

large loans ($S=0$), $\partial \ln\tau/\partial \ln i = a_{30} + a_{32}$.

The values of these different elasticities are reported in table 26, along with the values of the F-statistics for different null hypotheses about these elasticities.

These results indicate that there are significant differences between the elasticities of transaction costs with respect to the interest rate associated with different combinations of loan source and loan size. The response of

Table 26. Transaction Costs per Lempira (τ): Estimated Elasticities of τ with respect to Changes in the Explicit Interest Rate (i). Differences Between Lenders and Loan-Size Categories.

Lender/Loan-Size Category	Estimated Value of Elasticity	Null Hypotheses, H_o	F-Value (conclusion)
Development Bank			
Small Loans[a/] ($\partial \ln\tau/\partial \ln i = a_{30} + a_{31}$)	-0.5551	$a_{30} + a_{31} = 0$	5.05 (H_o rejected)†
		$a_{30} + a_{31} = -1$	3.24 (H_o rejected)°
Large Loans[b/] ($\partial \ln\tau/\partial \ln i = a_{30}$)	-0.8425	$a_{30} = -1$	0.63 (H_o not rejected)
Private Banks			
Small Loans[a/] ($\partial \ln\tau/\partial \ln i = a_{30} + a_{31} + a_{32}$)	-2.6692	$a_{30} + a_{31} + a_{32} = -1$	4.18 (H_o rejected)†
Large Loans[b/] ($\partial \ln\tau/\partial \ln i = a_{30} + a_{32}$)	-2.9566	$a_{30} + a_{32} = -1$	6.16 (H_o rejected)*

Source: Results presented in table 6.5, column 2 (extended version of transaction-costs function).

Significance levels: * .01
† .05
° .10

a/ Less than or equal to L.2,000
b/ Greater than L. 2,000

borrowing transaction costs to changes in the interest rate is very elastic in the case of private banks. For these loans, the absolute value of the elasticity is between three and five times as large as the values obtained for the development bank. In the latter, large loans show a unitary elasticity whereas for small loans the magnitude of the response of transaction costs to changes in the interest rate is inelastic (less than zero, greater than -1).

For small-loan operations (less than 2,000 lempiras), the absolute value of the elasticity is lower than the values obtained for loans of medium-to-large size (over 2,000 lempiras), denoting a less flexible response to changes in the interest rate in this class of loan operations. This result could be expected, on the basis that usually these smaller loans are associated with more rigid and cumbersome targeting schemes. These schemes prevent the modification of loan procedures when a more flexible interest rate environment would allow the substitution of explicit interest for implicit charges (transaction costs), thus reducing the level of borrower's transaction costs.

At this point, it is useful to summarize the results obtained with the transaction-costs function presented so far:

(a) loan amount, interest rate, and loan source are significant determinants of the level of transaction costs. The results obtained for loan use are ambiguous, and farm area is not a significant factor in the transaction-costs function;

(b) transaction costs per loan:
- increase with the loan amount, at a decreasing rate,
- decline with increases in the interest rate (i.e., the trade-off relationship),
- are higher for private-bank loans than for development-bank loans, at given loan-sizes and interest rates,
- are lower for credit unions than for the development bank, at given loan sizes and interest rates;

(c) transaction costs per lempira are a decreasing function of loan amount. All other relationships follow the same pattern indicated above for transaction costs per loan;

(d) the trade-off (negative elasticity) between transaction costs and interest rate exists and is significant in all cases. Its magnitude is affected by small-loan operations, and by the source of the loan.

A simulation exercise in which all the foregoing effects can be observed is presented in table 27. This table shows the estimated values of transaction costs per lempira, and total borrowing costs (interest rate plus transaction costs) for different combinations of loan sources and hypothetic loan-sizes. These estimates are obtained using the results of the extended version of the

Table 27. Transaction Costs per Lempira (τ): Estimated Values of τ, Changes in τ and in Total Borrowing Costs ($i+\tau$) with Increases in the Explicit Interest Rate (i), by Lender and Loan Size.

Lender/Loan Size	Estimated Value of Transaction Costs per Lempira $\hat{\tau}$, %	Estimated Total Borrowing Costs $(i+\hat{\tau})$, %	Change in τ with a one-point increase in the interest rate $\partial\tau/\partial i$, pct. points	Change in Total Borrowing Costs with a one-point increase in the interest rate $\partial(i+\tau)/\partial i$, pct. points
Development Bank				
Lps. 2,000	2.85	15.85	-0.123	0.877
Lps. 5,300[a/]	0.80	13.80	-0.052	0.948
Lps. 20,000	0.38	13.38	-0.025	0.975
Private Banks				
Lps. 2,000	5.77	18.77	-1.184	-0.184
Lps. 5,300[a/]	1.61	14.61	-0.366	0.634
Lps. 20,000	0.77	13.77	-0.175	0.825

Source: Extended-model results presented in table 24. Estimates evaluated at geometric means of farm area (35 Has.) and interest rate (13%). Differences by end-use are not considered.

a/ Median value of loan size in the overall sample.

transaction-costs function (see table 24, column 2). Also, the change in transaction costs per lempira, and in total borrowing costs predicted as a result of a one-point increase in the interest rate are reported in table 27. These changes are computed using the expression:

$$\partial\tau/\partial i = (\partial \ln\tau/\partial \ln i)\ (\hat{\tau}/i)$$

where, $\hat{\tau}$ denotes the estimated value of transaction costs per lempira, and the elasticity ($\partial \ln\tau/\partial \ln i$) has already been defined for the different combinations of loan source and loan size (see table 26).

The potential effects of loan use on the behavior of transaction costs are not considered in the results presented in table 27. However, these results are a valid representation of the average of end-uses. Tables 48 and 49 in appendix D present a similar exercise that takes into account different loan-uses, even though these results should be taken with some caution since the individual coefficients for different end-uses were not significantly different from zero in the estimated equations (see table 24).

The figures presented in table 27 show that, for any given loan size, transaction costs of borrowing from private banks are about twice as high as those associated with development-bank loans (see column 1 in table 27). For each type of lender, transaction costs per lempira borrowed vary substantially by loan size. The larger the loan size, the lower the level of transaction costs per lempira. At a given level of interest rate (13% in table 27), total borrowing costs are also higher in private-bank loans than in the case of loans granted by the development bank (see column 2 in table 27). However, this difference across institutions becomes less important as the loan size increases. These results indicate that under interest-rate restrictions, private banks tend to be more efficient in passing-on intermediation costs to the borrower, than the development-bank.

At the same time, the response of transaction costs per lempira to changes in the interest rate is considerably larger in the case of loans from private banks than in development-bank loans (column 3 in table 27). A one-point increase in the explicit interest rate will lead to a larger compensatory decline in borrowing-transaction costs in private-bank loans than in the case of loans from the development bank. The simulation with a loan size of 2,000 lempiras shows that this compensating decline could more-than-offset the increase in the interest rate in the case of the private bank, thus resulting in a decrease in total borrowing costs. In general, the compensatory change in transaction costs that occurs as a result of a change in the explicit interest rate is larger for small loans than for large loans.

The differences in the level of transaction costs and the response of these to changes in the interest rate, for different loan-sizes and loan sources, are represented in figure 5. In this figure, the functional relationships underlying the results presented in table 27 are graphed to allow more general comparisons between loan sources and loan sizes. It is clear from figure 5 that, for any given level of the interest rate, transaction costs are higher for small loans than for large loans. Also, for any given loan size, transaction costs decrease as the interest rate increases. Finally, for given levels of interest rate and loan size, loans from private banks entail higher transaction costs than those granted by the development bank. However, transaction costs of private-banks loans are more responsive to changes in the interest rate than are these costs associated with the development-bank loans.

Summarizing the foregoing results, changes in the explicit interest rate will have a differential effect on transaction costs, depending on the source of the loan and on the loan size. Column 4 in table 27 shows that a one-point increase in the interest rate will be almost fully translated into a corresponding increase in total borrowing costs in the case of large loans. This effect will be reduced for smaller loans due to the offsetting response of transaction costs to changes in the interest rate. This compensating effect is more important in the case of private-bank loans. Since this offsetting effect occurs for increases as well as decreases in the level of the interest

