Bangor University

DOCTOR OF PHILOSOPHY

Analysing the determinants of bank efficiency : the case of Italian banks.

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Award date:
2000

Awarding institution:
Bangor University

School of Accounting, Banking and Economics

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BANGOR

Analysing the Determinants of Bank Efficiency: The Case of Italian Banks

A thesis submitted to the University of Wales
in the candidature for the degree of
Philosophiae Doctor by

Claudia Girardone

– February 2000 –

To My Parents
and Marc

Acknowledgements

I am very grateful to my supervisors Professor Edward P.M. Gardener and Professor Philip Molyneux for their advice, support, and guidance in writing this thesis.

I wish to thank Margaret Brown, Barbara Casu, John Goddard and Jonathan Williams from the University of Wales, Bangor, and Pierluigi Morelli from Centro Europa Ricerche, Roma, with whom I have had the chance to confer about theoretical and methodological problems.

I also wish to express my gratitude to Professor Giovanni B. Pittaluga for his intellectual and moral support and for providing me with the Bilbank database, and to all colleagues and friends from the Dipartimento di Scienze Economiche e Finanziarie of the Università degli Studi di Genova (Italy).

Special thanks are owed to all the staff of the Institute of European Finance and General Office of SABE for their continuous assistance.

I would also like to thank Marc for his unconditional support, and all my friends whom I have met during my time in Bangor, in particular Ana, Arfon, Gabriele and Ross.

Last but by no means least, big thanks are owed to my mother and my father for all their support, understanding and advice throughout my studies.

Abstract

This thesis investigates the main determinants of Italian banks' cost efficiency over the period 1993-96, by employing a Fourier-flexible stochastic cost frontier in order to measure X-efficiencies and economies of scale. Quality and riskiness of bank outputs are explicitly accounted for in the cost function and their impact on cost efficiency levels are evaluated. The results show that mean X-inefficiencies range between 13 and 15 per cent of total costs and they tend to decrease over time for all bank sizes. Economies of scale appear present and significant, being especially high for popular and credit co-operative banks. Moreover, the inclusion of risk and output quality factors in the cost function seems to reduce the level and significance of the scale economy estimates. The sample is also subjected to a profitability test that allows for the identification of banks that are both cost and profit efficient. The results suggest that the most efficient and profitable institutions are more able to control all aspects of costs, especially labour costs. Finally, the data were pooled to carry out a logistic regression model in order to examine bank- and market-specific factors that influence Italian banks' inefficiency. According to these results, inefficiencies appear to be inversely correlated with capital strength and positively related to the level of non-performing loans in the balance sheet. The analysis also shows that there is no clear relationship between assets size and bank efficiency. Finally, from the results it is possible to infer that quoted banks seem to be on average more efficient than their non-quoted counterparts.

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List of Acronyms

ABI	—	Associazione Bancaria Italiana
ATMs	—	Automatic Teller Machines
BIS	—	Bank for International Settlements
BNL	—	Banca Nazionale del Lavoro
BOT	—	Buoni Ordinari del Tesoro
CARIPLO	—	Cassa di Risparmio delle Province Lombarde
CCT	—	Certificati di Credito del Tesoro
CDs	—	Certificates of Deposit
CES	—	Constant Elasticity of Substitution
COMIT	—	Banca Commerciale Italiana
CR	—	Cassa di Risparmio
D.lgs	—	Decreto legislativo
DEA	—	Data Envelopment Analysis
DFA	—	Distribution Free Approach
DL	—	Decreto Legge
EC	—	European Commission
ECB	—	European Central Bank
ECU	—	European Currency Unit

EEC	—	European Economic Community
EFA	—	Econometric Frontier Approach
EFTPOS	—	Electronic Funds Transfer at Point-Of-Sale
EM	—	Equity Multiplier
EMI	—	European Monetary Institute
EMS	—	European Monetary System
EMU	—	European Monetary Union
ERM	—	Exchange Rate Mechanism
ESCB	—	European System of Central Banks
EU	—	European Union
FCA	—	Functional Cost Analysis
FDH	—	Free Disposal Hull
G.U.	—	Gazzetta Ufficiale
GDP	—	Gross Domestic Product
IBCA	—	International Bank Credit Analysis
IMI	—	Istituto Mobiliare Italiano
IRI	—	Instituto per la Ricostruzione Industriale
IT	—	Information Technology
L.	—	Legge
L.bn	—	Billions of (Italian) Lire
Lgt	—	Legislative
LR	—	Likelihood Ratio
M&As	—	Mergers and Acquisitions
ML	—	Maximum Likelihood
NPLs	—	Non-Performing Loans
OBS	—	Off-Balance Sheet
OECD	—	Organisation for Economic Co-operation and Development
OJ	—	Official Journal (of the European Communities)
OLS	—	Ordinary Least Squared
PC	—	Personal Computer
POS	—	Point-Of-Sale

RAC	—	Ray Average Cost
ROA	—	Return On Assets
ROE	—	Return On Equity
S&Ls	—	Savings and Loans
SCP	—	Structure-Conduct-Performance
SEA	—	Single European Act
SEM	—	Single European Market
SFA	—	Stochastic Frontier Approach
SIM	—	Società di Intermediazione Mobiliare
SMEs	—	Small and Medium Enterprises
STDEV	—	Standard Deviation
TFA	—	Thick Frontier Approach
UK	—	United Kingdom
US	—	United States (of America)

Chapter 1

Background, Aims, Methodology and Structure of the Study

1.1 Introduction

The structure and organisation of the world banking industry has changed markedly over the last fifteen years. The transformation of the environment in which banks operate has had substantial implications for the economic role of banks and their business activities. Financial innovations, the diffusion of new forms of payment, technological progress and globalisation have gradually diminished the costs of information processing and transmission, and also offered new opportunities to extend the markets in which financial institutions can provide services.

In addition to these developments, a parallel process of deregulation has brought about a significant increase in competitiveness between banks, which is inducing them to modify their strategies in key areas such as in the development of new delivery systems, service quality and pricing.

These kinds of fundamental changes have forced banks to become more concerned about analysing and controlling their costs and revenues, as well as measuring the risks taken to produce acceptable returns. In this context, the maximisation of shareholders wealth and improved productive efficiency have become much more important strategic targets for bank management. Banks today are increasingly demand-oriented and are subject to external market tests of their productive and other efficiencies. Moreover, recent studies [see, for example, Di Battista *et al.*

(1996); Molyneux *et al.* (1996); European Commission (1997); Resti (1997a); Inzerillo *et al.* (1999)] on efficiency in Italian banking show that there is substantial room for reducing costs and improving the way that bank resources are used.

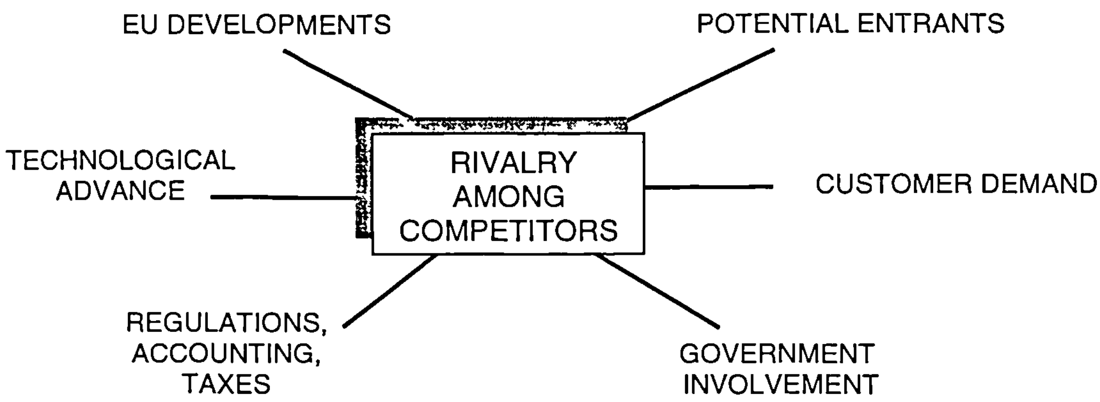
As a consequence, the issue of banks' efficiency and optimal dimension (i.e. size, business mix and respective strategies) have become more important, not only from a microeconomic point of view, but also for "the stability of the banking industry and, in turn, for the effectiveness of the monetary system" [Kolari and Zardkoohi (1987, p. 29)]. Banks play a critical role in determining the money supply and in transmitting the effects of monetary policy to the economy. At present, even in strongly market-oriented systems a process of prudential re-regulation and adaptation appears necessary to help preserve macro stability, especially during a period of strong contemporaneous (banking structure and conduct rules) deregulation.

1.2 Aims of the Study

This research aims to carry out an extensive analysis of the Italian banking industry. In particular, the thesis will investigate the main determinants of Italian bank efficiency and performance, in addition to evaluating the impact of risk and output quality factors on the production characteristics of Italian banks.

Such an investigation is important for a number of reasons. As discussed above, deregulation, increased competition and information technology are among the most important forces of change in modern banking (see Figure 1.1). At the micro level, these factors bring about intense pressures on banks, especially as regards their financial capability, overall performance and the need for appropriate control and analysis of costs; at the macro level, they influence the functioning of financial and economic systems as a whole. Heffernan (1996) stresses that modern banks, like any other profit-maximising business, have to bear two different types of risk: microeconomic risks, such as competitive threats, and macroeconomic risks, like the effects of recession. In addition, banks are subject to a collection of atypical risks and corresponding prudential supervisory regulation.

Figure 1.1 Forces of Change in European Banking



Source: Arthur Andersen (1993, p. 1).

From the macro perspective, banks can be strongly influenced by the expansions and contractions that the economy experiences over time. In this respect, banks' loan losses tend to be cyclical and highly influenced by macro-variables [Morgan Stanley (1995)]. Broadly speaking, there is evidence that the quality of bank loans and the default risk can influence banks' costs in a variety of ways [see, for example, Hughes and Mester (1991); McAllister and McManus (1993); Mester (1996); Berger and Mester (1997) and Altunbas *et al.* (1999)].

An important aim of this thesis is to analyse the extent to which risk and output quality factors affect efficiency and scale economy levels in the Italian banking system. The Italian banking market is particularly interesting in this respect because, on the one hand it includes highly capitalised banks, which are also the smallest banks in the system (i.e. credit co-operative banks). On the other hand, since 1993 Italian banks have suffered from a dramatic growth in the level of bad loans accompanied by a decrease in interest margins: some large and medium sized banks in the south of the country have incurred significant losses and sometimes have even experienced severe crises. Moreover, previous studies on Italian bank efficiency have tended to exclude risk and quality issues when investigating the cost characteristics of the industry.

Against this background, the main objectives of this thesis are to evaluate the following questions.

Main Research Question → What are the main determinants of Italian banks' performance, profitability, and efficiency?

Related Sub-Questions

1. To what extent and how does the quality of banks' assets affect the efficiency levels estimated for Italian banks?
2. To what extent do risks influence the efficiency levels of Italian banks?
3. Do the structural features of the Italian banking market explain the evidence of cost economies?
4. To what extent and how is Italian banks' profitability related to cost efficiency?
5. What are the main financial characteristics of efficient and inefficient banks in Italy?

1.3 Research Methodology and Data Sources

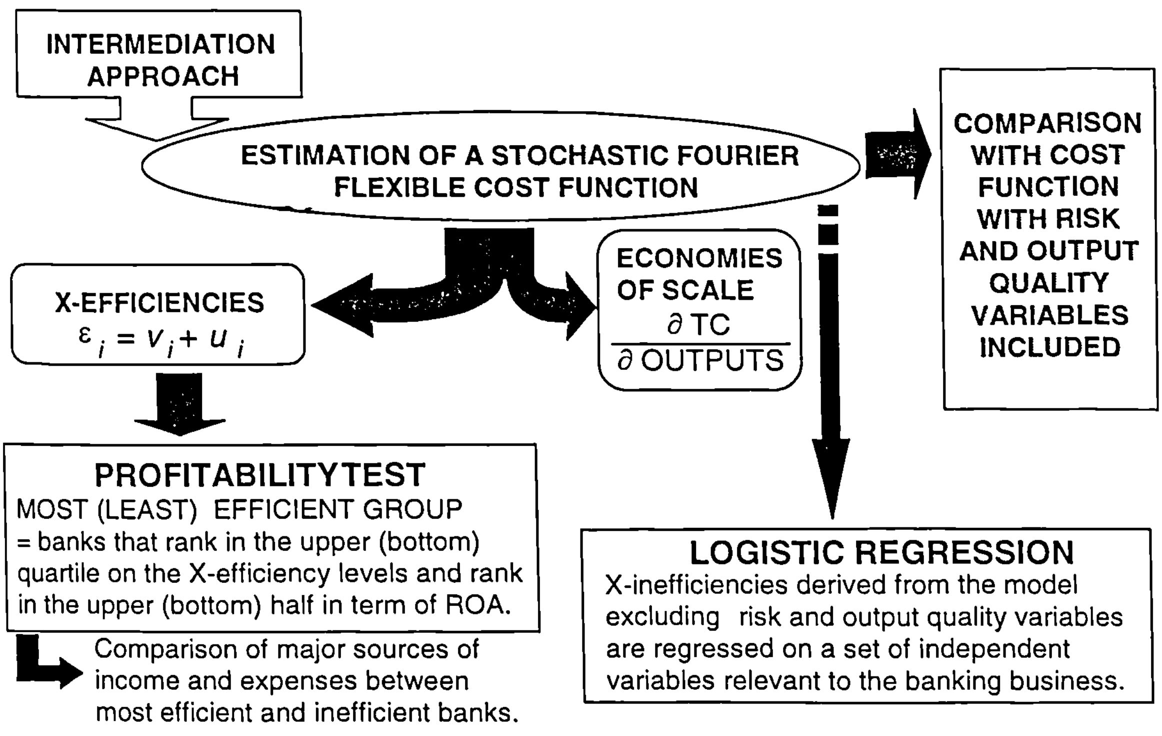
In this study, data observations for a sample of 1,958 Italian banks for the period 1993 to 1996 are obtained from the Italian database Bilbank of the Associazione Banche

Private Italiane which provides annual income and balance sheet data for a large number of Italian banks.

Estimates on Italian banks' scale and X-efficiencies are derived using a stochastic Fourier-flexible cost function (see Figure 1.2). The intermediation approach, which considers the bank as a mediator between the supply of and demand for funds (and thus deposits are inputs and interest on deposits is a component of total cost, together with labour and capital) is used for the purposes of the empirical research.

The same methodological technique is then repeated by taking into account the asset quality and banks' risk preferences in order to assess their influence on managerial X-efficiency and scale economy measures. Following Mester (1996), these factors are included as arguments in the cost function in the following way: quality is proxied by a variable measuring the non-performing loans to total loans ratio; the level of financial capital is measured as the average volume of equity capital (for each of the years considered).

Figure 1.2 Research Methodology



Following Spong *et al.* (1995) the cost efficiency measures derived from the Fourier model are also subjected to a profitability test. This is undertaken in order to identify banks that are both cost and profit efficient. This approach is taken because just looking at the cost-side may provide inaccurate rankings of efficiency: for example, a seemingly cost inefficient bank might be offsetting higher expenses with higher revenues. It follows that banks which will do well on both cost efficiency and profitability tests will comprise the overall "most efficient" bank category using this approach, while banks that fare poorly on the two tests will be grouped in the "least efficient" category.

In this way, a broader and pragmatic concept of efficiency is used: the combined tests allow the researcher to capture the ability of banks to use their resources efficiently both in producing banking products and services and in generating profits from these same products and services. The profitability test will be applied by using banks' returns on assets (ROAs). Efficient and inefficient banks will then be analysed by comparing their major sources of income and expenses and their balance sheet components.

The final part of the empirical analysis relates the inefficiency estimates to various different aspects of the banking business. The analysis considers factors that are at least partially exogenous and may explain some of the efficiency differences that remain after controlling for the efficiency concept and measurement method [see, for example, Berger and Mester (1997) and Berger and De Young (1997)]. This set of potential correlates with bank inefficiency are chosen in such a way that various aspects of banking business are covered: for instance bank size, market characteristics, geographic position, capital, performance and retail activities [see Mester (1996); Berger and Mester (1997) and Altunbas *et al.* (1999)].

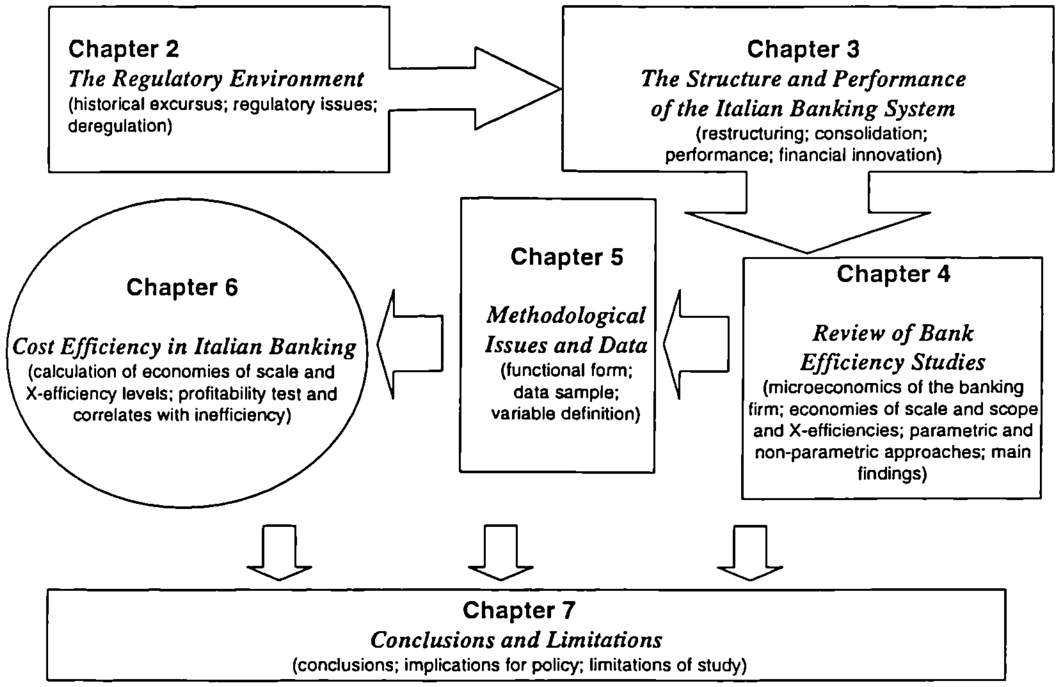
1.4 Structure Plan

The thesis is organised into seven chapters as shown in Figure 1.3.

