AN EMPIRICAL INVESTIGATION OF THE PROFITABILITY OF GREEK COMMERCIAL BANKS

by

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TO MY PARENTS

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ABSTRACT

This study seeks to identify the factors that accounted for Greek commercial bank profitability. Our aim is to isolate the characteristics and the management strategies that are common to high-performance financial institutions but are absent among the low-performance ones.

The main data consist of the 1977-1986 income statements and balance sheets for a sample of eight Greek commercial banks.

The emphasis of the analysis is more upon the empirical evidence and less upon the theoretical grounds. The first chapter describes and analyses the Greek financial system. The second chapter explores the profitability path of the sample banks during the period studied and subsequently ranks the firms according to their earnings for the whole period examined by employing a normalization criterion. The relationship between Greek bank earnings performance and their balance sheet structure is investigated in chapter three. This is done by describing and estimating a statistical cost accounting model. Chapter four examines the link between interbank profitability and various financial ratios (i.e. a financial ratio comparison approach). Chapter five analyses the market concentration in Greek commercial banking and its influence on earnings (i.e. the Structure-Conduct-Performance hypothesis). Finally, chapter six is concerned with scale economies in the preceding industry .

"...Models are to be used but not to be believed."

Henry Theil

Principles of Econometrics

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INTRODUCTION

This study seeks to identify the determinants of Greek commercial bank profitability. Our aim is to isolate the characteristics and the management strategies that are common to high-performance financial firms but are absent among the low-performance ones.

The emphasis of the analysis conducted here is more upon the empirical evidence and less upon the theoretical grounds. The starting point is the fact that some banks are more profitable than others. This difference in earnings might be the product of such factors as asset and liability portfolio management, expense control, size, market conditions, luck and so forth. Highlighting the importance of these factors will be useful not only to bank managers but to bank regulators as well. The former will be provided with some indications as to how and where they should allocate their time and attention in order to improve the performance of their institutions. The latter will be assisted in improving their understanding of the effects of their policies on bank profitability and in evaluating the soundness of the financial firms they supervise. Finally, the findings of this study may also be used as avenues for future work.

Previous studies with similar goals can be divided into four groups: statistical cost accounting works, research attempting to identify the financial ratios most closely related to bank earnings performance, investigations of economies of scale, and studies of market concentration-earnings relationship. It is recognized, however, that these studies are subject to various limitations that will be mentioned in the succeeding chapters. This is the reason we employ all of them in an endeavour to find out the coincident conclusions and thereby enhance our knowledge about bank profitability. Needless to say, there is no other work that is making use of the aforementioned four research groups for the same bank sample and time period. And of course this is the first time - as far as we know - that such analysis is conducted for this particular banking system.

There is no unanimity among researchers regarding the factors that account for high-earnings among financial firms. However, all the workers do not hesitate to disclose - either directly or indirectly - that these factors are associated with the specific banking system that is analyzed as well as the time period that this system is examined (i.e. the factors vary whenever the system and the time vary). Hence, the banking system that we are interested in is the Greek one and the interval we observe is from 1977 to 1986.

The data for the study are from a sample of eight banks. This is because there were only eight Greek commercial banks that were operating for at least five years before the period studied[1].

Two main sources of bank data are used. First, earnings and cost data are taken from the annual income statements of each bank. Second, balance sheet data are derived from the annual balance sheets of each firm.

This study consists of seven chapters and each one has taken the following shape. The first chapter presents the profile of the Greek financial system. This descriptive chapter serves two purposes. Firstly, to outline the basic structure of a system which is considerably different from the better known systems. And secondly, to provide the reader with a knowledge that would be useful in understanding the interpretation of the findings of the subsequent chapters.

Chapter two discusses the most commonly used profitability measures in banking, and explores the profitability path of eight Greek commercial banks (i.e. the sample banks) from 1977 to 1986. Subsequently, sample firms were ranked according to their earnings for the whole period examined by employing a normalization criterion. This ranking is utilized in the analyses of the succeeding parts to isolate the determinants of Greek bank profitability.

Chapter three describes and estimates a statistical cost accounting model. It presents the basic model, and examines the implications of incorporating the balance sheet identity in it as well as the potential for specification bias. The chapter is also concerned with the problem of heteroscedasticity and of testing for it in the model. Various studies of empirical evidence in this area are reviewed briefly, and reasonable answers are provided to almost all the critical arguments that have been raised regarding the capability of the model. Furthermore, the chapter considers and estimates a model using data for Greek banks. For the first time a statistical cost accounting model like the estimated one employs bank binary variables, as well as tests and corrects for autocorrelation utilizing pooled data.

Chapter four is devoted to a financial ratio comparison approach. It presents the general framework, discusses the employed operating ratios and briefly reviews the previous relevant studies. Then, it proceeds to develop and estimate a model which is also tested for autocorrelation and heteroscedasticity. This model is a modification of an older one but for the first time tests for autocorrelation and heteroscedasticity are reported. Concentration is studied next.

The fifth chapter discusses some theoretical aspects of concentration and provides a brief review of the main concentration measures usually referred to in this field. Subsequently, it investigates concentration in Greek commercial banking during the period studied by employing the concentration ratio and the Herfindahl-Hirschman index (H-index). In addition, the chapter tests the concentration-profitability hypothesis by utilizing the aforementioned two indexes. This is the first study of its kind that uses the concentration ratio and the H-index alternatively for the same sample, and also reports tests for autocorrelation and heteroscedasticity for pooled data.

Chapter six focusses upon economies of scale. It outlines the sources of scale economies in banking that have been proposed in the literature as well as the approaches that have been suggested in order to estimate them. The chapter also reviews briefly the relevant banking literature and subsequently explores economies of scale in Greek commercial banking by employing a translog cost function. This study is the second one that has utilized pooled data and the first one that is uses a least squares dummy variable (LSDV) model for this purpose. It also tests the model for autocorrelation and heteroscedasticity.

Finally, chapter seven is a summary of this whole study of the main determinants of the Greek bank profitability. Also, the main other inferences that have been found from the analyses conducted in the preceding chapters are reported briefly.

Notes

1. The behaviour of new banks may be quite different from that of older institutions. It usually takes time to train personnel, build up loan portfolios, attract depositors and so forth. For more discussion on this argument see Kwast (1981), p.38, and Kwast and Black (1983), p.42, fn.3. Moreover, Ford and Olson (1978) report that they exclude new banks from their analysis, because in the past they "have found that new banks tend to have such unusual operating characteristics that comparisons against them are not too meaningfull" [pp.37-38].

CHAPTER ONE

The Greek Financial System: A Bird's-Eye View

I.I Introduction

The Greek financial system consists of: (α) the Central Bank, the Bank of Greece; (β) thirty one commercial banks, twelve of which are Greek and nineteen foreign; (γ) eight Special Credit Institutions (SCIs); (δ) one hundred and forty eight life etc. insurance companies, seventy-eight of which are Greek and seventy are foreign. [However, the insurance companies have not carried out credit activities]; (ε) two mutual funds; (στ) ninety pension funds; (ζ) six investment funds; and (η) one stock exchange, the Athens Stock Exchange (ASE).

There are no Savings and Loan Associations, Credit Unions or any other financial intermediaries, except for those mentioned above. However, all the nonbank financial institutions apart from the SCIs do not play any important role in promoting a secondary market, as they are still in their infancy. Therefore, and mainly due to the underdeveloped nature of the capital market, the banking institutions "command" the biggest share of the total resources of the financial system. Nevertheless, a brief outline of the structural features of some of the aforementioned institutions is necessary for an understanding of the Greek financial system.

I.II The Bank of Greece

The Bank of Greece is the central bank of the country and was established in 1928 to take over the right of issuing bank notes, which until that time was exercised by the National Bank of Greece. It is the main economic advisor of the government on matters of financial policy and maintains twenty-eight branches, twenty-five of which are in the main Greek cities. The Bank of Greece operates in the legal form of a Société Anonyme (joint-stock company), and is administered by an 11-member General Council. The governor and its two deputy governors are appointed by the government. The other administrators are elected by the shareholders' general assembly, though their election is controlled in an indirect way by the Greek State. Therefore, the central bank directs its operations towards the control and oversight of the banking system rather than to the profit of its shareholders. However, we should point out that the dividends of its shareholders cannot exceed a certain percentage of the share capital. The rest of the net earnings, after deductions for reserves (as provided by law), are transferred to the State (also by law).

Except for the right of issue, the central bank has the following main functions:[1]

(i) The Bank of Greece carrys out the government's monetary policy and supports the financial system, helping it to overcome crises and ensuring that no panic develops. Thus, it fulfils the traditional role of the "lender of last resort"; a role which it can play through the discount mechanism.

(ii) It is the banker of the banking system. This is realized by providing banks with rediscounts of portfolio and overdraft facilities to be used for special purposes, according to the monetary policy. In other words the central bank extends low rate credit to commercial banks and SCIs for the refinancing of certain special categories. It should be noted though that the rediscount rate is not used to influence the interest rate level in the money market, but mainly used for the financing of banks. Nevertheless, because of the high liquidity of the commercial banking system (due to the absence of an active money and capital market), banks have rarely used funds provided through the discount window. Thus, the importance of the rediscount rate manipulation is limited only to an indicator of monetary policy trends.

(iii) The central bank operates as a cashier and as a banker for the Greek State. This is carried out by financing the deficits of the government budget and the commercial activites of the State. It can also provide advances for the implementation of the government budget and buy treasury bills and government bonds.

(iv) The Bank of Greece preserves and manages the country's exchange reserves as well as administering exchange controls. (Since 1980, commercial banks have been allowed to hold an amount of assets in foreign currency, the limit of which is daily arranged.)

(v) It functions as an interest-free depository for funds of the Greek State, public entities and individuals.

(vi) The Bank of Greece has also handled ordinary commercial banking transactions (like direct lending to private enterprises etc.). However, these activities have greatly diminished with the elapse of time.

Until recently, the role of the central bank in Greece was mainly to carry out the financial policy which was conducted by the Currency Committee. The latter was a collective body established in 1946 and constituted of six government ministers and the governor of the Bank of Greece. It was responsible for the formation and implementation of the monetary and credit policies as well as for the control of the operation of the banking system. Nevertheless, since June 1982 (law: 1266/82) the Currency Committee has been abolished and its functions have been distributed between the government and the Bank of Greece. The latter has been alloted the Currency Committee's functions of implementation of monetary, credit and exchange policies. Thus, the central bank has acquired the power to administer interest rates, change the reserve requirements, apply credit ceilings, impose penalties etc. In general, more power has been given to the bank than previously.

Table I.1 reveals, through selective balance sheet items, the main activities of the Bank of Greece during the last years.

I.III The Markets[2]

A. The Money Market

There is no well developed market for short-term loans in Greece, apart from the banking system. The first step towards creating a such market took place at the beginning of the 1980s when an interbank market has started operating with interest rates freely fluctuating according to supply and demand[3]. In this market optional treasury bills and certificates of deposits (CDs) were

TABLE I.1

Main Balance Sheet Items of the Bank of Greece in million DR.

	1979	%	1982	%	1985	%	1988	%
ASSETS								
Gold and foreign exchange	50973	10.9	71357	5.0	256230	8.3	695911	15.5
Deposits with banks (CC dec.)	—	—	74214	5.2	254206	8.2	324013	7.2
Loans and advances to the government	155213	33.2	818584	57.6	1652265	53.7	2320244	51.8
Loans and advances to banks and individuals	188075	40.2	313448	22.1	294686	9.6	213584	4.8
Other assets	73602	15.7	142948	10.1	620606	20.2	927846	20.7
TOTAL	467863	100.0	1420551	100.0	3077993	100.0	4481598	100.0
LIABILITIES								
Share capital	1070	0.2	3877	0.3	3877	0.1	11124	0.2
Reserves	3583	0.8	5181	0.4	7572	0.2	7615	0.2
Banknotes in circulation	189135	40.4	314832	22.2	534435	17.4	791514	17.7
Government current accounts	1012	0.2	109085	7.7	2199	0.1	120491	2.7
Bank's deposits	31905	6.8	219883	15.5	288092	9.4	363754	8.1
International institutions and foreign banks' deposits	14510	3.1	20503	1.4	46772	1.5	66166	1.5
Public entities' deposits	96388	20.6	156609	11.0	198696	6.5	269931	6.0
Other deposits	2855	0.6	2637	0.2	3574	0.1	24832	0.5
Long-term loans in foreign exchange on behalf of the Greek State	—	—	192570	13.5	859168	27.9	1145387	25.6
Redeposits in foreign exchange by commercial banks	—	—	300801	21.2	887427	28.8	1382269	30.8
Other liabilities	127405	27.3	94573	6.6	246181	8.0	298515	6.7
TOTAL	467863	100.0	1420551	100.0	3077993	100.0	4481598	100.0

Source:
The Statement of the Governor of the Bank of Greece for the years 1979, 1982, 1985, and 1988.

also allowed to be traded; the former since April 1986 and the latter since June 1986 when the CDs were introduced. The majority of the funds in the interbank market are lent overnight and weekly and only a small fraction monthly and quarterly. The interest rates of this market fluctuate remarkably[4]. This great variation might be attributed to the following reasons. First, it might be due to the relative small number of participants as well as to the usually low volume of transactions carried out daily. The market is very active only during the days that the exact compulsory reserve requirements are calculated as well as the new issues of treasury bills for the public are offered. Second, it might be due to the inaccurate forecasting by the banks of their compulsory reserve requirements[5].

The main holders of treasury bills are the commercial banks which are required by law to keep a specified proportion of their assets in government securities. However, since July 1985 the State has offered three-month, six-month and nine-month treasury bills usually renewable on maturity to the public, initially with poor results. It was only after attractive yields were established at the end of June 1987 that the popularity of treasury bills increased considerably. Nevertheless, the rate of interest at issue is fixed and it is not influenced by the rediscount rate. The latter affects only the cost of borrowing by the banks from the Bank of Greece.

From the foregoing it follows that the money market in Greece is still in its infancy. The public is not allowed to trade treasury bills or CDs with themselves but only with the banks. In consequence, neither the seller nor the buyer knows the volume of the market and be able to determine his position. Needless to say, there are no commercial bills, bankers' acceptances or any other debt instrument that are trading in the developed money markets.

B. The Capital Market

B1. The Primary Market

The Greek primary capital market on which new issues of securities are floated is not well developed. However, for analytical purposes we can make a distinction between the bond market and the share market.

(α) The bond market. The bond market is limited to certain bond issues of the State and of some public entities like the Public Power Corporation. However, there were no new government bond issues between 1973-1986 and no public entities bond issues between 1978-1987[6]. At the end of 1986 (i.e. 24.11.86), the State has started issuing a Greek State bond loan having an ECU clause for both interest and capital and being of three years duration. However, these bond loans initially have not been extremely popular among the public, as the demand has not met the supply. Nevertheless, the reluctance of the State to raise funds through the capital market from 1973 to 1986 was mainly due to the much cheaper borrowing from the banking system.

Investment and mortgage banks have been granted the right to issue short-term bank bonds (of annual duration), usually renewable on maturity, offered to the public at attractive terms. These bonds have been used as a source of funds by the aforementioned banks. However, these attractive terms that the bank bonds have been issued at, might have been one of the main reasons for the absence of new corporate bond issues on the market recently. This could be the case, as long as the private non-financial enterprises might not be able to withstand the competition from investment and mortgage banks, as far as the interest paid is concerned. As a result, the high yields on bank bonds might have discouraged the bond issues by large corporations which have felt unable to compete.

Needless to say, by far the greater part of the aggregate market value and of the total number of bonds is accounted for by bank bonds.

(b) The share market. Table I.2 indicates that the issuing of corporate shares in Greek capital market is particularly poor[7]. The reasons for the inadequate supply of new shares could be attributed as follows:[8]

(i) The Greek companies are mostly small in size, "family-owned" companies and therefore the owners are unwilling to relax their control by public share issues.

(ii) An easy access to bank credit, often under preferential conditions has been offered to Greek companies, especially the relatively larger ones by the banking system. Thus, there has been no need for the private non-financial enterprises to acquire funds by issuing new securities.

Moreover, the general public is hesitant to invest in shares. This inadequate demand of new shares is mainly due to the following reasons:

(i) Most of the "family-owned" companies present insufficient security for the rights and the interests of the minority of the shareholders.

(ii) Most of the companies do not provide accurate and

TABLE I.2

Security Issues (in million DR.)

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
I. SHARES											
Total gross	1324	2827	4490	7146	1199	11130	1664	2595	2267	5789	11342
-Private non-financial enterprises	520	400	197	130	1034	11130	1488	2595	2267	2686	4100
-Financial Institutions	804	2427	4293	7016	165	—	176	—	—	3103	7242
II. BONDS											
(a) Total gross	..	..	..	..	..	..	..	..	..	..	..
Public issues:Gross	6808	3987	6007	13892	17440	30420	57907	101068	151244	218030	222434
-Central Government	—	—	—	—	—	—	—	—	—	—	104868
-State and Local Government	—	—	—	—	—	—	—	—	—	—	..
-Public non-financial enterprises	3000	—	—	—	—	—	—	—	—	—	4600
-Private non-financial enterprises	—	—	—	—	—	—	—	—	—	—	..
-Financial Institutions	3808	3987	6007	13892	17440	30420	57907	101068	151244	218030	112966
-Rest of the world (traditional issues)	—	—	—	—	—	—	—	—	—	—	—
Private placings: Gross	..	..	..	..	..	..	..	..	..	..	..
(b) Total net	..	..	..	..	..	..	..	..	..	..	..
Public issues: Net	4447	312	982	5834	9355	14085	26443	45985	53286	..	110439
-Central Government	-774	-591	-904	173	-851	-689	-275	-475	867	..	103748
-State and Local Government	—	—	—	—	—	—	—	—	—	..	—
-Public non-financial enterprises	2443	-662	-446	-888	-723	-860	-851	-912	-885	..	—
-Private non-financial enterprises	-108	-54	-119	-100	-99	-87	-89	-83	—	..	—
-Financial Institutions	2886	1619	1930	6649	11028	15721	27658	47455	53304	74465	7520
-Rest of the world (traditional issues)	—	—	—	—	—	—	—	—	—	—	—
Private placings: Net	..	..	..	..	..	..	..	..	..	..	..
III. DEBT CERTIFICATES	—	—	—	—	—	—	—	—	—	—	—
Memorandum Items:											
Gross traditional issues abroad by residents											
-bonds	—	—	—	—	—	—	3672	6267	13963	11665	—
Gross international issues abroad by residents											
-bonds	—	—	—	—	1789	3590	—	15358	84307	9838	—

Note:
.. not available; — nil or no transaction over the period.
Source:
OECD Monthly Financial Statistics, (various issues).

contemporary information on their financial situation (often in order to facilitate tax evasion).

It is worth noting that investment bank activities like underwritting facilites for the issuing of new securities or other functions like investigation (in order to determine the price and the yield of the new issue), wholesale distribution or retail distribution of a new issue have not been very active. Furthermore, "private placings" are thought to include sizeable amounts of new corporate issues, which are not issued publicly.

B2. The Secondary Market

There is only one organized market in Greece, the Athens Stock Exchange (ASE). The ASE is a semi-public agency which was founded in 1876. Although over a hundred years have passed since then, this stock exchange has not produced the anticipated results. The number of securities transacted in it is limited and investment in securities with satisfactory efficiency, insurance and sufficient marketability is quite difficult. Moreover, the aggregate market value of transactions, as well as the volume of them is very low.

The Greek companies systematicaly avoid using the ASE as an external source of finance (see table I.3). Only one hundred-nineteen (119) companies were listed and not more than thirty (30) out of the one-hundred (100) largest industrial companies were quoted on the stock exchange in 1988. The reasons should be sought mainly in the short supply of attractive securities as well as in the short demand of the existing securities[9]. This remarkable abstention of the Greek companies from the ASE coupled

TABLE I.3

Sources of Finance

Years	Capital raised through the ASE by industrial and commercial companies			Total bank credit		
	Increases of share capital	New listings (capital raised from the public)	Total raised capital	Manufacturing	Trade	Total
1977	644	32	676	214148	55057	269205
1978	293	41	334	269276	66093	335369
1979	73	-	73	325912	72484	398396
1980	189	-	189	410260	78973	489233
1981	800	-	800	541391	95426	636817
1982	171	-	171	667937	114952	782889
1983	601	-	601	774667	122215	896882
1984	2632	-	2632	927030	143944	1070974
1985	16	-	16	1108545	170080	1278625
1986	115	-	115	1227447	192263	1419710
1987	3489	1030	4519	1232535	194973	1427508
1988	652	3442	4094	1378761[1]	232490[1]	1611251[1]

Note:
1. Provisional data.
Sourses:
The Athens Stock Exchange, 1988 Annual Bulletin; and the Monthly Statistical Bulletin of the Bank of Greece.

with the absence of regular bond issues of government and of public entities seems to be the cause of the inadequate performance of the stock exchange.

As a result of the insufficient demand and supply of securities, a dramatic fall in share and bond prices from the end of 1970s to the middle of 1980s took place. The general index of share prices fell in nominal terms by about 55.0 per cent between 1978 and the end of 1984 (by 48.2 per cent for banks and insurance companies and by 61.8 per cent for industrial companies)[10]. It is worth noting however, that in the following years the above course of the general index of share prices has been inverted considerably (see table I.4). Some of the reasons that this development has been attributed to are: (a) The improvement that the stabilization policy (1985-1987) brought upon the main indicators of most of the companies listed in the ASE. (b) The entrance of foreign investors in the ASE, who have been almost non-existent until recently. Moreover, in September 1988 a new law has been introduced (Law 1806/88) to reform and modernize the function of the ASE. Nevertheless and irrespective of the above changes in recent years, the preceding shortcomings of the secondary market in Greece still remains. Table I.5 reveals the aforementioned poor volume of activity in the stock market in 1988.

I.IV Special Credit Institutions (SCIs)[11]

There are eight SCIs in Greece which are mainly State-owned and have constituted a source of credit to the public sector. A high proportion of their funds has been financed by the Bank of Greece (until 1st of Juanuary 1988), which has also imposed credit ceilings on them. Moreover, there have been no ratio constraints (or reserve/rebate ratios) on their liabilities and assets during the period studied, but the range of their business and the terms on their assets and liabities have been prescribed by the authorities[12].

The eight SCIs and their main activities are the following: (α) The Agricultural Bank of Greece, which is controlled by the State, provides all forms of agricultural credit, supports farmers' cooperatives and endeavours to improve agriculture

TABLE I.4

Share Price Index on the Athens Stock Exchange

Years	General	Banks & Insurance Co.	Industrial Co.
1978	100.0	100.0	100.0
1979	89.9	99.4	80.6
1980	75.1	80.8	69.5
1981	65.5	67.9	63.1
1982	63.7	69.8	57.8
1983	54.5	59.1	50.0
1984	45.0	51.8	38.2
1985	50.4	59.1	41.6
1986	66.8	83.4	50.3
1987	196.0	218.5	173.7
1988	238.8	243.6	234.1

Source:
Monthly Statistical Bulletin of the Bank of Greece, (various issues).

TABLE I.5

Volume of Bonds and Shares Traded in the ASE in 1988

	Amount of Bonds & Shares	Value in million DR[1]	Percentage Ratio[1]
I. BONDS			
Total of Bonds	979893	4757791	9.680
(a) Pre-War II Loans	79123	374011	0.760
(b) Post-War II Loans	900770	4383780	8.920
-Government bonds	638549	292116	0.590
-Public Power Corporation bonds	247089	1517042	3.090
-Corporation bonds	—	—	—
-Short-term bank bonds	200	1331	0.001
-State bonds in ECU	14922	2568563	5.230
-Treasury bills	10	4728	0.010
II. SHARES			
Total of Shares	15812908	44380045	90.320
(a) Banks and Insurances	5295141	24197307	49.250
(b) Industials	10517767	20182738	41.070
III. GRAND TOTAL	16792801	49137836	100.000

Note:
1. Discrepancies in total are due to rounding.
Source:
The Athens Stock Exchange, 1988 Annual Bulletin.

occupation in Greece.

(β) The Postal Savings Bank, which is an autonomous government service, supplies credit either to public corporations through direct lending or to the government through purchases of treasury bills.

(γ) **The Deposits and Loans Fund**, which is a public entity, grants loans to public entities including local authorities, provides housing loans to civil servants and deposits part of its funds with the Bank of Greece.

(δ) The Hellenic Industrial Development Bank (HIDB), which is controlled by the State, extends medium and long-term credit to industry, tourism, shipping, mining and to a lesser extent participates in the share capital of private enterprises.

(ε) The National Investment Bank for Industrial Development (NIBID), whose main shareholder is the National Bank of Greece, performs the same functions with the HIDB.

(στ) The Investment Bank, whose main shareholders are the Commercial Bank of Greece and the Ionian Bank of Greece, employs the same activities with the aforementioned investment-industrial banks (i.e. the HIDB and the NIBID).

(ζ) The National Mortgage Bank of Greece, whose main shareholder is the National Bank of Greece, furnishes loans to the public for house and hotel construction as well as to public corporations and non-profit making organizations.

(η) The National Housing Bank, which is a subsidiary of the National Bank of Greece, is engaged with housing loans. However, its activities are quite limited.

Table I.6 reveals the branches and the employees that the SCIs had in 1988.

TABLE I.6

Number of Branches and Employees of the SCIs in 1988

SCIs	Branches	Employees
1.Agricultural Bank of Greece SA.	420	6982
2.National Mortgage Bank of Greece.	47	1061
3.Hellenic Industrial Development Bank.	9	812
4.National Investment Bank for Industrial Development SA.	1	169
5.Investment Bank SA.	1	127
6.National Housing Bank SA.	1	75
7.Deposits and Loans Fund.	4	—[2]
8.Postal Savings Bank.	906[1]	—[2]
TOTAL	1389	9226

Notes:
1. Including 795 post offices.
2. Not reported.
Source:
The Greek Banking System Today, (1989), Hellenic Banks' Association, p.24.

The aforementioned SCIs have been established to provide medium and long-term credit at favourable terms to agriculture and housing, industry, tourism and shipping as well as to support the creation of new enterprises. In general their role has been to extend to sectors where it was thought there was lack of interest by the commercial banks. Nevertheless, these institutions have not fulfilled their role with complete success. All of them, except the Postal Savings Bank and the Deposits and Loans Fund, have acquired only a small fraction of the aggregate resources of the monetary system. Thus, their sources of funds are quite limited[13]. Except for the Postal Savings Bank and the Deposits and Loans Fund which are mainly financed by private deposits, the rest until recently depended heavily for funds either on the Bank of Greece or on their own capital. Consequently, the form of their financing had considerable limitations that kept their credit to low levels.

The main reasons for the significant delay in their development should be attributed as follows:

(i) There is a lack of independence in SCIs' boards of directors to conduct freely their own policy. The decisions of their directors are influenced by the interest of shareholders, which in many cases are commercial banks that are competing with the SCIs for the same clientele. As far as the non-banking owned SCIs are concerned, their directors were influenced by the Bank of Greece which has been their main source of finance until recently. Moreover, there is no management independence as long as most of them are supervised by corresponding ministries. Thus, their directors might not be able to employ the best policy in accordance with their firms' interests.

(ii) The determination of ceilings on interest rates by the authorities which has been operational until recently as a means of influencing the allocation of funds to the various sectors of the economy may affected the SCIs unfavourably. The long-term interest rates have been set lower than the short-term interest rates in order to foster the development of the capital market in Greece. However, this policy shrank the interest margin (spread) of those institutions which dealt with long-term finance, as long as their cost of money (interest paid) was not much different from their competitors. Thus, the SCIs might have been less profitable than the commercial banks and also might have had a disadvantage to them, in attracting new funds by paying the current price (i.e.

interest rate)[14].

(iii) The increasing cost of their funds. The last years the State have started financing progressively a larger part of the considerable PSBR through sales of treasury bills directly to the public by establishing high yields. Consequently, the bank bonds - which is currently the main channel for acquiring funds by most of the SCIs - have also had to be offered with competitive interest rates. From the foregoing it follows that the cost of money for some of these financial institutions has risen to quite high levels and possibly higher than their competitors.

(iv) Most of the SCIs have only a few branches all over the country and therefore are in a disadvantage to their competitors in attracting private deposits.

(v) There is a shortage of new customers with sufficient collateral securities because many assets suitable as collaterals have already been mortgaged by commercial banks for previous loans[15].

(vi) The inability of SCIs to provide short-term loans to enterprises (e.g. to overcome liquidity problems) keeps away many potential customers.

(vii) Some of the SCIs are quite new in comparison with their competitors, especially with the two large banks (the National Bank of Greece and the Commercial Bank of Greece) which had early-entry in the banking system.

(viii) Last drawback but not least, is the oligopolistic structure of the Greek banking system and its relationship with the large non-financial enterprises. However, we shall look at them in a succeeding section.

I.V The Structure of Commercial Banking Controls

The main targets that remained virtually unchanged until the early 1980s and which the Greek authorities pursued in order to promote the economic development of the country, under conditions of monetary equilibrium, could be summarized under the following headings.

"First. Regulation of the liquidity of the economy in order that at each time the appropriate degree of expansionary impulses can be exerted, without jeopardizing internal and external monetary equilibrium.

Second. Maximization of private savings directed into "controlled channels" such as the banks and the capital market...

Third. Optimum allocation of savings, so as to provide amply for the credit needs of development-promoting sectors and to contain the excessive expansion of activities making a small or negative contribution to economic development...

Fourth. Formulation and implementation of fiscal policy in a way securing the sound financing and the optimal role of the public sector in the over-all development process..."[16]

In order to achieve the aforementioned goals, the monetary authorities could not rely on "orthodox" instruments of monetary policy like the discount rate or the open market operations. This was due to the high liquidity of the banking system and to the absence of an efficient money and capital market. Therefore, they have mainly relied on credit policy. The basic characteristics of this policy were:

(i) The maintenance of interest rates at low levels (sometimes at well below the rate of inflation) and the differentiation of various types of bank lending[17]. The authorities have attained this goal by imposing ceilings on almost all rates on deposits and credits, which have been revised periodically[18]. As far as credit is concerned, these ceilings "favoured" some activities like exports and long-term capital investment and "disfavoured" some others like trade and consumer credit. As regards deposits, these ceilings varied according to the length of notice required for withdrawal. In consequence, there has been "a large number of interest rates applied to different varieties of borrowers, which cannot always be justified by risk and maturity considerations. Spreads between deposits and lending rates and between different lending rates are ... wide and at times arbitrary. In general terms, they result in a transfer of real resources from small deposits and borrowers not receiving subsidised rates on the one hand, to the government and the "priority sectors" on the other...."[19]

Table I.7 indicates selected nominal and real interest rates during the last years. However, interest on bank deposits is tax free in Greece. Consequently, the difference in the after tax real interest rates between Greece and other countries is significantly smaller than before taxes.

(ii) The credit regulation system which accompanied the interest rate policy[20]. This system contained complex and detailed regulations referring to the conditions and terms under which each type of bank lending may be granted. Moreover, it embodied quantitative as well as qualitative controls having the aim to influence the commercial banks' portfolio and asset structure in a way that will be conducive to economic growth. For analytical purposes one[21] may classify these instruments into three

Selected Nominal and Real Interest Rates[1] in percentages

		1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Deposit Rates													
Savings[2]	Nominal	7.0	8.5	10.9	13.5	13.5	13.5	13.5	14.9	15.0	15.0	15.0	14.8
	Real	-4.5	-3.6	-6.8	-9.0	-8.8	-6.1	-5.6	-3.0	-3.6	-6.5	-1.2	1.1
Times[3]	Nominal	9.0	10.5	12.9	15.5	15.5	15.5	15.5	16.0	16.0	16.0	16.0	—[4]
	Real	-2.8	-1.9	-5.1	-7.4	-7.2	-4.5	-3.9	-2.1	-2.8	-5.7	-0.3	—[4]
Lending Rates													
Rediscount rate	Nominal	11.0	12.7	15.9	19.8	20.5	20.5	20.5	20.5	20.5	20.5	20.5	19.0
	Real	-1.0	0.1	-2.6	-4.0	-3.2	-0.3	0.2	1.7	1.0	-2.0	3.5	4.8
Industry:long-term	Nominal	10.5	11.0	13.1	16.8	18.0	16.0	18.0	18.0	18.0	18.0	18.1	18.5
	Real	-1.4	-1.4	-5.0	-6.4	-5.2	-4.0	-1.8	-0.4	-1.1	-4.1	1.5	4.4
short-term	Nominal	12.0	13.2	16.7	21.3	21.3	20.5	20.5	20.5	20.5	20.5	20.8	21.9
	Real	-0.1	0.5	-1.9	-2.8	-2.6	-0.3	0.2	1.7	1.0	-2.0	3.8	7.4
Small scale industry	Nominal	9.0	9.0	10.2	12.8	13.5	13.5	13.5	13.5	13.5	14.3	15.5	16.0
and handicraft[5]	Real	-2.8	-3.2	-7.4	-9.6	-8.8	-6.1	-5.6	-4.2	-4.9	-7.1	-0.8	2.2
Domestic trade and	Nominal	14.0	15.5	18.9	22.3	20.5	20.5	20.5	20.5	20.5	20.5	20.8	21.9
imports	Real	1.7	2.6	-0.1	-2.0	-3.2	-0.3	0.2	1.7	1.0	-2.0	3.8	7.4
Farmers, cultivation	Nominal	7.5	8.5	11.1	11.8	13.0	13.0	13.0	13.0	(12.6)-(14.6)	(16.0)-(18.0)	(16.5)-(18.5)	(17.0)-(19.0)
loans	Real	-4.1	-3.6	-6.6	-10.4	-9.2	-6.5	-6.0	-4.6	(-5.6)-(-3.9)	(-5.7)-(-4.1)	(0.1)-(1.8)	(3.1)-(4.8)
Consumer Price Index[6]		12.1	12.6	19.0	24.8	24.5	20.9	20.2	18.5	19.3	23.0	16.4	13.5

Notes:
1. Real interest rates have been obtained by using the form (1+r)=(1+R)/(1+P) where r the real interest rate, R the nominal interest rate and P the rate of inflation.
2. Rates on savings deposits with commercial banks.
3. Time deposits for six months to one year maturity.
4. Since 23.11.1987 this interest rate is freely determined by financial institutions.
5. Small scale industry for C.C./1421 Funds.
6. This is the general consumer price index calculated by the National Statistical Service of Greece.

Source:
Monthly Statistical Bulletin of the Bank of Greece, (various issues); and calculations by the author.

categories[22]:

(α) Compulsory reserve/rebate requirments on bank credits[23].

As has already been pointed out interest rates on lending to "privileged" sectors were lower than those to "non-privileged" sectors. This was a result of the authorities' desire to encourage the finance of some activities and to discourage the finance of others. On the other hand, commercial banks made more profits by lending to the other way round. Thus, there was a conflict of interests between monetary authorities and commercial banks. In order to offset this contradiction, the authorities have introduced a system of reserves and rebates that nearly equalized the net receipts of the commercial banks. According to this method, when commercial banks extented credit at high interest rates, they were obliged to deposit a specified percentage of their outstanding loans to these non-privileged borrowers on a non-interest-bearing account with the Bank of Greece. On the contrary, when they extented credit at low interest rates, they were allowed to withdraw a specified percentage of their outstanding loans to these privileged borrowers from their compulsory reserves (with no cost to the banks) with the Bank of Greece. Nevertheless, these percentages varied considerably according to the categories of nominal interest rates. Table I.8 column (c) indicates the reserve/rebate requirements for the basic categories of interest rates operational at the end of June 1986. In addition, column (d) reveals that the effective interest rates that banks enjoyed fluctuated between 15.62 per cent and 17.31 per cent according to the type of loans.

(β) Compulsory reserve requirements on bank deposits[24].

TABLE I.8

Selected Nominal and Effective Interest Rates which Were in Force in 30.6.1986

CREDIT	(a) Nominal rates %	(b) Contribution for third parties %[1]	(c) Reserve (-)/ Rebate (+) %	(d) Effective rates %
1. Export loans	10.5	1.5	+48.00	17.31
2. Long-term loans to handicrafts	15.0	1.5	+13.00	15.62
3. Minimum for working capital	16.0	1.5	+13.00	16.67
4. Special loans to handicrafts for working capital	17.5	1.5	+4.00	16.67
5. Long-term loans to industry	18.5	1.5	—	17.00
6. General	21.5	1.5	-20.00	16.67
7. Import, Domestic trade	21.5	2.5	-20.00	15.83
8. Housing loans	22.0	1.5	-20.00	17.08

Note:
1. It is a contribution to a common account with the Bank of Greece according to the law:128/1975.

Provisions for legally required reserves first appeared in Greece in 1931, with the passage of the law 5076/31. This law required the maintenance of 7 per cent of the drachma sight and savings bank depodits with the Bank of Greece. Although the above reserves were initially envisioned as a safeguard of bank liquidity, their original character has changed with the elapse of time and currently are mainly used to finance a large part of the PSBR.

At present commercial banks have to deposit 8 per cent of their total private deposits[25] in an interest-bearing account (currently awarding 12.5 per cent) with the Bank of Greece[26].

In addition commercial banks are required to invest a percentage (at present 38 per cent) of their total private deposits in treasury bills[27].

Table I.9 shows how the aforementioned percentages have changed with the elapse of time.

(γ) Compulsory credit requirements against bank deposits.

Until September 1987 banks were obliged to invest a percentage (standing at 17 per cent) of their total drachma deposits in medium and long-term "productive" investment. Any part of the aforementioned funds that were not invested in these privileged categories had to be deposited in an interest-bearing account (granting 12.5 per cent interest rate) with the Bank of Greece.

Moreover, a percentage (presently standing at 10 per cent) of the increase in banks' total drachma deposits relative to 1.1.1966 has to be invested in handicrafts. Any part of these funds that are not invested in handicrafts are required to be deposited (currently awarding an interest rate of 10 per cent) with the Bank of Greece.

Furthermore, commercial banks have to extent a percentage (currently standing at 10.5 per cent) of their total private deposits for financing public enterprises and public entities. If they fail to meet the above requirements, commercial banks must place a sum equal to the difference in an interest-bearing account (at present granting a 10 per cent interest rate) with the Bank of Greece.

As has already been mentioned, table I.9 indicates the variations of the aforementioned percentages with the elapse of time. It also reveals that two thirds of the funds deposited with commercial banks are earmarked for financing certain activities; of which 56.5 per cent of these funds are allocated to the public sector and the rest, 10 per cent, to "priority" activities.

TABLE I.9

Compulsory Reserve and Credit Requirements Effective at the End of Each-Year

Required Categories	1980 %	1981 %	1982 %	1983 %	1984 %	1985 %	1986 %	1987 %	1988 %
1.Reserves with the Bank of Greece[1]	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	8.00
2.Investment in treasury bills	36.00	37.00	37.00	37.00	38.00	38.00	38.00	38.00	38.00
3.Long-term "productive" loans	15.00	15.00	15.00	15.00	15.00	15.00	17.00	—	—
4.Loans to handicrafts	7.00	7.00	8.00	9.00	10.00	10.00	10.00	10.00	10.00
5.Loans to public corporations	—	2.50	2.50	2.50	3.50	3.50	3.50	10.50	10.50
6.Loans to "problematic"enterprises	—	—	1.00	1.00	1.00	—	—	—	—
7.Loans for fruit and vegetable production	—	—	—	0.75	0.50	—	—	—	—
TOTAL	64.50	68.00	70.00	71.75	74.50	73.00	75.00	65.00	66.50

Note:
1. The percentage of 6.50 per cent could be taken as an average rate of 5.00 per cent and 7.00 per cent which were the reserve requirements for special time deposits and for all the other private deposits respectively.

Apart from the aforementioned controls, lending to the same natural or legal person should not exceed one-fifth of the bank's share capital and legal reserves, unless special permission is granted by the Bank of Greece. In addition, there have been other credit regulations supplementing the controls and regarding the status of the depositors, the minimum ammount for certain deposit categories, the terms of loan repayment and so on. In the early 1980s, the Bank of Greece took gradual and systematic, but rather slow, steps towards abolishing, simplifying and rationalising these credit restrictions and controls. Nevertheless, this process of financial reform has been accelerated since the beginning of 1987.

I.VI Penalty Rates for the Banks' Debit Balances with the Bank of Greece

Greek banks maintain an obligatory current account deposits with the Bank of Greece, from where they can draw funds for short period to meet liquidity difficulties (C.C. 978/6/30.7.56). The overdrafts that banks can draw from this kind of account do not exceed (usually) the 25 per cent of their own capital[28]. Whenever the aforementioned current account of a bank reflects a debit, this financial institution is subject to a "penalty" interest rate which is far higher than the rediscount rate and varies according to the drawn funds.

Since 1.1.1986 (P.D. 709/6.3.86) there have been two ways[29] of calculating the penalty interest rates that have charged on the debit balances of the banks' obligatory current account deposits with the Bank of Greece. However, the selection of the way depends on the banks' preference.

First way[30]:

(i) For funds up to 15 per cent of a bank's equity capital, the penalty interest rate that is charged is 21.5 per cent.

(ii) For funds fluctuating between 15 and 30 per cent of a bank's equity capital, the penalty rate is 24.0 per cent.

(iii) For funds exceeding 30 per cent of a bank's equity capital, the penalty rate stands for 27 per cent.

The aforementioned equity capital is derived from the bank's annual balance sheet of the previous year.

Second way:

(i) For funds up to 0.25 per cent of a bank's total deposits, the penalty interest rate that is charged is 21.5 per cent.

(ii) For funds fluctuating between 0.25 and 0.50 per cent of a bank's total deposits, the penalty rate stands for 24.0 per cent.
(iii) For funds exceeding 0.50 per cent of a bank's total deposits, the penalty rate is 27 per cent.
The aforementioned bank's total deposits is derived from the aggregate deposits in drachmas and foreign exchange which were subsisted in the bank at 31st of December of the previous year.

I.VI Commercial Banking Institutions

A. The Characteristics of the System

There are some other features of the Greek banking system apart from those that have already been mentioned[31]. These main characteristics could be classified into seven categories.

1. High degree of liquidity.

Investment opportunities in Greece are very limited especially as far as small savers are concerned, owing to the absence of a broad and efficient capital market. Therefore, the major share of private savings are channelled to commercial banks' deposits[32]. Consequently, the liquidity of the Greek commercial banking system is remarkably high. Accordingly, commercial banks do not depend upon the Bank of Greece for funds and the discount rate is not used as a monetary policy instrument.

2. High degree of concentration.

The whole banking system is dominated by two major banks, namely the National Bank of Greece and the Commercial Bank of Greece. At the end of 1985 the National Bank of Greece provided 58.8 per cent of total commercial bank credit and accepted 62.3 per cent of the total commercial bank deposits. The equivalent ratios for the Commercial Bank of Greece were 16.2 per cent and 17.5 per cent respectively. Moreover, these two major banks also have controlling interests in other banks and financial institutions[33]. Nevertheless, this high degree of concentration discloses the oligopolistic structure, as it has been called, of the Greek commercial banking system[34], and leads one to suspect the third characteristic.

3. Lack of price competition.

As has already been pointed out credit and debit interest rates as well as the conditions and the terms under which bank credit has taken place, were determined by the authorities during the period studied. Thus, "Greek banks have no possibility of competing among themselves, as far as interest rates and credit are concerned, although of course, they have a limited degree of freedom in arranging the terms of comissions charged to customers"[35]. However, they did compete among themselves. Initially, by trying to offer better and faster services. And it was this function that the small private banks have exploited to some extent in order to perform better and attract more customers than their rivals. Secondly, by trying to enlarge their branch network. This second kind of competion is taking place mainly among the bigger banks and has the drawback of increasing their cost. Table I.13 reveals that the two major banks dispose 65.6 per cent of the total commercial banks' branch network at the end of 1988. Furthermore, table I.10 highlights the profile of the banking industry in Greece as far as branches, deposits and credit are concerned.

Needless to say, the aforementioned lack of price competition might allow commercial banks to overprice the cost of their services. In consequence, this policy might affect the prices of the goods of the financed enterprises and eventually jeopardise the competitiveness of the whole economy.

4. The close relation between commercial banks and large industrial enterprises.

Commercial banks in Greece undertake business which comes within the scope of "Banque d' Affaires"[36], granting short, medium and long-term credit to non-financial enterprises. The latter have depended traditionally on banks to raise funds due to the structure of the firms (mostly family-owned), and the absence of an efficient money and capital market. Thus, bank credit is the major external source of finance for the Greek manufacturing

TABLE I.10

Breakdown of Banks' Branches, Deposits and Credit in 1988

In Percentages

BANKS	Branches[1]	Deposits	Credit
Greek commercial banks	68.64	66.05	41.00
SCIs	28.84[2]	26.99	51.93
Foreign banks	2.51	6.96	7.07
TOTAL	100.00[3]	100.00	100.00

Notes:
1. The percentage ratios stated below are slighty different from those which will be derived from our tables, due to different sources. The figures that our tables provide for Greek commercial banks, SCIs and Foreign banks are 70.42, 26.80 and 2.77 respectively.
2. The Postal Savings Bank is not included.
3. The discrepancy in aggregate is owned to rounding.

Sources:
The Greek Banking System Today, Hellenic Banks' Association, (1989), p.27, Trapeziki, May-June 1989, and the Monthly Statistical Bulletin of the Bank of Greece, Table 8, Nov.1989.

enterprises (see table I.11 and I.12). Accordingly, the Greek financial system could be classified as a bank-based system[37]. In addition it is a common practice for industrial companies to borrow on a short-term[38] basis for financing long-term investment, relying for the maintenance of liquidity on the renewal of these loans.

Moreover, trading firms rely for financing mainly on commercial credits granted to them by their suppliers of manufactures at high interest rates. In consequence, the cost of financing has been increased, the indebtedness of the industry has been increased and the competitiveness of the whole economy has been reduced[39].

The structure of the Greek financial system, which might be characterized as a system workable only under "normal conditions"[40], has led to a substantial control of the large industrial firms by the commercial banks. The control has been mainly exercised through the financing (financial control) as well as the ownership (owner control) of the companies[41]. At this point it should be noted that commercial Greek banks are not only the principal suppliers of short and long-term credit to non-financial enterprises; they have also acquired substantial holdings (by coverting debt into equity) and in many cases have taken on completely the management of these enterprises. Thus, they also exercise management control. This was an inevitable result of continously financing many poorly performing enterprises by commercial banks, relying not so much on banking criteria but frequently on government directives and personal contacts. The aforementioned relations between industry and finance could also be found in other countries[42]. But the degree of closeness that

TABLE I.11

The Stucture of the Working Capital in the Greek Industry

In billion DR.

Year	Number of firms	Own Capital	Bank Credit		Non-Bank Credit		Total[1]		
			Short-term	Medium & Long-term	Short-term	Medium & Long-term	Short-term	Medium & Long-term	Grand Total
1977	2307	135	99	77	105	20	204	97	301
1978	2520	150	132	90	120	23	252	112	364
1979	2680	164	152	98	165	32	318	130	448
1980	2860	184	201	149	222	28	423	177	599
1981	3074	224	276	173	268	35	543	207	751
1982	3176	327	339	216	309	44	648	261	908
1983	3157	337	391	248	417	46	808	294	1102
1984	3113	284	525	262	677	69	1201	331	1533
1985	3166	264	670	338	748	67	1418	405	1824
1986	3263	358	706	318	932	113	1639	431	2070
1987	3337	662	650	351	1064	100	1714	451	2165

Note:
1. The discrepancies in aggregates owned to roundings.
Source:
The Greek Industry in 1985, [and in 1988], Federation of Greek Industries.

TABLE I.12

The Percentage Structure of the Working Capital in the Greek Industry

Year	Number of firms	Bank Credit		Non-Bank Credit		Total		
		Short-term	Medium & Long-term	Short-term	Medium & Long-term	Short-term	Medium & Long-term	Grand Total
1977	2307	33.0	25.6	34.8	6.6	67.9	32.1	100
1978	2520	36.3	24.6	32.9	6.2	69.1	30.9	100
1979	2680	34.1	21.8	36.9	7.2	70.9	29.1	100
1980	2860	33.6	24.8	37.0	4.6	70.5	29.5	100
1981	3074	36.7	23.0	35.7	4.6	72.4	27.6	100
1982	3176	37.3	23.8	34.0	4.9	71.3	28.7	100
1983	3157	35.5	22.5	37.8	4.2	73.3	26.7	100
1984	3113	34.3	17.1	44.1	4.5	78.4	21.6	100
1985	3166	36.7	18.5	41.1	3.7	77.8	22.2	100
1986	3263	34.1	15.3	45.1	5.5	79.2	20.8	100
1987	3337	30.0	16.2	49.2	4.6	79.2	20.8	100

Source:
The Greek Industry in 1988, Federation of Greek Industries.

has appeared in Greece must be a rather rare phenomenon.

Furthermore and in order to protect their business interests, commercial banks have often showed an unwillingness to finance the expansion of other enterprises (mainly small-to-medium size) that might compete with those to which the banks have lent large amounts of funds (mainly large size enterprises). Thus, it may be argued that banks' eclectic credit policy might discourage the development of competitive conditions in manufacturing industry by hindering either the entry of new enterprises or the expansion of others. In addition, this policy seems to operate as an obstacle that restrains the technological renovation of the Greek industry, as long as the large enterprises to which bank finance is more easily accessible, are less innovative than their medium-size rivals whose financial needs are not well accomodated.

5. The peculiar relation between commercial banks and the State, and the peculiar role of banks' employees[43].

Most commercial Greek banks are controlled by the State[44]. The latter appoints the chairmen of banks' boards and accordingly influences their credit policies. Therefore, there is an interdependence between the government and the banks' management which has unfolded even from the early years of the modern Greek State[45]. Needless to say, under these circumstances profitability and efficiency are not the only criteria that are employed by the government in order to evaluate the performance of banks' managers.

The peculiar relation between commercial banks and the State have affected banks' employees as well. Firstly, most of them have acquired the mentality of civil servants with the known consequences on their performance. Secondly, the salaries of banks' employees have been relatively high (at least during the period studied), owing to their increased bargaining power. And last but not least, banks' high-ranked personnel have established intimate relations with the upper economic class and have been placed fairly well in the social scale.

6. High degree of centralization.

The commercial banking system in Greece is quite centralized either in the sense of the banks' management structure or the geographical banks' distribution. High-ranked officials in Greek banks do not only make decisions on significant matters, but also tackle minor problems that could easily have been solved by much lower-ranked officials. In consequence, there is delay in making decisions and some times their quality might be questioned as long as the decision makers are very busy dealing with many various and complicated subjects.

There are no local banks, even though some financial institutions bear the names of various Greek regions. Most of the banks' head offices are based in Athens from where the banking policy is directed. Therefore, the branch managers do not enjoy much freedom in making decisions. However, this restriction is interlinked with the lack of specialized personnel, the absense of essential information (e.g. on clients' business, on studies of various sectors of economic activity etc.), as well as the lack of concrete incentives that the banks' branch managers also are faced with[46]. Needless to say, all the aforementioned problems degrade in a way, the banks' offering services.

7. Lack of specialization.

A number of authors[47] have claimed that there is lack of specialization in the Greek banking system. They argue that banks' financing to exports, handicrafts, tourism, shipping, commerce etc. could not be described as satisfactory. They also claim that this happens because commercial banks have neither the organizing structure nor the appropriate knowledge to acommodate the needs of these sectors of economic activity.

On the other hand some other specialists[48] have argued that there are enough specialized banks in the country and there is no need for more. Nevertheless, we might endorse the latter proposal, bearing in mind though that the question is not whether few or enough specialized institutions exist, but whether they function efficiently. And a positive answer to this question could hardly be justified by the evidence.

B. Greek Commercial Banks[49]

Commercial banks in Greece play a very crucial role in the country's economic life. They attract the lion's share of private savings and channel them into the various sectors of the economy.

The bulk of banks' private deposits are in the form of time and savings deposits. The sight deposits constitute only a small fraction of their total counterpart[50], owing to the limited use of cheques as a means of payment in the country. To the extent, therefore, that the concept of money is defined as M1 or narrow money, banks' ability to create money is not significant[51].

There are twelve Greek commercial banks in the country[52] (see table I.13) and all but two are controlled by the State[53]. However, all of them could be characterized as "Universal banks"[54] as they can supply a variety of services to their customers under one and the same roof. They also offer most of the

TABLE I.13

Selected Items of the Activities of the Greek Commercial Banks in 1988[1]

In billion DR.

COMMERCIAL BANKS[2]	Assets minus Depreciation	Credit	Deposits	Own Capital[3]	Total Branches[4]	Employees[5]
1. National Bank of Greece	3498.6	1013.9	3171.7	126.4	483	15963
2. Commercial Bank of Greece	922.2	353.9	798.5	45.2	288	7151
3. Ionian Bank	496.4	181.0	427.3	20.5	163	3307
4. Credit Bank	465.1	178.8	400.9	22.4	106	3127
5. Ergo Bank	174.3	64.9	147.5	7.5	48	1089
6. General Bank	163.0	66.6	127.7	6.3	79	1748
7. Macedonian-Thrace Bank	109.7	45.4	88.2	6.1	41	1153
8. Traders' Credit Bank	39.7	17.1	33.6	3.1	22	572
9. Bank of Central Greece	39.5	15.4	29.2	5.8	13	504
10.Bank of Attica	22.6	8.4	17.2	2.5	14	343
11.Bank of Piraeus	19.4	6.4	17.9	0.5	12	242
TOTAL	5950.5	1951.8	5259.7	246.3	1269	35199

Notes:
1. End of period balances.
2. The bank of Crete is excluded because the figures have not been published yet due to Koskotas' scandal. (However, it had 76 branches and 1276 employees in 1988.)
3. It includes share capital plus reserves plus provisions.
4. It also includes sub-brances (i.e. division of branches in separate locations).
5. These figures correspond to the end of July 1988.

Source:
All the data are taken from Trapeziki, May-June 1989, but the branch figures which are from the Bank of Greece (unpublished data) and the number of employees that are from The Greek Banking System Today, Hellenic Banks' Association, (1989), p.18.

internationally recognized banking services. The services that are provided by the Greek commercial banks are mainly the following:

(i) They accept all kinds of deposits through their extented branch network and they deal both in retail and wholesale banking.

(ii) They grant short, medium and long term credit to almost all the sectors of economic activity[55].

(iii) They handle a great number of activities in foreign currency (e.g. foreign exchange, settlements on the value of imported or exported goods etc.).

(iv) They also deal with various mediating and other banking activities (e.g. issue of credit letters, issue of cheques, safe-custody services etc.).

C. Foreign Commercial Banks

C1. The Incentives that have Attracted Foreign Banks into Settling in the Country

The establishment of foreign banks in Greece began as early as 1920[56], but most of them were set up after 1968. The attraction of foreign banks in Greece should be attributed mainly to the establishment of affiliates of multinational firms in the country as well as the increasing importance of Piraeus as a shipping centre[57]. In other words, they have followed their customers in Greece out of fear of losing not only the subsidiaries but also the parent companies as well. Thus, as soon as the Citibank set up a branch in Greece [in 1964], the Chase Manhattan Bank, the Bank of America and the Bank of Nova Scotia followed [in 1968]. None the less, there are some other factors that provided incentives to foreign banks to establish branches in Greece. One of those might be the accession of the country to the EEC and another that the country is relatively underbanked[58].

There were not only the foreign banks that were interested in coming to Greece. The Greek State was also in favour of their establishment, as it was anticipating some beneficial effects out of them. First, that they were going to modernize the banking system as well as fostering competition among banks. It was thought that the transformation of new management techniques by the foreign banks, would force the Greek counterparts to adapt these innovations as well as shaking them out of their lethargy. Second, that they were going to ease the accommodation of the current account deficit, as long as these banks were (and still are) the main creditors of the Greek State. And finally, that they were going to facilitate the inflow of foreign investment by improving the business climate as well as the outlook of the country.

Nevertheless, these objectives have not been accomplished to the expected extent. Although they injected some innovative spirit into the banking system, the competition has not been boosted enough, largely because foreign banks encroached on only a small fraction of the Greek banks' activities. Moreover, "the foreign commercial banks appear to be unwilling to try to attract business away from Greek commercial banks, perhaps because they fear that the monetary authorities, under the pressure of the Greek banks, might restrict their activities"[59]. Furthermore, the less than expected competition among Greek and foreign banks might also be attributed[60] first to the expansion of the banking activities that took place in the last decades (as a consequence of the rapid economic development of the country from 1960 to 1980) and second to their orientation in different sub-markets (multinational and marine customers for the foreign banks as opposied to traditional domestic customers for the Greek institutions). As far as the other anticipated objectives are concerned, although they might have been helped by the establishment of foreign banks in Greece, there are also many other factors that they were based upon.

C2. The Forms by which the Establishment has Taken Place

The foreign banks in Greece have been established under the following grounds:

(i) A branch office of the parent company. The permission to set up in the country as a branch office is granted to foreign financial firms by the Bank of Greece if they import at least Drs. 2 billion in foreign currency[61], which is also the minimum share capital that is required for the institution of a new Greek bank. Most of the foreign banks have chosen to operate under this legal form in order to deal with general banking activities. Therefore, they are exempt from the standard requirement to publish annual reports, balance sheets and income statements. Their only obligation is to publish a monthly summary statement (as also for the Greek banks) which though is not uncommonly brought out at irregular time periods. In any other aspect, foreign bank branches are being treated totaly like the Greek banks[62].

(ii) Participation in banks' share capital. Most of the foreign banks have chosen to establish joint-ventures with the Greek banks in order to deal mainly with special activities. The National Investment Bank for Industrial Development (NIBD), the Investment Bank and the Hellenic Investment Company are only a few among the results of Greek and foreign cooperation.

It is worth noting that the foreign banks have not penetrated into the Greek banking system via subsidiaries so far, because it was not allowed by law for the foreign interests to possess more than 40 per cent of a bank's share capital[63]. Nevertheless, this restriction has been abolished since 1986.

(iii) Banks' representative offices. These offices are not allowed to deal with banking activities but only to represent the interest of their parent bank in the country. At the end of 1987 there were twenty-one representative offices operating in Greece (see table I.14). Needless to say, there are no available data for the volume of their activities.

(iv) Off-shore offices (law 89/1967). There is a number of financial firms that have established off shore offices, dealing mainly with the markets of Middle-East. Indicatively, it is worth mentioning that there were seventeen such offices operating in Greece at the end of 1980[64]. None the less, the volume of their activities is unknown.

C3. The Foreign Banks' Policy and the Volume of their Activities

The banking policy that the foreign banks are employing in Greece has the following characteristics[65]:

(i) They concentrate on wholesale banking. The substantial part of their business is engaged with: (α) the Greek branches of multinational enterprises; (β) the Greek shipping firms; (γ) the large domestic enterprises; (δ) the public enterprises, the public entities and the public sector in general; (ε) mediating activities in foreign exchange; (στ) granting credit to large investment projects.

Moreover, with the objective of keeping their operating cost at low levels, the foreign banks' branch network is very limited and the bulk of their deposits should come from a relatively small number of customers. In addition, their ability to acquire large amounts of deposits could be fairly restricted.

The only foreign bank which is also interested in retail

TABLE I.14

Representing Offices of Foreign Banks in Greece at 31.12.1987

1. Banca Commerciale Italiana.
2. Banca Nationale del Lavoro.
3. Bankers Trust Company.
4. Bank of Cyprus.
5. Banque des Echances Internationaux.
6. Banque de la Mediterranee -France S.A..
7. Banque de l' Union Europeenne.
8. Bayerische Vereinsbank.
9. Credit Industriel et Commercial-Croupe.
10. Credit Lyonnais.
11. Dresner Bank.
12. Hambros Bank.
13. L' Europeenne de Banque.
14. Marine Midland Bank N.A.
15. Mellon International Finance Corporation.
16. Morgan Crenfell and Co. Ltd.
17. National Australia Bank.
18. Nederlandes Scheepshypotheek Bank NY.
19. Noiddentche Landesbank Luxemburg.
20. Skandinaviska Enskilda Banken.
21. Universal Bank SAL.

Source:
Trapeziki, Dec., 1988.

banking, up to a certain extent, is the Citibank which is the largest foreign bank in branches as well as in every other respect in Greece (see table I.15).