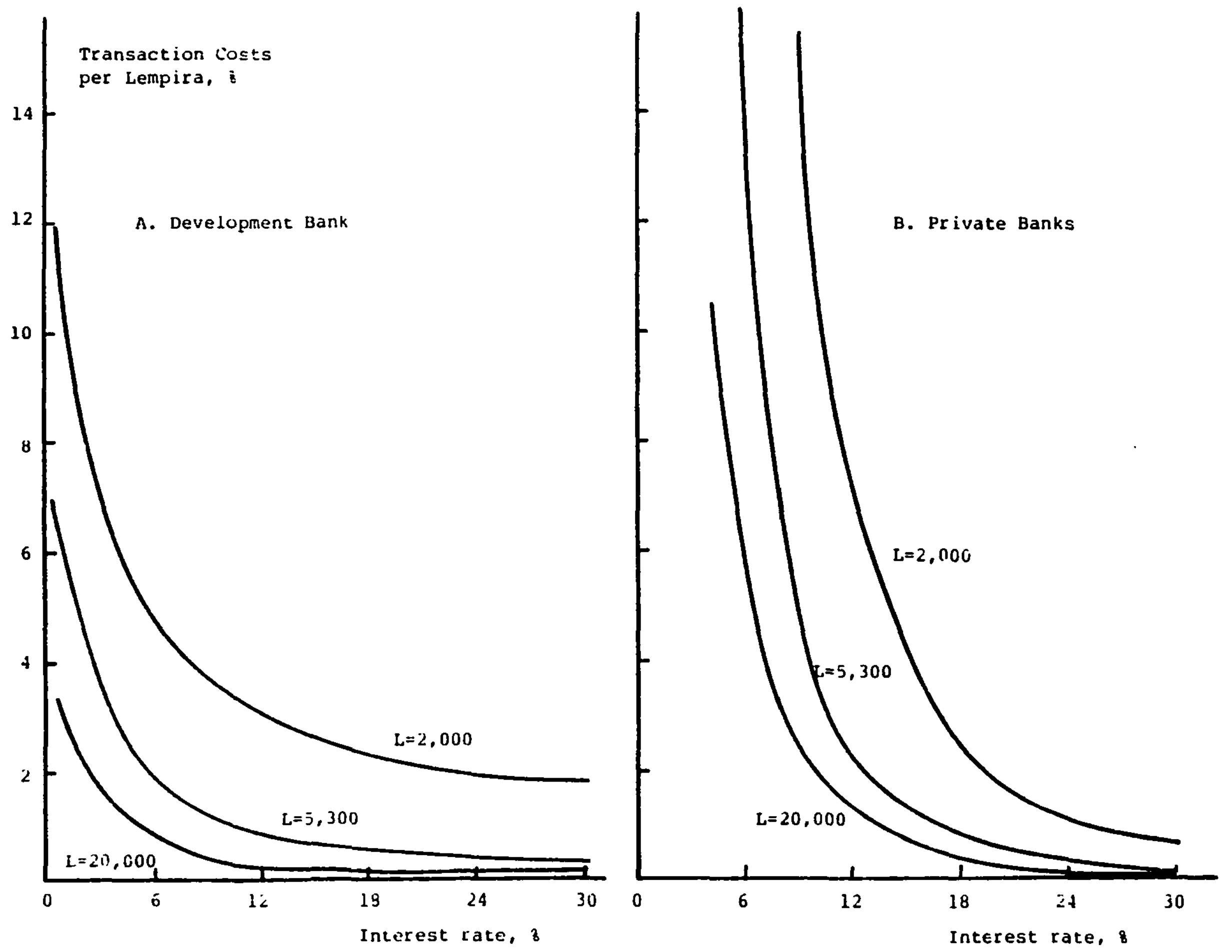

Figure 5. Trade-off Between Transaction Costs per Lempira and the Interest Rate, for The Development Bank and Private Banks, by Different Loan Sizes (L)

rate, it follows that further reductions in the interest rate on loans will benefit primarily borrowers of large amounts, instead of farmers borrowing small loan-amounts. In this sense, cheap-credit policies will not attain their intended distributional goals in the rural sector.

The main implication of the results discussed above is that interest-rate regulations will not be effective. Lenders will use the loan-application procedure, with its associated set of requirements and documentation to impose transaction costs on borrowers, in direct proportion to the perceived risk of the loan operations. It has been estimated that these costs range from negligible amounts (0.4%) to almost 6%, depending on the size of the loan and the loan source, and given the sample mean of explicit interest rate (13%). It has also been shown that this range will shift upward under further restrictions in the explicit interest rate. Therefore, interest-rate restrictions generate implicit-price adjustments in the credit market rather than the quantity adjustments predicted in earlier studies [31]. Transaction costs (i.e., implicit pricing), instead of quantity restrictions, play the role of rationing mechanism under the conditions prevailing in the Honduran financial system.

CHAPTER VII

Summary and Conclusions

This study has investigated the costs involved in financial intermediation in a small lesser developed economy. Aside from the explicit costs of finance, interest rates, all participants in financial markets use real resources when performing their roles in financial intermediation: savings mobilization, lending, and borrowing. The non-interest transaction costs borne by financial intermediaries and borrowers, have been the focus of this study. Financial regulation, and regulation-avoidance were additional major themes in this work. The effects of financial regulation on transaction costs and the mechanisms of regulatory circumvention by financial intermediaries were also addressed. The study was carried out in Honduras, where about 60% of the population live in the rural areas, and agriculture contributes about 30% of GDP and accounts for about two-thirds of export earnings during the period (1970-82). At the same time, agriculture receives about one-fourth of the total credit of the banking system.

Financial-intermediation issues dealt with in this study were classified into two areas. First, the magnitude of intermediation costs accruing to lenders and borrowers were measured and various hypotheses were tested concerning the response of these costs to different variables. Second, important policy issues associated with financial regulation were addressed, particularly the effects that regulatory policies have had on the costs of financial intermediation. Among these, interest-rate regulations and selective credit policies emphasizing agricultural credit received major attention.

Financial-intermediaries' cost functions were the basis for measuring and analyzing the costs incurred by these institutions. Several characteristics of the underlying technology of banks were assessed through these cost-function estimates: scale economies, economies of scope (cost complementarities), elasticities of factor substitution and factor demand. In the analysis, a number of methodological issues surrounding cost studies in banking were addressed. Among these were the definition of bank output, the choice of functional forms for the cost function, and the selection of an estimation procedure for the specified functions. Evaluating the effects of financial regulations posed an additional challenge of defining appropriate proxy-variables for these regulations, which are usually difficult to measure directly (e.g., loan-targeting strategies).

On the borrowers' side, a transaction-costs function was conceptualized within the framework of credit rationing under loan-pricing constraints. Transaction costs for borrowers arise from the use of the loan-application procedure established by lenders as a discriminatory device that substitutes for explicit pricing, when explicit interest rates are restricted. The limited range of administered loan-rates, and several risk related characteristics of loan operations entered the transaction-costs function as explanatory variables for loan rationing behavior.

Throughout the study, the contrasting performance was analyzed between the National Agricultural Development Bank of Honduras (BANADESA), and the largest private commercial bank in the country. The estimation and analysis of the cost functions of these financial institutions were based on branch-level data of the two banks. Finally, the borrowers' transaction-costs function was estimated using data from a field-survey of agricultural borrowers undertaken in several regions of the country. These borrowers held active loans from different financial institutions including the development bank, several private banks, and rural credit unions.

Results and Implications

a) Lenders' Costs

Estimation of lenders' intermediation costs indicated that these costs are considerably higher than is usually assumed. At the same time, there were important differences between the costs of deposit-mobilization and those associated with lending. Also, the findings revealed notorious contrasts across institutions (i.e. the development bank *versus* the private bank). All results summarized below are based on translogarithmic cost functions, estimated by seemingly unrelated regressions (GLS), with bank outputs defined as the value of loans and deposit balances.

For the development bank, over 70 percent of intermediation costs corresponded to lending, whereas less than 30 percent were attributed to the administration of deposit accounts. The opposite is true for the private bank, where only 28 percent of the costs were associated with lending, while 72 percent were related to deposit mobilization. This acute contrast reflects the development-bank's greater reliance on foreign funds and special rediscount lines from the central bank, as compared to the private bank which relied more heavily upon financial resources mobilized from the general public. This contrast in the composition of the banks' liabilities is reflected in the allocation of resources in each bank, and therefore in the share of lending and deposit-mobilization activities in total intermediation costs.

The average costs of lending in the development bank (10%) were almost three times as high as those estimated for the private bank (3.4%). The marginal costs of lending were 4.5 times larger in the development bank than in the private bank (7.6% *versus* 1.7%). This again reflects the differences in the sources of funds with which each bank operates.

The greater reliance on external loan sources by the development bank created additional costs of compliance with loan-targeting requirements imposed by foreign donors or the government. These in turn forced the institution to maintain a more centralized operation, and a heavier incidence of supervisory and record-keeping resources than would have been the case in the absence of these targeting requirements. The results obtained for the development bank indicate that the usual administrative margins contemplated by foreign donors for special credit projects (3 or 4%) are unrealistically low, and compromise the financial viability of lending institutions participating in these "targeted" programs.

The average costs of mobilizing deposits were also higher in the development bank compared to the private bank (8.8% versus 5.3%). On the other hand the marginal costs of deposit-mobilization showed the opposite pattern. These were lower in the development bank (2.7%) than in the private bank (6.7%). Furthermore, given the fact that the marginal cost of deposit mobilization was higher than the average costs in the private bank (6.7% versus 5.3%), deposit mobilization in this institution had reached a point of decreasing returns. Further expansion of the deposit-mobilization activity in the private bank is an unattractive option, unless this expansion relies upon larger-sized average deposit balances. In sharp contrast, the results for the development bank highlight the existence of excess capacity unexploited for deposit mobilization, i.e. the marginal costs of deposit mobilization (2.7%) were well below the average costs (8.8%).

Overall, intermediation costs were higher in the development bank than in the private bank. However, the difference between the average costs was larger than the difference between the marginal costs of intermediation. The latter were only two percentage points higher in the development bank than in the private bank, thus indicating a similar degree of economic efficiency in terms of marginal cost criteria. Marginal cost criteria are frequently used as efficient pricing strategies. However, in this case any policy emphasizing marginal cost pricing would represent large operational losses for the development bank (given its much higher average costs), whereas in the case of the private bank this policy would imply an almost break-even situation.