From the principles laid down in the 1936 Banking Law to the 1994 New Banking Law and subsequent decrees, **Chapter 2** provides a detailed investigation of the most relevant legislative changes that liberalised the Italian banking market from various structural constraints. The chapter focuses on important changes that Western European banking systems experienced over the last two decades, with particular reference to the Italian banking sector. Specifically, the chapter investigates the rationale for regulation in banking and describes the impact of the processes of structural deregulation and supervisory re-regulation in the context of the EU (European Union). As concerns the specific case of Italy, emphasis is given to the post-war reconstruction period under the governorship at the Bank of Italy of Donato Menichella (1948-60) – that is when the structure of the country's financial and banking systems was distinctively shaped. The last section of the chapter provides an overview of the regulatory changes over the last ten years that have liberalised the Italian banking system.

Chapter 3 analyses recent developments in the structure of the Italian banking market and investigates the performance and profitability of Italian banks. As far as the restructuring process is concerned, the focus is on the size of the banking market, the number and type of banks, branches, concentration, market share distribution and regional differences. The chapter also considers the features of the new operating environment that Italian banks are facing, as well as the characteristics of the Italian banking system in terms, for instance, of asset quality and labour costs. The performance of Italian banks is also investigated. The last section of the chapter is concerned with the way financial innovation and technology have affected Italian bank payments system over recent years. These non-regulatory changes both impact on bank cost efficiency and also reflect the scale of change experienced in Italian banking over recent years.

Figure 1.3 Structure of the Study



Chapter 4 provides an overview of the bank efficiency literature. In particular, the chapter explores the meaning of efficiency in the banking industry and surveys international and Italian empirical findings on this topic. This analysis requires, first, an evaluation of the peculiar features of the "banking firm" from a microeconomic point of view and a related explanation of the nature and the functions of financial intermediaries. The chapter explains why it is important to model efficiency and bank profit characteristics, and focuses on the concepts of economies of scale and scope and X-efficiencies in banking. Explanations on the various existent approaches to measuring efficiency (i.e. parametric and non-parametric, deterministic and stochastic) are provided, together with several "new views" on efficiency analysis in banking. In this context, particular emphasis is given to the criticism that has recently been made concerning the widespread use of the translog functional form in efficiency analysis.

Chapter 5 is the main methodological chapter and discusses in detail the econometric models used for the empirical analysis carried out by the researcher for the evaluation of economies of scale and X-efficiencies in the Italian banking system. It also examines the actual variables used in the empirical analysis, the data sources and provides a detailed description of the data sample. The chapter explains the characteristics of the model chosen for the cost function, that is the Fourier-flexible functional form; how the standard cost frontier (Model I) is modified in order to control for risk and quality factors (Model II); the characteristics of the profitability test for the identification of Italian banks that are both cost and profit efficient; and, finally, examines the variables included in the logistic model used for the evaluation of possible determinants of bank efficiency.

In **Chapter 6** the cost efficiency of the Italian banking sector is empirically analysed for the years 1993 to 1996 using the methodology summarised in the preceding chapter. Maximum Likelihood (ML) estimates for both Model I (the standard cost frontier specification) and Model II (the standard cost frontier specification including variables that control for risk and quality factors) are reported and analysed, followed by the results on the relevant structural tests. Scale economies and X-efficiency results are evaluated and discussed; most of the results are grouped according to bank size classes (very big, big, medium, small, and very small), types of bank (commercial, savings, popular, and credit co-operative), and geographical areas (north-west, north-east, centre, and south and islands). Findings from the profitability test and the examination of the potential correlates of the inefficiency conclude the chapter.

Finally, **Chapter 7** is the concluding chapter that summarises the main findings of the thesis and draws some general policy and other conclusions.

Chapter 2

The Regulatory Environment in the Italian Banking System

2.1 Introduction

The purpose of this chapter is to analyse the major changes in the bank regulatory environment at a European level and to focus on their consequences for the specific case of Italy. This chapter investigates briefly the rationale for regulation in banking and describes the impact of the processes of structural deregulation and supervisory re-regulation. This is particularly important when analysing the evolution of Italian banks over the last three decades: the system has experienced substantial reforms aimed at improving the efficiency and soundness of its banking market. Finally, regulatory developments at the EU level are discussed in the context of their influence on Italian banking sector reforms.

2.2 The Reasons for Financial Sector Regulation: A Brief Overview

The financial services industry in all systems is generally one of the most heavily regulated sectors of the economy. Especially in banking, the perceived riskiness of the intermediation process, the importance of banks as suppliers of credit and the special role of banks in operating the payments system has conspired to induce governments and national regulators in all countries to limit the activities and business operations of banks and similar financial institutions by means of specific rules, and to supervise that the same institutions are conducting their business according to the prescribed regulations.[1] In this context, Goodhart *et al.* (1998) distinguish between regulation (the establishment of specific rules of behaviour), monitoring (observing whether the rules are obeyed), and supervision (the more general oversight of financial firms' behaviour).

The main goals of the prudential regulation of the banking sector are to protect individual investors and to help thereby ensure the stability and soundness of the financial system. Such regulation is needed because of possible perceived market failures arising from asymmetric information problems, externalities, and/or problems of market power [Van Damme (1994)]. Specifically, the mere possibility that failures of individual financial institutions can propagate (so-called "contagion risk") and become systemic, combined with customer uncertainty about the condition of banks, can cause depositors and other creditors to lose confidence which may lead to a run on the banking system. This can have disastrous consequences for the real economy, and even large solvent banks can fail. Usually the social costs of such financial distress are higher than the private costs to shareholders and managers of failing institutions [see Hoenig (1996) and Goodhart *et al.* (1998)].[2]

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[1] Asymmetric information (between banks and their borrowers) has been the foundation of modern theories of commercial banking that help to explain the special character of banks and the unique regulatory treatment that banks receive [see, for instance, Nakamura (1991) and Saunders (1994)]. The corresponding "traditional" theories focus more on the financial intermediary role of banks.

[2] Freixas and Rochet (1997) specify the distinction between bank runs, that affect an individual bank, and bank panics, that concern the whole banking industry and as a consequence the payments system. Essentially, bank runs can develop into bank panics because of contagion or dominos effects. Moreover, without regulation, bank runs and bank panics are inherent to the nature of banking and more specifically to the fractional reserve system. Indeed, bank deposit contracts usually allow their holders to dispose of a nominal amount at their demand. Therefore, as soon as a fraction of these deposits is used for financing illiquid and risky loans or investments, there is always the possibility of a liquidity crisis.

There are several ways in which the stability of the financial system can be enhanced [Gual and Neven (1993)]: for example, investors can be protected against potential losses by deposit insurance, the possible bailout of failed banks and by use of lender of last-resort facilities. Another (not mutually exclusive) policy approach to increase financial system stability is to organise the banking system so as to reduce risks and minimise the associated probability of bank failures. Regulators can do this by ensuring that banks earn a high level of profitability, therefore helping to accumulate reserves that act as a cushion in case of financial difficulties.

It follows that the objectives of regulation can be classified as both micro (related to the consumer and producer) and macro (related to systemic interest). However, as argued by Llewellyn (1986), this does not imply that regulation is necessarily the most effective or efficient way of ensuring safety of financial institutions. On the contrary, some forms of regulation may be counterproductive and anticompetitive, thus reducing the efficiency with which financial markets help to allocate the economy's scarce resources. For instance, controls on branching and the range of allowable business restrict banks' capacity to react to changes in market conditions and to adjust their portfolios. Similarly, regulation keeps out new entrants who, if they could enter, might force existing firms in the market to be more efficient. Regulation, then, has many costs. Goodhart *et al.* (1998) argue that regulators supply regulatory services for which there is a consumer demand, but there is a cost to regulation and, one way or another, it is the consumer who pays that cost.

The theory of regulation contemplates four major failings of regulation: *i*) the creation of moral hazard, that is regulation causes people to behave in a counter-productive way; *ii*) the risk of agency capture, that is the regulatory process is likely to be captured by producers and used in their own interests rather than in the interests of consumers; *iii*) the creation of compliance costs for producers, that is the costs of adhering to regulations; and *iv*) the increase in the costs of entry into and exit from markets [Howells and Bain (1998)].

One taxonomy is to classify banking regulations according to their influence on market structure and firm behaviour as shown in Table 2.1.

Table 2.1 Classification of the Methods of Banking Regulation

REGULATIONS INFLUENCING THE STRUCTURE	REGULATIONS INFLUENCING THE CONDUCT	REGULATIONS INFLUENCING PRUDENTIAL CONCERNS
• FUNCTIONAL SEPARATION OF INSTITUTIONS	• REGULATION OF BANKS' DEPOSIT AND LENDING RATES	• DEPOSIT INSURANCE
• ENTRY RESTRICTIONS	• REGULATIONS OF FEES AND COMMISSIONS	• DISCOUNT WINDOW (LENDER-OF-THE-LAST RESORT)
• DISCRIMINATORY RULES AGAINST FOREIGN BANKS (AND INVESTORS)	• CREDIT QUOTAS	• MINIMUM CAPITAL REQUIREMENTS
• LIBERALISATION OF CAPITAL MOVEMENTS	• BRANCHING LIMITATIONS	• SOLVENCY RATIOS
	• RESERVE REQUIREMENTS	• OWNERSHIP RESTRICTIONS
	• MONEY LAUNDERING	• RESTRICTIONS ON ASSET CONCENTRATION (LARGE EXPOSURES)
		• INFORMATION DISCLOSURE REQUIREMENTS

Source: Adapted from European Commission (1997, p. 20).

Regulatory tools, or instruments, can be distinguished between those that affect directly the structure of the industry and those that influence the behaviour of the industry participants [Gual and Neven (1993)]. Indeed, the theory of industrial organisation suggests that conduct and structure regulation have potentially affected the shape and performance of the industry in different ways. As shown in Table 2.1, structural regulations include rules that functionally separate institutions (such as the separation between commercial and investment banking), entry requirements and discriminatory rules regarding foreign banks and investors. These regulations can be expected to reduce entry and thereby may encourage collusion. In addition they can also limit the presence of foreign firms, the size of banks, the frequency and type of mergers and acquisitions and the scope of products that can be offered. On the other hand, conduct regulations can take the form of direct restrictions on assets and liabilities composition (including prudential rules and rules on participation in non-banking firms), rules relating to information disclosure, limitations on branching, credit ceilings, and the determination of fees, commissions and rates on assets and liabilities. These regulations can be expected to provide banks with an incentive to overemphasise competitive approaches that are not specifically restricted. In short, banks may be incentivised to engage in regulation-avoidance and/or regulation-reducing activities.

All of these factors explain why the adequacy of financial regulatory policy is a often controversial issue. The complexity of changes in financial markets has increased the costs and difficulties of effectively monitoring the activities of large, globally active institutions that are involved increasingly in a wider range of financial activities. Moreover, distortions between regulated and unregulated institutions may occur. As such it follows that both within and (in the case of the EU) across countries there has been a move to establish a regulatory structure that promotes fair ("level playing field") competition as well as a sound banking/financial system. Overall, the recent literature [for example, Van Damme (1994) and Goodhart *et al.* (1998)] emphasises the need for a regulatory approach able to guarantee an efficient functioning of financial markets and to contribute optimally to the growth of the real economy in the context of general macroeconomic stability.

Having examined briefly the *raison d'être* of regulation for financial services firms, it is important to clarify what is meant by structural deregulation and supervisory re-regulation in the banking system. In broad terms, the process of deregulation essentially consists of breaking-down the rules and regulations that in the past have protected financial institutions, especially banks. The word deregulation suggests a movement away from regulation and, carried to its logical conclusion, even suggests an absence of regulation [Sinkey (1992)]. Structural deregulation, more generally, then, refers to the opening up, or liberalisation, of financial markets and institutions to compete more freely [Gardener (1991)]. However, this kind of "structural deregulation" encompasses structure and conduct and not prudential rules.

At present, since financial intermediaries are operating in more risky areas and financial activities are increasingly taking place outside of the traditional bank regulatory framework, the risk of bank crises has apparently increased. This fact has created the paradoxical situation that even in strongly market-orientated systems, a process of prudential (supervisory) re-regulation is deemed necessary. As stressed by Molyneux *et al.* (1996), while structural deregulation increases the competitive pressures on banks, supervisory re-regulation may impose additional costs.[3]

The next section presents a brief overview of the EU financial services legislation and focuses specifically on the banking sector.

2.3 The Process of Structural Deregulation in Western European Banking

Until the 1980s, the European financial sector was mainly nationally oriented with often marked institutional differences among individual country's banking systems. This was in part the consequence of the wide variety of regulations that were established to prevent crises in the banking sector. National governments invariably acted as protectors of their banks from foreign influences and sometimes were themselves owners of major banks.

The transformation of the world economy, the processes of internationalisation and globalisation of the financial markets, and the parallel widening of the objectives of the former European Community brought about a convergence of national views in the domain of economic policy, with the following main objectives: liberalising trade and capital flows and moving towards a largely market-oriented economy. The process of deregulation carried out by the European Community was aimed at harmonising and

[3] The completion of the European internal market is an example of structural deregulation (and concomitant globalisation), whereas the two complementary measures to the Second Banking Directive dealing with capital adequacy can be considered examples of supervisory prudential re-regulation.

integrating the legislation and practices of the Member States. It embodied an extensive financial liberalisation process aimed at creating a single market for financial services.[4]

The primary economic objective of structural deregulation was to ensure the achievement of economic gains from resource allocation through a freer market, rather than via central government direction [Gardener (1991)].

The benefits of a deregulated market within the EU Member States were identified by the 1988 Cecchini study that confirmed the importance of deregulating financial sectors within the overall internal market integration. Cecchini estimated that up to one-third of the total gains from deregulating all economic sectors during the first six years after 1992 would come directly and/or indirectly from deregulating financial services [see Gardener (1997)]. As recently pointed by Berger and Humphrey (1997, p. 22): "Deregulation is typically undertaken to improve the performance of the industry being deregulated. If efficiency is raised, the improvement in resource allocation will benefit society and may lead to price reductions and/or service expansion for consumers if competition is sufficient. However, in many cases, deregulation is initiated less by a desire to benefit consumers than by a need to improve the competitive viability of the industry [...] One such example [...] is the harmonisation and unification of banking markets in Europe – removing restrictions that have limited the ability of banks in one country from aggressively entering markets in other countries [...]".

In 1977, the EU's First Banking Co-ordination Directive was adopted. This Directive established the ground rules for dealing with bank authorisation and supervision, although it did not create a free internal market. The Directive established a definition of credit institutions, and created a Banking Advisory Committee, whose task

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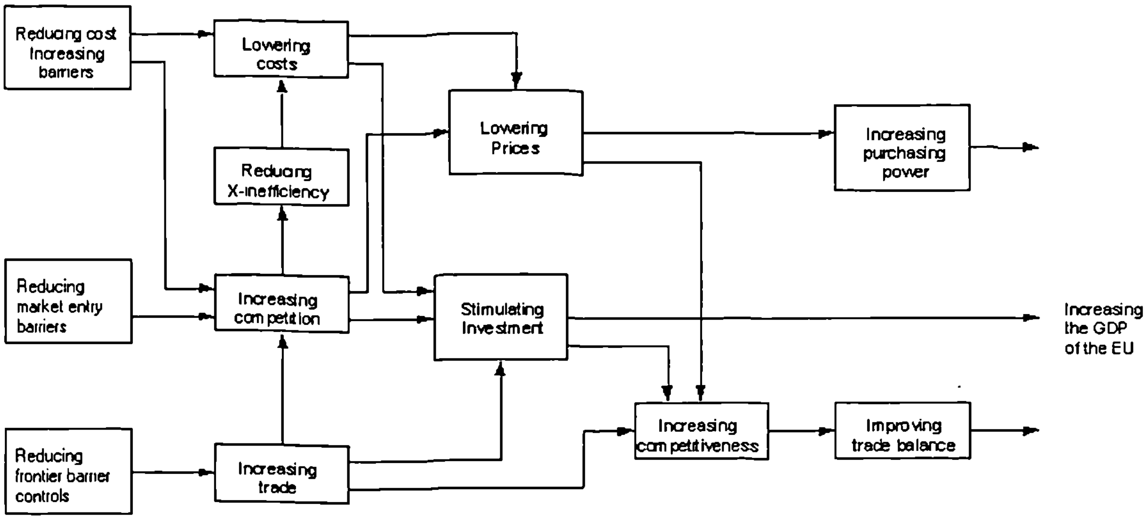
[4] The Treaty of Rome (1957) had postulated free internal trade, free movement of services, people and goods and a common external tariff. Article 2 of the Treaty of Rome (1957) states: "The Community shall have as its task, by establishing a common market and progressively approximating the economic policies of Member States, to promote throughout the Community a harmonious development of economic activities, a continuous and balanced expansion, an increase in stability, an accelerated raising of the standard of living and closer relations between the States belonging to it". In 1986, the signing of the Single European Act (SEA) reaffirmed a solemn commitment to these original objectives of the Common Market by stating that an "internal market" had to be created by the 1st January 1993 [see, for example, Molyneux *et al.* (1996) and European Commission (1997)].

was to establish and examine liquidity and solvency ratios for a trial period and to achieve an enhanced degree of co-operation among national bank supervisory authorities within the EU. Nevertheless, banks willing to operate in other Member States still needed authorisation from the supervisory bodies of the potential home country. Therefore, the First Bank Co-ordination Directive left many details open to interpretation and other Directives were required. In 1983, a Directive on Consolidated Supervision dealing with the supervision of consolidated accounts and the harmonisation of rules relating to annual accounts of credit institutions was adopted. Two other Directives followed in 1986 that dealt with Uniform Format for Bank Accounts and Consumer Protection.

However, the first major step towards achieving a Single European Market (SEM) in 1992 was the EU's 1985 White Paper on Completing the Internal Market which paved the way for the Single European Act (1986). The aim of this White Paper was to establish guidelines for a single banking licence, home country control and mutual recognition by liberalising trade and establishment in the banking, insurance and securities markets. According to the programme, all physical, technical and fiscal barriers, as well as regulations hindering the free movement of goods, services, people, and capital had to be removed or lifted by 31 December 1992. One of the main advantages from the completion of the SEM, related to the expected increase in GDP brought about through greater trade in banking services, as illustrated in Figure 2.1.