(ii) They employ selection of their clientele. By this policy, which has been mainly applied to their depositors, the foreign banks discourage the small savers or small companies from opening accounts with them. The reason of course is that the cost of servicing these customers is quite high and some times is greater than the actual payment that the banks receive out of them.

(iii) They apply price differentiation to the services they offer. On one hand thèy charge more than the Greek banks, for the

TABLE I.15

Selected Items of the Activities of Foreign Banks' Branches in 1988[1]

In billion DR.

FOREIGN BANKS	Assets minus Depreciation	Credit	Deposits	Total Branches[2]
1. Citibank NA	325.135	107.308	169.647	16
2. Algemene Bank Nederland NV	76.684	21.990	33.843	2
3. Societe Generale SA	76.159	17.749	28.040	1
4. Barclays Bank PLC	64.392	35.346	30.992	4
5. Credit Commercial de France SA	58.859	16.900	6.553	2
6. National Westminster Bank PLC	58.368	12.281	54.274	3
7. Midland Bank PLC	56.689	16.461	24.201	1
8. Banque Nationale de Paris (BNP)	55.575	11.954	29.520	1
9. American Express Bank Ltd	49.468	13.226	43.035	6
10.The Royal Bank of Scotland	46.450	18.787	25.186	1
11.Franco-Hellenic Bank	43.218	18.239	3.689	2
12.The Chase Manhattan Bank NA	41.372	4.547	29.403	1
13.Bank of America NT & SA	38.417	6.237	6.567	1
14.The Bank of Nova Scotia	36.759	6.445	22.385	3
15.Arab-Hellenic Bank	34.905	8.956	2.707	1
16.Grindlays Bank PLC	29.183	2.954	13.549	2
17.Banque Paribas	26.428	12.137	21.812	1
18.Arab Bank Ltd	14.042	3.091	8.726	1
19.Bank Saderat Iran	2.604	2.026	0.173	1
TOTAL	1134.707	336.634	554.302	50

Notes:
1. End of the year balanches.
2. It also includes sub-branches (e.g. divisions of branches in separate locations).
Source:
All the data are from Trapeziki, May-June 1989, but the branches that are unpublished data provided by the Bank of Greece.

unattractive banking services which do not yield satisfactory repayments, and on the other they charge less for the services that they wish to undertake or guide to other profitable activities. The aim of course of this policy is to minimize their operating cost.

As it might be expected from the preceding remarks, the foreign banks in Greece have gained an advantage over their Greek counterparts in attracting profitable business. This is due[66] first to the supply of services in a more efficient way as well as to the application of modern banking techniques. They are faster in reaching a decision on credit, they function more productively and their operating costs are lower than the Greek banks[67]. Second, it is due to their multinational character and their size. The foreign banks possess much and accurate information on various sectors and enterprises, they have close relations with multinational firms as well as the opportunity to exploit their international branch network by offering more and better services than the Greek banks. Finally, it is due to their aforementioned freedom in selecting clientele and offering services.

At present there are nineteen foreign banks in Greece having fifty branches (see table I.15). The available data are not accurate indications of the volume of their activities. Some of their business may not be real, appearing in their monthly statements only for accounting purposes, or may not be related to the Greek economy (they may have been transferred into these accounts only for tax purposes). On the other hand, banking business related to the Greek economy may have been tranferred into foreign branches' accounts, again for tax purposes. Consequently, we must be rather sceptical in drawing conclusions from published data about the foreign banks' volume of activities.

C4. The Effects of Foreign Banks' Establishment

The establishment of foreign banks in Greece has had some effects on Greek banking. First, the impact of their presence on the distribution of the banking market is quite considerable.

Although there are no data available, it is thought[68], that they have concentrated on the most profitable share of the market. Second, their establishment in the country has forced a faster rate of modernization of the Greek banking than would otherwise have been the case. The technology and innovation they employ has compelled the Greek banks to keep pace with the new techniques. Third, their settlement in Greece has had a rather poor effect in advancing the competition among banks regarding interest rates, credit and so forth. However, the reasons that this argument is based on have already been mentioned. Fourth, the employment effects of the presence of the foreign banks in Greece as well as the implications of the training of their employees on the Greek labour market are negligible, owing to the small number of their personnel. Last, but not least, the establishment of foreign banks in Greece has had a long-run implication on the governmental banking policy. The comparison among foreign and Greek banks, which favours the former by far, has induced the authorities to move towards deregulating the system. Since 1987 this kind of financial reform has taken root.

D. Banks' Taxation

Greek and foreign banks are liable to tax after allowable deductions including any distributed profits. The effective tax rate is 46 per cent on retained profits (law 1828/89). Dividends paid to shareholders are subject to withholding tax which is retained by the banks and subsequently rendered to the tax authorities. For banks listed on the ASE the withholding tax stands for 42 per cent for registered shares and 45 per cent for bearer shares. For banks not listed on the ASE the withholdind tax amounts to 47 per cent for the registered shares and 50 per cent for the bearer shares.

It is worth noting that the interest income on loans provided to any entity in Greece by a foreign bank which has been established in the country is taxable. It is also taxable even if the loan has been granted by the parent company or any other sister branch of the same bank abroad[69].

Banks' representative offices are not engaged in banking activities and cover their operational expenses with imported foreign exchange. Therefore, "such an office would normally not be subject to any Greek taxation since its "income" should always be zero"[70].

Moreover, banks' off shore offices are not subject to any kind of taxation[71].

Finally, all banks are liable to a special tax on bañking businesses (STBB), which currently stands for 3 per cent of their credit and 8 per cent of their gross income springs from all of their transactions.

Notes

1. See also Zitridis (1973), Gotsis (1977), and Halikias (1978).
2. See also Galanis (1962), Psilos (1964), and Demopoulos (1983).
3. The interbank market was established with the Currency Committe 's decision No 275/2/21.6.80.

4. See the Statement of the Governor of the Bank of Greece for the years 1987 and 1988, p.95 and p.94 respectively.
5. It is worth noting, that the banks estimate the volume of their deposits in the beginning of each predetermined period and place the obligatory funds with the Bank of Greece accordingly. After a lag of about a month the banks realize the exact figures of the above deposits and the relevant reserve requirements. To the extent that the estimated and the actual values do differ, the banks could find themselves either with excess liquidity or with a need for immediate funds.
6. Before 1986, the last issue of an Economic Development Lottery Loan was at 15.11.1972. Before 1987, the last issue of a Public Power Corporation Loan was at 1.12.1977.
7. "Issues of securities accounted for less than 0.25 per cent of total identified finance to the private sector over the last ten years" OECD Economic Surveys, Greece, (1986), p.53. Moreover, "statistics on net security issues ... overstate the share of this type of capital raised by private business. Figures are inflated by the conversion of bank loans into shares, which remain in the possession of banks." OECD Economic Surveys, Greece, (1986), p.70, fn.48.
8. The most recent statement on these reasons can be found in the Report of the Committee for the Reformation and the Modernization of the Banking System (1987), p.66.
9. These reasons have been articulated in the primary share market section.
10. See the Monthly Statistical Bulletin of the Bank of Greece.
11. See also Zitridis (1973), Gotsis (1977), Halikias (1978),

Gontikas (1981), and Bitros (1984).

12. Since September 1987, the Agricultural Bank of Greece has been obliged to join the compulsory reserve requirments system on bank deposits. However, the required percentage is still less than that of the commercial banks.

13. In the beginning of 1987 the Committee for the Reformation and the Modernization of the Banking System reported that the HIDB met 64 per cent of its needs in funds by short-term bank bonds; that the NIBID met 69 per cent; and the Investment Bank 42 per cent. However, the Committee stated that the interest rate of short-term bank bonds was subsidized by the authorities in order to be competitive and also profitable for the banks, and therefore the aforementioned investment banks were not substantially self-powered institutions. For a concise presentation of the investment banks see the Report of the Committee for the Reformation and the Modernization of the Banking System (1987), p.59.

14. For more information about this argument see Gontikas (1981), p.111.

15. Greek banks usually register mortgages over collateral even for short-term loans.

16. Zolotas (1967). However, there has not been any difference in the objectives of the authorities until the middle of 1980s. At present, the third and possibly the second headings seem to be abandoning.

17. At present the interest rates have been liberalised.

18. The only exception were the foreign currency deposits and interbank credits.

19. OECD Economic Surveys, Greece, (1986), p.52.

20. Recently, this system has been simplified as well as rationalised.
21. For another classification into primary and secondary reserves see Demopoulos (1984).
22. See also Zitridis (1973), Courakis (1981a), and Courakis (1981b).
23. This mechanism which was introduced in 1968 (C.C. 1509/1/14.9.68) was simplified in June 1988 and finally abolished at the end of 1988 (P.D. 1417/27.12.88).
24. Since 1.1.1987 the calculation of banks' reserves on their deposits has been taking place every ten days and not once per month as it was before.
25. Total private deposits include private deposits in drachmas as well as in foreign currency.
26. It is worth noting that 3.5 per cent of the aforementioned percentage awards no interest, while the rest 4.5 per cent grants the preceding 12.5 per cent interest rate.
27. Commercial banks are not allowed to choose the duration of the treasury bills and consequently the corresponding yields (currently varying from 16.5 to 19.0 per cent). The Bank of Greece offers to the banks mainly three-month treasury bills and therefore the interest rate that the financial institutions enjoy should not exceed the 17.0 per cent.
28. According to a letter that the Governor of the Bank of Greece Dimitrios Chalikias sent in the 26th of July 1988 to George Koskotas, who was then chairman of the Bank of Crete.
29. See the Statement of the Governor of the Bank of Greece for the year 1985, p.114.
30. The interest rates stated below are effective since

1.11.1986.

31. The principal features that have already been mentioned are the State determined interest rates (until recently) and the excessive reserve requirements which help in financing of the high PSBR.

32. Alternatively a lot of funds are spent by the public for acquiring consumer and durable goods.

33. The National Bank of Greece possesses 46.7 per cent of the shares of the National Mortgage Bank, 55.0 per cent of the National Industrial Development Bank, 96.5 per cent of the Traders Credit Bank and is the only shareholder of the National Housing Bank. The Commercial Bank of Greece possesses 67.8 per cent of the shares of the Ionian Bank (which is the third biggest bank), 39.3 per cent of the Investment Bank (21.3 per cent of which is owned by the Ionian Bank), and controls 88.1 per cent of the Bank of Piraeus and 99.0 per cent of the Bank of Attica. Moreover, both of them also possess the majority of shares of the biggest insurance companies and mutual funds.

34. However, we should take into account that some authors have challenged this immediate link between bank concentration and bank market structure. They argue that "it would be invalid to use them [i.e. the bank concentration figures] (as they often are used) as a rough index of competition in the banking system. Bank concentration is not related to banking market structures in any single, direct relation; and a given level of bank concetration can have quite different effects in different banking markets" Alhadeff [(1968), p.342]. Consequently, they claim that "...any market concentration

effect from bank concentration must be sought in the submarkets" (e.g. "large" customers submarket as opposied to "small" customers submarket) Alhadeff [(1968), p.343]. For more information about concentration in Greek commercial banking refer to chapter six.

35. Korliras (1986).

36. "A bank engaged in financing business operations on a long term basis and taking an equity participation in the business so financed; a merchant bank" [Perry (1979)].

37. "Financial systems tend to be classified between bank-based and market-based systems. Bank-based financial systems are those where the banking sector plays a major role in the financing of industry and where the securities markets are neither very active nor so well developed. In contrast, market-based systems are those where the securities markets are both highly active and provide a major source of finance for industrial companies but where the banking sector plays a less dominant role" [Vittas (1986), p.3].

38. For an applied investigation of the factors that determine the demand for short-term bank credit of Greek industrial firms see Simigiannis (1982). A similar investigation that deals with long-term credit is Manassakis (1982).

39. As long as these trading firms have passed their "expensive" financing into production costs.

40. The characterization is of S. Rousseas (1980) who argues that it is unlikely for the system to survive in case of lack of public confidence. The same article reveals more information and a critical view on the relations between Greek commercial banks and industrial enterprises.

41. For more information about the types of bank control exercised on non-financial enterprises see Kotz (1978,1979). Using data from the U.S. economy this worker found that 69 of the 200 largest non-financial corporations in 1969, or 34.5 per cent of the total, were under financial control (that is, controlled by a financial institution). Briefly stated, Kotz classified a corporation as under financial control "if one of the two following conditions was met: (1) a financial institution held 5 per cent or more of the company's voting stock, with full or partial voting authority over the stock, and/or (2) a financial instiution was the leading supplier of debt capital to a company that relied on debt capital to a substantial extent, and the financial institution was strongly represented on the company's board of directors" Kotz [(1979), p.410].
42. For a comparison of banks' relations with industry among the USA, the UK, Germany, France and Japan see Vittas (1986).
43. This characteristic was mentioned in Petoussis (1985a).
44. The State controls ten out of twelve currently existing Greek banks. At the end of 1988 the assets minus depreciation of the State-controlled banks accounted for 89.25 per cent of the assets less depreciation of the total Greek commercial banks, as well as 74.96 per cent of the corresponding account of the whole commercial banking industry.
45. See Dertilis (1982).
46. For an interesting debate on this issue see Petousis (1985a), (1985b) and replies.
47. See Gotsis (1977), Petoussis (1985a).
48. See the reply in Petoussis (1985a), and Korliras (1986).

49. See also Andreadis (1966), Zitridis (1973), Gotsis (1977), and Halikias (1978).

50. In 31.12.1988 the private sight deposits represented only a 4.10 per cent of the total private deposits with commercial banks. See the Statement of the Governor of the Bank of Greece for the year 1988, p.82.

51. The ability of the banks to create money in Greece increases considerably when money is defined as M3 or broad money, because time amd savings deposits are included in its concept. None the less, in 1988 the private sight deposits accounted for only 32.31 per cent of the currency in circulation (i.e. coins and banknotes outside the monetary system). See the Statement of the Governor of the Bank of Greece for the year 1988, p.80.

52. For a historical evolution of the Greek banks see Zitridis (1973).

53. The Credit Bank and the Ergo Bank are the only private Greek commercial banks in the country.

54. See Perry (1973).

55. Except agriculture which is financed by the Agricultural Bank.

56. In 1920 the first branch of International American Express was established in Greece [see Gotsis (1977)].

57. For more information about these motives see Petrochilos (1985).

58. See Petrochilos (1985). As far as the second motive is concerned, Kostopoulos [(1981), p.91] reported that one banking branch corresponded to ten thousand inhabitants in Greece. Although at present (end of 1988) the aforementioned

relation has increased to one branch for just below seven thousand (actually 9740417 inhabitants divided by 1395 branches provides 6982.38), it is quite far away from the average of EEC countries. [According to Kostopoulos one branch corresponded to two thousand-five hundred inhabitants in the EEC countries]. Needless to say, the aforementioned relation in Greece is different if we do not take into account the sub-branches (e.g. the division of branches established in separate locations). In that case the above figure will be (9740417/1100=) 8854.92. The same realization was also found in Giannopoulos [(1981), p.232]. Using data of 1977, he mentioned that the density of bank branches to ten thousand inhabitants was 4.2 in the U.K., 3.3 in Ireland, 2.2 in Italy and only 0.8 in Greece. However, at the end of 1988, this index should be increased to 1.43 for Greece.

59. Halikias (1978), p.15.

60. See Giannitsis (1982), p.95, fn.49.

61. This sum must remain in Greece either as a blocked deposit or as an advance payment.

62. The monetary authorities have applied the same banking controls to the Greek as well as to the foreign banks since 1981 (C.C. 298/22.1.1981).

63. However, in 1978 an exemption was granted to the Arab-Hellenic Bank where foreign interest possessed 60 per cent of its share capital.

64. See Giannitsis (1982), p.67.

65. Ibid., p.120.

66. Ibid., p.68.

67. See the Reports of the Committee of Disincentives (1979),

p.45.

68. See Giannitsis (1982), p.175.

69. See the circular of the Ministry of Finance (E.12793/pol, No. 294/20.10.1976), as well as Peat et al (1981), p.44.

70. Peat et al (1981), p.49.

71. See Giannitsis (1982), p.113.

CHAPTER TWO

Measuring Commercial Greek Bank Profitability

II.I Profitability Measures

Bank profitability refers to the ability of a bank to generate revenues in excess of expenses, and it is the net outcome of a large number of policies and decisions. Bank profitability can be measured in several ways. However, there are three measures that are more commonly used for this purpose, as they are provide information about bank performance and therefore can be employed to compare performance over time and/or across banks. These three measures are the following.

(i) The adjusted net interest margin (NIM)[1]. It is the excess of interest income net of loan losses over interest expense that a bank earns by its operation, deflated by the average interest earning assets of that bank. NIM is roughly similar to the nonfinancial firms' profit margin on sales, and indicates how much net income is generated from a bank's interest earning assets. Variations in a bank's NIM can be attributed mostly to movements in market interest rates and/or shifts in the composition of the bank's porfolio. However, this measure cannot be used for assessing or comparing Greek banks performance, as Greek banks' imcome statements do not report net interest earnings.

(ii) Return on assets (ROA). It is the ratio of a bank's net income to its average total assets, the latter including both financial and physical assets such as building and equipment. Average total assets is the arithmetic mean of the assets held by a bank at the end of the year, and at the previous year. It is employed because a bank's income is earned throughout the year, while total assets are reported in balance sheets in year-end values and are likely to vary during the year. ROA measures the efficiency with which total assets are employed within the financial firm, and it is especially useful for measuring changes in a bank's performance over time. ROA is an estimate of a bank's earnings per drachma of its total assets, or alternatively, it shows bank's profits as a per cent of its total assets. Consequently, this profitability measure reveals the return to both depositors and shareholders.

(iii) Return on equity (ROE). It is the ratio of a bank's net income to its average capital equity. ROE measures the efficiency with which common shareholders' equity is being employed within the firm. It is an estimate of a bank's earnings per drachma of shareholders' investment, or alternatively, it shows bank's profits as a per cent of the invested euity capital. ROE is especially useful for comparing the profit levels of firms in different industries as ROA is rather deficient for this purpose. This argument is based upon the claim that "different business lines require vastly different amounts (as well as types) of assets to attain the same level of profit"[2].

Measuring bank profitability in terms of ROE differs from that of ROA, depending on the gearing distribution of the banks. Some banks are more geared, relying less on capital equity and more on borrowed funds to finance their assets. Some other financial institutions are less geared, financing their assets more by capital equity rather than by deposits and other liabilities. In general, the less geared a financial institution, the greater its ROA tends to be (interest expenditure is lower, increasing the numerator of ROA), and the smaller its ROE tends to be (capital equity is higher, increasing the denominator of ROE more than the numerator), and vice versa. This relationship can be seen from the following identity:

$$\frac{\text{Net Income}}{\text{Equity}} \equiv \frac{\text{Net Income}}{\text{Total Assets}} \times \frac{\text{Total Assets}}{\text{Equity}} \qquad \text{or}$$

$$\text{ROE} \equiv \text{ROA} \times \frac{\text{Total Assets}}{\text{Equity}}$$

The third term of the above identity, Total Assets/Equity, is the so-called "equity multiplier" and it measures the drachma value of assets per drachma of equity. The equity multiplier indicates the extent to which a financial institution relies on both equity and non-equity funds to finance its assets. It is equal to the Debt/Equity ratio plus unity[3] and may be interpreted as a measure of the degree of financial gearing. Consequently, the larger the equity multiplier, the more highly geared the bank.

As a profitability measure, ROE is subject to three problems[4]. These are the following.

(a) The timing problem. ROE reports earnings for only one year and therefore it fails to evaluate managers' decision with a longer horizon. For example, the calculation of a bank's ROE just after the purchase of an expensive computer system, will show a quite low value suggesting rather poor performance. However, this indication is incorrect, as the sacrifice of present income is made in anticipation of higher future income.

(b) The risk problem. ROE reveals nothing about the business risk a bank is exposed to.

(c) The value problem. Shareholders' equity is reported in book value which is not necessarily any guide to its market value. Consequently, ROE does not disclose the real annual return on the investment of shareholders, as long as a divergence between the book value and the market value of a bank's equity takes place.

As a profitability measure, ROA is also subject to pitfalls. The aforementioned risk problem is the most serious one. A high (low) ROA could stem from efficient (inefficient) operations or a low (high) cost deposit base. However, a high (low) ROA could also arise from lending at high (low) rates to risky (safe) borrowers.

Revell (1980) emphasizes the importance of profits as a measure of maintaining capital ratios and a risk cushion in financial institutions own right. Therefore, he suggests that a "...measure of profitability that is of operational importance to the institutions themselves is the ratio of the profit figures (in this case profit before tax) to total capital (PBT/TC)..."[5]. He also adds that a notable feature of this profitability criterion is that "institutions that have permitted their capital ratios to decline are likely to show a rising (or a less sharply declining) PBT/TC ratio because the denominator has been rising at a slower pace than with institutions whose capital ratios have been maintained"[6]. It is worth mentioning, however, that a similar measurement of bank profitability, the ratio of net income after taxes to total capital accounts, is also being used by Haslem

(1968)[7].

Nevertheless, bank analysts keep on using ROA and/or ROE, despite their drawbacks, as admittedly imperfect measures of banks' financial performance. Consequently, in our analysis we measure bank profitability in terms of ROA, which is the most common profitability criterion.

II.II The Rises and Falls of Profitability in the Greek Banking Industry Over the Last Years

Before we proceed to our studies, it is worth while exploring the profitability path in recent years of the whole Greek commercial banking industry. To measure the whole banking industry earnings, we average the profitability measurements of all the banks of our sample. However, one[8] may carry out the average procedure by utilizing either of the following two statistical methods[9].

(i) The weighted arithmetic mean. "The calculation of a weighted arithmetic mean is performed by multiplying each item to be averaged by the weight assigned it, totaling the products, and dividing the total by the sum of all the weights used"[10]; that is

$$\mu = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i}$$

where μ is the weighted arithmetic mean of a series of values of a variable $x_1, x_2, \ldots, x_n$; x is the value of an individual variable;

and w is the weight assigned to each x value.

For the purpose of this study, the chosen weight is the drachma value of the banks' data. Consequently, we can calculate the commercial Greek banks' ROA or ROE, by adding together all banks' net income, and dividing it by the sum of all banks' total assets. However, the arithmetic mean is based on all the values of the statistical population, and therefore it can distort results when the lowest or the highest figures in a series are out of keeping with the whole range. In other words, a few extremely high-performing or extremely poor-performing banks have an undue influence on the mean. For example, if bank income distribution is skewed to the right, the mean is pulled up by the extreme high incomes, and vice versa. Moreover, "the method is flawed for other reasons as well, such as the effect of differences in bank size within a peer group"[11].

(ii) The median. "The median is the value of the middle item in an array"[12]. This method divides the bank profitability distribution into two equal parts and determines that half of the bank population is more profitable and half is less profitable than the median bank. However, if there are an even number of banks, there is no middle value, and the median is indeterminate to a certain extent. In this case the median bank is generally defined as the arithmetic mean of the two middle banks.

Nevertheless, we explore the profitability path of the Greek commercial banking industry by utilizing both the aforementioned averaging methods.

Table II.1 reveals the ROA, calculated by the two methods, from 1977 to 1986. According to the arithmetic mean procedure, 1980 was the most profitable year (i.e. ROA was 0.85 per cent),

TABLE II.1

Percentage Return on Assets[1]

Year	Arithmetic Mean	Differences	Median	Differences
1977	0.647620	NA[2]	0.650845	NA[2]
1978	0.654323	0.00670	0.597650	-0.05319
1979	0.598321	-0.05600	0.507175	-0.09047
1980	0.848281	0.24996	0.974800	0.46762
1981	0.710397	-0.13788	0.641200	-0.33360
1982	0.265918	-0.44448	0.229235	-0.41197
1983	0.069795	-0.19612	0.148885	-0.08035
1984	0.324130	0.25434	0.242680	0.09380
1985	0.432145	0.10802	0.295955	0.05328
1986	0.535473	0.10333	0.662090	0.36614

Notes:
1. (ROAx100).
2. NA = Not Available.

Source:
Calculated by the author.

and 1983 was the least profitable year (i.e. ROA was 0.07 per cent). The Greek banks experienced a decline in ROA by 6, 14, 44 and 20 basis points[13] in 1979, 1981, 1982 and 1983 respectively. On the other hand, the Greek banking industry experienced an increase in ROA by 25, 25, 11 and 10 basis points in 1980, 1984, 1985 and 1986 respectively; while in 1978 the ROA remained almost the same with those of 1977.

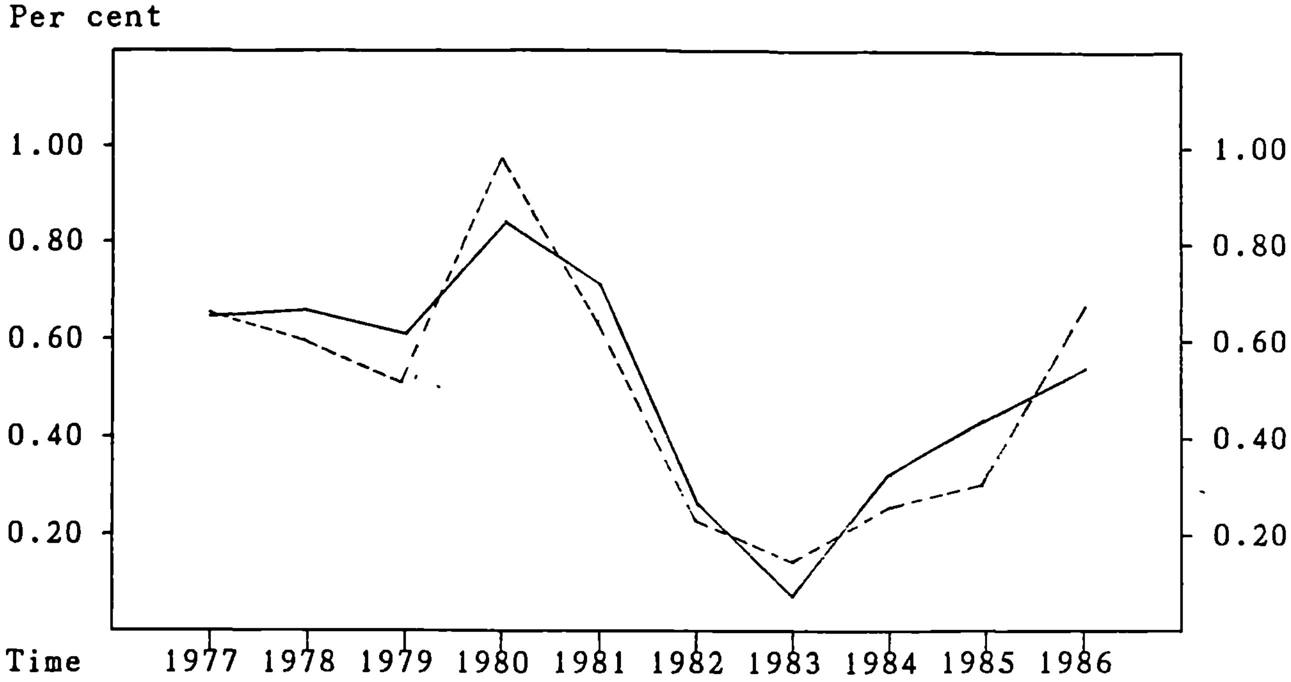
The picture does not change considerably, as far as the median is concerned (see table II.1). The percentage magnitudes of the ROA, as well as their changes over the years differ from those computed by the arithmetic mean, but the changes moved in the same direction. The only difference is observed in 1978 when a decline in ROA by 5 basis points occured, according to the median procedure. However, this difference is rather small.

Chart II.1 plots ROA according to the two utilized averaging methods and exhibits the aforementioned differences.

Table II.2 shows the ROE, calculated by the two averaging techniques, from 1977 to 1986. According to the arithmetic mean

CHART II.1

Percentage ROA[1]



Notes:
1. (ROAx100)
2. Arithmetic Mean: ————
Median : --------

procedure, 1986 was the most profitable year (i.e. ROE was 18.83 per cent), while 1983 was the least profitable year (i.e. ROE was 2.91 per cent). ROE declined by 1.46, 0.46, 9.99 and 3.49 percentage points in 1979, 1981, 1982 and 1983 respectively. On the contrary, ROE rose 2.59, 4.70, 5.94, 4.37 and 5.60 percentage points in 1978, 1980, 1984, 1985 and 1986 respectively.

The median averaging method does not reveal the same picture (see table II.2). According to this technique, 1986 was the most profitable year (i.e. ROE was 22.07 per cent), and 1983 was the least profitable year (i.e. ROE was 5.15 per cent). However, profitability changes did not always move in the same direction with those computed by the arithmetic mean. ROE was found to increase in 1981 by 2.04 percentage points, and decrease in 1985 by 5 basis points. The divergence of these figures from those calculated by the arithmetic mean may be attributed to two factors that may influence the arithmetic mean averaging method. First, two banks (i.e. the Commercial Bank of Greece and the Piraeus Bank) experienced considerably low ROE in 1981. Second, three banks (i.e. the Commercial Bank of Greece, the Credit Bank and the Attica Bank) experienced considerably high ROE in 1985.

TABLE II.2

Percentage Return on Equity[1]

Year	Arithmetic Mean	Differences	Median	Differences
1977	11.0371	NA[2]	14.0944	NA[2]
1978	13.6261	2.58900	14.8448	0.75040
1979	12.1674	-1.45870	12.0893	-2.75550
1980	16.8659	4.69850	16.4121	4.32280
1981	16.4010	-0.46490	18.4501	2.03800
1982	6.4082	-9.99280	5.2446	-13.20550
1983	2.9149	-3.49330	5.1530	-0.09160
1984	8.8581	5.94320	8.8200	3.66700
1985	13.2322	4.37410	8.7714	-0.04860
1986	18.8349	5.60270	22.0662	13.29480

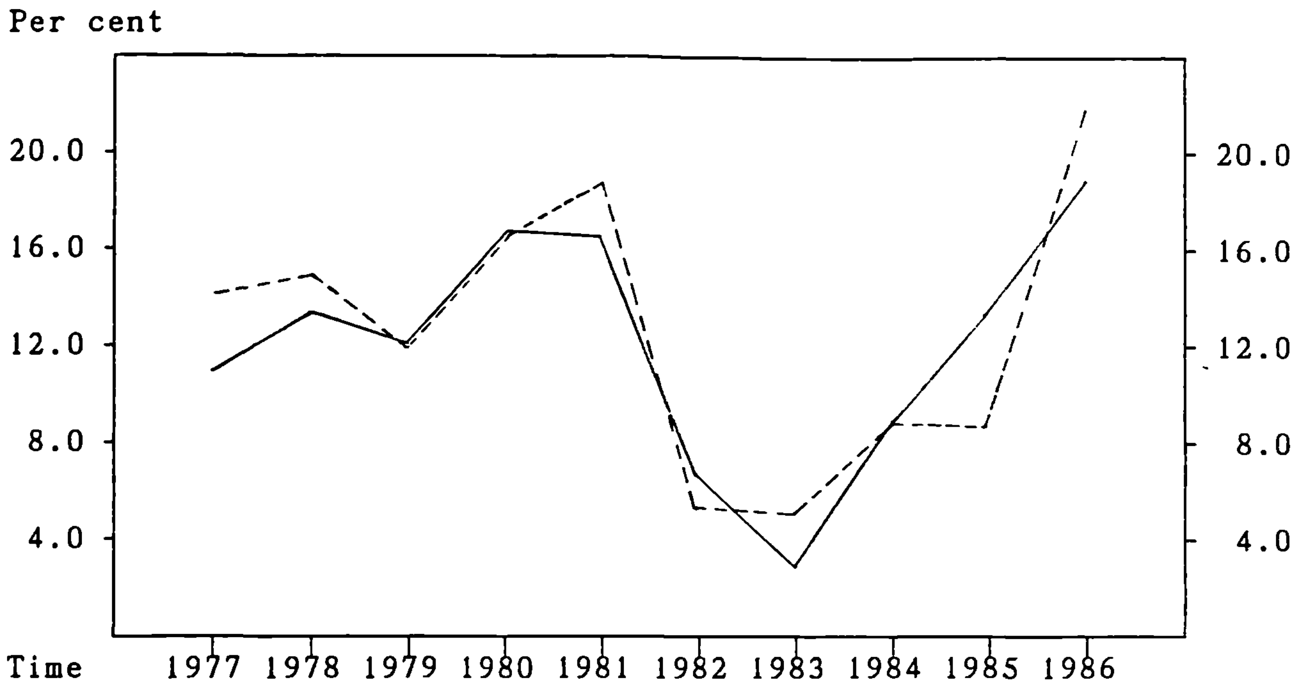
Notes:
1. (ROEx100).
2. NA = Not Available.
Source:
Calculated by the author.

Chart II.2 plots ROE according to the arithmetic mean and the median, and exhibits the aforementioned differences.

To sum up our analysis, we may conclude that the Greek commercial bank profitability moved up and down from 1977 to 1980, experienced a sharp decrease from 1980 to 1983 and a considerable increase afterwards.

CHART II.2

Percentage ROE[1]



Notes:
1. (ROEx100)
2. Arithmetic Mean: ————
   Median : --------

II.III Profitability Ranking of the Sample Banks Over a Ten Year Period

Before we explore the determinants of Greek bank profitability, we rank our sample banks according to their ROA[14] for the whole time period we examine (i.e. 1977-1986). This ranking will be utilized in the analyses of the following chapters to accomplish our goal.

Table II.3 shows the annual ROA experienced by each financial institution of our sample for a ten year period. Two firms (i.e. the Traders' Bank and the Piraeus Bank) reported loses in 1983 and 1986 respectively, and therefore two negative values appear in the table.

TABLE II.3

Annual Percentage ROA

Year	COMMERCIAL BANKS							
	National	Commercial	Ionian	Credit	General	Traders'	Attica	Piraeus
1977	0.62403	0.67766	0.06377	0.45765	0.74266	0.55185	1.30217	0.76117
1978	0.55185	0.49459	0.79861	0.38751	0.64345	0.39428	1.13435	0.82994
1979	0.41803	0.42072	0.96699	0.35734	0.79900	0.55061	0.46374	0.81014
1980	0.52021	0.97841	0.97119	0.37203	1.04825	1.21535	1.05402	0.62679
1981	0.46102	0.49044	0.83946	0.30853	0.79196	1.26150	1.45084	0.07943
1982	0.32383	0.25575	0.90616	0.20272	0.00731	0.30444	0.07067	0.05646
1983	0.33947	0.27566	0.57557	0.15918	0.13859	-1.08932	0.02202	0.13719
1984	0.27360	0.61325	0.60639	0.21176	0.13332	0.45667	0.13534	0.16271
1985	0.07535	0.86709	0.38506	0.38370	0.12391	0.20821	1.38166	0.03218
1986	0.14752	0.83884	0.66118	0.66300	0.20236	1.03439	0.92679	-0.19030

Source:
Calculated by the author.

To carry out our task we follow the succeeding procedure. First, we normalize the values of the ROA experienced by the eight banks per year, by assigning the value of 10.00 to the highest ROA (i.e. the base observation is that of the most profitable bank)[15] of each particular year, and expressing the ROA of the remaining firms of that year accordingly. That is, the original value of each bank's ROA per year is divided by the most profitable bank's ROA of that year and subsequently multiplied by 10.00. Table II.4 reveals the banks' normalized ROA for each year. Second, we add the annual normalized ROA for each bank. Finally, we rank the firms in the order of the products of the above addition from the largest to the smallest; that is the bank that is associated with the highest sum, is placed first. The bank that is associated with the second higher sum, is placed second; and so forth.

TABLE II.4

Normalized ROA

Commercial Banks	YEARS									
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
National Bank	4.79223	4.86490	4.32300	4.28033	3.17761	3.57365	5.89798	4.46148	0.54536	1.42615
Commercial Bank	5.20408	4.36012	4.35082	8.05044	3.38039	2.82235	4.78934	10.00000	6.27571	8.10951
Ionian Bank	0.48972	7.04024	10.00000	7.99103	5.78603	10.00000	10.00000	9.88814	2.78694	6.39198
Credit Bank	3.51452	3.41614	3.69538	3.06109	2.12656	2.23713	2.76561	3.45308	2.77709	6.40957
General Bank	5.70325	5.67241	8.26275	8.62509	5.45863	0.08067	2.40787	2.17399	0.89682	1.95632
Traders' Bank	4.23793	3.47582	5.69406	10.00000	8.69496	3.35967	-18.92593	7.44672	1.50696	10.00000
Attica Bank	10.00000	10.00000	4.79571	8.67256	10.00000	0.77988	0.38258	2.20693	10.00000	8.95977
Piraeus Bank	5.84540	7.31644	8.37796	5.15728	0.54748	0.62307	2.38355	2.65324	0.23291	-1.83973

Source:
Calculated by the author.

Table II.5 presents the outcome of the aforementioned procedure.

The above method is similar to constructing an index with the potential most profitable bank of the ten year period having a value of 100 and the remaining financial institutions having

TABLE II.5

Profitability Ranking According
to the Normalization Criterion

Commercial Banks	Scores
1. Ionian Bank	70.37408
2. Attica Bank	65.79744
3. Commercial Bank	57.34276
4. General Bank	41.23781
5. National Bank	37.34269
6. Traders' Bank	35.49018
7. Credit Bank	33.45618
8. Piraeus Bank	31.29758

Source:
Calculated by the author.

values downwards. This ranking criterion may be preferable to others[16], as it also take into account the magnitudes of the relative profitability differences among banks for each year we examine.

Notes

1. This profitability measure is being referred by Wall (1986), and in previous bank profitability papers by the same author in the same review. This reference is only indicative, as NIM is employed by many bank analysts.
2. Mead and O'Neil (1986), p.277.
3. To see this let us define D = Debt = Total Liabilities = TL,

TA = Total Assets, and E = Equity. Then, TA ≡ TL + E ==> TA ≡ D + E ==> (TA/E) = (D/E) + 1.

4. For a general discussion on these problems see Higgins (1983), pp.33-35. For particular problems in measuring bank performance see Walter and Mengle (1986), pp.32-33.

5. Revel (1980), p.121. It is worth pointing out that profit before tax is arrived at by adding other income (net) to interest margin (i.e. interest received less interest paid) and deducting operating costs and other credits (net) from the product; total capital (TC) is of two sorts, share capital and reserves.

6. Ibid., p.121.

7. For more information about this ratio see Haslem (1968), p.168. Moreover, for a listed literature supporting the general type of this profitability criterion, see fn.7 in the aforementioned paper and page.

8. Alternatively, a third common average measure, the mode, can be used. The mode is the value of the variable that occurs most often in a series. However, it is not always easy to locate the mode of bank earnings, and therefore this measure is not used for our study.

9. For more information about the different results that could be generated by the use of these two methods, see Nejezchleb (1986), and Cates (1986).

10. Stockton and Clark (1975), p.49.

11. Cates (1986), p.49.

12. Stockton and Clark (1975), p.59. In the same page they also state that "an array is an arrangement of values in the order of their size from the smallest to the largest, or from the

largest to the smallest".

13. A basis point is one-hundredth of a percentage point.

14. We chose ROA as a profitability measure firstly because it is subject to less pitfalls than is ROE (for reasons stated in the previous section), and secondly because it reveals the return to both depositors and shareholders.

15. The most profitable bank of each year is chosen as the base observation for two reasons. First, we cannot utilize one firm as a base for the whole time period, because none of them exhibits consistency. A time plot of each bank's ROA reveals that all the banks' ROA vary considerably from year to year. Second, we cannot utilize the least profitable bank of each year as a base, because two firms experienced negative ROA. Moreover, changing the scale of a series by dividing with numbers that are close to zero is generally avoided in Statistics (i.e. the denominator must be other than zero).

16. For example, an alternative profitability ranking could be based upon the following procedure. First, to rank the banks annually from one to eight (i.e. to assign the value of one to the most profitable bank, the value of two to the less profitable one and so on). Second, to add the annual ranks for each bank. Finally, to rank the firms in the order of the products of the above addition from the smallest to the largest.

CHAPTER THREE

A Statistical Cost Accounting Approach

III.I Introduction

Commercial banks may be described as economic agents whose balance sheets consist mainly of financial assets and liabilities, the latter including demand deposits which can serve as a medium of exchange for their holders. Commercial banks have two basic economic functions[1]. First, they may perform a transformation of assets by borrowing funds qualitatively different from the funds they lend. And second, they may serve as dealers or brokers in the credit markets basing their existence on the cost of transactions and the cost of evaluating credit risks in these markets. However, commercial banks are basically firms and as such their main objective is to earn a profit. Rapid bank growth and high rising net income are important to ownership interests - whoever the owners are - and therefore a prime argument in their objective function. In addition, over the long run, banks must earn a sufficient rate of return on their capital in order to continue to play their role in the financial system (e.g. to facilitate the payments system, to serve as the vehicle of monetary expansion, or to accomodate the functioning of the credit system). Hence, it is worth examining Greek commercial bank earnings performance in an endeavour to determine the factors that account for interbank differences in profitability. In order to achieve the aforementioned aim, we concentrate in this chapter on the relationship between Greek bank earnings performance and their balance sheet structure, since differences in banks' earnings should be reflected in at least one of the following four headings: (i) net rates of return on earning assets, excluding operating expenses and loan losses, (ii) net rate of cost on liabilities, including operating expenses but eliminating service charges to depositors, (iii) composition of asset portfolio, and (iv) sources of liability funding.

The above investigation is performed at this point by the employment of a statistical cost accounting model. This model was first applied in the transportation industry by Meyer and Kraft (1961). Donald D. Hester was the first to use this technique for commercial bank samples from India and the United States[2].

The statistical cost accounting model is an empirical model based on accounting relationships. It attributes differences in banks' earnings to differences in the structure of their balance sheets by regressing accounting earnings on bank assets and liabilities. In other words, a flow variable is regressed against various balance sheet stock variables[3]. The fundamental hypothesis of the model[4] is that the rates of return for assets are positive and vary across assets and the rates of return for liabilities are usually negative and vary across liabilities. Providing that this theoretical proposition is correct and the balance sheets of individual banks are not just scalar multiples of each other, variations in bank porfolios[5] should explain variations in bank earnings.

III.II The Model

Economic theory of the firm defines profit as revenue less cost. In the case of multi-output firm[6], revenue equals the sum, over all outputs, of the level of each output times the price of each output and cost is the sum, over all inputs, of the level of each input times the price of each input. In general, the aforementioned relationship can be written as

$$Y \equiv R-C \qquad \text{or} \qquad Y = f(R,C)$$

where Y is the profit of a firm and R and C are its revenue and cost respectively.

However, the revenues of a firm may be associated with the assets reported in its balance sheet. Similarly, the costs of a firm are related to the liabilities presented in its balance sheet. To the extent that the assets and liabilities of a firm may be viewed as proxies of its revenues and costs respectively, a firm's profit can be written as a function of them. That is,

$$Y = f(A,L)$$

where A denotes the total assets of a firm and L its total liabilities. This assumption may seem quite strong, but it does not appear unrealistic as a firm's earnings should be reflected on its assets and liabilities.

Economic theory does not specify whether the income function should be studied with a single-equation model or with a simultaneous equations one. Consequently, we choose to investigate interbank differences in profitability with the simplest way; that is, by employing a single-equation model.

Economic theory does not indicate the mathematical form (linear or non-linear) of the income function. Therefore, we assume that the relationship can be described by the simplest possible mathematical form; that is, it is linear.. The parameters of the assets are expected to have positive signs, given that the assumption that assets are proxies for revenues is valid. On the same grounds (i.e. the liabilities are assumed to be proxies for expenses), the parameters of the liabilities are expected to appear with negative signs. As regards the magnitude of the parameters, there are no constraints on a priori reasons; they can be any real number.

However, the above linearity assumption can be replaced by the assumption that banks earn constant marginal rates of return from elements of their portfolios[7]. Then, the net income that is realized by a bank will be a linear function of the elements of its portfolio[8]. Although this new assumption may seem unrealistic for certain elements of a bank's portfolio, one may claim that the net rate of return on these elements may be approximately the same at all sizes of banks. This conjecture is based upon the view that variations in return on revenues and costs could be in the opposite direction and cancel-out[9].

Apart from the above assumptions there is also another, more formal, way for defining a single-equation linear model. From mathematical economics we know that an economic phenomenon can be studied by a single-equation linear model such as

$$Y = \alpha_0+\alpha_1 X_1+\alpha_2 X_2+\ldots+\alpha_n X_n,$$

which is a function of degree 1 and therefore is a linear polynomial in n independent variables, only when the following two conditions are met:

(i) The explanatory variables X_i, where $i=1,2,\ldots,n$, are independent and

(ii) The parameters α_i, where $i=1,2,...,n$, are constant fixed (non-zero) numbers.

The first condition is necessary for the determination of a single-equation model. If X_i are dependent then the phenomenon is best described by a multi-equation model (i.e. a system of simultaneous equations) and not by a single-equation one. In simultaneous equation systems where some endogenous variables appear among the explanatory variables (i.e. some explanatory variables in one equation feed back into variables in another equation), these (endogenous) variables are, in general, correlated with the disturbance of the equation in which they appear. As a consequence, the application of ordinary least squares (OLS) to an equation belonging to a simultaneous equation model leads to biased and inconsistent parameter estimates[10]. This bias is called simultaneous equation bias and its direction is not always be possible to be predicred. The second condition is required for the function to be linear.

The aforementioned two conditions can be written for our case as: (i) "the percentage of a bank's resources held as any asset is not related to variations in interest rates across banking markets"[11] and (ii) "a bank does not influence the interest rates at which it borrows or lends by varying its own portfolio mix"[12]. The second condition should have been satisfied in Greece during the period examined as interest rates were fixed by the authorities[13]. The first condition should have been partly satisfied as the Greek banking regulations obliged banks to place a certain percentage of their portfolios on specific assets. However, to the extent that this condition is violated and banks do place a high percentage of their portfolios in high net return assets, Hester and Pierce [(1975), p.100] claim that this technique would tend to produce estimated loan interest rates that are positively biased. But if assets are not gross substitutes, then the above authors note that this bias may not be positive. Nevertheless, irrespective of the violation of this condition, the statistical cost accounting method can still be used to explore differences in yields earned by high and low-income banks on their balance sheet items. To the extent that the aforementioned bias exist on the estimated returns, this bias will be the same for both banking groups. It is worth noting, however, that Hester and Pierce (1975) believe that nonlinearities are of negligible importance and "variations in bank portfolios are more likely to reflect differences in portfolio preferences by individual banks than variations in asset markets"[14].

Thus, a bank's net income (profit) can be expressed as the weighted sum of its various assets and liabilities, the weights being the net revenue (prices) or costs ascribable to each item. Hence, it can be written as

$$Y = \sum_{i=1}^{M} b_i A_i + \sum_{j=1}^{N} c_j L_j \qquad (1)$$

where Y is the net operating income of a bank, that is total revenue less total costs; A_i is the ith asset, i=1,2,...,M; L_j is the jth liability or equity, j=1,2,....N; b_i is the net rate of return on assets after deducting directly associated operating expenses[15]; and c_j is the net rate of cost on liabilities, including operating expenses but eliminating service charges. Therefore, the sign of each b_i should be non-negative (i.e.

positive or zero), and each c_j should be non-positive (i.e. negative or zero).

It is worth noting, however, that the interpretation of the parameters of the assets and liabilities change, whenever the definition of the dependent variable changes[16].

Apart from the aforementioned, a bank may realize earnings which are not related to balance sheet items. Revenues produced by trust departments, underwriting, safe deposit facilities, traveller's cheques as well as expenses for electricity, advertising and officer' salaries may be included in this category. For this reason a constant term is usually added to equation (1) immplying the existence of income that is unrelated to banks' portfolio composition. By inserting a constant term in the model, it is assumed that such revenues and expenses are constant and invariant with respect to the size of the bank .

Finally, an error term is added to equation (1) to acçount for stochastic differences among individual banks. Thus, the basic statistical cost accounting model takes the following form.

$$Y_k = a + \sum_{i=1}^{M} \sum_{k=1}^{K} b_i A_{ik} + \sum_{j=1}^{N} \sum_{k=1}^{K} c_j L_{jk} + \varepsilon_k \qquad (2)$$

where k is the number of sample banks and k=1,2,...,K; a is the constant term; and ε_k is the error term.

Equation (2) relates a bank's earnings with the structure of its assets and liabilities at a point in time. However, the same technique could be applied over a sample of banks as well as at a longer period of time. In order to achieve this expansion, we should make two additional conjectures. First, we should asssume "that all banks face identical interest rates on various asset and liability items, so that interbank variations in portfolio mix simply reflect different portfolio preferences"[17]. And second we should hypothesize the intertemporal stationarity of the estimated structure. Then, the only difference from the previous analysis would be that the coefficients should be interpreted as the average coefficients of the sample in the given period of time.

As an alternative, the model could be presented by two equations, one for revenues and one for costs[18]. The revenue equation can be described by

$$R = r_0 + \sum_{i=1}^{M} r_i A_i + \sum_{j=1}^{N} r_j L_j + e \tag{3}$$

where R is the current operating revenue of a bank; r_0 represents fixed revenue; r_i represents gross rates of return on assets; r_j represents gross rates of return on liabilities; and e is a stochastic term associated with the bank.

Similarly, the cost equation can be described by

$$C = k_0 + \sum_{i=1}^{M} k_i A_i + \sum_{j=1}^{N} k_j L_j + u \tag{4}$$

where C is the current operating cost of a bank; k_0 represents fixed costs; k_i represents rates of cost on assets; k_j represents rates of cost on liabilities; and u is a stochastic term associated with the bank.

Equations (3) and (4) generate eatimates of the revenue and cost coefficients for the various elements of a bank's portfolio. Subtracting the estimates of the cost coefficients from the corresponding estimates of the revenue coefficients, will produce estimates of the net rates of return on the elements of a bank's porfolio.

III.III Modifications of the Model

In order to estimate the parameters of the model, an ordinary least squares regression is usually applied to a cross-sectional sample of banks. This method produces estimates which according to Gauss-Markov theorem are BLU (best, linear, unbiased) provided that the usual conditions[19] are satisfied for each firm k.

The use of least squares method in cases such the above, might bring about a potential heteroscedasticity problem. It is well known that the error term expresses the influence on the dependent variable of errors in its measurement and of omitted variables. Therefore, there are reasons for expecting, especially with cross-sectional samples which are used in the statistical cost accounting models, that the variance of the errors vary over time, or vary systematically with the explanatory variables. If the homoscedasticity assumption is violated, the OLS estimators will be unbiased but they will not have the minimum variance property in the class of unbiased estimates and consequently they will be inefficient or asymptotically inefficient. Furthermore, if the disturbances are heteroscedastic, we cannot apply the formulae of the variances of the coefficients to conduct tests of significance and construct confidence intervals. Otherwise, the tests are invalid and the constructed confidence intervals incorrect[20].

Most of the statistical cost accounting studies have assumed implicitly or explicitly that the variance of the error term is systematically related to an independent variable such as bank size. For this reason and in order to eliminate heteroscedasticity from the disturbances of the model, most of the researchers have deflated equation (2) by total assets[21]. Thus, equation (2) can be written as

$$\frac{Y_k}{TA_k} = \frac{a}{TA_k} + \Sigma\ \Sigma\ b_i \frac{A_{ik}}{TA_k} + \Sigma\ \Sigma\ c_j \frac{L_{jk}}{TA_k} + \frac{\varepsilon}{TA_k} \tag{5}$$

However, the aforementioned transformation will be appropriate, only if the variance of the disturbances of the model [equation (2)] is of the form $\sigma_k{}^2 TA_k{}^2$. If the original undeflated model is homoscedastic, or the variance of the error term is related to some variable other than $\sigma_k{}^2 TA_k{}^2$, then the application of the above transformation will not provide homoscedastic disturbances. Consequently, it is important to test the model for heteroscedasticity and, if the variance of the error term in the estimated equation is not constant, to eliminate the problem of heteroscedasticity[22]. Although most of the statistical cost accounting studies deflate their models in order to eliminate heteroscedasticity, only two of those report test for it. Hester and Pierce (1975) mention that one of the three equations they estimate appears to indicate heteroscedasticity, but they are not concerned with the solution of the problem[23]. Maisel and Jacobson (1978) report that a Goldfeld-Quandt test for heteroscedasticity could not reject the assumption of homoscedasticity in each of their estimated equations[24].

The usual assumption that the independent variables have finite, different from zero, mean and variance, it is required so that the values of the explanatory variables in the sample are not all the same, and that they do not grow or decline without limit. The first requirement is crucial, since otherwise the determination of the least squares regression coefficients would become impossible. The second requirement is less crucial and it is employed mainly in providing the desirable asymptotic properties of the least squares estimators[25].

The assumption that the independent variables are uncorrelated with the error term is very important. If it is violated, the application of OLS in the model will yield biased and inconsistent estimates. The most common cases of dependence between the errors and the explanatory variables occur[26]: (a) When the equation being studied belongs to a wider system of simultaneous equations[27]. (b) When the independent variables are stochastic and/or include errors of measurement.

Portfolio theory suggests that the higher the yield of an asset the higher the percentage of the funds that an investor will place on, all other things being equal. Similarly, if two financial firms are facing two different net rates of return on a particular loan category, the bank that face the higher yield will place a relatively larger amount of funds on this loan category than the bank that face the lower yield. In consequence, the former firm will tend to exhibit higher income (i.e. a positive residual) than the latter. In other words, the expected value of this loan category and the disturbance will be positive; that is, $E\ (\varepsilon_k/TA_k\ A_{ik}/TA_k) > 0$. In this case, the estimated rates of return for some types of loans produced by the statistical cost accounting procedure will be positively biased. In Greece, however, the interest rates on identical assets and liabilities were mostly fixed by the authorities, during the period studied, and therefore did not vary among banks. Consequently, high and low profit banks may not have systematically different portfolio compositions due to the above reason and the argument that the coefficient estimates of the OLS suffer from a simultaneous equations bias might be rejected. Moreover, there are many explanations for variation in banks' portfolio allocations apart from the aforementioned yields. Hester and Zoellner (1966) mention the aggressiveness of lending officers, differences in risk aversion among lending officers, differences in the degree of deposit predictability and so on[28].

We may reject partly the second requirement by assuming that the independent variables are non-stochastic; that is they are fully controllable or at least fully predictable. We may consider the values of the explanatory variables to be held fixed as long as our sample amounts almost to the whole population of the Greek commercial banks.

As far as the errors in measurement are concerned, we cannot dismiss the possibility of their existence a priori. There are several possible sources of measurement errors in variables. The use of book values instead of market values in the procedure (as long as they differ), the possible presence of "window dressing" in the elements of the banks' balance sheets, as well as variations of composition within the balance sheet categories used as independent variables are a few of the causes that may generate measurement errors. However, one may assume that there are not any considerable errors of measurement in the independent variables. But even if there are some errors causing a bias to the estimates, this bias might not be significant.

The classical condition that no exact linear relationship must exist between any of the independent variables is violated in equation (2)[29]. An exact linear relationship exists among explanatory variables and consequently the model exhibits perfect collinearity. This problem arises from the fact that the sum of all assets [or asset proportions as far as equation (5) is concerned] equals the sum of all liabilities and equity (or liability plus equity proportions)[30]; that is,

$$\sum_{i=1}^{M} A_i/TA = \sum_{j=1}^{N} L_j/TA$$

The consequences of the presence of perfect collinearity in the model are that the estimates of the coefficients are indeterminate and the standard errors of these estimates become infinetely large[31]. However, the incidence of this problem can be achieved by incorporating the balance sheet identity directly into equation (2) or (5).

The balance sheet identity that every bank firm is facing to is

$$\sum_{i=1}^{M} A_i \equiv \sum_{j=1}^{N} L_j \equiv TA \tag{6}$$

As far as equation (5) is concerned, excluding one asset proportion from the asset side and one liability proportion from the liability side and adding an intercept, would eliminate perfect collinearity. For instance, the Mth asset and the Nth liability can be written as

$$A_M = TA - \sum_{i=1}^{M-1} A_i \quad \text{and} \quad L_N = TA - \sum_{j=1}^{N-1} L_j$$

Dividing by total assets, the Mth asset proportion and the Nth liability proportion can be written as

$$A_M/TA = [\ 1 - \sum_{i=1}^{M-1} A_i/TA\ ] \quad (7), \quad \& \quad L_N/TA = [\ 1 - \sum_{j=1}^{N-1} L_j/TA\ ] \quad (8)$$

Then, equation (5) can be written in the following way[32] which incorporates the above expressions.

$$Y/TA = a/TA + \sum_{i=1}^{M} b_i\ A_i/TA + \sum_{j=1}^{N} c_j\ L_j/TA + \varepsilon/TA - b_M\ A_M/TA +$$

$$+ b_M\ A_M/TA - c_N\ L_N/TA + c_N\ L_N/TA \qquad \Longrightarrow$$

$$Y/TA = a/TA + \sum_{i=1}^{M-1} b_i\ A_i/TA + b_M\ A_M/TA + \sum_{j=1}^{N-1} c_j\ L_j/TA +$$

$$+ c_N\ L_N/TA + \varepsilon/TA \qquad \overset{(7)\&(8)}{\Longrightarrow}$$

$$Y/TA = a/TA + \sum_{i=1}^{M-1} b_i\ A_i/TA + b_M\ [\ 1 - \sum_{i=1}^{M-1} A_i/TA\ ] +$$

$$+ \sum_{j=1}^{N-1} c_j\ L_j/TA + c_N\ [\ 1 - \sum_{j=1}^{N-1} L_j/TA\ ] + \varepsilon/TA \qquad \Longrightarrow$$

$$Y/TA = a/TA + \sum_{i=1}^{M-1} b_i\ A_i/TA + b_M - \sum_{i=1}^{M-1} b_M\ A_i/TA +$$

$$+ \sum_{j=1}^{N-1} c_j\ L_j/TA + c_N - \sum_{j=1}^{N-1} c_N\ L_j/TA + \varepsilon/TA \qquad \Longrightarrow$$

$$Y/TA = (b_M + c_N) + a\ 1/TA + \sum_{i=1}^{M-1} (b_i - b_M) A_i/TA +$$

$$+ \sum_{j=1}^{N-1} (c_j - c_N) L_j/TA + \varepsilon/TA \tag{9}$$

The independent variables of equation (9) are not exactly intercorrelated in a linear form and therefore it does not exhibit perfect collinearity. However, equation (9) is quite different from equation (5). First, it includes an intercept which is the sum of the coefficients of the deleted asset and liability. Second, the interpretation of the coefficients of the remaining assets and liabilities has changed. Asset and liability coefficients are now measured relative to the rate of return on the excluded asset and liability respectively. In other words, the estimated coefficients of any asset (or liability) are rates of return on that asset (or liability) less the rate of return on the excluded asset (or liability). The problem now is that the model does not provide any separate estimates of the coefficients of the omitted asset and liability, but only of their sum which is estimated by the intercept. The model is underidentified. Identification can be established by making one of the following assumptions or identifying restrictions.

(a) $b_M+c_N=0$. This means that either b_M and c_N are both zero, or they have equal absolute values opposite signed. If the second case is correct, underidentification still remains. By itself, therefore, this restriction is not sufficient to solve the problem. However, it has an advantage. It is testable within the model. By including an intercept in the estimated equation, one may examine if it is significantly different from zero. In the opposite case, the assumption of a zero sum of the coefficients of the excluded asset and liability is valid.

(b) $b_M=0$ and $c_N=0$. This assumption is similar to restriction (a), as it implies that $b_M+c_N=0$, but it is more accurate than the latter since it can grant identification to the model. However, it has a drawback. It is not testable within the model. Nevertheless, this is the restriction which has been employed by many statistical cost accounting studies. Usually cash has been omitted on the asset side and equity capital on the liability side. The justification of this exclusion is based on the notion that the rate of return on cash is zero ($b_{cash}=0$) and the cost of equity is not directly reflected in net income ($c_{equity}=0$)[33]. Dividends paid out are not deducted in computing a bank's net income and consequently equity capital lead to no cost on the bank's income statement. Moreover, equity is not typically manipulated to produce earnings.