Evidence on Scale and Scope Economies

Scale-economies estimates for both banks were not significantly different from one, even though the estimated levels (i.e. the elasticity of costs to increases in output) were consistently lower in the case of the development bank. These results of non-significant scale economies were not surprising, considering the small size of financial markets in low-income countries. An important finding was the substantial difference in the separate effects of the expansion of different outputs on intermediation costs. For the development bank, there were important economies of scale to the expansion of deposit-mobilization activities, whereas lending activities were approaching constant returns-to-scale for the average-branch case. The opposite is found for the private bank, where the expansion of lending activities showed cost advantages as compared to deposit mobilization. These different cost effects of different outputs indicate that both banks could benefit from "economies of scale" by engaging in unbalanced output expansion. Expansion strategies for the development bank should emphasize deposit mobilization over lending activities, whereas the private bank's expansion should be biased towards lending operations.

Both banks show cost complementarities (economies of scope) associated with the joint production of loans and deposits. This finding argues against the strategy of creating a specialized lending institution with no deposit-mobilization functions. The joint provision of deposit services will not only improve the financial viability of the institution and promote financial savings, but also will reduce the marginal costs of lending through cost-complementarity effects.

Interest-Rate Restrictions

Interest-rate restrictions that reduced the level of real deposit rates or real lending rates had cost-increasing effects on financial intermediaries. This strongly suggests that increases in the level of real rates of interest would generate reductions in total intermediation costs. This trade-off between real rates and costs reflects the costs of regulatory-avoidance. Restrictions on deposit-rates force financial intermediaries to offer non-interest rewards to depositors in order to at least maintain their deposit balances. This is particularly important in the Honduran case, where real deposit-rates have been low (usually negative) and unstable, thus discouraging the holding of financial savings. The provision of free banking services or preferential treatment in loan contracts to selected clients generate additional costs of deposit-mobilization for the institution, that could be avoided if explicit interest compensation could be paid to depositors.

On the other hand, multiple ceilings on lending rates constrained the ability of financial intermediaries to discriminate between potential borrowers in Honduras. In response to these constraints, financial institutions created rationing mechanisms of more complicated loan procedures that substituted for a more flexible interest-rate environment. This, in effect, passed on to borrowers a substantial part of the costs of intermediation. However, a proportion of these additional costs had to be borne by the lender, and this was reflected in the inverse relationship estimated between real lending-rate ceilings and lenders' intermediation costs.

Loan targeting was found to be a cost-increasing factor affecting the development bank. Both foreign-funded projects and central-bank rediscount lines created additional intermediation costs, due to the increased resources that the bank devoted to accounting, monitoring, record-keeping and reporting, in order to comply with the requirements of targeted programs.

An additional finding in the case of the development bank was a direct relationship between the delinquency rate and intermediation costs. Increases in delinquency created a lagged cost-increasing effect due to additional resources allocated to loan-recovery, loan-evaluation and monitoring. Despite these efforts, high delinquency and increasingly older delinquent balances continued to characterize the loan portfolio of the development bank.

Borrowing Costs: Magnitudes and Incidence

The effectiveness of regulatory circumvention by financial intermediaries was evident from the results obtained in the analysis of borrowing transaction costs. Borrower's transaction costs were important and amounted, on average, to 3 percentage points above and beyond the explicit interest rate charged on loans. At the sample mean of this explicit rate (13%) transaction costs of borrowing ranged between very small amounts (0.4%) to almost 6%, depending primarily on the size of the loan, and the loan source. Transaction costs per lempira borrowed were a decreasing function of the loan amount, and varied depending on the loan source. Thus a rather homogeneous set of explicit interest rates resulted in a wide range of total borrowing costs, that penalized those loans perceived by lenders as riskier or costlier than average, and favored preferred customers borrowing larger sized loans.

The most interesting finding of the borrowers' cost analysis was the existence of a trade-off (i.e. an inverse relationship) between transaction costs and the explicit interest-rate charged on loans. This negative elasticity implied that increases in the explicit interest rate would be partially offset by a compensating change in transaction costs to the borrower. In short, under a more flexible interest-rate environment, lenders would substitute explicit interest charges for implicit pricing through transaction costs. This trade-off between transaction costs and the interest rate is more important for small loans than large loans. A change in the explicit interest rate induced a larger compensating change in the opposite direction in the level of transaction costs for small loans than for larger-sized loans. It follows from this result that, contrary to conventional wisdom, an increase in the explicit interest rate on loans would have a progressive impact, since it would reduce transaction costs more for small loans than for large loans.

Borrowing from private banks entailed, in general, higher transaction costs than borrowing from the development bank. On the other hand, the elasticity of transaction costs with respect to changes in the explicit interest rate was larger for private banks than for the development bank. These results indicate that private banks were more effective in passing on intermediation costs to borrowers. At the same time, these banks were more responsive to changes in the economic and regulatory environment, and were more flexible in adjusting their loan procedures and requirements.

In summary, total intermediation costs including costs borne by lenders and borrowers were estimated, on average, to be about 20 percent in the case of the development bank, and approximately 11 percent in the case of the private bank in Honduras. These costs, however, had a wide range of variation depending upon the average size of deposit-balances, the average size of loans and, more importantly, on the nature and level of existing regulations affecting financial intermediaries.

Conclusions

Financial intermediation costs in Honduras are substantial and vary widely depending on the conditions under which financial intermediaries and borrowers operate. These transaction costs associated with deposit-mobilization, lending, and borrowing were two or three times the level of the deposit rates of interest received by savers. Part of the intermediaries' costs were explained by various forms of non-interest compensation paid for financial savings by intermediaries. In general, however, a good proportion of total intermediation costs have been introduced into the financial system through the impact of financial regulations.

An important implication of the results discussed here is that financial market regulations will not be effective, or their effects will be distorted by the regulatory-circumvention response of financial intermediaries. The only certain effect of regulation was the increase of intermediation costs. Financial intermediaries will respond to deposit-rate ceilings through non-interest rewards to depositors. At the same time, they will counteract lending-rate ceilings through implicit pricing. In fact, this study confirms that transaction costs (implicit pricing), rather than quantity restrictions, become the principal rationing mechanism under interest-rate restrictions in Honduras.

Only when the overall intensity of financial regulations restrict the ability of financial intermediaries to implicitly compensate depositors, will the total price received by savers decrease. This may have been one of the reasons underlying the decline in financial activities observed in Honduras after 1978.

Policy-makers should consider both the real effectiveness and the costs of financial regulations when evaluating policy measures. The Honduran experience strongly suggests that for many of these measures costs will offset benefits, due to the effects of regulatory circumvention. The development bank analyzed here provides a good example of the cost-increasing effects of creating a specialized institution to deal with agriculture. The usual social benefits that may be argued in support of this institution should be weighed against the less widely recognized social costs of maintaining and subsidizing these costly operations. In the end, taxpayers are providing the resources to cover the bank's operational losses, thus distributional effects attributed to the institution should be adjusted accordingly.

Transaction costs are a measure of the "friction" existing in the functioning of financial markets. The higher the costs of intermediation, the less efficient the performance of the financial sector in resource allocation and distribution. This study has shown that there are several ways in which transaction costs can be reduced, thus reducing the friction and improving financial-markets performance. Financial reforms that provide a more flexible interest-rate environment and reduce the cost-increasing burden of targeting schemes should greatly benefit the overall performance of the Honduran financial system. Maintaining the present set of financial regulations and targeting requirements will reduce potential resource mobilization within the Honduran financial sector and only add to the real costs of financial intermediation.

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APPENDIX A

Appendix to Chapter II

Honduras: Country Profile, Selected Indicators, 1982.

Area: 112,100 square kilometers (43,281 square miles)

Population: 3.96 million

Population Growth: 3.5% per year

Percent of Population in Rural Areas: over 60%

Gross Domestic Product (GDP): US $2.8 billion

Gross National Product (GNP): US $2.6 billion

Growth Rate of Real GNP (average 1978-1982): 3.3% per year

GNP Per Capita: U.S. $660.1

Share of Agriculture in Total GDP: 27.5%

Share of Agriculture in Total Employment: 60%

Share of Agriculture in Total Export Earnings: 67%

Main Exports: Bananas, coffee, lumber, meat.

a/ Sources: Banco Central de Honduras [9], International Monetary Fund [42], and Wheeler, Richard O. *et al.*, Report of the U.S. Presidential Agricultural Mission to Honduras, November 1982.

Table 28. Honduras: Size and Composition of the Financial System. Number of Institutions and Number of Offices of Main Financial Institutions.[a] Selected Years, 1950-82

	Financial Institutions								
	Private Commercial Banks		Public Development Banks		Total Banks		Other Financial Institutions		Ratio of Total Population per Office (Thousand Inhabitants per Office)
Year	Number	Number of Offices	Number	Number of Offices	Number	Number of Offices	Number	Number of Offices	
1950	2	7	0	0	2	7	2	2	160.0
1968	8	52	2	23	11	75	4	7	28.2
1976	13	175	3	29	16	204	5	8	15.1
1977	13	183	3	30	16	213	6	9	15.0
1978	13	191	3	31	16	222	8	12	14.7
1979	14	200	3	31	17	231	8	21	14.1
1980	15	218	3	31	18	249	8	29	13.3
1981	15	212	3	31	18	243	8	31	13.9
1982	15	212	3	31	18	243	8	31	14.5

Sources: Financial institutions in 1950 and 1968, Yu-Shan [97].
Financial institutions in 1976-1982, Banco Atlantida, Economic Studies Division.
Population, International Monetary Fund [42].

a/ Not including Central Bank offices

Table 29. Relative Importance of Commercial Banks, Development Banks, and Other Financial Institutions in the Banking System. Proportion of Total New Loans Granted, and Shares in Overall Deposit Mobilization. Selected Years, 1960-1982