The principles of the White Paper were incorporated in the 1988 proposals for a Second Banking Co-ordination Directive (adopted in 1989). In general terms, the Second Banking Directive provided for: *i*) the harmonisation of minimum capital standards for the authorisation and continuation of banking business; *ii*) supervisory control of major shareholders and banks' participation in the non-banking sector; *iii*) proper accounting and control mechanisms; and *iv*) standards and own funds, solvency ratios and deposit protection legislation [Molyneux *et al.* (1996)].

Figure 2.1 How the SEM Increases GDP of the EU



Source: Molyneux *et al.* (1996, p. 39).

The 1988 Directive, then, plugged a number of gaps left by the First Banking Co-ordination Directive of 1977, and introduced the concept of a "single banking licence" for banks and other financial firms to operate throughout the Union. In other words, this "single passport" allowed any credit institution authorised to operate in any Member State to set up branches or to supply cross-border services in all other Member States without having to obtain further authorisation from each state. An Appendix to the Directive listed a wide range of services for which a banking licence was valid (Table 2.2).

Table 2.2 The List of Services Credit Institutions are Allowed to Offer Under the Second Banking Directive

1. Deposit-taking and other forms of borrowing
2. Lending
3. Financial leasing
4. Money transmission services
5. Issuing and administering means of payments (credit cards, travellers' cheques and bankers' drafts)
6. Guarantees and commitments
7. Trading for own account or for account of customers in:
   (a) money-market instruments
   (b) foreign exchange
   (c) financial futures and options
   (d) exchange and interest rate instruments
   (e) securities
8. Participation in share issues and the provision of services related to such issues
9. Money broking
10. Portfolio management and advice
11. Safekeeping of securities
12. Credit reference services
13. Safe custody services

Source: Second Banking Co-ordination Directive (see OJ L 386, 30/12/89).

Essentially, a bank was now able to provide any of the services on the list in all of the other Member States, provided that it was authorised to do so in its home country. Moreover, banks could provide services regardless of whether or not the host country did not allow its domestic credit institutions to provide them. The Directive also stated that branches established in other Member States should give the host authorities the same amount of information as that required from the country's domestic institutions for monitoring liquidity and controlling monetary policies.

It is important to point out that other Directives harmonising regulations on accounting for foreign branches, deposit insurance, reorganisation and winding-up procedures have also been adopted by the Commission. Specifically, the Money Laundering Directive (effective 1 January 1993), imposing certain obligations on credit and financial institutions designed to prevent money laundering; the Large Exposure Directive (effective January 1994), placing limits on the exposures to individual companies or groups which banks can take on; and the Deposit-Guarantee Schemes (effective January 1994), setting minimum standards for deposit-guarantee schemes which would protect depositors in the event of bank failure. All of this legislation was passed at the EU level in time for the introduction of the single financial market from 1 January 1993.

Moreover, since the application of the principle of home country control could have encouraged institutions to base their business in the Member State with the lowest standard of supervision, the Directive included certain provisions to harmonise some essential supervisory standards. These concerned minimum capital requirements, the control of majority shareholders and bank participation in the non-bank sector [Dixon (1993)]. As discussed in section 2.4, along with the structural deregulation process of financial markets, banking supervision (or prudential regulation) has expanded in most Western countries over the last two decades. Capital adequacy rules occupy a central place in this supervisory re-regulation process.

2.4 Supervisory Re-Regulation in Banking

During the 1980s the perceived riskiness of banking business increased sharply. Financial institutions rapidly adapted their portfolios and strategies to the new environment, and periodic bouts of apparent excessive risk-taking, possible underpricing of risks and perceived overshooting behaviour by banks in adapting their portfolios to the new environment increased the need for prudential re-regulation. Strengthened supervision was considered to be an important element in improving the safety of the system. Capital adequacy convergence also became a central issue in the need to help level internationally the "playing fields" on which banks compete [Gardener and Molyneux (1990) and Molyneux *et al.* (1996)].

As a consequence, capital adequacy standards became one of the fundamental components in bank prudential re-regulation. This has taken place in the context of a gradual shift from direct forms of control, often at the full discretion of regulatory authorities, to more indirect and objective types of controls.

The European Commission's supervisory approach to financial services was based on three fundamental principles: minimum essential harmonisation, home and host country control, and the related concept of "mutual recognition". In particular, mutual recognition essentially means that the supervisory authorities in one country will recognise the prudential equivalence of the bank supervisors of the other Member States.

The Second Banking Directive of the European Commission's programme for an internal market in banking could not ensure that banks were adequately capitalised to protect depositors. For this reason, it was linked to two complementary measures, namely the Own Funds and Solvency Ratio Directives. Moreover, a final provision in the Banking Directive stated that the concepts of mutual recognition and home country control could only come into effect if these two Directives were implemented at the same time. As stressed by Dixon (1993, p. 68), these Directives formed "a vital part of the harmonisation of prudential standards needed to complete the internal banking market". Two main reasons could be identified: the crucial role of capital adequacy for the protection of depositors and investors and for the stability of the whole banking system; and the need to harmonise capital ratios in order to ensure fair competition after 1992. In other words, capital adequacy was a core target and a fundamental instrument of banking supervision which, in turn, was concerned primarily with the prudential soundness of banking business. Gardener (1992) made three important observations on the relevance of capital adequacy: *i*) capital adequacy regulation is cyclical and tends to increase (become more severe or restrictive) when banking risks grow; *ii*) the main perceived economic objective of capital adequacy regulation is to help preserve the stability of the banking system; and, finally, *iii*) there has been and continues to be a re-regulation of capital adequacy in particular and supervision in general.

The provisions contained in the Own Funds Directive and the Solvency Ratio Directive (both effective on 1 January 1993) were consistent with those of the Basle agreement on capital adequacy implemented in July 1988, and they were similar in most important aspects, including the capital definition, the risk-weighting and the minimum ratio. The Basle (1988) proposals for convergence were the result of a long and continuing process of co-operation between the bank regulatory authorities in different countries. This process began in the early 1970s, and became urgent in the 1980s when the more risky environment and, in particular, the international debt crisis as well as the different capital adequacy regimes, brought about relevant competitive distortions in the banking market. All this led to international linkages among the UK, the US and other industrialised countries' bank supervisory practices. This interconnection was focused in the Basle Supervisory Committee, which has served as a forum for multilateral efforts to arrive at a convergence of capital adequacy standards among the leading industrialised countries [Norton (1992)].

The basic objectives of Basle include: *i*) to improve capital adequacy standards globally; *ii*) to stimulate greater consistency of capital standards; and *iii*) to encourage fairer competition. Modern banking systems regulatory frameworks are invariably modelled on the Basle 1988 international bank capital adequacy system of risk assets ratios. In the EU, for example, by 1992 banks were required to have a minimum capital to risk assets ratio of 8 per cent; moreover, the risk assets ratio approach comprised five categories of risk classes or "risk weight", and off-balance sheet items were also included in the formula.

By the beginning of 1993 all EU Member States had implemented the Second Banking Directive and related capital adequacy rules into their domestic banking legislation. However, significant barriers still remained to the formation of a single European banking market. A major barrier, of course, was that all countries still had their own national currencies. As part of the EU's on-going single market programme, the introduction of a single currency was viewed as a central element in the harmonisation process. As such, post 1992 substantial emphasis was placed on moving towards a single currency and European Monetary Union.

2.5 European Monetary Union and the Adoption of the Euro

The significant experience of the European Monetary System (EMS) and the sanctioning of the Single European Act (1986) both gave a concrete incentive to the process towards monetary integration.[5] From the late 1980s, the need for a stable monetary policy in Europe became more and more intense. Particular concern was also related to the potential economic impact that the possible realisation of a monetary union might have had on individual countries' economies. In this context, the problems of achieving a large consensus among participants about the main targets of monetary policy grew significantly.

In 1989, the Delors Committee completed a report and plan entitled *Economic and Monetary Union in the European Community*. On the basis of this report, which served as a background for the Maastricht Treaty, the monetary union and the economic union were to be achieved together as a result of a gradual process. The key features of the monetary union were laid down as follows: *a*) complete freedom of capital movements in fully integrated financial markets; *b*) total and irreversible convertibility

[5] In December 1978 a plan to implement a new monetary regime that would include all currencies of the Community was approved, and began operating in March 1979. The new zone of monetary stability was the European Monetary System (EMS), and it established a system of fixed parities with permitted fluctuations within a range of ±2.25%, and ±6% for those countries unable to keep their currencies in a narrower band. The EMS, whose key feature the Exchange Rate Mechanism (ERM) linked the member currencies to each other, changed strategies and procedures in the way of conducting monetary policy. Nevertheless, in Italy with the gradual removal of controls on capital movements and the loss of the exchange rate as an adjustment instrument, controls on the monetary aggregates became more difficult and monetary authorities had a major need to adjust interest rates. As a result, Italy experienced a substantial growth in public debt and an increase in net debt with foreign countries. The main real effect was a significant growth in consumption and a decrease in investments, which in turn brought about negative consequences in terms of productivity, employment and prices. During the first ten years the Italian lira participated within the ERM in wider fluctuation margins of 6% around bilateral central rates and only since 1990 has it adopted standard margins of 2.25%. However, in September 1992 the Italian lira was devaluated and had to exit the ERM. On 25 November 1996 the lira rejoined the ERM at the central rate of 1906.48 lire to the ECU.

of currencies; and *c*) irrevocably fixed exchange rates with no fluctuation margin between members' currencies.

At the Maastricht Summit in December 1991, the Member States adopted substantial amendments to the original 1957 Treaty of Rome. The main point was the decision to introduce EMU in the Union and to adopt the Euro as single currency no later than 1 January 1999.

The first stage began on 1 July 1990 and Member States had to abolish all remaining capital controls. It required also a higher co-operation among national central banks and underlined the need of a new Treaty to permit the realisation of an economic union. The second stage began on 1 January 1994, a few months after the coming into force of the Maastricht Treaty.[6] As a precursor to the European Central Bank, the EMI (European Monetary Institute) was created. Within the final stage, exchange rates between national currencies were to be fixed and a European central bank created. The transition to the third stage of the monetary union was made on the basis of a series of "convergence criteria", the objective of which was to establish an economic environment of sustainable low inflation in all the member countries and thus in the EMU.

On the basis of the Maastricht Treaty, the essential conditions to participate in the economic and monetary union are the following:

a) the level of prices must not exceed by more than 1.5 percentage points the inflation rates of the three best-performing Member States;
b) long-term nominal interest rates must not exceed by more than 2 percentage points those of the Member States that have achieved the best results in terms of stability of prices, that is with the lowest inflation;
c) the exchange rate must have been held for two years within the narrow band of fluctuation of the exchange rate mechanism of the EMS without a devaluation at the Member State's own initiative;

[6] The Maastricht Treaty came into force on 1 November 1993. It sanctioned the creation of the European Union (EU) and set the constitutional foundations of economic and monetary union.

d) the general government deficit, which includes the consolidated deficit of the central, state and local governments and the social security funds, must not exceed 3 per cent of GDP;

e) the ratio of public debt to GDP should be no higher than 60 per cent.

Preparation for the adoption of the Euro (see also the 1995 Green Paper on Introducing a Single Currency) has had a major influence on European banks. In particular, it has: *i*) forced banks to translate their accounting records and systems, monetary instruments and documentation of all kinds; *ii*) resulted in a re-drafting of legal rules in contracts; *iii*) forced banks to incur substantial costs associated with software conversion and adaptation; *iv*) led to changes in banks' hardware to accept and distribute new Euro notes (ATMs and counting machines); and *v*) increased staff training costs. In addition, many other potential and actual costs have been identified [see Molyneux *et al.* (1996)] from the cost of manufacturing, warehousing and distributing Euro-denominated notes and coins, to the organisation of efficient arrangement of cross-border payment and settlement.

The official decision on EMU membership was taken in May 1998. As stressed by ECB (1999b) the participation of 11 countries in EMU reinforced the significance of the Euro for the whole European banking sector. The Euro was adopted as a single currency on 1 January 1999 and will replace national currencies by 1 July 2002.[7] The 11 Euroland countries participating in EMU are the following: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Spain, and Portugal. Greece did not satisfy the conditions while Sweden failed to fulfil the condition with respect to Exchange Rate Mechanism (ERM) membership and lacked sufficient independence of its central bank. Denmark and the UK exercised their "opt-outs" from proceeding in 1999.

[7] The irrevocably fixed conversion rate between the Euro and the Italian lira is 1,936.27. It is important to mention that although Euro notes and coins will not appear until 1 January 2002, the new currency can be used by consumers, retailers, companies of all kinds and public administrations from 1 January 1999 in the form of "written money" (that is, by means of cheques, travellers' cheques, bank transfers, credit cards and electronic purses).

The above provides a brief overview of regulatory developments in EU banking culminating with the most recent developments – the creation of EMU and the introduction of a single currency. The following section provides a detailed account of regulatory developments in the Italian banking system starting with a historical perspective which illustrates how the regulatory structure evolved and ending on recent regulatory developments.

2.6 The Processes of Deregulation and Re-Regulation in Italy

2.6.1 The 1936 Banking Law

The Italian banking industry was strongly shaped by a Banking Act dating back to 1936, which approached and solved the banking crisis of the 1930s, assuming as its primary objective the safeguard of the stability of credit institutions.

The social and economic history of Italy had left it with a shortage of private capital willing and able to engage in banking. Prior to the 1930s Italy had experienced a succession of bank failures and financial crises, and the position deteriorated during the economic crisis of the 1930s. An intense process of reorganisation of banks' property had preceded the 1936 Banking Law. The newly-established IRI (*Istituto per la Ricostruzione Industriale*) in 1931 and its acquisition of the three major Italian banks implied the transfer of a large part of the banking system to the State. As pointed out by the Bank of Italy (1994), the Banking Law of 1936 was characterised by its "neutrality", because the supervisory instruments it provided for could be used to pursue any aim (stability, efficiency, economic planning, monetary policy).

This legislation was modified and integrated after the end of the Second World War, when decrees were enacted in order to authorise new institutions for the control of the banking and exchange markets. Few other changes were made in the succeeding years and, as a result, the 1936 Banking Act prevailed in Italy for about 50 years.

The fundamental principles of this regulation can be outlined as follows:

a. Specialisation of banks
b. Separateness between bank and industry
c. Structural controls
d. State dominance within the proprietary structure in the banking sector

The 1936 Banking Law classified ordinary credit institutions (retail banking institutions financed by the general public's deposits and mainly providing short-term loans) on the basis of their institutional specialisation (point *a.*) into national interest banks, public law banks, savings banks, co-operative banks, ordinary banks, and rural and artisans' banks. Moreover, lending institutions in Italy were segregated according to maturity (i.e. temporal specialisation). Banks were also classified into two categories according to which the credit activity in the short run was carried out by ordinary credit institutions (*Aziende di Credito*); whereas the credit activity in the long run, was carried out by different credit institutions, namely *Istituti di Credito Speciale*. As a result, there was a remarkable segmentation of the banking market, stratification of operating areas and weakening of competitive relations among different bank categories and among single banks within the same category. It is important to note that such distinctions did not exist anywhere else in Europe.

With regard to point *b.* above, the 1936 Act introduced rules that did not allow banks to invest in the equity capital of industrial companies, thus weakening the capacity of credit institutions to support industrial development. This was mainly due to the need to control and restrain risk contagion. Another factor that mostly influenced Italian banks was the extensive power that the Bank of Italy had to intervene in the structure of the banking system in the form of controls on branches and credit granting, mergers and acquisitions and the creation of new banks (point *c.*). As pointed out by Schuster (1996), from the point of view of regulation philosophy, one could say that the banking authorities have applied the classical Structure-Conduct-Performance (SCP) paradigm, thus strictly regulating the supply structure in order to influence sector performance. This set-up furthermore reduced the scope of strategic and entrepreneurial choices for banks and the industry structure was effectively administered as a variable external to the market.

Finally, post 1936 the State dominance within the ownership structure of Italian banks can be considered a consequence of the increased public intervention that followed economic crises during the 1920s (point *d.*). Most Italian banks became state-owned, either directly or under the control of charitable, non-profit-making foundations that were themselves government-supervised. At the end of the 1980s some 65% of financial intermediation was controlled by public banks; thus, a market of control for banking equity barely existed and bank management were highly constrained in making commercial decisions.

The following section 2.6.2 briefly reviews the banking policies carried out after the end of the Second World War in Italy and particularly during the governorship of Donato Menichella (1948-60). Such an *excursus* is important for three main reasons. First of all, during the 1950s the Italian economy experienced its most intense growth. In this context, the banking system was a major conduit for the expansion of credit to the economy. Secondly, the 1950s represented the first period where banking policies were conducted in an institutional environment that was subject only to minor regulatory changes. Lastly, the supervisory system during the 1950s contributed heavily to the inefficiencies that affected Italian banks for decades.

2.6.2 Italian Banking Policies in the 1950s and Beyond

Since 1947 the Bank of Italy officially became the national supervisory authority and obtained the right to employ the control instruments introduced by the 1936 Banking

Law.[8] Throughout the period of governorship of Donato Menichella (1948-60) the main objectives of the central bank were to ensure:

- the stability of the financial system, and
- the support of economic activity.

Post 1946 there was an urgency for post-war reconstruction and development of the domestic economy and this created a need for promoting economic activity by expanding credit to the economy through the banking system. Credit institutions were operating in an imperfectly competitive environment where there was little market-driven resource allocation. In this context, Menichella believed that money and credit were public goods and he considered their control and supervision as an exclusive task for the State.