(c) $b_M=\alpha$ or $c_N=\alpha$, where α has any particular value including zero. If one assumes that a specific asset or liability yields a constant non-zero return, then equation (9) is identified and can provide estimates of the remaining parameters of the model. However, this restriction suffers from the same weakness as the second assumption; its validity cannot be tested within the model. A special case of this restriction emerges when one assumes that a specific liability (or asset) has a zero return. Then, equation (2) becomes

$$Y = a + \sum_{i=1}^{M} b_i A_i + \sum_{j=1}^{N-1} c_j L_j + \varepsilon \qquad \text{or}$$

$$Y/TA = a/TA + \sum_{i=1}^{M} b_i \; A_i/TA + \sum_{j=1}^{N-1} c_j \; L_j/TA + \varepsilon/TA \qquad (10)$$

which does not exhibit perfect collinearity as the sum of all asset proportions does not equal the sum of all liability proportions; that is

$$\sum_{i=1}^{M} A_i/TA \neq \sum_{j=1}^{N-1} L_j/TA$$

Equation (10) does not have an intercept, as "a" is the coefficient of the reciprocal of total assets, and the coefficients of the model can be estimated by using OLS. An alternative approach would be to estimate equation (9) which contains an intercept, by assuming that a specific liability (or asset) has a zero return; that is, $c_N=0$. If the obtained estimate of the intercept is significantly different from zero, then it can be interpreted as the value of the other omitted asset (or liability) of the equation. By adding this value to the estimated differences of the coefficients of the asset (or liability) variables, we can acquire independent estimates of the coefficients of these variables. However, this approach is more complicated than the aforementioned, and should provide equivalent results. Moreover, both of them are not testable within the model.

From the preceding discussion it is obvious that although the first restriction is testable, it is not sufficient to identify the model. The second and third restrictions are sufficient to grant identification to the model, but they are not testable within it. If they are invalid, they will introduce specification error to the appropriate regression equation. And unfortunately, most of the specification errors lead to biasedness and inconsistency of the least squares estimates[34]. However, if the task is simply to estimate differences in yields between any two assets or liabilities, equation (9) can be used in its unrestricted form[35].

For the purposes of this chapter we employ the third restriction assuming that the rate or return on equity is zero. This should be the case as long as net income includes dividend payments and consequently equity contributes no expense on the income statement. Moreover, we do not exclude cash from the asset side of the estimated equation, partly because of the ambiguity of its definition and partly because Greek banks do not provide separate accounts for cash in their balance sheets[36]. Furthermore, even if our assumption is invalid, the specification error which will be introduced into the model will not shadow the scene as long as our task is to estimate differences in yields between two banking groups; the high-profitable group and the low-profitable one.

III.IV Some Critical Arguments Regarding the Capability of the Model

There are a number of problems related to the use of a statistical cost accounting model which cause less than ideal results. These problems are associated either with the technique itself or with the data it employs.

The technique could be criticized because it has no adjustment for differences in liquidity, risk, and maturity between various assets and liabilities. Although one may argue that "variations in rate of return reflect, among other things, variations in risk exposure"[37], interest rate ceilings might distort this exposure. There has been an accusation that these studies "suffer from the lack of theoretical constructs from which to derive behavioural relationships"[38] and their conclusions have be challenged. The interpretation of the regression coefficients "...as the marginal interest rates that an average sample bank could earn if it could substitute a dollar of the asset or liability for a dollar of vault cash"[39] has been characterized as incorrect. "If, for example, an asset item rises, the effect on profit is not simply the marginal return on that item. Since the level of vault cash is now reduced, the regression coefficient is an estimate of a linear approximation of the marginal return adjusted by the marginal cost and probability of short-term borrowing. Nor will the assumption of risk neutrality, implicitly made by Hester and Pierce [1975], alter the validity of this claim..."[40]. To overcome this problem and to obtain estimates of the marginal returns and costs of asset and liability items, Ratti (1980) has proposed the addition of the item $[-r_p\mu(b)]$ in the estimated regression; where r_p is the penalty rate that a bank suffering from insufficient reserves must borrow at, and $\mu(b)$ is the expected absolute value of a bank's reserve deficiency given that reserves will be deficient. However, if banks hold excess reserves or if a carry-over allowance is provided by the authorities (i.e. a procedure that permits banks to carry forward into the next reserve period a reserve deficiency or excess), $\mu(b)$ might be zero. To the extent that this conjecture is true, Ratti's adjustment is zero and the estimated coefficients can be interpreted as the marginal rates of return on balance sheet items. Moreover, the zero adjustment argument may be reinforced if the observed period is a long one (e.g. ten years). In this case, a deficiency adjustment might be offset by an excess one, and vice versa. This claim is valid as long as deficient reserves equal on the average excess reserves and the penalty rate equals on the average the interbank lending rate. Nevertheless, and regardless of its validity, this procedure cannot be employed and its significance be tested within a sample of Greek banks, because of the lack of analogous data.

Plotkin (1968) also claims that the estimated coefficients of the statistical cost accounting model are not marginal rates of return. His argument can be illustrated as follows[41]. Defining Y as income, A as total assets and D as deposits, the partial regression coefficient associated with $\partial(Y/A)/\partial(D/A)$ does not in general equal $\partial Y/\partial D$. This is because

$$\frac{\partial(Y/A)}{\partial(D/A)} = \frac{\partial(Y/A)}{\partial D}\,\frac{\partial D}{\partial(D/A)}$$

From the quotient rule of differentiation this relation can be written as

$$\frac{\dfrac{A\partial Y - Y\partial A}{A^2}}{\partial D}\;\frac{\partial D}{\dfrac{A\partial D - D\partial A}{A^2}} = \frac{A\partial Y - Y\partial A}{A^2\partial D}\;\frac{A^2\partial D}{A\partial D - D\partial A} =$$

$$= \frac{A \dfrac{\partial Y}{\partial D} - Y \dfrac{\partial A}{\partial D}}{A^2} \quad \frac{1}{\dfrac{A\partial D - D\partial A}{A^2 \partial D}} =$$

$$= \frac{A \dfrac{\partial Y}{\partial D} - Y \dfrac{\partial A}{\partial D}}{A^2} \quad \frac{1}{\dfrac{A - D \dfrac{\partial A}{\partial D}}{A^2}} =$$

$$= \frac{A . \dfrac{\partial Y}{\partial D} - Y \dfrac{\partial A}{\partial D}}{A^2} \Big/ \frac{A - D \dfrac{\partial A}{\partial D}}{A^2}$$

If the above relation equals $\partial Y/\partial D$, then

$$\frac{A \dfrac{\partial Y}{\partial D} - Y \dfrac{\partial A}{\partial D}}{A^2} \Big/ \frac{A - D \dfrac{\partial A}{\partial D}}{A^2} = \frac{\partial Y}{\partial D} \qquad ==>$$

$$A \frac{\partial Y}{\partial D} - Y \frac{\partial A}{\partial D} = A \frac{\partial Y}{\partial D} - D \frac{\partial A}{\partial D} \frac{\partial Y}{\partial D} \qquad ==>$$

$$Y \frac{\partial A}{\partial D} = D \frac{\partial A}{\partial D} \frac{\partial Y}{\partial D}$$

The above equation is true if and only if $Y/D = \partial Y/\partial D$. This equality means that Y can always be expressed as a linear function of D or any other balance sheet items. However, Plotkin (1968) argues that the true relationship may not be linear in general. Nevertheless, linearity holds to the extent that the assumption that banks earn constant marginal rates of return from elements of their portfolios is valid.

Furthermore, Plotkin (1968) claims that even if linearity is the case, D/A (or any other balance sheet proportion item) cannot be varied without altering either total liabilities (or assets) or other liability (or asset) items. This argument is based upon the balance sheet identity that links bank assets and liabilities. Consequently, $\partial(D/A)$ cannot be interpreted as meaning a change of the ratio of D to A without changing any other variable of the model, as long as the other variables are also deflated by A. However, this objection can be met by dividing the model (if it is necessary as otherwise this argument is not applicable) by another variable that is not related to the observed differences in banks' porfolios[42].

The data that has been used in statistical cost accounting studies might cause some ambiguity in the interpretation of the conclusions. The banks' balance sheets and income statements contain data which is not immediately amenable to economic application[43]. First, accounting and economic income differ in definition. The traditional accounting income[44] of a firm may be defined as the amount left over after deducting from gross income all payments to hired factors and an allowance for depreciation of capital equipment. However, economic income is not so easy to be defined. Economists have had divergent ideas on the concept of profit[45]. The best-known definition is that of Hicks (1946) who formulates a firm's profit as the maximum value which the company can distribute during the year, and still expect to be as well off at the end of the year as at the beginning[46]. The "well off" conception may interpreted as meaning that the company must own assets with the same present value. Hence, the Hickisian profit of a firm is equal to the present value of all future net cash flows of the company at the end of the period, minus that at the beginning, plus net cash flows arising within the period, minus any introduction of new capital by shareholders during the period. However, there are two major difficulties in measuring this economic income concept. First, the estimation of the present value of future cash flows is highly subjective, as the future is unknowable. And second, the aforementioned ex post income definition only provides a guide to the income distribution of a company if it is expected that this income will be maintained in the future. Various unanticipated events, luck or misfortune that may have affected current profit will prevent it from being indicative of likely future performance.

The aforementioned problems of measuring Hicksian profit in association with the disagreement of most economists about the definition of economic income, oblige us to utilize the traditional accounting profit for our study. Nevertheless, this use is consistent with the view that accounting income may be treated as a suitable surrogate for economic income as long as no preferable alternative measure of firms' earnings is available for empirical work.

Second, the asset variables are reported in book values which are diferent from economic values as the rates of return and the amount of assets are not corrected for changes in market values. "For many purposes, however, we would like to know what happened from year to year in actual or total or market-corrected returns.

The return on an asset may be positive or negative. It equals the sum of an interest component, plus any change in the present value of future cash flows due either to a shift in market interest rates or in the observed probability of default"[47]. Unfortunately, as long as we are unable to acquire the change in market values during the year for each of a bank's assets or class of assets, we are not in a position to estimate their actual returns.

Third, potential "window dressing" might cause an upward bias in estimates of returns. Banks in order to show their cash ratios substantially higher than they were at other times of the year, might have increased temporarily their holdings of cash and decrease their non-deposit debts by reducing their stocks of earning assets. Accordingly, their gross income is shown to be generated by a lower average stock of earning assets than it actually had been. Thus, an upward bias of the yields of earning assets will be produced. However, this bias is unlikely to be important if net operating income is used as a dependent variable, because in case of "window dressing" both revenues and costs will be biased upward.

III.V A Brief Review of the Relevant Literature

Many authors have used statistical cost accounting models for various purposes. These studies do differ, "...in the way they have handled the difficulties of interpretation posed by the balance sheet identity and the attendant potential for specification error"[48]. Therefore, one[49] may classify these studies in two main categories[50]:

(i) The first category comprises the studies that impose restrictions on the excluded item(s) of the balance sheet in order to recover estimates of the parameters of the model. This group can be divided into three subsections regarding the type of the restriction.

(α) The sum of the yields of the excluded asset and liability equals zero and therefore the model should be estimated without an intercept. The first estimated equation of Rose and Wolken (1986) falls into this category. However, by testing the assumption that the sum of cash and equity equals zero, they report that the estimated value of the intercept is positive and statistically significant. Consequently, they state that their assumption is incorrect for their sample of banks and the estimated coefficients would be biased.

(β) The yields of the excluded asset and liability equals zero and therefore the model should be estimated without an intercept. The studies of Hester and Pierce (1975), Hester (1979), Kwast and Rose (1982), Gendreau (1983), and Kwast and Black (1983) belong to this group. However, Hester and Pierce (1975) report that in two of their four estimated regressions the intercept is significantly different from zero[51], but they have decided to suppress it because "inclusion of an intercept makes the interpretation of estimated interest rates somewhat ambiguous"[52]. Hester (1979) also states the finding of an intercept statistically different from zero, but he decide to suppress it. Both these studies [i.e. Hester and Pierce (1975) as well as Hester (1979)] employ models that are deflated by total assets. Therefore, the inclusion of an intercept would imply the existence of earnings that are linearly related to bank size, but unrelated to portfolio composition[53].

But Hester (1979) argues that this approach may introduce ambiguity into the interpretation of the estimated coefficients, because there is no method of distributing an estimated intercept across the regression coefficients of assets and liabilities[54]. Nevertheless, omission of the intercept for any reasons, when it is significantly different from zero, leads to specification error. Kwast and Black (1983) exclude cash and equity capital from their model and estimate it correctly without an intercept. They also add a time trend in their model which shows the growth path of their sample banks, as their study covers a three-and-one-half-year period. Kwast and Rose (1982) omit cash and equity capital from their model assuming that their yields are zero. They also incorporate into their model, which they call an expanded least squares cost accounting one[55], the Herfindahl-Hirschman market concentration index (H-index) associated with each bank observation, a set of region binary variables and a set of year binary variables. However, they do not employ an F test to decide upon whether they should include the dummy variables in their model or not[56]. Gendreau (1983) deletes vault cash and capital accounts from his model. Testing for the existence of an intercept, he finds it not significantly different from zero and by suppressing it, a reduction in the standard errors on the remaining coefficients is produced.

(v) The yield of either an asset or a liability is zero. The work of Kwast (1981) can be contained in this section. Although he excludes cash and capital account of his regressions, he assumes that only the rate of return on cash is zero. However, by not assuming a zero yield on the omitted liability and not interpreting his estimates adequately, his results might be disputable. The second estimated equation of Rose and Wolken (1986) is also in this category. Their identifying restriction is the assumption that the return on equity is zero (which of course is not testable within the model).

(ii) The second category consists of studies that estimate the model without explicitly employing any restrictions and therefore their estimated coefficients do not represent absolute rates of return on each asset and liability of their model, but deviations from the omitted variables. This category can divided into two subsections regarding the estimation with or without an intercept.

(α) Estimation with an intercept. The papers of Graham (1977) and Ratti (1980) belong in this section. However, only Graham (1977) takes into account that his estimated coefficients are deviations of the excluded asset and liability elements. Ratti (1980) excludes reserves from his model, without though making any assumption regarding the yield of the omitted asset. Moreover, he does not report any appropriate modification of the interpretation of the estimated coefficients. In the same category may also be classified the works by Taylor (1968), and Haslem and Longbrake (1971a) who estimate a variation of the model in order to relate the average loan interest rates charged by the individual banks to their loan mix.

(β) Estimation without an intercept. The works by Hester and Zoellner (1966), Bond (1971), and Maisel and Jacobson (1978) are in this group. Hester and Zoellner (1966) exclude three variables of their regressions[57], but they do not make any explicit assumptions regarding their yields. In addition, they find that the intercept usually is positive and significant in about one-third of their regressions, but they suppress it since they find that the "inclusion of the intercept aggravates collinearity. Standard errors of all coefficients typically rise when an intercept is included"[58]. However, omission of a significant intercept, causes specification bias. Bond (1971) reports that "the exclusion of certain variables was necessary in order to avoid perfect multicollinearity. These variables include federal funds, banker's acceptances, interbank time deposits, etc."[59]. But he does not employ any explicit assumptions for the yields of the excluded balance sheet items and therefore the interpretation of the estimated coefficients might be disputable. Moreover, his model does not include an intercept. Finally in Maisel and Jacobson's (1978) work neither the exclusion of any balance sheet element is reported, nor the inclusion of an intercept is stated.

III.VI The Data

The data assets and liabilities employed for the study of this chapter are obtained from bank balance sheets. Balance sheets report year-end data. Therefore, we transform them to mid-year data by averaging (using the money weighted arithmetic mean) each year-end balances with the year-end balances of the previous year.

The data of the earnings of the firms are obtained from bank income statements.

Finally, recall that our sample consists of ten years (1977-1986) observations of eight Greek commercial banks; in total eigthy observations.

III.VII Estimation Method

We start our estimation procedure by assuming that the rate of return on equity is zero[60]. Then, equation (2) can be written in the following form:

$$Y_{kn} = a + \sum_{i=1}^{M} \sum_{k=1}^{K} \sum_{\eta=1}^{H} b_i A_{ik\eta} + \sum_{j=1}^{N} \sum_{k=1}^{K} \sum_{\eta=1}^{H} c_j L_{jk\eta} + \varepsilon_{k\eta} \tag{11}$$

where k denotes the number of banking firms and therefore k=1,2,...,8; η denotes the time period studied and therefore η=1,2,...,10.

The model of equation (11) can be used to estimate different rates of return on balance sheet items for the high-profitable banks alone and the low-profitable banks alone. To accomplish this task we divide our sample banks in two groups. The first group incorporates the four more profitable firms, while the second the four less profitable firms. Any split of this nature bound to be ad hoc, but it is necessary to divide the sample into high and low profit groups in order to highlight their differences regarding rates of return on identical assets and liabilities. The idea is that these differences in yields may explain why some banks are more profitable than others.

Let us assume now that all the coefficients of equation (11) are constant for each bank group. That is, there is a common intercept and a common set of slope coefficients for each bank class for the whole time period studied (i.e. 1977-1986). This assumption may seem too strigent, but it is necessary for our purpose as we can employ neither solely cross-section nor solely time-series analysis due to the small population of the Greek commercial banks. This assumption permits us to run an OLS regression for each bank group by pooling all the respective observations.

The regression analysis employed in this chapter utilizes two income measures as dependent variables: net income before income taxes, and net augmented income before income taxes. Net income before taxes is the income that a bank receives in a year minus operating costs (including interest expenses), loan losses and securities losses (or gains). This income measure is the closest approximation of the profit from which dividends may be distributed and therefore it is most likely to appear in a bank's objective function. Net augmented income before taxes differs from net income in that it includes staff salaries, contributions to the staff welfare funds and general expenses and third party remunerations. Consequently, the difference of these two income definitions should be a measure of bank operating expenses. Furthermore, the estimates of the first regression (i.e. the regression which employs net income before taxes as a dependent variable) may be interpreted as rough estimates of marginal rates of return net of operating costs, loan loss provisions, and depreciations. The estimates of the second regression may be interpreted as marginal rates of return incorporating though directly associated operating expenses. Thus, the difference among the estimated coefficients obtained by the aforementioned two regressions may be an estimate of the operating costs associated with servicing each particular asset or liability.

At first we report the estimation procedure of the regressions employed the first income measure (i.e. net income before taxes) as a dependent variable and subsequently the second.

To test for heteroscedasticity in our model, a Breusch-Pagan test is employed[61]. The relevant statistic is $\eta=39.33362$ for the model applied to the first bank group and $\eta=22.66480$ to the second. The tabulated critical value of chi-square with 15 degrees of freedom is 24.996 at the 5 per cent level of significance and 30.578 at the 1 per cent. Thus, the null hypothesis that the errors are homoscedastic would be rejected for the first group, but it would be accepted at the 5 per cent level for the second group.

To eliminate heteroscedasticity from the errors of the model of the first bank group, we assume that the variance of the disturbances is of the form $\sigma^2 TA$ and we deflate equation (11) by the square root of total assets[62]. A reapplication of the Breusch-Pagan test to the deflated model provides a statistic $\eta=16.45448$. Consequently, the null hypothesis of homoscedasticity can be accepted at the 5 per cent level of significance.

Our observations also consist of time series data (as well as cross-section) and therefore it is possible that the assumption of serial independence of the values of the disturbances may be violated. To test for autocorrelation in our model, we cannot utilize the Durbin-Watson statistic because of the transition of the ordered sample across banking firms. Instead, the autocorrelation coefficient (ρ) is computed directly using the regression residuals and assuming that the parameter ρ has the same value for all the banks (i.e. all cross-sectional units)[63]. The value of the autocorrelation coefficient is found $\rho=-0.15974$ for the model applied to the first bank group and $\rho=0.05196$ to the second. The magnitudes of the estimated ρ values offer no evidence of correlated disturbances[64].

The employed assumption that regression coefficients are equal across all banks and over all years studied may seem too strong. Therefore, we replace it by the assumption that the slope coefficients are constant, but the intercept varies across banking firms and over time. This assumption may also appear quite strong. A more general one would be that all coefficients vary over time and firms. However, the number of sample banks is very limited (i.e. eight banks) and therefore it is better to treat the slope coeffients as fixed even when the random assumption looks more attractive[65]. This means that the intercept contains a component that is constant over time and varies from firm to firm, and also a component that varies over time and is constant across firms. The idea behind this kind of model is the supposition that each banking firm and each time period are characterized by their own special intercept.

Two alternative approaches have been suggested for the above case: the "fixed effects" (FE) models and the "random effects" (RE) models. For the purpose of our study we utilize a FE model because the number of firms in our sample is small and the time effects as well as the firms' effects of the intercept may be correlated with the explanatory variables[66]. This approach, which is called least squares with dummy variables (LSDV), or analysis of covariance (ANCOVA), includes dummy variables for the firms as well as the time periods in the model in an attempt to improve the specification of the classical pooling model.

Knowing that "if one needs to differentiate N items, N-1 dummy variables will suffice"[67], we use three bank binary variables and nine year binary variables. The effects of the omitted binary variables will be captured by the regression intercept. Furthermore, the coefficients of the included dummy variables will represent the effect of the difference of the included dummy from the omitted dummies on the income measure (i.e. differential effects)[68]. Thus, the LSDV model takes the following form:

$$Y_{k\eta} = a + \sum_{i=1}^{M}\sum_{k=1}^{K}\sum_{\eta=1}^{H} b_i A_{ik\eta} + \sum_{j=1}^{N}\sum_{k=1}^{K}\sum_{\eta=1}^{H} c_j L_{jk\eta} + \sum_{k=1}^{K-1} d_k D_k + \sum_{\eta=1}^{H-1} t_\eta T_\eta + \varepsilon_{k\eta}$$

where k denotes the number of banks and for the first group is k=1,2,3,4 while for the second is k=5,6,7,8; η denotes the time period and $\eta=1,2,\ldots,10$; D represents the bank dummy variables; T represents the year dummy variables; d_k and t_η are the coefficients of bank dummy and year dummy variables respectively.

However, several problems are associated with the use of this model[69]. First, the coefficients of the dummy variables are difficult to interpret. Moreover, dummy variables measure the shifts of the regression line over time and across firms, but they do not identify the variables that might cause these shifts. Finally, the model is using up a large number of degrees of freedom, the decrease of whom will decrease the statistical power of the model.

To decide upon whether we should include the dummy variables in our model and consequently sacrifice the associated degrees of freedom (i.e. 12 degrees of freedom), or omit them absolutely, we utilize an F test. This test compares the restricted (i.e. the intercepts are restricted to be equal across banks and over time in our classical pooling model) and the unrestricted residual sum of squares. The relevant F-Statistic is F=1.24875 for the first bank group and F=1.27366 for the second. The tabulated critical values of F with (12,12) degrees of freedsom is 2.69 at the 5 per cent level of significance and 4.16 at the 1 per cent level. Thus, we cannot reject the null hypothesis that the equal-intercept restrictions are correct at the 5 per cent level of significance for both banking groups. Consequently, we do not employ the LSDV model for our study.

In addition, a Chow test is performed to determine whether the set of coefficients obtained from the two bank classes differ significantly[70]. The relevant statistic is F=11.55167. The tabulated critical values of F with (16,48) degrees of freedom is 1.86 at the 5 per cent level of significance and 2.40 at the 1 per cent level. Thus, we reject the null hypothesis of no structural change at the 1 per cent level.

Tables III.2 and III.3 show the regression results of our model for the two banking groups. Nine out of the sixteen coefficients of the first regression are statistically significant in a two-tailed t test and ten coefficients of the second regression. The coefficient of multiple determination (R^2)is very high in both cases[71], showing that 94 and 99 per cent of the variation of the dependent variable is explained by the regression plane for the first and the second banking class respectively. The F-Statistics calculated from the regressions are much higher than the tabulated critical values of the F distribution at the 1 per cent level of significance with (15,24) degrees of freedom [$F_{0.01(15,24)}$=2.89]. Hence, we reject the null hypothesis of no relationship between the dependent and the independent variables at the 1 per cent level of significance for both banking groups.

The aforementioned regression analysis is also applied to the model of equation (11), with net augmented income before taxes as dependent variable. At first, an OLS regression is run for both banking groups.

To test for heteroscedasticity a Breusch-Pagan test is employed. The relevant statistic is $\eta=24.24581$ for the model applied to the first bank group and $\eta=36.93943$ to the second. Thus, the null hypothesis of homoscedastic disturbances is accepted for the first class, but rejected for the second. To correct for heteroscedasticity in the model applied to the second group, we employ a number of transformations. However, none of them provide a Breusch-Pagan statistic that could accept the null hypothesis. Consequently, we apply the formulae suggested by White[72] to compute consistent variances of the estimators. Hence, we can apply the formulae of the variances of the coefficients to conduct test of significance and costruct confidence intervals, assuming of course that the asymptotic properties hold approximately in a sample as small as ours.

To test for autocorrelation we compute the autocorrelation coefficient in the way described previously. The value of the parameter ρ is found $\rho=-0.36742$ for the first group and $\rho=-0.23005$ for the second, offering some evidence of correlated disturbances.

To correct for autoregression, assuming first-order pattern, we apply the Cochrane-Orcutt iterative method. Regarding the first group, rho is estimated as $\rho=-1.08471$. To ensure location of a global minimum we also apply the Hildreth-Lu method. This search technique is provided a similar to the Cochrane-Orcutt estimation of rho ($\rho=-1.10000$). However, the value of rho cannot be dimineshed beyond -1.00 ex hypothesi[73]. Accordingly, we assume that $\rho=-1.00$[74]. Under this assumption the appropriate transformation is to take the first sums of the original data and apply OLS to the transformed model. This is the procedure that is performed. We should bear in mind, however, that the errors of the transformed model are serially independent as long as the true value of the autoregressive coefficient coincides with the assumed. Nevertheless, the assumed value of rho is very closed to the estimated value of rho by both the aforementioned techniques and therefore the problems that arise from the assumed pattern of autocorrelation should have been eliminated.

As far as the second banking group is concerned, the rho is estimated by the Cochrane-Orcutt as $\rho=0.0816125$ and is found statistically insignificant. The estimation of rho by the Hildreth-Lu techique is $\rho=0.150000$ and is also found statistically insignificant. Hence, the evidence sugest that there is no first-order autocorrelation in the model applied to the second group.

Subsequently, we employ an F test to decide upon whether we should include a set of bank and year dummy variables in the model. The relevant statistic is found F=1.46243 for the first group and F=2.42505 for the second. Thus, we cannot reject the null hypothesis that the equal intercept restrictions are correct at the 5 per cent level of significance for both banking classes. In consequence, we do not utilize the LSDV model for our study.

Tables III.5 and III.6 report the regression results for the first and the second banking group respectively. Thirteen out of the sixteen coefficients of the first regression are statistically significant in a two-tailed t test and twelve coefficients of the second regression. The coefficient of multiple determination (R^2) is very high in both cases, showing that 99 per cent of the variation of the dependent variable is explained by the regression plane. The F-Statistics calculated from the regressions are much higher than the tabulated critical values of the F distribution at the 1 per cent level of significance with (15,24) degrees of freedom. Thus, we reject the null hypothesis of no relationship between the dependent and the independent variables at the 1 per cent level of significance for both banking groups.

III.VIII Empirical Results

The explanatory variables employed in the aforementioned regression analysis are discribed in table III.1

Tables III.2 and III.3 report the estimated coefficients of the model that employs net income before income taxes as dependent variable and is applied to the first banking group and the second

TABLE III.1

Definition of Variables

Symbol	Description
A1	Cash and due from banks
A2	Discounts
A3	Loans and advances up to one year
A4	Loans and advances over a year
A5	Sundry asset accounts
A6	Total securities
A7	Buildings and other fixed assets
A8	Unclassified and miscellaneous assets
L1	Loss provisions
L2	Sight deposits
L3	Savings deposits
L4	Time deposits
L5	Sundry liability accounts
L6	Dividends payable
L7	Unclassified and miscellaneous liabilities

TABLE III.2

Regression Results for the First Banking Group

Dependent Variable: Net Income before Taxes

Variables	Coefficients	t-Statistics
1/√TA	-0.0049864410	-0.32492620
A1	0.0426714800	2.70161500*
A2	0.1471553000	2.73021300*
A3	0.0805507900	2.53842600*
A4	0.0550044900	1.97953800
A5	0.0834568800	3.32462700**
A6	-0.1752478000	-2.38352600*
A7	0.2232203000	1.17703000
A8	0.1569095000	1.80846300
L1	1.1432380000	1.75908800
L2	-0.1352061000	-2.59820600*
L3	-0.0668508200	-3.68770600**
L4	-0.1017825000	-2.32564000*
L5	-0.0002202201	-0.03227667
L6	1.5174820000	2.02006500
L7	0.7133620000	3.62895100**

SER = 0.0158887
R^2 = 0.937160

$\bar{R}^2$ =0.897885
F-Statistic = 23.8599

Note:
Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.

respectively. These estimates appear generally reasonable. All but one the rates of return on assets are found positive, while most of the rates of return on liabilities are negative. As previously mentioned, these coefficients may be interpreted as rough estimates of marginal rates of return or cost, net of operating costs, loan losses and capital losses or gains on securities[75].

The intercept of the first banking group is found

TABLE III.3

Regression Results for the Second Banking Group

Dependent Variable: Net Income before Taxes		
Variables	Coefficients	t-Statistics
C	-0.029445000	-2.2374050*
A1	0.120160600	2.7414690*
A2	0.083012710	1.5836070
A3	0.066690970	1.4957640
A4	0.114563100	3.0531130**
A5	0.128741600	2.9463760**
A6	0.142525200	2.3004420*
A7	0.081984290	4.3194890**
A8	0.081833080	1.5877060
L1	-0.043399230	-0.3056351
L2	-0.079621670	-1.4819240
L3	-0.093433202	-2.3476430*
L4	-0.129639500	-2.8737900*
L5	-0.117472800	-2.8607440*
L6	2.524707000	12.1352800**
L7	0.042426740	0.3737899
SER = 0.0402317 R^2 = 0.999357 $\bar{R}^2$ =0.998954 F-Statistic = 2484.91		

Note:
Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.

insignificantly negative and the second significantly negative. It is worth mentioning, however, that the former is the estimate of the reciprocal of the square root of total assets, whereas the latter is the estimate of a constant term. The finding of a significantly negative intercept for the low-income banks suggests that the net expenses that are unrelated to their balance sheet items exceed their respective earnings.

The coefficient of cash and due from banks is found significantly positive for both banking groups.. However, low-earnings firms appear to enjoy 12 per cent per year rate of return on this particular asset category, while high-earnings firms only 4.3 per cent. In other words, the second class realizes a higher rate of return on cash and due from banks, than the first banking class. This divergence may be explained by the conjecture that the composition of cash and due from banks of low-performance banks favours more interest-bearing components that are also less liquid, than that of their high-performance rivals[76].

The coefficient of discounts is significantly positive for the first banking group and insignificantly positive for the second. The estimated annual rate of return on discounts of the high-earnings banks is 14.7 per cent.

The coefficient of loans and advances up to one year is found significantly positive for the first class and insignificantly positive for the second. The estimated rate of return on this asset category is 8.0 per cent per annum for the high-income group.

The coefficient of loans and advances over a year is found insignificantly positive for the more profitable sample firms and significantly positive for the less profitable firms. The estimated return for the low-profit financial institutions is 11.5 per cent per year.

The coefficient of sundry asset accounts is found significantly positive for both banking categories. However, low-earnings firms appear to earn a higher rate of return on these asset accounts, than their high-earning opponents. The former are found to earn 12.9 per cent per year, while the latter only 8.3

per cent. Nevertheless, this odd divergence should not bother us enormously due to the unknown composition of these accounts.

The coefficient of total securities is found significantly negative for the first banking class and significantly positive for the second. High-performance banks appear to experience a rate of cost on securities of 17.5 per cent per annum, whereas low-performance banks a rate of return of 14.2 per cent. The negative estimate for the first group does not seem very realistic. However, it may be attributed to realized capital losses on total securities. Apart from this explanation, it is possible that one of the components of total securities (e.g. participations) may yield a high negative return that not only offsetting the positive returns of the other components, but also enforce the whole account to exhibit a negative sign[77].

The coefficient of buildings and other fixed assets is found insignificantly positive for the first banking class and significantly positive for the second. The estimated annual rate of return on this asset category is 8.2 per cent for the low-earnings firms.

The estimated rates of return on unclassified and miscellaneous assets are found insignificantly positive for both banking groups. Consequently, no inference can be drawn about the yields of this asset account.

The coefficient of loss provisions is found insignificantly positive for the first group and insignificantly negative for the second. In consequence, no conclusions can be drawn about the rates of costs on loss provisions.

The coefficient of sight deposits is found significantly negative for the first banking class and insignificantly negative for the second. The estimated rate of cost on sight deposits for the high-performance firms is 13.5 per cent per annum. This estimate appears unreasonably high. One possible explanation is that this group of banks tend to have relatively more interest-bearing current account deposits, than non interest-bearing sight deposits[78]. Another explanation could be the existence of implicit interest expenses like free banking, free other services and so forth.

The estimated rate of return on savings deposits is found significantly negative for both banking groups. The first class experience an annual rate of cost of 6.7 per cent, while the second of 9.3 per cent.

The coefficient of time deposits is found significantly negative for both groups. The estimated rate of cost on time deposits is 10.2 per cent per year for the first class, whereas 13.0 per cent for the second. The estimated difference of 2.8 percentage points may be attributed to a different composition of time deposits between the two banking groups. That is, high-earnings firms may have relatively more low-interest time deposits than their low-earnings opponents[79]. The aforementioned divergence of the estimated rates of costs on savings and time deposits between the two banking groups, suggests that the cost of funds of the high-earnings firms may be lower than that of the low-earnings firms.

The estimated net rate of return on sundry liability accounts is found insignificantly negative for the first class and significantly negative for the second. Low-income banks appear to experience an annual rate of cost of 11.7 per cent on this liability category during the period examined.

The coefficient of dividends payable is found just insignificantly positive for the first class and significantly positive for the second. This positive relationship is expected as an increase (decrease) in net income most of the times is accompanied by an inrease (decrease) in dividends payable.

The coefficient of unclassified and miscellaneous liabilities is found significantly positive for the first banking group and insignificantly positive for the second. However, the positive sign of this kind of liabilities should not trouble us excessively, partly because of their relatively small volume and partly because of the unknown of their composition.

Table III.4 reports the differences of the estimated rates of return or cost on bank balance sheet items presented in tables III.2 and III.3. Five out of the sixteen differences in coefficients are found statistically significant in a one-tailed z test[80]. Consequently, high-income financial firms appear to experience a lower return on cash and due from banks, as well as total securities, but a higher return (or a relatively lower rate of cost) on loss provisions, sundry liability accounts, as well as unclassified and miscellaneous liabilities than low-income firms.

To sum-up, the preceding analysis seems to provide some support to two conclusions. First, high-income banks do not seem able to earn higher net rates of return on their assets, than their low-income rivals. In fact, the findings presented in table III.4 suggest exactly the opposite. And second, high-earnings firms appear to out-perform their low-earnings counterparts with respect to liabilities.

The estimates presented in tables III.5 and III.6 appear generally plausible in that their signs conform to a priori

TABLE III.4

Differences of the Estimated Yields
Presented in Tables III.2 & III.3

Variables	Difference in Coefficients	z-Statistics
C	0.0244586	1.2098
A1	-0.0774892	-1.6632*
A2	0.0641426	0.8531
A3	0.0138598	0.2532
A4	-0.0595587	-1.2756
A5	-0.0452848	-0.8986
A6	-0.3177730	-3.3051**
A7	0.1412361	0.7410
A8	0.0750765	0.7439
L1	1.1866372	1.7838*
L2	-0.0555845	-0.7431
L3	0.0265812	0.6078
L4	0.0278570	0.4432
L5	0.1172526	2.8168**
L6	-1.0072250	-1.2922
L7	0.6709353	2.9558**

Note:
Starred *(**) terms indicate parameters statistically significant at the 0.05 (0.01) confidence level in a one-tailed z test.

expectations. All the rates of return on assets but one are found positive and most of the significant rates of return on liabilities are found negative. As previously discussed, these coefficients should approximate the marginal rates of return or cost that banks realize from holding various assets and liabilities, including directly associated expenses. Consequently, the difference between the estimates reported in tables III.5 and III.2, as well as III.6 and III.3 should be attributed to operating costs associated with servicing each particular asset or liability.

The intercept of the first banking group is found

TABLE III.5

Regression Results for the First Banking Group

Dependent Variable: Net Augmented Income before Taxes		
Variables	Coefficients	t-Statistics
C	0.0843328500	2.4463110*
A1	0.1310175000	7.1216750**
A2	0.3802931000	7.0562150**
A3	0.1170582000	4.8701810**
A4	0.0920165100	3.3264690**
A5	0.1720721000	7.5996810**
A6	-0.0460896900	-0.8791674
A7	0.7779087000	4.4176300**
A8	0.5336461000	6.3746350**
L1	0.4223130000	0.8294220
L2	-0.2091806000	-4.6427500**
L3	-0.1214523000	-6.1594430**
L4	-0.2063081000	-5.2483670**
L5	0.0012688414	0.1754090
L6	3.4750700000	4.2649630**
L7	0.9298419000	5.9770500**
SER = 0.142826		
R^2 = 0.999851		
$\bar{R}^2$ = 0.999739		
F-Statistic = 8944.68		

Note:
Starred *(**) terms indicate parameters statistically different from zero at 0.05 (0.01) confidence level in a two-tailed t test.

significantly positive, while the second insignificantly positive. The finding of a positive intercept for the high-income banks indicates that the earnings that are unrelated to their balance sheet items exceed their respective expenses.

The coefficients of cash and due from banks are found significantly positive for both banking groups. High-earnings firms appear to enjoy an annual rate of return on this particular asset category of 13.1 per cent, while low-earnings firms 26.0 per

TABLE III.6

Regression Results for the Second Banking Group

Dependent Variable: Net Augmented Income before Taxes		
Variables	Coefficients	t-Statistics
C	0.009752496	0.4822190
A1	0.260305600	3.4940320**
A2	0.206731400	2.3480490*
A3	0.202551500	2.9451550**
A4	0.188206700	2.6192360*
A5	0.235789200	3.5531070**
A6	0.175421500	1.9074650
A7	0.317461300	8.3308620**
A8	0.299623300	3.3465270**
L1	0.202103600	0.9758103
L2	-0.232747600	-2.5828870*
L3	-0.179123900	-2.8123620*
L4	-0.273635100	-3.5786280**
L5	-0.199552200	-2.6491070*
L6	2.400602000	5.0486980**
L7	0.316813200	1.7810060

SER = 0.0919454
R^2 = 0.999960

$\bar{R}^2$ = 0.999935
F-Statistic = 39732.1

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

cent. This finding is similar to the one reported in tables III.2 and III.3, in that the second class experience a higher rate of return on cash and due from banks, than the first class. Furthermore, the divergence of the respective coefficients (i.e. the difference of the estimates presented in tables III.5 and III.2, as well as III.6 and III.3) implies that the first group realizes a rate of operating cost on this asset category of 8.8 per cent per year, whereas the second group of 14 per cent.

The coefficients of discounts are found significantly positive for both groups. The estimated annual rate of return on discounts for the high-income banks is 38.0 per cent, while for the low-income firms is 20.7 per cent. The rate of operating cost on discounts for the first group should approximate 23.3 per cent per year.

The coefficients of loans and advances up to one year are found significantly positive for both banking classes. The estimated rate of return for the first class is 11.7 per cent per year, whereas for the second is 20.2 per cent. That is, low-income banks appear to earn a higher rate of return on this asset category than their high-income counterparts. The estimated operating rate of cost on loans and advances up to one year for the first group is approximately 3.7 per cent.

The coefficients of loans and advances over a year are found significantly positive for both groups. The estimated rate of return for the first group is 9.2 per cent per annum, while for the second is 18.8 per cent. This finding implies that low-earnings firms experience a higher rate of return on this asset category than their high-earnings opponents. The estimated operating rate of cost on loans and advances over a year for the second class seems to be 7.3 per cent per year.

The coefficients of sundry asset accounts are found significantly positive for both classes. The estimated return on this kind of accounts for the high-performance banks is 17.2 per cent per year and for the low-performance banks is 23.6 per cent. These estimates suggest that the second group earns a higher return on sundry asset accounts than the first. The annual operating rate of cost appears to approximate 8.9 per cent for the first class and 10.7 per cent for the second.

The coefficient of total securities is found insignificantly negative for the first banking group and insignificantly positive for the second. Consequently, no inference can be drawn about their estimated values.

The coefficients of buildings and other fixed assets are found significantly positive for both groups. The estimated rate of return for the high-earnings firms is 77.8 per cent per annum and for the low-earnings is 31.7 per cent. These estimates appear unreasonably high. However, the finding that the estimated operating rate of cost on this asset category for the second group is 23.5 per cent, suggests that the major component of the preceding estimated returns are operating expenses.

The coefficients of unclassified and miscellaneous assets are found significantly positive for both financial classes. High-earnings firms appear to enjoy an annual rate of return on this asset category of 53.4 per cent and low-earnings firms of 30.0 per cent. However, the insignificant results obtained from the net income regressions may imply that the operating costs of this kind of assets are quite high.

The coefficients of loss provisions are found insignificantly positive for both groups. In consequence, no conclusions can be drawn about the rates of cost of this liability category.

The coefficients of sight deposits are found significantly negative for both banking classes. High-income firms seem able to experience an annual rate of cost of 20.9 per cent, while the low-income firms of 23.3 per cent. This result appears surprisingly high. It may be attributed partly to the high servicing cost per cheque, as cheques are not very popular as a means of payment in the country, and partly to the aforementioned structure of this account. None the less, the above finding suggests that the first group has a lower rate of cost on sight deposits than the second. Moreover, the estimated operating rate of cost on this kind of deposits for the first group approximates 7.4 per cent per annum.

The coefficients of savings deposits are found significantly negative for both bank categories. The estimated return on this kind of deposits for the first group is 12.1 per cent per year and for the second is 17.9 per cent. That is, the estimated rate of cost on savings deposits is lower for the high-earnings banks than for the low-earnings. The estimated operating rate of cost on savings deposits should be about 5.4 per cent per year for the first group and 8.6 per cent for the second.

The coefficients of time deposits are found significantly negative for both classes. The estimated rate of return on this kind of deposits is 20.6 per cent per year for the first class and 27.4 per cent for the second. This finding indicates that the rate of cost on time deposits is higher for the low-earnings banks, than for the high-earnings. The estimated operating rate of cost approximates 10.4 per cent per annum for the first group and 14.4 per cent for the second.

The coefficient of sundry liability accounts is found insignificantly positive for the high-performance banks and significantly negative for the low-performance firms. The estimated annual rate of cost appears 19.9 per cent for the second group. This estimate implies that the operating rate of cost of this liability category for the low-earnigs banks is about 8.2 per cent per annum.

The coefficients of dividends payable are found significantly positive for both banking groups. However, this positive relationship is already expected as previously mentioned.

Finally, the coefficient of unclassified and miscellaneous liabilities is found significantly positive for the first class and insignificantly positive for the second. The estimated return for the high-earnings banks appears unreasonably high, but the argument mentioned before when we interpreted the net income regression results should be applicable at this situation as well. Nevertheless, the annual operating rate of cost on this kind of liabilities for the first group is approximately 21.7 per cent.

Table III.7 tabulates the differences of the estimated rates of return or cost on bank balance sheet items reported in tables III.5 and III.6. Eight out of the sixteen differences in coefficients are found statistically significant in a one-tailed z test. Consequently, high-income banks appear to experience lower rates of return on cash and due from banks as well as total securities, but higher rates of return (or relatively lower rates of cost) on discounts, buildings and other fixed assets, unclassified and miscellaneous assets, sundry liability accounts as well as unclassified and miscellaneous liabilities, than low-income banks. A comparison of the findings presented in tables III.4 and III.7 seems to indicate that the operating rate of cost of discounts, buildings and other fixed assets as well as unclassified and miscellaneous assets is higher in the first group than in the second, while the operating rate of cost on loss provisions is the other way round.

TABLE III.7

Differences of the Estimated Yields Presented in Tables III.5 & III.6

Variables	Difference in Coefficients	z-Statistics
C	0.0745804	1.8660*
A1	-0.1292881	-1.6848*
A2	0.1735617	1.6813*
A3	-0.0854933	-1.1735
A4	-0.0961902	-1.2493
A5	-0.0637171	-0.9087
A6	-0.2215111	-2.0925*
A7	0.4604474	2.5556**
A8	0.2340228	1.9092*
L1	0.2202094	0.4006
L2	0.0235670	0.2339
L3	0.0576716	0.8650
L4	0.0673270	0.7831
L5	0.2008206	2.6537**
L6	1.0744680	1.1389
L7	0.6130287	2.5941**

Note:
Starred *(**) terms indicate parameters statistically significant at the 0.05 (0.01) confidence level in a one-tailed z test.

III.IX Concluding Remarks

The hypothesis that is tested in this chapter is proved generally valid. Most of the estimated rates of return on assets (liabilities) are found positive (negative) and vary across assets (liabilities). Moreover, the preceding study seems to support three conclusions as far as the interbank differences in profitability is concerned. First, there are no evidence to suggest that high-profit banks earn higher rates of return on their assets than their low-profit counterparts. Second, the regression results indicate that high-earnings financial firms may experience lower rates of cost on their liabilities than their low-earnings rivals. This finding implies that liability management is an important factor in achieving high earnings in Greek banking. And last but not least, the more profitable bank group appears in general to experience higher operating rates of cost on its assets, but there are some evidence to suggest that it may enjoy lower operating rates of cost on its liabilities, than the lower profitable group. This result, which is obtained by assessing the operating cost of specific asset and liability categories hints that expense control may play a role in improving commercial bank earnings performance.

At this stage, one may argue that the above conclusions may be tempered by pointing out that the State control on the Greek banking sector makes for an industy that is far from competitive. In addition, one may ask if this study is still informative as Greek banks appear severely limited in their portfolio choice. The above criticism would be valid if we had used the statistical cost accounting method to estimate rates of return on balance sheet items for the whole banking sector. Then, the estimated yields might be biased to the extent that the notion of substitutability of assets and liabilities seems to be severely constrained by the banking controls we detail in chapter one. In this case, the finding rates of return might deviate from the actual ones considerably. However, we can object against the above two points. First, even if we were using the present technique to estimate yields for the whole banking industry, these yields, albeit imprecise, may be treated as suitable surrogates for the actual yields. Second and more important, we actually employ the statistical cost accounting approach to find out differences in rates of return earned (and paid) by high and low income banks on their balance sheet elements. Consequently, to the extent that the preceding bias exist on the estimated yields, this bias will be the same for both banking groups. Thus, we do not feel obliged to qualify the findings mentioned previously.

To sum up the analysis of this chapter, we may conclude that liability and to a lesser extent expense management appear to explain interbank differences in profitability in Greece during the period studied.

Notes

1. See Niehans (1978), chapter 9, p. 166f. for emphasis on the distinction between those two basic functions. For a classic and more detailed discussion of the functions of financial intermediaries see Gurley and Shaw (1960), pp.116f., 191f..
2. See Hester (1964), and Hester and Zoellner (1966) respectively.
3. Income statement items are flow variables because they report activity during a given time span (i.e. one year). Balance sheet items are stock variables because they show activity at a given date (i.e. 31st of December).
4. See Hester and Pierce (1975), p.96.
5. Hester [(1979), p.4, fn.3] notes that a degenerate case might exist when all bank portfolios are identical and consequently there are not sufficient information to identify interest rates on individual assets and liabilities. This might occur

when banks are not constantly buffeted by sizable random shocks to their deposits and to demand for their loans, there are no disequilibria (in the sense that different firms are earning quite different net rates of return from similar assets), all institutions have the same expectations about interest rates, all banks face the same expense scedules and all firms have the same objective functions.

6. In the case of single-output firm, revenue equals the level of output times the price of output.

7. See Hester and Zoellner (1966), p.373.

8. From basic algebra we know that only linear functions possess the property of constant partial derivatives. That is, given the linear function

$$Y = \alpha_0+\alpha_1X_1+\alpha_2X_2+\alpha_3X_3$$

then $\partial Y/\partial X_1=\alpha_1$, $\partial Y/\partial X_2=\alpha_2$, $\partial Y/\partial X_3=\alpha_3$. (We may note that the partial derivative $\partial Y/\partial X_1$ relates to the marginal rates of change in Y with respect to infinitesimal changes in X_1, while X_2 and X_3 are held constant).

9. See Hester and Zoellner (1966), p.373, where they provide as an example to their argument that although the interest rates on business loans may be lower at larger banks, the costs of acquiring and servicing these loans may also be smaller at larger financial institutions. Nevertheless, interest rates were fixed in Greece during the period studied and consequently all banks (small or large) were faced with the same interest rates. Thus, the aforementioned assumption appears quite realistic in our case.

10. For more information about this problem see Pindyck and Rubinfeld (1976), pp.132-137. It is worth noting, however,

that the OLS produces inconsistent estimates to the extent that the sample variance of the exogenous variable is finite as the size of the sample tends to infinity. If the sample variance of the exogenous variable grows without limit (e.g. the values of the variable follow an upward trend with no bounds), the OLS method produces consistent estimates. For more information about this case see Kramer (1984), who states that the "...necessary condition for the consistency of OLS is that the number of trending exogenous variables excluded from the equation is at least equal to the number of right-hand endogenous variables in the equation" [p.28].

11. Hester and Pierce (1975), p.99.
12. Ibid., p.99.
13. During the period studied interest rates fluctuated only in the interbank market. However, the amounts which were traded mostly overnight were relatively small in comparison with the elements of banks' porfolio.
14. Hester and Pierce (1975), p.100. Their claim is based upon the notion that "...bias is [not] likely to be very pronounced because competition, albeit imperfect, will trend to prevent interest rate differentials from being very important for long periods of time" [p.100]. None the less, we discuss more about the above bias when we consider the classical condition that the independent variables are uncorrelated with the disturbances in the model (section III.III).
15. We should bear in mind that as the model provides separate estimates of the cost of funds (liabilities), operating expenses include only non-financing costs. However,

operating expenses include loan losses, as the dependent variable is actually the net of those losses.

16. For alternative definitions of the dependent variable and the related interpretations of the parameters of the independent variables, see Hester and Pierce (1975), pp.95-98, and Kwast and Rose (1982), pp.237-238.
17. Kwast and Rose (1982), p.238.
18. See Hester and Zoellner (1966), p.373.
19. For more information about these conditions see Koutsoyiannis (1977), pp.118-119, or any other econometric textbook.
20. See Koutsoyiannis (1977), p.184.
21. It is worth noting that deflating equation (2) by total assets or any other independent variable does not change the values of the coefficients b_i and c_j. However, dividing all income, asset and liability variables in equation (2) by total assets, we eliminate the existence of an intercept. The interpretation of the parameter "a" varies with the income measure used. By using net operating income as a dependent variable, the coefficient "a" represents net operating income or costs not associated with balance sheet items. Therefore, the sign of "a" may be positive or negative. Furthermore, by making the assumption that banks earn constant marginal rates of return from their non-portfolio items, the coefficient on the inverse of total assets can be interpreted as a measure of economies of scale.
22. For tests of homoscedasticity see Koutsoyiannis (1977), pp.185-196, and Kmenta (1986), pp.292-298, or any other econometric textbook.
23. See Hester and Pierce (1975), p.228.

24. See Maisel and Jacobson (1978), p.690.
25. See Kmenta (1986), p.335 and p.393.
26. See Koutsoyiannis (1977), p.259.
27. See also the discussion on linearity.
28. See Hester and Zoellner (1966), p.374.
29. It is also violated in equation (5).
30. For a discussion on an alternative source of perfect collinearity owing to the fact that the asset proportions (or the liability proportions) sum to unity and its rejection, see Rose and Wolken (1986), p.3, fn.9.
31. See Koutsoyiannis (1977), p.234.
32. The subsequent procedure follows that of Graham (1977).
33. It is worth noting that the rate of return on cash depends on the definition of cash. For instance, if cash includes interest-bearing interbank balances, its rate of return should be non-zero.
34. See Kmenta (1986), pp.442-455.
35. This suggestion is stated by Rose and Wolken (1986), p.4.
36. Most of the Greek banks state the consolidate account "Cash in hand, cheques in course of collection and deposits with domestic banks" in their balance sheets.
37. Hester (1967), p.480.
38. Federal Reserve Bank of New York (1986), p.54.
39. Hester and Pierce (1975), p.213.
40. Ratti (1980), p.319, fn.12.
41. See Plotkin (1968), pp.151-154.
42. See Hester (1979), p.7, fn.5. Hester (1979) also reports that deflating his model by total assets observed on a date outside the time period he studies, he finds that the

estimated coefficients do not change by as much as a standard error.

43. For a proposed procedure to obtain economic financial statements from accounting statements, see Hancock (1985), p.193.

44. The contemporary accountants avoid the controvercial term "profit" in favour of other concepts like business income or earnings.

45. For an old but highly articulating survey referring to the different views hold by economists in this area see Weston (1954). For an excellent book of readings on the concept and measurement of income at the level of the individual firm, see Parker et al (1986).

46. This definition of a company's profit is the parallel to Hicks (1946) definition of an individual's income: "the maximum value which [a man] can consume during a week, and still expect to be as well off at the end of the week as he was at the beginning" [p.172].

47. Maisel and Jacobson (1978), p.696.

48. Rose and Wolken (1986), pp.4-5.

49. For a different classification see Rose and Wolken (1986), p.5.

50. Some papers are difficult to be classified into any category because although the authors might eliminate at least one asset (or liability) in order to estimate the equations as reported, there is no discussion on this matter. See for example the works of Gilbert and Peterson (no date), Maisel and Jacobson (1978), and Crockett and King (1982).

51. Hester and Pierce (1975), p. 214.

52. Ibid., p.99.

53. Recall that the intercept in the undeflated model becomes the coefficient of the inverse of total assets in the deflated model. Consequently, the deflated model does not have an intercept.

54. This is the reason for which Hester (1979) does not include an intercept in his estimated regression. See Hester (1979), p.5, fn.4.

55. They call their model so because they integrate some of the explanatory variables employed by the operating ratio approach into the statistical cost accounting technique.

56. An F statistic can test the hypothesis that the set of coefficients of the model with the dummy variables is equal to the set of coefficients of the model without the dummy variables.

57. See Hester and Zoellner (1966), p.376.

58. Ibid., p.374.

59. Bond (1971), p.43, fn.13.

60. By this assumption we overcome the problem of perfect multicollinearity. However, some degree of multicollinearity may occur, as long as bank balance sheet items (especially loans and deposits) may be correlated with each other or with a linear combination of them. At this point it is worth mentioning that there is no agreement among the econometricians of a method of detecting and assessing multicollinearity, as most of the suggested tests suffer from various weaknesses being in reality "rules of thumb". Nevertheless, we do not embark upon the task of diagnosing the presence and nature of potential multicollinearity

problem in our study. The reason is based upon the various remedies that have been suggested. Two of the traditional approaches for solving multicollinearity, once it has been detected and deemed "harmful", is either to obtain, in one form or another, more information, or to scale down the model by changing its specification. Neither of these conventional prescriptions seem appropriate in our case. For example, additional data of a different type are not available, and omitting some of the explanatory variables may lead to a serious misspecification of the model. Consequently, we follow the so called "leaving things alone" approach, which is consistent with the view that multicollinearity is a feature of the population and not of the sample [see Intriligator (1978), p.155]. However, Kmenta (1986) argues that multicollinearity is a feature of the sample and not of the population being investigated. He states that "if the explanatory variables are stochastic and there is an underlying relation among them in the population, such a relation should be specified as a part of the model" [p.431, fn.10]. But, as far as we know, such a relation among the explanatory variables of our model, has not yet been specified in the banking literature. Nevertheless, if the present degree of multicollinearity is high enough to be "harmful", the estimates of the regression coefficients are highly imprecise; that is, they have large variances. Therefore, the acceptance region for the hypothesis that the regression coefficients are zero will be wide. This means that the power of the t tests is weak. Hence the tests - although correct - are not very helpful in discriminating between true and false hypotheses. For more information about multicollinearity see Intriligator (1978), pp.151-156, Judge et al (1985), pp.896-938, and Kmenta (1986), pp.430-442.

61. For more information about this test see Breusch and Pagan (1979).

62. A number of other transformations have also been applied. Deflation of the model by either total assets or the square of total assets did not reduce heteroscedasticity. Moreover, deflating the model by the sum of total assets and liabilities, the square of the sum of total assets and liabilities, as well as the square root of the aforementioned sum, did not provide any better Breusch-Pagan statistic than deflating the model by the square root of total assets. Therefore and since almost all the previous statistical cost accounting studies deflate the basic model by total assets, we employ the square root of total assets as deflator.

63. See Kmenta (1986), pp.618-622.

64. The model of the high-earnings bank group is also estimated by using the Cochrane-Orcutt (1949) iterative method and the Hildreth-Lu (1960) search technique. However, both these methods provide estimations of rho that are statistically insignificant. Consequently, we accept that there is no autocorrelation in the model applied in the first group.

65. See Judge et al (1985), pp.550-551.

66. See Judge et al (1985), p.527 and p.537. See also Dielman (1983), p.117.

67. Pindyck and Rubinfeld (1976), p.78.

68. For more information on the use of binary variables see

Pindyck and Rubinfeld (1976), pp.77-84, or Kmenta (1986), pp.461-476.

69. For the disadvantages of using the LSDV approach see Pindyck and Rubinfeld (1976), pp.205-206, and Dielman (1983), p.115. Furthermore, we are unable to test whether the slope coefficients are equal (i.e. to test the hypothesis of homogeneity of the regressions by conducting an F test), because our observations are not enough. For more information about such tests see Maddala (1977), pp.322-326.

70. This is not a real Chow test. It does not compare the sum of squares of least squares residuals obtained from the actually reported regressions, but from their (undeflated) OLS forms. Therefore, the validity of this test is only indicative.

71. It is usual for models employing panel data to exhibit a high R^2.

72. "...in general White gives two terms in his formulae, the second of which vanishes if the model is correctly specified up to an additive error. TSP [which is the computing package we make use for this work] computes only the first term since the properties of the estimators are extremely dubious if the model is misspecified in some unknown way" Hall and Schnake [(1987), pp.37-38]. For more information about White's method see White (1980) and White (1982).

73. Recall that in cross-sectionally heteroscedastic and timewise autoregressive models when the time horizon is small (e.g. in our case only ten years), the estimated autocorrelation coefficient may exceed unity in absolute value. For more information see Kmenta (1986), p.619.

74. Alternatively, we can follow Kmenta's [(1986), p.619]

suggestion and estimate rho by the sample coefficient of correlation between the disturbances.

75. We should bear in mind that this interpretation is based upon the assumption that the rate of return on equity is zero. To the extent that this assumption is invalid, the estimated coefficients should be interpreted as the difference between the rate of return on each particular asset or liability and the rate of return on equity capital.

76. It is worth noting that cash and due from banks is a consolidated account consisting of cash in hand, deposits with domestic and foreign banks, deposits with the Bank of Greece, and interest-bearing Greek treasury bills.

77. We should bear in mind, that total securities consist of bonds, shares and participations. Consequently, to the extent that some of the shares and participations of the first banking group are of problematic firms, the above argument may offer an interpretation of the estimated negative coefficient.

78. Current account deposits are included in sight deposits.

79. The interest rates on time deposits set by the Greek authorities during the period studied, depended upon the time and the volume of the funds placed at the bank.

80. In the classical normal linear regression model the shape of the distribution of the dependent variable (Y_i) is determined by the shape of the distribution of the error (u_i) which is normal by assumption [see Koutsoyiannis (1979), p.59]. Consequently, the distribution of the dependent variable is normal. Moreover, since the least square estimators are linear combinations of normally and independently distributed

random variables $Y_1, Y_2, \ldots, Y_n$, [see Koutsoyiannis (1979), pp.74-76] they must themselves be normally distributed [see Kmenta (1986), p.224]. That is, we can write

$$\hat{\alpha}_1 \sim N(\alpha_1, \sigma_1^2) \quad \text{and} \quad \hat{\alpha}_2 \sim N(\alpha_2, \sigma_2^2)$$

where $\hat{\alpha}_1$ and $\hat{\alpha}_2$ are the two similar (in the sense that the independent variable is the same) least squares estimates of α_1 and α_2 obtained from the regressions 1 and 2 respectively; α_1 and α_2 are the true values of α_1 and α_2; σ_1^2 and σ_2^2 are the variances of α_1 and α_2.