	Proportion of New Loans Granted			Shares in Overall Deposit Mobilization [a/]		
Year	Private Commercial Banks %	Public Development Banks %	Other Financial Institutions %	Private Commercial Banks %	Public Development Banks %	Other Financial Institutions %
1960	77.6	16.9	5.5	n.a.	n.a.	n.a.
1965	70.5	21.2	8.3	n.a.	n.a.	n.a.
1970	82.3	10.4	7.3	91.2	6.3	2.5
1975	86.8	9.2	4.0	91.4	6.6	2.0
1976	86.7	8.0	5.3	91.0	7.2	1.8
1977	83.9	14.0	2.1	92.1	5.0	2.9
1978	86.9	11.0	2.1	91.1	4.8	4.1
1979	82.3	14.7	3.0	88.7	5.8	5.5
1980	78.8	16.6	4.6	86.4	6.0	7.6
1981	80.4	11.4	8.2	86.2	5.2	8.6
1982	82.5	11.7	5.8	86.5	5.4	8.1

Sources: Proportion of New Loans, 1960-80 from Gonzalez-Vega [33], 1981-82 computed from Central Bank Statistical Bulletin [9].
Shares in Overall Deposit Mobilization, computed from Central Bank Statistical Bulletin [9].

a/ Based on end-of-year balances of private-sector and public-sector deposits.

n.a.: not available

Table 30. Interest-rate Ceilings: Nominal and Real Rates on Savings and Time Deposits, 1970-1982. Real Rates Computed for Two Deflators: the Consumer-Price Index (CPI) and the Implicit GDP Deflator (ID)

	Interest-rate Ceiling on Savings Deposits			Interest-rate Ceiling on Time Deposits		
	Nominal rate	Real rate[a/]		Average Nominal rate[b/]	Real rate[a/]	
Year	%	(CPI) %	(ID) %	%	(CPI) %	(ID) %
1970	4.0	0.1	1.1	7.0	3.0	4.0
1971	4.0	1.9	3.7	7.0	4.8	6.7
1972	4.0	0.8	-0.4	7.0	3.7	2.4
1973	4.0	-0.6	-1.2	7.0	2.3	1.6
1974	5.0	-6.9	-4.0	7.8	-4.4	-1.4
1975	6.0	-1.9	0.7	8.5	0.4	3.0
1976	6.0	0.9	-8.7	8.5	3.2	-6.6
1977	6.0	-2.2	-2.5	8.5	0.1	-0.2
1978	6.0	0.3	-3.5	8.5	2.6	-1.3
1979	7.0	-4.5	-4.1	c/	-	-
1980	7.8	-8.7	-6.2	-	-	-
1981	d/	-	-	-	-	-
1982	-	-	-	-	-	-

Sources: Central Bank publications, Statistical Bulletin [9], National Accounts [10], Consumer Price Index [11].

a/ Computed as $r = [(i - \dot{p}) / (1 + \dot{p})]$,
where: r is the real rate of interest,
i is the nominal interest-rate,
$\dot{p}$ is the rate of inflation, according to the CPI or to the Implicit GDP Deflator (ID).

b/ Annual average of rates for time-deposits of less than L.100,000, different terms. Rates for time deposits over L.100,000 were free most of the period (excepting those of less than 6 months-term between 1974 and 1978, fixed at 8%).

c/ Free after 1978.

d/ Free since May 1981.

Table 31. Interest-rate Ceilings: Nominal and Real Lending-rate Ceilings, 1970-1982. Real Rates Computed for Two Deflators: the Consumer Price Index (CPI) and the Implicit GDP Deflator (ID)

Year	Number of Different Lending-rate Ceilings a/	Maximum Lending-rate Ceiling b/			Average Lending-rate Ceiling		
		Nominal rate	Real rate c/		Nominal rate	Real rate	
			(CPI)	(ID)		(CPI)	(ID)
		%	%	%	%	%	%
1970	n.a.	18	13.6	14.7	-	-	-
1971	n.a.	18	15.6	17.7	-	-	-
1972	n.a.	18	14.3	13.0	-	-	-
1973	7	18	12.8	12.1	12.0	7.1	6.4
1974	8	18	4.6	7.9	12.8	0.0	3.1
1975	9	16	7.3	10.2	12.1	3.7	6.5
1976	9	16	10.4	-0.1	12.1	6.7	-3.4
1977	9	16	7.0	6.6	12.1	3.4	3.1
1978	9	16	9.7	5.5	12.1	6.1	2.0
1979	8	16	3.5	3.9	12.0	-0.1	0.3
1980	9	19	0.8	3.6	13.3	-4.1	-1.4
1981	7	19	8.8	17.3	14.3	4.5	12.6
1982	7	19	8.8	11.5	15.0	5.1	7.8

Sources: Central Bank publications: Statistical Bulletin [9], National Accounts [10], Consumer Price Index [11]. Also Banco Atlantida, Economic Studies Division (internal records).

a/ Lending-rate ceilings established by the Central Bank for different end-uses and/or loan-sizes, with or without use of rediscount funds.

b/ Usually allowed for operations with resources mobilized from the general public.

c/ Real rate computed as $r = [(i - \dot{p}) / (1 + \dot{p})]$,
where r is the real rate of interest,
i is the nominal interest-rate
$\dot{p}$ is the rate of inflation, according to the CPI, or to the Implicit GDP Deflator (ID)

n.a.: not available

Table 32. Central Bank Rediscount Lines: Number of Rediscount Lines, Discount Rates and Associated Lending-rates of Main Rediscount Lines, 1970-1982

		Selected Rediscount Lines, Discount Rates and Associated Lending-rate Ceilings					
		General Production b/		Basic-Grains Production		Marketing c/	
Year	Number of Rediscount Lines a/	Discount rate %	Lending-rate ceiling %	Discount rate %	Lending-rate ceiling %	Discount rate %	Lending-rate ceiling %
1970	n.a.	4	n.a.	n/e	-	n/e	-
1971	n.a.	4	n.a.	n/e	-	n/e	-
1972	n.a.	4	n.a.	n/e	-	n/e	-
1973	3	4	9	n/e	-	6	n.a.
1974	3	4	9	n/e	-	6	13
1975	4	5	10	3	7	7	13
1976	4	5	10	3	7	7	13
1977	7	5	10	3	7	7	13
1978	6	6	11	5	11	8	13
1979	8	8	13	6	13	4	13
1980	5	8	13	7	13	9	13
1981	7	11	16	7	13	12	16
1982	9	14	19	10	16	15	19

Sources: Central Bank Statistical Bulletin [9]. Banco Atlántida, Economic Studies Division (internal records).

a/ Counts lines with different discount-rates, i.e., it is a lower bound for the total number of existing rediscount lines. These are defined according to end-use of loans and/or to loan-size.
b/ Agriculture (includes Livestock), and Manufacture.
c/ Agriculture and Non-agricultural products. Includes export financing in some years.

n.a.: not available
n/e: nonexistent

APPENDIX B

Appendix to Chapter IV

B.1. Shares of Each Output in Total Marginal Cost, in Multi-Output Production.

The share of the ith output in total marginal cost, is defined as in Laitinen [61]:

$$g_i = \frac{q_i}{\rho}\frac{\partial C}{\partial q_i} \tag{1}$$

where, g_i is the share of output i in total marginal cost,

q_i is the quantity of output i,

ρ is Laitinen's definition of total or overall marginal cost,

$$\rho = \Sigma_i q_i \frac{\partial C}{\partial q_i} \quad , \tag{2}$$

$\frac{\partial C}{\partial q_i}$ is the individual marginal cost of output i.

Recalling that: $\frac{\partial \ln C}{\partial \ln q_i} = \frac{\partial C}{\partial q_i}\frac{q_i}{C}$,

and dividing (2) by C,

$$\frac{\rho}{C} = \Sigma_i \frac{q_i}{C}\frac{\partial C}{\partial q_i} = \Sigma_i \frac{\partial \ln C}{\partial \ln q_i} \tag{3}$$

or $\frac{\rho}{C} = ES$ (see equation 4.4 in the text)

Substituting ρ in (1):

$$g_i = \frac{q_i}{C\Sigma_i(\partial \ln C/\partial \ln q_i)}\frac{\partial C}{\partial q_i} = \frac{1}{\Sigma_i(\partial \ln C/\partial \ln q_i)}\frac{\partial \ln C}{\partial \ln q_1} \quad ,$$

$g_i = ES_i/ES$, i.e., expression (4.8) in the text.