Given this environment, Menichella supported the economy through policies that encouraged the accumulation and allocation of capital. The authorities targeted three main areas [Albareto and Trapanese (1998)]: *i*) encouraging monetary savings by carrying out a structural policy aimed at widening the geographical configuration of the system (branch banking) and a monetary policy that could ensure monetary stability; *ii*) restraining the cost of credit and giving a wider supply of capital through a monetary policy that advocated economic growth and the acceptance of banking cartels; and finally, *iii*) investing locally through savings and popular banks, and controlling the

[8] Article 47 of the Constitution of the Italian Republic reads: "The Republic shall encourage and protect saving in all its forms; it shall regulate co-ordinate and monitor the exercise of credit". This article is similar to article 1 of the 1936 Banking Law, which in turn reads: "The taking of savings from the public in any form and the exercise of credit are function of public interest [...]". It is important to note that there is no indication of the organ charged with these duties and it is not even clear whether the protection accorded to savings refers to nominal value or real value.

interbank market with the aim of avoiding savings flows from the southern regions to the northern ones.[9]

On the other hand, the stability of the banking system was pursued through the adoption of various structural policies and a range of control instruments that influenced the functioning of single credit institutions.[10] Since monetary savings were scarce, Menichella tried to create a solid banking system that was able to reach even the most remote centres of the country. The main objective was to increase the amount of bank savings without increasing deposit rates. Also, banks were given the task of selecting only those investments that were actually worthwhile to finance. The Bank of Italy could intervene through credit limits when banks were unable to give a fair evaluation of their investments.[11]

One of the most important targets of the banking policies of Menichella was the sustenance of local economic activities. Given the diffusion in Italy of small and

[9] As pointed out by Sutcliffe (1996), the government's pragmatic approach to the economy was based on a tradition dating back to the later nineteenth century. Its holding companies and controls over banking encouraged cartels and inefficiencies, but it guaranteed an adequate supply of capital to large companies and allowed them to build up a strong position in the home market before venturing abroad. The advent of Italian multinationals like Fiat, Olivetti and Pirelli can be considered one of the products of this policy.

[10] These instruments could be distinguished as instruments whose aim was to prevent the occurrence of a crisis and were thus related to the prevention (*ex-ante*) of liquidity and solvency problems for the whole system (i.e. they focused on banking areas like equity capital, credit limits, supervisory issues) and those instruments whose objective was to solve (*ex-post*) single pathological cases of crisis (and were thus concerned with cases of actual crises for single banking firms).

[11] In such a context, even the so-called "moral suasion", which can be defined as the way by which credit institutions were following the "suggestions" of the (Governor of the) Bank of Italy, had a pivotal role in the pursuit of macroeconomic targets during the 1950s. In fact, not only has the banking system played a fundamental role in the policy of supporting national development, but also in other type of policies such as those related to inflation control. The importance of moral suasion was probably connected to the deterrent power that the Bank of Italy was able to apply, given the wide supervisory powers granted by the 1936 Banking Law. It follows that "special collaborations" occurred between commercial banks and the central bank in the pursuit of specific macroeconomic targets (i.e. credit rationing, bank interest rates, and so forth). Overall, the moral suasion was useful to govern the economic process in a context of stability and was based on the fact that the Governor enjoyed immense political prestige and not only in the world of banking.

medium sized enterprises (SMEs) operating in a local environment, it was felt necessary to build a widely networked banking system so that firms could find the funds needed for their own activity. Therefore, a redistribution activity was also indispensable for the following reasons: *i*) to guarantee the equal distribution of savings; and *ii*) to allow excess savings to flow from the richest areas of the country to poorer regions in order to promote local economic activity. According to Menichella, an increase in the number of local banks rather than an expansion of large banks was necessary because small banks had a higher allocative efficiency coming from a better knowledge of local entrepreneurs and a better savings custody in a local environment (in this context local banks included: savings banks, popular co-operative banks and rural and artisans' banks).

The pursuance of these policies, however, had various drawbacks, among which was the creation of interbank flows from small to big banks and from southern to northern banks [Albareto and Trapanese (1998)]. In fact, although formally forbidden, interbank flows were often disguised in banks' accounts. The flows of these funds were usually from smaller banks operating locally to bigger banks which were often located outside the region. Interbank flows were also connected to the monetary flows from the south to the north of the country: that is from the poorest regions to the richest ones, in the opposite direction as Menichella was aiming. In fact, bigger banks that were usually borrowing in the interbank market tended to invest funds in the more profitable northern companies rather than in the south. In this way, the presumably insufficient branching structure of bigger banks was substituted by the indirect exploitation of very small local banks whose branches had particularly high bank deposits and savings rates.

The aforementioned factors have had a substantial influence on the present structure as well as performance of the Italian banking system [for an extensive review on banking policies in the 1950s, see Albareto and Trapanese (1998)]. For many years the resulting environment and bank practices in Italy have not provided substantive incentives to encourage efficient bank behaviour, in relation both to internal management (by restraining costs) and to the evaluation of the creditworthiness of customers.

Until the 1970s the entire system experienced a period during which banks concretely attained the monopoly of financial intermediation in Italy. In this context, the banking market was highly fragmented, banks were overspecialised and they were not allowed to hold stakes in industrial and commercial companies. As a consequence, Italian banks were thought more as public institutions carrying out social functions, rather than firms operating in order to maximise their profits. The whole banking activity was subject to the discretionary power of the authorities; there was no transparency in the market and massive controls existed on the movements of capital to and from abroad. In this context, even the central bank was obliged to act as a residual purchaser of Treasury Bills: that is the Bank of Italy was required to take into its own portfolio any government security not taken up by the market [see, for example, Costi (1994) and Pittaluga (1996)].

The prudential supervision of the Italian banking industry, whose purpose was to ensure stability in the system and to prevent banking crises, dominated structural control, which in turn aimed at ensuring the sound functioning of the market and a better allocation of resources. Entry and exit barriers imposed by the authorities on the banking system had, on the one hand, the positive effect of hindering competition, especially from abroad, thus giving stability and protection to the banks. On the other hand, they impeded a more efficient allocation of financial resources in the system.

2.6.3 The Process of Liberalisation of the Italian Banking System

The Italian financial system began to evolve in the late 1970s when the general economic conditions finally changed and the awareness of the costs of the previous policies started to become apparent. Two main determinants can be identified [Pittaluga (1996)]:

- the diffusion of a large market of Treasury bills, namely BOT (*Buoni Ordinari del Tesoro*) and CCT (*Certificati di Credito del Tesoro*)[12], and the simultaneous disintermediation of banks;
- the process of structural deregulation and a detailed re-examination of the supervisory policies in the banking system.

In particular, new financial products and new financial intermediaries in the market gradually encouraged banks to improve their efficiency and to become more market-oriented. In this context, other important factors have also played a significant role in the process of change of the Italian banking system.

The process of change in Italy began later compared with other European countries. Bruni (1993) asserts that the process of internal and external financial deregulation, re-regulation and innovation can be considered to have started only in 1983. Prior to 1983, only a few changes in financial regulation occurred: the gradual weakening of portfolio constraints (1979 and 1982), whereby banks were obliged to buy certain categories of bonds issued by public special credit institutions; and the so-called "divorce" between the central bank and the Treasury in 1981. This latter sanctioned the Treasury as primarily responsible for financing the public deficit, while the role of the central bank became to determine the amount of borrowing to be funded with monetary base. Moreover, in 1983, as a main consequence of the diffusion of financial

[12] The burden of a high public deficit induced the Italian authorities to pursue policies suitable for a country that was lacking both monetary and financial markets, and characterised by a high liquidity preference of savers. The government responded to this situation by issuing bonds whose main feature was their high substitutability with banking deposits. In 1977, the BOTs, short-term debt instruments issued in 3, 6, and 12-month maturities were issued to finance the deficits of the government. A few years later, in 1982, the Treasury issued the variable rate medium term CCTs in 7-year maturities. The main characteristic of CCT was that their yield was determined by fixing a mark-up on short-term rates, namely the 6-month maturity BOT. In addition, and as far as the funding of the banking system is concerned, the issue of marketable CDs (Certificates of Deposit) represented another innovation introduced in Italy, although the authorities required a higher percentage of reserve requirement on them with respect to other liabilities. On the other hand, firms seeking capital either provided it themselves through retained earnings or entered into special relationships with investment banks.

innovations and the deregulation process, various restrictions on bank lending were abolished.[13]

The first step towards a bank new regulatory framework in Italy was made in 1985, when Parliament finally approved the First European Economic Community Directive on Banking, issued eight years before.[14] Before this Directive, the EU enacted only one structural measure concerning Freedom of Establishment in 1973. This is shown in Table 2.3 that summarises Italian banking legislation adopted in Italy since 1973. Some legislation was implemented in phases and this is indicated by the shaded areas in the table (beginning and ending with the process of implementation).

As a consequence of this legislation, the freedom of access to the market was expanded (first attenuating and then substantially eliminating administrative barriers to entry and geographical segmentation), while the discretional powers of the central authorities decreased, although credit controls were removed in 1988 and the limitations on the opening of new bank branches were formally eliminated in 1990. With Law 287/1990, competitiveness in Italy became an autonomous objective together with stability and efficiency (which traditionally were assigned to supervisory authorities) on the protection of free and fair competition within the banking markets. In this context, the Bank of Italy was assigned the task of preventing conduct harmful to competition, preventing collusive or exclusionary practices and prohibiting amalgamations that diminish competition.

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[13] During the 1970s, given the peculiarities of the Italian financial system, it was very difficult for monetary authorities to control the money supply. In this context, monetary policy was based on the quantity of loans available rather than on the actual costs of borrowing. In other words, limits were introduced to the lending opportunities of credit institutions. In Italy, a credit ceiling was temporarily reintroduced only once to date (in 1986 and for approximately six months) [see, for details, Pittaluga (1996)].

[14] The pressures for deregulation came also from internal organisations, such as, for instance, Confindustria, the Italian Employers' Association and ABI, the Italian Bankers' Association. They maintained that inefficiencies in Italian banking were threatening the long-term viability of Italian manufacturing, and pointed to the risks of unsystematic *ad hoc* lending criteria and undisciplined loan-monitoring procedures. Also, the Bank of Italy tried to bring Italian banking practices into line with the rest of Europe.

Table 2.3 Deregulation Process in Italy[a]

		73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
Interest Rate Deregulation	CONDUCT																		F					
73/183 Freedom of Establishment	STRUCTURE	D		E																				
77/180 + 85/345 + 86/137 + 86/524 First Banking Directive	STRUCTURE					D		E						I										
83/350 Consolidated Surveillance	PRUDENTIAL											D		E	I									
86/635 Consolidated Accounts	PRUDENTIAL														D				E		I			
1988 Article 67 of the EEC Treaty Liberalisation of Capital movements	STRUCTURE											I							I					
89/117 Branch Establishment & Head Offices outside EU	STRUCTURE																P	D		E	I			
89/299 + 92/16 Own Funds Directive	PRUDENTIAL																P	D		E		EI		
89/646 Second Banking Directive	CONDUCT																P	D				EI		
89/647 + 91/31 Solvency Ratio Directives	PRUDENTIAL																P	D		D E		I		
91/308 Money Laundering Directive	CONDUCT																			D	E	I		
91/633 Modifications to 89/299 (Own Funds Directive)	PRUDENTIAL																			D	I	E		
92/121 Large Exposures Directive	PRUDENTIAL														R						D		EI	
92/30 Modifications to 83/350 (Consolidated Surv.)	PRUDENTIAL																				D E	I		
94/7 Modifications to 89/647 (Solvency Ratio)	PRUDENTIAL																						D E	
94/19 Deposit Insurance Directive	PRUDENTIAL																						D E	

[a] R = EU recommendation; P = EU proposal; D = EU directive; E = Official enactment deadline; I = Implemented into national law (shaded area indicates beginning and end of process of implementation); F = Interest Rates fully deregulated.

Source: European Commission (1997, p. 382).

The 1936 Banking Act was significantly altered by Law No. 218 of 30 July 1990 and its implementing legislation, the "Amato Act". This Act dealt with three main areas [Bisoni and Ferretti (1993)]: *i*) restructuring the public sector banks and increasing their equity capital; *ii*) encouraging bank mergers; and, finally, *iii*) regulating the polyfunctional bank group model [on this last issue, see for details Casu and Girardone (1998)]. The first point is particularly important because it allowed public sector banks to convert into joint stock companies, the form of corporation considered more suitable for the mobilisation of equity capital and, therefore, the most likely to facilitate private investment in bank shares. However, the Act stated that private investors might not hold more than 49 per cent of the capital, thus leaving the majority to the public sector.

There is no doubt that one of the aims of these measures was to improve the efficiency of the system by stimulating banks to cut costs (such as labour and other administrative costs), thereby increasing the overall profitability of financial institutions. In this context, the Amato Law provided fiscal incentives for internal reorganisation (privatisation) and for mergers (concentration) in order to relieve Italian banks from public constraints and to overcome the traditional segmentation of the system.

In 1992, the Legislative Decree No. 481 implemented the EU's Second Banking Directive (effective on 1 January 1993), whose most important aspect was the provision of a "single banking licence" (as discussed above). Although Member States were not obliged to remove any restrictions on the operations of their domestic banks by the Directive, this legislation encouraged deregulation and liberalisation, especially in those countries where credit institutions could be more discriminated and disadvantaged with respect to other countries (such as the United Kingdom, in which restrictions on the range of activities carried out by their banks had been removed before).

Following this Directive, Italy adopted the principle of mutual recognition, enabling other EU banks to operate in Italy on the basis of the authorisation received from the competent authority in the banks' home country (see Table 2.2 in section 2.3 for the list of activities covered by mutual recognition). In addition, banks were permitted to operate as universal banks, which enabled them to undertake activities in a wider range of businesses, such as financial instruments, factoring, leasing and merchant banking, that previously could only be carried out through subsidiaries.

Another important effect of the Second Directive on banking co-ordination in Italy was the option given to the banks to extend their operations beyond the short term, both in terms of funding and lending. Medium- and long-term funding was also allowed through the issuance of bonds; and the granting of medium- and long- term credit was authorised with the possibility of also operating in subsidised financing.

Moreover, the distinction between ordinary credit institutions and special credit institutions was abolished and Italian banks are now either:

- banks in corporate form owned directly and indirectly by the private sector or by public law foundations (controlled by local authorities);
- co-operative banks (comprising popular banks and credit co-operative banks);
- central institutions, which provide centralised management services to other, usually small-sized banks.

The new regulations allowed banks *de facto* to carry out directly activities that before were restricted to special credit institutions. As a consequence, the term specialisation and the distinction between banks and special credit institutions was abandoned; all entities operating in the credit segment were recognised under the single heading of credit institutions.

Several legislative acts as well as rules and provisions necessary for the adoption of the EU Directive were embodied in the Legislative Decree No. 385/1993. The "New Banking Law" [otherwise known as *Testo Unico delle Leggi in Materia Bancaria e Creditizia* and effective 1st January 1994)] consists of a set of statutory provisions dealing with many aspects of the banking system, like supervisory authorities, banks' activities and organisation, mergers and acquisitions (M&A) and banking groups, supervisory powers and crisis procedures. It also includes provisions concerning non-bank financial intermediaries (previously subject to the Law 197 of 5 July 1991), as well as rules on disclosure of terms and conditions of contract and consumer credit. Moreover, confirming the approach formerly adopted by the 1936 Banking Law, the *Testo Unico* only lays down general principles, assigning to the credit authorities the task of issuing secondary legislation specifying the technical details.

The *Testo Unico* was enacted pursuant to Italy's 1991 Community Legislation Implementation Law, which delegated powers to the government not only to transpose the Second Banking Directive but also to issue a codified law that would co-ordinate those implementing provisions with the other relevant provisions in force.

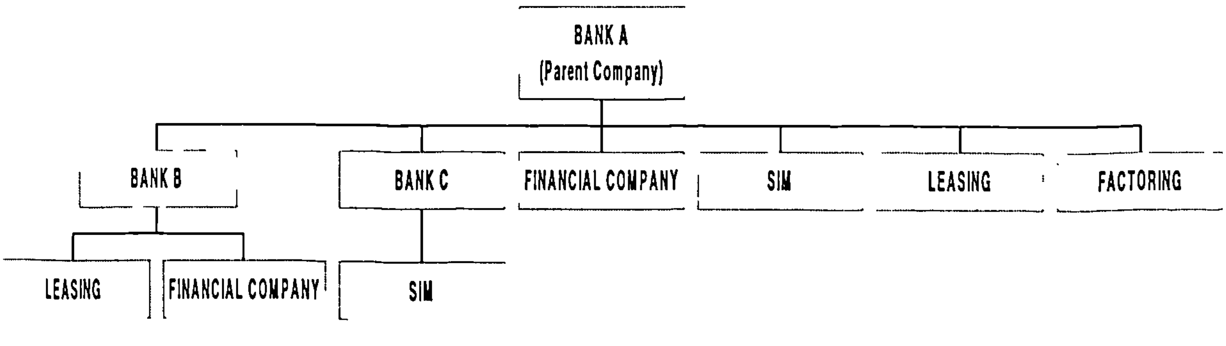
Some of the main features of the 1994 Banking Law can be summarised as follows.

- The supervisory authorities are the Credit Committee (Interministerial Committee for Credit and Savings) (art. 2); the Minister of the Treasury (art. 3); the Bank of Italy (art. 4);
- The aims of supervision (art. 5) are: *i*) the sound and prudent management of the persons subject to supervision; *ii*) the overall stability of the financial system; *iii*) the efficiency and competitiveness of the financial system; *iv*) compliance with the provisions concerning credit and *v*) the exercise of credit authorities' power "in harmony with the provisions of the EU" (art. 6). Prudential regulation now includes capital adequacy and permissible holdings, corporate organisation and internal controls.
- The law confirms the traditional notion of banking activity (art. 10) as well as the entrepreneurial nature of this activity (and it restricts it to banks). It allows the universal bank model. It also confirms the "despecialisation" of the banking system (i.e. the elimination of the regulatory segmentation that separated the various product markets which intermediaries were allowed to enter). (See also the Second Banking Directive provisions above).
- The law covers the organisational structure of banking institutions. In particular, banks can be constituted in the form of limited companies [*società per azioni* or a *società cooperativa per azioni a responsabilità limitata*] (art. 14); banks constituted as co-operatives may only be in the form of a *banca popolare* or a *banca di credito cooperativo* (see also the next section for more details on this issue).
- The law regulates banking groups and defines the aims of the supervision on a consolidated basis. The regulation of banking groups is among the most important

innovations introduced by the 1994 Banking Law. In particular, it includes specific rules concerning banking groups (supervision and consolidated balance sheet data)[15]. According to the Banking Law, a banking group shall be composed of either of the following: *a*) an Italian parent bank and the banking, financial, and instrumental companies it controls[16]; *b*) a parent financial company (having its registered office in Italy) and the banking, financial, and instrumental companies it controls where the group has a significant banking component.

More specifically, the typical structure of a group is defined as "vertical" and can be illustrated in Figure 2.2 [Casu and Girardone (1998)]. The definition of vertical group is related to the presence of a dominant parent company (Bank A in Figure 2.2) which is responsible for the management and the strategies implemented by all the other companies forming the group[17]. The parent company must be a bank or a financial company, thus excluding the possibility of an insurance company leading a banking group.