The above normality implies, assuming statistical independence of α_1 and α_2 estimates [i.e. their covariance is zero, $cov(\alpha_1, \alpha_2)=0$], that

$$(\hat{\alpha}_1 - \hat{\alpha}_2) \sim N((\alpha_1 - \alpha_2), (\sigma_1^2 + \sigma_2^2))$$

We wish to test the null hypothesis that $\hat{\alpha}_1 - \hat{\alpha}_2 = 0$. If we assume that the two unknown variances are equal (i.e. $\sigma_1^2 = \sigma_2^2$), appart of course from the assumptions that both samples are drawn randomly and both populations are normal, the appropriate stastistic is

$$t = \frac{\hat{\alpha}_1 - \hat{\alpha}_2}{\sqrt{(s_1^2 + s_2^2)/2}} \sim t_{2n}$$

where s_1 and s_2 are the standard errors of estimate for α_1 and α_2 respectively; n is the number of degrees of freedom (actually it is $t_{\lambda-k+\mu-k}$ where λ and μ are the observations for the first and the second regression respectively and k is the number of the estimated coefficients).

The assumption of a common variance is, however, untenable. Employing the F test we reject the null hypothesis of common variance at the 5 per cent level for nine and fourteen of the sixteen coefficients presented in tables III.2 and III.3, as well as III.5 and III.6 respectively.

If the variances are unknown and not equal, only approximate solutions are available for testing the aforementioned null hypothesis. For large samples (i.e. the observations should exceed thirty), an approximate statistic is

$$z = \frac{\hat{\alpha}_1 - \hat{\alpha}_2}{\sqrt{s_1^2 + s_2^2}} \sim N(0,1)$$

Our observations are more than thirty and therefore we employ the above z test. The critical values for a one-tailed test are $z_{0.05}=1.6449$ and $z_{0.01}=2.3263$; for a two-tailed test they are $z_{0.05}=1.9600$ and $z_{0.01}=2.5758$. For more information about the aforementioned tests see Newbold (1988), pp.362-367.

CHAPTER FOUR

A Financial Ratio Comparison Approach

IV.I The General Framework

A number of studies in an implicit endeavour to discover the determinants of bank profitability examine the relationship between commercial bank profitability and various aspects of bank operating performance. The explicit objective of these studies is to identify a set of financial ratios that could best explain variations in commercial bank earnings over a short period of time, usually one or two years[1].

A comparison of a firm's financial statements over time, as well as intra-industry comparisons of these statements, can be meaningful only when differences in size have been taken into account. This task can be achieved by the use of ratios. Therefore, the most frequently cited reason for employing data in ratio form is to control for the effect of size differences among firms at a point in time or over time[2].

A ratio may be defined as the relationship between one value and another. It is usually measured in percentages, but it can also be expressed as a fraction, a decimal or an integer. A financial ratio is that showing a relationship within or among financial statements.

A ratio is not meaningful by itself, but it has to be compared with something before it becomes valuable. Therefore, a ratio of a firm is usually compared with either of the following: (i) The same ratio of other firms in the same industry or the industry norm which may be a location measure, such as the industry mean and median ratio; (ii) The same ratio of the firm computed for several years. The method that employs ratios in order to provide insights into a firm's performance over time and/or to evaluate the company's present position is called financial ratio analysis.

The use of ratios in evaluating the performance of a firm is appropriate only when two conditions are met[3]. First, the numerator of each ratio must be strictly proportional to its denominator; That is, y=bx and y/x=b where b is the proportionality factor. This assumption, which is necessary in order to use ratios to control for size differences, is violated if (i) there is a non-zero intercept term in y=bx; (ii) there is an error term that it is not normally distributed; (iii) a non-linear relation exist between the numerator and the denominator. Second, the financial ratios should follow a normal distribution. The normality asumption is required for three reasons: (α) Normal distribution has the attractive property that knowledge of its mean and standard deviation would be sufficient to generate the whole distribution. Consequently, given only the mean and the standard deviation of a ratio, the statistical significance of deviations of the mean can be easily determined. (β) The revealed skewness of a non-normal distributed ratio provides evidence for a non-zero intercept. Consequently, the proportionality assumption should be violated[4]. (γ) Only normally distributed ratios can be used in statistical models that assume multivariate normality (e.g. regression analysis assumes that the error term and consequently the dependent variable are normally distributed).

The empirical evidence provided by McDonald and Morris (1984,1985) suggest that the proportionality assumption is not violated as far as an intra-industry sample is concerned. Consequently, the proportionality assumption seems not unrealistic in our case as long as we employ ratios that are computed from a homogeneous commercial banking industry. Moreover, the empirical work carried out by Ricketts and Stover (1978) indicates that "a normality assumption could not be rejected for most of the commercial bank ratios [they] examined"[5], with the exception of those contained at least one item from the income statements. Therefore, the employment of the normality assumption regarding the ratios utilized for this study, does not seem unreasonable.

IV.II A Brief Review of the Literature

Financial ratio comparison banking studies vary considerably in the procedure they employ, but most of them agree that expense ratios are significant factors in achieving high bank profitability. For review purposes these studies can be classified into two categories.

The first category contains those studies that do not report any statistical testing, which also is their major weakness. The works by Cawthorne (1962), Ford (1974,1978), Olson (1975), and Ford and Olson (1976,1978) are in this class. Comparing various ratios between the average and the highest-earning banks, Cawthorne "analyzes and seeks to evaluate the relative importance for bank earnings of several conditions that can be studied through published bank operating ratios reports"[6]. Ford and Olson's papers belong in a continuing research sponsored by the American Bankers Association. Comparing various operating ratios and balance sheet items between "high-performance" banks and "average" banks, these authors are seeking to determine the basic operating characteristics of the first group and how these characteristics differ from the second group.

The second category consists of studies that explain interbank differences in profitability by using various techniques and do report statistical testings. These papers can be divided into four subsections regarding the method they employ[7].

(a) Studies which compare interbank financial ratios, but also state statistical testings of their findings. The works by Bryan (1972) and Kwast and Rose (1983) are in this group. Bryan seeks to identify important elements of management behaviour in medium-sized banks. He identifies two bank groups, one termed "successful" and the other "laggardly", by employing a measure of management performance. Thereafter, using data from a management questionnaire, he compares percentage differences in the replies he received by the aforementioned two bank groups. Bryan also reports comparisons of management practices and operating ratios of "successful" and "laggardly" banks of his sample. Kwast and Rose (1983) explore the behaviour of large commercial banks over a long period of time (i.e. a decade), by comparing financial ratios of high- and low-earnings firms. Their sample is "...based on the criteria that a bank's return on equity had to have been in the highest or lowest 30% of all the listed banks for at least seven of the 10 years, 1970-79"[8]. Moreover, Kwast and Rose's paper states the difference in each financial ratio between the high and low profit banks and also reports the statistical significance of that difference.

(b) Studies using regression analysis with a profitability measure as a dependent variable, in order to explain differences in earnings among banks. The work by Gady (1972), as well as a part of the paper by Kohers and Simpson (1978) belong into this category. Regressing a measure of bank profitability on a number of intuitively chosen financial ratios, growth and location variables, Gady examines which of these explanatory variables bear a consistent relationship with bank profitability during the observation years and which are statistically significant. Kohers and Simpson provide insights into the economic and financial factors that determine the difference between accounting returns and market returns. They employ a stepwise multiple regression analysis using three rate of return measures - one being the ROE - as dependent variables and a set of empirically chosen variables as independent.

(c) Studies employing regression analysis with a set of operating ratios as dependent variables, in order to explain diffferences in interbank profitability. The works by Haslem (1968) and Wall (1985) are in this group[9]. In general, the procedure is to regress a number of financial ratios on a set of profitability quartile binary variables, the Herfindahl-Hirschman market concentration index (H-index), a measure of bank size, a set of region binary variables and a set of year binary variables. However, Haslem's model does not have an H-index as an explanatory variable and makes use of a set of dummy variables in order to measure the size effect on bank profitability[10]. Wall's paper does not have a set of region dummy variables but a set of branch dummy variables as an explanatory variable, and employs the inverse of bank's total assets in order to take into account the size effect on bank earnings[11].

(d) Studies utilizing various selection methods to find a subset of explanatory variables which explain differences in interbank profitability. The papers by Haslem (1969), and Haslem and Longbrake (1971b) are in this group. Haslem (1969) divides his sample banks into four quartiles based upon the distribution of their profitability. Then, he uses the Wherry-Doolittle technique to select a number of independent variables (i.e. operating ratios) in the order of highest correlation with his dependent variable (i.e. a profitability ratio), and the lowest correlation with any independent variable previously selected. Subsequently, he employs a multiple regression model to test the relevance of the previously selected operating ratios for all his sample banks. In fact, Haslem regresses net income after taxes to total capital accounts on a set of binary location variables, a set of binary size variables, and the operating ratio variables that the Wherry-Doolittle method selected. Haslem and Longbrake (1971b) also divide their bank sample into four quartiles based upon their relative profitability and then use discriminant analysis to distinguish between banks in the first and the fourth quartiles. Subsequently, they regress the ratio of net income after taxes to total capital accounts on the financial ratios which are selected by the discriminant analysis, in order to test whether these operating ratios explain differences in interbank profitability. However, their grouping criterion is criticized by Eisenbeis (1977) mainly because the groups are arbitrary and not truly discrete, and the groups are not exhaustive in that the second and the third quartiles are omitted[12]. Therefore, he concludes "in most instances, regression and not discriminant analysis is the more appropriate technique for such problems"[13]. Altman et al (1981) also criticize the analysis of Haslem and Longbrake[14]. Their general claim is "...that tests for determining relative importance of individual discrimination variables are not very well developed and at least six different ones have been utilized by various authors to assess this problem. [However,]...the ranking of importance of each variable based on these tests has not been consistent and , therefore, is difficult to draw conclusions from"[15].

IV.III Some Problems Associated with the Approach

The major weakness of bank financial ratio comparison studies is that they are heavily data driven, with theory playing a rather small role in variable choice or model specification. Put differently, there is a lack of theoretical justification in attributing observed income statement differences to observed balance sheet differences. Therefore, the system of relationships which are described by these models may be questioned, and their coclusions might also be challenged.

There are some other shortcomings of this approach associated with the data it employs. "Ratios are constructed from accounting data, and these data are subject to different interpretations and even to manipulation"[16]. Interbank differences in the use of depreciation methods, inventory valuation methods, in the treatment of research and development expenditure's, pension plan costs and so forth, can influence the comparative ratios.

Moreover, bank management has the ability to misrepresent the timing and amount of transactions or events reported in the financial statements of their financial institutions. Management has also considerable discretion as to the time and amount of expense recognition according to their interests. For example, a banking firm can choose the time to classify a bad loan as bad. Furthermore, accounting data is not immediately amenable to economic application. Epigrammatically, as long as we have discussed this pitfall in the third chapter, we might state the following. First, accounting and economic profit differ in definition. Second, some elements of banks' balance sheets are reported in historical cost values which differ from market values. Finally, potential "window dressing" may temporarily alter the composition of the banks' portfolio which might cause the technique to provide incorrect conclusions. Consequently, the findings of financial ratio comparison studies should be used with judgment and caution, and not in an unthinking, mechanical manner. In fact, these conclusions should not be thought as the complete answers to questions about banks' performance, but rather as a basis for questions and further investigation and analysis.

IV.IV The Model

The hypothesis which will be tested in this chapter is that differences in relative bank profitability, asset size, and changes in the general environment significantly affect bank operating relationships (i.e. financial ratios). Subsequently, the study will try to identify the relatonships that are influenced solely by the differences in relative bank profitability. The notion is that these factors may help to explain differences in bank earnings of our sample, provided that the two way-causation stands. The hypothesis is going to be tested statistically by regression analysis.

The technique that is employed is to regress a set of various operating ratios on two sets of profitability binary variables, a measure of bank size and a set of year binary variables. This method permits us to isolate financial ratio differences among different profitability bank groups and seems more advanced than the simple ratio comparison statistical studies, as it takes into account the influence of year differences and bank size on the various ratios. Moreover, it is not subject to the aforementioned criticisms associated with the methods employing discrimination techniques. Hence, Greek bank performance may be better examined by the use of this approach.

The eight banks of our sample are ranked according to their ROA, following the criterion used in the second chapter. Thereafter, the sample is cut in four groups. Each group includes two banks. Consequently, the whole sample is divided in four percentiles denoting that the 75 , the 50 and the 25 per cent of the firms are less profitable than those classified in quartile 1 (or the upper quartile), 2 and 3 respectively. Needless to say, the last quartile (quartile 4 or the lower quartile) includes the least profitable banks of our sample.

The first set of profitability binary variables is used as a proxy for ascribing the qualitative effect of a profitability difference between the two firms within each group to the value of the operating ratios. In consequence, these dummy variables are assigned a value of 1 to the observations associated with the first bank of each group and (-1) to those of the second bank of each group. In other words, this set of binary variables takes into account interbank differences within each quartile.

The second set of profitability binary variables as well as year binary variables are utilized as proxies for describing the qualitative effect of a profitability quarter and a particular year to the value of the operating ratios. The dummy variables are assigned a value of 1 to the presence and 0 to the absense of the attribute in question. To avoid the problem of perfect collinearity we use three profitability quartile binary variables and nine year binary variables. The omitted quartile is quartile 1 (i.e. the most profitable bank group) and the omitted year is 1983 (i.e. the least profitable year of the period studied). However, the effects of the two excluded binary variables will be captured by the regression intercept. Moreover, the coefficients of the included dummy variables will represent influences of the difference of the included dummy from the omitted dummy on the financial ratios (i.e. differential effects).

A measure of bank size in the form of the reciprocal of total assets of the financial institutions, is added in the model as an explanatory variable. Inclusion of this variable in the model allows for the possibility of economies of scale in commercial Greek banking, as well as of effects of bank size on the financial ratios.

The stucture-conduct-performance theory suggests that the structure of a market, especially with respect to the number of firms and their size distribution, influences the conduct of firms in the market and ultimately their profitability[17]. Therefore, the Herfindahl-Hirschman index (H-index) of bank market concentration may be used as a proxy of market structure. However, the recent empirical evidence do not seem to support the hypothesis that a concentration index can be a proxy for the firms' ability to collude. That is, a strong positive relationship between market concentration and firms profitability is not detected in most recent empirical studies[18]. Nevertheless, we do not employ the H-index as an explanatory variable in our model, because all the Greek banks face the same index, as they operate in the whole country. Consequently, whenever this variable was included in the model was found to be perfectly collinear with the other dummy variables. Put differently, the H-index has no cross-section variation and so its effect (if any) is entirely accounted for by the time binary variables.

Thus, the model takes the following form[19].

$$FR_{nt} = a_0 + a_{1k}I_k + a_{2i}Q_i + a_3(10^{10}/TA_{nt}) + a_{4j}T_j + e_{nt}$$

where FR_{nt} is a financial ratio varying across banks (n=1,2,...,8) and over time (t=1,2,...,10); I_k is a set of four (k=1,2,3,4) profitability intragroup (i.e. within each group) binary variables; Q_i is a set of three (i=2,3,4) profitability quartile binary variables; $10^{10}/TA_{nt}$ is the inverse of bank's total assets in 1977 drachma[20] multiplied by 10^{10}; T_j is a set of nine year binary variables (j=1,2,...,6 & j=8,9,10); a_0 is a constant term capturing also the effects from the omitted binary variables (i.e. the first quartile and 1983 binary variables); a_{1k} is a parameter measuring differential effects between the two banks within each quartile; a_{2i} is a parameter reflecting differential effects for each quartile compared with quartile 1; a_3 is a parameter representing the influence of bank size on the value of the operating ratios; a_{4j} is a parameter showing the differential effect for each of the nine years compared with 1983; and e_{nt} is a random error term.

The above model is one where it is assumed that the intercept term captures differences in activity over banks within each quartile, over bank quartiles and over time and that the slope coefficient is constant. That is, the intercept contains a component that is constant over quartiles and over time and varies from bank to bank within each quartile, a component that is constant over banks within each quartile and over time and varies from quartile to quartile and also a component that varies over time and is constant over banks within each quartile and over quartiles. Thus, the intercept can be written in the following way.

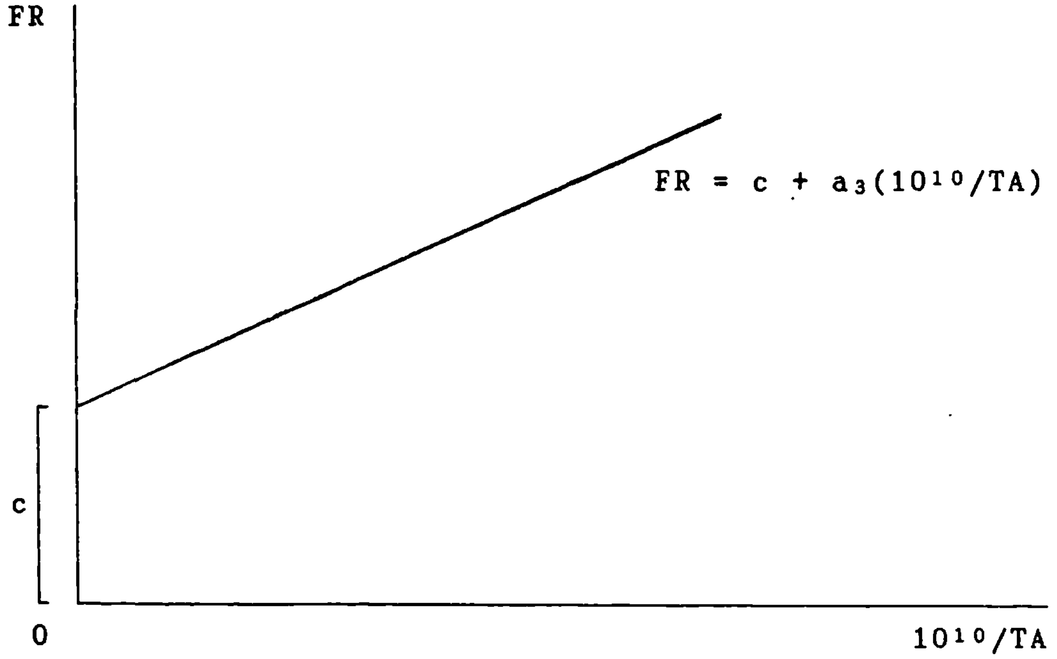
$$c = a_0 + a_{1k} + a_{2i} + a_{4j}$$

where a_0 is in general[21] the "mean intercept"; a_{1k} is a fixed parameter representing the difference from this mean for the kth intragroup and is common to all quartiles and all years; a_{2i} is a fixed parameter measuring the difference from this mean for the ith quartile and is common to all intragroups and all years; and a_{4j} is a fixed parameter reflecting the difference from this mean for the jth year and is common to all intragroups and all quartiles. Consequently, the aforementioned model is equivalent to one that would have had eight profitability binary variables, one for each sample bank, as independent variables.

The graphical exposition of the employed model can be pictured as in figure IV.1, where $c>0$ and $a_3>0$.

The employment of the aforementioned model permit us to

Figure IV.1



isolate intragroup as well as intergroup ratio differences. When the coefficient a_{1k} appears statistically significant and positive, the first bank of the kth group has a higher ratio in question than the second. On the other hand, when a_{1k} emerges significantly negative, the second bank of the kth group has a higher ratio than the first. The same interpretation applies to a_{2i} coefficients as well. When a_{2i} turns out significantly positive (negative), the ith quartile firms have a higher (lower) ratio than the first quartile firms.

One may argue that the above method succeeds in highlighting intergroup ratio differences that account for bank profitability in Greece, as long as the groups exhibit homogeneity in terms of ratios. This assumption implies that each pair of banks in each profitability group should disclose more or less identical financial ratios. Otherwise, if for example one firm exhibit an excessively high ratio due to historical or other reasons and the second display an average (in terms of the whole bank sample) ratio, a conclusion based solely upon the coefficients of the quartile variables will be biased. Consequently, a finding of intragroup coefficients being statistically significant suggests that the corresponding bank groups are not homogeneous regarding the ratio in question. In such case, the bank classes do differ, if the quartile coefficients are found statistically significant, but the inference based upon this difference should be less robust than otherwise should be.

IV.V The Utilized Operating Ratios

The financial ratios employed for this study are illustated in table IV.1[22]. These ratios may be classified in six categories according to the information they produce.

(i) Income ratios. These ratios distinguish succesful or high-performance banks from the rest and we employ them in order to explore the effect of bank size on them. Two ratios are used for this purpose; the return on assets (ROA) and the return on equity (ROE). The former is defined as net income before taxes as a percent of average assets held during a year, and the latter as net income before taxes as a percent of average book value of equity capital outstanding during a year[23].

(ii) Liquidity ratios. These ratios show how much liquid are the banks' asset structure and we employ them in order to find out whether there is any difference in liquidity among the banks classified in the four percentiles. Three ratios are utilized for this purpose. The numerator, "cash and due from banks", is the

TABLE IV.1

Operating Ratios

Ratios	Variable Name
A. Income Ratios	
1. Net income before taxes / total assets (ROA)	INC1
2. Net income before taxes / equity capital (ROE)	INC2
B. Liquidity Ratios	
3. Cash and due from banks / total assets	LIQ1
4. Cash and due from banks / total deposits	LIQ2
5. Cash and due from banks / sight + savings deposits	LIQ3
C. Capital Adequacy Ratios	
6. Total loans /equity capital	CAD1
7. Equity capital / total liabilities	CAD2
8. Equity capital / total deposits	CAD3
D. Asset and Liability Composition Ratios	
9. Cash in hand and deposits with domestic and foreign banks /total assets	ALC1
10.Deposits with the Bank of Greece / total assets	ALC2
11.Total loans / total assets	ALC3
12.Discounts + loans and advances up to one year / total loans	ALC4
13.Loans and advances over one year / total loans	ALC5
14.Total securities / total assets	ALC6
15.Total deposits / total liabilities	ALC7
16.Sight + savings deposits / total deposits	ALC8
17.Time deposits / total liabilities	ALC9
E. Investment Policy Ratios	
18.Total loans / total deposits	INV1
19.Total loans / time deposits	INV2
20.Total securities / total deposits	INV3
21.Total securities / time deposits	INV4
22.Total securities / sight + savings deposits	INV5
F. Expense Ratios	
23.Staff salaries + contributions to staff welfare funds + general expenses and third party remunerations / total assets	EXP1
24.Staff salaries + contributions to staff welfare funds / number of employees (10^7)	EXP2
G. Productivity Ratios	
25.Total assets / number of employees (10^8)	PRD1
26.Net income before taxes / number of employees (10^6)	PRD2

same in all of them. This account may also referred to as "cash assets" as it includes the most liquid of the assets held and fulfills banks' working and legal reserve requirements[24]. The first ratio reflects the percent of banks' total assets that are relatively liquid. The second ratio shows the extent to which banks' total deposits are covered by these reserves. The third ratio indicates how much of banks' deposits subject to withdrawal on demand can be met by the firms' most liquid assets.

(iii) Capital adequacy ratios. These ratios examine whether there is any difference among high-performance banks and the rest as far as their capital base is concerned. To the extent that the most important function of bank equity capital is to protect depositors and other creditors, possible systematic divergence in these ratios may affect public confidence significantly and ultimately bank survival. Three ratios are used for this purpose. The first ratio identifies the extent to which banks' loans are financed by banks' capital. The second ratio is a measure of the degree of banking gearing, describing the relationship between financial firms' equity finance and debt finance[25]. This equity-to-debt ratio shows how much shareholders supply to the financial institution for every drachma supplied by creditors. Consequently, it explores the possibility that some banks trade more financial risk for higher than average returns[26]. The lower the ratio, the more highly geared the firm. Under the same token, this second ratio measures the banks' capital cushion. The third ratio is the first measure of capital adequacy that was introduced by U.S.A. banking authorities[27] and it identifies the extent of capital protection enjoyed by depositors.

(iv) Asset and liability composition ratios. These ratios explore the possible differences among the four bank groups as far as the asset and liability structure of their portfolios is concerned. Nine ratios are employed for this purpose. The first ratio shows the proportion of banks' working (primary) reserves to their total assets. Working reserves are nonearning assets which can provide immediate liquidity without any risk or loss. Their main function is to serve as the first line of defense in meeting depositors' withdrawals. Consequently, the higher the ratio, the more liquid but less profitable a bank is. The second financial ratio indicates the proportion of the deposits that a firm has with the Bank of Greece to its total assets. These two ratios explore in some depth the structure of "cash assets" of Greek banks[28]. The third financial ratio denotes the extent that banks' total assets are tied up to loans, which in general are less liquid, more risky but more profitable than almost any other asset. Put differently, it illustrates the relative volume of credit of the financial institutions examined. The fourth ratio shows banks' share of discounts and loans and advances up to one year to their total loans. The fifth ratio indicates the proportion of banks' loans and advances over a year to their total loans[29]. Consequently, the fourth and the fifth ratios are measures of banks' loan composition. The sixth ratio presents the proportion of total securities to total assets; that is, it measures the relative volume of total securities. The seventh ratio reflects the proportion of banks' total deposits to their liabilities. In consequence, it is a measure of drachma volume of banks' total deposits. The eighth ratio identifies banks' deposits which can be withdrawn or transferred at any time without notice, as a percentage to their total deposits. Finally, the ninth ratio describes how much of banks' total deposits are composed of time deposits; the latter being funds that cause more interest expenses than any other kind of deposits, but their variability is more foreseeable[30].

(v) Investment policy ratios. These ratios investigate the possible differences among the four bank classes regarding their investment policy. Five financial ratios are utilized for this purpose. The first ratio indicates the extent to which banks finance their credit with their total deposits. The second ratio denotes the extent that banks' total loans are financed by the more expensive but also with more foreseeable variability time deposits. In the appendix (table IV.37) a ratio showing total loans as a proportion of sight and savings deposits is also reported. The third ratio describes how much of banks' investment in total securities is financed with their total deposits. The fourth and the fifth ratios illustrate the extent that firms' investment in total securities is funded by their time deposits as well as sight and savings deposits respectively. In consequence, the aforementioned ratios reflect the way that firms finance their investment, as well as the relative cost of these funds.

(vi) Expense ratios. In banking industry employee expenses in the form of wages, salaries and benefits are second only to interest expenses in importance. Therefore, we employ two expense ratios to find out if the most profitable banks significantly outperform the rest of the industry in controling non-interest cost expenses. The first ratio is a measure of operating expenses, indicating the amount of money which banks have to pay annually in order to manage their property and legal rights (i.e. their assets). The second ratio reflects bank staff expenses per bank employee.

(vii) Productivity ratios. Productivity may be defined as the relationship between physical quantity of output(s) produced by a firm and the physical quantity of inputs of the factors of production the firm employs. Productivity might be associated with profitability by price recovery; the latter being the relationship between the unit cost of purchased inputs and the unit price of sold output(s)[31]. Consequently, bank productivity plays a very important role in improving bank profitability. Therefore, we employ two ratios in order to find out whether high profit banks differ from the rest as far as productivity is concerned. The first ratio is the most common productivity criterion and measures productivity in terms of assets per employee. In fact, this ratio shows the extent to which the average bank employee helps the firm in handling its assets. The second ratio indicates how much the average bank employee helps the financial institution in generating net income. In consequence, both ratios explore the possibility that high-performance banks utilize their personnel more effectively than their less profitable rivals.

IV.VI The Data

The financial ratios used for the study of this chapter are computed from data obtained from bank balance sheets and income statements. Balance sheets report year-end data. Therefore, we transform them to mid-year data by averaging (employing the money weigted arithmetic mean) each year-end balances with the year-end balances of the previous year. The annual number of employees per bank is obtained from the Bank of Greece. These data are year-end figures and therefore we apply the aforementioned transformation to them as well. That is, we average (by using the arithmetic mean) each bank's number of employees per year with its number of employees of the previous year.

We bear in mind that the Greek commercial banks that were operating for at least five years before the ten years period we examine (i.e. 1977-1986), are eight. Consequently, our sample consists of eighty observations; that is, ten years observations of eight commercial banks.

IV.VII Estimation of the Model

Let us assume that all the parameters of the model of this chapter remain constant across all banks of our sample and over all years of the period encountered. Then, we can run an OLS regression on each of the twenty-six financial ratios reported in table IV.1. The OLS method produces estimates which according to the Gauss-Markov theorem are BLU, provided that the classical conditions are satisfied. Therefore, we apply some test on each regression to ensure that these conditions are met.

To test for autocorrelation we cannot employ the Durbin-Watson statistic because of the transition of the ordered sample across banking firms. Therefore, we compute the autocorrelation coefficient (ρ) directly, using the regression residuals and assuming that the parameter ρ has the same value for all the banks[32]. The values of the estimated autocorrelation coefficients of each of the twenty-six regressions are shown in table IV.3 in the appendix and all but one offer evidence of serious autocorrelation[33].

To correct for correlated disturbances, assuming first-order autocorrelation[34], we apply the Cochrane-Orcutt iterative method. However, this technique does not offer a guarantee that it will locate a global minimum. To ensure location of a global minimum, we also use the Hildreth-Lu method. This research method produces similar to the Cochrane-Orcutt estimations of rhos[35]. Thus, the previous estimations of rhos are global minimum. Table IV.4 in the appendix illustrates the rho estimates of these two techniques[36].

To test for heteroscedasticity in our new model, which is free of the assumed pattern of autocorrelation, we employ a Breusch-Pagan test. The relevant statistics are shown in table IV.5 in the appendix. The tabulated chi-squared values for 16 degrees of freedom that the statistics are compared with are $x^2_{0.95,16}$=26.296 and $x^2_{0.99,16}$=32.000. Thus, we accept the null hypothesis that the errors are homoscedastic at 5 and 1 per cent level of significance for ten and three ratios respectively. We also reject the null hypothesis for the remaining thirteen ratios. However, we can compute standard errors in the presence of unknown heteroscedasticity. This is achieved by employing the formula suggested by White (1980), which utilize the data to estimate the magnitude of the heteroscedasticity[37]. Consequently, we compute consistent variances of the estimators for the thirteen heteroscedastic regressions, as well as for those regressions we accept the null hypothesis at 1 per cent level of significance[38]. Hence, we can apply the formulae of the variances of the coefficients to conduct test of significance and construct confidence intervals, assuming of course that the asymptotic properties hold approximately in our sample. The regresion results of the employed operating ratios are shown in tables IV.6-IV.36.

IV.VIII Empirical Results[39]: Comparing the "Best" with the "Worst"

In this section we bring together the finding differences among the most profitable banks (i.e. quartile 1) and the least profitable banks (i.e. quartile 4) of our sample. The technique of comparing the "best" with the "worst" might let us find out the characteristics of the most profitable financial institutions, as well as isolate the factors that account for profitability in Greek commercial banking. Table IV.2 illustrates these differences, which may be classified in the following eight categories.

First, the most profitable bank group employs more equity capital to finance its credit than the least profitable one. In fact, total loans as a percentage of equity capital is found 5.589 percentage points lower at the former group than at the latter. However, the low-income group is not homogeneous one as the statistically significant coefficient of intragroup 4 variable denotes. The seventh sample firm has 6.889 percentage points higher ratio than the eighth firm. In consequence, the aforementioned conclusion appears less powerful than otherwise would be.

Second, the high profit banks are less highly geared and therefore are exposed to less financial risk than the low profit banks. In fact, equity capital as a percentage of total liabilities is found 0.012 percentage points higher at the former than at the latter.

Third, the depositors of the most profitable firms are more capital protected than those of the least profitable ones.

TABLE IV.2

Summary of Regressions' Results[1,2]

Ratios	Intragroup 1	Intragroup 2	Intragroup 3	Intragroup 4	Quartile 2	Quartile 3	Quartile 4	10^{18}/size
INC1	0.000	0.000	-0.000	0.000	0.002	-0.003*	-0.004**	-0.000
INC2	-0.001	0.007	-0.012	0.043	-0.059	-0.082	-0.058	-0.015
LIQ1	-0.070**	-0.020	-0.061**	-0.049	-0.149**	-0.069**	-0.042*	-0.031**
LIQ2	-0.144**	-0.017	-0.091**	-0.072*	-0.250**	-0.166**	-0.116**	-0.053**
LIQ3	-0.132*	0.043	0.076	-0.063	-0.302**	-0.031	-0.070	-0.059*
CAD1	1.778	-3.470**	4.758**	6.889**	5.480**	3.235**	5.589**	0.039
CAD2	0.004	0.009**	-0.006	-0.005	-0.003	-0.003	-0.012**	0.006*
CAD3	-0.002	0.010**	-0.008	-0.009	-0.011	-0.011**	-0.019**	0.005
ALC1	-0.088*	0.006	-0.059*	-0.030	-0.148**	-0.122**	-0.082**	-0.030
ALC2	0.010	-0.016	0.007	-0.011	0.025	0.059**	0.042*	0.009
ALC3	0.062	-0.009	-0.010	0.067	0.109*	0.056	-0.026	0.039**
ALC4	0.067	0.029	0.011	0.059	0.045	-0.029	-0.030	0.058**
ALC5	-0.055	-0.022	0.000	-0.056	-0.048	0.031	0.043	-0.053**
ALC6	0.019**	0.017**	0.014**	0.014**	0.011*	-0.000	-0.010**	0.004**
ALC7	0.061	-0.004	0.003	-0.005	0.067	0.091**	0.074**	0.023
ALC8	-0.043*	-0.057**	-0.106**	-0.017	-0.043	-0.138**	-0.081**	-0.011
ALC9	0.054*	0.044**	0.094**	0.013	0.055*	0.135**	0.091**	0.017
INV1	-0.125	-0.063	-0.303*	0.106	0.052	-0.096	-0.251	0.070**
INV2	-0.245	-0.331**	-0.350**	-0.053	-0.114	-0.555**	-0.557**	-0.037
INV3	0.024**	0.021**	0.018**	0.018**	0.012	-0.002	-0.014**	0.005**
INV4	0.076**	0.056**	0.038**	0.059**	0.039*	-0.029*	-0.059**	0.019**
INV5	0.035**	0.034**	0.036**	0.027**	0.020*	0.006	-0.017**	0.008**
EXP1	-0.005	-0.003**	-0.005*	-0.001	0.000	-0.004	-0.001	0.003
EXP2	0.018**	0.016**	0.038**	0.010*	0.001	0.003	-0.009*	0.003*
PRD1	0.328**	0.281**	0.636**	0.201**	-0.003	0.221*	-0.058	-0.014
PRD2	0.031	0.156*	-0.029	0.038	-0.166	-0.194	-0.239*	-0.033

Notes:
1. For more information about the following coefficients see the separate tables in the appendix to this chapter.
2. Asterisk *(**) denotes parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.

Actually, equity capital as a percentage of total deposits is found 0.019 percentage points higher at the former than at the latter.

Fourth, high-performance financial institutions are relatively more liquid than their low-performance rivals. Cash and due from banks as a percentage of total assets is found 0.042

percentage points higher at the former than at the latter. As far as the structure of these "cash assets" is concerned[40], the first group has more cash in hand and deposits with domestic and foreign banks, less deposits with the Bank of Greece and more or less the same volume of interest-bearing Greek treasury bills than the last group. Indeed, cash in hand and deposits with domestic and foreign banks as a percentage of total deposits is found 0.082 percentage points higher at the most profitable firms than at the least profitable. The deposits with the Bank of Greece as a percentage of total assets appears 0.042 percentage points lower at the first group than at the last one. Finally, the interest-bearing Greek treasury bills as a percentage of total assets provides statistically insignificant coefficient regarding the divergence of the two bank categories. It is worth mentioning, however, that except of the case of deposits with the Bank of Greece to total assets ratio, where the two banks within each group do not differ significantly, the first bank group is not a homogeneous one. The coefficient of intragroup 1 variable is found statistically significant. The second sample bank has 0.070 percentage points higher cash and due from banks to total assets ratio than the first one. Moreover, the second sample firm has 0.088 percentage points higher cash in hand and deposits with domestic and foreign banks to total assets ratio than the first one. Consequently, the above conclusion, as far as these two ratios are concerned, emerges less robust than otherwise would be.

At this stage, the second and the fourth point require a more extended discussion. According to these characteristics the most profitable firms are those that are relatively more capitalized as well as relatively more liquid. Both cases advocate for the firms to be less financial risky. However, in general, higher than average returns are associated with less capitalized (and consequently more geared) and less liquid institutions. In other words, the above findings contradict with the rule. However, this outcome should be expected. Most of the interest rates on deposits were fixed by the authorities during the period observed and sometimes were exceeding the interest rates from credit gained by the banks. Hence, it is obvious that the more geared a firm the less profitable it was. Furthermore, most of the rates of return on assets were determined exogenously by the authorities during the period studied. These yields did not reflect the risk of the particular asset, but either the preferences of the policy makers towards economic development or the endeavour to cover cheaply a part of the high PSBR. Adding to the above scene the reserve/rebate mechanism which was applicable on bank credit until recently, and one might end up with a rather shadowy picture. In consequence, we should not be surprised that liquidity went hand in hand with high-performance in Greek banking.

Fifth, although the relative volume of loans as well as the loan structure do not differ significantly between the two bank classes, there are evidence that the relative volume of deposits as well as the deposit stucture do. In fact, total deposits as a percentage of total liabilities is found 7.4 per cent lower at the most profitable firms than at the least profitable. Moreover, sights and savings deposits as a percentage of total deposits appear 8.1 per cent higher at the former class than at the latter class. On the other hand, time deposits as a percentage of total liabilities is found 9.1 per cent higher at the lower quartile than at the upper quartile (i.e. quartile 1). This finding suggests that high-performance banks have a deposit structure that favours less time deposits and more sight and savings deposits than low-performance banks. It is worth noting, however, that the first group is not a homogeneous one as far as the second and the third ratio is concerned. The first sample bank is found to have 4.3 per cent relatively less sight and savings deposits and 5.4 per cent relatively more time deposits than the second sample bank. Subsequently, the aforementioned conclusions regarding these two ratios seem less weighty than otherwise would be.

Sixth, high-performance firms finance their credit less with the more expensive time deposits than their low-income opponents. Actually, total loans as a percentage of time deposits is found 0.557 percentage points higher at the former than at the latter. This outcome is expected as the two groups do not have a significantly different relative volume of loans, while the first group has relatively less time deposits than the second one. Nevertheless, this is an interesting result because combined with the insignificant divergence between the two bank classes regarding both the total loans to total deposits ratio and the total loans to sight and savings deposits ratio[41], highlights the advantage of employing cheaper money by the upper quartile banks.

Seventh, the most profitable banks invest relatively more in total securities financing them with less of their deposits and particularly less time deposits as well as less sight and savings deposits, than the least profitable banks. In fact, total securities as a percentage of total assets is found 1.0 per cent higher at the first group than at the last one. Total securities as a percentage of total deposits appears 1.4 per cent higher at the former than at the latter. Total securities as a percentage of time deposits is found 5.9 per cent higher at the upper quartile than at the lower quartile. And finally, total securities as a percentage of sight and savings deposits emerges 1.7 per cent higher at the high-performance class than at the low-performance one. Nevertheless, both bank classes are not homogeneous regarding the above ratios and consequently the aforementioned conclusions turn out less rigorous than otherwise would be.

Eighth, high-performance financial institutions appear to pay their personnel more, but also utilize it more effectively than the low-performance ones. In fact, staff salaries and contributions to staff welfare funds per employee is found 0.9 times more at the former than at the latter. On the other hand, net income before taxes per employee is found 23.9 times more at the upper quartile than at the lower quartile. It is worth mentioning, however, that the two bank classes are heterogeneous as far as the expense ratio is concerned. The cost per employee is 1.8 (1.0) times more at the first (seventh) sample bank than at the second (eighth) sample bank. Accordingly, the finding that is based upon the expense ratio seems less rigid than otherwise would be.

IV.IX Concluding Remarks

To sum up this chapter let us repeat the robust conclusions of the previous section. High-performance financial institutions stand on a higher capital base, hold less deposits with the Bank of Greece, have less total deposits, finance their credit with less time deposits and utilize their employees more effectively than their low-performance rivals. The synopsis of these evidence suggests that liability and to a lesser extent asset portfolio management is the most important factor in achieving high bank profitability in Greece. Moreover, expense control is not found to have a significant influence on bank earnings. This conclusion contradicts those found by other studies of bank financial ratios udertaken for other countries (mostly for the USA). These studies find that expense control and particularly non-interest expense control has a major influence over bank profits. Nevertheless, our findings should not be surprising if they are placed in a context of regulated interest rates on deposits and loans, as well as regulated to some extent labour bank market, as it was the case in Greece during the period examined.

Furthermore, the reciprocal of bank size is found to have a substantial impact on the bank behaviour ratios. The most important association is between bank size and the loan stucture variables (i.e. ALC4 and ALC5). Actually, most of the inter-bank variation as far as the aforementioned two variables are concerned can be explained by the bank size variable. Moreover, an interesting finding that is worth pointing out is the positive coefficient of the inverse of total assets variable regarding the expense ratios which suggests that large size banks might be able to enjoy scale economies in Greece.

Needless to say, changes in the general environment is found to affect significantly almost all the bank operating relationships. Differences of each of the nine years we examine from 1983 appear to have none influence, or virtually none, only on the volume of the relatively most liquid assets, the relative volume of deposits and the loan structure.

Overall, the study presented in this chapter indicates that all variables tested - profitability,size and time - influence the majority of bank financial ratios, that subsequently may determine bank profitability. Consequently, the hypothesis that is tested in this chapter is proved valid.

Notes

1. Among these studies are the works by Cawthorne (1962), Haslem (1968,1969), Haslem and Longbrake (1971b), Bryan (1972), Gady (1972), Olson (1975), Fraser (1976), Ford (1978), Ford and Olson (1978), Kohers and Simpson (1978), Kwast and Rose (1983), and Wall (1985).
2. Other reasons for employing data in ratio form are reported in Foster (1986), p.96.
3. A further discussion on these two conditions can be found in Foster (1986), pp.96-113, and Barnes (1987).
4. See Barnes (1982) for further discussion on this matter.
5. Ricketts and Stover (1978), p.123.
6. Cawthorne (1962), p.1.
7. The work by Fraser (1976) may be classified in more than one subsections. He employs three techniques. First, a univariate "t" test of the differences between the sample means of high and low profit banks for a large number of financial and economic ratios. This method may be classified in class (a) below. Second, multiple regressions of financial ratios upon a profitability binary variable, bank

size, and economic variables. This method may be classified in group (c) below. Finally, multiple discriminant analyses of the "best" and "worst" financial institutions in his sample. This technique may be classified in group (d) below. Consequently, we do not attempt to classify the work by Fraser (1976) in any of our four classes.

8. Kwast and Rose (1983), p.54. Ford and Olson (1978) use similar selection criteria. To be included in their five-year sample of high-performance banks, a financial institution must meet two conditions. "First, a bank must have a very high average rate of return [on equity] for the last five years. Second, to insure that performance has not fallen off, it must rank in at least the top 50% in profitability for ..." the last year they analyze [p.37].

9. A possible problem associated with the estimation of these papers is that Haslem (1968) and Wall (1985) do not test their models for heteroscedasticity and autocorrelation.

10. Actually, Haslem "tests whether management and other selected variables are significant influences on relative profitability and, if so, on the operating relationships through which these influences are transmitted" [p.167]. Therefore, he examines management effects on the value of his operating ratios, by employing profitability quartile dummy variables as proxies to management variables.

11. In a working paper appeared in November 1983 under the same title, Wall includes a set of region dummy variables in his model. However, he replaces them by a set of branch dummy variables in his 1985 paper.

12. Apart from these two major criticisms, Eisenbeis (1977) also

mentions two other problems with Haslem and Longbrake (1971b) grouping scheme. For further discussion about this type of criterion to form groups see Eisenbeis (1977), pp.887-888, and Altman et al (1981), pp.131-132.

13. Eisenbeis (1977), p.888.
14. For more information see Altman et al (1981), pp.236-237.
15. Altman et al (1981), p.236.
16. Weston and Brigham (1981), p.159.
17. For more information about this hypothesis see chapter six.
18. It is worth pointing out that the relevant findings of the analysis presented in chapter six appear ambiguous.
19. This model is similar to that of Haslem (1968) and Wall (1985), except that they do not have variables that take into account bank differences within each quartile. Running a regression without the above adjustment it is assumed that the aforementioned differences are random and therefore they would be captured by the standard errors of the coefficients. Consequently, these errors will be inflated.
20. Deflating total assets to their 1977 value, we eliminate the inflationary increase of bank assets.
21. By excluding one quartile and one year binary variable to avoid perfect multicollinearity, their effects will be captured by a_0. Consequently, the "mean intercept" will also incorporate the effects of the omitted binary variables.
22. This is a subset of the ratios actually used. The remaining ratios are shown in the appendix (table IV.37) of this chapter and their regression results are not reported because the coefficients of the variables of interest are found statistically insignificant. It is worth pointing out,

however, that although all the ratios employed for this work are widely utilized in the relevant literature, their selection as well as their assignments as specific liquidity, capital adequacy and so forth relationships remains ad hoc.

23. For more information about ROA and ROE see the relevant section in chapter two.

24. It is worth noting, however, that in Greece some components of this account such as "Deposits with the Bank of Greece" and "Interest-bearing Greek treasury bills" are not as liquid as the label "cash assets" seems to indicate. However, these assets are relatively more liquid than the other assets held by Greek banks.

25. Another common measure of financial gearing is to divide the book value of a bank's liabilities with the book value of its assets. This debt-to-assets ratio indicates the percentage of a bank's capital (i.e. funds), in book value terms, that it comes from creditors of one kind or another.

26. In the finance literature the risk caused by the employment of financial gearing is called financial risk and it is shown in the increased variability in a firm's net income. Financial risk should be distinguished from business risk; the latter being the natural uncertainty or fluctuation of expected before taxes returns on the firm's portfolio of assets. For more information on financial gearing see Weston and Brigham (1981), pp.555-574.

27. It was introduced in 1909 by a California banking law and also emerged in 1914 annual report of the Comptroller of the Currency.

28. In fact the investigation is completed only when interest-

bearing Greek treasury bills to total assets is also employed. However, the coefficients of the variables of interest are found statistically insignificant. Therefore, this ratio appears only in table IV.37 in the appendix to this chapter.

29. At first, the employment of this ratio seems an unecessary repetition as long as the fourth ratio is utilized. Total loans consist of discounts plus loans and advances up to one year plus loans and advances over a year. Therefore, the fourth ratio equals unity minus the fifth ratio. To see this, let us define TL=total loans, SLA=discounts plus loans and advances up to one year and LLA=loans and advances over one year. Then, TL/TL=SLA/TL+LLA/TL ==> SLA/TL=TL/TL-LLA/TL ==> SLA/TL=1-LLA/TL or LLA/TL=1-SLA/TL. However, we employ the fifth ratio because we are interested about the coefficient of the bank size variable. For more about the aforementioned reason see the following discussion on the empirical evidence section of this chapter.

30. The employment of this ratio also appears as an unecessary repetition as long as the eighth ratio is used. Total deposits consist of sight plus savings plus time deposits. Subsequently, the eighth ratio equals unity minus the nineth ratio and vice versa. However, we utilize this ratio because we are interested about the coefficient of quartile 2 binary variable. For more information about the above reason see the discusion on the empirical evidence section that follows.

31. For more information about the relationship "profitability = productivity X price recovery", as well as produtivity measurements, see Total Bank Productivity Measurement (1982),

Parker (1981), and Giannopoulos (1979).

32. The method utilized is that of Kmenta (1986), pp.618-622. In this case that the time period is small (only ten years), the estimated autocorrelation coefficient exceeded the unity on rare occasions. Therefore, we follow Kmenta's [(1986), p.619] suggestion and estimate rho by the sample coefficient of correlation between the disturbances.

33. The first income ratio is also employed as a dependent variable of two different models, whose regression results appeared in tables IV.7 and IV.8. In these cases the estimated rhos are $\rho=0.30233$ and $\rho=0.31614$ respectively. In addition, the second income ratio is used in two different models, whose regression results are reported in tables IV.11 and IV.12. In these cases the estimated rhos are $\rho=0.37061$ and $\rho=0.40859$ respectively. For more information see the appendix to this chapter.

34. We employ the assumption of first-order autoregression for two reasons. First, we utilize annual data for our study and therefore we do not expect to observe more than a year dependence of errors (i.e. a second or a higher-order autoregressive scheme). Second, the use of a higher than a first-order autocorelation pattern and the associated loss of degrees of freedom (multiples of eight in this case), would decrease the reliability of our estimates.

35. In three cases (i.e. ALC8, INV1 and EXP2) where the rhos do differ, we employ the rhos estimated by the Hildreth-Lu technique.

36. Recall fn.33 of this chapter. The rho estimates regarding INC1 are $\rho_{C-O}=0.332600^{**}$, $\rho_{H-L}=0.350000^{**}$ and

ρ_{C-O}=0.336371**, ρ_{H-L}=0.350000** respectively. Similarly, the rho estimates regarding INC2 are ρ_{C-O}=0.415311**, ρ_{H-L}=0.400000** and ρ_{C-O}=0.438343**, ρ_{H-L}=0.450000** respectively.

37. See fn.72 in the third chapter. Additionally, it is worth noting that the variance of the coefficient estimates, the standard errors and the associated t-statistics are consistent even when the disturbances are not homoscedastic and when their variances are correlated with the independent variables in the model. However, they are not consistent when the disturbances are not independent. Therefore, we use White's formulae on the rho-transformed variables, employing as rho the estimation obtained by the Cochrane-Orcutt techinque. In this case the disturbances are not correlated and the aforementioned formulae can be used.

38. We use White's formulae even for the three ratios that the null hypothesis can be accepted at the 1 per cent level of significance, because in small samples the stated level of significance (according to the Breusch-Pagan test) is only a rough indication of the true level. Consequently, we are not completely convinced that the errors of the regressions of these ratios are homoscedastic. For more information about the inaccuracy of the Breusch-Pagan test in small samples see Kmenta (1986), p.295.

39. For a report of the empirical results for each employed ratio separately, see the appendix to this chapter.

40. Cash and due from banks consists of cash in hand and deposits with domestic and foreign banks, deposits with the Bank of Greece, and interest-bearing Greek treasury bills.

41. The regression results of the total loans to sight plus savings deposits ratio are not reported in the tables, because the coefficients of all the variables of interest, but bank size, are found statistically insignificant. The coefficient of the inverse of total assets appears significantly positive, suggesting that larger firms finance their credit more with sight plus savings deposits than smaller ones.

Appendix to the Fourth Chapter

I. Empirical Results for Each Employed Operating Ratio

A. Income Ratios.

The regression results of table IV.6 reveal that the coefficients of profitability quartiles 3 and 4 are negative and statistically significant. The coefficient of quartile 2 variable is found insignificantly negative. The coefficients of intragroup variables are also found statistically insignificant. The above finding confirms that banks in quartile 1 did have statistically larger returns on assets (ROA) than banks classified in the third and fourth group, but not in the second one. The same table also shows that bank size does not have a significant effect on bank profitability measured by return on assets, as the coefficient of the inverse of total assets emerges statistically insignificant. In other words, bank size is found not to affect the efficiency with which total assets are employed within the banks.

The same regression is also run under three different versions. First, we exclude the profitability quartile binary variables from the set of the explanatory variables, just in case they are correlated with bank size and therefore pick up some of the effect of the reciprocal of banks' total assets on the dependent variable. Second, we exclude both the intragroup and the quartile binary variables from the model for the same reason mentioned in the first case. Third, we compute White's standard errors, assuming that the disturbances are not correlated. This assumption relies upon the statistically insignificant estimations of rho, at the 0.05 confidence level in a two-tailed t test, produced by both Cochrane-Orcutt and Hildreth-Lu techniques. However, the coefficient of the reciprocal of size is found statistically insignificant in all cases. These regression results are shown in tables IV.7-IV.9 respectively. It is worth mentioning, though, that the F-Statistic calculated from the regression presented in table IV.7 is lower than the appropriate critical value of the F distribution (at the 5 per cent significance level) with 13 and 58 degrees of freedom. Consequently, we cannot reject the null hypothesis of no relationship between the dependent and the independent variables at the 5 per cent significance level in this case. In other words, we cannot reject the hypothesis that none of the explanatory variables helps to explain the variation of ROA about its mean.

The regression results of table IV.10 illustrate that none of the variables in question is statistically significant. This finding indicates that the financial firms classified in the second, third and the fourth group are not significantly different from those classified in the first group in terms of returns on equity (ROE).

The same regression is also run under two different versions. Firstly, we omit the quartile binary variables from the explanatory variables and secondly we exclude both the intragroup and quartile binary variables. The reason for this omission rests on the possibility that these variables are correlated with banks' total assets and consequently pick up some of the effect of the inverse of bank size on the ROE. These regression results are shown in tables IV.11 and IV.12 respectively. Table IV.11 reveals the same results with table IV.10. But table IV.12 presents us with an interesting outcome. The coefficient of the reciprocal of bank size is found significantly negative. This negative sign indicates that larger banks are more profitable than smaller ones as far as the rate of return on shareholders' investment.

B. Liquidity Ratios.

The regression results of table IV.13 suggest that the second bank of our sample possesses relatively more liquid assets than the first bank (actually 7.0 per cent more liquid assets). Similarly, the sixth bank holds 6.1 per cent more liquid assets than the fifth firm of our sample. This finding is based upon the significantly negative values of intragroup 1 and intragroup 3 variables. In addition the coefficients of all quartile variables are found significantly negative. This evidence indicates that the banks classified in the first group possess relatively more liquid assets than the banks classified in any other group. The coefficient of the excluded from the regression quartile 1 banks, exceeds the coefficients of any other quartile banks and therefore we observe negative quartile coefficients. The actual divergence of quartile 1 firms from quartile 2, 3 and 4 firms is found to be 14.9, 6.9 and 4.2 per cent respectively. This means that the divergence is decreasing as we move from group 2 banks to group 4. The coefficient of the inverse of bank size appears significantly negative, suggesting that larger banks hold relatively more liquid assets than their smaller rivals.

Table IV.14 reveals that the coefficients of all the variables of interest have significantly negative values, but the coefficient of intragroup 2 variable which has insignificantly negative values. This evidence suggests the following. Firstly that the second, the fourth and the eighth firm of our sample hold reserves that cover a larger proportion of their total deposits than the first, fifth and seventh bank of our sample. Secondly that the reserves held by quartile 1 banks cover a larger proportion of their total deposits, than those held by quartile 2, 3 and 4 banks. The divergence of group 1 financial firms from group 2, 3 and 4 is found 25.0, 16.6 and 11.6 per cent respectively. This result offers an indication that high-performance banks may be equipped with a better defense than their rivals against massive deposit withdrawals. However, we postpone the drawing of any definite conclusion on this matter, until we examine banks' asset structure. Finally, the negative coefficient that is found of the reciprocal of size denotes that larger banks have higher ratio in question than their smaller competitors.

The evidence presented in table IV.15 indicate that only the second bank of our sample has a significantly higher ratio in question than the first firm. All the other three coefficients of the intragroup variables are statistically insignificant. Moreover, quartile 1 banks appear to have a larger coverage of their deposits that are subject to withdrawal on demand by relatively liquid assets, only to quartile 2 banks. The coefficients of quartile 3 and 4 variables are statistically insignificant and therefore we can draw no inferences about their divergence from quartile 1 variable. This evidence combined with those presented in table IV.14 suggest that quartile 1 banks should have a higher ratio of cash and due from banks to time deposits, than quartile 3 and 4 banks[1]. This finding indicates that group 1 banks have either relatively more cash and due from banks than group 3 and 4 firms, or relatively less time deposits, or both. The first case is supported by the findings presented in table IV.13. The other two cases will be checked when the investigation of banks' liability structure will take place. Furthermore, the significantly negative coefficient of bank size variable of table IV.14 suggests that larger firms have in general a better defense than their smaller rivals.

C. Capital Adequacy Ratios.

Examination of table IV.16 reveals that all the variables of interest, but intragroup 1 and bank size variables, have statistically significant coefficients. The fourth firm of our sample has a higher ratio of total loans to equity capital than the third firm, while the sixth and eighth bank a lower ratio than the fifth and seventh respectively. Moreover, quartile 1 banks employ more equity capital to finance their loans than any other quartile banks. This conclusion is based upon the statistical significance of the coefficients of quartile 2, 3 and 4 variables and their positive values. Finally, we are unable to draw any inference about different total loans to equity capital ratios among large and small firms, as the coefficient of the reciprocal of bank size is statistically insignificant.

The regression results presented in table IV.17 provide evidence that the third bank of our sample has a higher equity-to-liability ratio than the fourth bank. This finding is based upon the statistically positive coefficient of intragroup 2 variable. In addition, the same table reveals that apart from the coefficient of quartile 4 which is significantly negative, the coefficients of the other two profitability binary variables are insignificantly negative. This revelation suggests that the firms classified in the first group are less highly geared (i.e. they have higher equity-to-liabilities ratio), than those classified in the fourth group. Consequently, high-performance banks are expossed into less financial risk than the least profitable banks. Furthermore, the coefficient of bank size variable is significantly positive. This disclosure indicates that larger financial institutions are more highly geared (i.e. they rely more upon debt and less upon equity finance), than smaller firms.

The regression results of table IV.18 show that the coefficients of intragroup 1 and profitability variables 3 and 4 are statistically significant, while the coefficients of all the other variables of interest are not. The positive coefficient of intragroup 2 variable indicates that the third bank of our sample has a higher equity capital to total deposits ratio than the fourth firm. Furthermore, the negative values of quartile 3 and 4 binary variables provide evidence that depositors of group 1 banks are more capital protected than those of group 3 and 4 banks. Consequently, in the extreme case of liquidation depositors of quartile 1 banks may be compensated relatively more than those of quartile 3 and 4 banks. Finally, we can draw no inferences about different depositors' capital protection among quartile 1 banks and quartile 2 banks, as well as large and small firms, because the coefficients of the relevant variables are statistically insignificant.

D. Asset and Liability Composition Ratios.

Table IV.19 reveals that the coefficients of intragroup 1 and 3 variables as well as the three quartile binary variables are negative and statistically significant. These findings indicate the following. First, the second and the sixth sample firms have higher ratios in question, than the first and the fifth sample firms respectively. Second, the banks classified in the first category are not only more profitable but also more liquid than any other banking group. Subsequently, quartile 1 banks have a larger first line of defense in meeting their depositors' withdrawals than the remaining quartile banks. This claim confirms a similar one that was made interpretting the results presented in table IV.13. The coefficient of the inverse of total assets is insignificantly negative and therefore we can draw no inferences about its value.

Examination of the regression results of table IV.20 shows that the coefficients of quartile 3 and 4 binary variables are significantly positive. This finding suggests that the banks classified in the first group have relatively less deposits with the Bank of Greece than those classified in the third and the fourth group. These deposits, however, do not provide as much immediate liquidity in Greece as in other countries and gain relatively low interests[2]. Therefore, these accounts should not be very popular among Greek banks. The coefficients of the remaining variables of interest are found statistically insignificant and consequently we can draw no inferences regarding this ratio.

The regression results of table IV.21 reveal that the coefficients of quartile 2 and bank size variables are significantly positive, while the coefficients of the remaining variables of interest are statistically insignificant. Consequently, high-performance banks are found to grant relatively less loans to their customers than the banks classified in the second category. Moreover, large firms are found to exhibit less loan aggressiveness than their smaller opponents. This claim is based upon the positive coefficient of bank size variable which denotes that larger firms have lower total loans to total assets ratio than smaller firms.

Table IV.22 shows that all the coefficients of intragroup and quartile binary variables are statistically insignificant. This finding suggests the following. First, the loan structure between the firms within each group do not differ substantially. Second, the loan structure of the first group does not differ substantially from that of the other three banking groups. However, the coefficient of the bank size variable appears significantly positive, indicating that larger financial institutions grant relatively less short-run loans than their smaller competitors.

The above finding (i.e. the second one) combined with the equivalent that appears in table IV.21, tells us nothing about the possible difference between small and large firms as far as the long-run loans are concerned. This question is answered by the results appearing in table IV.23. Examination of this table reveals that the coefficients of all the variables of interest, but the bank size, are statistically insignificant. The coefficient of the reciprocal of total assets is found significantly negative. This outcome suggests that larger banks grant relatively more long-run loans than their smaller rivals.