B.2. Allen Partial Elasticities of Substitution in the Translog Cost Function

From Uzawa [89]:

$$\sigma_{ij} = \frac{C \dfrac{\partial^2 C}{\partial p_i \partial p_j}}{\dfrac{\partial C}{\partial p_i} \dfrac{\partial C}{\partial p_j}} \tag{1}$$

where, C is the unit cost function

and

$$\sigma_{ij} - 1 = \frac{\dfrac{\partial^2 \ln C}{\partial p_i \partial p_j}}{\dfrac{\partial \ln C}{\partial p_i} \dfrac{\partial \ln C}{\partial p_j}} \quad , \; i = j \tag{2}$$

thus

$$\sigma_{ij} = \frac{\dfrac{\partial^2 \ln C}{\partial p_i \partial p_j}}{\dfrac{\partial \ln C}{\partial p_i} \dfrac{\partial \ln C}{\partial p_j}} + 1 \tag{3}$$

$$\frac{\partial^2 \ln C}{\partial p_i \partial p_j} = \frac{\partial \left(\dfrac{1}{p_i} \dfrac{\partial \ln C}{\partial \ln p_i}\right)}{\partial p_j} \tag{4}$$

$$= \frac{1}{p_i} \frac{\partial^2 \ln C}{\partial \ln p_i \partial \ln p_j} \frac{1}{p_j} = \frac{1}{p_i p_j} \frac{\partial^2 \ln C}{\partial \ln p_i \partial \ln p_j}$$

$$\sigma_{ij} = \frac{\dfrac{1}{p_i p_j} \dfrac{\partial^2 \ln C}{\partial \ln p_i \partial \ln p_j}}{\dfrac{1}{p_i p_j} \dfrac{\partial \ln C}{\partial \ln p_i} \dfrac{\partial \ln C}{\partial \ln p_j}} + 1 \tag{5}$$

$$\sigma_{ij} = \frac{\dfrac{\partial^2 \ln C}{\partial \ln p_i \partial \ln p_j} + \dfrac{\partial \ln C}{\partial \ln p_i} \dfrac{\partial \ln C}{\partial \ln p_j}}{\dfrac{\partial \ln C}{\partial \ln p_i} \dfrac{\partial \ln C}{\partial \ln p_j}}$$

recall: $\dfrac{\partial \ln C}{\partial \ln p_i} = \dfrac{\partial C}{\partial p_i} \dfrac{p_i}{C}$

and, $\dfrac{\partial C}{\partial p_i} = x_i$, (Shephard's lemma, [91]) therefore $\frac{\partial \ln C}{\partial \ln p_i} = \frac{p_i x_i}{C} = S_i$ the cost share of factor i

$$\text{then} \quad \sigma_{ij} = \frac{\frac{\partial^2 \ln C}{\partial \ln p_i \partial \ln p_j} + S_1 S_2}{S_1 S_2} \quad , \ i \neq j$$

for i = j, (4) becomes:

$$\frac{\partial^2 \ln C}{\partial p_i{}^2} = \frac{\partial \left(\frac{\partial \ln C}{\partial p_i}\right)}{\partial p_i} = \frac{\partial \left(\frac{1}{p_i} \frac{\partial \ln C}{\partial \ln p_i}\right)}{\partial p_i}$$

$$= \frac{1}{p_i} \frac{\partial^2 \ln C}{\partial (\ln p_i)^2} \frac{1}{p_i} + \frac{\partial \ln C}{\partial \ln p_i} \left(- \frac{1}{p_i^2}\right)$$

$$\frac{\partial^2 \ln C}{\partial p_i{}^2} = \frac{1}{p_i{}^2} \left(\frac{\partial^2 \ln C}{\partial (\ln p_i)^2} - \frac{\partial \ln C}{\partial \ln p_i} \right)$$

$$\sigma_{ii} = \frac{\frac{1}{p_i{}^2} \left(\frac{\partial^2 \ln C}{\partial (\ln p_i)^2} - \frac{\partial \ln C}{\partial \ln p_i} \right)}{\frac{1}{p_i{}^2} \left(\frac{\partial \ln C}{\partial \ln p_i}\right)^2} + 1$$

$$\sigma_{ii} = \frac{\frac{\partial^2 \ln C}{\partial (\ln p_i)^2} - \frac{\partial \ln C}{\partial \ln p_i} + \left(\frac{\partial \ln C}{\partial \ln p_i}\right)^2}{\left(\frac{\partial \ln C}{\partial \ln p_i}\right)^2}$$

$$\sigma_{ii} = \frac{\frac{\partial^2 \ln C}{\partial (\ln p_i)^2} + S_i(S_i - 1)}{S_i{}^2}$$

In terms of the parameters of the translog function:

$$\sigma_{ij} = \begin{matrix} (\delta_{ij} + S_i S_j) \ / \ S_i S_j & , \quad i \neq j \\ (\delta_{ii} + S_i(S_i - 1)) \ / \ S_i{}^2 & , \quad i = j \end{matrix}$$

B.3. Simultaneity and Estimation Bias in the Transaction-Costs Function

The issue of simultaneity in the transaction-costs function was discussed in section 4.2. It was pointed out in that section that, if the "true" model involved a loan-demand function that depends on the magnitude of transaction costs, then the trade-off equation (4.20) includes a variable (loan amount) that is correlated with the error term. In this case, the single-equation estimation of (4.20) would yield biased and inconsistent estimates of the parameters in the function. This appendix shows that the expected signs of the biases in the estimated coefficients of the variables loan-amount and interest-rate are negative and positive, respectively. For simplicity, other variables are omitted and the equations are written in linear form without the logarithm notation. The exposition draws upon the treatment given to this simultaneity problem in Johnston [51].

Let the simultaneous-equation system be:

$T_j = \alpha + \beta L + \delta i_j + u_j$, transaction-costs function, (1)

$L_j = a + bT_j + v_j$, loan-demand function, (2)

$j = 1,\ldots,n,$

where, T is transaction costs per loan,

L is loan amount,

i is the interest rate,

u,v are stochastic error terms.

The following assumptions apply:

$E(u) = 0, \quad E(v) = 0,$

$E(u^2) = \sigma_u^2, \quad E(v^2) = \sigma_v^2,$

$\mathrm{Cov}(u,v) = 0,$

$\mathrm{Cov}(i,u) = 0, \quad \mathrm{Cov}(i,v) = 0$

$\beta > 0, \quad \delta < 0, \quad b < 0.$

Using Johnston's notation for second-order moments, for any two variables X and Y:

$$m_{YX} = \frac{1}{n} \Sigma_j (Y_j - \bar{Y})(X_j - \bar{X}) \tag{3}$$

$$m_{XX} = \frac{1}{n} \Sigma_j (X_j - \bar{X})^2 \tag{4}$$

The OLS estimate for the coefficients in equation (4.21) can be written as:

$$\hat{\beta} = \frac{m_{TL}}{m_{LL}} \tag{5}$$

$$\hat{\delta} = \frac{m_{Ti}}{m_{ii}} \tag{6}$$

The reduced-form system of equations that corresponds to the structural form (1), (2) is the following (j-subscripts omitted):

$$T = \frac{\delta}{\lambda} i + \frac{\alpha + a\beta}{\lambda} + \frac{1}{\lambda} u + \frac{\beta}{\lambda} v \tag{7}$$

$$L = \frac{b\delta}{\lambda} i + \frac{a + b\alpha}{\lambda} + \frac{b}{\lambda} u + \frac{1}{\lambda} v \tag{8}$$

where, $\lambda = (1 - b\beta)$

In deviations from the sample means:

$$T - \bar{T} = \frac{\delta}{\lambda} (i-\bar{i}) + \frac{1}{\lambda} (u-\bar{u}) + \frac{\beta}{\lambda} (v-\bar{v}) \tag{9}$$

$$L - \bar{L} = \frac{b\delta}{\lambda} (i-\bar{i}) + \frac{b}{\lambda} (u-\bar{u}) + \frac{1}{\lambda} (v-\bar{v}) \tag{10}$$

therefore,

$$m_{TL} = \frac{1}{\lambda^2} [b\delta^2 m_{ii} + 2b\delta m_{iu} + \delta(1 + b\beta)m_{iv} + bm_{uu} + \\ + \beta m_{vv} + (1 + b\beta)m_{uv}] \tag{11}$$

$$m_{LL} = \frac{1}{\lambda^2} [b^2\delta^2 m_{ii} + 2b^2\delta m_{iu} + 2b\delta m_{iv} + b^2 m_{uu} + \\ + m_{vv} + 2bm_{uv}] \tag{12}$$

$$m_{Ti} = \frac{1}{\lambda} (\delta m_{ii} + m_{iu} + \beta m_{iv}) \tag{13}$$

Now, the OLS estimate for the coefficient of the loan amount variable in (A.1) is:

$$\hat{\beta} = \frac{m_{TL}}{m_{LL}} \quad ,$$

$$\hat{\beta} = \frac{b\delta^2 m_{ii} + 2b\delta m_{iu} + \delta(1+b\beta')m_{iv} + bm_{uu} + \beta m_{vv} + (1+b\beta)m_{uv}}{b^2\delta^2 m_{ii} + 2b^2\delta m_{iu} + 2b\delta m_{iv} + b^2 m_{uu} + m_{vv} + 2bm_{uv}}$$

Under the assumptions laid out above, as $n \to \infty$:

$$m_{uu} \to \sigma_n^2 \ , \ m_{vv} \to \sigma_v^2 \quad ,$$

$$m_{iu} \to 0 \quad , \ m_{iv} \to 0 \quad , \ m_{uv} \to 0 \quad ,$$

and m_{ii} tends to some value $\bar{m}_{ii} > 0$.