Figure 2.2 Possible Structure of an Italian Banking Group



Source: Casu and Girardone (1998, p. 4)

[15] See, respectively, Capo II/Titolo III and Capo II/Titolo IV of the Decree No. 385/93.

[16] Instrumental companies are defined as those which engage exclusively or primarily in activities of an auxiliary nature with respect to the business of companies belonging to the group, including real estate management, data processing and other services (see art. 59, 1994 Banking Law).

[17] It should be noted that SIM (Società di Intermediazione Mobiliare) indicates a company which is authorised to deal in the Italian Stock Exchange (Law No. 1/91).

Before concluding this chapter, it is relevant for the aims of the present thesis to clarify briefly important issues concerning the organisational structure of Italian banks, with particular attention to the actual role of joint-stock companies and co-operative banks in the context of the New Banking Law and subsequent Decrees.

2.6.4 Bank Organisational Structure in Italy

The privatisation of state activities usually differs from country to country and depends on various factors like: the fiscal needs of deficit-burdened governments; political discomfort with anything associated with market socialism; and the urgency to rationalise the financial sector in order to raise efficiency and to reduce the distortions occurring where public and private sectors coexist [Molyneux *et al.* (1996)]. In this respect, the motivation for the rapid privatisation programme of the Italian financial system was driven strongly by the state of budget finances and a number of other factors. In particular, the low levels of bank profitability, the capacity of the stock market, and the difficulties of establishing a suitable criterion for the transfer of bank assets from public into private hands [see, among others, Morgan Stanley (1995) and Molyneux *et al.* (1996)].

Italian banks' organisational structures have been particularly influenced by: *i*) "the Amato Law" (Law No. 218/90) and subsequent implementation decrees (i.e. Lgt. Decree No. 356/90) whereby all public banks adopted the joint-stock company form which in turn became the main legal form for exercising banking activity; and *ii*) Law No. 474/1994 and subsequent Directives, whereby some important banks previously held directly or indirectly by the Italian Treasury were subject to the public offering of shares representing the majority of votes. The objective of this latter was to create the conditions for a growing separation between foundations and controlled banks.

The 1994 Banking Law (art. 14) dedicates several of its Chapters to the organisational structure of banks. Banks constituted as co-operatives comprise the following two categories: *banche popolari* (co-operative banks), and *banche di credito cooperativo* (mutual banks, formerly called rural and artisans' banks). Institutions different from joint-stock companies and co-operative banks and which were created before 1993 were allowed to continue their banking activities (Legislative Decree 481/1992). While future legislation may consider new types of credit institutions (either public or private), according to the present law neither public nor private banks can create institutions that are different from joint-stock companies and/or co-operative banks.

In 1994 a new privatisation law, the "Dini Directive", was designed to dilute the ownership of foundations in the savings banks (*Casse di Risparmio*), allowing banks to raise outside capital and to pursue mergers. This explains why in the following years there has been a considerable transfer of banking ownership away from the State and regional foundations, thus accelerating also the pace of rationalisation within the banking industry. However, it has been argued [Inzerillo *et al.* (1999)] that among the main reasons for the slow process of consolidation in the savings banks sector is the low "contestability" of ownership rights, the high share of state-owned banks and the spread of forms of corporate governance which make any take-overs difficult.

Moreover, privatisation can be more difficult for local banks in comparison with larger banks. This is because local banks enjoy niche markets that render them less efficient from the perspective of selection and business conduct. Moreover, in Italy as in other European countries, a considerable number of public sector savings institutions are controlled by local or regional councils, which implies the nomination of Board members and sometimes executives, according to political criteria. These factors could be significant obstacles to change and, in particular, to privatisation. The fact that consolidation in Europe, unlike in the US, has not eroded the market share of small banks could be partly a result of many European savings institutions' being state-owned.

The more recent "Ciampi Law" (Law No. 461/98) is concerned directly with the legal *status* of banking foundations and was designed to give bank foundations the status of private juridical persons with unlimited independence in management and statutory matters. This legislation was hoped to facilitate savings banks transform their legal status from public institutions to private law foundations.

Overall and as a consequence of the privatisation programme boosted by the Amato Law, by the end of 1993 over 90 per cent of the banks previously acting as public foundations had become joint-stock companies. Despite this, only some 30 banks are publicly listed and more than 50 per cent of the banking system is still in public hands [see Resti (1998)]. The need for a gradual programme for the reduction of banking foundations (so as to avoid sudden changes in bank ownership and to ensure continuity and stability in the system) has also recently been emphasised by the Governor of the Bank of Italy [Fazio (1999)].

2.7 Conclusions

As shown throughout this chapter, the processes of structural deregulation and supervisory re-regulation in Italy have been fuelled by the issuing of important Banking Directives and Laws at the EU level in an attempt to create a single market for financial services in Europe. Indeed, the departure from the principles of the 1936 Banking Law (that is, banks' specialisation; separateness between banks and industry; structural controls; and state dominance within the proprietary structure in the banking sector) has represented a fundamental turnaround for the Italian banking system.

The reforms carried out during the 1990s have changed significantly the shape of the domestic banking system thanks to the progressive liberalisation programme: branching restrictions have been removed and specialisation requirements have been abolished. In addition, substantial advances have been made to alter the legal structure of Italian banks in order to facilitate privatisation and/or to promote a greater market orientation. The most relevant pieces of reforming legislation impacting Italian banks have been the following: the Amato Law (dealing with privatisation issues; M&As and banking groups); the Law implementing the EU Second Banking Directive; and the

Testo Unico (or "New Banking Law") that reorganised and codified most previous legislation.

The following chapter focuses on the consequences of these legal changes on the structure and performance of Italian banks.

Chapter 3

The Italian Banking Market: Structure and Performance

3.1 Introduction

This chapter explores the main changes in the structure and performance features of the Italian banking market. Section 3.2 investigates recent developments in the structure of the banking market, including M&A activity, market concentration and the recent privatisation trend. Section 3.2.1 investigates important competitive developments in the Italian financial system. Section 3.3 analyses other issues, such as the level of personnel expenses, non-performing loans and equity capital during the 1990s. The profitability of Italian banks will also be investigated in section 3.4, and section 3.4.1 explores the special role of mutual and co-operative banks in the Italian banking system. Section 3.5 is concerned with the way financial innovation and information technology have affected bank business strategies in recent years, focusing in particular on the development of new forms of payments media. Section 3.6 is the conclusion.

3.2 The Present Structure of the Italian Banking System

As noted in the previous chapter, the Italian banking industry was highly specialised for many years. However, the process of deregulation, together with the consolidation of activities within individual banks, has brought about the erosion of traditional differences between institutions.

Table 3.1 displays the structure of the more liberalised Italian banking system. At present, only the legal status co-operative banks (*banche popolari and banche di credito cooperativo*) and different types of shareholder structure provide any kind of distinction among categories of banks operating in the Italian market.

Table 3.1 Structure of the Italian Banking System: Number of Banks

Banks	1993	1994	1995	1996	1997	% change 1993-97
Limited company banks accepting short-term funds[a]	174	170	163	176	190	+9%
Limited company banks accepting medium and long-term funds[b]	46	35	34	33	32	-30%
Co-operative banks (popular banks)	100	95	96	80	69	-31%
Mutual banks (credit co-operative banks)[c]	671	643	619	591	583	-13%
Central credit and refinancing institutions	5	6	6	6	6	20%
Branches of foreign banks	41	45	52	51	55	34%
Total	1,037	994	970	937	935	-10%
New Registrations (Total)	23	25	53	40	42	83%
Cancellations (Total)	59	68	77	73	44	-25%

[a] Includes former public law banks, banks of national interest, savings and popular banks that changed their legal status following the Amato Law, and Monte dei Paschi di Siena, which changed its status from public law bank to limited company in July 1995.

[b] Includes former special credit institutions, which were abolished following implementation of the Second Banking Directive in 1993. Although there are no longer any legal distinctions between a limited company accepting short-term funds and medium- to long- term funds, the Bank of Italy kept the distinction in its Annual Reports, to ease comparison with older statistics.

[c] Includes former rural and artisans' banks.

Source: Adapted from Bank of Italy, *Annual Report*, several issues.

With the process of restructuring and, to a lesser extent, the increase in bank crises, the number of banks fell from 1,037 in 1993 to 935 by the end of 1997. From

1990 the total number of banks declined by a fifth: the largest decline was in the mutual bank sector whose numbers fell from 671 in 1993 to 583 in 1997. Compared with the number of institutions in other industrialised countries within Europe, Italy is still a country with a relatively large number of banks, as shown in Table 3.2.

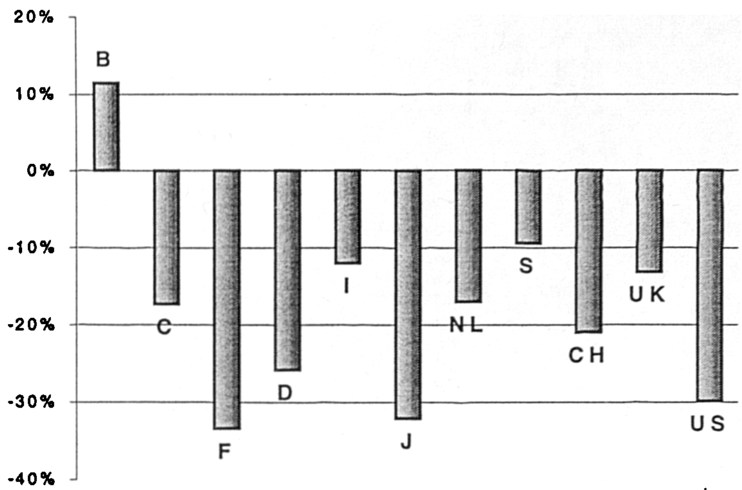
Table 3.2 International Comparison: Number of Banks

Countries	1993	1994	1995	1996	1997
Belgium	133	148	146	143	136
Canada[a]	2,721	2,644	2,553	2,497	2,413
France	630	627	613	547	519
Germany	3,893	3,730	3,617	3,509	3,409
Italy	1,037	994	970	937	935
Japan	5,619	5,287	4,929	4,635	4,266
Netherlands	130	128	127	126	127
Sweden	111	107	109	125	125
Switzerland	421	395	384	372	362
United Kingdom	578	591	565	561	553
United States[b]	25,749	24,720	23,958	23,123	22,331

[a] Deposit-taking institutions only.
[b] Includes commercial banks, thrift institutions (savings banks, savings and loan associations, co-operative and industrial banks) and credit unions.
Source: BIS, *Statistics on Payment Systems in the Group of Ten Countries*, Basle, several issues and Bank of Italy, *Annual Report*, several issues.

Figure 3.1 shows that, with the exception of Belgium, there has been a contraction in the number of credit institutions throughout Europe during the 1990s.

Figure 3.1 Variation in the Number of Banks (% Change 1990-1997)[a]



[a] B = Belgium; C = Canada; F = France; D = Germany; I = Italy; J = Japan; NL = Netherlands; S= Sweden; CH = Switzerland; UK = United Kingdom; US = United States.
Source: Bank for International Settlement, *Statistics on Payment Systems in the Group of Ten Countries*, Basle, several issues and Bank of Italy, *Annual Report*, several issues.

With regard to the number of branches (Table 3.3), by comparing the 1997 data with those of 1993 (when legal restrictions on opening new branches in Italy were eliminated), more than 3,000 new branches have been opened, with an annual increase of nearly 3.5%. Between 1990 and 1997 the total number of branches across the country increased by over 40% (in 1990 the total number of branches was 17,721). Moreover, as displayed in the table below, the incorporation of the Second Banking Directive into Italian law also appears to have influenced the growth in the number of foreign bank branches of EU banks with more than 60% increase between 1993 and 1997 (from 50 branches of foreign banks in 1993 to 82 in 1997).

Table 3.3 Structure of the Italian Banking System: Number of Branches[a]

Banks	1993	1994	1995	1996	1997	% change 1993-97
Limited company banks accepting short-term funds	15,826	16,535	16,621	17,524	18,026	+14%
Limited company banks accepting medium and long-term funds	124	119	95	86	98	-21%
Co-operative banks (popular banks)	3,896	4,045	4,239	4,163	4,357	+12%
Mutual banks (credit co-operative banks)	2,226	2,343	2,379	2,530	2,659	+19%
Central credit and refinancing institutions	11	8	28	28	28	+155%
Branches of foreign banks	50	70	78	75	82	+64%
Total	22,133	23,120	23,440	24,406	25,250	+14%

[a] See notes *a*, *b* and *c* to Table 3.1.
Source: Adapted from Bank of Italy, *Annual Report*, several issues.

In 1996, the eight largest Italian banks in assets size were (see also Table A3.1 in the Appendix):

1st	Istituto Bancario San Paolo di Torino
2nd	Banca di Roma
3rd	Banca Nazionale del Lavoro (BNL)
4th	Banca Commerciale Italiana (COMIT)
5th	Cassa di Risparmio delle Provincie Lombarde (CARIPLO)
6th	Credito Italiano
7th	Banca Monte dei Paschi di Siena
8th	Banco di Napoli

With average assets of nearly billions 223,000 lira at the end-1996, Italy's largest bank, the Istituto Bancario San Paolo di Torino ranked 52nd worldwide (BankScope ranking) and 29th in Europe [*The Banker* (1997)] in terms of total assets. Table 3.4

shows the European ranking of Italy's top banks. It can be seen that no Italian banks ranked in the top 20 European banks. Italy's eighth largest bank, Banco di Napoli, has a particularly low ranking (79th) following its very poor performance in 1996 (see Table A3.1 in the Appendix which shows some characteristics, including number of personnel and branches and world ranking, of these major Italian banks in 1996).

Table 3.4 Main Banks in Italy: European Ranking (1996)

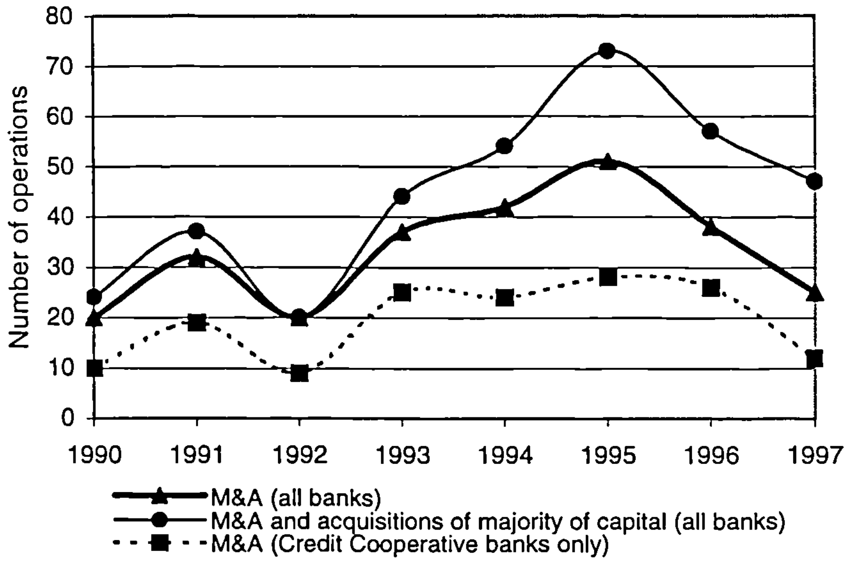
Banks	Assets annual % change	Top 500 European ranking	Tier I capital annual % change	Top 500 European ranking
CARIPLO	3.4	36	-2.9	25
San Paolo Torino	2.8	29	3.4	29
BNL	1.1	42	2.1	30
Banca di Roma	1.7	32	2.0	31
COMIT	10.6	37	0.3	35
Monte dei Paschi	4.7	48	1.1	40
Credito Italiano	7.4	40	10.1	46
Banco di Napoli	-15.0	79	-12.0	171

Source: Adapted from *The Banker*, Top European Banks Listing (1997, p. 40), September.

Figure 3.2 illustrates the restructuring activities in the form of mergers and acquisitions (M&As) that have been undertaken in the Italian market between 1990 and 1997. M&A activity rose on average from 27 deals per year in the early 1990s to 39 over the 1994-97 period. In addition, there has been a considerable increase in operations involving the acquisition of majority stakes, especially for banks based in the central and northern regions of the country. As in other European countries, the M&A trend became more intense in recent years as a consequence of growing competitive pressures [see, for example, Focarelli *et al.* (1999)].

The largest number of mergers occurred in 1995 (73 including credit co-operative banks) and in contrast to previous years consolidation did not involve only those banks experiencing distress. On the contrary, there was an increase in M&As involving sound and profitable banks: this phenomenon was linked to changes in the strategic rationale of banks that wished to improve operational efficiency and strengthen their branch networks [Bank of Italy (1995)].

Figure 3.2 Merger and Acquisition Activities



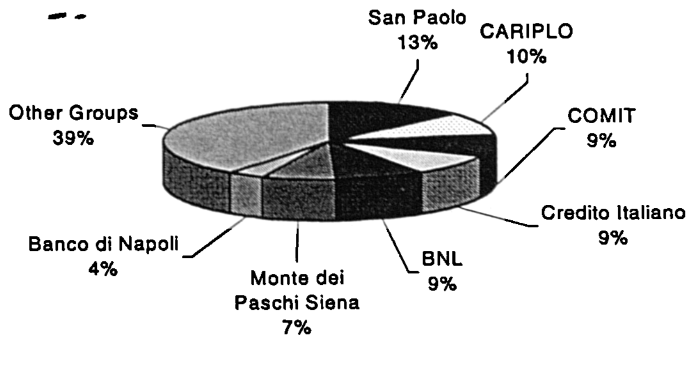
Source: Bank of Italy, *Annual Report*, several issues.

Although the M&As that were announced during 1997 and in the first quarter of 1998 involved primarily the largest Italian banks, these banks are still relatively small compared with their European counterparts. The Bank of Italy (1997) noted that this fact reflected Italy's lower ratio of gross financial assets to GDP and the comparative size of the economy. Including those operations carried out in the first quarter of 1998, the share of each country's five largest banking groups in the total banking assets of the fifteen members of the EU was estimated at 11% for Germany, 10% for France, 8% for the UK and 4% for Italy. The issue of domestic market concentration will be analysed later in this chapter.