The regression results presented in table IV.24 indicate that the coefficients of intragroup binary variables are significantly positive. This finding suggests that the first, the third, the fifth and the seventh sample banks invest relatively more in total securities than the second, the fourth, the sixth and the eighth sample bank respectively. The coefficient of quartile 3 profitability variable appears insignificantly negative, while the coefficients of quartile 2 and 4 variables are significantly positive and significantly negative respectively. Consequently, group 2 firms possess relatively more total securities than group 1 firms and group 4 banks relatively less than group 1 banks. The coefficient of the reciprocal of total assets is found significantly positive, suggesting that large financial institutions invest relatively less in total securities than the small ones.

Table IV.25 shows that the coefficients of group 3 and 4 are significantly positive, while those of the other variables of interest are statistically insignificant. This outcome suggests that quartile 3 and 4 banks have relatively larger drachma volume of total deposits than quartile 1 banks. Inferences about differences in the volume of deposits among the other sets of banks cannot be drawn.

Examination of the results presented in table IV.26 reveal that the coeficients of intragroup 1, 2 and 3 variables are significantly negative. In consequence, the second, the fourth and the sixth sample banks have a higher sight and savings deposits to total deposits ratio, than the first, the third and the fifth sample banks respectively. The coeficients of quartile 3 and 4 variables are significantly negative. This finding indicates that the banks classified in the first group should have more sight and savings deposits, and consequently less time deposits, as a proportion to their total deposits, than the banks classified in the third and the fourth group. The coefficients of the remaining variables of interest are found insignificantly negative and therefore provide no information about differences in the structure of deposits between the corresponding bank sets.

The aforementioned table (i.e. table IV.26), reveals no information about the possible difference in deposit stucture between group 1 and group 2 banks. However, the t-Statistics of quartile 2 coefficients of tables IV.25 and IV.26 are statistically different from zero at the 0.10 confidence level in a two-tailed t test. In consequence, there are good reasons to believe that the deposit structure of group 1 firms do differ than that of group 2 firms. This claim is verified by the regression results presented in table IV.27. This table shows that the coefficient of quartile 2 variable is significantly positive. This finding suggests that the banks classified in the second category have relatively more time deposits than the firms classified in the first category. In the same table (i.e. table IV.27) the coefficients of intragroup 1, 2 and 3 and quartile 3 and 4 variables are found significantly positive as well. This means that the first, the third and the fifth sample banks have a higher time deposits to liabilities ratio than the second, the fourth and the sixth sample firms respectively. Similarly, quartile 3 and 4 financial institutions have a higher ratio in question than quartile 1 institutions. Needless to say, this result is expected after the interpretation of the findings presented in tables IV.25 and IV.26.

E. Investment Policy Ratios.

The regression results presented in table IV.28 indicate that the coefficients of all the quartile variables, and all the intragroup variables but one, are statistically insignificant. The coefficient of intragroup 3 variable is significantly negative, suggesting that the sixth sample firm has a higher total loans to total deposits ratio than the fifth sample firm. The coefficient of the bank size variable is found significantly positive. This finding implies that larger financial institutions finance their credit more with their deposits than smaller firms. However, the aforementioned indications are questionable because the F-Statistic calculated from the regression is lower than the appropriate critical value of the F distribution at the 5 per cent significance level with (16,55) degrees of freedom. In consequence, we cannot reject the null hypothesis of no relationship between the dependent and the independent variables at the 5 per cent significance level.

Table IV.29 reveals that the coefficients of intragroup 2 and 3 as well as quartile 3 and 4 variables are significantly negative. Consequently, the fourth and the sixth sample bank has a higher total loans to time deposits ratio than the third and the fifth sample bank respectively. Moreover, the firms classified in the first group are found to finance their credit with less time deposits than the firms classified in the third and the fourth group. The coefficients of the remaining variables of interest appear insignificantly negative and therefore we can draw no inferences as far as this ratio is concerned.

Examination of the regression results of table IV.30 show that the coefficients of all intragroup binary variables are significantly positive. This finding indicates that the first, the third, the fifth and the seventh sample firms have a higher total securities to total deposits ratio than the second, the fourth, the sixth and the eighth sample banks respectively. In addition, the coefficient of quartile 4 variable is found significantly negative, while the coefficients of quartile 2 and 3 appear statistically insignificant. Consequently, the financial institutions classified in the first group seem to finance their investment in securities with less of their deposits than the institutions classified in the fourth group. The coefficients of quartile 2 and 3 are found statistically insignificant and therefore they provide no information about the divergence of group 2 and 3 from group 1 banks as far as this ratio is concerned. Finally, the coefficient of bank size variable is found significantly positive, denoting that large firms finance their investment in securities with more of their deposits, than their smaller opponents.

Table IV.31 illustrates that the coefficients of all the variables of interest are statistically significant. The positive values of the coefficients of the intragroup variables indicate that the first, the third, the fifth and the seventh sample banks have a higher total securities to time deposits ratio than the second, the fourth, the sixth and the eighth sample banks respectively. The positive coefficient of quartile 2 binary variable suggests that the banks classified in the first group employ more time deposits to finance their investment in securities than the second bank group. The negative coefficients of quartile 3 and 4 binary variables imply that the firms classified in the first group finance their investment in securities with less time deposits than the firms classified in the third and the fourth group. Finally, the positive coefficient of the reciprocal of total assets provide evidence that large banks employ more time deposits to fund their investment in securities than their smaller rivals.

The regression results reported in table IV.32 indicate that the coefficients of all the intragroup variables are significantly positive. This finding suggests that the first, the third, the fifth and the seventh sample banks have a higher total securities to sight and savings deposits ratio than the second, the fourth, the sixth and the eighth sample banks respectively. The significantly positive coefficient of quartile 2 binary variable denotes that the banks classified in the first group employ more sight and savings deposits to finance their investment in securities than the banks classified in the second group. The significantly negative coefficient of quartile 4 variable indicates that group 1 firms utilize less sight and savings deposits to finance their investment in securities than group 4 firms. Moreover, the coefficient of bank size variable appears significantly positive, showing that larger institutions employ more sight and savings deposits to fund their investment in securities than smaller ones. Finally, the coefficient of quartile 3 variable is found statistically insignificant, providing us with no evidence to draw any inferences about the possible divergence between group 3 and group 1 banks regarding this ratio.

F. Expense Ratio.

Table IV.33 reveals that only the coefficients of intragroup 2 and 3 binary variables are significantly different from zero at the 0.01 and 0.05 level respectively. The negative values of their coefficients indicate that the fourth and the sixth sample banks outperform significantly the third and the fifth sample banks respectively in controlling operating expenses. The coefficients of the remaining variables of interest are found statistically insignificant. Nevertheless, the coefficients of quartile 3 and the bank size variables appear significant at the 10 per cent confidence level. The negative value of quartile 3 variable implies that the banks classified in the first group might have a higher expense ratio in question than those classified in the third group. The positive value of the coefficient of the reciprocal of total assets provides some support to the claim that larger financial institutions have relatively less operating expenses than their smaller competitors. Consequently, large size firms might be able to reap economies of scale in Greece. None the less, this indication is investigated further in the fifth chapter.

The regression results presented in table IV.34 show that the coefficients of all the intragroup binary variables are significantly positive. This finding indicates that the first, the third, the fifth and the seventh sample banks have a higher staff expenses-to-employee ratio than the second, the fourth, the sixth and the eighth sample banks respectively. The coefficient of quartile 4 profitability variable appears significantly negative, suggesting that the group 1 banks have a higher staff related cost per employee than the group 4 banks. In addition, the coefficient of the bank size variable is found significantly positive. This outcome provides evidence that larger firms have a lower staff driven cost per employee, than their smaller opponents. This indication supports the following considerations. First, the above finding reinforces the one appeared in table IV.33 that scale economies in Greek banking might be present, to the extent that staff expenses are the major type of expenditure in banking (they are only second in importance after interest expenses). Second, it reveals that larger financial institutions pay relatively less their personnel than smaller ones. However, to the extent that the salaries are more or less fixed exogenously during the period studied, the aforementioned outcome implies that larger firms may employ relatively younger personnel than that of their smaller rivals[3].

G. Productivity Ratios.

Examination of the results illustrated in table IV.35 reveal that the coefficients of the intragroup binary variables as well as quartile 3 dummy variable are significantly positive. Consequently, the first, the third, the fifth and the seventh sample banks appear more productive than the second, the fourth, the sixth and the eighth sample banks respectively. Moreover, the average employee of group 3 firms is found to provide more help than the average employee of group 1 firms in managing the assets of their company. The coefficients of the remaining variables of interest are statistically insignificant, offering no information as far as this ratio is concerned.

The regression results of table IV.36 indicate that the coefficients of intragroup 2 and quartile 4 binary variables are found statistically significant. The positive coefficient of intragroup 2 variable implies that the third sample bank is more productive regarding this ratio than the fourth sample bank. The negative coefficient of quartile 4 variable suggests that firms classified in the first group are helped more by their employees in generating net income than firms classified in the fourth group. Put differently, high-performance banks seems to utilize their personnel more effectively, than the least profitable banks. The coefficients of the remaining variables of interest are found statistically insignificant, providing us with no support in drawing inferences regarding this ratio.

II. Tables

TABLE IV.3

Estimated Autocorrelation Coefficients 1

Dependent Variables	Rhos Estimated Directly
INC1	0.11193
INC2	0.27636
LIQ1	0.57586
LIQ2	0.71300
LIQ3	0.78432
CAD1	0.45634
CAD2	0.58100
CAD3	0.61241
ALC1	0.45741
ALC2	0.60923
ALC3	0.55958
ALC4	0.68601
ALC5	0.68601
ALC6	0.59405
ALC7	0.69449
ALC8	0.64098
ALC9	0.65798
INV1	0.47950
INV2	0.54139
INV3	0.61821
INV4	0.58583
INV5	0.60691
EXP1	0.51957
EXP2	0.66196
PRD1	0.84686
PRD2	0.38638

TABLE IV.4

Estimated Autocorrelation Coefficients 2

Dependent Variables	Rhos Estimated by Cochrane-Orcutt	Rhos Estimated by Hildreth-Lu
INC1	0.156710	0.150000
INC2	0.317119**	0.300000**
LIQ1	0.729840**	0.750000**
LIQ2	0.690626**	0.700000**
LIQ3	0.768517**	0.800000**
CAD1	0.596279**	0.600000**
CAD2	0.502367**	0.500000**
CAD3	0.516817**	0.500000**
ALC1	0.597271**	0.600000**
ALC2	0.635420**	0.650000**
ALC3	0.825689**	0.850000**
ALC4	0.741549**	0.750000**
ALC5	0.795616**	0.800000**
ALC6	0.499423**	0.500000**
ALC7	0.709719**	0.700000**
ALC8	0.739500**	0.739500**
ALC9	0.679035**	0.700000**
INV1	0.945500**	0.945500**
INV2	0.528490**	0.550000**
INV3	0.541098**	0.550000**
INV4	0.474501**	0.500000**
INV5	0.545237**	0.550000**
EXP1	0.680421**	0.700000**
EXP2	0.756000**	0.756000**
PRD1	0.892231**	0.900000**
PRD2	0.531500**	0.550000**

Note:
Starred ** terms indicate rho estimates statistically different from zero at the 0.01 confidence level in a two-tailed t test.

TABLE IV.5

Tests for Heteroscedasticity

Dependent Variables	Breusch-Pagan Statistics
INC1	44.59007
INC2	18.38697**
LIQ1	24.01347**
LIQ2	20.16199**
LIQ3	18.28753**
CAD1	39.79546
CAD2	24.60151**
CAD3	29.33791*
ALC1	42.15698
ALC2	15.78868**
ALC3	21.33726**
ALC4	42.92071
ALC5	36.15186
ALC6	56.43312
ALC7	39.33528
ALC8	25.94732**
ALC9	39.67428
INV1	19.19420**
INV2	28.25864*
INV3	64.61188
INV4	65.63540
INV5	65.95389
EXP1	31.77996*
EXP2	58.78573
PRD1	19.24422**
PRD2	47.11167

Note:
Asterisk **(*) indicates statistics lower than the critical values of x^2_{16} at the 5 (1) per cent level of significance.

TABLE IV.6

Regression Results

Dependent Variable: INC1

Variables	Estimated Coefficients	t-Statistics
Constant	0.0033765210000	0.9154165000
Intragroup 1	0.0000004640793	0.0001482186
Intragroup 2	0.0008054575000	1.2699890000
Intragroup 3	-0.0008825050000	-0.3474712000
Intragroup 4	0.0002739577000	0.1046755000
Quartile 2	-0.0025419360000	-0.8443566000
Quartile 3	-0.0033495340000	-2.0098650000*
Quartile 4	-0.0044238300000	-3.7120440000**
10^{10}/size	-0.0000584358400	-0.0491884900
1978	0.0049655690000	3.1666420000**
1979	0.0051632820000	2.8265640000**
1980	0.0077833180000	4.2808100000**
1981	0.0064195840000	3.2612660000**
1982	0.0019682570000	1.0817490000
1984	0.0025351550000	1.6015900000
1985	0.0036057940000	1.7825450000
1986	0.0046355670000	2.2946510000*

SER = 0.00337025
R^2 = 0.430840

$\bar{R}^2$ = 0.265266
F-Statistic = 2.60210

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.7

Regression Results

Dependent Variable: INC1		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	0.0003969680	0.2022234
Intragroup 1	0.0007065605	0.4188498
Intragroup 2	0.0009855876	1.4520940
Intragroup 3	-0.0006577082	-0.3719475
Intragroup 4	0.0009588695	0.6947859
10^{10}/size	0.0001716961	0.3257093
1978	0.0038839160	2.8067590**
1979	0.0046097340	2.6865760**
1980	0.0075249420	3.9916430**
1981	0.0062951550	3.1103880**
1982	0.0019239540	1.0627880
1984	0.0025727980	1.8784940
1985	0.0036826230	1.7001820
1986	0.0047267190	2.3321120*
SER = 0.00355506		
R^2 = 0.285315		
$\bar{R}^2$ = 0.125127		
F-Statistic = 1.78112		

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.8

Regression Results

Dependent Variable: INC1		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	0.0006887639000	0.435604300
10^{10}/size	0.0000004620889	0.001522642
1978	0.0039070890000	2.952103000**
1979	0.0046388090000	2.815200000**
1980	0.0075728910000	4.074275000**
1981	0.0063402270000	3.165477000**
1982	0.0019446300000	1.104292000
1984	0.0025490000000	1.839730000
1985	0.0036310990000	1.693144000
1986	0.0046650220000	2.295584000*
SER = 0.00348227 R^2 = 0.266468 $\bar{R}^2$ = 0.159988 F-Statistic = 2.50251		

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.9

Regression Results

Dependent Variable: INC1		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	0.0018373280	0.6359377
Intragroup 1	0.0005329453	0.2604667
Intragroup 2	0.0007607680	1.5236260
Intragroup 3	0.0002827126	0.1535261
Intragroup 4	0.0010577530	0.6292982
Quartile 2	-0.0010328570	-0.4731483
Quartile 3	-0.0027006810	-2.1093570*
Quartile 4	-0.0038167640	-3.6116080**
10^{10}/size	0.0004378733	0.6084672
1977	0.0053290350	2.6229130*
1978	0.0055821610	3.2176370**
1979	0.0051256940	2.7767610**
1980	0.0076289580	4.2980580**
1981	0.0062789370	3.1558490**
1982	0.0019050380	1.0081870
1984	0.0026054910	1.4350130
1985	0.0037570160	1.8285470
1986	0.0048164730	2.2922070*

SER = 0.00342772
R^2 = 0.450170

$\bar{R}^2$ = 0.299410
F-Statistic = 2.98600

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.10

Regression Results

Dependent Variable: INC2		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	0.10392970	1.32283400
Intragroup 1	-0.00145747	-0.02082448
Intragroup 2	0.00755596	0.28816330
Intragroup 3	-0.01211933	-0.22551900
Intragroup 4	0.04271618	0.66576180
Quartile 2	-0.05890287	-0.82868990
Quartile 3	-0.08174642	-1.92349400
Quartile 4	-0.05783838	-1.60432900
10^{10}/size	-0.01478141	-0.52623560
1978	0.08549502	2.60978900*
1979	0.08830647	2.37783900*
1980	0.14179430	3.68857400**
1981	0.13827410	3.71252400**
1982	0.03661865	1.14350200
1984	0.05740219	1.78719900
1985	0.09875520	2.62884200*
1986	0.15390480	3.91555700**

SER = 0.0731329
R^2 = 0.437707

$\bar{R}^2$ = 0.274132
F-Statistic = 2.67587

Note:
Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.

TABLE IV.11

Regression Results

Dependent Variable: INC2		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	0.032113650	0.8205823
Intragroup 1	0.030537650	0.6623564
Intragroup 2	0.014160310	0.4716316
Intragroup 3	0.006123578	0.1568719
Intragroup 4	0.076301420	1.7365970
10^{10}/size	-0.001986245	-0.1279751
1978	0.073977640	2.3822370*
1979	0.079242580	2.1654940*
1980	0.134651100	3.5387870**
1981	0.133376900	3.6339540**
1982	0.034583530	1.1160420
1984	0.059401460	1.9060290
1985	0.102923100	2.7590980**
1986	0.158874500	4.0113140**
SER = 0.0738635		
R^2 = 0.378119		
$\bar{R}^2$ = 0.238732		
F-Statistic = 2.71272		

Note:
Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.

TABLE VI.12

Regression Results

Dependent Variable: INC2

Variables	Estimated Coefficients	t-Statistics
Constant	0.05845797	2.083707*
10^{10}/size	-0.01756789	-2.556305*
1978	0.07456310	2.633461*
1979	0.08043007	2.977819**
1980	0.13805580	4.617810**
1981	0.13697940	4.176032**
1982	0.03627896	1.239846
1984	0.05733813	2.545450*
1985	0.09839028	2.185732*
1986	0.15344300	3.384012**

SER = 0.07368836
R^2 = 0.335854

$\bar{R}^2$ = 0.239445
F-Statistic = 3.48366

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.13

Regression Results

Dependent Variable: LIQ1

Variables	Estimated Coefficients	t-Statistics
Constant	0.58225200	20.225270**
Intragroup 1	-0.07011333	-2.799505**
Intragroup 2	-0.01988043	-1.344831
Intragroup 3	-0.06151656	-3.195699**
Intragroup 4	-0.04880980	-1.867124
Quartile 2	-0.14923160	-5.317171**
Quartile 3	-0.06951616	-3.058299**
Quartile 4	-0.04204809	-2.030437*
10^{10}/size	-0.03069047	-2.735491**
1978	-0.02975351	-4.765387**
1979	-0.03450140	-4.447309**
1980	-0.02757443	-3.382455**
1981	-0.01452387	-1.857523
1982	-0.01039898	-1.681951
1984	0.02767532	4.198627**
1985	0.02980203	3.294823**
1986	0.01536839	1.468814

SER = 0.0167249
R^2 = 0.637121

$\bar{R}^2$ = 0.531557
F-Statistic = 6.03536

Note:
Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.

TABLE IV.14

Regression Results

Dependent Variable: LIQ2		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	0.78747960	24.137580**
Intragroup 1	-0.14399220	-5.067231**
Intragroup 2	-0.01669394	-1.106824
Intragroup 3	-0.09093775	-4.221361**
Intragroup 4	-0.07186343	-2.484482*
Quartile 2	-0.25003810	-8.091782**
Quartile 3	-0.16609400	-7.063859**
Quartile 4	-0.11637650	-5.543447**
10^{10}/size	-0.05312492	-4.210051**
1978	-0.04704646	-6.420114**
1979	-0.05340536	-5.876333**
1980	-0.03335326	-3.459468**
1981	-0.01753860	-1.893707
1982	-0.01422101	-1.939272
1984	0.03966952	5.129886**
1985	0.04434930	4.231318**
1986	0.03088527	2.575146**

SER = 0.0194592
R^2 = 0.788935

$\bar{R}^2$ = 0.727535
F-Statistics = 12.8490

Note:
Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.

TABLE IV.15

Regression Results

Dependent Variable: LIQ3

Variables	Estimated Coefficients	t-Statistics
Constant	1.15115300	17.8021100**
Intragroup 1	-0.13225020	-2.3449290*
Intragroup 2	0.04325614	1.1454160
Intragroup 3	0.07640543	1.7134150
Intragroup 4	-0.06304623	-1.0414490
Quartile 2	-0.30222170	-4.5837510**
Quartile 3	-0.03156435	-0.5520767
Quartile 4	-0.07044217	-1.3217130
10^{10}/size	-0.05915141	-2.3461340*
1978	-0.08614612	-6.3140730**
1979	-0.12129950	-7.1453200**
1980	-0.10049520	-5.7010450**
1981	-0.06372141	-3.7802560**
1982	-0.03982718	-2.9890420**
1984	0.04738481	3.2969770**
1985	0.03654487	1.8317170
1986	-0.00492207	-0.2108380

SER = 0.0367575
R^2 = 0.698183

$\bar{R}^2$ = 0.610381
F-Statistic = 7.95184

Note:
Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.

TABLE IV.16

Regression Results

Dependent Variable: CAD1		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	6.23796700	3.49036200**
Intragroup 1	1.77789700	1.28873800
Intragroup 2	-3.46970100	-4.11716400**
Intragroup 3	4.75851600	4.95672000**
Intragroup 4	6.88934800	4.74224100**
Quartile 2	5.48020800	3.00663000**
Quartile 3	3.23467000	2.80622800**
Quartile 4	5.58864600	3.85593200**
10^{10}/size	0.03869629	0.06924021
1978	1.07868800	1.48976800
1979	0.82620260	1.07766000
1980	1.18705700	1.42455600
1981	2.99951500	3.70907800**
1982	1.04806700	1.60278300
1984	1.25789900	3.21999300**
1985	3.23119800	4.62849500**
1986	4.89139400	5.39388300**

SER = 1.72990
R^2 = 0.717378

$\bar{R}^2$ = 0.635161
F-Statistic = 8.72539

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.17

Regression Results

Dependent Variable: CAD2

Variables	Estimated Coefficients	t-Statistics
Constant	0.041956420	6.0515080**
Intragroup 1	0.004257461	0.6934670
Intragroup 2	0.008736125	3.5072010**
Intragroup 3	-0.005662203	-1.2170370
Intragroup 4	-0.005573706	-0.9593641
Quartile 2	-0.002787206	-0.4417499
Quartile 3	-0.003117032	-0.7756433
Quartile 4	-0.012021380	-3.5148930**
10^{10}/size	0.006492097	2.5295140*
1978	0.001051629	0.5069622
1979	0.002575468	1.0293200
1980	0.001087673	0.4081670
1981	-0.006021818	-2.3528810*
1982	-0.001897789	-0.9123138
1984	-0.004675918	-2.2122910*
1985	-0.010285220	-3.8533190**
1986	-0.014949580	-5.1317370**

SER = 0.00509213
R^2 = 0.806322

$\bar{R}^2$ = 0.749979
F-Statistic = 14.3110

Note:
Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.

TABLE IV.18

Regression Results

Dependent Variable: CAD3

Variables	Estimated Coefficients	t-Statistics
Constant	0.058089470	8.66542200**
Intragroup 1	-0.001978048	-0.35556770
Intragroup 2	0.009954046	5.54409700**
Intragroup 3	-0.008211220	-1.71723400
Intragroup 4	-0.009357234	-1.53300500
Quartile 2	-0.011180510	-1.82167800
Quartile 3	-0.010900060	-2.77519200**
Quartile 4	-0.018875180	-4.64730500**
10^{10}/size	0.004978260	1.89037300
1978	0.000159573	0.06951129
1979	0.001789959	0.58498840
1980	0.001663547	0.61240780
1981	-0.006156509	-2.51548000*
1982	-0.002080774	-1.13220000
1984	-0.005011680	-2.46430600*
1985	-0.011423640	-5.51386300**
1986	-0.016478990	-7.41686000**

SER = 0.00576008
R^2 = 0.788387

$\bar{R}^2$ = 0.726827
F-Statistics = 12.8068

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.19

Regression Results

Dependent Variable: ALC1		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	0.2539976000	6.6409320**
Intragroup 1	-0.0881143500	-2.5210600*
Intragroup 2	-0.0064586530	-0.7177640
Intragroup 3	-0.0587464700	-2.0979560*
Intragroup 4	-0.0305425800	-0.8334439
Quartile 2	-0.1482816000	-4.4672210**
Quartile 3	-0.1220610000	-6.5446140**
Quartile 4	-0.0824995000	-5.3088670**
10^{10}/size	-0.0297418100	-1.6646690
1978	-0.0078134000	-1.1410850
1979	0.0055383720	0.5592811
1980	0.0084459030	0.9132277
1981	0.0068635830	0.9735523
1982	0.0007168286	0.1295879
1984	0.0054847970	0.8494597
1985	-0.0015135690	-0.1933940
1986	-0.0111210800	-1.3977900

SER = 0.0200441
R^2 = 0.559551

$\bar{R}^2$ = 0.431420
F-Statistic = 4.36703

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.20

Regression Results

Dependent Variable: ALC2		
Variables	Estimated Coefficients	t-Statistics
Constant	0.091002860	3.3055230**
Intragroup 1	0.010131760	0.4206342
Intragroup 2	-0.016518760	-1.4481830
Intragroup 3	0.007028267	0.3872587
Intragroup 4	-0.011125590	-0.4669313
Quartile 2	0.025066950	0.9834140
Quartile 3	0.059175360	3.2774560**
Quartile 4	0.041612240	2.6388300*
10^{10}/size	0.009541996	0.9084427
1978	-0.023221650	-3.5128120**
1979	-0.046441300	-5.6893840**
1980	-0.050339660	-5.7681440**
1981	-0.035275620	-4.2059330**
1982	-0.007804613	-1.1704270
1984	-0.002025381	-0.2920015
1985	-0.015134140	-1.6410700
1986	-0.029533190	-2.8385950**

SER = 0.0172469
R^2 = 0.578942

$\bar{R}^2$ = 0.456452
F-Statistic = 4.72645

Note:
Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.

TABLE IV.21

Regression Results

Dependent Variable: ALC3

Variables	Estimated Coefficients	t-Statistics
Constant	0.286858300	7.85034100**
Intragroup 1	0.061634690	1.90056800
Intragroup 2	-0.009233037	-0.34479550
Intragroup 3	-0.010282710	-0.36847870
Intragroup 4	0.066842140	1.85138000
Quartile 2	0.108966400	2.63270800*
Quartile 3	0.056135200	1.41859800
Quartile 4	-0.025902170	-0.06773807
10^{10}/size	0.039365440	2.88241100**
1978	0.037180830	5.10546300**
1989	0.044649810	4.91580700**
1980	0.038089150	4.11881700**
1981	0.026440890	3.01162900**
1982	0.012129820	1.74697000
1984	-0.011769460	-1.54223000
1985	-0.013630180	-1.26537100
1986	-0.016899310	-1.31452600

SER = 0.0197260
R^2 = 0.464680

$\bar{R}^2$ = 0.308951
F-Statistic = 2.98389

Note:
Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.

TABLE IV.22

Regression Results

Dependent Variable: ALC4

Variables	Estimated Coefficients	t-Statistics
Constant	0.687931900	15.3839300**
Intragroup 1	0.066643260	1.6636480
Intragroup 2	0.029007970	1.1763990
Intragroup 3	0.010669830	0.3998760
Intragroup 4	0.059333460	1.3586560
Quartile 2	0.045430870	1.0155520
Quartile 3	-0.029293650	-0.9391110
Quartile 4	-0.030354930	-0.8798174
10^{10}/size	0.058049520	3.5537260**
1978	0.013886720	1.9112990
1979	0.005998549	0.6615799
1980	-0.008884976	-0.9411027
1981	-0.008110113	-0.7843389
1982	-0.006391690	-0.8921822
1984	0.019162040	1.4668830
1985	0.015747560	1.1326880
1986	-0.033851030	-1.8561930

SER = 0.0287598
R^2 = 0.479514

$\bar{R}^2$ = 0.328099
F-Statistic = 3.16690

Notes:
1. Starred *(**) terms indicate parameters statistically differrent from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.23

Regression Results

Dependent Variable: ALCS		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	0.3010749000	6.40385800**
Intragroup 1	-0.0552913900	-1.29314100
Intragroup 2	-0.0225460900	-0.71157170
Intragroup 3	0.0005741133	0.02072282
Intragroup 4	-0.0481153400	-0.95353640
Quartile 2	-0.0481153400	-0.95353640
Quartile 3	0.0314444200	0.79400590
Quartile 4	0.0433290600	1.00901300
10^{10}/size	-0.0534200100	-3.18789400**
1978	-0.0189553900	-2.43183700*
1979	-0.0090826830	-0.95641670
1980	0.0064362250	0.67114590
1981	0.0063589010	0.63106910
1982	0.0056425320	0.81406060
1984	-0.0184156600	-1.40304000
1985	-0.0141985300	-0.99622910
1986	0.0356959900	1.95194900

SER = 0.0287753
R^2 = 0.428669

$\overline{R}^2$ = 0.262464
F-Statistic = 2.57916

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.24

Regression Results

Dependent Variable: ALC6

Variables	Estimated Coefficients	t-Statistics
Constant	0.01864169000	4.00724200**
Intragroup 1	0.01922132000	6.16947400**
Intragroup 2	0.01671895000	6.88738000**
Intragroup 3	0.01451474000	6.46890300**
Intragroup 4	0.01441709000	4.79964500**
Quartile 2	0.01134802000	2.49153700*
Quartile 3	-0.00008950269	-0.02847686
Quartile 4	-0.01018674000	-3.67594400**
10^{10}/size	0.00430448700	3.44259100**
1978	0.00214550000	1.33201600
1979	0.00113090000	0.44048600
1980	-0.00115950000	-0.59726420
1981	0.00129496100	0.66449600
1982	0.00355153500	2.59039300*
1984	-0.00573409200	-5.13201700**
1985	-0.00974238400	-5.47175400**
1986	-0.00824216900	-4.74000500**

SER = 0.00464227
R^2 = 0.745343

$\bar{R}^2$ = 0.671261
F-Statistic = 10.0611

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.25

Regression Results

Dependent Variable: ALC7		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	0.760166600	20.6702700**
Intragroup 1	0.061234140	1.8327380
Intragroup 2	-0.004578566	-0.4080712
Intragroup 3	0.002895456	0.1521637
Intragroup 4	-0.005112801	-0.1696516
Quartile 2	0.066721970	1.9123990
Quartile 3	0.090609740	3.5781770**
Quartile 4	0.074549040	3.2214100**
10^{10}/size	0.022704140	1.6133010
1978	0.011280410	1.5456790
1979	0.009995470	1.3016570
1980	-0.008289877	-1.1217530
1981	-0.010725440	-1.5626770
1982	-0.001494527	-0.3365797
1984	-0.009044793	-1.3273330
1985	-0.013304540	-1.6109070
1986	-0.020981720	-2.3363930*

SER = 0.0189265
R^2 = 0.466366

$\bar{R}^2$ = 0.311127
F-Statistic = 3.00418

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.26

Regression Results

Dependent Variable: ALC8

Variables	Estimated Coefficients	t-Statistics
Constant	0.69332320	28.594120**
Intragroup 1	-0.04268009	-2.022939*
Intragroup 2	-0.05751844	-4.484088**
Intragroup 3	-0.10599490	-6.501232**
Intragroup 4	-0.01709489	-0.771029
Quartile 2	-0.04357071	-1.825863
Quartile 3	-0.13824610	-7.035412**
Quartile 4	-0.08158685	-4.532336**
10^{10}/size	-0.01158239	-1.224395
1978	0.01980577	3.793742**
1979	0.04273787	6.586116**
1980	0.04432816	6.518794**
1981	0.02877369	4.414398**
1982	0.01224824	2.376787*
1984	0.01373978	2.493775*
1985	0.02666774	3.516875**
1986	0.03640842	4.139283**

SER = 0.014008
R^2 = 0.786875

$\bar{R}^2$ = 0.724875
F-Statistic = 12.6915

Note:
Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.

TABLE IV.27

Regression Results

Dependent Variable: ALC9		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	0.22820960	9.3873150**
Intragroup 1	0.05447174	2.4802800*
Intragroup 2	0.04434941	6.4567140**
Intragroup 3	0.09360690	5.8447840**
Intragroup 4	0.01282140	0.6793894
Quartile 2	0.05546576	2.5456350*
Quartile 3	0.13541580	8.3332370**
Quartile 4	0.09070672	7.0214030**
10^{10}/size	0.01673183	1.8260580
1978	-0.01829447	-4.5243130**
1979	-0.03992088	-8.8379000**
1980	-0.04549069	-9.0129530**
1981	-0.03146793	-5.7889750**
1982	-0.01296360	-3.3431010**
1984	-0.01285547	-2.0588580*
1985	-0.02299948	-3.5052650**
1986	-0.03180128	-4.9131030**

SER = 0.0132723
R^2 = 0.817948

$\bar{R}^2$ = 0.764987
F-Statistic = 15.4444

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.28

Regression Results

Dependent Variable: INV1		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	0.3536174000	2.52685500*
Intragroup 1	-0.1255898000	-0.95188980
Intragroup 2	-0.0628481700	-0.48845200
Intragroup 3	-0.3031900000	-2.19578000*
Intragroup 4	0.1065829000	0.82194230
Quartile 2	0.0523522000	0.28404450
Quartile 3	-0.0956135400	-0.52236820
Quartile 4	-0.2512877000	-1.34075600
10^{10}/size	0.0702375200	3.66135200**
1978	0.0370129600	3.42675100**
1979	0.0471747800	3.47238100**
1980	0.0461500700	3.44193300**
1981	0.0293679300	2.35374200*
1982	0.0111583000	1.13021100
1984	-0.0054871900	-0.48266990
1985	-0.0007014737	-0.04189451
1986	0.0014250640	0.06730079

SER = 0.0297499
R^2 = 0.342074

$\bar{R}^2$ = 0.150677
F-Statistic = 1.78725

Note:
Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.

TABLE IV.29

Regression Results

Dependent Variable: INV2

Variables	Estimated Coefficients	t-Statistics
Constant	1.76653000	8.1306760**
Intragroup 1	-0.24513340	-1.2823910
Intragroup 2	-0.33103300	-5.5800370**
Intragroup 3	-0.35052170	-2.6835270**
Intragroup 4	-0.05318538	-0.3071523
Quartile 2	-0.11398570	-0.5918533
Quartile 3	-0.55462600	-4.6556870**
Quartile 4	-0.55675970	-5.9734090**
10^{10}/size	-0.03679537	-0.4387508
1978	0.39347940	9.5507830**
1979	0.61046630	8.5793320**
1980	0.57786640	8.5793320**
1981	0.34968220	5.5034780**
1982	0.13119270	2.4180430*
1984	0.01337435	0.3271547
1985	0.05967605	0.9117977
1986	0.06776722	1.0350510

SER = 0.137814
R^2 = 0.794626

$\overline{R}^2$ = 0.734881
F-Statistic = 13.3003

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.30

Regression Results

Dependent Variable: INV3		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	0.024177220	3.6593310**
Intragroup 1	0.023842990	5.4119900**
Intragroup 2	0.021304010	6.7215230**
Intragroup 3	0.018131900	6.0298940**
Intragroup 4	0.018355110	4.3846380**
Quartile 2	0.012485470	1.9792860
Quartile 3	-0.002179882	-0.4815947
Quartile 4	-0.014039300	-3.4559660**
10^{10}/size	0.005383533	3.0950610**
1978	0.001269099	0.6258413
1979	0.000316731	0.1001672
1980	-0.001773028	-0.7058985
1981	0.001391792	0.5321581
1982	0.004340121	2.4706470*
1984	-0.006812810	-4.9921830**
1985	-0.011759430	-5.2440830**
1986	-0.009834812	-4.3161760**

SER = 0.00594881
R^2 = 0.705580

$\bar{R}^2$ = 0.619931
F-Statistic = 8.23801

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.31

Regression Results

Dependent Variable: INV4		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	0.06714270	3.477374**
Intragroup 1	0.07574306	5.596133**
Intragroup 2	0.05602201	4.763308**
Intragroup 3	0.03812873	3.940698**
Intragroup 4	0.05947193	4.534163**
Quartile 2	0.03956844	2.054622*
Quartile 3	-0.02882546	-2.337184*
Quartile 4	-0.05949535	-5.631592**
10^{10}/size	0.01951869	3.232527**
1978	0.01892965	2.428324*
1979	0.02441750	1.989742
1980	0.01463539	1.672446
1981	0.01604061	1.957621
1982	0.01686337	2.835406**
1984	-0.01592129	-3.217106**
1985	-0.02718081	-3.695809**
1986	-0.02127853	-3.132854**
SER = 0.0207099 R^2 = 0.695551 $\bar{R}^2$ = 0.606984 F-Statistic = 7.85338		

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.32

Regression Results

Dependent Variable: INV5		
Variables	Estimated Coefficients	t-Statistics
Constant	0.0377733400	3.7770470**
Intragroup 1	0.0351810900	5.2047150**
Intragroup 2	0.0337121100	8.4585930**
Intragroup 3	0.0356825700	7.4248260**
Intragroup 4	0.0274405800	4.2961320**
Quartile 2	0.0198740600	2.1534810*
Quartile 3	0.0061312000	0.8759311
Quartile 4	-0.0175757500	-2.7910460**
10^{10}/size	0.0076171070	2.9828750**
1978	-0.0007694648	-0.2791301
1979	-0.0037865260	-0.8694550
1980	-0.0067832460	-1.8611840
1981	-0.0010158690	-0.2595864
1982	0.0051359890	1.9062530
1984	-0.0112940000	-5.6552340**
1985	-0.0197619200	-5.8588160**
1986	-0.0167336200	-4.5371700**
SER = 0.0086655 R^2 = 0.745168 $\bar{R}^2$ = 0.671035 F-Statistic = 10.0518		

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.33

Regression Results

Dependent Variable: EXP1

Variables	Estimated Coefficients	t-Statistics
Constant	0.0291277600	8.6780000***
Intragroup 1	-0.0046256490	-1.5294860
Intragroup 2	-0.0034678350	-3.0844250***
Intragroup 3	-0.0050888900	-2.1616400**
Intragroup 4	-0.0008893005	-0.2629218
Quartile 2	0.0005331421	0.1729047
Quartile 3	-0.0041563940	-1.7515130*
Quartile 4	-0.0009918622	-0.5423120
10^{10}/size	0.0027110780	1.6815430*
1978	0.0009844005	1.1828640
1979	-0.0013781230	-1.5069530
1980	-0.0024602440	-2.7444350***
1981	-0.0011669140	-1.6855140*
1982	-0.0008080230	-1.5017760
1984	0.0018012800	2.4202760**
1985	0.0003648547	0.4336962
1986	-0.0017161610	-2.1428030**

SER = 0.00202577
R^2 = 0.727919

$\bar{R}^2$ = 0.648768
F-Statistics = 9.19660

Notes:
1. Starred *(**)(***) terms indicate parameters statistically diffferent from zero at the 0.10 (0.05) (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.34

Regression Results

Dependent Variable: EXP2		
Variables	Estimated Coefficients	t-Statistics
Constant	0.1274420000	25.0275100**
Intragroup 1	0.0180440900	3.6551220**
Intragroup 2	0.0161393400	2.8663510**
Intragroup 3	0.0382874400	8.6761200**
Intragroup 4	0.0098138150	2.0913380*
Quartile 2	0.0007243659	0.1056599
Quartile 3	0.0027533110	0.5602130
Quartile 4	-0.0089202600	- 2.0151780*
10^{10}/size	0.0035094470	2.0726830*
1978	-0.0139373300	-11.3688400**
1979	-0.0269224900	-17.1362100**
1980	-0.0317945200	17.2045100**
1981	-0.0280478800	-14.2702100**
1982	-0.0152234000	-13.1989600**
1984	0.0264744200	14.1110500**
1985	0.0478797600	19.1028700**
1986	0.0583583100	21.4907700**

SER = 0.00472111
R^2 = 0.945650

$\bar{R}^2$ = 0.929839
F-Statistic = 59.8099

Notes:
1. Starred *(**) terms indicate parameters statistically diferent from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.35

Regression Results

Dependent Variable: PRD1

Variables	Estimated Coefficients	t-Statistics
Constant	0.79496770	10.89244900**
Intragroup 1	0.32761950	4.83889900**
Intragroup 2	0.28099220	4.20584700**
Intragroup 3	0.63623210	9.48721900**
Intragroup 4	0.20106370	2.72702500**
Quartile 2	-0.00356695	-0.03757834
Quartile 3	0.22126920	2.29731600*
Quartile 4	-0.05850374	-0.60563370
10^{10}/size	-0.01427232	-0.69279020
1978	-0.04558532	-4.07236200**
1979	-0.07596492	-5.41853700**
1980	-0.08710237	-6.22720300**
1981	-0.07936159	-6.04307800**
1982	-0.04727220	-4.54866900**
1984	0.07188202	6.14074500**
1985	0.17474200	10.35106000**
1986	0.26379700	12.71626000**

SER = 0.0305302
R^2 = 0.877712

$\bar{R}^2$ = 0.842137
F-Statistic = 24.6723

Note:
Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.

TABLE IV.36

Regression Results

Dependent Variable: PRD2		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	0.29448450	1.1480260
Intragroup 1	0.03149399	0.1292979
Intragroup 2	0.15601320	2.5633350*
Intragroup 3	-0.02898952	-0.1710952
Intragroup 4	0.03764305	0.1935898
Quartile 2	-0.16608210	-0.6931990
Quartile 3	-0.19372650	-1.4121800
Quartile 4	-0.23902290	-2.6419800*
10^{10}/size	-0.03337518	-0.3656283
1978	0.02626186	0.7522299
1979	0.03801575	0.7817567
1980	0.12313100	2.1766620*
1981	0.12024130	2.0327390*
1982	0.04203370	0.7858118
1984	0.11565370	2.7882710**
1985	0.19835050	2.4021420*
1986	0.33146000	3.8785700**

SER = 0.140042
R^2 = 0.416696

$\bar{R}^2$ = 0.247007
F-Statistic = 2.45565

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

TABLE IV.37

Operating ratios that produced statistically insignificant results

Ratios
A. Income Ratio 1. Dividends paid per share / net income before taxes
B. Asset and Liability Composition Ratios 2. Buildings and other fixed assets / total assets 3. Discounts + loans and advances up to one year / total assets 4. Interest-bearing Greek treasury bills / total assets
C. Investment Policy Ratio 5. Total loans / sight + savings deposits
D. Expense Ratio 6. Staff salaries + contributions to staff welfare funds + general expenses and third party remuneratios / net income before taxes
E. Productivity Ratio 7. Total assets / number of branches

Notes on the Appendix

1. We should bear in mind that total deposits consist of sight plus savings plus time deposits.
2. To the extent that the main components of these accounts are obligatory, high-performance banks may have found ways of not fully complying with the authorities' requirements.
3. Younger personnel should be cheaper, ceteris paribus.

CHAPTER FIVE

Concentration in Greek Commercial Banking and its Influence on Profitability

V.I Introduction

In the first chapter we saw that the Greek commercial banking industry was intensely regulated during the period studied. Since then, the authorities have moved towards deregulation of the banking sector. And it might be argued that in a deregulated industry the structure plays a crucial role. Consequently, it will be interesting to analyse an important aspect of the structure of the banking market[1]: its degree of concentration. Moreover, a tendency towards high concentration might be one feature of an industry facing with unexploited economies of scale (which will be studied in the next chapter) and which recently become more deregulated. So it is important to examine the pattern of the Greek commercial banking concentration for this reason as well.

The level of concentration in an industry is important because it may affect the overall "performance" of this market. According to the traditional view, the structure-conduct-performance model implies that the structure of a market, influences the conduct of firms in that market and hence their price and profit performance. In other words, the higher the market concentration, the greater the possibility of collusive price agreements among the firms and the higher their profits (supranormal or monopoly).

V.II Some Theoretical Aspects of Concentration

Seller concentration is usually defined as the degree in economic activity in a market with respect to production, that is controlled by a few large firms. Put differently, it refers to the size (in terms of output, or employment, or sales and so forth) distribution of firms that sell a particular product or a set of products. Seller concentration should be distinguished from buyer concentration which refers to the number and size distribution of firms that purchase a particular type of good, service or material, as well as aggregate concentration which concerns with the number and shares of the overall economic activity of firms in an economy[2].

Concentration can be measured at the plant level and/or at the firm level[3]. At the firm level, which we are interested in this study, concentration depends on the number of firms in the market as well as the relative sizes of these firms. Consequently, the fewer the firms in a market or the more unequal the size distribution of a given number of firms in a market, the higher is the concentration in that market.

The concentration of the firms in a market has important effects on the behaviour of these firms. The relevant literature usually refers to two implications regarding the behaviour of firms within a market[4].

The first implication of concentration is related to the interdependence of firms in the market. Suppose we observe a market where there are a few firms selling a homogeneous product at a single price, a case very similar to the Greek commercial banking industry. Then it can be shown[5] that high concentration implies that the average marginal revenue of all the firms in the market is significantly different from the uniform industry price for at least some firms with a large share in that market. Consequently, these firms are able to influence the market price, as they have some "monopoly power" over that price. This implication is also applicable in cases where we observe a large number of firms but of great differences in their sizes. "In general inequality of firm sizes leads to a more important role for the large firms, which must take "industry" considerations into account, while a small firm can afford to act more or less independently"[6].

The second implication of concentration regards the ability of each firm to collect information about the activities of other firms in the market[7]. However, this information gathering task becomes more difficult and more costly as the concentration decreases in a market. Moreover, as the concentration in an industry declines, the interdependence of the firms in that industry becomes lower and consequently the value of collecting information decreases. Hence, the aforementioned check on other firms' activities appears to exhibit a positive relation with market concentration.

Furthermore, Stigler (1964) points out that an increase in concentration, as measured by the H-index, is associated with an increase in the probability that secret discounts offered by a firm to some customers of its opponents will be detected, because the firm's sales will be increased. A similar argument is put forward by Hannah and Kay (1977). They show that market concentration, as measured by the H-index, is positively related with the likelihood that price agreements (either formal or informal) will be violated, in the sense that some firms will sell more goods by offering some under the counter discounts, because a random fluctuation in market share is misinterpreted as a proof of secret price cutting by other firms[8]. In consequence, the more concentrated a market, the less fluctuations in market shares should be expected[9].

V.III Concentration Measures

There is a large number of alternative measures of concentration that have been proposed[10]. These measures can be classified into two categories.

(i) **Absolute measures of concentration.** These are measures that are based upon the absolute number of firms in a market as well as their market shares. The most common absolute measures of concentration are the Concentration Ratio and the Herfindahl-Hirschman index[11].

(a) The Concentration Ratio (CR_n), is the simplest and most popular measure of concentration. This measure may be defined as the percentage of total industry output (or sales, or employment, or value added, or capacity) attributable to the top n firms in the industry, ranked in order of market shares. Thus, identifying the largest firm in the market as 1, the second largest as 2 and so forth, the n-firm concentration ratio can be written as

$$CR_n = \sum_{i=1}^{n} s_i$$

where s_i is the share of the i firm and n is the number of the firms we are interested in (i.e. the number of the largest firms).

The concentration ratio takes values in the range of n/m to 1, where m is the total number of firms in the market. Moreover, n times the inverse of the concentration ratio would produce the numbers equivalent; that is, the number of equally-sized firms that would construct the same n-firm concentration ratio as that observed.

The drawback of this measure is that it is based on an arbitrary number of firms (i.e. the choice of the value of n), as economic theory does not specify the number of firms we should look at[12]. In empirical research, however, the value of n is usually in the range of three to five firms.

Apart from the aforementioned theoretical problem there are some other pitfalls associated with the use of concentration ratios[13]. In general, "...concentration ratios understate the true quantum of monopoly power when markets are defined to include nonsubstitutes, when meaningful markets are local or regional rather than nationwide, when sellers enjoy strong product differentiation advantages within relevant product lines, and when special institutional features (like the soft drink franchise pattern) intrude. The degree of monopoly power is overstated when substitutes are excluded from the industry definition and when import competition is significant"[14].

(b) The Herfindahl-Hirschman index (H-index) is the sum of the squared market shares of the firms in the market[15]. In relevant banking studies, each bank's share of the market is usually taken to be equal to the percentage of total deposits in the market that it controls[16]. That is,

$$\text{H-index} = \sum_{i=1}^{k} (td_i/TD)^2$$

where td_i is the total deposits of the ith bank in the market; TD is the total deposits of all financial institutions in the market; and k is the number of firms in the market.

The H-index reflects both the number of firms and their relative size, and its value can vary from 1/k through 1. As a market becomes more concentrated, either through a decrease in the number of firms or a widening inequality in the firms' relative sizes, the H-index number approaches the unity. Moreover, the reciprocal of the H-index is the "number-equivalent", which is the number of equal-sized firms that would give the same value of the index.

The problem with the H-index is that there is no a priori reason suggesting that the weighting scheme should be quadratic, as with this measure. Moreover, by squaring market shares, this measure of concentration places more weight to large firms relatively to small ones. Consequently, it is important to have accurate data on the market shares of large firms and less important of small ones.

(ii) Relative measures of concentration. These are measures that emphasize the inequality of firm sizes in a market without though, taking into account the differences in the number of firms. The most often cited relative measures of concentration are the Gini coefficient and the variance of the logarithms of firm size[17].

All the relative measures of market concentration have been criticized on the grounds that they highlight an aspect that is not interesting from the point of view of firm behaviour. For example, an entry of a few very small firms in a market dominated by large firms will increase inequality measures (which should be low before the entry), although market conditions or firms' behaviour should not have changed significantly.

V.IV Concentration in Greek Commercial Banking

In order to investigate the concentration in Greek commercial banking we employ, at first, the concentration ratio approach[18]. The choice of this concentration measure is based upon four considerations. First, it is easily computable. Second, the pitfalls associated with its use are minimal in our case[19]. The industry is meaningful defined (in the sense that only those firms that appear to be competitors are included) and is nationwide, the product is homogeneous, there is no important competition of foreign suppliers[20] and there are no special institutional features in the market. Third, all plausible concentration measures are highly (but not perfectly) correlated[21]. Therefore, "...the choice of index is not of critical importance"[22] and consequently one may argue that the four-firm concentration ratio can be employed as well as more complicated measures that require much more information[23]. Finally, the Greek commercial banking industry is dominated mainly by two large institutions (and definitely not more than four) which may take into account the competitive responses of each other, but may also ignore the behaviour of their smaller rivals. Consequently, the concentration ratio appears to approximate more the reality of business behaviour in Greek banking than other concentration measures that place some weight to all the firms in the market.

Following the selection of concentration measure, we have to decide upon the choice of the size variable. Size can be measured in various ways such as output, employment, sales, assets, value-added and so on. However, the value-added figures are not readily available, the valuation of assets is based upon accounting conventions and employment would underestimate the importance of capital-intensive firms. Therefore, we avoid using all these measures for our study. Consequently, we choose output as an evaluation variable. However, commercial banks are multiproduct firms and the correct measurement of their output has been the subject of disagreement in the banking literature. Nevertheless, for the purpose of this chapter we focus on two alternative size variables that may be thought as proxies for bank output: total deposits, as well as the sum of total deposits and loans.

In addition to the common four-firm concentration ratio we calculate the two-firm one, because the Greek commercial banking industry is expected to be dominated by two large institutions (i.e. the National Bank of Greece and the Commercial Bank of Greece). Hence, we present two concentration tables which provide some breakdown on the Greek commercial banking industry for each year of the period we analyze.

Table V.1 reports the ten years concentration ratios employing total deposits as the size measure, whereas table V.2 presents the same concentration measures utilizing though the sum of total deposits and total loans as the size variable. Both

TABLE V.1

Time Distribution of Two-Firm and Four-Firm Concentration Ratios (in percentages) for the Greek Commercial Banking Industry

Years	CR_2	Numbers Equivalent	CR_4	Numbers Equivalent	Total Number of Firms in the Market
1977	80.2911	2.49	93.4030	4.28	22
1978	79.4600	2.52	93.1647	4.29	25
1979	78.4677	2.55	92.7938	4.31	25
1980	77.0060	2.60	91.4081	4.38	29
1981	76.0226	2.63	89.9739	4.45	33
1982	76.4106	2.62	90.0567	4.44	35
1983	77.0995	2.59	90.5076	4.42	34
1984	77.1597	2.59	90.4394	4.42	33
1985	77.3481	2.59	90.4827	4.42	33
1986	76.9128	2.60	90.2699	4.43	33

Notes:
1. The size variable is total deposits.
2. The CR_2 is the cumulative share of the National Bank of Greece and the Commercial Bank of Greece.
3. The CR_4 is the cumulative share of the National Bank, the Commercial Bank, the Ionian Bank and the Credit Bank.

Sources:
Calculated from the Monthly Statistical Bulletin of the Bank of Greece (various years) and the balance sheets of the four largest Greek commercial banks. The total number of banks (year-end data) has been provided by the Bank of Greece.

tables reveal almost exactly the same values of concentration indicators and consequently the conclusions based on each of them will be identical.

The inferences drawn from these two tables can be classified as follows. First, the two leading banks accounted for 77 per cent of the market for most of the period we encounter, whereas the four largest firms for 90 per cent. This evidence suggests that the pattern in Greek commercial banking is an oligopolistic one[24]. Second, the level of bank concentration decreased modestly over the period 1977 to 1980 in Greece. Since then, the

TABLE V.2

Time Distribution of Two-Firm and Four-Firm Concentration Ratios (in percentages) for the Greek Commercial Banking Industry

Years	CR_2	Numbers Equivalent	CR_4	Numbers Equivalent	Total Number of Firms in the Market
1977	80.8766	2.47	93.5550	4.28	22
1978	79.7441	2.51	93.0870	4.30	25
1979	78.9918	2.53	92.9670	4.30	25
1980	77.9248	2.57	91.9444	4.35	29
1981	76.9988	2.60	90.5503	4.42	33
1982	76.9869	2.60	90.3756	4.43	35
1983	77.3531	2.59	90.6704	4.41	34
1984	77.3459	2.59	90.5802	4.42	33
1985	77.1617	2.59	90.3876	4.42	33
1986	76.2499	2.62	89.8477	4.45	33

Notes:
1. The size variable is the sum of total deposits and total loans.
2. The CR_2 is the cumulative share of the National Bank of Greece and the Commercial Bank of Greece.
3. The CR_4 is the cumulative share of the National Bank, the Commercial Bank, the Ionian Bank and the Credit Bank.

Sources:
Calculated from the Monthly Statistical *Bulletin of the Bank of Greece* (various years) and the balance sheets of the four largest Greek commercial banks. The total number of banks (year-end data) has been provided by the Bank of Greece.

concentration ratios have remained almost unchanged. Finally, the number of firms of equal size that would give the same value of the two-firm concentration ratio (four-firm concentration ratio) ranged during the period examined from 2.49 (4.28) to 2.63 (4.45).

In addition to the concentration measures reported in the aforementioned tables, we compute a reasonable approximation to the Herfindahl-Hirschman index for each year of the period examined. This rather "rough" H-index is calculated from the sample banks only[25], and the share of each firm equals to the percentage of total deposits of the eight sample banks that it controls. We construct the H-index, not only because it is increasingly used in the relevant literature, but also to verify (or refute) the inferences drawn from the concentration ratio approach. Moreover, we are going to utilize the H-index (as well as the four-firm concentration ratio) to test the structure-conduct-performance hypothesis in the subsequent section of this chapter.

Table V.3 reports the H-index and its numbers equivalent for the ten years we encounter. Having in mind that this index can vary from (1/8=)0.125 through 1, the evidence of table V.3 suggests that the market in question is highly concentrated during

TABLE V.3

Time Distribution of the Herfindahl-Hirschman Indexes for the Greek Commercial Banking Industry

Years	H-index	Numbers Equivalent
1977	0.45331	2.21
1978	0.44444	2.25
1979	0.44088	2.27
1980	0.43871	2.28
1981	0.43940	2.28
1982	0.44448	2.25
1983	0.45215	2.21
1984	0.46071	2.17
1985	0.46434	2.15
1986	0.46268	2.16

Note:
The share of each bank is the percentage of total deposits of the eight sample banks that it controls.
Source:
Calculated from the balance sheets of the eight sample banks.

the period examined. The H-index is found to range from 0.43 to 0.46. The number of banks of equal size to which the given unequal market structure is equivalent ranges from 2.15 to 2.28. Moreover, the presented values of the H-index show that the level of bank concentration decreased modestly between 1977 and 1980, and increased modestly afterwards.

The above analysis indicates that the Greek commercial banking market during the period studied is characterized by a high degree of concentration and a small number of firms. In such a case, economic theory suggests that price competition, at least, will be limited[26]. But as long as the banking industry is regulated, as it was the Greek case during the period examined, collusive agreements might be restricted. To the extent, however, that bank deregulation is taking place, oligopoly arrangements might start emerging.

Table V.4 shows a rather different picture. It reveals the market shares of the eight sample banks regarding the sum of total deposits and loans during the period studied. Comparing the first with the last year reported in this table we may conclude the following. First, the market shares of the two large size banks (i.e. the Commercial Bank and the National Bank) has decreased. Second, only one of the three medium size banks (i.e. the Credit Bank) has increased its share. The market slices of the remaining two financial institutions has not been changed. Third, one of the small size firms (i.e. the Traders' Bank) has increased its share, while the rest remained more or less the same. Nevertheless, apart from the largest institution in Greece which lost almost 3 per cent of its market share over the first three years of the period examined (i.e. 1977-1980), the rest of the

TABLE V.4

Market Shares[1]

Years	Banks							
	AT	PI	TR	GE	CR	IO	CO	NA
1977	0.287	0.389	0.291	2.614	5.632	7.047	17.153	63.723
1978	0.308	0.394	0.346	2.721	5.855	7.488	17.236	62.509
1979	0.331	0.394	0.408	2.745	6.021	7.954	17.089	61.902
1980	0.306	0.410	0.426	2.768	6.164	7.855	17.136	60.789
1981	0.282	0.423	0.434	2.810	6.075	7.476	16.903	60.096
1982	0.285	0.400	0.460	2.812	5.942	7.447	16.557	60.430
1983	0.312	0.376	0.493	2.816	5.830	7.487	16.339	61.014
1984	0.323	0.339	0.542	2.788	5.977	7.258	16.100	61.246
1985	0.342	0.325	0.599	2.768	6.221	7.005	16.241	60.921
1986	0.347	0.333	0.639	2.698	6.554	7.044	16.116	60.134

Note:
1. The sum of bank deposits and credits as a percentage of the sum of deposits and credits of the whole commercial banking industry.
Sources:
The Monthly Statistical Bulletin of the Bank of Greece and banks' balance sheets of various years respectively.

banks experienced changes which might not be considered as drastical.

V.V The Structure-Conduct-Performance (S-C-P) Hypothesis

A. Introduction

It has been already mentioned that the S-C-P theory suggests that the structure of a market influences the conduct of firms in the market and ultimately their performance[27]. Put simply, the traditional S-C-P paradigm -based exclusively upon neoclassical theory- postulates that exogenous basic conditions determine the structure of a market and that there is an one-way causation scheme from market structure, through conduct, to performance. Therefore, a market concentration measure is often used as a proxy of market structure[28]. *However, that is only half the story.* Needless to say, the above approach has frequently been used to provide the theoretical justification for policy prescriptions.

Market structure usually refers to factors like concentration, barriers to entry, product differentiation, diversification, cost structures, vertical integration, and conglomerateness. However, the structural characteristic that has received by far the greatest attention is buyer concentration.

The conduct of firms is concerned with the decisions that these firms make, as well as the way in which these decisions are taken. Consequently, product strategy, price-setting behaviour, advertising and marketing strategy, legal tactics, and also R&D planning and implementation are some of the factors listed under the heading of conduct. These features, however, appear quite difficult to identify empirically. Therefore, most of the empirical research either ignores conduct entirely or assumes that it takes some simple form like profit maximisation, under zero conjectural variation.

The performance of firms points to various indicators such as production and allocative efficiency, progress, full employment, equity, technological progressiveness, and quality of output. Despite the considerable number of performance measures that can be found in the relevant literature, the overwhelming emphasis in the traditional S-C-P approach is on the extent to which a firm's conduct differs from the Paretian allocative efficiency ideal. The latter requires that firms should set price equal to marginal cost. Consequently, the neoclassical model of perfect competition displays a price and output mixture that is both productively and allocatively efficient. Put differently, perfect competition represents an "ideal" or benchmark market structure. The performance of firms operating in a monopolistic, oligopolistic or monopolistic competition environment, although it might appear productively efficient, evaluated by the Pareto criterion, is allocative inefficient. This is due to the power of these firms to raise price above the level of marginal cost.