Therefore,

$$\underset{n \to \infty}{\text{plim}}\hat{\beta} = \frac{b\delta^2 \ \bar{m}_{ii} + b\sigma_n^2 + \beta\sigma_v^2}{b^2\delta^2 \ \bar{m}_{ii} + b^2\sigma_n^2 + \sigma_v^2} \quad ,$$

that can be transformed into:

$$\underset{n \to \infty}{\text{plim}}\hat{\beta} = \beta + \frac{(1-b\beta)(b\delta^2 \ \bar{m}_{ii} + b\sigma_n^2)}{b^2\delta^2 \ \bar{m}_{ii} + b^2\sigma_u^2 + \sigma_v^2} \tag{14}$$

Given the signs assumed for β and b in the structural form, the second term on the right-hand side of (14) is negative, therefore :

$$\operatorname*{plim}_{n \to \infty} \hat{\beta} < \beta \quad ,$$

i.e., the estimate $\hat{\beta}$ is biased downward, and this bias does not vanish as $n \to \infty$. Thus, the estimate is also inconsistent. In turn, the estimated coefficient of the interest-rate variable is:

$$\hat{\delta} = \frac{m_{Ti}}{m_{ii}} \quad ,$$

$$\hat{\delta} = \frac{1}{\lambda} \left(\delta + \frac{m_{iu}}{m_{ii}} + \beta \frac{m_{iv}}{m_{ii}}\right) \quad .$$

Under the assumptions used here:

$$\operatorname*{plim}_{n \to \infty} \hat{\delta} = \frac{\delta}{\lambda} \quad ,$$

that can be written as:

$$\operatorname{plim} \hat{\delta} = \delta + \frac{\delta b \beta}{\lambda} \tag{15}$$

where the second term on the right-hand side is positive, therefore:

$$\operatorname{plim} \hat{\delta} > \delta \quad ,$$

i.e., $\hat{\delta}$ is biased upward. Since the magnitude of the bias $(\delta b \beta / \lambda)$ is given by parameters with real values different from zero, the estimate of δ is also inconsistent.

APPENDIX C

Appendix to Chapter V

Table 33. Development Bank: Estimated Parameters of the Cost Function, for Different Output Definitions and Functional Forms. Dependent Variable: Administrative Costs (lnC)

	Model (output definition, functional form)							
	(1)		(2)		(3)		(4)	
	Number of Loans (q_1), Number of Deposit Accounts (q_2)				Value of Loans (q_1), Deposit Balances (q_2)			
	Cobb-Douglas		Translog		Cobb-Douglas		Translog	
Parameter (Variable)	Estimate	t-ratio	Estimate	t-ratio	Estimate	t-ratio	Estimate	t-ratio
α_0 (intercept)	0.9294	1.321	24.7935	2.665*	3.7372	8.055*	-1.2233	-0.244
α_1 ($\ln q_1$, loans)	0.1519	4.085*	-1.5198	-1.722°	0.4786	15.018*	-0.4352	-0.889
α_2 ($\ln q_2$, deposits)	0.4574	5.238*	-2.9849	-1.747°	0.1753	5.502*	1.3378	2.316†
β_1 ($\ln p_1$, price of labor)	1.3163	8.129*	-0.9386	3.596*	0.7355	6.175*	2.4714	0.986
β_2 ($\ln p_2$, price of capital)	-0.1473	-2.992*	-2.4711	-2.286†	0.1150	3.068*	-0.2199	-0.337
γ_{11} $(\ln q_1)^2$			-0.1104	-1.978†			0.0633	1.974†
γ_{22} $(\ln q_2)^2$			-0.1632	-0.568			-0.0438	-1.057
γ_{12} $(\ln q_1 \ln q_2)$			0.1796	1.427			0.0568	1.702°
δ_{11} $(\ln p_1)^2$			-0.7590	-0.765			-0.1449	-0.216
δ_{22} $(\ln p_2)^2$			0.1487	1.611°			0.0363	0.786
δ_{12} $(\ln p_1 \ln p_2)$			0.5351	2.689*			0.1671	0.977
η_{11} $(\ln q_1 \ln p_1)$			0.2275	1.672†			0.0419	0.382
η_{12} $(\ln q_1 \ln p_2)$			-0.0068	-0.141			0.0158	0.407
η_{21} $(\ln q_2 \ln p_1)$			0.6444	1.621°			-0.2400	-1.493
η_{22} $(\ln q_2 \ln p_2)$			-0.0685	-0.494			-0.0975	-2.313†
R^2	0.7567	---	0.7922	---	0.8208	---	0.8598	---
F-value	120.54*		39.49*		324.03*		119.59*	
F-test of functional form[a/]	---		2.47*		---		7.60*	

OLS estimation, N=160 for models (1) and (2), N=288 for models (3) and (4).

a/ $F = [(SSE_C - SSE_T)/10] / (SSE_T/N-14)$, where SSE = error sum of squares
C denotes Cobb-Douglas form
T denotes Translog form

Significance levels: *, .01
†, .05
°, .10

Table 34. Development Bank: Estimated Parameters of the Cost Function, for the Single-Output Definition (Loans + Deposits), and Different Functional Forms. Dependent Variable: Administrative Costs (lnC)

	Model (output definition, functional form)							
	(1)		(2)		(3)		(4)	
	Number of Loans + Deposit Accounts				Value of Loans + Deposit Balances			
	Cobb-Douglas		Translog		Cobb-Douglas		Translog	
Parameter (Variable)	Estimate	t-ratio	Estimate	t-ratio	Estimate	t-ratio	Estimate	t-ratio
α_0 (Intercept)	0.6644	0.932	15.6583	1.786°	1.9225	4.114*	0.9483	0.198
α_1 (lnQ, loans + deposits)	0.4752	6.116*	-0.8433	-0.481	0.6431	13.661*	-1.9831	-2.067†
β_1 ($\ln p_1$, price of labor)	1.4704	8.919*	-2.4458	-0.735	1.0043	8.553*	5.2828	2.217†
β_2 ($\ln p_2$, price of capital)	-0.1797	-3.529*	-0.9955	-0.915	0.1306	2.984*	-2.2977	-2.554*
γ_{11} $(\ln Q)^2$			-0.5788	-3.042*			-0.0037	-0.049
δ_{11} $(\ln p_1)^2$			-0.9617	-0.936			-1.6008	-2.252†
δ_{22} $(\ln p_2)^2$			0.0807	0.902			0.0369	0.419
δ_{12} ($\ln p_1 \ln p_2$)			0.4596	2.296†			0.6276	3.067*
η_{11} ($\ln Q \ln p_1$)			1.1400	2.831*			0.5154	2.255†
η_{12} ($\ln Q \ln p_2$)			-0.2070	-1.765°			-0.1199	-1.488
R^2	0.7325	---	0.7650	---	0.7946	---	0.8167	---
F-value	142.43*		54.25*		364.97		137.17	
F-test of functional form a/	---		3.45*		---			

OLS estimation, N=160 in models (1) and (2), N=288 in models (3) and (4).

a/ $F = [(SSE_C - SSE_T)/6] / (SSE_T/N-10)$, where SSE = error sum of squares
C denotes Cobb-Douglas form
T denotes Translog form

Significance levels: *, .01
†, .05
°, .10

Table 35. Development Bank: Estimated Parameters of the Cost Function, Including Loan-Size and Deposit-Size Effects. Single-Equation Estimation with Two Output Definitions[a]

Parameter (Variable)	Model (output definition): (1) Number of Loans (q_1), Number of Deposit Accounts (q_2) — Estimate	t-ratio	(2) Value of Loans (q_1), Deposit Balances (q_2) — Estimate	t-ratio
α_0 (intercept)	-0.2973	-0.101	5.1313	5.652*
α_1 ($\ln q_1$, loans)	-0.2284	-0.527	0.0574	0.297
α_2 ($\ln q_2$, deposits)	1.3004	1.376	0.0768	0.212
β_1 ($\ln p_1$, price of labor)	0.4525	0.913	0.7055	3.233*
β_2 ($\ln p_2$, price of capital)	0.5475	1.105	0.2945	1.350
γ_{11} $(\ln q_1)^2$	0.0838	1.790°	0.0887	2.362*
γ_{22} $(\ln q_2)^2$	-0.1563	-0.809	0.0368	0.375
γ_{12} ($\ln q_1 \ln q_2$)	-0.0179	-0.184	0.0256	0.601
δ_{11} $(\ln p_1)^2$	0.1222	2.281†	0.1191	1.257
δ_{22} $(\ln p_2)^2$	0.1222	2.281†	0.1191	1.257
δ_{12} ($\ln p_1 \ln p_2$)	-0.1222	-2.281†	-0.1191	-1.257
η_{11} ($\ln q_1 \ln p_1$)	-0.0536	-1.493	-0.0452	-1.007
η_{12} ($\ln q_1 \ln p_2$)	0.0536	1.493	0.0452	1.007
η_{21} ($\ln q_2 \ln p_1$)	0.0080	0.076	-0.0284	-0.394
η_{22} ($\ln q_2 \ln p_2$)	-0.0080	-0.076	0.0284	0.394
θ_1 ($\ln q_1 \ln LS$, loan-size interaction)	0.0855	11.500*	-0.0068	-1.059
θ_2 ($\ln q_2 \ln DS$, deposit-size interaction)	0.0205	2.304†	-0.0143	-0.974
R^2	0.8905	---	0.8786	---
F-value	109.42		97.37	

a/ OLS estimation. Factor-price homogeneity restrictions imposed on estimation. However, none of these restrictions was statistically significant.
Levels of significance: *, .01; †, .05. °, .10.