With particular regard to the evolution of Italian banking groups, in 1997 there were 89 (68 in 1990) Italian banking groups – of which 23 were "large" groups (that is groups including more than 10 subsidiaries according to the official definition of the Bank of Italy). This growth can be viewed as part of the industry rationalisation and restructuring process that had been undertaken in recent years, as well as one of the responses of the Italian authorities to the challenge of increased competition within the Single European Market (SEM). The creation of banking groups has usually been motivated by the following: *i*) the possibility of exploiting scale and scope economies; *ii*) the capacity of the group to isolate risk from its different activities; *iii*) organisational flexibility; and *iv*) the facilitation of alliances with other businesses [Casu and Girardone (1998)].

The process towards consolidation in the industry is also reflected in the evolution of the consolidated total assets of the seven leading banking groups, as shown in Figure 3.3. It is important to note that 85% of total assets is concentrated within the first 20 groups. (Table A3.2 in the Appendix shows that with respect to the total, the first 7 major groups controlled more than 60% of total loans, 50% of equity capital and 45% of branches. These groups also controlled 56% of total deposits.

Figure 3.3 Total Assets Share for the 7 Major Italian Banking Groups (1996)[a]



[a] "Other Groups" includes a total of 43 banking groups (see also Table A3.2 in the Appendix to this chapter).
Source: BankScope and author's calculations.

As a consequence of the changes in the Banking Law allowing the formation of holding companies, 87 of the 935 banks operating in 1997 were owned by banking groups. These major groups also owned 142 auxiliary companies and 311 financial companies.

Table 3.5 illustrates the structure and dimension of the leading financial conglomerates at year-end 1997 in terms of number and characteristics of the companies forming the groups. It is possible to observe that the banking component (that is the share of banking activities controlled by banking groups) is usually relatively high among resident institutions. As pointed out by the Bank of Italy (1997), this share reached 87% in 1997.

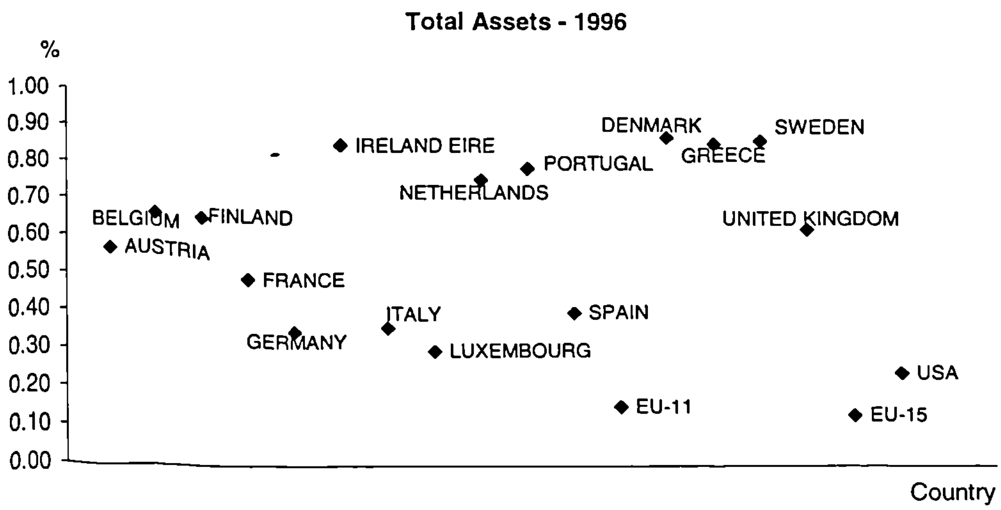
Table 3.5 Structure of Leading Italian Banking Groups

	Resident Institutions						Non-Resident Institutions		
Group	Banks	Financial	SIM[a]	Leasing	Factoring	Others	Banks	Others	Total
COMIT	3	1	1	1	2	6	10	35	59
San Paolo di Torino	2	3	3	2	1	9	5	29	54
Monte dei Paschi	5	-	1	1	1	8	6	24	46
BNL	5	1	2	4	2	7	8	10	39
CR di Roma	4	3	2	1	-	21	3	4	38
IMI	2	2	3	1	1	7	3	19	38
Credito Italiano	7	2	4	1	2	9	4	5	34
CARIPLO	9	1	2	1	1	10	3	3	30
Ambroveneto	2	1	4	3	2	8	1	-	21
Banco di Napoli	2	1	2	2	-	3	1	1	12
Banco di Sicilia	3	-	-	1	-	3	1	-	8
Banco Sardegna	2	-	-	1	-	4	-	-	7

[a] SIMs (*Società di Intermediazione Mobiliare*) indicates a company which is authorised to deal in the Italian Stock Exchange (Law No. 1/91).
Source: Associazione Nazionale Banche Private, *Struttura e dimensione dei gruppi bancari* (1997).

In order to evaluate possible trends in terms of the market structure in Italian banking, basic concentration indicators for EU countries and the US have been calculated using international data from BankScope (details on the sample used are given in Table A3.3 in the Appendix). Figure 3.4 shows the 5-firm concentration ratios across a range of banking markets in 1996. One can see that there is a lower level of concentration in France, Germany, Italy, Luxembourg, Spain and the US [see also De Bandt (1998)]. This means that with the exception of the UK, small countries such as, for instance, Denmark, Greece, Portugal and Sweden tend to have considerably higher degrees of market concentration. Similar patterns can be found in the levels of concentration calculated in terms of total loans, deposits, securities and off-balance sheet activities (see Figure A3.1 in the Appendix). Overall, while the Italian banking market has experienced substantial M&A activity, this does not appear to have resulted in a highly concentrated banking market – at least compared with many other European banking systems.

Figure 3.4 Market Concentration in European and US Banking (1996)[a,b]



[a] Share of the 5 largest institutions in total assets/liabilities held by credit institutions.
[b] The size of the banking market was calculated from the BankScope database.
Source: BankScope and author's calculations.

The increase in the number of mergers involving major Italian banks during recent years has been accompanied by the privatisation (partial or total) of state-controlled banking firms (see also the last section of Chapter 2). In many European countries the privatisation process, together with the political willingness to liberalise the banking systems in line with EU legislation, has represented a substantial impulse to the process of reshaping the structure of domestic banking markets, and has increased the contestability of bank ownership. The implications of a process of privatisation is important because it allows banks to become more market-oriented and helps them acquire greater flexibility in pursuing the strategies of their boards without state intervention.

However, the privatisation issue needs more accurate specifications. Although the term privatisation is generally used to cover sales of shares of all public institutions, in Italy not all public institutions are government-owned, although they can be deeply influenced by the government (such as in case of foundations regulated by special statutes). In other words, in Italy all the former public law banks[1] have now assumed the legal status of limited companies; however, these are still owned by public law foundations that have only disposed of small portions of their stakes in the banks.

Table 3.6 displays the main privatisations carried out in Italy over the period 1993-96.

[1] Until the implementation of Law 218/1990, public law banks included: *i*) Public Law Credit Institutions (*Istituti di Credito di Diritto Pubblico*, namely Banco di Napoli, Banco di Sicilia, Banca Nazionale del Lavoro, Istituto Bancario San Paolo di Torino, Monte dei Paschi di Siena, and Banco di Sardegna; *ii*) Savings banks and Pawnbrokers (*Casse di Risparmio* and *Banche del Monte*); and *iii*) Public Law Special Credit Institutions and Units (*Istituti di Credito e Sezioni di Credito Speciale di natura pubblica*) [see, for details, Costi (1994)].

Table 3.6 Main Privatisations in the Italian Banking Sector

Company	Period	Number of emplo-yees	Method of sale	% sold	Remaining public holding (%)	Comple-tion date of sale	Gross proceeds (billions of lire)
IMI (3rd tranche)	7.96-12.97	883 (1995)	Auction	6.93	1.13	8.7.96	501
IMI (2nd tranche)	1.95-5.96	917 (1993)	Auction	19.03	8.07	1.7.95	1,200
IMI	1.93-4.95	917 (1993)	Publ. Offer	33.00	27.82	1.2.94	2,180
Comit	1.93-4.95	17,997 (1993)	Publ. Offer	54.00	2.02	1.3.94	2,891
Credito Italiano	1.93-4.95	15,824 (1993)	Publ. Offer	67.00	1.99	8.12.93	1,829

Source: Bank of Italy, *Annual Report*, several issues.

The Bank of Italy (1997) notes that when taking into account all the M&As that have been implemented, banks and groups controlled by the state, local authorities and foundations account for approximately 25% of the total assets of the banking system, compared with 68% at the end of 1992.

3.2.1 Further Competitive Developments

Following the stages of banking sector development of banks as outlined by Rybczynski (1988), Italy is characterised by the bank-oriented rather than the market-based stage, because capital markets are still underdeveloped compared with other industrialised countries.[2] Traditionally, Italian security markets have been less developed compared with those of the UK and US despite: *i*) the development of a large bond market during the 1980s as a result of persistently high government deficits; and *ii*) the significantly high potential for securities markets, flowing from particularly high savings volumes [for instance, see Steinherr (1992); Canals (1993) and Howells and Bain (1998)]. With respect to point *ii*), Italian savings products have until recently been unsophisticated and only a small proportion of Italian savings has been professionally managed.

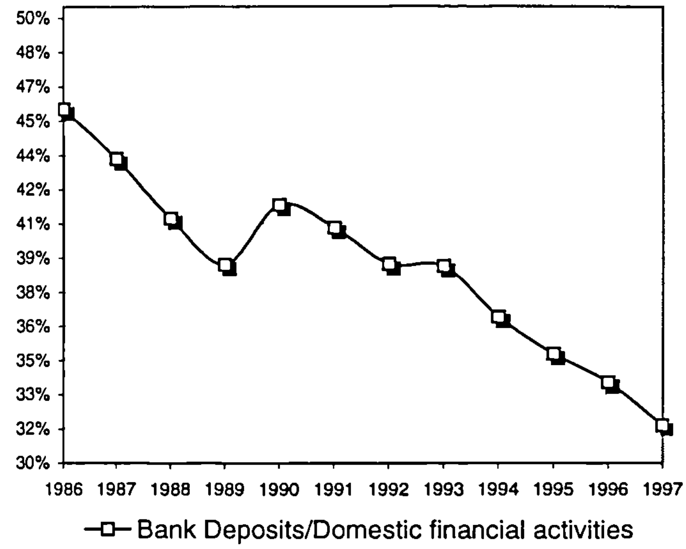
As pointed out by Pittaluga (1996), the inefficiency of capital markets in Italy depends on both supply and demand factors. As concerns supply factors, the focus is on the main features of the productive system: in Italy there is only a relatively small number of large firms and existing small and medium firms are generally owned by families, which rarely demand risky capital to finance their business. Another supply factor is represented by the fiscal legislation, which makes equity market financing of business more costly and less convenient compared with bank financing. In particular, the structure of Italian enterprises is characterised by: a relatively high leverage; low capital mobility; low monitoring mechanism (i.e. signalling) from capital markets on the quality of corporate investments; low preference for quotation of risky capital; a high preference for short-term debts; and a high fragmentation of credit lines [see, for instance, Zadra (1998)].

In the past, the demand factors that have hindered capital market development in Italy have related to the high liquidity preference of savers and the relative underdevelopment of institutional investors. This, however, has begun to change. Over the past few years the Italian financial system has been characterised by a considerable process of disintermediation as shown, for instance, in Figure 3.5: credit institution liabilities declined sharply relative to total Italian financial activities. This latter includes the financial claims held by the private sector and in particular liquid assets, medium

[2] The distinction between market-based and bank-based financial systems depends on whether firms generally obtain most of their finance from the issue of loans or securities. On this classification system, Germany and Japan are regarded as bank-based, while the UK and the US are regarded as market-based systems, with other developed European countries banking systems somewhere in between these two extremes, but these generally tending towards bank finance.

and long term securities (including repos), shares of investment trusts, and other financial activities (shares are not included).

Figure 3.5 Bank Disintermediation in Italy



Source: Bank of Italy, *Annual Report*, several issues and author's calculations.

The positive performance of financial markets and the contraction in new issues of government securities have helped to sustain a net flow of savings to institutional investors (including investment funds, portfolio management services, insurance companies, pension funds and securities firms), which reached record levels in 1997 [Bank of Italy (1997)]. Indeed, the increasing diversification of financial assets is quite recent in European financial markets and stems mostly from the following factors [Inzerillo *et al.* (1999)]: *i*) the reduction in actual and expected inflation, which has induced households to retain a higher share of long term assets in their portfolios and to accept a higher level of market risk; *ii*) the restructuring of state pension schemes, which has induced individuals to shift to the private sector; *iii*) advances in technology and the globalisation of financial markets, which has encouraged the development of a number of personalised products as a response to new customer needs; and, finally *iv*) technological innovations that have allowed a relevant reduction in transaction costs, thereby increasing profit possibilities related to portfolio renewals.

Table 3.7 details net fund-raising by institutional investors between 1994 and 1997. The table shows that over the whole period, investment funds recorded the highest growth (+505%), followed by portfolio management services and insurance companies (+152% and +106%, respectively).[3] The growth in institutional investors funds compares with the decline in total bank deposits (-5% over the four years) shown in Table 3.7.

Table 3.7 Institutional Investors: Net Fund-Raising and % Composition

	1994		1995		1996		1997	
	L.bn	%	L.bn	%	L.bn	%	L.bn	%
Investment Funds	23,667	26.4	-10,490	-42.6	58,226	42.5	143,377	52.5
Portfolio Mgt Services	32,875	36.7	2,019	8.2	50,457	36.9	82,970	30.4
Insurance Companies	21,355	23.9	28,334	115	29,772	21.7	43,960	16.1
Pension Funds	11,108	12.4	4,372	17.7	-2,118	-1.5	2,339	0.9
Securities Firms (SIM)	467	0.5	400	1.6	550	0.4	400	0.1
Total	89,472	100	24,635	100	136,887	100	273,046	100
Total Bank Deposits	923,371	–	935,199	–	912,740	–	882,278	–

Source: Bank of Italy, *Annual Report*, several issues and author's calculations.

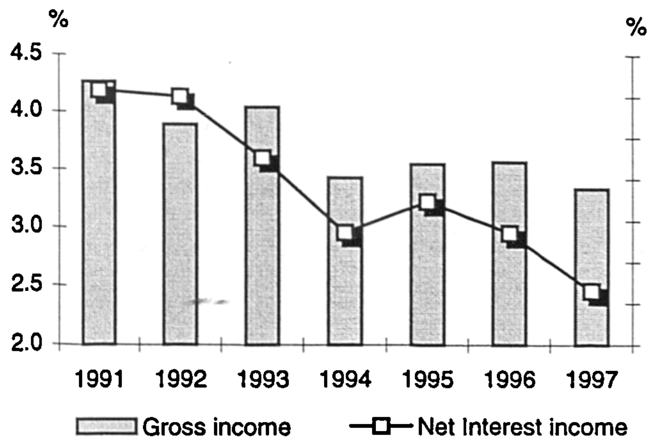
Over the last few years, therefore, there has been a decline in the level of traditional intermediation activity. Moreover, there has been a gradual reduction in the spread between lending and borrowing rates fostered by the downturn in the economy especially during 1993 and 1994. Indeed, the achievement of more competitive

[3] It is important to note that in 1995 insurance companies benefited from the fact that they were relatively unaffected by financial market turbulence compared with investment funds and other institutional investors.

conditions in the output market has brought about situations of crises.[4] For example, over the 1993-96 period the main banks in the south of Italy experienced such a drastic reduction in their net interest income that they were no longer able to cover the excessively high operating expenses and loan losses. As a consequence, many banks had to reduce their size and/or were acquired by more healthy (northern) banks.

In such a context, the reduction of bank interest margins has often been offset by the growing importance of non-interest income derived from securities trading and other services. (Figures 3.6 and 3.7, below). It has been argued [Inzerillo *et al.* (1999)] that the growing importance of non-interest income in virtually all banking systems in Europe confirms the commitment on the part of banks to become key providers of non-traditional financial services.

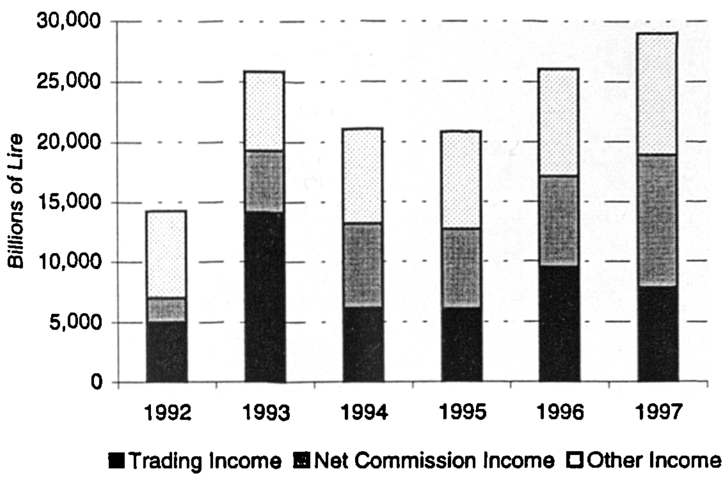
Figure 3.6 Interest Margin and Intermediation Margin (% of Total Assets)



Source: Bank of Italy, *Annual Report*, several issues.

[4] This is a consequence of the fact that when in a market where competitive conditions prevail and there is freedom of entry for new firms, we have excess capacity when there exists at least one firm attaining a lower level of profits than the "normal" one, i.e. the minimum required in order to stay on the market [Inzerillo *et al.* (1999)].

Figure 3.7 Other Net Income



Source: Bank of Italy, *Annual Report*, several issues and author's calculations

Increasing competition in the banking sector has forced many banks to offer their customers a wider range of higher quality services. To a certain extent, the increasing focus on non-interest income can be illustrated by the growth of the Italian derivatives markets in recent years. Interest-rate and currency swaps, financial futures, options for debt instruments, and forward-rate agreements are among the most common derivative instruments that provide a source of non-interest income as well as a means of covering risks in times of market instability.

By using derivatives, a bank can actually gain from operations off the balance sheet. In Italy, the growth of derivative markets between 1994-97 is shown in Table 3.8. In notional value terms, the Italian derivatives market has expanded nearly threefold over 1994 to 1997.