The above simple S-C-P framework can be defined in a more rigorous way, which will now be considered. In general, oligopoly theory has raised two broad approaches that are seeking to explain the way that firms earn abnormal profits. The first category incorporates the profit maximisation models, while the second class embodies the limit-pricing models.

B. The Profit Maximisation Approach[29]

Let us consider a simple model[30] where there is an industry with N firms producing a homogeneous product[31] and selling it at a single price in a market with no possibility of entry. We also assume that inputs are purchased at given prices, and outputs are sold to price-takers. Then, the profit equation for the ith firm can be written as

$$\Pi_i = p(Q)\, q_i - MC_i\, q_i - F_i \quad , \qquad \text{and } i=1,2,\ldots,N \quad (1)$$

where Π_i is the profit of the ith firm, $p(Q)$ is the selling price which is also a function of total output Q[32], q_i is the output of the ith firm, MC_i is the marginal cost of the ith firm[33], and F_i

is the fixed cost of the ith firm.

Equation (1) can be rearranged to give

$$\Pi_i + F_i = p(Q)\, q_i - q_i\, MC_i$$

Summing over all the N firms in the industry gives

$$\Pi + F = \Sigma\, (\Pi_i + F_i) = p(Q)\, \Sigma\, q_i - \Sigma\, q_i\, MC_i$$

Assuming myopic profit maximisation behaviour, the first-order conditions for a maximum are

$$\frac{d(\Pi + F)}{dq_i} = p + \Sigma\, q_i \frac{dp}{dQ} \frac{dQ}{dq_i} - \Sigma\, MC_i = 0 \qquad (2)$$

This is the well known marginal revenue equals marginal cost condition. The second-order condition for equilibrium requires that

$$\frac{d^2(\Pi + F)}{dq_i^2} < 0 \qquad \text{or} \qquad MR < MC$$

that is, the marginal cost of each firm must be increasing faster than the marginal revenue of the output, or the MC must cut the MR curve from below.

Let us return to the first-order condition (2). The term dQ/dq_i can be written as

$$\frac{dQ}{dq_i} = \frac{dq_i}{dq_i} + \frac{dQ_i}{dq_i} = 1 + \lambda_i \qquad (3)$$

where Q_i is the output of all the firms, except from the output of the ith firm; and $\lambda_i = dQ_i/dq_i$ is the conjectural variation term (i.e. the conjectured beliefs of the ith firm about how the other firms in the industry will respond to its output changes). Now equation (2) can take the following form

$$(2) \overset{(3)}{\Longrightarrow} \quad p + \Sigma\, q_i \frac{dp}{dQ} (1 + \lambda_i) - \Sigma\, MC_i = 0 \quad \Longrightarrow$$

$$p - \Sigma\, MC_i = - \Sigma\, q_i \frac{dp}{dQ} (1 + \lambda_i)$$

Multiplying the RHS of the above equation by Q/Q, and dividing through by p it becomes

$$\frac{p - \Sigma\, MC_i}{p} = - \Sigma \frac{q_i}{Q} \frac{Q}{p} \frac{dp}{dQ} (1 + \lambda_i) \quad \Longrightarrow$$

$$\frac{p - \Sigma\, MC_i}{p} = \frac{\Sigma\, s_i\, (1 + \lambda_i)}{\eta} \tag{4}$$

where η is the industry price elasticity of demand (i.e. $\eta = p/Q\ dQ/dp$); and s_i is the share of the ith firm in the industry output (i.e. $s_i = q_i/Q$). Multiplying equation (4) by $\Sigma\, q_i$, dividing by Q, and rearranging the RHS slightly it gives

$$\frac{p\, \Sigma\, q_i - \Sigma\, MC_i\, q_i}{pQ} = \frac{\Sigma\, s_i^2\, (1 + \lambda_i)}{\eta} \tag{5}$$

The LHS of the equation (5) is the (gross) profit to revenue ratio, often labelled the profit margin, which can be expressed as

$$\frac{\Pi + F}{R} = \frac{\Sigma\, s_i^2\, (1 + \lambda_i)}{\eta} = \frac{H}{\eta} (1 + \mu) \tag{6}$$

where μ (= $\Sigma s_i^2 \lambda_i / \Sigma s_i^2$) is the weighted sum of conjectural variation terms; and H (= Σs_i^2) is the H-index. In consequence, equation (6) exhibits that the profit-revenue ratio is related: (i) directly to the degree of concentration in the industry (i.e. the H-index) and to the conjectural variation term, and (ii) inversely to the industry price elasticity of demand. Thus, it is shown that structure (H and η) influence performance (the profit-revenue ratio) through conduct (μ) as stated by the traditional S-C-P hypothesis. It is worth pointing out, however, that different oligopoly theories imply different conducts; that is, there is a large number of forms λ_i amd so μ can take, each producing a distinct theory of oligopoly[34].

C. The Limit-Pricing Approach

Let us consider Modigliani's limit-pricing model[35]. The main assumptions of this model, briefly stated, are the following. The firms in the industry produce a homogeneous product and face a known market demand. The largest firm in the market sets the price (i.e. the limit-price) at the highest possible level it can charge without inducing entry. The long-run average cost (LAC) curve is the same for all firms in the industry and is L-shaped; that is, costs remain constant beyond the minimum optimal scale of output q^o. Consequently, new firms must enter the industry at a scale of output of at least q^o. The flat part of the LAC curve and the demand curve determine the competitive output q_c and the competitive price p_c (i.e. p_c = LAC). Finally, all firms are assumed to behave according to the Sylos postulate[36]. Hence, we may say that the entry limiting output is

$$q_1 = q_c - q^o \quad ====> \quad \frac{q_1}{q_c} = \frac{q_c}{q_c} - \frac{q^o}{q_c}$$

If we define the size of the market as $s = q_c / q^o$, which is a reciprocal measure of the minimum feasible scale of operation (q^o) relative to the competitive output level (q_c), then the above equation may be written as

$$\frac{q_1}{q_c} = 1 - \frac{1}{s} \quad ====> \quad q_1 = q_c \left(1 - \frac{1}{s}\right) \tag{7}$$

Equation (7) can also take the following form

$$q_1 = q_c - \frac{q_c}{s} \quad ====> \quad q_c - q_1 = \frac{q_c}{s} \quad ====>$$

$$\frac{q_c - q_1}{q_c} = \frac{1}{s} \tag{8}$$

The formula for the industry elasticity of demand

$$\eta = \frac{p_c}{q_c} \frac{dq}{dp}$$

may be written aproximately in finite differences as

$$\eta = \frac{p_c}{q_c} \frac{\Delta q}{\Delta p} \tag{9}$$

But $\Delta p = p_1 - p_c$ (10)

and $\Delta q = q_c - q_1$ (11)

Thus

$$(9) \overset{(10)\&(11)}{=========>} \quad \eta = \frac{p_c}{q_c} \frac{q_c - q_l}{p_l - p_c} \quad \overset{(8)}{=====>}$$

$$\eta = \frac{p_c}{p_l - p_c} \left(\frac{1}{s} \right) \quad ====> \quad p_l - p_c = \frac{p_c}{\eta s} \quad ====>$$

$$p_l = p_c + \frac{p_c}{\eta s} \quad ====> \quad p_l = p_c \left(1 + \frac{1}{\eta s} \right) \qquad (12)$$

From the above expression of the equilibrium limit-price, we can derive the profit margin as follows

$$(12) \; ====> \quad p_l = p_c + \frac{p_c}{\eta s} \quad ====> \quad p_l - p_c = \frac{p_c}{\eta s} \quad ====>$$

$$\eta s = \frac{p_c}{p_l - p_c} \quad ====> \quad \eta s = \frac{p_c + p_l - p_l}{p_l - p_c} \quad ====>$$

$$\eta s = \frac{p_l - (p_l - p_c)}{p_l - p_c} \quad ====> \quad \eta s = \frac{p_l}{p_l - p_c} - \frac{p_l - p_c}{p_l - p_c} \quad ====>$$

$$\eta s = \frac{p_l}{p_l - p_c} - 1 \quad ====> \quad (1 + \eta s) = \frac{p_l}{p_l - p_c} \quad ====>$$

$$(1 + \eta s)(p_l - p_c) = p_l \quad ====> \quad p_l - p_c = \frac{p_l}{1 + \eta s} \quad ====>$$

$$\frac{p_l - p_c}{p_l} = \frac{1}{1 + \eta s} \qquad (13)$$

Thus, the profit margin is

$$(\Pi/R)_l \equiv \frac{p - c}{p} = \frac{1}{1 + \eta s},$$

when the limit price is changed and assuming that the average cost equals approximately the competitive price. In consequence, the scale-barriers cause the limit price (p_l) to be higher than its competitive counterpart (p_c), while their difference is the entry gap or premium. This premium indicates the amount by which the price can exceed the LAC without inducing entrance. Equation (13) shows that the determinants of the premium are the industry elasticity of demand (η), the absolute market size (q_c) and the minimum feasible scale (q^o). The relationship between scale-barriers to entry in the market and profit margin can be revealed if we define the importance of scale economies as q^o/q_c or $1/s$. Then

$$\frac{\partial(\Pi/R)_l}{\partial(q^o/q_c)} > 0. \quad \text{Moreover,} \quad \frac{\partial(\Pi/R)_l}{\partial\eta} < 0 \quad \text{and} \quad \frac{\partial(\Pi/R)_l}{\partial s} < 0.$$

The above analysis shows that the entry gap and consequently the profit margin "tends to increase with the importance of economies of scale and to decrease with the size of the market and the elasticity of demand"[37].

D. Some Problems Associated with the S-C-P Paradigm

The theory of limit pricing raises a number of critical remarks[38]. First, it may appear more profitable for the established firms to delay the rate of entry instead of preventing or freely allowing it. In this case higher current profits can be gained before the entry has taken place. Second, if the limit price is very close to average cost, due to relatively small scale economies, it might be more attractive for the incumbents to raise the price by producing less and permitting limited entry, in lieu of what the above theory suggests. This option of course is based upon the possibility of a very limited number of potential entrants, otherwise the oligopolistic structure of the market will be endangered. Finally, the Sylos postulate does not seem to be the only sensible belief as far as post-entry outcomes are concerned. Collusion or aggressive post-entry actions are two of the responses that have been proposed.

The S-C-P paradigm, which is mainly based upon and the profit maximisation approach, is overwhelmingly dominant in the specialist industrial economics literature. Despite its widespread use, however, the S-C-P school has been criticised on several grounds. First, the validity of the empirical tests has been questioned[39]. Simple regression analysis which has mostly been employed in empirical work to test the existence of a positive relationship between profits and (usually) a concentration measure, says nothing about the direction of the causation. The causation might run from structure to performance or the other way round. In addition, mutual causality might be the case. Then, a simultaneous equation system appears a more suitable econometric technique to deal with the above situation[40]. Second, the S-C-P framework has been attacked because it is based upon the neoclassical theory. The latter is relatively static, focuses on equilibrium, and ignores the process by which new equilibria are reached. Moreover, the neoclassical school of thought assumes that producers and consumers are perfectly informed, and that tastes are constant. To the extent that the above conditions of the traditional approach depart from the actual world considerably, the generated results might be challenged.

E. Alternative Approaches

E1. The Efficiency Hypothesis

The above neoclassical view has some rivals in the field of industrial economics, but not (as yet) very influential. Under the heading of rival approaches one may include the Marshallian tradition, the Austrian revival, the Marxian viewpoint, and the workable competition[41].

In addition, there are some developments to traditional theory, such as the efficiency hypothesis and the theory of contestable markets. The efficiency hypothesis which is put forward by Demsetz (1973,1974), points out that the observed relationship between profitability and concentration reflects the superior efficiency of the large oligopolistic firms and not the power to elevate prices above the competitive levels. The proponents of this approach suggest that an industry may become concentrated because one or more firms in that industry have a strong efficiency advantage over their rivals. It is apparent that the firm with the lowest costs in a market will tend to increase its size as well as the market share it commands. This expansion may enforce all the firms in the market either to be efficient or to exit from the industry. As a result, there will be a tendency for market concentration to increase. Consequently, Demsetz argues that performance determines market structure rather than the other way round. Given that the efficiency hypothesis is correct, its advocates claim that a positive relation between profitability and market share of firms in an industry should exist[42].

The major weakness of the above technique is that it does not appear to be grounded in theory. This might be the reason for not being very popular recently. Another explanation could be the advent of a new approach that is based upon a much more sound theoretical background. This method will now be considered.

E2. The Theory of Contestable Markets: An Overview

A novel school of thought which also supposes that the theoretical linkage is not from structure to performance but in the opposite direction is the contestability theory of Baumol et al. (1982)[43]. A market is said to be perfectly contestable if it satisfies the following three conditions: "(1) all producers have access to the same technology; (2) this technology may have scale economies such as fixed costs, but must not have sunk costs[44]; and (3) incumbents cannot change prices instantly [while] ... consumers respond instantly to price differences"[45]. The important implication of the above definition is that because "entry is absolutely free and exit is absolutely costless ... potential entrants find it appropriate to evaluate the profitability of entry in terms of the incumbent firms' pre-entry prices"[46].

The kernel of the theory is that potential entry in a perfectly contestable market constrains established firms from pricing above average costs even if the number of actual competitors is quite small or concentration is high. Otherwise, the market will be vulnerable to hit-and-run entry. If in a perfectly contestable market economic profit is positive, then whatever the economies of scale or cost complementarities, an (unidentified) potential entrant might enter the market, duplicate the incubents' output pattern, undercut the existing firms' price slightly, collect his gains and then depart without cost, when the price has been pushed down to the point where economic profit is zero. For the same reason, the established firms are also vulnerable to hit-and-run tactic even if they do not gain above average profits but are tecnologically inefficient. Thus, contestability can be viewed as a general theory embracing perfect competition within it. A perfectly competitive market is always a perfectly contestable market, while the other way round does not hold necessarily. This is due to the large number of markets which are not perfectly competitive (including oligopoly), but may be contestable. Consequently, contestability can be considered as an alternative benchmark market structure to the notion of perfect competition.

The important implication of the above theory is that the conditions of entry and exit into an industry play the crucial role as far as performance is concerned, and not the internal structural characteristics of the industry (e.g. concentration). The threat of hit-and-run entry influences the performance of the firms in a contestable market and ultimately the structure of the market.

The theory of contestability also suggests that entry barriers are absent while scale economies are present. But let us discuss entry barriers in more detail. Bain [(1956), p.3] defines the condition of entry in an industry as the margin by which existing firms can elevate their price above the competitive price level persistently without inducing entry. Then, the lag of entry (i.e. the time needed for an entrant firm to be established) depends upon various factors which are known as barriers to entry. Bain distiguishes three main categories of barries (apart from legal exclusions): absolute cost advantage of established firms, product differentiation advantages, and economies of scale. The first of the above three characteristics of a perfectly contestable market as summarised by Dixit seems to dismiss the absolute cost advantage type of barrier. The scale economies do not also constitute an entry barrier according to this approach. Even if there are substantial economies of scale in a market, provided that the capital costs are salvageable, the established firms cannot exploit their power by pricing in excess of average costs due to the threat of the hit-and-run entry view. It is only the presence of sunk costs that is sufficient to obstruct the above attractive outcome. This is because the potential entrant needs to make a commitment on entry which has already been made by the existing firms in the industry. Thus, the presence of sunk costs acts as a barrier to exit. Put differently, it is the inability to withdraw costlessly that discourages entry, and prevent incumbents to act competitively. However, the obstacle of sunk costs may be overcome if it is assumed that the lag in incumbents response to entry is long enough so that the entrants have the time to gain sufficient positive profit to cover any sunk costs. This conjecture is an implication of the third characteristic of a perfectly contestable market and seems rather heroic, because there is usually no lag in incumbents responce to entrants' actions in the real world. Nevertheless, an example which is often cited in the contestability literature is the case of small, naturally monopolistic airline markets. Finally, the contestable market approach does not appear to pay any attention to product differentiation advantage as an entry barrier.

E3. Contestability, Scale Economies, and Economies of Scope in a Single-Product Context

Most of the contestability analysis is specifically designed for multiproduct firms, but it is simpler to outline its main features for single-product firms[47].

The most important concept in the relevant literature is that of subadditivity. This is because it provides a definitional characteristic of natural monopoly. Consider industry output x produced at a total cost C(x). Contrast now the case in which the output x is produced by a single firm (i.e. a centralised production), with the case in which x is produced by n firms (i.e. a decentralised production where the ith firm produces x_i and $\Sigma x_i = x$), assuming that all firms have identical cost functions. Then, the cost function C(x) is said to be subadditive at x and the industry is said to be a natural monopoly at x if:

$C(x) < \Sigma C(x_i)$, for any possible disaggregation of x.

If the above condition is satisfied, centralised production will be more efficient than decentralised production, and in the multiproduct case economies of scope are said to exist[48]. That is, economies of scope occur when it is cheaper to produce x than the components $x_1, x_2, \ldots, x_n$ separately.

Subadditivity is associated with falling average costs and economies of scale. In fact, falling average costs imply subadditivity. Let us consider industry output x produced by n firms; that is, the ith firm contributes x_i towards the x and $\Sigma x_i = x$. Then, falling average costs denote

$$\frac{C(x)}{x} < \frac{C(x_i)}{x_i} \qquad \text{where } i=1,2,\ldots,n \quad \text{and } x_i < x.$$

$$\Longrightarrow \quad \frac{x_i}{x} C(x) < C(x_i) \quad \Longrightarrow \quad \Sigma \frac{x_i}{x} C(x) < \Sigma C(x_i)$$

$$\Longrightarrow \quad C(x) < \Sigma C(x_i)$$

It is apparent that the above inequality is the condition for cost subadditivity. However, the shape of the average cost curves reflects the laws of return to scale. According to these laws the unit costs of production decrease as plant size increases, provided there are economies of scale. In other words, economies of scale occur when the average cost of production decreases as output increases; that is, when there are falling average costs. Thus, scale economies imply falling average costs, which in turn point to subadditivity, which is the condition for defining natural monopoly.

The theory of contestability examines also the existence of equilibrium in a market or in the terminology of Baumol et al. (1982) the sustainability of a market. A feasible (i.e. incumbent firms break even) industry configuration is said to be sustainable if the following three conditions are satisfied. First, total output of established firms meets the market demand at the prevailing price. Second, the prevailing price implies zero profit for incumbents. Third, there is no inducement for entry (i.e. it is impossible to make a non-negative profit), and potential competitors enter on the expectation that the incumbents' price remains fixed. These requirements for price sustainability[49] can also be written in a succint form as

$x = D(p)$

$px - C(x) = 0$

$p^e x^e - C(x^e) < 0$ for all $p^e \leq p$ and $x^e \leq D(p^e)$.

where D(p) denotes the market demand function, x indicates the incumbents' output, x^e expresses the entrant's output, p is the incumbents' price, p^e implies the entrant's price, and C denotes the cost function.

A significant outcome emerges from the above analysis. If there are several firms in a sustainable industry configuration, each and every incumbent firm will earn a zero profit and set price equal to marginal cost. Otherwise, profitable entry would be induced. Consequently, a perfectly competitive market as well as a monopoly can be a sustainable contestable market. It is worth noting, however, that a natural monopoly, defined by the condition of subadditivity, need not be sustainable. For the natural monopoly case, contestability implies that a price is sustainable if it is Ramsey optimal. In this context, Ramsey optimal prices are those which maximise social welfare subject to a break-even constraint (e.g. for the sigle-product firm the setting of price equal to average cost is Ramsey optimal).

From the foregoing it follows that sustainability does not always exist. It turns out to be true that the existence of a sustainable price is likely when there are few rivals in the industry with flat-bottomed average cost curves. On the other hand, if there are few firms in the market, each characterised by U-shaped average cost curves, then a sustainable price will generally not exist[50].

E4. Further Considerations on Contestability

The analysis so far is dealt with the single-product case. Things become far more complex in the multiproduct case[51], but the logic remains always the same. As a result, the proponents of this approach are able to demonstrate that a monopoly, defined by subadditivity, need not be sustainable. However, for the case of multiproduct natural monopoly, Ramsey prices are price sustainable under the hypotheses of trans-ray convexity and decreasing ray average cost. This is the "weak invisible hand theorem" of Baumol, Bailey, and Willig (1977). This proposition appears to be powerful in a static context, but it loses its strength in a dynamic framework. This failure of existence of equilibrium in a contestable market is the "intertemporal unsustainability" result particularly emphasised by Baumol (1982) in his presidential address to the American Economic Association.

The theory of contestable markets gives rise to two major policy implication conclusions. Laconically, these new insights are the following. First, the analysis focuses regulatory policy towards removing artificial barriers to entry as well as to exit from a market. Second, "it tells us that a history of absence of entry in an industry and a high concentration index may be signs of virtue, not of vice"[52].

The main obstacle to contestability theory is the existence of sunk cost. A perfectly contestable market requires by definition that there are no sunk costs while scale economies may be present. Commenting on the above, however, Weitzman (1983) has argued that economies of scale must imply sunk costs. Put differently, he claims that contestability is confined to constant returns to scale because increasing returns must involve fixed costs which are also sunk costs. To the degree that this argument is correct in most cases, it constitutes a severe restriction to the value of this approach[53].

E5. **Contestability and the Greek Commercial Banking Market**

Let us now turn to the Greek commercial banking industry. This market was one in which neither entry was absolutely free nor exit was absolutely costless during the period studied. Entry was liable to the approval of the Bank of Greece. However, the decisions of the latter could have been influenced by the established firms most of which were State controlled. In consequence, permission to entry could have been denied if the potential entrant was threatening the profits of the incumbents.

Moreover, it is apparent from the first chapter that the SCIs as well as the nonbank financial intermediaries were not well developed during the period examined. Consequently, the transfering of financial expertise between contiguous markets was very limited. Thus, substantial sunk cost, in terms of developing financial expertise, might have been incurred in the industry in question.

Further, recent advances in computing and telecommunications technology which lead to electronic funds transfer (EFT) systems using point-of-sale (POS) terminals, automatic teller machines (ATMs) and home banking networks are still in their infancy in Greece. Consequently, the need to establish retail branches which involve huge fixed costs seems to be undeniable. This entry cost may constitute an entry barrier. In addition, all the required capital for investing in the setting up of many retail outlets does not appear to be salable or resuable without loss other than that corresponding to normal user cost and depreciation. In other words, some capital looks to be sunk.

Thus, the threat of hit-and-run tactic is not applicable in the case of Greek commercial banking industry during the period studied. Consequently, a perfectly contestable market does not seem a reasonable approximation to the market we are interested in[54].

V.VI The Model

We start this section by summing up the S-C-P framework. In the profit maximisation approach above average profit rates arise from market power. Consequently, the profit-revenue ratio of the firms in an oligopolistic industry is related to the degree of concentration in the industry[55] as well as the industry price elasticity of demand[56]. Thus,

profit margin = f ("concentration", η).

where η is the elasticity of demand facing the firms. In the limit-pricing approach, the limit price at which the firms sell their products will be higher than the competitive price due to the scale-barriers to entry in the market. Consequently, the profit margin is related to the barriers to entry in the market and the industry price elasticity of demand. Thus,

profit margin = f ("barriers", η)[57].

In this case, concentration can be used as a proxy for firm-level scale economies, as long as a high degree of concentration may indicate a high degree of firm-level economies of scale[58]. Hence, profit margin = f ("concentration",η).

In intra-industry analyses, as in our case, *one may ignore* the elasticity of demand, assuming that the price elasticity is constant over time[59]. Then, the above relationships can be written as

profit margin = f ("concentration").

Following the preceding discussion, we can employ an often used single equation linear model linking Greek bank profitability and concentration[60]. Then, to the extent that the Bain-Sylos-Modigliani limit-pricing model characterizes the Greek banking industry more than the profit maximazation approach, concentration may serve as a proxy of scale economies in that industry. Consequently, we can test the impact of scale economies found in the previous chapter on profitability. On the other hand, if we accept that the profit maximization approach is more suitable for the market in concern, the S-C-P hypothesis can be tested. However, we cannot distinguish the influences of the two explanations on banks' earnings. To sum up, the hypothesis which will be tested in this section is that a concentration measure affects significantly the ROA of the financial firms of our sample[61]. Thus, the model can be written in the following form[62]:

$$Y_{kn} = a + b\ CM_n + \sum_{k=1}^{K-1} c_k D_k + e_{kn} \qquad (1)$$

where Y_{kn} is the ROA varying across banks (k=1,2,...,8) and over time (n=1,2,...,10); CM_n is a concentration measure; D represents the bank dummy variables; a is a constant term capturing also the effect of the omitted bank dummy variable (i.e. the least profitable firm of the sample); b is a parameter indicating the influence of a one-unit difference in concentration on profitability; c_k are parameters measuring differential effects for each firm compared with the excluded one; and e_{kn} is a random error term.

V.VII Estimation of the Model and the Empirical Results

(α) Concentration Measure: CR_4.

We begin by employing firstly the four-bank concentration ratio as a concentration measure[63]. Then, let us assume that the intercept of equation (1) varies across banks, while it remains constant over the whole period studied. In addition, let us assume that the parameter b is constant across all firms and over the whole time horizon examined. Subsequently, we can run an OLS regression of Y_{kn} on CR_4 and D_k by pooling all the eighty observations of our sample[64].

To test for autocorrelation in our model, we compute the autocorrelation coefficient directly[65]. The rho is found $\rho=0.21624$. To be more precise, we employ the Cochrane-Orcutt and the Hildreth-Lu techinques which, however, provide statistically insignificant estimations of rho[66]. This finding may suggest that the disturbances of the model are not correlated.

To test for heteroscedasticity in equation (1), we utilize a Breusch-Pagan test. The relevant statistic is found n=42.54990. The tabulated chi-squared values for 8 degrees of freedom that the statistic is compared with is $x^2_{0.95,8}=15.507$ and $x^2_{0.99,8}=20.090$. Thus, we reject the null hypothesis that the errors are homoscedastic at the 5 per cent level of significance. However, we can compute consistent variances of the estimators by employing White's formula.

Table V.5 reports the regression results of our model[67]. Five out of the nine coefficients appear statistically significant in a two-tailed t test. The coefficient of multiple determination (R^2) is rather low, showing that 22 per cent of the variation of the dependent variable is explained by the regression plane. The F-Statistic calculated from the regression is higher than the tabulated critical values of the F distribution at the 5 per cent level of significance with (8,71) degrees of freedom

TABLE V.5

Regression Results of Equation (1)

Dependent Variable: ROA		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	-0.0765613000	-3.0372180**
CR_4	0.0008738518	3.1632360**
Bank 1	0.0034686760	2.7527090**
Bank 2	0.0046358960	2.5289980*
Bank 3	0.0026066910	2.2531060*
Bank 4	0.0013251060	1.0843060
Bank 5	0.0004292009	0.4954497
Bank 6	0.0015822670	0.7291656
Bank 7	0.0001976924	0.2057811
SER = 0.0038066		
R^2 = 0.223468		
$\bar{R}^2$ = 0.135972		
F-Statistic = 2.55402		

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05 (0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.
3. The size variable is the sum of total deposits and total loans.

[$F_{0.05(8,71)} \approx 2.07$]. Hence, we reject the null hypothesis of no relationship between the dependent and the independent variables at the 5 per cent level of significance.

The evidence presented in table V.5 show that the coefficient of the concentration ratio variable is found positive and statistically significant. This finding indicates that the concentration ratio has a positive but quite small effect on banks' profitability. A one-unit increase in concentration seems to increase banks' profitability by only 0.00087 unit.

The positive coefficient of CR_4 variable suggests that either firm-level scale economies were operational in the Greek commercial banking industry during the period examined, or the market power explanation is confirmed. Nevertheless, the hypothesis that is tested in this section is proved valid.

At this point, it is worth mentioning that the same model is also run including banks' market shares among the explanatory variables (the regression results are not presented in the tables). However, the coefficient of market share variable is found statistically insignificant. This indication seems to oppose the efficiency hypothesis claimed by Demsetz.

(β) Concentration Measure: H-index.

The analysis so far is based upon the employment of the concentration ratio as a concentration measure. However, it has been argued that this measure tends to exhibit the significant positive relationship between concentration and profitability[68]. Therefore, we duplicate the estimation of equation (1), by utilizing though the H-index reported in table V.3 as the concentration variable.

Employing the assumptions stated in the beginning of this section, we run an OLS regression of Y_{kn} on H-index and D_k by pooling all the eighty observations of our sample.

To decide upon whether we should include the bank dummy variables in our model, we employ an F test. The F-Stastistic is found F=1.16061. This value is lower than the tabulated critical values of the F distribution with (7,71) degrees of freedom at the 5 per cent (as well as at the 10 per cent) level of significance [$F_{0.05(7,71)} \approx 2.16$ and $F_{0.10(7,71)} \approx 1.80$]. Thus, we cannot reject the null hypothesis that the equal-intercept restrictions are correct at the 5 per cent level of significance. Consequently, we omit the dummy variables from equation (1). Hence, the aforementioned equation takes the following form:

$$Y_{kn} = a + b\,H_n + e_{kn} \tag{2}$$

To test for autocorrelation in our model we compute the autocorrelation coefficient directly. The rho is found $\rho=0.37046$ and offers evidence of autoregression. To correct for correlated disturbances, assuming first-order autocorrelation, we employ the Cochrane-Orcutt and the Hildreth-Lu techiques. Both provide similar estimations of rho (i.e. the former: $\rho=0.370461$ and the latter: $\rho=0.35000$) which are also statistically significant.

To test for heteroscedasticity in equation (2), we utilize a Breusch-Pagan test. The relevant statistic is found n=1.61537. The tabulated chi-squared values for 1 degree of freedom at the 5 and 1 per cent level of significance that the statistic is compared with are $x^2_{0.95,1}=3.84$ and $x^2_{0.99,1}=6.63$ respectively. Hence, we cannot reject the null hypothesis that the errors are homoscedastic at the 5 per cent level of significance.

Table V.6 shows the regression results of our model. Both coefficients are found statistically insignificant in a two-tailed t test. The coefficient of multiple determination (R^2) is extremely low, showing that only 3 per cent of the variation of the dependent variable is explained by the regression plane. The F-Statistic calculated from the regression [F=2.54] is lower than the tabulated critical values of the F distribution with (1,70) degrees of freedom at the 5 per cent (as well as at the 10 per cent) level of significance [$F_{0.05(1,70)} \approx 4.00$ and $F_{0.10(1,70)} \approx 2.79$]. Consequently, we cannot reject the null hypothesis of no relationship between the dependent and the independent variable at the 5 (and 10) per cent level of significance.

The findings presented in table V.6 reveal that the H-index variable has no influence on banks' profitability. The hypothesis

TABLE V.6

Regression Results of Equation (2)

Dependent Variable: ROA		
Variables	Estimated Coefficients	t-Statistics
Constant	0.0483143	1.771401
H-index	-0.0964894	-1.593791
SER = 0.00374952		
R^2 = 0.0350174		
$\bar{R}^2$ = 0.0212319		
F-Statistic = 2.54017		

that there is a significant positive relationship between the H-index and the ROA of sample firms during the period studied, is proved invalid.

In the light of the two opposing results reported in tables V.5 and V.6, the synopsis of this chapter should be that while the argument that the market in concern is highly concentrated is not disputable, the evidence regarding the concentration-profitability relationship for the same industry appears ambiguous. However, the high degree of concentration cannot be taken as fundamental or exogenous. Therefore, in the next chapter we are going to explore one of the factors which it is generally hypothesised that influence the structure of a market[69]; that is, economies of scale.

Notes

1. Market structure has been defined by Caves (1967) as "the economically significant features of a market which affect the behaviour of firms... suppling the market" [p.11].
2. In the rest of the chapter whenever concentration is mentioned, seller concentration is meant.
3. For a coherent survey of the literature on the measurement and determinants of concentration see Curry and George (1983).
4. A third implication of the number of firms in a market deals with the consumers of the product(s) that the firms supply. For more information about this implication of concentration see Hay and Morris (1979), pp.93-94 and their references.
5. See Hay and Morris (1979), pp.94-95.

6. Hay and Morris (1979), p.97.
7. For more information about this implication see Hay and Morris (1979), pp.99-100 and their references.
8. See Hannah and Kay (1977), pp.16-18.
9. Formal or informal cartels cannot survive otherwise.
10. For an extensive list of concentration measures see Curry and George (1983), pp.207-210 and pp.247-249. In the same paper, [pp.204-207], the authors also discuss the properties that concentration measures must possess in order to be meaningful (in the sense that measures that do not meet these criteria are not concentration measures).
11. Other widely used absolute measures of concentration are the number of firms which account for a given percentage of industry output (e.g. 80 per cent), and the entropy which can be considered as a measure of uncertainty that firms have about their market shares. For a short discussion on them see Sawyer (1985), p.29.
12. Theoretical support for the use of concentration ratios as measures of market conncentration is provided by Saving (1970).
13. For more information about the limitations of concentration ratios see Scherer (1980), pp.59-64.
14. Scherer (1980), p.64.
15. For the history of this index see Hirschman (1964).
16. See for example Federal Reserve Bulletin (1965), pp.1212-1222, and Marfels (1975), pp.485-503.
17. For more information about these two relative measures of concentration see Sawyer (1985), pp.30-32.
18. For a pragmatic defence of concentration ratio as a

reasonable concentration measure see also Hart and Clarke (1980), pp.104-105.

19. The only problem might arise from the omission of the Special Credit Institutions (SCIs) from the market, to the degree that some of them (e.g. the Agricultural Bank of Greece, or the Postal Savings Bank) offer to the public some of the services (e.g. deposits) provided by commercial banks. Consequently, the level of monopoly power may be overstated to some extent by the reported concentration ratios. However, we exclude SCIs from the industry because they do not seem fully competitive towards the Greek commercial banks.

20. Foreign banks operating in Greece are included in the industry measurement.

21. See Heggestad (1979), p.470, and Schmalensee (1988), p.653. However, Davies et al (1988) argue that "...this is a dangerous argument: of course different indexes will be correlated, what is at issue is the marginal differences between them" [p.85]. On the other hand, Ferguson (1988) finds "...pointless agonising at length over the choice of which market concentration measure to adopt. [Because] If a relationship is going to exist between a concentration measure and the performance of an industry, then it is likely to show up whether studies use concentration ratios, the Hirschman-Herfindahl index or some other construct" [pp.40-41].

22. Heggestad (1979), p.470.

23. See Shepherd [(1979), p.190], who also claims that the concentration ratio is "...the best all-purpose measure of

the degree of competition." Moreover, Curry and George [(1983), p.211] point out that the concentration ratios may well provide similar results to an ideal measure chosen by the researcher but cannot be calculated because of lack of data.

24. Scherer (1980) claims that "...when the leading four firms control 40 per cent or more of the total market, it is fair to assume that oligopoly is beginning to rear its head" [p.67].

25. The firms that have not been taken into account are several (e.g. their number was variant from year to year and ranged from 14 to 27), but their market share was unimportant (e.g. their sum of shares in terms of total deposits and loans extended from 2.864 to 6.135 per cent over the period studied).

26. However, there is a wide number of possible non-price competitive devices open to banks. These include new branches, extended operating hours, automated teller machines (ATMs), etc.

27. For reviewing the S-C-P literature in banking see Rhoades (1977), Heggestad (1979), Rhoades (1982), and Gilbert (1984) with comments by Heggestad, Peltzman and Schmidt.

28. For recent empirical evidence that do not seem to support the hypothesis that a concentration index can be a proxy for the firms' ability to collude, see Whalen (1987) regarding banking firms and Ravenscraft (1983) regarding manufacturing companies.

29. In recent years the traditional assumption that firms maximise profits has been criticised considerably by the

agency theory. However, we discard this approach for the purpose of our study, because "...no tractable, general alternative to the profit-maximisation assumption has yet emerged from this research" [Schmalensee (1988), p.652]. For more information about the agency theory see Schmalensee and Willig (1989), ch.2.

30. The subsequent procedure follows that of Cowling and Waterson [(1976), pp.267-269], and Waterson [(1984), pp.18-20].

31. A model specification with heterogeneous products is not applicable in our case, because we are interested in the Greek commercial banking industry that produces almost the same array of services. It is worth noting, however, that those features appearing important in the homogeneous product cases -industry demand elasticity, market structure, and firms' conjectures about rivals- seem also important in the differentiated product cases. For more information see Waterson [(1984), pp.26-31].

32. It is worth noting that the inverse market demand is a function of total output (where total output is the sum of the outputs of all the N firms in the industry); that is, $p=f(Q)$ and $Q=\Sigma q_i$.

33. We assume that marginal cost equals average variable cost at the level MC_i for the ith firm, but that there is a distribution of efficiency in the industry with each MC_i being distinct. This assumption is necessary, otherwise we are unable to find industry magnitudes.

34. For more information about the assumptions that various oligopoly theories utilise as conjectural variations, see Koutsoyiannis (1979), pp.216-254, and Waterson (1984), pp.21-

36.

35. For more information about limit-pricing theory see Koutsoyiannis (1979), pp.284-322.

36. The Sylos postulate includes two behavioural conditions. First, the established firms expect that a potential entrant cannot enter the industry at a scale of output smaller than the minimum optimal scale, and that he will not enter if he anticipates that the price post-entry will fall below the flat segment of the LAC curve. Second, the entrant assumes that the established firms will maintain output at the pre-entry level after any entry into the market, and the established firms know this to be the case.

37. Modigliani (1958), p.220.

38. For further discussion see Davies et al. (1988), pp.40-41 and the stated references.

39. For more information see Ferguson (1988), pp.15-16.

40. For a detailed discussion see Reid (1987), pp.30-33 and pp.48-62.

41. For more information about these schools of thought see Reid (1987), pp.65-137, and Davies et al. (1988), pp.10-19.

42. An alternative explanation about this relation based upon economies of scale is presented by Scherer (1980), pp.280-281. Moreover, Clarke et al. [(1984), pp.436-439] provide an extensive discussion in these arguments.

43. For a summary of the theory of contestable markets see Baumol (1982). For criticism on ultra-free entry of the contestability approach see Shepard (1984).

44. These are costs which cannot be recovered once they have been spent (e.g. advertising costs). However, under contestabil-

ity, sunk costs are distinct from fixed costs. For instance, railway tracks constitute sunk costs, while railway locomotives are fixed costs and not sunk costs.

45. Dixit (1982), p.15.
46. Baumol (1982), pp.3-4.
47. The section below largely follows Reid (1987).
48. If the inequality is replaced by equal to or less than, then the economies of scope are said to be weak. If the inequality is reversed, diseconomies of scope are said to exist. For more information about economies of scope see the introduction of chapter six.
49. It is worth pointing out that entrants assume that incumbent firms will not change their price in the face of entry. For this reason Brock (1983) calls Baumol et al.'s notion "price sustainability" in order to differentiate it from the rival notion of quantity sustainability advanced by Brock and Scheinkman (1983). According to quantity sustainability, entrants enter on the expectation that incumbents' quantities remain fixed.
50. For more information see Reid (1987), pp.141-171.
51. For instance, average cost is not uniquely defined when the firms and the industry produce a multiplicity of commodities. Moreover, it can be shown that in the multiproduct case economies of scale are neither necessary nor sufficient for natural monopoly. For more information see Bailey and Friedlander (1982).
52. Baumol (1982), p.14.
53. It is worth pointing out, however, that the debate about sunk costs is far from ended. For more information see Reid

(1987), pp.169-171 and the stated references.

54. It is worth noting, however, that by the end of 1992, when the completion of the EEC will have taken place, the possibility of an easy entry and a costless exit into the Greek banking market will be increased. Then, the relevance of the contestability theory to the market in question might be enlarged.

55. This is accurate to the extent that a market concentration measure can be employed as a proxy of market structure.

56. This is true if the assumption that the conjectural variation term equals zero (i.e. $\lambda_i=0$ for all i, so $\mu=0$) is valid, as it is for example in the Cournot's case.

57. Some researchers claim that while firms are short run profit maximizers, they may be constrained in doing this by the threat of competition from potential entrants. Thus, they modify the S-C-P hypothesis as:

profit margin = f ("concentration","barriers",n).

However, Sawyer (1982) argues that such an estimating equation is methodologically suspect because it is based upon two different views; that is, the profit maximization approach and the limit-pricing approach.

58. See Sawyer (1985), pp.85-86.

59. Of course it is constant across banks.

60. Economic theory does not specify whether this economic phenomenon should be studied with a single-equation model or with a simultaneous equation one. Similarly, Economic theory does not indicate the mathematical form (linear or non-linear) of the above function. Therefore, we assume that the relationship can be described by the simplest possible way;

that is, by a sigle-equation linear model.

61. The reasons for employing ROA as a profitability measure are referred to in the second chapter.

62. We do not incorporate year dummy variables in the model because if we do, the effect (if any) of the concentration measure on income is entirely accounted for by the time dummy variables. (Recall that the concentration measure has no cross-section variation). Thus, we cannot find estimates of the parameters of the concentration measure and the year binary variables even if we drop one of the dummies. In other words, the concentration measure operates like a dummy variable which is perfectly collinear with the year dummy variables.

63. The reasons for utilizing the concentration ratio as a concentration measure are stated in the relevant section at the beginning of this chapter.

64. To decide upon whether we should include the bank dummy variables in our model and consequently sacrifice the associated degrees of freedom (i.e. 7 degrees of freedom), or omit them absolutely, we employ an F test. The relevant F-Statistic is found F=1.91597 and is higher than the tabulated critical values of the F distribution with (7,71) degrees of freedom at the 10 per cent level of significance. Thus, we can reject the null hypothesis that the equal-intercept restrictions are correct at the 10 per cent level of significance.

65. For more information about this approach see analogous treatement in the previous chapters.

66. The estimated rho by Cochrane-Orcutt is ρ=0.225044 (t-

Statistic=1.95983), while the one estimated by Hildreth-Lu is $\rho=0.2260$ (t-Statistic=1.96861). These t-Statistics are statistically insignificant at the 0.05 confidence level in a two-tailed t test, but significant at the 0.10 level. If we choose the higher level of significance and run the OLS regression taking into account the estimated rho, the coefficient of the concentration ratio variable appears statistically insignificant. However, the disturbances are heteroscedastic, as the Breusch-Pagan statistic is found n=54.25530. Computing consistent variances of the estimators by utilizing Whites's formulae, the coefficient of the concentration ratio variable appears significant at the 0.05 confidence level; that is, b=0.0008154985 (t-Statistic= 2.245957). None the less, the F-Statistic calculated from the regression [F=1.52045] is lower than the tabulated critical values of the F distribution with (8,63) degrees of freedom at the 5 per cent (as well as at the 10 per cent) level of significance [$F_{0.05(8,63)} \approx 2.097$ and $F_{0.10(8.63)} \approx 1.775$]. Consequently, we cannot reject the null hypothesis of no relationship between the dependent and the independent variable at the 5 (and at the 10) per cent level of significance.

67. The size variable is the sum of total deposits and total loans.

68. See Whalen (1987), p.6, fn.10

69. Other determinants of market structure that have been suggested include the height of barriers to entry in the market, merger activities by participating firms, various government policies, market size, and historical chance. For

more information about these factors see Scherer (1980), pp.118-150, and Curry and George (1983), pp.217-247.

Appendix to the Fifth Chapter

One may argue that the way we have computed the H-index may lead to biased results. This could be possible to the extent that the market share of the sample banks may, as a group within the industry, have been decreasing (or increasing) during the period studied. Therefore we calculate once more the share of the eight financial institutions we examine, as a percentage of the whole commercial banking industry (see table V.7). The presented figures show that the market share of the group decreased modestly over the period 1977-1981, and remained almost unchanged afterwards. Consequently, the above possibility seems rather remote. To be on the safe side, however, we calculate the H-index from shares of the total industry, instead of the eight sample banks. This could be done by assuming that none of the firms outside the observed institutions has more than 1 per cent of the total banking sector deposits, and ignoring their effect on the H-index (which should be only in the third or the fourth decimal place). Table V.7 presents the H-index and its numbers equivalent using the above method. Comparing these figures with those of the table V.3 we can conclude that they exhibit almost the same pattern; that is, their changes move in the same direction. Subsequently, we duplicate our study by utilizing though the H-index reported in the table V.7 as the independent variable.

To decide upon whether we should include the bank dummy variables in our model we employ an F test. The F-Statistic is found F=1.74797. This value is lower than the critical values of the F distibution with (7,71) degrees of freedom at the 5 (and 10)

TABLE V.7

Time Distribution of the Market Shares[1] and the Herfindahl-Hirschman Indexes[2] for the Greek Commercial Banking Industry

Years	Sample Group's Share	H-index	Numbers Equivalent
1977	97.14068	0.42776	2.34
1978	97.04074	0.41852	2.39
1979	96.81110	0.41321	2.42
1980	95.43729	0.39959	2.50
1981	94.01585	0.38839	2.57
1982	94.13509	0.39330	2.54
1983	94.59816	0.40462	2.47
1984	94.42294	0.41076	2.43
1985	94.33656	0.41324	2.42
1986	94.04394	0.40920	2.44

Notes:
1. The sum of deposits of the sample banking group as a percentage of the sum of deposits of the whole commercial banking industry.
2. The share of each bank is the percentage of total deposits of the total banking industry that it controls.
Sources:
The Monthly Statistical Bulletin of the Bank of Greece and banks' balance sheets of various years respectively.

per cent level of significance. In consequence, we omit the bank dummy variables from our model and estimate equation (2).

To test for autocorrelation in our model we compute the autocorrelation coefficient directly. The rho is found ρ=0.41191 and offers evidence of autoregression. To correct for correlated disturbances, assuming first-order autocorrelation, we employ the Cochrane-Orcutt and the Hildreth-Lu techiques. Both provide similar estimations of rho (i.e. the former: ρ=0.442220 and the latter: ρ=0.45000) which are also statistically significant.

To test for heteroscedasticity in equation (2), we utilize a Breusch-Pagan test. The relevant statistic is found n=0.00141, which is lower than the tabulated chi-squared value for 1 degree of freedom at the 5 per cent level of significance. Hence, we reject the hypothesis that the errors are homoscedastic at the 5 per cent level of significance.

Table V.8 shows the regression results of the model that uses the new H-index as independent variable. Comparing the tables V.6 and V.8 we can conclude that the finding is almost the same; that is, the H-index variable has no effect on banks' profitability.

Table V.8

Regression Results of Equation (2)

Dependent Variable: ROA		
Variables	**Estimated Coefficients**	**t-Statistics**
Constant	0.03645243	1.364227
H-index	-0.07826297	-1.183873
SER = 0.00377619 R^2 = 0.0196292 $\bar{R}^2$ = 0.00562392 F-Statistic = 1.40156		

CHAPTER SIX

Economies of Scale

VI.IA Introduction

Economies of scale in banking occur when the average cost of production decreases as output increases. Formally, scale economies (S) in the single-product case are measured by the ratio of average cost (AC) to marginal cost (MC); that is,

$$S = AC/MC = C(Y) / (YdC/dY)$$

which is the reciprocal of the elasticity of cost with respect to output. This means that the firm enjoys increasing, constant or decreasing returns to scale as S is greater than, equal to or less than 1. The existence or non-existence of economies (diseconomies) of scale plays a very important role to the regulatory authorities, the decision makers in the finance industry and the economic understanding[1]. If there are economies of scale, then larger banks are more efficient than smaller ones. On the other hand, if there are diseconomies of scale, then smaller banks are more efficient than their larger rivals. The main implications are obvious. In an unregulated environment, banking industry would be characterised by larger (smaller) and probably fewer (more) financial institutions, given that it is subject to significant economies (diseconomies) of scale[2].

VI.IB Scale Economies and the S-C-P Hypothesis

The established economic theory points out that long-run equilibrium for a single-product firm in perfect competition occurs at the point where the competitive price level (i.e. the horizontal demand curve facing a firm) equals to the long-run average cost (LRAC). The height of the demand curve confronting a competitive firm is determined by the market price; that is, the price charged by the other firms in the market. The shape of the LRAC curve is determined by the existence of scale economies, as we shall see later on. Consequently, the size of a firm is mainly determined by the position of the cost function. If the industry is a constant-cost industry (where factor prices remain constant as industry output expands), the long-run equilibrium of the industry occurs at the point where the long-run supply curve (which is a horizontal line at a price equal to the minimum long-run average cost) intersects the market demand curve. At this point supply equals demand and each firm in the industry earns non-negative profits from its market activities. Consequently, the size of the market is determined by the position of the market demamd curve. The interaction between the above two exogenously given constructs (i.e. the cost function and the market demand curve) gives us the opportunity to make inferences about market structure. Thus, in a single-product industry we may confront with the following three situations:

(i) When the market inverse demand curve intersects the competitive price level at an output level which is a large multiple of the output which minimises the LRAC curve of each firm, then the market is classified as structurally competitive.

(ii) When the intersection between the market inverse demand curve and the competitive price level corresponds to an output level which is a small multiple of the output which minimises the firm's LRAC curve, then the market is usually referred to as oligopoly.
(iii) When the above intersection corresponds to an output level smaller than the level which minimises the firm's LRAC curve, then the market is traditionally classified as a natural monopoly. [It should be noted, however, that the market demand curve must not lie entirely to the left of the firm's LRAC curve, because in this case there exists no firm in the market which could break even (excluding of course discriminatory pricing policies and/or subsidies)].

The above analysis provides a justification of the standard textbook practice of determining the structure of a market by employing the relative positions of the market demand and the LRAC curves. We noted earlier, however, that it is not the LRAC itself that plays this important role in the determination of market strtucture, but rather that the shape of the LRAC curve which indicates the output level at which scale economies become exhausted. Consequently, the above discussion also shows how the existence of economies of scale affect industry structure in the single-product setting. Further, this influence may also have an effect upon the performance of the market participants via the S-C-P hypothesis.

In the profit maximisation approach outlined in the fifth chapter we saw that the profit-revenue ratio is related: (i) directly to the level of concentration in the market (i.e. the H-index) and to the conjectural variation term, and (ii) inversely to the industry price elasticity of demand. Economies of scale enter the picture by affecting the H-index. If substantial scale economies exist in an unregulated market, the market tends to be more concentrated. Recall, however, that the H-index reflects both the number of firms in an industry, and their relative size. Moreover, the H-index approaches the unity as a banking market becomes more concentrated, either through a decrease in the number of firms or a widening inequality in the firms' relative sizes. Thus, the exploitation of scale economies in a banking market may lead to a higher H-index, which in turn may indicate higher profit margins for the incumbents ceteris paribus. In consequence, it was shown that market structure as expressed by the H-index influences the performance of the firms in the market, through conduct, as stated by the S-C-P paradigm. Put differently, in the profit maximisation approach economies of scale may determine market structure by affecting the H-index which influences the conduct of firms in that market, and ultimately their performance.

The above analysis is an idirect route that scale economies can influence the profit to revenue ratios via higher degrees of concentration. However, there is another more direct route which emerge from the limit-pricing theory. In the limit-pricing approach we saw that the entry gap and consequently the profit margin depends upon the industry elasticity of demand, the absolute market size, and the minimum feasible scale. The minimum efficient scale (MES) can be defined as the scale of output before which unit costs decline quite rapidly and after which unit costs either decrease slowly or increase; that is, the level of output after which economies of scale being negligible. Consequently, the larger the scale economies in a market, the larger the minimum optimal scale of output will be. The MES is usually expressed either in units of output, or as a percentage of the total market size. Needless to say, any firm producing at a smaller scale than the MES suffers a cost disadvantage compared to firms producing at the MES. On the other hand, any firm producing at a larger scale takes the risk of causing excess supply in the market which would lead to lower prices and profits. In the limit-pricing context where entry occurs with the minimum efficient scale, the entry gap will be higher the larger the MES. This implies that large scale economies constitute a barrier to entry, which may allow established firms to earn a high profit margin without attracting entry into the industry. This positive relationship between economies of scale and price-cost margins was also appeared in the limit-pricing section of the previous chapter where we defined the importance of scale economies as the ratio of minimum feasible scale to absolute market size.

From the foregoing it follows that the existence of economies of scale in a market can influence the mark-up of price over costs. However, there is a case where the presence of economies of scale in a market have no impact on prices. This is the case of perfectly contestable markets. In the fifth chapter we saw that even if there are substantial economies of scale in a perfectly contestable market, provided there are no sunk costs, the incumbents cannot exploit their power by pricing in excess of average costs due to the threat of the hit-and-run entry strategy. The threat of this tactic influence the performance of the firms and ultimately the structure of the market. In consequence, a contestable market need not be populated by a large number of firms, in order to price competitively. The important point is that the conditions of entry and exit into an industry play the crucial role as far as performance is concerned, and not the market concentration. Recall that a perfectly contestable market was defined as one in which entry and exit was easy and costless, which may or may not be characterised by economies of scale, but which entry barriers are absent. Thus, this new theory of industry structure suggests that the possibility of costlessly reversible entry may lead to efficient outcomes of purely competitive markets.

The preceding analysis is concentrated on single-product firms. But single-product firms are very rare in reality. Most businesses are multiproduct firms. For instance, banks produce various different products like loans, deposits, investments and so. In this case the problem of determining the market structure is much more complicated. This is because average cost is not a meaningful defined concept when the firm produces more than one product. Baumol et al (1982) overcome this problem by introducing the concept of ray average cost (RAC), which shows how total costs vary as outputs vary in fixed proportions; that is, by moving along a ray through the origin of output space. They also assume that RAC curves are strictly U-shaped. However, the firms of the industry may operate on different output rays. Moreover, the minimum ray average costs at which scale economies are exhausted will tend to vary with the composition of the outputs. Consequently, the minimum ray average costs will be a locus rather than a single point. Let call M the set of such minima. Following Baumol et al. (1982) let T denote the region of all output vectors that can generate a total revenue that is greater than or equal to total (industry) cost; that is, T is the region of all potentially profitable output vectors for the industry as determined by the interaction of the market demand function and the firm's cost function. In addition, let Y be the relevant subregion which is composed of all outputs that can be produced efficiently by financially viable firms. The region Y is a subset of T, because T may include some industry output vectors which do not yield prices that permit each of the firms to cover its production cost. Put differently, the set T includes all industry output vectors that are feasible financially but not efficient necessarily. Then, the market cost-minimising structure of the industry will depend upon the relative distance of Y and M (or rather, the maximum and minimum distance of M) from the origin. If the M locus is very much closer to the origin than the Y region, we may expect a competitive structure to be least costly. Where the above relative distance is small, the market structure may be characterised as oligopoly. Finally, where Y lies closer to the origin than M, the industry may be classified as natural monopoly.

The above discussion suggests that the determination of the market structure of a multiproduct industry is mainly based on a minimum of information about the cost function of each firm; that is, the M locus. Clearly, however, the cost function of a multiproduct firm will be sensitive to the scale of output as well as to the composition of output. The first measure is related to the concept of economies of scale, while the second measure is related to the concept of economies of scope[3]. But there is no single measure of economies of scale in the multiproduct setting. For this reason Baumol et al. (1982) measure economies of scale by considering two related concepts: ray economies of scale and product-specific economies of scale. The former is a natural generalisation of single-product economies of scale, and shows how costs change due to a proportional variation in the output. The latter indicates the behaviour of costs resulting from a proportional change in one product (or a subset of products) holding the other output levels constants.

The above constructs describe the behaviour of the cost surface over conveniently selected cross sections of output space. However, the discussion so far have not dealt with the effect of changes in the composition of output on costs. This effect is reflected by the concept of economies of scope. Whenever it is less costly to produce several products together in a single firm than separately in specialised firms, then economies of scope occur. These economies are called so because the cost savings result from the scope rather than the scale of the firm. For example, in the simplest two product case, economies of scope are said to exist at the output vector (y_1,y_2) if $C(y_1,y_2) < C(y_1,0) + C(0,y_2)$. Then, the degree of scope economies is measured by the proportion of the cost of joint production that is saved by joint production; that is,

$$S_c = [C(y_1,0) + C(0,y_2) - C(y_1,y_2)] / C(y_1,y_2)$$

Thus, separate production increases, decreases, or leaves total costs unchanged as S_c is greater than, less than, or equal to zero. Moreover, it can be shown that multiproduct scale economies are related to scope economies for the two-product case as follows:

$$S_{1,2} = [W\ S_1 + (1-W)\ S_2] / (1-S_c)$$

where $S_{1,2}$ is the overall degree of scale economies for both products, S_1 and S_2 are the measures of product-specific scale economies of the two outputs, S_c is the scope economy measure, and

W is a weight which roughly corresponds to the share of the variable costs of production incurred for output 1. The interesting implication of the above relation is that even with product specific constant returns to scale (i.e. $S_1=S_2=1$), the overall scale measure can falsely reflect economies (i.e. $S_{1,2}>1$), or diseconomies (i.e. $S_{1,2}<1$) depending upon the value of economies of scope (i.e. $S_c \gtrless 0$).

From the preceding discussion, it should be clear that the presence (absence) of economies of scope in banking is quite important. If there are economies of scope in banking, then specialised institutions would be less efficient than full-service commercial banks. In other words, the existence of such economies underlines some of the disadvantages of specialisation. The main implications are straightforward. In an unregulated environment, specialised financial institutions would tend to vanish, given that the industry is subject to substantial economies of scope.

Economies of scope arise mainly because of the existence of sharable inputs. Bank employees, information and technology are some of such inputs which once used for the production of one output, would be also available for the production of other outputs. Another source of economies of scope[4] in banking might be the existence of sharable outputs. The common production of transactions in government and corporate securities might be an example of such a source.

It is worth noting, however, that this area of research is quite new and the empirical evidence is rather contradictory regarding the existence of economies of scope in banking[5]. Berger et al. (1987) claim that "..the detection and measurement of scope economies in this literature has often been incomplete, potentially inappropriate, or subject to unknown exrtapolation error"[p.502]. Furthermore, Humphrey (1990) states that "the scope economy results derived from a multiproduct specification have [...] been dissapointing as there has been a lack of consistency in the value of scope economies estimated"[p.47, fn.19]. Humphrey [(1985), pp.773-775] in an endeavour to explain the results of some preliminary studies which reveal that economies of scope in banking, when they exist, are quantitatively small, refer to four reasons. First, he shows that the operating cost shares for five bank function (i.e. the operating costs for one bank function as a percentage of the operating costs for all five functions), do not exhibit great variation across the bank size classes in his data. This finding provides some evidence that, on average, bank product composition do not vary much across bank size classes. Second, he claims that regression analysis may not identify the possible economies of scope, even if they do exist, since the equilibrium position will be shown in the data. To the extent that this position (as measured by the cost shares) appears quite similar across bank size classes, it may not turn out to be statistically significant in a regression equation [p. 773]. Third, Humphrey argues that the aforementioned similarity in bank output composition across bank size classes (as indicated by the measured cost shares in his sample) may not be due to economies of scope (a supply side influence), but rather due to the homogeneity of the users of bank services (a demand side influence). However, the separation of these two influences and their evaluation has not been performed yet. Finally, he states that the available data do not permit a convincing examination for the existence of scope economies in banking, offering as an example the jointness of production of domestic and international loans (The FCA data do not cover very large banks with international operations).

To conclude, there are strong theoretical reasons to explore scale economies by using a multiproduct specification rather than relying upon an aggregate index of the different outputs. As a matter of fact, however, "... the scale economy results from single output studies are quite similar to those found in multiproduct analyses... As a result, biases that could be due to commingling scope economies with scale economies appear in practice to be slight" Humphrey [(1990), p.46]. In addition, the existence of scale economies do not imply the existence of scope economies and vice versa; that is, they are independent of each other. Their implications differ considerably only when we are dealing with heterogeneous financial institutions (e.g. samples including commercial banks and specialised institutions). But when we are dealing with fairly homogeneous financial institutions (e.g. samples incorporating commercial banks only), even if these two kinds of economies do exist and overlap each other, there is no reason to believe that they are going to shadow the scene substantially, because they are not going to have any different implications. In this particular case, they might collapse into the conventional single output economies of scale. A comparable point is found in Humphrey (1990), who claims that "banks produce very similar product mixes, on average, so that the importance of measured scope economies using current observed production is apparently small enough not to bias the scale economy results obtained specifying single versus multiple outputs"[p.46].