Table 36. Private Bank: Estimated Parameters of the Cost Function, for Different Functional Forms. Dependent Variable: Administrative Costs (lnC)

	Model (functional form, deposit-size interaction)							
	(1) Cobb-Douglas		(2) Translog		(3) Cobb-Douglas, Deposit-Size Interaction		(4) Translog, Deposit-Size Interaction	
Parameter (Variable)	Estimate	t-ratio	Estimate	t-ratio	Estimate	t-ratio	Estimate	t-ratio
α_0 (intercept)	-2.9043	-3.591*	76.9435	2.693*	-3.0105	-3.705*	70.7300	2.518*
α_1 ($\ln q_1$, loans)	0.0369	1.594	1.2882	1.010	0.0500	1.957*	1.1854	0.948
α_2 ($\ln q_2$, deposits)	0.9122	29.049*	0.3836	0.199	0.9697	16.977*	0.0959	0.051
β_1 ($\ln p_1$, price of labor)	0.8976	8.109*	-18.5176	-2.334†	0.9033	8.164*	-16.4716	-2.109†
β_2 ($\ln p_2$, price of capital)	0.2347	7.193*	-2.2939	-1.274	0.2360	7.237*	-2.2602	-1.280
γ_{11} $(\ln q_1)^2$			0.0221	0.547			0.0144	0.364
γ_{22} $(\ln q_2)^2$			-0.0814	-1.058			-0.0709	-0.939
γ_{12} $(\ln q_1 \ln q_2)$			0.1099	1.198			0.1256	1.395
δ_{11} $(\ln p_1)^2$			2.4241	2.196†			2.1233	1.953†
δ_{22} $(\ln p_2)^2$			-0.0337	-0.435			-0.0269	-0.354
δ_{12} $(\ln p_1 \ln p_2)$			0.2425	1.005			0.2414	1.021
η_{11} $(\ln q_1 \ln p_1)$			-0.2197	-1.330			-0.2088	-1.290
η_{12} $(\ln q_1 \ln p_2)$			-0.0275	-0.556			0.0033	0.067
η_{21} $(\ln q_2 \ln p_1)$			0.0734	0.301			0.1124	0.470
η_{22} $(\ln q_2 \ln p_2)$			0.0960	1.350			0.0615	0.870
θ_2 ($\ln q_2 \ln DS$, deposit-size interaction)	---	---	---	---	-0.0097	-1.204	-0.0232	-2.856*
R^2	0.9699	---	0.9758	---	0.9701	---	0.9764	---
F-value	1487.77*		503.31*		1143.41*		489.52	
F-test of functional form[a/]	---		4.11*		---		5.09*	

OLS estimation, N=190. Significance levels: *, .01; †, .05; °, .10.

a/ $F = [(SSE_C - SSE_T)/10] / (SSE_T/N-14)$, where SSE = error sum of squares, C denotes Cobb-Douglas form, T denotes Translog form

Table 37. Private Bank: Correlation Coefficients Between Selected Variables of the Cost Function. All Variables in Natural Logarithms.[a/]

Variables	Loans ($\ln q_1$)	Deposits ($\ln q_2$)	Loans x Deposits ($\ln q_1 \ln q_2$)	$(\text{Loans})^2$ $(\ln q_1)^2$	$(\text{Deposits})^2$ $(\ln q_2)^2$	Loans x Price of Labor ($\ln q_1 \ln p_1$)	Deposits x Price of Labor ($\ln q_2 \ln p_2$)
Loans ($\ln q_1$)	1	0.88	0.97	0.99	0.89	0.99	0.89
Deposits ($\ln q_2$)		1	0.95	0.90	0.99	0.89	0.99
Loans x Deposits ($\ln q_1 \ln q_2$)			1	0.99	0.97	0.98	0.96
$(\text{Loans})^2$, $(\ln q_1)^2$				1	0.91	0.99	0.91
$(\text{Deposits})^2$, $(\ln q_2)^2$					1	0.91	0.99
Loans x Price of Labor, ($\ln q_1 \ln p_1$)						1	0.91
Deposits x Price of Labor ($\ln q_2 \ln p_1$)							1

a/ All coefficients statistically significant at 0.01 level.

Table 38. Means, Standard Deviations, and Correlation Coefficients for Interest-Rate Ceilings and Implicit Rates Paid on Deposits. Nominal and Real Terms. Results for the Development Bank and the Private Bank

Bank, Variable	Mean %	Standard Deviation %	Correlation Coefficients with Selected Variables: Nominal Average Deposit-Rate Ceiling (d_c)	Real Average Deposit-Rate Ceiling ($d_c - \dot{p}$)	Nominal Lending-Rate Ceiling (ℓ)	Real Lending-Rate Ceiling ($\ell - \dot{p}$)
Development bank						
Nominal Implicit Rate Paid on Deposits (d_p)[a/]	3.62	2.58	-0.0059		0.0186	
Real Implicit Rate Paid on Deposits ($d_p - \dot{p}$)	-4.51	5.43		0.8055*		0.8428*
Private bank						
Nominal Implicit Rate Paid on Deposits (d_p)	3.73	1.20	0.2954*		0.2346*	
Real Implicit Rate Paid on Deposits ($d_p - \dot{p}$)	-4.13	4.84		0.9315*		0.9520*
All						
Nominal Average Deposit-Rate Ceiling (d_c)	6.56	1.65	1	-0.4306*	-0.3455*	
Real Average Deposit-Rate Ceiling ($d_c - \dot{p}$)	-2.51	3.62		1		0.8799*
Nominal Lending-Rate Ceiling (ℓ)	17.22	1.60			1	0.6132*
Real Lending-Rate Ceiling ($\ell - \dot{p}$)	9.08	5.51				1

* : significant at 0.01 level
a/ Total Interest Payments/Total Deposit Balances (includes demand deposits)

Table 39. Shares of Different Sources of Funds in the Portfolio of New Loans of the Development Bank, and Average Loan Size by Source, 1971-1982.

	Source of Funds										
	Deposits			Central Bank			Foreign Funds			Central Bank and Foreign Funds Combined	
Year	Share in No. of Loans %	Share in Loan Amount %	Average Loan Size Lps.1/	Share in No. of Loans %	Share in Loan Amount %	Average Loan Size Lps.	Share in No. of Loans %	Share in Loan Amount %	Average Loan Size Lps.	Share in No. of Loans %	Share in Loan Amount %
1971	64.5	64.7	1223	0	0	--	35.5	35.3	1217	35.5	35.3
1972	32.0	53.4	2215	0	0	--	68.0	46.6	910	68.0	46.6
1973	24.9	54.6	3318	3.7	0.5	208	71.4	44.9	953	75.1	45.4
1974	19.6	51.5	3348	41.0	8.9	276	39.4	39.6	1282	80.4	48.5
1975	19.6	39.8	2236	43.2	20.0	507	37.2	40.2	1188	80.4	60.2
1976	30.4	56.1	2679	9.0	12.1	1942	60.6	31.8	760	69.6	43.9
1977	31.9	64.5	4528	22.5	14.7	1464	45.7	20.8	1021	68.2	35.5
1978	10.4	33.0	8976	76.1	35.2	1306	13.5	31.8	6608	89.6	67.0
1979	7.7	46.2	17953	80.4	33.8	1256	11.9	20.0	5027	92.3	53.8
1980	5.9	34.7	15107	79.2	40.5	1312	14.9	24.8	4293	94.1	65.3
1981	4.3	42.1	22496	77.2	36.5	1036	18.5	21.4	2641	95.7	57.9
1982	5.0	49.8	27238	63.5	30.2	995	31.5	20.0	1729	95.0	50.2

Source: BANADESA, Economic Studies Department.
1/ 1 US$ = 2 lempiras

Table 40. Shares of Agriculture Loans in Portfolio of New Loans of the Development Bank, 1971-1982.

Year	Crops		Livestock		Total Agriculture (Crops + Livestock)	
	Share in No. of Loans %	Share in Loan Amount %	Share in No. of Loans %	Share in Loan Amount %	Share in No. of Loans %	Share in Loan Amount %
1971	74.3	40.1	23.6	27.5	97.9	67.6
1972	70.7	43.2	25.7	30.2	96.4	73.4
1973	67.7	46.5	27.4	29.6	95.1	76.1
1974	83.9	62.6	13.9	19.8	97.8	82.4
1975	88.8	74.2	8.8	13.6	97.6	87.8
1976	86.1	61.3	12.4	13.8	98.5	75.1
1977	79.8	79.2	14.4	12.6	94.2	91.8
1978	89.1	85.2	9.3	7.1	98.4	92.3
1979	91.4	76.0	7.0	6.7	98.4	82.7
1980	96.7	72.4	1.5	3.9	98.2	76.3
1981	94.7	57.3	3.8	8.4	98.5	65.7
1982	93.1	68.2	5.4	8.5	98.5	76.7

Source: BANADESA, Economic Studies Department.

Table 41. Correlation Coefficients Between Sources of Funds and New Loans to Agriculture in the Development Bank[a]

Loans to Agriculture	Source of Funds					
	Deposits		Central Bank		Foreign Funds	
	Number	Amount	Number	Amount	Number	Amount
Crops[b]						
Number	-0.36		0.38		-0.32	
Amount		-0.25		0.33		-0.28
Livestock[c]						
Number	0.44		-0.48		0.41	
Amount		0.31		-0.42		0.36

a/ All coefficients significant at .01 level.
b/ N = 283
c/ N = 292

Table 42. Correlation Coefficients Between Shares of Sources of Funds in the Loan Portfolio of the Development Bank[a/]

Source of Funds	Deposits Number	Deposits Amount	Central Bank Number	Central Bank Amount	Foreign Funds Number	Foreign Funds Amount
Deposits						
Number	1.		-0.85		0.56	
Amount		1.		-0.79		0.13[b/]
Central Bank						
Number			1.		-0.91	
Amount				1.		-0.69
Foreign Funds						
Number					1.	
Amount						1.

a/ N = 299, all coefficients significant at .01 level, unless specified otherwise.

b/ Significant at .05 level.