Table 3.8 Italian Market for Financial Derivatives Instruments[a]

FINANCIAL DERIVATIVES	1994	1995	1996	1997
Securities and Interest Rates Instrum.	826,892	935,000	1,623,551	2,598,359
Futures	*27,799*	*34,179*	*86,663*	*231,995*
Call Options	*25,168*	*47,365*	*92,156*	*120,762*
Put Options	*31,963*	*55,307*	*142,879*	*130,070*
Interest Rate Swaps	*445,117*	*632,668*	*1,011,417*	*1,618,246*
Forward Rate Agreement	*292,317*	*162,108*	*284,728*	*479,517*
Currency, Gold and Other Metals Instruments	149,533	194,770	191,268	235,706
Currency Swaps	*86,671*	*122,889*	*98,939*	*108,145*
Domestic Currency Swaps	*32,058*	*31,217*	*27,985*	*37,520*
Call Options	*12.007*	*15,453*	*28,414*	*38,279*
Put Options	*17,535*	*24,386*	*34,220*	*49,337*
Total	976,425	1,129,770	1,814,819	2,834,065

[a] Notional amounts at end year in billions of lire.
Source: Bank of Italy, *Annual Report*, several issues.

To summarise, the process of globalisation and increased integration between different economic systems has strengthened the securitisation process. Changes in the financial preferences of Italian consumers and the process of disintermediation in banking have also accelerated, thereby creating a shift of financial resources to institutional investors. In this context, the urgency for banks to reconfirm their central role in the financial system has increased sharply. Italian credit institutions have and are continuing to invest resources in order to be able to face the growing demand for new products and services, which in the past were traditionally associated with investment banks, brokerage houses and insurance companies.

3.3 Italian Banks' Productivity: Staff Costs

Recent studies of Italian banking [see, for instance, Di Battista *et al.* (1996)] have pointed to the need for an internal reorganisation of domestic credit institutions and, in particular, of their labour force. These studies maintain that despite recent developments, the Italian banking market is characterised by an extreme rigidity of the productive factors employed, especially in terms of their labour force.

As shown in Table 3.9, over 1993-97 the number of staff employed in the Italian banking sector decreased by only 5% (a decline of approximately 1.3% per annum). Moreover, as recently remarked by Inzerillo *et al.* (1999), Italian banks still have too high a proportion of staff costs to gross income (approximately 43%) compared with Germany, France and Spain (38% is an average indicator for these three countries). Inzerillo *et al.* (1999) argue that wider forms of profit sharing explain the high unit staff costs present in the Italian banking system (and in other Continental European countries) compared with banks operating in Anglo-Saxon countries where salary levels tend to be kept stable while staff numbers are more varied.

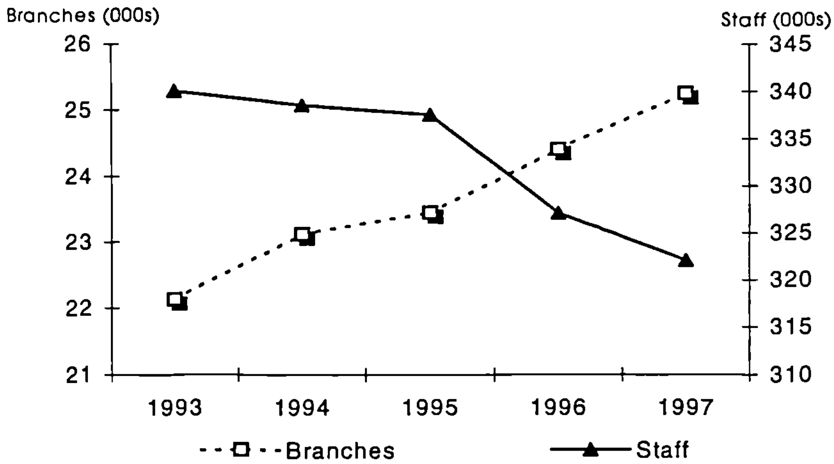
Table 3.9 Banks' Staff Numbers and Costs in Italy[a]

	NUMBER OF PERSONNEL	PERSONNEL EXPENSES	TOTAL ASSETS PER EMPLOYEE		STAFF COSTS PER EMPLOYEE	
			Current Prices	Constant Prices (base 1995)	Current Prices	Constant Prices (base 1995)
1993	339,949	34,769	6,618	7,246	103.6	113.5
1994	338,488	36,070	6,980	7,341	108.3	113.9
1995	337,456	37,133	7,133	7,133	111.4	111,4
1996	327,048	38,617	7,665	7,370	118.3	113.8
1997[b]	322,055	38,333	8,316	7,837	118.2	111.4

[a] Millions of lire.
[b] Provisional data.
Source: Bank of Italy, *Annual Report*, several issues.

The contraction in the number of bank personnel is shown in Figure 3.8. It is apparent that despite the growth in the number of branches, there has been a parallel decrease (in absolute terms) in the number of employees.

Figure 3.8 Italian Branch and Staff Numbers



Source: Bank of Italy, *Annual Report*, several issues.

Looking at the average number of personnel per bank branch over the period 1993-96, Table 3.10 shows that there has been a slight reduction for all bank sizes, geographical areas and bank types.[5]

[5] Data are drawn from the Bilbank sample that will be employed for the empirical analysis on the calculation of efficiency levels of Italian banks. The sample comprises an unbalanced panel of 1,958 bank observations distributed in the following way: 545 banks in 1993; 523 in 1994; 466 in 1995 and 424 in 1996. See, for details Chapter 5, section 5.6.

Table 3.10 Average Number of Personnel per Bank Branch[a]

		1993	1994	1995	1996
BY BANK SIZE[b]					
	Very Big	23	22	21	20
	Big	18	17	17	15
	Medium	15	14	13	13
	Small	15	15	14	13
	Very Small	10	10	9	9
BY REGION					
	North-west	13	12	11	11
	North-east	12	11	10	10
	Centre	12	12	11	11
	South and Islands	10	10	9	9
BY BANK TYPE					
	Commercial	17	16	16	16
	Savings	14	13	13	12
	Popular	13	12	12	11
	Credit Co-op.	9	9	9	8

[a] The sample is composed by 1,958 bank observations distributed in the following way: 545 banks in 1993; 523 in 1994; 466 in 1995 and 424 in 1996. Details can be found in Chapter 5, section 5.6.
[b] The Bank of Italy categorises banks according to five size groups: very big, big, medium, small and very small.
Source: Bilbank and author's calculations.

The Bank of Italy (1997) reckons that the aim of lower and more flexible costs in Italy is also being achieved by "re-engineering" production processes and outsourcing the activities most easily decentralised, such as the management of Information Technology (IT) systems and buildings, staff training and legal advice.

Staff costs in Italian banking contribute to over 60% of total operating costs and average labour cost is amongst the highest in Europe: roughly one-quarter higher than in France, one-third higher than in Germany and twice as much again as Britain. It is generally agreed that the Italian banking sector employs 15%-30% excess staff [Salomon Brothers (1996)].[6]

The policy implemented in Italy of gradual cost cutting was possible especially because of the slight increase in labour productivity (see, for example, the trend of total assets per employee in Table 3.9), however, as shown in Table 3.11, the ratio of staff costs/operating expenses for Italy over 1990-95 was always the highest compared with that of the other major banking systems.

Table 3.11 Staff Costs/Operating Expenses (%): International Comparison

	1990	1991	1992	1993	1994	1995
France	53.89	53.33	53.11	54.95	54.12	54.20
Germany	63.79	63.43	63.22	61.43	60.88	60.38
Italy	65.84	65.45	64.32	63.37	65.21	63.93
Spain	62.39	60.65	60.75	61.95	60.85	61.39
United Kingdom	56.89	55.35	54.64	55.16	56.04	55.80
United States	44.68	42.52	41.78	41.64	42.04	42.36

Source: OECD, *Bank Profitability* (1997), and author's calculations.

Summarising, despite the slight reduction in the number of staff employed in the Italian banking sector during the 1993-97 period, Italian banks still appear to have relatively high staff costs compared with their European counterparts.

[6] Salomon Brothers (1996) forecast that between 50,000 to 100,000 jobs would have to be cut in a fully liberalised and competitive Italian market, but this would require first of all political willingness because a reduction of personnel implies costs in the region of Lit. 60-70 million per employee (a minimum two-year compensation package). In addition, this cost would exceed the industry earnings' capacity, representing over 2% of reported equity and be almost impossible without the support of the unions.

3.3.1 Asset Quality and Equity Capital

During the 1990s, the deregulation process, technological innovation, the diversification of customer portfolios, changes in economic policies and the economic recession brought about an important transformation in banks' activities. In particular, over the last few years there has been a worsening in the quality of Italian banks' lending activities.

Non-Performing Loans (NPLs) in 1991 were equal to about 5% of total loans, whereas in 1997 this percentage had almost doubled (Table 3.12). Specifically, the level of NPLs in Italy showed a dramatic upward trend over 1991-96 and started to diminish (only slightly) in 1997. It is important to mention that these figures might be misleading because banks in the south of Italy are generally far worse off, from an asset quality point of view, than their northern counterparts. In fact, the NPLs to total loans ratio reaches over 25% among southern Italian banks. During 1997 there appears to be some evidence of improvement, however loan losses are still relatively high.

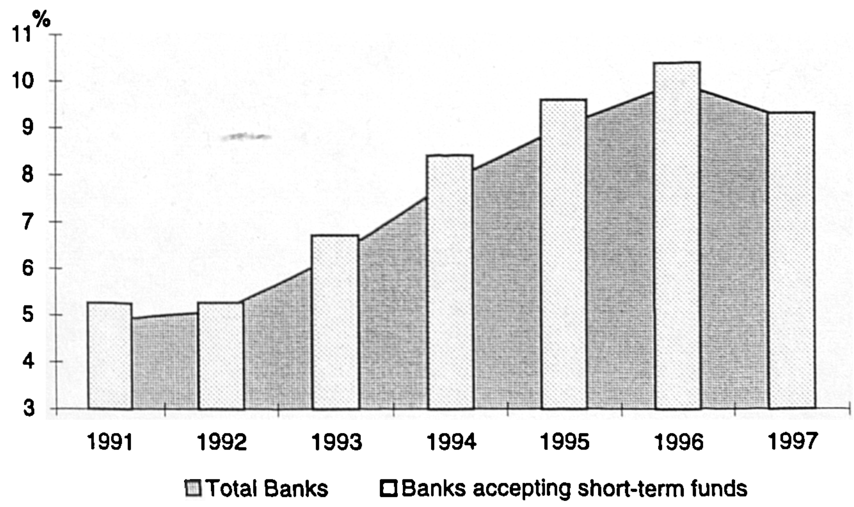
Table 3.12 shows Bank of Italy data that distinguish between all banks and banks accepting short-term funds (as with the former Italian banking Law). One of the features of these latter banks is that they usually lend to small and medium-sized enterprises. From Table 3.12 it appears that banks accepting short-term funds have always had comparatively higher NPLs.

Table 3.12 Italian Banks' Asset Quality[a]

	Banks accepting short-term funds			Total Banks		
Years	Total loans	Total NPLs	NPLs / Net loans 1991=100	Total loans	Total NPLs	NPLs / Net loans 1991=100
1991	750,940	39,502	100	947,310	46,472	100
1992	884,918	46,659	100.2	1,070,264	54,448	103.7
1993	933,703	62,771	127.5	1,165,854	73,046	123.2
1994	957,510	80,532	125.1	1,195,448	94,054	125.6
1995	1,027,871	98,669	114.1	1,261,643	114,050	114.9
1996	1,058,197	109,936	108.2	1,283,269	127,868	110.2
1997	1,138,441	106,000	89.6	1,364,213	124,899	91.9

[a] "Banks accepting short-term funds" do not include medium- and long- term credit institutions (as with the former Italian Banking Law).
[b] Unless otherwise stated, data are in billions of lire.
Source: Bank of Italy, *Annual Report*, several issues.

Figure 3.9 Italian Banks' NPLs/Net Loans



Source: Bank of Italy, *Annual Report*, several issues.

The growth of bad debts has stimulated a wide debate among researchers.[7] Recent studies [see, for instance, Morelli and Pittaluga (1998)] have shown that the acceleration of NPLs in Italy has primarily been determined by cyclical factors and not by a worsening of the screening and monitoring activities of banks. In particular, the growth in NPLs has been fuelled by the size and extent of the economic recession that affected the country especially during the early 1990s, and mainly in the southern regions.

Table 3.13 reports the ratio of NPLs-to-total loans for different bank sizes and type, while Figure 3.10 shows how non-performing loans differ for banks based in various geographical regions of Italy (the Bilbank sample is detailed in Chapter 5, section 5.6).

Table 3.13 Italian Banks' NPLs/Total Loans (by Bank Size and Bank Type)[a]

		1993	1994	1995	1996
BY BANK SIZE[b]					
	Very big	2.94%	3.78%	4.38%	5.65%
	Big	3.75%	4.56%	4.92%	4.89%
	Medium	3.95%	5.13%	4.91%	5.48%
	Small	4.46%	5.65%	5.35%	5.53%
	Very Small	5.50%	6.00%	5.69%	5.50%
BY BANK TYPE					
	Commercial	4.72%	5.83%	5.59%	5.30%
	Savings	4.55%	5.53%	5.35%	5.52%
	Popular	5.57%	6.19%	5.85%	5.52%
	Credit Co-op.	5.40%	5.83%	5.54%	5.38%

[a] The sample is composed by 1,958 bank observations distributed in the following way: 545 banks in 1993; 523 in 1994; 466 in 1995 and 424 in 1996. Details can be found in Chapter 5, section 5.6.
[b] The Bank of Italy categorises banks according to five size groups: very big, big, medium, small and very small.
Source: Bilbank and author's calculations.

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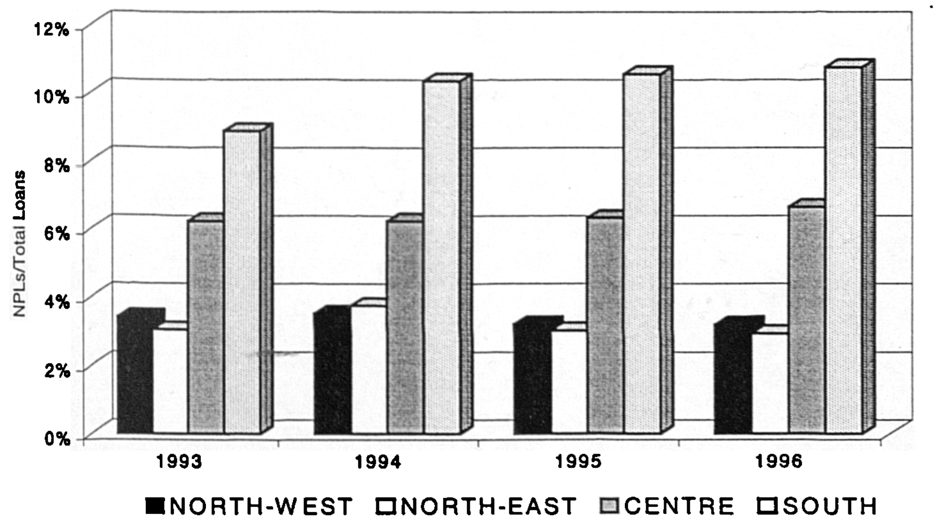
[7] As it will be discussed in the following chapter, bad debts are a common cause of bank failure in that they are likely to have repercussions on the relationship between banks and enterprises, on their respective balance sheets and, broadly, on supervisory policies. When a failing bank reports large loan losses, this often comes as a shock to shareholders, depositors, regulators and bank analysts because the bank concerned had not set aside adequate provisions against possible loan defaults.

It is important to recall that the manufacturing industry of southern Italy is characterised by a strong presence of small firms [see, for details, Ferri and Messori (1998)]. One might expect to find a wide range of small and medium sized local banks able to engage in long-term relationships with such customers.[8] This should enable banks to better select and monitor their customers, thereby reducing their credit risk. In practice, a significant number of large sized banking groups have recently entered the market in order to save local banks facing structural crises. These "rescues" have also brought about the process of acquisition of local southern banks by medium to medium and large banks from the centre and, especially, the north of Italy. The latter, therefore, had to bear high operating and fixed costs related to the acquisition of banks in crises.

Figure 3.10 Banks' NPLs/Total Loans (by Geographical Region)



Source: Bilbank and author's calculations.

[8] Nonetheless, as stressed by Generale and Gobbi (1999), in the south of Italy the benefits deriving from long term customer relationships are usually offset by the adverse local economic conditions.

One of the most relevant issues as to the underlying reasons for the increase of bank NPLs in Italy seems to be related to the low allocative and operating efficiency of a relatively segmented loan market, unable to signal with efficient prices (rates of interest) the quality of borrowers and thus to allocate saving flows [see, for instance, Zadra (1998)].[9]

The relationship between margins, capitalisation and growth has become one of the primary concerns for banks seeking to make the right strategic choices in order to optimise their risk management. Table 3.14 shows the equity-to-assets ratio by banks' size, and geographical areas. Figure 3.11 shows graphically the differences in the level of capitalisation by bank type.

As discussed earlier in section 3.2.2, very small co-operative banks show the highest equity to assets ratios (around 10% as an average for the four years). Moreover, in the south, despite the high level of NPLs, the level of bank capitalisation appears to be relatively low.

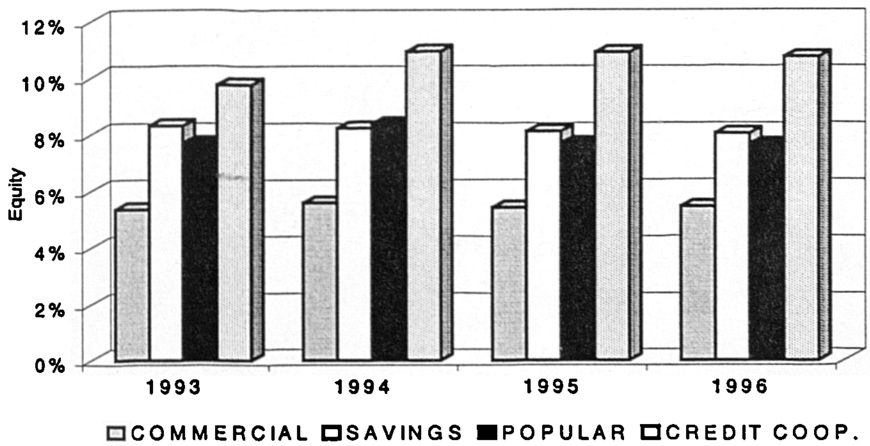
[9] The joint effects of a profound transformation in the operating environment (i.e. deregulation, despecialisation, liberalisation and European integration) and the slowdown in productivity have been amplified by the particular financial structure of domestic enterprises. This situation can be explained in the following way. Traditionally in Italy the weaknesses of the capital market have been offset by bank credit as the main financing instrument. As discussed in the previous chapter, the system has also been highly segmented (i.e. regulations distinguishing between short and long term debt) for decades, thus increasing risk assessment costs. With regard to the domestic industrial system, Italy is characterised by a high number of small and medium sized firms and by a low number of large firms, thus limiting share quotations. Moreover, the high corporate income taxes tend to encourage a high financial leverage. Finally, in Italy banks are often small in size (i.e. local co-operative banks) compared with the enterprises they finance so these latter are forced to finance themselves using more than one bank. This peculiarity of the Italian market structure has two main effects: on the one hand it allows banks to partially ensure themselves against the risk of default from the borrower (by the sharing of the risk with other banks). On the other hand, it forces banks to virtually "underprice" their loans [see Zadra (1998)].