Recall that our sample consists of eight Greek commercial banks which produce -more or less- the same set of services, and operate in the same geographical market. Needless to say, there is no financial institution which is remarkably more specialised than the other firms in the sample. But even if there are some differences among the sample banks, they will be captured by the bank dummy variables of our model, as we are going to see later on. Consequently, it appears not unreasonable to investigate economies of scale in Greek commercial banking by employing the conventional single output approach. Put differently, in our study we are considering economies of scale only.

VI.II Sources of Economies of Scale[6]

Microeconomic theory distinguishes between economies of scale and returns to scale. The former is a broader concept which incorporates, among other things, the latter. But let us start with a concise description of the latter. Returns to scale show the relationship between changes in output resulting from equal-proportional changes in all inputs. Obviously, returns to scale refer to the long-run analysis of production as all factor inputs can be varied[7]. Moreover, returns to scale are technical economies as they are a feature of the production function[8]. If output increases by the same proportion of all inputs, constant returns to scale exist. On the other hand, if output increases by a greater (smaller) proportion of all inputs, increasing (decreasing) returns to scale occur.

Increasing returns to scale arise from technical and/or managerial indivisibilities. The basic idea is that while most production processes can be duplicated (in principle, at least), it may not be possible to halve them. For example, although an automated-teller machine (ATM) or a teller can be easily duplicated it is impossible to have a half ATM or a half teller.

Decreasing returns to scale are mostly ascribed by the relevant literature to the diminishing returns to management. As output grows, the firm is getting more difficult to manage and the top management becomes less efficient in its role. This argument has been used by the Neoclassical theorists in order to explain the eventual rise in the long-run average cost (LRAC) curve[9]. However, this interpretation has been questioned by some economists[10].

Economies of scale usually are distinguished between internal (to the firm) economies of scale and external economies[11]. The former are realised from the firm's own actions as it increases its output and therefore they are a feature of the LRAC curve. In fact internal economies determine the shape of the LRAC curve, which relates long-run costs to output per period of time. The latter (i.e. the external economies) arise from independent of the actions of the firm factors, being rather the effects of the activities of other firms in the same or in another industry. The external economies affect the position of the LRAC curve. For example, an improvement in technology and/or a change in input prices will cause a shift on the firm's cost curve, both the short-run and the long-run. Nevertheless, the distinction between internal economies of scale and external depends on where the dividing line between firms (or plants) is drawn. Scale economies which are external to one firm may be internal for a firm with a greater degree of vertical integration.

Internal scale economies may be achieved from an increase in the production of a particular plant (i.e. scale economies at a plant level), or/and from an expansion in the number of plants of a firm (i.e. scale economies at a firm level). In general, economies of scale at a plant level are of the same nature as that at the firm level. But the importance of each type of scale economies, that will be discussed in the following of this section, may be different whether economies occur at the plant level or at the firm level. Nevertheless, banking firms can expand either by increasing solely the quantity of services they produce (and possible economies of scale at a plant level may emerge), or/and by establishing more branches (and possible economies of scale at a firm level may appear). A third way that financial institutions can expand is of course by increasing the range of services they produce (and possible economies of scope may turn up). In the succeeding analysis we use the aforementioned types of internal scale economies interchangeably, because all Greek banks are branch banks and consequently they are faced with identical (potential) economies of scale. Unit banks which could reap scale economies only at a plant level do not exist in Greece.

Internal economies of scale are usually distinguished between real economies and pecuniary economies of scale[12]. Real economies are those related with a reduction in the physical quantity of inputs. They are called real because they exhibit real resource savings[13]. Pecuniary economies are those achieved from paying lower prices for inputs employed in production and distribution of the product(s), owing to increased factor purchases that accompanies any firm increase. They are called pecuniary because they do not demonstrate any physical resource savings for the industry in question, but only a redistribution of income from sellers to buyers.

The sources of real economies of scale in banking can be classified into five categories.

(i) Production economies. These economies may arise from the factors employed by the banking industry. They may be subdivided into labour economies, technical economies and stochastic economies.

Labour economies arise, as the scale of output increases, partly from the division of labour employed by banks and the resultant specialisation and partly from the nonproportionality of the labour activities to output. A large scale of operation may allow bank employees to become more specialised, resulting in an improvement of their skills and hence of their productivity. On the other hand, this division of labour may not be profitable at small scale of operation, because specialised bank employees would spend part of their working time unemployed. Moreover, labour activities such as book keeping, credit and finance and so on may be nonproportional to output. Doubling the size of credit of a financial institution may not double the administrative cost required. A cheque of a thousand pounds might be riskier than a cheque of ten pounds, but its operating cost is more or less the same (and definitely the administrative cost has not been increased a hundredfold).

Technical economies in banking arise mainly from the specialisation and indivisibilities[14] of capital equipment used by the firms and the initial fixed costs. The argument about specialisation of capital goes hand in hand with the aforementioned argument about specialisation of labour. Increases in size usually imply the use of more quantity and more specialised capital equipment. New equipment is usually more efficient than the previous available one, having lower variable costs for this large scale of operation. However, at low scale of operation the high average-fixed costs of the new equipment may more than offset the lower variable costs. This is a feature of discontinuous production changes arising from indivisibilities. In general, while most processes can be duplicated, it may not be possible to halve them. A biological example which is usually cited in the literature and shows the existence of nonproportionalities in the nature (which could also imply that the absolute amount of the inputs employed in production may affect its efficiency), is that of the flea. Although a flea can jump over a man who is scaled down to the size of the flea, the insect cannot jump at all if he is scaled up to the size of a man[15].

Initial costs are a major factor in banking industry. The use of computers and ATMs would decrease the average cost of the firm only if the scale of output is large enough to spread the unit costs of such "fixed" expenses. The introduction of a new financial product implies (among other things) fixed costs for research and development (R&D), as well as costs for market exploration. Hence, the larger the bank, the lower the unit costs of such expenses.

Stochastic economies in banking are those associated with the random changes of variables existing in the production function of these financial institutions[16]. Put differently, the occurance of these economies is due to the stochastic nature of banking activities. Stochastic economies may arise from reserves and from capital accounts[17].

A hundred years ago, Edgeworth (1888) in his pioneering article in this field argued that by the law of large numbers commercial banks' holdings of cash reserves for purposes of liquidity vary less than proportionately to the volume of deposits. More recently, Baltensperger (1972) shows that optimal reserves depend on volume and structure of assets, as well as on volume and structure of deposits. An increase in the size of the bank leads to a reduction in the variance of total outflows (or reserve loss), owing to the law of large numbers. As a result, the optimal level of reserves and the associated costs to achieve them decrease relatively with increasing scale of operation. Moreover, the average size of reserve adjustment is relatively smaller for larger banks and their reserves will also, on the average, be relatively closer to the optimal level than the smaller banks' reserves. These economies derive from pooling independent risks of deposits withdrawals and loan repayments. These risks can be reduced by pooling, only if the assumption of the independence of banks' customers holds[18]. However, on the whole, some degree of independence between different bank customers might be expected[19]. This last point is less valid as far as specialised financial firms are concerned that are dealing mainly with a particular geographical area or trade.

The optimal capital account depends on volume and structure of deposits, as well as on volume and structure of loans. Let us make the assumption that an increase in the size of a bank takes the form of an increase in the number of debtors or depositors and not only in terms of volume. Then, the aforementioned increase leads to a reduction in the variance of losses either from the asset side (e.g. default loans), or from the liability side (e.g. security sales at unfavourable conditions due to deposit withdrawals), owing to the law of large numbers. In other words, if the independence assumption of bank customers holds, the larger the bank the smaller the deviation of the losses from the expected mean (i.e. the losses approach their anticipated value). As a result, larger banks may be able to operate with lower optimal equity/deposit ratio (i.e. a higher degree of gearing) than smaller banks and hence increase their profitability (ROE).

Another implication of smaller variability of losses and earnings of large banks is their smaller capital cost. Investors in financial markets are supposed to be risk-averse. Therefore, they will be willing to accept lower dividend payments, if they expect the firm's profit to be stable, than if they do not[20].

(ii) Marketing economies. These economies in banking arise mainly from advertising economies. Advertisement is decided and carried out regardless of the size of the firm. Therefore, increases in the size of operations may be accompanied by decreases in the advertising cost per unit, implying declines in the unit cost of output.

(iii) Managerial economies. These economies are mainly associated with the specialisation and decentralisation of management, as well as the mechanisation of managerial functions. Increases in scale of operation permit the division of managerial work. This division implies increases in specialisation and consequently leads to increases in working efficiency. Moreover, large banks may introduce decentralisation of their decision-making process and increase the efficiency of their management. Last but not least, technological innovations as the teletype, telefax and computerized information systems may simplify, accelerate and increase the accuracy of managers' decisions. To the extent that the aforementioned mechanisation of managerial functions is employed more by larger banks than their smaller counterparts, the former might have an advantage over the latter.

The aforementioned arguments are also employed by many theorists in order to demonstrate the existence of managerial diseconomies. The whole debate started in the middle 1920s, when many economists tried to resolve the famous "Marshall's dilemma"[21]. In brief, this dilemma states that increasing returns are difficult to reconcile with competitive conditions. If long-period average cost is a decreasing function of output, because of economies of scale, marginal cost is less than average cost. Moreover, if prices equal average cost plus normal profit, then marginal cost is less than prices for any output. Thus, there is no position of long-period equilibrium, until perfect competition is abandoned. Many economists have tried to answer Marshall's dilemma, such as Pigou who proposed the idea of an optimum size of firm, at which long-period costs are at a minimum[22]. However, Kaldor (1934) was the first who introduced the costs of management into the theory of long-run costs and provided a rationalization for the eventual rise in the long-run average cost (LRAC) curve. The basic argument is that as the firm grows, it becomes more and more difficult to be controlled by the top management because of the rise of organizational complexity and sluggishness. Therefore, increases in size beyond a certain stage produce less than proportional increases in output (due to the indivisibility of managerial functions). At some critical point, according to the Neoclassical theory, these managerial diseconomies overpower the economies of scale and cause an upward turn in the LRAC curve. Thus, the latter takes its familiar U shape. However, the controversy among economists regarding the existence and the magnitude of the diseconomies of management and the associated shape of the LRAC curve is far from settled. In brief, two other possible shapes for the LRAC curve have been proposed by various authors; that is, the L-shaped curve and the inverse J-shaped curve[23].

(iv) Learning economies. These economies are associated with effects that arise from repetition of the same work. It has been found, firstly in the aircraft industry, that labour productivity is a function of the cumulative number of products made previously. Therefore, an increase in output may be related with a relative decrease in labour hours as bank employees become more skilled. In consequence, a reduction in unit costs may arise. Moreover, to the extent that larger banks are also older than their smaller rivals, they might enjoy these kind of economies as their labour and management could be more learned. However, there is no agreement among the economists if learning effects are continuous, diminish, or vanish after a certain cumulative output is reached[24].

(v) Research and development economies. These economies are associated with research and development (R&D) projects of firms that may reduce unit costs. There are some a priori reasons for someone to expect a general Schumpeterian hypothesis relating bank size with R&D expenditure and consequently effectiveness, to hold. Indivisibilities and high cost in research equipment, the attraction of better scientists and the pooling of risks of various projects are some of the reasons that are mentioned in the literature. However, the empirical work in this area does not support the existence of economies of scale in the conduct of R&D[25].

The sources of pecuniary economies of scale in banking can be classified into three categories.

(i) Economies that arise due to lower cost of input factors. Large banks may be able to buy an extended range of products such as writing materials, calculators and so on at special discounts from their suppliers because of the vast quantities they order. Moreover, larger firms may pay less their employees than their smaller competitors because of the prestige associated with the employment by them.

(ii) Economies that arise due to lower advertising unit cost. The cost per advertisement may be less for larger banks than for their smaller rivals, provided that the former advertise at larger scale than the latter.

(iii) Economies associated with raising capital through common stock issues and borrowing. Transaction costs in stock issues are nearly fixed. To the extent that larger banks raise larger issues, the unit cost of that capital would be lower than that of the smaller banks.

VI.III Estimation Methods of Scale Economies

There are various types of empirical cost studies that are trying to investigate economies of scale. The more active approaches that have been proposed and used by industrial economists to carried through the aforementioned task may be grouped under three headings[26].

(a) The Engineering Approach. This method constructs hypothetical production and cost data by employing direct technological information such as the engineering theory, the blueprints, practitioners' knowledge and so on[27]. Hence, the investigator finds out the technically-optimal input combinations, as well as their cost, for producing any given level of output. Relating different levels of output with their lowest cost estimates, the researcher is able to produce the LRAC curve.

The shortcomings of the engineering approach may be classified as follows. First, it is difficult to assess the cost-output relation in some parts of the production process, such as managerial and advertising costs, where the intensity and efficiency of labour may vary considerably. Second, due to the previous argument these studies are not in a position to offer conclusive evidence about the existence of managerial diseconomies. Third, to the extent that this technique is based mainly on the use of questionnaire interviews of various practitioners, problems associated with such use could arise (e.g. differences in interpretation of costs and profits, non-representative samples and so forth). Last but not least, the technical laws of input-output transformation are not as well known in some industries (such as banking), as in others (such as oil-refining) where the engineering approach has been applied.

(b) The Survivor Technique. This method which was advocated by Stigler (1958), is based upon the biological notion of the survival of the fittest. The basic idea is that in a reasonably competitive environment the more efficient firms in an industry will increase their market share over time. Consequently, one can draw inferences about the shape of cost curves as well as scale economies within an industry, by classifying the firms in that industry into size classes and then examining the market shares of these groups over time. An increase (decrease) in a share of a particular class over time indicates an efficient (inefficient) size.

The use of the survivor technique in drawing inferences about scale economies suffers from various drawbacks[28]. First, this approach indicates only the approximate shape of the LRAC curve and does not show the actual magnitude of the scale economies. Second, the survivor technique cannot explain situations where the market share of all size-classes remain constant over time, as it suggests that all groups are equally efficient. Third, in empirical research it is often difficult to obtain the required results from the application of the aforementioned method (e.g. inconsistent estimates of the optimal size class for different time periods, multiple optimal size classes and so on). Fourth, it is based on the rather "heroic" assumption that differences in costs are the only (or at least the major) explanation of differences in firms' growth rates. Finally, the survivor technique seems more applicable in competitive markets, as otherwise inefficient firms might survive for long periods of time.

(c) Statistical Cost Analysis. This method consists of the application of regression analysis to time series or cross section data, in order to estimate a cost function and subsequently the average and marginal costs[29]. The cost function that is used may be linear, quadratic, cubic, or more complex.

The main advantage of this technique is that it employs standard statistical techniques (such as the OLS) and it is based upon the actual operating experience of firms. In consequence, several dozen of empirical studies have utilized the Statistical Cost Analysis in investigating economies of scale. However, these statistical cost studies have been attacked for the estimation methods they used as well as the conclusions they reached[30]. The main criticisms of these attempts may be grouped under three headings.

(i) Inadequate use of data. Statistical cost studies employ accounting data which differ from economic data. Accounting cost does not include several estimated costs which involve actual payments such as profit or opportunity costs, though economic cost does. Depreciation methods of capital equipment are different between accountants and economists (the former usually employ a linear method, while the latter a non-linear one), as well as the concept of depreciation is different (the former include obsolescence costs to their depreciation figures, while the latter do not).

(ii) Inadequate deal with changes in technology, factor prices and in the quality of the product. Changes in technology and/or input prices cause shifts to the cost curves. To the extent that these changes have not been taken into account (and usually have not), statistical studies obtain joint points belonging to shifting cost curves and do not show the real shape of these curves. Moreover, changes in the quality of the product might cause changes in its production cost. If these changes have not been accounted for in estimating the cost curves, the outcome might be biased.

(iii) Interpretation problems associated with the technique. Friedman (1955) commenting on Smith (1955) claims that the LRAC curve is non-observable even in principle. He argues that in a competitive industry all firms in long-run equilibrium will produce at the minimum point of their LRAC curves. Moreover, the average cost curve would actually be the same for all firms and independent of the output of the industry, so that all we can observe is a single output-cost combination. In this case, the only reason of observing temporary differences in the size of the firms could only be either to "errors", or historical changes in the optimum size of the firms. However, Friedman's argument is valid only in a perfectly competitive world.

Last but not least, economies of scale could be attributed to the "regression fallacy" possibility put forth by Friedman (1955)[31] and elaborated by Stigler (1955)[32]. They argue that any firm in a given period may produce more or less than its normal output, due to transient factors of a random nature. But the important point is that they show that the average transient component of output is negative for small size firms and positive for the rest. Thus, they conclude, the observed in empirical studies economies of scale may well be caused by transient changes in output from year to year, while costs remained relatively unchanged.

VI.IV A Brief Review of the Relevant Literature[33]

A large number of studies explore the existence and the degree of scale economies in banking. Their findings differ almost as widely as the methods used. In general, however, the conclusion, of these papers is that either economies of scale exist only at relatively low output levels, or they do exist in large output levels but tend to be small in an absolute sense.

All but one of the works that investigate economies of scale in banking are cost studies[34], based mainly on the Statistical Cost Analysis. One[35] may classify these papers into two broad categories according to the particular technique they employ.

(i) Non-regression studies. Alhadeff (1954) and Horvitz (1963) use tabular analysis to analyze economies of scale by relating unit costs, computed as the average ratio of total operating costs to output (the latter defined as total loans plus investments), to different deposit size groups. Kalish, and Gilbert (1973) use a similar to the frontier technique that had been used to estimate production functions. Moreover, the authors employ two bank output measures. One is loans plus investments and the other, which they call "adjusted revenue", is an index weighting each asset category by its expected yield[36].

(ii) Regression studies. These papers employ multiple regression analysis in order to investigate economies of scale in banking. They may be subdivided into five groups according to the form of the cost function they use.

(a) In the first group belong the studies by Schweiger and McGee (1961) and Gramley (1962), who are using a linear cost function. They regress total operating cost divided by total assets on bank size, as measured by deposit size groups (the former study) and logarithm of total assets (the latter study) and on other independent variables, being in the RHS of the function to hold bank characteristics constant.

(b) The second category includes Greenbaum (1967) and Powers (1969), who are using a cubic function and measure bank output as total revenue. These studies relate unit cost (total operating cost to total assets) to total operating revenue divided by total assets. Powers (1969) uses gross operating income to measure output, while Greenbaum (1967) calculates output by computing an average yield for each of sixteen types of earning assets, multiplying it with the year-end amount of each of these assets and adding the product to nonlending gross operating income.

(c) The third group includes the works by Benston (1965), Bell and Murphy (1968), Murphy (1972), Schweitzer (1972), Mullineaux (1975), Longbrake (1974), Longbrake and Haslem (1975) and Durham (1981). The common feature of these studies is that they derive their cost functions from a prespecified production function generally of the Cobb-Douglas type. All but one use data gathered by the Federal Reserve System in its Functional Cost Analysis Program (FCA) and employ the number of accounts of separate banking functions as a measurement of output[37]. They analyze each of six banking services by fitting separate regressions for demand deposits, time and savings deposits, mortgage loans, installment loans, business loans and securities.

(d) The fourth category incorporates the studies by Benston et al (1982b) and Flannery (1983). They use a translog cost function relating total operating costs of various deposits and loan functions mainly to total bank output and the prices of labour and capital inputs. Benston et al (1982b) measure bank output by a Divisia multilateral index number. This index is the weighted sum of the number of five types of accounts, with the weights based on the proportionate share of each account in total operating costs. Flannery (1983) uses two alternative measures of bank output. One is calculated following Greenbaum (1967) and Powers (1969) and the other is a weighted average of each bank's average number of six types of accounts (each type is weighted by the sample's average

proportion of total reported costs arising from that activity).
(e) The fifth group includes the studies by Murray and White (1983), Benston et al (1983), Gilligan and Smirlock (1984), Gilligan, Smirlock and Marshall (1984), Lawrence and Shay (1986), Berger, Hanweck and Humphrey (1987). They employ a similar to the aforementioned (fourth category) translog cost function, though instead of using one measure of output they include several categories of output into their regression separately, to examine for the existence of economies of scope.

At this point, a special reference should be made to Pavlopoulos and Kouzelis (1989)[38] who do not make use of aggregate data as the above workers do but figures referring to a single Greek commercial bank[39]. Using a translog cost function and cross-sectional data of 1983, they find U-shaped marginal cost curves for two bank products (i.e. deposits, loans) and an L-shaped LMC curve for a third product (i.e. ancillary services). Scale economies appear to vary in the range 0.34-1.23 per branch in the firm's network, while the bank is also found to enjoy economies of scope of 0.2165 in the joint production of "loans-deposits" and "loans-ancillary services". Moreover, the most efficient branch emerges the one that employs 6-10 persons and produces 3000-4000 new deposit accounts, 500-1000 new loans and 200000-1000000 transactions of ancillary services.

VI.V The Model

We explore economies of scale in Greek commercial banking by employing the Statistical Cost Analysis approach. This method has been selected for two reasons. First, bank output-product is more homogeneous than in almost any other industry and subsequently many problems associated with the aforementioned technique seems to be overcome. And second, the other two active approaches appear to suffer from more drawbacks than the Statistical Cost Analysis one.

The conventional analysis of the theory of production, which was used in banking studies employing this method up to the eighties, derives cost functions from prespecified forms of production functions mainly of the type of Cobb-Douglas. However, the Cobb-Douglas form used by these studies to estimate scale economies in banking may lead to two unsatisfying results[40].

(a) Since the model assumes that economies of scale are constant for all sizes of banks, it can only estimate economies of scale, diseconomies, or constant costs. It cannot estimate all three at the same time (e.g. a U-shaped average cost curve) even if this is the case.

(b) Because of the aforementioned assumption the model may provide incorrect evidence about the shape of the LRAC curve when in fact they are only concerned with the average bank in the data set.

The above drawbacks are associated with the use of the Cobb-Douglas form in cases of models that presume a single homogeneous product. Models which recognize multiple output typically specify transformation functions which are not very general imposing severe a priori restrictions on the structure of production and cost such as factor homogeneity[41] and functional separability[42]. However, these "a priori restrictions of homogeneity and separability can result in substantial errors in the estimation of marginal costs and scale economies"[43].

The aforementioned problems of the multiproduct functions have been overcome with the advent of the duality approach[44]. According to the Shephard-Uzawa duality theorem, if there is a well behaved cost function[45], then there exists one corresponding well-behaved production function. Consequently, the duality approach permits us to use any specific cost function which satisfies several basic requirements without specifying the associated production function. Needless to say, the duality approach applies to single-output functions as well.

The banks of our sample could be assumed to pursue cost-minimizing behaviour and treat output levels and input prices as exogenous elements in their decision process. Then, we can investigate scale economies in Greek commercial banking by employing a transcendental logarithmic (translog)[46] cost function. The translog model allows economies of scale to vary across different size classes of banks and can estimate a U-shaped cost curve if it exists in the data. We adopt this particular flexible[47] functional form, because it has been shown that it performs as well as the extended generalized Cobb-Douglas (EGCD) and better than the generalized Leontief (GL), which are two other well-known flexible forms[48].

The translog function provides a local approximation to an arbitrary, twice differentiable cost or production function. In our study, we choose to approximate the total cost function, which of course is dual to the production function, by a simplified translog form[49] which we write as

$$\ln TC = \alpha_{TC} + \alpha_Q \ln Q + \alpha_{QQ} (\ln Q)^2/2 + \alpha_B \ln B + \alpha_{BQ} \ln B \ln Q + \\ + \alpha_{BB} (\ln B)^2/2 \qquad (1)$$

where TC denotes the total operating cost of the eight Greek commercial banks excluding the interest paid; Q is the total bank output measurement; B is the number of branches; α_{TC} denotes a constant invariant cost; and α's are various parameters. It is worth noting, however, that all the parameters but the intercept have difficult meaningful interpretation by themselves (i.e. taking them separately). Nevertheless, this difficulty presents no problem in our case, because of the use of the parameters in conjunction with each other, as we are going to see later on.

If we assume that the above cost function satisfies the desired regularity or duality conditions over the range of our observations, then the estimated scale economies obtained from this cost function would be the same with those that could be obtained from its dual production function[50].

Economies of scale can be expressed by the elasticity of cost with respect to output (that is, the impact of a percentage change in bank output on a percentage change in total bank operating costs):

$$n_1 = \partial \ln TC/\partial \ln Q = \alpha_Q + \alpha_{QQ} \ln Q + \alpha_{BQ} \ln B \qquad (2)$$

This elasticity varies with the level of output and the number of offices and for values less than, equal to, or greater than 1.00 shows economies of scale, constant costs, and diseconomies of scale respectively.

Apart from the aforementioned elasticity, we can also obtain the elasticity of cost with respect to the number of branches (that is, the impact of a percentage change in the number of branches on a percentage change in total bank operating cost):

$$n_2 = \partial \ln TC/\partial \ln B = \alpha_B + \alpha_{BQ} \ln Q + \alpha_{BB} \ln B \quad (3)$$

This elasticity varies with the level of output and the number of offices and for values less than, equal to, or greater than 1.00 shows economies of scale, constant costs, and diseconomies of scale respectively.

The measure of cost elasticity with respect to output assumes that output can be increased without an increase in the number of offices. However, bank expansion does not only take the form of increasing output, but also of increasing the number of branches. Therefore, Benston et al (1982b) propose an augmented scale economy measure n^*, which accounts for the two sources of banks' output expansion. In order to find the rate of change of the cost function with respect to output, when output and number of branches are related, we first differentiate the cost function (1) totally, to get the total differential.

$$d\ln TC = (\partial \ln TC/\partial \ln Q) d\ln Q + (\partial \ln TC/\partial \ln B) d\ln B$$

Dividing both sides of the above equation by the differential $d\ln Q$, we obtain the total derivative of the cost function that we are seeking (that is, the n^*).

$$n^* = d\ln TC/d\ln Q = (\alpha_Q + \alpha_{QQ} \ln Q + \alpha_{BQ} \ln B) + $$
$$+ (\alpha_B + \alpha_{BQ} \ln Q + \alpha_{BB} \ln B)\ (d\ln B/d\ln Q)$$

The above equation can also be written in terms of elasticities n_1 and n_2 as

$$n^* = n_1 + n_2\ (d\ln B/d\ln Q) \quad (4)$$

where $d\ln B/d\ln Q$ is a ratio showing the percentage change in the number of branches due to a percentage change in bank output.

VI.VI Measurement of Bank Output and Operating Cost

Measuring bank output is a difficult task, because financial institutions are multiplant, multiproduct firms producing services rather than physical products. In general, services can be measured from their cost of production, provided that the net production of services (i.e. their value added) can be distinguished from their gross production. However, this approach used in national income accounting, does not offer any assistance in a study of banking costs, as services are expressed in terms of their costs. Therefore, banking services have not yet been measured directly, but only with the employment of a proxy measure. In consequence, there is no unanimity among researchers on the definition of bank output. The measurements that have been employed vary considerably from simple definitions such as the volume of assets in money terms, to more complicated ones such as various indexes.

In our study we measure bank output as the total drachma volume of deposits and loans. This output measurement is consistent with the notion that a bank's main services can be classified into two categories; those provided to lenders and those provided to borrowers. However, this output definition has some drawbacks. First, it does not take into account the quality of services. To the extent that scale economies (diseconomies) exist and lead to improvement (deterioration) in the quality of the provided services without affecting their charges, an underestimation of these scale economies (diseconomies) will take place. Second, it does not take into account the effect of differences in the number of deposit and loan accounts created and serviced and the activity in these accounts, on the total operating cost. Consequently, one may conclude that "it is meaningless to report that a large bank enjoys lower costs per dollar of loans than a small bank if this "economy" is achieved because the large bank makes larger loans"[51]. However, this argument is based on the assumption that large financial firms have the same number but larger accounts than the small firms. Put differently, the assumption that large and small banks have the same portfolio structure and face the same activity in their accounts implies that only changes in volume of accounts matters. Though the logical sequence of this thought is true, the opposite does not hold necessarily. Observing that large and small banks have different volume of accounts (an implication of our definition), we make no other assumption; neither implicity nor explicity. Then, if larger banks have larger number of accounts than their smaller rivals (which might well be the case, especially in Greece), Benston's et al (1982a) argument is not valid. Nevertheless, we use the aforementioned definition mainly because of the constraint of data availability. Though the number of deposit and loan accounts might be a better measurement, it is not obtainable for Greek banks. Another reason for the adoption of the above output definition is that it has been shown that it provides similar results with other potentially more suitable measurements[52].

Measuring bank operating cost is less controversial than output. The usual disagreement among researchers is whether to include or omit interest from operating expenses. Recently, Humphrey (1985) claims that bank output is properly defined in money terms only when interest expenses are included in operating costs[53]. His argument is based upon the finding that larger banks rely more on purchased money (large CDs and federal funds in the USA) to fund new loans than smaller financial institutions. Consequently, the exclusion of the interest costs of purchased funds from operating expenses will bias the conclusions toward finding economies of scale. However, this argument is valid to the extent that there is a well developed market for such funds and that larger banks do rely more havily on this kind of liability management than their smaller rivals. Though this has been the case in the USA economy since the late sixties, it is not the case in Greece during the period studied[54]. Furthermore, in our study we exclude interest expenses from the measurement of bank operating cost, because Greek banks do not report such expenses separately[55]. Nevertheless, this omission may also be theoretically justified as we are interested in the banks' ability to produce and service deposits and loans using internal resources and management; the traditional economies of scale concern.

Moreover, the use of cost accounting data instead of their economic values in banking creates less problems than in almost any other industry. This happens because salaries, which can be measured by accounting data (i.e. their opportunity cost is almost the same with their accounting), are the major type of expenditure in banking, leaving only a small room for depreciation and occupancy expenses which might create a problem. Therefore, one may conclude "that bank operating costs, as usually reported, measure economic values reasonably well and, to the extent they do not, appear not to bias economies of scales estimates"[56].

VI.VII The Data

The data of deposits and loans employed for this study are obtained from bank balance sheets. Balance sheets report year-end data. Therefore, we transform them to mid-year data by averaging (using the money weighted arithmetic mean) each year-end balances with the year-end balances of the previous year.

To find the annual operational number of branches per bank, we apply the same aforementioned transformation. We average (by using the arithmetic mean) each bank's number of offices per year with its number of offices of the previous year.

The cost data used for this study are from bank's income statements. The dependent variable is the sum of all reported operating expenses other than interest payments[57]; that is, it includes staff salaries, contributions to staff welfare funds, general expenses and third party remunerations, taxes[58], loan loss provisions, other provisions, depreciations and contributions paid to special account with the Bank of Greece (Law 128/75).

Finally, our sample consists of ten years (1977-1986) observations of eight commercial Greek banks; totally eighty observations[59].

VI.VIII Estimation Method

To estimate the translog function (equation 1) we add an error term to account for stochastic differences among the individual banks and the years of our time period. Thus, the model takes the following form:

$$\ln TC = a_{TC} + a_Q \ln Q + a_{QQ} (\ln Q)^2/2 + a_B \ln B + a_{BB} (\ln B)^2/2 + a_{BQ} \ln B \ln Q + \varepsilon \quad (5)$$

where ε is the error term.

Let us assume now that all the parameters of the translog cost function remain constant at all sizes of banks and through the whole time period. This assumption may seem too stringent leading to a serious model misspecification. Therefore, we are going to replace it with a less stringent assumption later on. However, it is nesessary to employ this assumption for the time being, as we can use neither cross-sectional analysis nor time series due to the small population of Greek commercial banks. This assumption permits us to pool all our bank observations and run an OLS regression on equation (5). The OLS method produces estimates which according to the Gauss-Markov theorem are BLU, provided that the classical conditions are satisfied. Therefore, we apply some tests to ensure that these conditions are met.

To test for heteroscedasticity we employ a Breusch-Pagan test. The relevant statistic is $n=2.850$ and it is lower than $X^2_{0.95,5} = 11.070$ and $X^2_{0.99,5} = 15.086$. Thus, we accept the null hypothesis that the errors are homoscedastic at 5 per cent level of significance.

To test for autocorrelation we cannot use the Durbin-Watson statistic because of the transition of the ordered sample across banks. Therefore, we compute the autocorrelation coefficient (ρ) directly, using the regression residuals and assuming that the parameter ρ has the same value for all the banking firms[609]. The value of the autocorrelation coefficient in our model is found $\rho=0.62$ and offers evidence of serious autocorrelation.

To correct for correlated disturbances, assuming first-order autocorrelation[61], we apply the Cochrane-Orcutt iterative method. The convergence is achieved after three iterations and the final value of rho is $\rho=0.569954$ and it is statistically significant. However, as we have already mentioned, this technique does not offer a guarantee that it will locate a global minimum. To ensure location of a global minimum we also use the method suggested by Hildreth and Lu. This search technique gives us a similar to the Cochrane-Orcutt estimation of rho ($\rho=0.550000$). Thus, the previous estimation of rho is a global minimum.

To test for heteroscedasticity in our new model, which is free of the assumed pattern of autocorrelation, we reapply a Breusch-Pagan test. The relevant statistic is now $n=13.627$ and we can accept the null hypothesis of uncorrelated disturbances at 1 per cent level of significance. However, we can compute standard errors of the estimated coefficients which are consistent even in the presence of unknown heteroscedasticity[62]. This has been done by employing the formulae suggested by White (1980)[63] and using the data to estimate the magnitude of heteroscedasticity.

Let us now relax the assumption of constant intercept and slope coefficients. Instead, we assume that the slope coefficients are constant, but the intercept varies across banks and over time. This assumption may also seem quite strong. A more general one would be that all coefficients vary over time and banks. However, the number of firms in our sample is very limited (i.e. eight banks) and therefore it is better to treat the slope coefficients as fixed even when the random assumption looks more attractive[64]. This means that the intercept contains a component that is constant over time and varies from bank to bank, and also a component that varies over time and is constant over banks. The idea behind this kind of model is the supposition that each firm and each time period are characterized by their own special intercept.

We have already mentioned that two alternative approaches can be found in the relevant literature to deal with the above predicament: the "fixed effects" (FE) models and the "random effects" (RE) models. In our study we employ a FE model because the number of firms in our sample is small and the time effects as well as the firms' effects of the intercept may be correlated with the explanatory variables[65]. This approach, which is called either least squares with dummy variables (LSDV) or analysis of covariance (ANCOVA), incorporates dummy variables for the firms as well as the time periods in the model, attempting to improve the specification of the classical pooling regression.

The binary variables are used as proxies for ascribing the qualitative effect of a particular bank and a particular year to the value of the total operating cost. In our case we omit from our model one dummy for the least profitable bank (D8) and one dummy representing the least profitable year of our time period (T7), since their addition would result in perfect collinearity among the explanatory variables. Consequently, we use seven bank binary variables and nine year binary variables. For the same reason (i.e. a singular data matrix), we also exclude from our model the first year dummy (T1), as the Cochrane-Orcutt technique estimates differences of the included variables and therefore drops the first year observation in a time series-cross sectional analysis. Nevertheless, the effects of the three omitted binary variables will be captured by the regression intercept. Moreover, the coefficients of the included dummy variables will represent the effect of the difference of the included dummy from the omitted dummies on the total operating cost (i.e. differential effects). Thus, the LSDV model takes the following form:

$$\ln TC = a_{TC} + a_Q \ln Q + a_{QQ} (\ln Q)^2/2 + a_B \ln B + a_{BB} (\ln B)^2/2 + + a_{BQ} \ln B \ln Q + \sum_{i=1}^{7} a_{Di} D_i + \sum_{j=2}^{6} a_{Tj} T_j + \sum_{k=8}^{10} a_{Tk} T_k + u$$

where D represents the bank dummy variables and therefore $i=1,\ldots,7$; T represents the year dummy variables and therefore $j=2,\ldots,6$ and $\kappa=8,9,10$; and u is a stochastic term associated with each bank per year.

To decide upon whether we should include the dummy variables in our model and consequently sacrifice the associated degrees of freedom (i.e. 15 d.o.f.) or omit them absolutely, we employ an F test. This test compares the restricted (i.e. the intercepts are restricted to be equal over banks and over time in our classical pooling model) and the unrestricted residual sum of squares. The relevant F-Statistic is found F=2.540 and we can reject the null hypothesis that the equal-intercept restrictions are correct at 1 (5) per cent level of significance based on (15,51) degrees of freedom as the tabulated critical value of the F distribution is lower [i.e. $F_{0.01(15,51)} = 2.380$ and $F_{0.05(15,51)} = 1.854$].

The problem of the assumed pattern (i.e. first-order) of autocorrelation in this LSDV model is corrected by the application of the Cochrane-Orcutt iterative method. The convergence is achieved after four iterations and the final value of rho is $\rho=0.390539$ and it is also statistically significant. However, as we have already mentioned this technique does not guarantee that it will locate a global minimum. To ensure location of a global minimum we apply the Hildreth-Lu search technique. This method offer us a similar to the Cochrane-Orcutt estimation of rho ($\rho=0.400000$). Thus, the previous estimation of rho is a global minimum.

To test for heteroscedasticity in our LSDV model, we apply a Breusch-Pagan test. The relevant statistic is n=57.255 and we reject the null hypothesis of homoscedastic disturbances, as $X^2_{0.95,20} = 31.410$ and $X^2_{0.99,20} = 37.566$. However, we can compute consistent variances of the estimators by using White's formulae. Hence, we can apply the formulae of the variances of the coefficients to conduct tests of significance and construct confidence intervals assuming of course that the asymptotic properties hold approximately in a sample as small as ours.

In addition we should bear in mind that estimating the translog function a multicollinearity problem may occur[66]. This flexible functional form really lends itself to this problem because each of the two explanatory variables are entered into the equation first of all by themselves, then in a squared term, and then they are multiplied by each other to create an interaction term. However, we do not embark upon the task of diagnosing the presence and nature of potential multicollinearity problem in our study[67].

Table VI.1 shows the regression results of the LSDV model. The regression intercept captures the effects of the three omitted binary variables (D8,T1,T7), and therefore its negative value

TABLE VI.1

Translog Cost Function Parameter Estimates

Variables	Estimated Coefficients	t-Statistics
Constant	-64.87269000	-2.6737640**
lnQ	7.39309600	3.1471000**
$(\ln Q)^2/2$	-0.33057840	-2.8576170**
lnB	-7.92191500	-2.5984790*
$(\ln B)^2/2$	-0.59597750	-2.1466620*
lnBlnQ	0.40913650	2.5785350*
D1	0.49665770	0.6403848
D2	0.27860420	2.6561730*
D3	0.96224100	0.9612932
D4	0.49345720	0.9609782
D5	1.22236500	0.9091587
D6	0.27095220	2.5120140*
D7	0.62789100	0.9265708
T2	-0.20897140	-1.5635070
T3	-0.25189300	-1.5075400
T4	-0.20102700	-1.4072600
T5	-0.08573551	-0.9364215
T6	-0.05909219	-1.2471670
T8	0.14295180	2.6561460*
T9	0.18638660	1.8030170
T10	0.23582340	1.6323740
S.E.R. = 0.0865707 R^2 = 0.995376 $\bar{R}^2$ = 0.993562 F-Statistic = 548.906		

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05(0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

should not trouble us excessively. This argument may also reinforced, if we interpret the regression as being linear function of best fit over the ranges of output and bank offices experienced by Greek banks throughout the ten-years period. All the coefficients of the necessary, for the calculation of the elasticities variables are significant in a two-tailed t test. Most of the coefficients of the binary variables are insignificant. However, we do not exclude from the regression those dummy variables whose coefficients are not significant, because this omission would bias the statistical tests when the new regression is run[68]. The coefficient of multiple determination (R^2) is very high, showing that 99 per cent of the variation of the dependent variable is explained by the regression plane. The F-Statistic calculated from the regression is higher than the tabulated critical value of the F distribution at 1 per cent level of significance with (20,51) degrees of freedom [$F_{0.01(20,51)} \approx 2.300$]. Hence, we reject the null hypothesis of no relationship between the dependent and the independent variables at 1 per cent level of significance.

VI.IX Empirical Results

Table VI.2 shows the annual ranking of the eight Greek commercial banks according to their assets. Table VI.3 presents the annual cost elasticities per bank, calculated from the coefficients of the LSDV model. Judging from the magnitudes of n_1s, the elasticities with respect to output (i.e. the conventional ones), five banks experienced diseconomies of scale in 1977, four in 1978 and only one in 1979. The remaining banks in these three years, as well as all the banks since 1980 have been found to face unexploited scale economies. Moreover, all economies of scale were found to increase with the lapse of time.

The elasticity with respect to offices (n_2) has not a meaningful interpretation by itself, as it is highly improbable

TABLE VI.2

Banks' Annual Ranking According to Assets

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	AT	AT	AT	AT	AT	AT	AT	PI	PI	PI
2	TR	TR	PI	PI	PI	PI	PI	AT	AT	AT
3	PI	PI	TR	TR	TR	TR	TR	TR	TR	TR
4	GB	GB	GB	GB	GB	GB	GB	GB	GB	GB
5	CR	CR	CR	CR	CR	CR	CR	CR	CR	CR
6	IO	IO	IO	IO	IO	IO	IO	IO	IO	IO
7	CO	CO	CO	CO	CO	CO	CO	CO	CO	CO
8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Note:
The ranking is tabulated in reverse order; that is from the smaller bank (1) to the larger one (8).

for a bank to increase its number of branches and hold its output constant at the same time. Moreover, some of the estimated elasticities have negative values, denoting that a percentage increase in the number of offices was accompanied by a percentage decrease in operating expenses. This unusual result might be explained with the assistance of the following conjecture. Let us suppose that an increase in operating costs is due solely to an increase in output and not to an accompanied expansion in the number of offices. This supposition might hold in cases where expansion by establishing new branches result in more efficient distribution and use of bank employees and capital equipment, in less operating costly output composition and generally cost gains

TABLE VI.3

Annual Cost Elasticities per Bank

Elasticity $n_1 = (\partial \ln TC/\partial \ln Q)$

Years	Banks							
	AT	PI	TR	GE	CR	IO	CO	NA
1977	1.02221	0.96092	0.97481	1.09384	1.05488	1.19786	1.11875	0.92408
1978	0.92423	0.91714	1.02359	1.02828	0.97404	1.10301	1.04595	0.87504
1979	0.87272	0.88337	0.95651	0.97481	0.90812	1.02048	0.98917	0.82471
1980	0.86476	0.88609	0.87322	0.91818	0.83425	0.96311	0.92806	0.76981
1981	0.80237	0.87717	0.77799	0.88040	0.75937	0.89784	0.85439	0.69197
1982	0.71089	0.84711	0.69524	0.84923	0.69701	0.81842	0.78699	0.61112
1983	0.61063	0.79632	0.66804	0.81456	0.64148	0.75698	0.73314	0.54625
1984	0.61522	0.75556	0.61871	0.76651	0.57279	0.70304	0.66910	0.47552
1985	0.61242	0.69001	0.52316	0.68907	0.50200	0.64194	0.59043	0.40511
1986	0.56320	0.61564	0.45250	0.63165	0.43741	0.58459	0.52911	0.34999

Elasticity $n_2 = (\partial \ln TC/\partial \ln B)$

	AT	PI	TR	GE	CR	IO	CO	NA
1977	-0.18130	-0.11398	-0.11318	-0.44560	-0.44440	-0.66892	-0.61809	-0.42954
1978	-0.06003	-0.06759	-0.21316	-0.36937	-0.34584	-0.55153	-0.52877	-0.37310
1979	-0.00482	-0.03297	-0.14210	-0.30671	-0.26643	-0.45026	-0.46003	-0.31366
1980	-0.00277	-0.05495	-0.03901	-0.24000	-0.17572	-0.38099	-0.38640	-0.24756
1981	0.07445	-0.06389	0.07885	-0.20563	-0.08516	-0.30189	-0.29767	-0.15291
1982	0.18768	-0.03524	0.17583	-0.17961	-0.01205	-0.20526	-0.21733	-0.05488
1983	0.31176	0.02762	0.19493	-0.14471	0.05470	-0.13165	-0.15343	0.02341
1984	0.28608	0.07806	0.24345	-0.09045	0.13653	-0.06725	-0.07552	0.10973
1985	0.26837	0.15920	0.35789	0.00540	0.21926	0.00682	0.02097	0.19519
1986	0.32469	0.25124	0.44169	0.07646	0.29514	0.07553	0.09642	0.26199

Elasticity $n^* = n_1 + n_2(d\ln B/d\ln Q)$

	AT	PI	TR	GE	CR	IO	CO	NA
1977	NA	NA	NA	NA	NA	NA	NA	NA
1978	0.92423	0.89450	0.78226	0.96004	0.95504	1.10301	1.02824	0.79638
1979	0.87119	0.87104	0.91091	0.92239	0.88272	1.00573	0.95189	0.77667
1980	0.86298	0.84119	0.87322	0.88029	0.82890	0.92921	0.89118	0.74532
1981	0.80237	0.83206	0.77799	0.78812	0.75241	0.87457	0.82628	0.68213
1982	0.71089	0.83194	0.72382	0.76121	0.69499	0.80568	0.75981	0.60710
1983	0.61063	0.79632	0.77301	0.75831	0.64712	0.74222	0.71165	0.54834
1984	0.85373	0.75556	0.71478	0.74421	0.59006	0.69471	0.66428	0.48131
1985	0.81613	0.69001	0.56137	0.68907	0.53973	0.64246	0.59116	0.41899
1986	0.63542	0.61564	0.51335	0.63165	0.48527	0.59311	0.53135	0.37038

Note:
The augmented scale economy estimates (n^*) for the year 1977 cannot be estimated, as the weights (dlnB/dlnQ) have been computed directly from the data.

that are offsetting the increases in costs associated with the operation of the new offices. Then, increases in the number of offices with unchanged the volume of output, may lead to decreases in the operating expenses and consequently negative cost elasticities with respect to the number of branches. However, this is a hypothetical situation as changes in the number of offices always cause changes in bank output. Nevertheless, the magnitudes of n_2s offer two indications. Firstly, Greek banks have faced with great unexploited office economies. And secondly, these branch economies have diminished over time. The first indication is not surprising at all as Greece have been relatively underbranched[69]. The second indication is caused by the way that Greek banks have traditionally competed with each other; that is, by establishing more branches. The more new offices Greek banks establish, the more attractive locations are taken up, the less office economies are left to be exploited.

The magnitudes of the augmented scale economy estimates (n^*s) denote that only two banks experienced slight diseconomies of scale in 1978 and one bank had almost constant returns to scale in 1979. The remaining banks in these two years, as well as all the banks since 1980, have enjoyed economies of scale. Moreover, all scale economies were found to increase over time. Last but not least, the largest bank in Greece (i.e. the National Bank of Greece) has faced with greater scale economies than any other bank in any year of the period examined.

The aforementioned conclusions are based upon elasticities relating individual banks with individual years. However, this presentation does not uncover the general relationship between bank size and scale economies and ultimately cost efficiency.

Therefore, an alternative tabulation is employed. This is done by classifying our sample in three categories; small, medium and large size banks. This classification is based upon the banks ranking according to their ten years average deflated assets. The small size group is associated with Attica, Piraeus and Traders bank; the medium size with General, Credit and Ionian bank; and the large size with Commercial and National bank. Table VI.4 illustrates the three aforementioned groups. In consequence, we construct the average augmented scale economy estimates (n*s) for each of those three categories per year, which are shown in table VI.5. The magnitudes of n*s appear to lead to four conclusions. First, scale economies have been sustained for all three bank groups throughout the whole time period[70], with the exception of

TABLE VI.4

Ten-year Period Average[1] Deflated[2] Assets per Bank (in billion DR.)

Size Groups	Banks	Assets
Small size	AT PI TR	2.0 2.2 2.8
Medium size	GE CR IO	15.9 37.1 44.8
Large size	CO NA	101.2 356.8

Notes:
1. The figures denotes the arithmetic means of each bank's assets for the whole time period (1977-1986).
2. The figures are expressed in 1977 values, deflated by the general consumer price index.

1978 when medium size banks were found to face almost constant returns to scale. Second, all the economies of scale have increased substantially with the lapse of time. Third, large size

TABLE VI.5

Average[1] Augmented Scale Economy Estimates (n^*) by Size Class

Years	Small size banks	Medium size banks	Large size banks	TOTAL[2]
1977	——	——	——	——
1978	0.86699	1.00603	0.91231	0.92844
1979	0.88438	0.93694	0.86428	0.89520
1980	0.85913	0.87946	0.81825	0.85228
1981	0.80414	0.80503	0.75420	0.78779
1982	0.75555	0.75396	0.68345	0.73098
1983	0.72665	0.71588	0.62999	0.69084
1984	0.77469	0.67632	0.57279	0.67460
1985	0.68917	0.62375	0.50507	0.60599
1986	0.58813	0.57001	0.45086	0.53633
TOTAL[2]	0.77209	0.77415	0.68791	0.74471

Notes:
1. The figures are the arithmetic means of three banks for the small and medium size groups and of two banks for the large size group.
2. The figures are the arithmetic means of each row or collumn.

banks have experienced greater scale economies than any other group for all the years, but 1978. Therefore, large size banks appear to be more cost efficient than small and medium size banks.

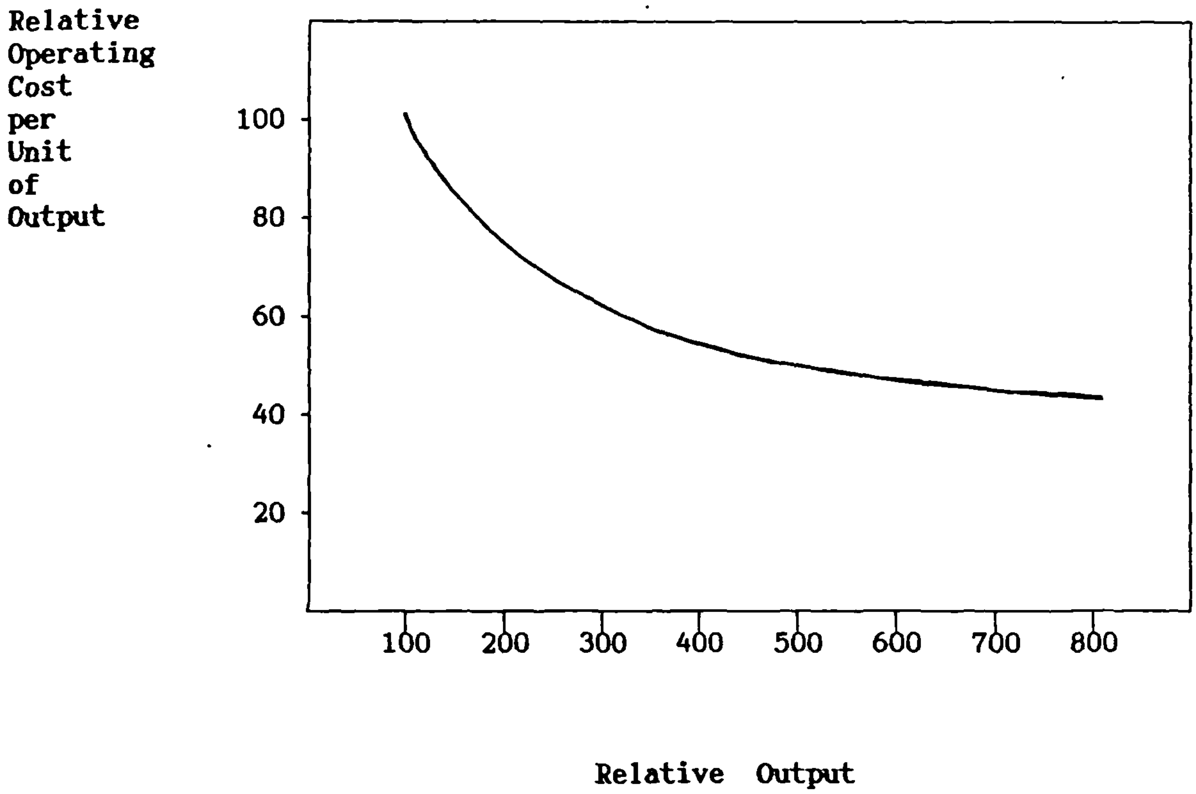
Finally, medium size banks were found to face less economies of scale than small size banks up to 1981. Since 1982 the previous finding have been reversed and medium size banks have enjoyed greater scale economies than their smaller rivals.

The aforementioned findings indicate that larger banks are preferable ceteris paribus. However, the magnitudes of the estimated elasticities should not exagerate their significance for public policy. Given the estimated potential overall augmented elasticity of 0.74, a bank with say DR 100 billion output may realise a "saving" of 26 per cent compared to no economies or diseconomies of scale, by growing to output DR 200 billion. Similarly, to achieve another 26 per cent lower costs, the bank's output must grow to DR 400 billion and another 26 per cent cost saving requires a bank of output DR 800 billion. Since doubling the output (i.e. the total drachma volume of deposits and loans) for a large bank is more difficult than for a small one, it is apparent that scale economies become less important with the size[71]. Chart VI.1 reveals the aforementioned relationship between cost and output.

Not surprisingly, our findings appear to be supported by those emerged from Kouzelis's (1986) study. Recall that he finds coefficients of scale economies varying in the range 0.28-1.01 per branch[72] in the network of the largest Greek bank in 1983. These significant signs of existence of scale economies at a broad range of branches do not become obsolete even if we inflate the above coefficients by the economies of scope (21.65 per cent) that Kouzelis finds, as he actually does. In this case the coefficients that exceed unity are only 5 out of the 27 reported ones and correspond only to 6 large branches out of the 362

CHART VI.1

Relationship Between Cost and Output Based Upon an Overall Elasticity of 0.74



outlets of the sample. Furthermore, the 4 out of the 5 coefficients are found to have values very close to one. In fact, they vary in the range 1.02-1.06, while the "outlier" takes the value of 1.23. Thus, these coefficients do not seem to point to diseconomies of scale but rather to constant costs. Consequently, it sounds not unreasonable to claim that "...the coexistence of economies of scope and economies of scale at a broad range of branches indicates the formation of some kind of "natural monopoly" particularly in the minor urban areas"[73] of Greece. As a result and to the extent that Greek commercial banks have only a few large branches such as those that are associated with coefficients of scale economies over unity in Kouzelis work[74], it appears that one potential success formula for financial institutions in Greece should be the expansion of their size.

At this point one may wonder if the ability of Greek banks to exploit economies of scale might be restricted by the regulatory structure we detail in chapter one. The answer is negative. It is apparent of course that mergers and take overs among the Greek banks can be prohibited by the monetary authorities. However, there is no regulation to restrict the expansion of the financial firms as far as deposits and credit are concerned. This kind of enlargment is in the discretion of the firms' management. The decisions of the banks' directors can be influenced indirectly by the authorities, but not as much as to obstruct the increase of their firms' clientele.

The estimated elasticities and consequently the conclusions we have reached at so far, should not be accepted without any reservations. First, bank output measurement accounts only for the volume of bank deposits and loans, without considerations about their quality and their turnover. Second, although technological progress has been disembodied from the estimated scale economies by the employment of year dummy variables, only one of them (1984) is statistically significant. This fact suggests that technical change have had little impact on banks' costs over the ten-years period. However, technological progress (e.g. computers) may have taken the form of providing new opportunities to banks for enjoying scale economies. This argument may receive some support from the finding that economies of scale have increased with the lapse of time. Third, the cost of risk has not been taken into account. Finally, Greek commercial banks do not employ a uniform accounting plan and though we care for such bank differences in our model by the use of a dummy variable per firm, some "ambiguity" may remain. Thus, we sum up by concluding that this study offers suggestive evidence that Greek commercial banking have experienced economies of scale from 1978 to 1986.

Notes

1. For a detailed discussion about the questions that a study of economies of scale in finance industry seeks to answer, see Benston (1972), pp.314-316.
2. It has been argued that the structure of the firms are not determined only by the technology of production, but it also depend upon the transactions costs and vertical integration. However, we put aside the work on transactions costs for the purpose of our study, for the following reasons. "First, transaction cost theory and models are still very primitive. Only gross predictions are usually available. Secondly, severe measurement problems are posed" [Schmalensee and Willig (1989), ch.3, p.174]. And finally, "..predictions from this framework are difficult to test because it is not clear, for instance, how asset specificity can be routinely quantified" [Schmalensee (1988), p.656]. As far as the theory of vertical integration is concerned, "very little empirical work has been devoted to integration to market

imperfections,...(and) generally ambiguous welfare analyses make it hard to make strong policy prescriptions" [Schmalensee (1988), p.657]. Therefore, it does not appear irrational to decline the incorporation of this work in our analysis. Thus, it seems more reasonable to follow the conventional approach in our case.

3. For more information about economies of scope see Panzar and Willig (1981), Baumol, Panzar and Willig (1982), pp.71-79, Schmalensee and Willig (1989), ch.1, and the relevant section [V.V (E3)] of chapter five.

4. Baumol, Panzar and Willig (1982) refer to a source arising from the existence of public inputs. They define these inputs such as "once they are acquired for use in producing one good, they are available costlessly for use in the production of others". [Baumol et al (1982), p.76]. Given this definition of public inputs, information may serve as an example of that source. But, if we define public inputs such as "once purchased, they can be used in each period without reducing their availability in subsequent periods" [Panzar (1976) p.522], information may not fall in this category as it is going to deteriorate with the lapse of time. It is worth noting, however, that the adoption of the second public inputs definition may imply the existence of economies of scope even in the case of one-product firms. Moreover, all financial institutions are using similar in a sense, if not exactly the same, inputs. Therefore, the inputs utilized by specialized institutions may be as sharable as those employed by commercial banks. Once these inputs are used for the production of one output in a time period, they may also be

available for the production of the same output in subsequent periods (e.g. information, computers etc). However, this is a slightly different definition from the one mentioned above about sharable inputs. To the extent that these claims are true, specialized institutions may as well enjoy scope economies as full-service commercial banks. Consequently, all financial institutions may be placed on an equal footing as far as cost efficiency is concerned.

5. See Mester (1987), pp 22-25, and Clark (1988), pp.19-22. Moreover, Berger et al (1987) claim that "the detection and measurement of scope economies in this literature has often been incomplete, potentially inappropriate , or subject to unkown extrapolation error"[p.502].

6. In this section we adopt the conventional approach to outline the forces determining internal economies of scale in banking. For an alternative approach exploring the possible existence of economies of size (i.e. a broader concept than economies of scale), based upon a functional study of five different activities provided by financial institutions, see Davis and Lewis (1981).

7. In the short-run at least one factor - usually capital - is kept constant and therefore increases in output are described by the law of diminishing returns of the variable factor(s) - usually labour.

8. Geometrically, returns to scale are a feature of the isoquant map.

9. The LRAC curve was first discussed by Viner (1931) and reveals the lowest possible cost of producing at any scale of output after all possible adjustment to that scale has

occured. It is also the "envelope" of the short-run average cost (SRAC) curves; the latter indicating the relationship between average costs of production and the extent to which output is produced.

10. See for example Blaug (1978), pp.481-482, and Shone (1981), pp.156-157.
11. For more information about external economies see Blaug (1978), pp.400-404 and pp.406-407.
12. It is worth noting that although the forces making for economies of scale are listed below separately, they are interrelated.
13. Returns to scale are included in this category.
14. Both indivisible (such as capital equipment) and divisible (such as labour) factors of production give rise to nonproportionalities. This source of economies, where physical inputs grow less than proportional to the size of the financial firm, is called [by Lewis and Davis (1986), p.201] "real resource" savings.
15. See Blaug (1978), p.480.
16. Lewis and Davis [(1986), p.202] prefer to classify these economies as pecuniary economies.
17. For a detailed discussion on these economies see Baltensperger (1972), and Lewis and Davis (1986) pp.73-79.
18. In the extreme opposite case when one account goes up or down and all other accounts increase or decrease by the same amount, an increase in bank size would not reduce the risk.
19. This expectation is unrealistic only during financial panics or run on the banks.
20. For more discussion about this argument see Scherer (1980),

pp.106-107 and his references.

21. See Marshall (1920), fn. to page 459.

22. For a discussion on Marshall's dilemma and people who work on it, see Shackle (1967), p.11 et seq., and Robinson (1971), pp.58-63 and pp.97-108.