APPENDIX D

Appendix to Chapter VI

Table 43. Distribution of Loans by Loan Size, Mean and Median Values by Loan-Size Category, by Source of Loan. Total Sample

	Loan Source											
	BANADESA			Private Banks			Credit Unions			All Sources		
Loan Size Category (Lps.)	Pct. of No. of Loans	Mean Value Lps.	Median Value Lps.	Pct. of No. of Loans	Mean Value Lps.	Median Value Lps.	Pct. of No. of Loans	Mean Value Lps.	Median Value Lps.	Pct. of No. of Loans	Mean Value	Median Value
Less than 1,000	9.62	830	900	0.0	--	--	30.95	538	480	11.62	665	600
1,001 - 2,000	31.73	1,610	1,700	3.85	1,350	1,350	28.57	1,505	1,450	23.74	1,572	1,500
2,001 - 5,000	16.35	3,556	4,000	1.92	4,000	4,000	23.81	3,385	3,138	14.14	3,510	3,638
5,001 - 10,000	18.27	6,743	6,400	9.62	9,000	10,000	9.52	7,125	7,000	14.14	7,200	6,800
10,001 - 15,000	6.73	11,547	12,000	3.85	15,000	15,000	2.38	12,000	12,000	5.05	12,283	12,000
15,001 - 25,000	4.81	20,800	22,000	11.54	21,762	22,285	2.38	18,000	18,000	6.06	21,048	21,935
25,001 - 50,000	7.69	34,250	35,500	25.00	40,937	41,540	2.38	40,000	40,000	11.11	38,463	39,500
50,001 - 100,000	3.85	83,925	87,350	30.77	76,759	77,500	0.0	--	--	10.10	78,193	80,000
More than 100,000	0.96	110,000	110,000	13.46	179,379	182,400	0.0	--	--	4.04	170,707	176,200
All Loans	100.0	11,101	4,000	100.0	62,082	47,622	100.0	3,748	1,650	100.0	22,930	5,290

Source: Survey results.

Table 44. Farm-Size Distribution of Loans Granted by the Development Bank, by Loan Size.[a]

Farm Size Category (Has.)	Loan Size Category (Lps.) Less then 5,000 Row Pct.	Column Pct.	5,001 - 25,000 Row Pct.	Column Pct.	More than 25,000 Row Pct.	Column Pct.	Total Row Pct.	Column Pct.
Less than 5	100.0	23.33	0.0	0.0	0.0	0.0	100	13.46
5.1 - 10	89.47	28.33	10.53	6.45	0.0	0.0	100	18.27
10.1 - 20	80.0	20.0	20.0	9.68	0.0	0.0	100	14.42
20.1 - 50	39.13	15.0	56.52	41.94	4.35	7.69	100	22.12
50.1 - 100	50.0	13.33	25.0	12.90	25.0	30.77	100	15.38
100.1 - 200	0.0	0.0	75.0	19.35	25.0	15.38	100	7.69
More than 200	0.0	0.0	33.33	9.68	66.67	46.15	100	8.65
Total	57.69	100	29.81	100	12.50	100	100	100

Source: Survey results.

a/ N = 104

Table 45. Farm-Size Distribution of Loans Granted by Private Banks, by Loan Size[a]

	Loan Size Category (Lps.)							
	Less then 5,000		5,001 - 25,000		More than 25,000		Total	
Farm Size Category (Has.)	Row Pct.	Column Pct.	Row Pct.	Column Pct.	Row Pct.	Column Pct.	Row Pct.	Column Pct.
Less than 5	50.0	33.33	0.0	0.0	50.0	2.78	100	3.85
5.1 - 10	0.0	0.0	50.0	7.69	50.0	7.69	100	3.85
10.1 - 20	0.0	0.0	33.33	7.69	66.67	5.56	100	5.77
20.1 - 50	0.0	0.0	0.0	0.0	100.0	16.67	100	11.54
50.1 - 100	20.0	66.67	20.0	15.38	60.0	16.67	100	19.23
100.1 - 200	0.0	0.0	50.0	38.46	50.0	13.89	100	19.23
More than 200	0.0	0.0	21.05	30.77	78.95	41.67	100	36.54
Total	5.7	100	25.0	100	69.23	100	100	100

Source: Survey results.

a/ N = 52

Table 46. Farm-Size Distribution of Loans Granted by Credit Unions, by Loan Size[a/]

Farm Size Category (Has.)	Loan Size Category (Lps.): Less then 5,000 Row Pct.	Less then 5,000 Column Pct.	5,001 - 25,000 Row Pct.	5,001 - 25,000 Column Pct.	More than 25,000 Row Pct.	More than 25,000 Column Pct.	Total Row Pct.	Total Column Pct.
Less than 5	100.0	37.14	0.0	0.0	0.0	0.0	100	30.95
5.1 - 10	66.67	5.71	33.33	16.67	0.0	0.0	100	7.14
10.1 - 20	100.0	22.86	0.0	0.0	0.0	0.0	100	19.05
20.1 - 50	66.67	22.86	33.33	66.67	0.0	0.0	100	28.57
50.1 - 100	100.0	2.86	0.0	0.0	0.0	0.0	100	2.38
100.1 - 200	100.0	8.57	0.0	0.0	0.0	0.0	100	7.14
More than 200	0.0	0.0	50.0	16.67	50.0	100.0	100	4.76
Total	83.33	100	14.29	100	2.38	100	100	100

Source: Survey results.

a/ N = 42

Table 47. Estimated Coefficients of the Transaction-Costs Function, with Alternative Proxies for Firm Size. Dependent Variable: lnT

Parameter (Independent Variable)	Model (1) Estimate	(1) t-ratio	(2) Estimate	(2) t-ratio	(3) Estimate	(3) t-ratio
a_0 (intercept)	2.6804	2.581*	3.2154	3.310*	1.3820	1.292
a_{11} (lnG, guarantee/loan amount)	0.0855	1.426*				
a_{12} (lnW, labor costs)[a]	--	--	0.0402	0.472	0.0989	1.179
a_2 (lnL, loan amount)	0.4299	5.408*	0.3412	3.936*	0.4830	4.403*
a_{30} (lni, interest rate)	-0.9384	-3.414*	-0.8715	-3.643	-0.8163	-3.281*
a_{31} (Slni, small loans x interest rate)					0.3210	3.190*
a_{32} (D_1lni, private banks x interest rate)					-1.5407	-1.944*
b_1 (D_1, private banks)	0.4762	1.557	0.4797	1.813°	4.3920	2.054*
b_2 (D_2, credit unions)	-0.6346	-2.122†	-0.8283	-3.229*	-0.7405	-3.006*
c_1 (U_1, basic grains loans)	0.3495	1.218	0.3345	1.334	0.3529	1.469
c_2 (U_2, export crops loans)	-0.3341	-0.965	-0.3661	-1.230	-0.2452	-0.856
c_3 (U_3, livestock loans)	0.3521	1.010	0.4679	1.523	0.5117	1.734
R-square	0.4397	--	0.4654	--	0.5161	--
F-value	14.12*		19.37*		18.77*	
N	153		187		187	

OLS estimation. S, D_1, D_2, U_1, U_2, and U_3 are dummy variables.
Levels of significance: *, 0.01
†, 0.05
°, 0.10

a/ lnW was set equal to zero in observations with no hired labor.

Table 48. Transaction Costs per Lempira (τ): Estimated Values of τ, Changes in τ and in Total Borrowing Costs ($i+\tau$) with Increases in the Explicit Interest Rate (i). Results by Loan Use and Loan Size for the Development Bank

Loan Use/Loan Size	Estimated Value of Transaction Costs per Lempira $\hat{\tau}$, %	Estimated Total Borrowing Costs $(i+\hat{\tau})$, %	Change in τ with a one-point increase in the interest rate $\partial\tau/\partial i$, pct. points	Change in Total Borrowing Costs with a one-point increase in the interest rate $\partial(i+\tau)/\partial i$, pct. points
Basic Grains				
Lps. 2,000	3.84	16.84	-0.164	0.836
Lps. 20,000	0.51	13.51	-0.033	0.967
Export Crops				
Lps. 2,000	2.13	15.31	-0.091	0.909
Lps. 20,000	0.28	13.28	-0.018	0.982
Livestock				
Lps. 2,000	4.19	17.19	-0.179	0.821
Lps. 20,000	0.56	13.56	-0.036	0.964

Source: Extended-model results presented in table 6.5. Estimates evaluated at geometric means of farm area (35 Has.) and interest rate (13%).

Table 49. Transaction Costs per Lempira (τ): Estimated Values of τ, Changes in τ and in Total Borrowing Costs ($i+\tau$) with Increases in the Explicit Interest Rate (i). Results by Loan Use and Loan Size for Private Banks

Loan Use/Loan Size	Estimated Value of Transaction Costs per Lempira $\hat{\tau}$, %	Estimated Total Borrowing Costs $(i+\hat{\tau})$, %	Change in τ with a one-point increase in the interest rate $\partial\tau/\partial i$, pct. points	Change in Total Borrowing Costs with a one-point increase in the interest rate $\partial(i+\tau)/\partial i$, pct. points
Basic Grains				
Lps. 2,000	7.77	20.77	-1.595	-0.595
Lps. 20,000	1.04	14.04	-0.236	0.764
Export Crops				
Lps. 2,000	4.30	17.30	-0.882	0.118
Lps. 20,000	0.57	13.57	-0.131	0.869
Livestock				
Lps. 2,000	8.47	21.47	-1.739	-0.739
Lps. 20,000	1.13	14.13	-0.257	0.743

Source: Extended-model results presented in table 6.5. Estimates evaluated at geometric means of farm area (35 Has.) and interest rate (13%).