23. For a more detailed discussion of managerial diseconomies see Koytsoyiannis (1979), pp.134-135, Hay and Morris (1979), pp.63-66, Scherer (1980), pp.85-88, and their references. For a short but articulating discussion about whether management should enter the production function as an input and in what way, see Shone (1981), pp.156-157.

24. For more information about learning effects see Hay and Morris (1979), pp.49-50, and Shone (1981), pp.168-171.

25. For more information see Hay and Morris (1979), pp.447-448, Scherer (1980), pp.413-416 and their references.

26. Two other approaches can be found in the relevant literature, though currently they do not look very popular. One is based on questionnaires and its main reference is Eiteman and Guthrie (1952), as well as comments in various issues of AER (1953). The other is based on the econometric estimation of production functions and its main reference is Walters (1963).

27. The main references to this approach are Chenery (1949), Bain (1956), and Pratten (1971). For a recent survey of this area see Wibe (1984).

28. For more information about the shortcomings of this method see Hay and Morris (1979), pp.78-81, and Sawyer (1985), pp.57-61.

29. For comprehensive surveys on the field of statistical cost

functions see Johnston (1960), and Walters (1963).

30. For extented discussion on these criticisms see Johnston (1960), pp.169-194, Walters (1963), pp.1-66, Hay and Morris (1979), pp. 71-77, Koutsoyiannis (1979), pp.139-142 and their references.

31. See Friedman (1955), pp.236-237.

32. See Stigler (1955), pp.143-144.

33. For a more detailed discussion see any of the several studies that survey the literature. These papers, according to their chronological appearance, are: Benston (1972), Benston et al (1982a), Gilbert (1984), Kouzelis (1986), Mester (1987), and Lewis and Davis (1987).

34. The only study that is not using a cost fuction is Mullineaux (1978). Instead, Mullineaux uses a translog profit function having prices of various bank outputs, prices of inputs and quantities of fixed factors of production as dependent variables. However, Gilber (1984) [fn.16, p.637] questions his results because they depend, as he claims, on a rejected hypothesis.

35. Other authors employ other classifications. For example, Benston et al (1982a) group the studies according to the type of data used. Gilbert classifies the studies according to the changes of bank output measurements and the forms of the cost functions. Recently, Humphrey (1985) proposes a distinction according to the approach that the papers employ in defining bank output. He goes on identifying two different approaches: the "production" approach and the "intermediation" approach. In the former, bank output definition is viewed as the number of deposit and loan

accounts "produced", while in the latter it is viewed as the money value of total assets (or total deposits, loans, deposits plus loans, or any other money value of the same nature) "intermediated" [pp 753-756]. However, the problem with such classification is that some studies do not strictly fall in either of these approaches, but rather in between.

36. This output measure is similar to that developed by Greenbaum (1967), and Schweitzer (1972).

37. Schwitzer do not use FCA data. He estimates a logarithmic cost function relating total operating cost to output, measured by revenue from loans and investments. Longbrake and Haslem (1975) measure bank output as the product of number of accounts per office, average account size and number of offices.

38. This paper is based heavily upon a doctoral thesis submitted at the National University of Athens. For more information see Kouzelis (1986).

39. The remark that follows is rather lengthy because the paper is dealing with the Greek case.

40. See Humphrey (1985), p.765.

41. A production function is assumed to be homogeneous if a proportionate increase in all inputs, results in a proportionate increase in output(s). Algebraically, a function $F(x)$ is said to be homogeneous of degree r in x if $F(\lambda x)=\lambda^r F(x)$ for all $\lambda>0$, and linearly homogeneous if $r=1$.

42. An efficient transformation function of a vector of inputs into a vector of output(s) is characterized as a separable one, if the two vectors are independent. Thus, the existence of a production function possessing separability implies that

it can be expressed with inputs on the RHS and output(s) on the LHS.

43. Brown, Caves and Christensen (1979), pp.269-270, who also present an empirical demonstration of this problem.

44. For an excellent description of the duality theory see McFadden (1978).

45. In the sense that it is linearly homogeneous in prices for producible output bundles and strictly positive input prices, it is strictly monotonically increasing in outputs, it is concave in input prices, it is differentiable with respect to input prices and output quantities, and it is monotone nondecreasing in input prices.

46. The translog function has been devised by Christensen, Jorgenson and Lau (1973).

47. The word flexible usually describes the functional forms that a priori do not constrain the relevant elasticities of substitution.

48. See Guilkey, Lovell and Sickles (1983). Moreover, Berndt, Darrough and Diewert (1977) found the translog model to be preferred than the other two forms on Bayesian grounds a posteriori.

49. The following form is slightly different from a pure translog function, because it does not include factor prices (usually for labour and capital). The reasons for this exclusion are based partly on the non-availability of data (i.e. the price of capital of Greek banks can be found only at historical accounting values) and partly on improving estimation efficiency.

50. However, Benston et al [(1982b), p.437, fn.5] state that

there is very little empirical impact on the results of economies of scale, if the concavity condition on the cost function is not met.

51. Benston et al (1982a), p.10. They also go on comparing this case with that "of a wholesaler selling by the case and a retailer selling by the item" [p.11].

52. Benston et al [(1982b), pp.446-447] report that using three different measures of bank output (i.e. the sum of the number of accounts, the total dollars of deposits and loans and a Divisia index), they obtain the same basic results.

53. See Humphrey (1985), pp.771-772.

54. For a detailed discussion about the characteristics of the Greek Financial System during the period examined see the first chapter.

55. Greek banks report only a consolidated account of gross income, the main part of which is interest and commission earned net of debit interest and charges.

56. Benston et al (1982a), p.10. For more details on measuring operating costs see Benston (1972), pp.318-319, and Benston et al (1982a), pp.8-10.

57. For an alternative employment of operating costs definition, and the subsequent findings, see the appendix.

58. These are not income taxes. The main part of this account consists of payments due to the Special Tax of Banking Business (STBB). For more information about the STBB see the relevant section in the first chapter.

59. We should bear in mind that the data used for this study are undeflated. Consequently, the findings are based upon the supposition that inflation has had - on the average - the

same impact on banks' output and costs measurements over the ten year period. The employment of this supposition was necessary because deflated data produced results which were not realistic.

60. See analogous treatment in the previous chapters.

61. We make this assumption for two reasons. First, because we do not expect to have more than a year errors dependence (i.e. a second or higher-order autocorrelation scheme), as we employ annual data for the purpose of our study. And second, because the loss of degrees of freedom associated with the use of a higher than a first-order autocorrelation pattern would decrease the reliability of our estimates.

62. We make use of this technique because of the possible inaccuracy of the Breusch-Pagan test in small samples. For more information see fn.38 in the fourth chapter.

63. See fn.72, and fn.37 of the third and the fourth chapter respectively.

64. See Judge et al (1985), pp.550-551.

65. See Judge et al (1985), p.527 and p.537, and Dielman (1983), p.117.

66. For more information about multicollinearity see fn.60 in the third chapter and the stated references.

67. The reason was mentioned in fn.60 in the third chapter.

68. See Pindyck and Rubinfeld (1976), p.206, fn.28.

69. A Greek ex-banker [see Doukaris (1980), p.40] estimated in 1980 that on the basis of income, population and other factors, Greece required at least 250 new bank offices to match with the European standards. See also fn.58 in the first chapter.

70. The same inference, that is, Greek commercial banking experienced scale economies during 1977-1986, is also found in Vasiliou (1988), where the estimated elasticity of costs with respect to output (n_1) appears 0.59 (or 0.70 if an approximation of interest expenses are included in total costs).

71. This argument is not valid in the case of bank merging. Large banks can easily double their output by merging and consequently reap scale economies.

72. It is worth noting that the *only* coefficient that exceeds unity corresponds to one branch which is also extremely large utilizing at least 751 employees.

73. Pavlopoulos and Kouzelis (1989), p.282.

74. We should remind that Kouzelis (1986) examines the largest Greek bank (i.e. the National Bank of Greece).

Appendix to the Sixth Chapter

It has been argued that the main drawbacks in employing accounting data for cost study purposes, are associated with the measurement of capital cost[1]. Therefore, in this section we duplicate our study omitting from the measurement of total operating cost the depreciation figures appearing in the income statements of the Greek banks. We should bear in mind, however, that to the extent that large banks are more capital intensive than their smaller rivals, the omission of capital costs from operating costs may overestimate the possible scale economies. We also exclude from our cost definition the account labelled "contribution paid to special account with the Bank of Greece under the Law 128/75". This omission is based on the discontinuity of published information about this account[2]. Thus, our total operating costs consist of the summation of total salaries, contributions paid to staff welfare funds, general expenses and third party remunerations, taxes[3], loan loss provisions and other provisions.

Table VI.6 shows the regression results of the LSDV model employing the new cost definition. Table VI.7 illustrates the annual elasticities per bank, computed from the new translog cost function estimated parameters.

Comparing the tables VI.3 and VI.7 we can conclude that the findings in both cases are more or less the same. Scale economies are present and are increasing throughout the whole time period. However, the figures in the latter table (i.e. table VI.7) are greater in magnitude than those presented in the former table

TABLE VI.6

Translog Cost Function Parameter Estimates

Variables	Estimated Coefficients	t-Statistics
Constant	-56.91819000	-2.6308120*
lnQ	6.47436800	3.0646350**
$(\ln q)^2/2$	-0.27897440	-2.6511830*
lnB	-6.58881700	-2.3736090*
$(\ln B)^2/2$	-0.46562400	-1.6304170
lnBlnQ	0.33503870	2.2614410*
D1	0.18234650	0.2562419
D2	0.22132200	2.4522890*
D3	0.60078330	0.6527783
D4	0.35627740	0.7552983
D5	0.64840230	0.5254895
D6	0.21635820	2.2691770*
D7	0.42455520	0.6883869
T2	-0.13809670	-1.0122670
T3	-0.20373070	-1.2828310
T4	-0.16275460	-1.2302250
T5	-0.04713105	-0.5587102
T6	-0.03908298	-0.8932342
T8	0.13430880	2.6309970*
T9	0.15646680	1.6499370
T10	0.19350420	1.4497260

S.E.R. = 0.0876464
R^2 = 0.995962

$\bar{R}^2$ = 0.994378
F-Statistic = 628.900

Notes:
1. Starred *(**) terms indicate parameters statistically different from zero at the 0.05(0.01) confidence level in a two-tailed t test.
2. The t-Statistics shown are heteroscedastic-consistent estimates.

(i.e. table VI.3). This finding implies that the economies of scale estimated from the model employing the limited cost definition are not as great as those provided from the model utilizing the overall cost definition. As far as the augmented scale economy estimates are concerned, the divergence mentioned

TABLE VI.7

Annual Cost Elasticities per Bank

Elasticity $n_1 = (\partial \ln TC/\partial \ln Q)$

Years	Banks							
	AT	PI	TR	GE	CR	IO	CO	NA
1977	1.08153	1.02883	1.04260	1.12192	1.08367	1.19890	1.12676	0.95650
1978	0.99884	0.99099	1.07925	1.06603	1.01528	1.11886	1.06524	0.91464
1979	0.95440	0.96167	1.02127	1.02051	0.95940	1.04912	1.01716	0.87184
1980	0.94679	0.96185	0.95098	0.97234	0.89699	1.00051	0.96535	0.82529
1981	0.89414	0.95203	0.87062	0.93904	0.83355	0.94523	0.90291	0.75941
1982	0.81693	0.92569	0.80017	0.91129	0.78046	0.87802	0.84567	0.69095
1983	0.73232	0.88283	0.77555	0.88113	0.73338	0.82589	0.79992	0.63598
1984	0.73392	0.84843	0.73249	0.83998	0.67505	0.78010	0.74572	0.57615
1985	0.72913	0.79311	0.65142	0.77463	0.61475	0.72836	0.67923	0.51654
1986	0.68707	0.73035	0.59138	0.72618	0.55978	0.67970	0.62743	0.46986

Elasticity $n_2 = (\partial \ln TC/\partial \ln B)$

	AT	PI	TR	GE	CR	IO	CO	NA
1977	-0.21401	-0.15674	-0.16059	-0.38650	-0.37376	-0.54571	-0.49231	-0.32481
1978	-0.11470	-0.11681	-0.23255	-0.32285	-0.29267	-0.44959	-0.41897	-0.27752
1979	-0.06735	-0.08666	-0.17137	-0.27066	-0.22710	-0.36644	-0.36231	-0.22814
1980	-0.06372	-0.10000	-0.08695	-0.21519	-0.15264	-0.30928	-0.30150	-0.17355
1981	-0.00049	-0.10233	0.00956	-0.18394	-0.07795	-0.24409	-0.22823	-0.09562
1982	0.09223	-0.07672	0.09033	-0.15949	-0.01707	-0.16454	-0.16167	-0.01483
1983	0.19384	-0.02525	0.10962	-0.12891	0.03809	-0.10365	-0.10866	0.04978
1984	0.17781	0.01606	0.15249	-0.08317	0.10589	-0.05033	-0.04452	0.12077
1985	0.16861	0.08250	0.24716	-0.00468	0.17487	0.01071	0.03471	0.19117
1986	0.21588	0.15787	0.31669	0.05351	0.23802	0.06755	0.09661	0.24623

Elasticity $n^* = n_1 + n_2(d\ln B/\ln Q)$

	AT	PI	TR	GE	CR	IO	CO	NA
1977	NA	NA	NA	NA	NA	NA	NA	NA
1978	0.99884	0.95187	0.81595	1.00639	0.99921	1.11886	1.05121	0.85612
1979	0.93301	0.92927	0.96627	0.97425	0.93775	1.03711	0.98780	0.83690
1980	0.90566	0.88013	0.95098	0.93836	0.89234	0.97298	0.93658	0.80813
1981	0.89414	0.87980	0.87062	0.85649	0.82718	0.92641	0.88135	0.75326
1982	0.81693	0.89266	0.81485	0.83314	0.77760	0.86780	0.82545	0.68986
1983	0.73232	0.88283	0.83458	0.83102	0.73731	0.81427	0.78470	0.64044
1984	0.88217	0.84843	0.79266	0.81948	0.68844	0.77387	0.74288	0.58253
1985	0.85712	0.79311	0.67781	0.77463	0.64484	0.72917	0.68044	0.53014
1986	0.73509	0.73035	0.63500	0.72618	0.59837	0.68732	0.62968	0.48903

Note:
The augmented scale economy estimates (n^*) for the year 1977 cannot be estimated, as the weights ($d\ln B/d\ln Q$) have been computed directly from the data.

above is not considerable (e.g. 1 to 12 basis points), although it increases over time.

To sum up, the conclusions reported previously in the chapter remain the same regardless of the use of the limited operating cost definition.

Notes on the Appendix

1. See for example Walters (1963), pp.42-43 and p.46, as well as the relevant section of this chapter.
2. Sometimes this account is presented separately in the Greek banks' income statements and other times it is included in the account appeared under the heading "gross profit from usual banking business". Nevertheless, the magnitude of the contribution paid under the law 128/75 is relatively trivial.
3. See fn.58 of this chapter.

CHAPTER SEVEN

Summary and Conclusions

This study was undertaken to identify the factors that accounted for Greek commercial bank profitability. The main data consisted of the 1977-1986 Income Statements and Balance Sheets for a sample of eight Greek commercial banks.

In the first chapter we described and analysed the financial system of Greece. In the second chapter we looked at the profitability path of the sample banks during the period studied and subsequently we ranked the firms according to their ROA. The relationship between Greek bank earnings performance and their balance sheet structure was investigated in chapter three. Chapter four examined the link between interbank profitability and various financial ratios. Chapter five analysed the market concentration in Greek commercial banking and its influence on earnings. Finally, chapter six was concerned with the economies of scale.

To the extent that the economic conditions as well as the banking system in concern has not been changed dramatically since the observed period, the conclusions that emerge from the studies contained in the preceding chapters may serve as guides to action for improved bank earnings. Bearing in mind that both the strengths and the weaknesses of these findings are based upon the advantages and the drawbacks of the studies which stand behind them, the synthesis of these inferences might take the following succinct form.

At first, the findings of the second chapter point out that from 1977 to 1980 the profits of the Greek banking industry, as far as our sample is concerned, were moving up and down without following a steady trend. However, the earnings of these firms went through a sharp decrease from 1980 to 1983 and a considerable increase afterwards.

The conclusion that springs immediately to surface is that the high-performance financial firm is the one that is looking after the liability side of its balance sheet very carefully. In the third chapter we found that this kind of institution might experienced lower rates of cost on its liabilities than its less profitable opponents. Actually, the evidence denote that successful banks observe lower net rates of cost on savings and time deposits, than laggardly firms. The same finding also emerge even when the rate of cost on liabilities incorporates the operating costs associated with servicing each particular liability. In addition, the most profitable group seems able to experience an annual rate of cost on sight deposits lower than the least profitable one.

The above argument is also reinforced with the findings of chapter four where among the robust conclusions are that a high-earning bank appears to have relatively less total deposits and finance its credit with relatively less time deposits (which are more costly than the savings deposits) than its low-earnings rivals. In fact, total deposits as a percentage of total liabilities is found 7.4 per cent lower at the first class than at the second class. Moreover, total loans as a percentage of time deposits is found 0.557 percentage points higher at the former group than at the latter one.

Highly geared strategies should have been avoided - as far as the cost of money was determined exogenously and sometimes was exceeding the interest from credit during the period examined - and a higher capital cushion should have been preferred[1]. The findings of the fourth chapter suggest that high-performance banks are less highly geared and therefore are expossed into less financial risk than the low-performance firms. Equity capital as a percentage of total liabilities is found 0.012 percentage points higher at the former group than at the latter. Furthermore, the depositors of the upper category firms are more capital protected than those of the lower category firms. Equity capital as a percentage of total deposits is found 0.019 percentage points higher at the former than at the latter.

The asset side of the balance sheet was not found to be as important as the liability side in achieving high bank profitability in Greece during the period studied. In chapter four we found that only the relative volume of deposits with the Bank of Greece which earned lower interest than their cost mattered and consequently should have been minimized as much as possible. Moreover, the findings of the third chapter indicate that high-income financial firms appear to experience lower net rates of return on cash and due from banks, sundry asset accounts, and total securities than their low-income rivals. No significant differences emerge elsewhere, as far as the observed asset categories are concerned. The same result also comes out even when the rates of return include directly associated expenses. In addition, the more profitable group seems to face with higher marginal rates of return (including though directly associated expenses) on discounts, buildings and other fixed assets, as well as unclassified and miscellaneous assets, than the less profitable group. Finally, the least successful banks were found to confront with net expenses unrelated to their balance sheet items which exceeding their respective earnings.

As far as the expense control is concerned, no evidence were found to justify its importance in inreasing bank earnings. In the third chapter, high-performance firms appear in general to experience higher operating rates of cost in servicing their assets, while they may have enjoyed lower operating rates of cost in servicing their liabilities than the low-performance firms. However, the evidence regarding the latter case seem rather weak. Nevertheless, the analysis of the fourth chapter implies that the most profitable bank class have a higher staff related cost per employee than the least profitable class. In the same chapter we also found no indication that the upper group outperform the lower one in controling operating expenses.

A bank with the aim to be more profitable should also utilize its employees more effectively than its rivals. While this finding sounds hardly a revelation, it appears that the above firm should apply more productive techniques and possibly offer some incentives to the average bank employee to help more the financial institution in generating net income. This was apparent from the evidence of the fourth chapter where the net income before taxes per employee was found 23.9 times more at the high-performance financial firms than at the low-performance firms. On the other hand, staff salaries and contributions to staff welfare funds per employee was found 0.9 times more at the former group than at the latter.

Chapter five furnish us with ample evidence that the Greek commercial banking industry during 1977-1986 was characterized by a high degree of concentration and a small number of firms (i.e. an oligopolistic market). The two leading firms accounted for 77 per cent of the market for most of the observed period, while the four largest institutions for 90 per cent. The number of firms of equal size that would give the same value of the two-firm concentration ratio (or the H-index) ranged from 2.49 (2.15) to 2.63 (2.28). As far as the concentration path is concerned, the level of bank concentration decreased modestly over the span 1977-1980 without practised any considerable variations afterwards. Moreover, the first three years of the period examined comes out as the only interval during which the largest institution in Greece lost almost 3 per cent of its market share (regarding the sum of total deposits and loans), while the rest of the sample firms have experienced no remarkable changes over the whole time studied.

The findings of the fifth chapter also reveal that while the concentration ratio appears to have a positive but quite small influence on banks' earnings, the H-index does not. This outcome obliges us to admit that the evidence regarding the concentration-profitability relationship for the Greek commercial banking industry during the period examined turn out to be ambiguous. In addition, the indication provided by the same chapter seems to oppose the efficiency hypothesis claimed by Demsetz. These results may denote that in a deregulated banking environment, as it might be the Greek case in the near future, a highly concentrated market does not necessarily leads to monopoly profits for the participant firms. Put differently, in a deregulated banking industry the market structure does not show up to play the crucial role it has been hypothesized.

Despite some qualifications that are hedged around the estimates, the evidence of the sixth chapter support the hypothesis that large size commercial banks might be able to reap economies of scale in Greece. In fact, the findings suggest that almost all the banks investigated have enjoyed economies of scale thoughout almost the whole time period examined (and especially since 1980). A potential overall (i.e. across all banks and over all years studied) elasticity of cost with respect to output and the number of branches (i.e. an augmented scale economy measure n*) was estimated at 0.74. In the same chapter all scale economies appear to increase over time. Moreover, large size financial institutions have experienced greater scale economies than any other size group for all the years encountered, but 1978. Consequently, large size banks seem to be more cost efficient than small and medium size firms. Finally, before 1982 medium size banks were found to face less economies of scale than small size banks and more economies afterwards. It is worth noting, however, that evidence about the possible existence of scale economies in Greek commercial banking were also found in chapter four. An increase of total assets by 1 per cent seems to decrease the utilized expense ratios[2] by 0.3 basis points. This indication provides some support to the claim that larger financial institutions have relatively less operating expenses than their smaller competitors. To the extent that the above findings regarding economies of scale are true, enlargments, mergers and take overs among Greek banks should be encouraged, while break ups of the existing institutions should be avoided at all cost. This course of action is not necessary only for improving the earnings of the firms, but also for facing successfully the keen competition from the banks of the Greece's counterparts in the European Community from the end of 1992 when a single market will start operating. And we should bear in mind, as Pratten (1988) points out, that the completion of the Common Market which will take place at the above date, may urge the finance industry to exploit economies of scale[3]. However, the above argument should not make us overlook the possible risk of monopolistic exploitation of domestic (i.e. within Greece) customers that a high concentrated banking industry may impose.

As far as the large financial institutions are concerned another interesting finding emerge from the fourth chapter. The analysis of this study suggest that large banks exhibit less loan aggresiveness, having a lower total loans to total assets ratio than their smaller opponents. Moreover, large size firms were found to grant relatively less short-run loans as well as relatively more long-run loans than their smaller rivals[4]. Actually, most of the interbank variation as far as the loan structure variables is concerned appear to be explained by the bank size variable.

From the foregoing it follows that the fruits of improved profitability are within reach of almost all the Greek commmercial banks. However, we should not forget that many times the key to business success rests in the bankers' ability to innovate. To the extent that the successful manager is characterized by his own flair or life style, our data are unable to capture these factors and their importance on the problem in concern. These remarks are not lie down to dissapoint us. Instead, they provide us with a useful perspective within which to interpret our conclusions and understand their limitations.

Notes

1. It is worth noting that by the end of 1992, when the completion of the EEC will have taken place, the capital formation of the Greek banks ought to strengthen. This is due to the solvency ratio directive [COM(86)194 (proposal)], which goes in tandem with the own fund directive [COM(86)169 (proposal), COM(88)15 (amendment)] as well as the second banking directive [COM(87)715 (proposal)], whose propositions seem exceptionally severe for the Greek financial institutions.
2. We should bear in mind that the two employed expense ratios are: (a) Staff salaries + contributions to staff welfare funds + general expenses and third party remunerations / total assets; and (b) Staff salaries + contributions to staff welfare funds / number of employees (10^7).
3. The main sources of scale economies which might be reaped by the banking industry through the creation of the single market are:

   "1. There are technical economies for large data and information processing systems. There may be some scope for spreading the costs of developing and using these systems.

   2. There is scope for spreading costs of acquiring expertise and knowledge over increased throughputs.

   3. Completion of the EC will increase the size of some

transactions and deals. Some costs of providing services are specific and fixed or semi-fixed relative to the size of transactions.

An advantage of larger organizations providing these services will be that they are able to cope with larger transactions and deals" [Pratten (1988), p.143].

4. This conclusion was pointed to by the significantly positive and significantly negative estimated coefficient of the reciprocal of total assets variable as far as "Discounts + loans and advances up to one year / total loans" and "Loans and advances over one year / total loans" dependent variables respectively.

REFERENCES

1. Alhadeff, D. A., (1954), Monopoly and Competition in Banking, University of California Press, Berkeley.

2. Alhadeff, D. A., (1968), Competition and Controls in Banking, University of California Press, Berkeley.

3. Altman I. E., R. B. Avery, R. A. Eisenbeis, and J. F. Sinkey Jr., (1981), Application of Classification Techinques in Business, Banking and Finance, Jai Press Inc., Greenwich, Connecticut.

4. Andreadis, S. G., (1966), Banking in Greece, in H. W. Auburn, (eds.), Comparative Banking, Waterlow and Sons Ltd., London, pp.72-75.

5. Bailey, E. E., and A. F. Friedlander, (1982), "Market Structure and Multiproduct Industries", Journal of Economic Literature, vol.20, pp.1024-1048.

6. Bain, J. S., (1956), Barriers to New Competition: Their Character and Consequences in Manufacturing Industries, Harvard University Press, Cambridge, Mass.

7. Baltensperger, E.,(1972), "Economies of Scale, Firm Size and Concentration in Banking", Journal of Money, Credit and Banking, Vol.4, August, pp.467-488.

8. Barnes, P., (1982), "Methodological Implications of Non-Normally Distributed Financial Ratios", Journal of Business Finance and Accounting, Spring, pp.51-62.

9. Barnes, P., (1987), "The Analysis and Use of Financial Ratios: A Review Article", Journal of Business Finance and Accounting, Winter, pp.449-461.

10. Baumol, W. J., (1982), "Contestable Markets: An Uprising in the Theory of Industry Structure", American Economic Review, vol.72, pp.1-15.

11. Baumol, W. J., E. E. Bailey, and R. D. Willig, (1977), "Weak Invisible Hand Theorems on the Sustainability of Multiproduct Natural Monopoly", American Economic Review, vol.67, June, pp.350-365.

12. Baumol, W. J., J. C. Panzar, and R. D. Willig, (1982), Contestable Markets and The Theory of Industry Structure, Harcourt Brace Jovanovich Inc., New York.

13. Bell, F. W., and N. B. Murphy, (1968) Costs in Commercial Banking: A Quantitative Analysis of Bank Behaviour and its Relation to Bank Regulation, Research Report No 41, Federal Reserve Bank of Boston, Boston.

14. Benston, G. J., (1965), "Economies of Scale and Marginal Costs in Banking Operations", National Banking Review, vol.2, June, pp.507-549.

15. Benston, G. J., (1972), "Economies of Scale of Financial Institutions", Journal of Money, Credit and Banking, vol.4, May, pp.312-341.

16. Benston, G. J., A. N. Berger, G. A. Hanweck, and D. B. Humphrey, (1983), "Economies of Scale and Scope in Banking", Research Paper in Banking and Financial Economics, Board of Governors of the Federal Reserve System, June.

17. Benston, G. J., G. A. Hanweck, and D. B. Humphrey, (1982a), "Operating Costs in Commercial Banking", Economic Review, Federal Reserve Bank of Atlanta, November, pp.6-21.

18. Benston, G. J., G. A. Hanweck, and D. B. Humphrey, (1982b), "Scale Economies in Banking: A Restructuring and

Reassessment", Journal of Money, Credit and Banking, vol.14, no.4, November, part I, pp.435-456.

19. Berger, A. N., G. A. Hanweck, and D. B. Humphrey, (1987), "Competitive Viability in Banking", Journal of Monetary Economics, vol.20, pp.501-520.

20. Berndt, E. R., M. Darrough, and W. E. Diewert, (1977), "Flexible Functional Forms and Expenditure Distribution: An Application to Canadian Consumer Demand Functions", International Economic Review, Vol.18, October, pp.651-675.

21. Bitros, G. K., (1984), Special Credit Institutions in Greece: Problems and Perspectives for their Development, in Scientific Annals, Athens School of Economics and Business Science, Athens, (in Greek).

22. Blaug M. (1978), Economic Theory in Retrospect, (3rd edn.), Cambridge University Press, Cambridge.

23. Bond, R. E., (1971), "Deposit Composition and Commercial Bank Earnings", Journal of Finance, vol.26, March, pp.39-50.

24. Breusch, T. S., and A. R. Pagan, (1979), "A Simple Test for Heteroscedasticity and Random Coefficient Variation", Econometrica, vol.47, September, pp.1287-1294.

25. Brock, W. A., (1983), "Contestable Markets and the Theory of Industry Structure: A Review Article", Journal of Political Economy, vol.91, no.6, pp.1055-1066.

26. Brock, W. A., and J. A. Scheinkman, (1983), Free Entry and the Sustainability of Natural Monopoly: Bertrand Revisited by Cournot", in D. S. Evans, (ed.), Breaking up Bell: Essays on Industrial Organization and Regulation, North-Holland, Amsterdam.

27. Brown, R. S., D. W. Caves, and L. R. Christensen, (1979),

"Modelling the Structure of Cost and Production for Multiproduct Firms", Southern Economic Journal, vol.46, July, pp. 256-273.

28. **Bryan, W. R.,** (1972), "The Determinants of Bank Profits: A Study of Medium-sized Banks", Research paper No 8, Department of Research and Planning, The American Bankers Association.

29. **Cates, D. C.,** (1986), "Are small banks still profitable?", ABA Banking Journal, September, pp.49-52.

30. **Caves, R.,** (1967), American Industry: Structure, Conduct and Performance, (2nd edn.), Prentice-Hall, Englewood Cliffs.

31. **Cawthorne, D. R.,** (1962), "Selected Factors Affecting Bank Earnings", Essays on Commercial Banking, Federal Reserve Bank of Kansas City, August, pp.1-8.

32. **Chenery, H. B.,** (1949), "Engineering Production Functions", Quarterly Journal of Economics, vol.63, November, pp.507-531.

33. **Christensen, L. R., D. W. Jorgenson, and L. T.** Lau, (1973) "Transcendental Logarithmic Production Frontiers", Review of Economics and Statistics, vol.55, no.1, pp.28-45.

34. **Clark, J. A.,** (1988), "Economies of Scale and Scope at Depository Financial Institutions: A Review of the Literature", Economic Review, Federal Reserve Bank of Kansas City, September/October, vol.73, No.8, pp.16-33.

35. Clarke R., S. Davies, and M. **Waterson,** (1984), "The Profitability-Concentration Relation: Market Power or Efficiency?", The Journal of Industrial Economics, vol.32, June, pp.435-450.

36. **Cochrane, D. and G. H.** Orcutt, (1949), "Application of Least Squares Regressions to Relationships Containing Autocorrelated Error Terms", Journal of the American

Statistical Association, vol.44, pp.32-61.

37. Courakis, A. S., (1981a), Banking Policy and Commercial Bank Behaviour in Greece, in A. Verheirstraeten (eds.), Competition and Regulation in Financial Markets, Macmillan, London.

38. Courakis, A. S., (1981b), Financial Structure and Policy in Greece: Retrospect and Prospect, The Greek Economic Review, vol.3, December, pp.205-244.

39. Cowling, K., and M. Waterson, (1976), "Price-Cost Margins and Market Structure", Economica, vol.43, pp.267-274.

40. Crockett, J., and A. T. King, (1982), "The Contribution of New Asset Powers to S&L Earnings: A Comparison of Federal-and State-Chartered Associations in Texas", Research Working Paper 110, Federal Home Loan Bank Board, Office of Policy and Economic Research, Washington DC.

41. Curry, B., and K. George, (1983), "Industrial Concentration: A Survey", Journal of Industrial Economics, vol.31, pp.203-255.

42. Davis, K. T., and M. K. Lewis, (1982), "Economies of Scale in Financial Institutions", Australian Financial System Inquiry, Commissioned Studies and Selected Papers, Part I, Austalian Government Publishing Service, Canberra.

43. Davies, S., B. Lyons, H. Dixon, and P. Geroski, (1988), Economics of Industrial Organisation, Longman, New York.

44. Demopoulos, G. D., (1983), Financial Markets and Institutions in Greece, European Economy, No.15, March, pp.146-155.

45. Demopoulos, G. D., (1984), An Analytic Formulation and Evaluation of the Existing Structure of Legal Reserve Requirements of the Greek Economy: An Uncommon Case, Economic

Papers, No.33, June, pp.1-19.

46. Demsetz, H., (1973), "Industry Structure, Market Rivalry, and Public Policy", Journal of Law and Economics, vol.16, April, pp.1-10.

47. Demsetz, H., (1974), Two Systems of Belief About Monopoly, in H. J. Goldsmith, H. M. Mann and J. F. Weston (eds), Industrial Concentration: The New Learning, Little Brown, pp.175-181.

48. Dertilis, G., (1982), The Subject of Banks, The Educational Institution of the National Bank of Greece, Athens, (in Greek).

49. Dielman, T. E., (1983), "Pooled Cross-Sectional and Time Series Data: A Survey of Current Statistical Methodology", The American Statistician, May, vol.37, No.2, pp.111-122.

50. Dixit, A. K., (1982), "Recent Developments in the Oligopoly Theory", American Economic Review, Papers and Proceedings, vol.72, pp.12-17.

51. Doukaris, P., (1980), "Interview Note", in Oikonomikos Tachydromos, no.50 (1388), 11 December, Athens, pp.38-40, (in Greek).

52. Durham, C., (1981), "Commercial Bank Costs and Corespondent Banking", New England Economic Review, Federal Reserve Bank of Boston, September/October, pp.22-36.

53. Edgeworth, F. Y., (1888), "The Mathematical Theory of Banking", Journal of the Royal Statistical Society, vol.51, March, pp.113-127.

54. Eisenbeis, R. A., (1977), "Pitfalls in the Application of Discriminant Analysis in Business, Finance, and Economics, The Journal of Finance, vol.32, No.3, June, pp.875-900.

55. Eiteman, W. J., and G. E. Guthrie, (1952), "The Shape of the Average Cost Curve", American Economic Review, vol.42, No.5, Dec., pp.832-838.

56. Federal Reserve Bank of New York, (1986), "Recent Trends in Commercial Bank Profitability: A Staff Study", New York.

57. Federal Reserve Bulletin, (1965), "Measures of Banking Structure and Competition", September, pp.1212-1222.

58. Ferguson, P. R., (1988), Industrial Economics: Issues and Perspectives, Macmillan, London.

59. Flannery, M. J., (1983), "Correspondent Services and Cost Economies in Commercial Banking", Journal of Banking and Finance, Vol.7, March, pp.83-99.

60. Ford, W. F., (1974), "Profitability: Why Do Some Banks Perform Better than the Average? An In-depth Analysis", Banking, October, pp.29-33 & p.54.

61. Ford, W. F., (1978), "Using "High-Performance" Data to Plan Your Bank's Future" and "1977 "High-Performance" Bank Study", Banking 70, October, 40ff.

62. Ford, W. F., and D. A. Olson, (1976), "How to Manage High Performance Banks", Banking, August, pp.36-38 and pp.80-92.

63. Ford, W. F., and D. A. Olson, (1978), "How 1000 High-Performance Banks Weathered the Recent Recession", Banking 70, April, pp.36-48.

64. Foster, G., (1986), Financial Statement Analysis, Prentice-Hall, Englewood Cliffs, New Jersey.

65. Fraser, D. R., (1976), "The Determinants of Bank Profits: An Analysis of Extremes", Financial Review, pp.69-87.

66. Friedman, M., (1955), "Comment", on C. Smith, "A Survey of

the Empirical Evidence on Economies of Scale" in Business Concentration and Price Policy, National Bureau of Economic Research, Princeton University Press, Princeton, pp.230-238.

67. Gady, R. L., (1972), "Anatomy of Profitable Medium-size Banks in the Fourth District, 1966-1970", Economic Review, Federal Reserve Bank of Cleveland, October-November, pp.20-32.

68. Galanis, D., (1962), Prospects and Problems of the Greek Capital Market, Bank of Greece, Athens.

69. Gendreau, B. C., (1983), "The Implicit Return on Bankers' Balances", Journal of Money, Credit, and Banking, vol.15, November, pp.411-424.

70. Giannitsis, A., (1982), The Foreign Banks in Greece: The Postwar Experience, Gutenberg, Athens, (in Greek).

71. Giannopoulos, J., (1979), "Productivity and Efficiency in Banks", Trapeziki, September, issue 233, pp.239-246, (in Greek).

72. Giannopoulos, J., (1981), Comparative Study of the Greek Banking System with those of the EEC Countries, in Summary of Reports of the Committee for the Study of the Banking System, Bank of Greece, Athens, pp.223-264, (in Greek).

73. Gilbert, A. R., (1984), "Bank Market Structure and Competition: A Survey", Journal of Money, Credit, and Banking, vol.16, No.4, November, part II, pp.617-660, (it also includes comments by A. A. Heggestad, S. Peltzman, and P. J. Schmidt).

74. Gilbert, G. G., and M. O. Peterson, (no date), "Reserve Requirements, Federal Reserve Membership and Bank Performance", Working Paper 74-8, Federal Insurance Corporation, Washington DC.

75. Gilligan, T. W., and M. L. Smirlock, (1984), "An Empirical Study of Joint Production and Scale Economies in Commercial Banking", Journal of Banking and Finance, vol.8, March, pp. 67-77.

76. Gilligan, T. W., M. L. Smirlock, and W. Marshall (1984), "Scale and Scope Economies in the Multiproduct Banking Firm", Journal of Monetary Economics, vol.13, May, pp.393-405.

77. Gontikas, G., (1981), Special Credit Institutions, in Summary of Reports of the Committee for the Study of the Banking System, Bank of Greece, Athens, pp.101-130, (in Greek).

78. Gotsis, H. P., (1977), The Morphology of the Greek Monetary System, Karaberopoulos Press, Piraeus, (in Greek).

79. Graham, D. R., (1977), "Estimating the Earnings Impact of NOW Accounts", in Federal Reserve Bank of Chicago, Proceedings of a Conference on Bank Structure and Competition, pp.53-70.

80. Gramley, L. E., (1962), "A Study of Scale Economies in Banking", Federal Reserve Bank of Kansas City.

81. Greenbaum, S. I., (1967), "Banking Structure and Costs: A Statistical Study of the Cost-Output Relationship in Commercial Banking", National Banking Review, vol.4, June, pp.415-434.

82. Guilkey, D. K., C. A. K. Lovell, and R. C. Sickles, (1983), "A Comparison of the Performance of Three Flexible Functional Forms", International Economic Review, vol.24, October, pp. 591-616.

83. Gurley, H. G., and E. S. Shaw, (1960), Money in a Theory of Finance, The Brookings Institution, Washington DC.

84. Halikias, D. J., (1978), Money and Credit in a Developing Economy: The Greek Case, New York University Press, New York.

85. Hall, B. H., and R. Schnake, (1987), TSP User's Guide, Version 4.0, January, TSP International.

86. Hancock, D., (1985), "Bank Profitability, Interest Rates, and Monetary Policy", Journal of Money, Credit, and Banking, vol.17, No.2, May, pp.189-202.

87. Hannah, L., and J. Kay, (1977), Concentration in Modern Industry, Macmillan, London.

88. Hart, P. E., and R. Clarke, (1980), Concentration in British Industry, 1935-75, Cambridge University Press, Cambridge.

89. Haslem, J. A., (1968), "A Statistical Analysis of the Relative Profitability of Commercial Banks", The Journal of Finance, vol.23, March, pp.167-176.

90. Haslem, J. A., (1969), "A Statistical Estimation of Commercial Bank Profitability", The Journal of Business, vol.42, January, pp.22-35.

91. Haslem, J. A., and W. A. Longbrake, (1971a), "A Note on the Average Interest Charges on Bank Loans, the Loan Mix, and Measures of Competition", The Journal of Finance, vol.26, March, pp.159-164.

92. Haslem, J. A., and W. A. Longbrake, (1971b), "A Discriminant Analysis of Commercial Bank Profitability", Quartely Review of Economics and Business, vol.11, Autumn, pp.39-46.

93. Hay, D. A., and D. J. Morris, (1979), Industrial Economics: Theory and Evidence, Oxford University Press, Oxford.

94. Heggestad, A. A., (1979), Market Structure, Competition, and Performance in Financial Industries: A Survey of Banking Studies, in F. R. Edwards (ed), Issues in Financial Regulation, McGraw Hill, New York.

95. Hester, D. D., (1964), "Indian Banks: Their Portfolios,

Profits, and Policy", Bombay University Press, Bombay.

96. Hester, D. D., (1967), "Comment on Competition and Efficiency in the Banking System - Empirical Research and its Policy Implications", Journal of Political Economy, vol.75, Part II, August, pp.479-481.

97. Hester, D. D., (1979), "Income and Interest Rates at Weekly Reporting Banks: An Exercise in Dissequilibrium Econometrics", Working Paper 7920, Madison: University of Wisconsin, Social Systems Research Institute.

98. Hester, D. D., and J. L. Pierce, (1975), "Bank Management and Portfolio Behavior", Yale University Press, New Haven.

99. Hester, D D., and J. F. Zoellner, (1966), "The Relation Between Bank Portfolios and Earnings: An Econometric Analysis", Review of Economics and Statistics, vol.48, November, pp.372-386.

100. Hicks, J. R., (1946), Value and Capital, (2nd edn.), Clarendon Press, Oxford.

101. Higgins, R. C., (1983), Analysis for Financial Management, Dow-Jones-Irwin, Homewood, Illinois.

102. Hildreth, C., and J. Y. Lu, (1960), "Demand Relations with Autocorrelated Disturbances", Michigan State University Agricultural Experiment Station Technical Bulletin 276, East Lansing, Mich.

103. Hirschman, A. O., (1964), "The Paternity of an Index", American Economic Review, vol.54, pp.761-762.

104. Horvitz, P. M., (1963), "Economies of Scale in Banking" in P. M. Horvitz et al , eds., Private Financial Institutions, pp.1-54, Prentice-Hall Inc., Englewood Cliffs, New Jersey.

105. Humphrey, D., (1985), "Costs and Scale Economies in Bank

Intermediation", in R. Aspinwall and R. Eisenbeis, (eds.), Handbook for Banking Strategy, pp.745-783, John Wiley and Sons, New York.

106. Humphrey, D., (1990), "Why Do Estimates of Bank Scale Economies Differ?", Económic Review, Federal Reserve Bank of Richmond, Sept/Oct, vol.76/5, pp.38-50.

107. Intriligator, M. D., (1978), Econometric Models, Techniques and Applications, Prentice-Hall, Englewood Cliffs, New Jersey.

108. Johnston, J., (1960), Statistical Cost Analysis, McGraw Hill, New York.

109. Judge G. G., W. E. Griffiths, R. C. Hill, H. Lutkepohl, and T. Lee, (1985), The Theory and Practice of Econometrics, (2nd edn.), John Wiley and Sons, New York.

110. Kaldor, N., (1934), "The Equilibrium of the Firm", Economic Journal, vol.44, March, pp.60-76.

111. Kalish, L., and R. A. Gilbert, (1973), "An analysis of Efficiency of Scale and Organizational Form in Commercial Banking", Journal of Industrial Economics, vol.21, July, pp. 293-307.

112. Kmenta, J., (1986), Elements of Econometrics, (2nd edn.), Macmillan Publishing Co., New York.

113. Kohers, T., and G. W. Simpson, (1978), "The Relationship of Rates of Return and the Financial and Economic Characteristics of Commercial Banking Firms", paper presented at the Eastern Finance Association meetings, April.

114. Korliras, P. G., (1986), Competition is the key to Success, an interview in Greece's Weekly, April 14, pp.3-6.

115. Kostopoulos, Y., (1981), The Competitiveness of the Greek

Banking System in Comparison to that of other EEC Banking Systems, in Summary of Reports of the Committee for the Study of the Banking System, Bank of Greece, Athens, pp.87-99, (in Greek).

116. Kotz, D. M., (1978), Bank Control of Large Corporations in the United States, University of California Press, Berkeley.

117. Kotz, D. M., (1979), The Significance of Bank Control over Large Corporations, Journal of Economic Issues, vol.13, June, pp.407-426.

118. Koutsoyiannis, A., (1977), Theory of Econometrics, Macmillan Press Ltd, London.

119. Koutsoyiannis, A., (1979), Modern Microeconomics, (2nd edn.), MacMillan Press Ltd, Hong Kong.

120. Kouzelis, A., (1986), Economies of Scale in the National Bank of Greece, Unpublished Ph.D. Thesis, National University of Athens, Athens, (in Greek).

121. Kramer, W., (1984), "On the Consequences of Trend on Simultaneous Equation Estimation", Economics Letters, No.14, pp.23-30.

122. Kwast, M. L., (1981), "New Minority-Owned Commercial Banks: A Statistical Analysis", Journal of Bank Research, vol.12, Spring, pp.37-45.

123. Kwast, M. L., and H. Black, (1983), "An Analysis of the Behaviour of the Mature Black-Owned Commercial Banks", Journal of Economics and Business, vol.35, pp.41-54.

124. Kwast, M. L., and J. T. Rose, (1982), "Pricing, Operating Efficiency, and Profitability Among Large Commercial Banks, Journal of Banking and Finance, vol.6, June, pp.233-254.

125. Kwast, M. L., and J. T. Rose, (1983), "Profitability

Differences Among Large Commercial Banks During the 1970s", The Magazine of Bank Administration, vol.59, September, pp.54-62.

126. Lawrence, C., and R. Shay, (1986), "Technology and Financial Intermediation in a Multiproduct Banking Firm: An Econometric Study of U.S. Banks, 1979-1982", in C. Lawrence and R. Shay, (eds.), Technological Innovation, Regulation and the Monetary Economy, Ballinger, MA.

127. Lewis, M. K., and K. T. Davis, (1987), Domestic and International Banking, Philip Allan, Oxford.

128. Longbrake, W. A., (1974), "The Differential Effects of Single-Plant, Multi-Plant, and Multi-Firm Organizational Forms on Cost Efficiency in Commercial Banks", Working Paper No.74-7, Federal Deposit Insurance Corporation.

129. Longbrake, W. A., and J. A. Haslem, (1975), "Productive Efficiency in Commercial Banking: The Effects of size and Legal Form of Organization on the Cost of Producing Demand Deposit Services", Journal of Money, Credit, and Banking, vol.7, August, pp.317-330.

130. Maddala, G. S., (1977), Econometrics, McGraw-Hill, New York.

131. Maisel, S. J., and R. Jacobson, (1978), "Interest Rate Changes and Commercial Bank Revenues and Costs", Journal of Financial and Quantitative Analysis, vol.13, November, pp.687-700.

132. Manassakis, J., (1982), Investments and Credit of the Greek Industry, in The Greek Economy, vol.II, Bank of Greece, Athens, pp.164-185, (in Greek).

133. Marfels, C., (1975), "A Bird's-Eye View to Measures of Concentration", The Antitrust Bulletin, Fall, pp.485-503.

134. Marshall, A., (1920), Principles of Economics, (8th edn.), MacMillan, London.

135. McDonald, B., and M. H. Morris, (1984), "The Statistical Validity of the Ratio Method in Financial Analysis: An Empirical Examination", Journal of Business Finance and Accounting, Spring, pp.89-98.

136. McDonald, B., and M. H. Morris, (1985), "The Functional Specification of Financial Ratios: An Empirical Examination", Accounting and Business Research, Summer, pp.223-228.

137. McFadden, D., (1978), "Cost, Revenue, and Profit Functions", in M. Fuss and D. McFadden, (eds.), Production Economics: A Dual Approach to Theory and Applications, North Holland.

138. Mead, R. H., and K. A. O'Neil, (1986), "Performance of the Banks' Competitors", in Recent Trends in Commercial Bank Profitability: A Staff Study, Federal Reserve Bank of New York, pp.269-366.

139. Mester L. J., (1987), "Efficient Production of Financial Services: Scale and Scope Economies", Business Review, Federal Reserve Bank of Philadelphia, January-February, pp.15-25.

140. Meyer, J. R., and G. Kraft, (1961), "The Evaluation of Statistical Costing Techniques as Applied in the Transportation Industry", American Economic Review, vol.51, May, pp.313-334.

141. Modigliani, F., (1958), "New Developments on the Oligopoly Front", Journal of the Political Economy, vol.66, pp.215-232.

142. Monthly Statistical Bulletin, (various issues), Bank of Greece, Athens, (in Greek).

143. Mullineaux, D. J., (1975), "Economies of Scale of Financial

Institutions: A Comment", Journal of Monetary Economics, vol.1, April, pp.233-240.

144. **Mullineaux, D. J.,** (1978), "Economies of Scale and Organizational Efficiency in Banking: A Profit-Function Approach", The Journal of Finance, vol.33, March, pp.259-280.

145. **Murphy, N. B,** (1972), "A Re-estimation of the Benston-Bell-Murphy Cost Functions for a Larger Sample with Greater Size and Geographical Dispersion", Journal of Financial and Quantitative Analysis, vol.7, December, pp.2097-2105.

146. **Murray, J., and R. White,** (1983), "Economies of Scale and Economies of Scope in Multiproduct Financial Institutions: A Study of British Columbia Credit Unions", The Journal of Finance, vol.38, June, pp.887-902.

147. **Nejezchleb, L. A.,** (1986), "Declining Profitability at Small Commercial Banks: A Temporary Development or a Secular Trend?", Banking and Economic Review, FDIC, June, pp.9-21.

148. **Newbold, P.,** (1988), Statistics for Business and Economics, (2nd edn.), Prentice-Hall, Englewood Cliffs, New Jersey.

149. **Niehans, J.,** (1978), The Theory of Money, The John Hopkins University Press, Baltimore.

150. **OECD Economic Surveys, Greece,** (1986), January, OECD, Paris.

151. **OECD Monthly Financial Statistics,** (various issues), OECD, Paris.

152. **Olson, D. A.,** (1975), "How High-Profit Banks Get That Way", Banking, vol.67, May, pp.46-58.

153. **Panzar, J. C.,** (1976), "A Neoclassical Approach to Peak Load Pricing, The Bell Journal of Economics, vol.7, No.2, Autumn, pp.521-530.

154. **Panzar, J. C., and R. D. Willig,** (1981), "Economies of

Scope", The American Economic Review, vol.71, No.2, May, pp. 268-272.

155. Parker, G. G. C., (1981), "Now Management will Make or Break the Bank", Harvard Business Review, November-December, pp.140-148.

156. Parker, R. H., G. C. Harcourt, and G. Whittington, (eds.), (1986), Readings in the Concept and Measurement of Income, Philip Allan, Oxford.

157. Pavlopoulos, P. G., and A. K. Kouzelis, (1989), "Cost Behaviour in the Banking Industry: Evidence from a Greek Commercial Bank", Applied Economics, vol.21, No.3, March, pp.285-293.

158. Peat, Marwick, Mitchell & Co., (1981), Bank Taxation in Europe, September, pp.43-50.

159. Perry, F. E., (1979), A Dictionary of Banking, Macdonald and Evans Ltd, Plymouth.

160. Petoussis, E., (1985a), The Greek Banking System, Trapeziki, July-August, pp.117-120, (in Greek).

161. Petoussis, E., (1985b), The Greek Banking System (II), Trapeziki, October, pp.173-177, (in Greek).

162. Petrochilos, G. A., (1985), Foreign Banks in Greece, National Westminster Bank Quarterly Review, February, pp.57-69.

163. Pindyck, R. S., and D. L. Rubinfeld, (1976), Econometric Models and Economic Forecasts, McGraw-Hill Book Co., New York.

164. Plotkin, I. H., (1968), The Determinants of Commercial Bank Operating Costs: An Econometric Analysis of Activities and Services, unpublished MIT Ph.D. dissertation.

165. Powers, J. A.,(1969), "Branch Versus Unit Banking: Bank

Output and Cost Economies", Southern Economic Journal, vol.36, October, pp. 153-164.

166. Pratten, C. F., (1971), Economies of Scale in Manufacturing Industry, Cambridge University Press, Cambridge.

167. Pratten, C. F., (1988), "A Survey of the Economies of Scale", Economic Papers, No.67, Commission of the European Communities, Directorate-General for Economic and Financial Affairs.

168. Psilos, D. P., (1964), Capital Markets in Greece, KEPE, Athens.

169. Ratti, R. A., (1980), "Bank Attitude Toward Risk, Implicit Rates of Interest, and the Behavior of an Index of Risk Aversion for Commercial Banks", Quarterly Journal of Economics, vol.95, September, pp.309-331.

170. Ravenscraft, D. J., (1983), "Structure-Profit Relationships at the Line of Business and Industry Level", Review of Economics and Statistics, vol.65, pp.22-31.

171. Reid, G., (1987), Theories of Industrial Organization, Basil Blackwell, Oxford.

172. Report of the Committee for the Reformation and the Modernization of the Banking System, (1987), Hellenic Banks' Association, Athens, (in Greek).

173. Reports of the Committee of Disincentives, (1979), Bank of Greece, Athens, (in Greek).

174. Revell, J. R. S., (1980), Costs and Margins in Banking: An International Survey, OECD, Paris.

175. Rhoades, S. A., (1977), "Structure-Performance Studies in Banking: A Summary and Evaluation", Staff Economic Studies No 92, Board of Governors of the Federal Reserve System,

Washigton DC.

176. Rhoades, S. A., (1982), "Stucture-Performance Studies in Banking: An Updated Summary and Evaluation", Staff Economic Studies No.119, Board of Governors of the Federal Reserve System, Washington DC.

177. Ricketts D., and R. Stover, (1978), "An Examination of Commercial Bank Financial Ratios", Journal of Bank Research, Summer, pp.121-124.

178. Robinson, J., (1971), Economic Heresies: Some Old - fashioned Questions in Economic Theory, MacMillan, London.

179. Rose, J. T., and J. D. Wolken, (1986), "Statistical Cost Accounting Models in Banking: A Reexamination and an Application", Staff Economic Studies No.150, Board of Governors of the Federal Reserve System, Washington DC.

180. Rousseas, S., (1980), The Report of Harissopoulos for the Structure of the Banking System, Economy & Society, vol.14, August-September, pp.78-88, (in Greek).

181. Saving, T. R., (1970), "Concentration Ratios and the Degree of Monopoly", International Economic Review, vol.11, No.1, February, pp.139-46.

182. Sawyer, M. C., (1982), "On the Specification of Structure-Performance Relationships", European Economic Review, vol.17, pp.295-306.

183. Sawyer, M. C., (1985), The Economics of Industries and Firms, (2nd edn.), Croom Helm, London.

184. Scherer, F. M., (1980), Industrial Market Structure and Economic Performance, (2nd edn.), Rand NcNally, Chicago.

185. Schmalensee R., (1988), "Industrial Economics: An Overview", The Economic Journal, vol.98, September, pp.643-681.

186. Schmalensee R., and R. D. Willig, (eds.), (1989), Handbook of Industrial Organization, North-Holland, Amsterdam.

187. Schweiger, I., and J. S. McGee, (1961), "Chicago Banking: The Structure and Performance of Banks and Related Financial Institutions in Chicago and Other Areas", Journal of Business, vol.34, July, pp.203-366.

188. Schweitzer, A. A., (1972), "Economies of Scale and Holding Company Affiliation in Banking", Southern Economic Journal, vol.39, October, pp.258-266.

189. Shackle, G. L. S., (1967), The Years of High Theory: Invention and Tradition in Economic Thought 1926-1939, Cambridge University Press, London.

190. Shepard, W., (1984), "Competition versus Contestability", American Economic Review, vol.74, No.4, pp.572-587.

191. Shepherd, W. G., (1979), The Economics of Industrial Organization, Macmillan, London.

192. Shone, R., (1981), Applications in Intermediate Microeconomics, Martin Robertson, Oxford.

193. Simigiannis, G., (1982), The Demand of Short-term Bank Credits of the Greek Industry, in The Greek Economy, vol.II, Bank of Greece, Athens, pp.202-235, (in Greek).

194. Statement of the Governor of the Bank of Greece for the years 1977-1988, (1978-1989), Bank of Greece, Athens, (in Greek).

195. Stigler, G., (1955), The Theory of Price, (rev. edn.), MacMillan, New York.

196. Stigler, G. J., (1958), "The Economies of Scale", Journal of Law and Economics, vol.1, October, pp.54-71.

197. Stigler, G. J., (1964), "A Theory of Oligopoly", Journal of Political Economy, vol.72, pp.44-61.

198. Stockton, J. R., and C. T. Clark, (1975), Introduction to Business and Economic Statistics, South-Western Publishing Co., Cincinnati, Ohio.

199. Taylor, C. T., (1968), "Average Interest Charges, the Loan Mix, and Measures of Competition: Sixth Federal Reserve District Experience", The Journal of Finance, vol.23, December, pp.793-803.

200. The Athens Stock Exchange, 1988 Annual Bulletin, (1989), The Athens Stock Exchange, Athens.

201. The Greek Banking System Today, (1989), Hellenic Banks' Association, Athens.

202. The Greek Industry in 1985 [and in 1988], (1986 & 1989), Federation of Greek Industries, Athens, (in Greek).

203. Total Bank Productivity Measurement: A Conceptional Framework, (1982), Bank Administration Institute, Rolling Meadows, Illinois.

204. Trapeziki, (1985a), Another Consideration for another Policy, July-August, pp.120-124, (in Greek).

205. Trapeziki, (1985b), Another Consideration for another Policy (II), October, pp.177-179, (in Greek).

206. Trapeziki, (1988), "Representing Offices of Foreign Banks", December, pp.288, (in Greek).

207. Trapeziki, (1989), "Economic State of Greek Banks (and Foreign Banks in Greece) in 1988/1987", May-June, pp.115-116, (in Greek).

208. Vasiliou, D., (1988), "Economies of Scale in Greek Commercial Banking: A Cobb-Douglas Approach", unpublished manuscript.

209. Viner, J., (1931), "Cost Curves and Supply Curves", Zeitschrift fur Nationalokonomie, vol.3, pp.23-46, reprinted

in G. J. Stigler and K. Boulding, (eds.), Readings in Price Theory (1952), pp.199-232, Richard D. Irwin, Homewood, Illinois.

210. Vittas, D., (1986), "Banks' Relations with Industry: An International Survey", National Westminster Bank Quarterly Review, February, pp.2-14.

211. Wall, L., (1985), "Why Are Some Banks More Profitable Than Others?", Journal of Banking Research, Winter, pp.240-256.

212. Walter, W. L., and D. L. Mengle, (1986), "A Review of Bank Performance in the Fifth District", Economic Review, Federal Reserve Bank of Richmond, July/August, pp.29-37.

213. Walters, A. A., (1963), "Production and Cost Functions: An Econometric Survey", Econometrica, vol.31, January-April, pp. 1-66.

214. Waterson, M., (1984), Economic Theory of the Industry, Cambridge University Press, Cambridge.

215. Weitzman, M. L., (1983), "Contestable Markets: Comment", American Economic Review, vol.73, pp.486-487.

216. Weston, F. J., (1954), "The Profit Concept and Theory: A Restatement", The Journal of Political Economy, April, No.2, pp.152-170.

217. Weston, F. J., and E. F. Brigham, (1981), Managerial Finance, (7th edn.), The Dryden Press, Hinsdale, Illinois.

218. Whalen, G., (1987), "Concentration and Profitability in Non-MSA Banking Markets", Economic Review, Federal Reserve Bank of Cleveland, Quarter 1, pp.2-9.

219. White, H., (1980), "Using Least Squares to Approximate Unknown Regression Functions", International Economic Review, vol.21, February, pp.149-170.

220. **White H.**, (1982), "Maximum Likelihood Estimation of Misspecified Models", Econometrica, vol.50, pp.1-26.

221. **Wibe, S.**, (1984), "Engineering Production Functions: A Survey", Economiça, vol.51, pp.401-411.

222. **Zitridis, A. H.**, (1973), The Banking System of Greece, Bank of Greece, Athens, (in Greek).

223. **Zolotas, X.**, (1967), "Monetary Planning in Economic Development", The Banker, July, pp.605-609.