Table 3.14 Italian Banks' Equity/Total Assets (by Bank Size and Geographical Region)[a]

		1993	1994	1995	1996
BY BANK SIZE[b]					
	Very big	5.3%	5.5%	5.4%	5.6%
	Big	6.2%	6.2%	5.7%	5.5%
	Medium	7.3%	7.8%	7.6%	7.5%
	Small	8.7%	9.5%	9.2%	9.0%
	Very small	9.2%	10.2%	10.2%	10.0%
BY REGION					
	North-west	6.1%	6.5%	6.2%	6.1%
	North-east	8.4%	8.6%	8.2%	7.8%
	Centre	6.4%	6.2%	6.0%	6.3%
	South	5.3%	5.6%	5.4%	5.4%

[a] The sample is composed by 1,958 bank observations distributed in the following way: 545 banks in 1993; 523 in 1994; 466 in 1995 and 424 in 1996. Details can be found in Chapter 5, section 5.6.
[b] The Bank of Italy categorises banks according to five size groups: very big, big, medium, small and very small.
Source: Bilbank and author's calculations.

Figure 3.11 Banks' Equity Levels (by Bank Type)[a,b]



[a] The sample is composed by 1,958 bank observations distributed in the following way: 545 banks in 1993; 523 in 1994; 466 in 1995 and 424 in 1996. Details can be found in Chapter 5, section 5.6.
[b] Percentage of total assets.
Source: Bilbank and author's calculations.

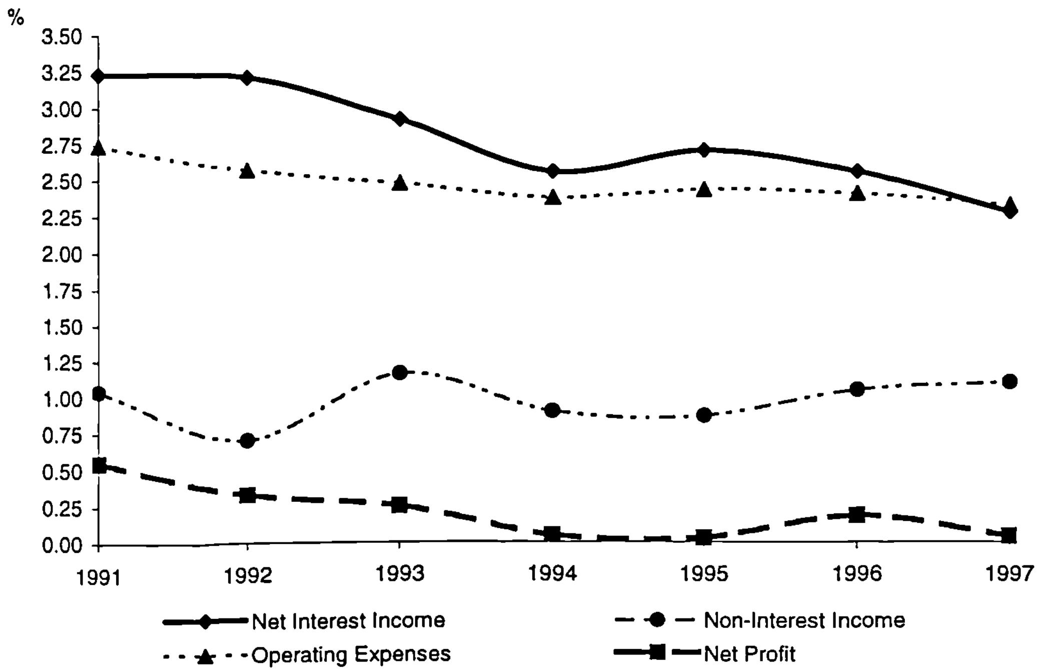
3.4 Profitability of Italian Banks

The strategy of expansion followed by leading Italian banks, the substantial growth in bad loans, the poor state of many of the banks acquired and the long lead-time before the consolidation process produces the results expected, has brought about a considerable shrinking of interest and intermediation margins in Italian banking.

Figure 3.12 charts the general trends in performance of Italian banks for the period 1991-97. Data on income, expenses, provisions and profits (as a percentage of average balance sheet totals) are displayed in the chart, from which it is possible to observe that bank income and profits have declined during the 1990s despite the increase in non-interest income as a percentage of total assets.

Banks' profits are heavily influenced by the interest rate environment as well as cyclical factors, in addition to banks' own actions. Deregulation and increased competition have also influenced banks' interest income. The Bank of Italy (1995) reckoned that the strategy of expansion of the banks during the early 1990s contributed to the decline in profit margins. Other factors that have also tended to shrink profit margins include the pattern of the demand for funds and increasing competition in the Italian banking market over recent years.

Figure 3.12 **Italian Banks' Income, Expenses and Profits (% of Total Assets)**



Source: Bank of Italy, *Annual Report*, several issues.

Trends in Italian bank incomes and costs are shown in Table 3.15. The table shows substantial differences in performance between banks across the regions of Italy. In particular, banks based in the north tend to have higher income and positive profits; and they also have lower expenses, especially in terms of overall staff costs.

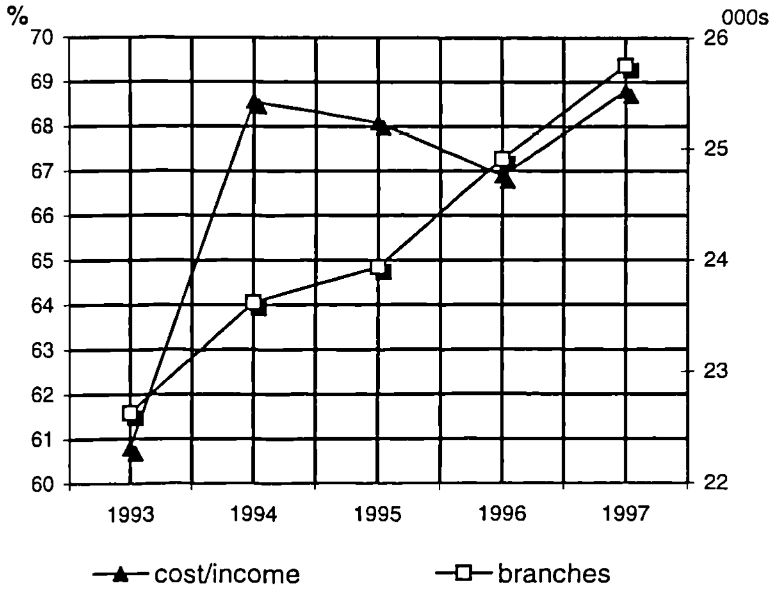
Table 3.15 Italian Banks' Profit and Loss Accounts by Geographical Region (% of Total Assets in 1996-97)

	NORTH-WEST		NORTH-EAST		CENTRE		SOUTH + ISLANDS	
	1996	1997	1996	1997	1996	1997	1996	1997
Net Interest income (a)	2.36	2.02	3.15	2.79	2.35	2.14	2.81	2.83
Non-interest income (b)	1.09	1.13	1.22	1.28	0.92	0.95	0.79	0.92
securities and foreign ex trading	0.40	0.25	0.44	0.38	0.32	0.29	0.35	0.38
services	0.34	0.50	0.42	0.53	0.21	0.27	0.18	0.23
Gross income (c=a+b)	3.45	3.15	4.37	4.07	3.27	3.09	3.60	3.75
Operating expenses (d)	2.24	2.16	2.69	2.57	2.21	2.17	3.02	2.89
staff costs	1.43	1.34	1.67	1.55	1.45	1.40	2.02	1.86
Net income (e=c-d)	1.21	0.99	1.68	1.50	1.06	0.92	0.58	0.86
Value adjustments, readjustments and allocations to provisions (f)	0.63	0.44	0.59	0.41	0.62	1.31	1.31	0.73
Profit before tax (g=e-f)	0.58	0.55	1.09	1.09	0.44	-0.39	-0.74	0.14
Tax (h)	0.31	0.27	0.55	0.50	0.24	0.23	0.21	0.17
Net profit (g-h)	0.27	0.28	0.54	0.59	0.20	-0.62	-0.95	-0.03

Source: Bank of Italy, *Annual Report*, several issues.

The trend in cost-to-income ratios for the Italian banking sector between 1993 and 1997 is shown in Figure 3.13. The average value of cost-to-income ratio is 66.6%, hitting a peak of 68% in 1997. The upward trend in the cost-to-income ratio can be explained by several factors. In particular, among the most important factors can be found the adverse effects of the business cycle, the creation of banking groups (that temporarily inflates banks' cost structures), and the substantial increase in branch numbers during the 1990s.

Figure 3.13 Italian Banks' Cost/Income Ratio and Branches

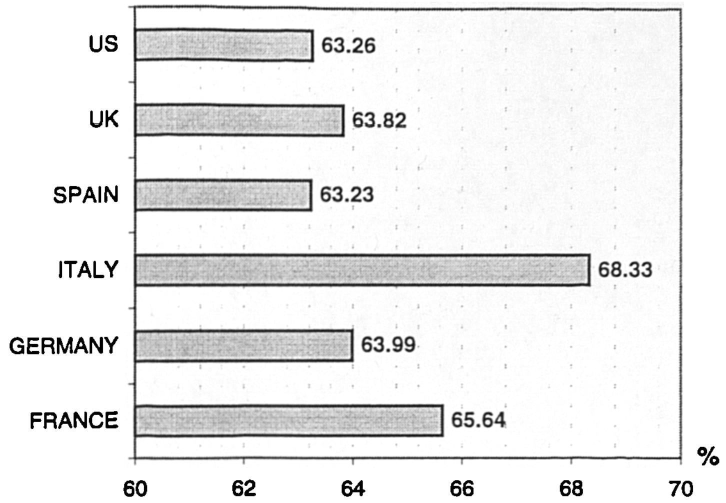


Source: Bank of Italy, *Annual Report*, several issues and author's calculations.

Figure 3.14 compares the cost-to-income ratios for banks in various other European countries and the US for 1995. Italian banks, on average, had the highest cost ratios.

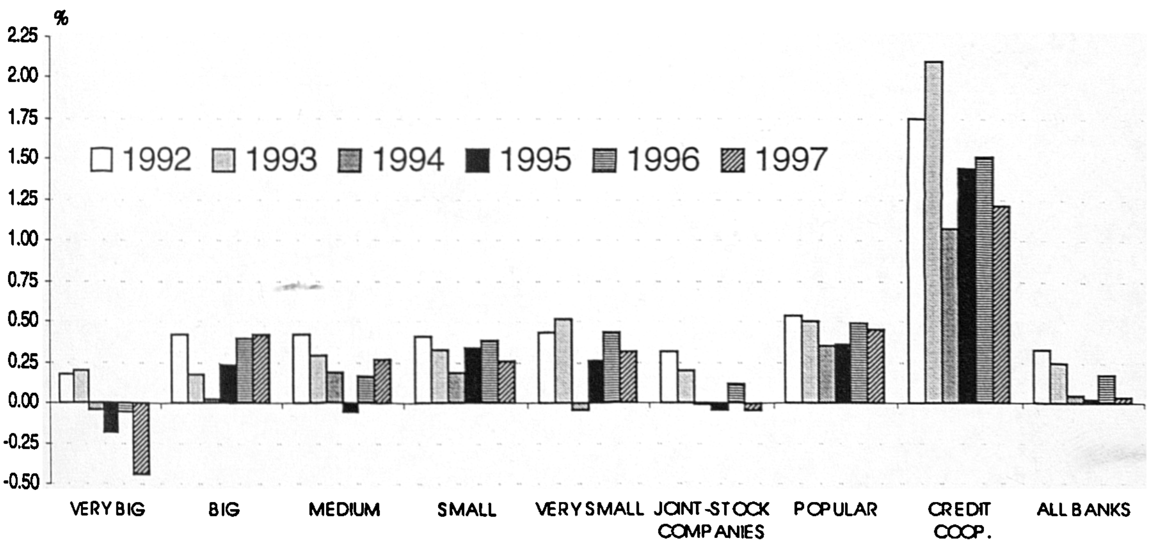
As discussed above, profitability in the Italian banking sector has followed a downward trend since the beginning of the 1990s. Figure 3.15 displays the ROA of the sector over the period 1992-97. It shows that co-operative banks have been the most profitable types of banking institutions. The figure also shows that since 1994 the least profitable banks have been the largest banking institutions.

Figure 3.14 Cost/Income Ratio: International Comparison with Selected Countries (1995)



Source: OECD, *Bank Profitability* (1997) and author's calculations.

Figure 3.15 Italian Banks' ROA[a,b,c]



[a] Ratio calculated as Net Income/Total Assets.
[b] The Bank of Italy categorises banks according to five size groups: very big, big, medium, small and very small.
[c] The groups of joint-stock and co-operative banks are defined in Table 3.1.
Source: Bank of Italy, *Annual Report*, several issues and author's calculations.

The relatively low level of profitability for Italy's largest banks is (to a certain extent) confirmed in Table 3.16 that illustrates return on equity (ROE) for the banking sector. Overall, joint-stock companies posted poor returns between 1994-97 with the (mainly small) credit co-operative banks being the most profitable. It should be noted that both reported values of ROA and ROE for the top banks and the average for the system, overall could have been largely affected by the financial crisis of Banco di Napoli, which suffered substantial losses over the period, especially in 1994-95. Nevertheless, returns in Italian banking during the latter half of the 1990s have remained relatively low.

Table 3.16 Italian Banks' ROE (by Bank Size and Bank Type)[a]

	1994	1995	1996	1997[b]
Very big, big and medium- sized banks	0.4	-0.3	2.4	-
Small and very small banks	3.4	6.3	7.0	5.2
Limited Company Banks raising short-term funds	-0.5	-0.3	2.2	-0.5
Limited Company Banks raising medium- and long- term funds	2.4	0.8	2.3	2.0
Co-operative banks (popular banks)	3.4	5.4	7.4	6.6
Mutual banks (credit co-operative banks)	9.5	14.0	13.8	10.5
All banks	1.2	1.6	3.8	1.6

[a] See also notes *a*, *b*, and *c* to Table 3.1 for details on different size and type categories.
[b] Provisional data.
Source: Bank of Italy, *Annual Report*, several issues.

Finally, the differences in bank performance across the regions of Italy are still marked. Table 3.17 shows the substantial fall in performance of southern banks during 1995-96 although this seems to have been slightly reversed by 1997. The table also shows the differences in the amount of supervisory capital set aside by banks across the regions. At present, the minimum solvency ratio is 8% (as in the BIS rules) for banking groups and banks not belonging to banking groups, and 7% for individual banks belonging to banking groups.

Table 3.17 Selected Performance Indicators for Italian Banks by Geographical Region[a]

	1995		1996		1997	
	Centre and North	South	Centre and North	South	Centre and North	South
Net income	27,971	2,071	30,769	1,760	27,914	2,494
Charges for loan losses	10,347	5,436	8,902	2,394	11,889	2,249
ROE (%)	4.8	-33.2	5.4	-12.5	1.7	0.3
Allocations to supervisory capital	5,518	-4,791	6,931	-2,534	846	-91
Supervisory capital	177,854	17,732	186,185	16,476	194,214	18,023
Solvency ratio (%)	13.4	11.5	13.2	10.6	12.5	14.6

[a] Amounts in billions of lire unless otherwise stated.
Source: Bank of Italy, *Annual Report*, several issues.

3.4.1 The Role and Performance of Co-operative Banks

Previous sections have noted that co-operative and mutual banks have been among the most profitable institutions operating in the Italian market. Today, there are still many banks in Italy that are classified as very small (*banche minori*) in the form of co-operative (*banche popolari*) and mutual (*banche di credito cooperativo*) bank ownership (see Table 3.1 in section 3.2). During the 1990s these banks have even increased their market share, as illustrated in Table 3.18 below (see Chapter 2 for the legal status of co-operative banks).

Table 3.18 Market Share of Italian Co-operative and Mutual Banks

	Popular (Co-operative) Banks		Credit Co-operative (Mutual) Banks	
	Loans	Deposits	Loans	Deposits
1992	10.5	15.8	0.30	0.64
1993	10.6	16.0	0.32	0.67
1994	11.2	16.4	0.36	0.68
1995	12.7	17.0	0.38	0.70
1996	12.8	16.9	0.42	0.79
1997	13.6	16.3	0.48	0.78

Source: Bank of Italy, *Annual Report*, several issues and author's calculations.

Given that Italy has a large number of small banks, this is of particular interest for the empirical analysis on efficiency that follows later in this thesis because if the Italian banking market is characterised by substantial scale economies, one might expect that these small local co-operative banks would eventually be driven out of the market. The empirical analysis undertaken in Chapter 6 investigates this issue in detail, but first it is important to recall briefly what is "special" about these banks.

Table 3.19 provides an insight into the income characteristics of popular and co-operative banks. It can be seen that the majority of their income comes from net interest sources.

Table 3.19 Profit and Loss Accounts of Main Italian Popular and Credit Co-operative Banks (% of Total Assets)

	1995			1996			1997[a]		
	POP	CC	ALL	POP	CC	ALL	POP	CC	ALL
Net Interest income (a)	3.44	4.27	2.69	3.23	4.08	2.54	2.78	3.45	2.26
Non-interest income (b)	1.07	0.94	0.86	1.24	1.29	1.04	1.33	1.26	1.09
Gross income (c=a+b)	4.51	5.21	3.56	4.47	5.37	3.58	4.11	4.71	3.35
Operating expenses (d)	2.86	3.38	2.42	2.80	3.36	2.39	2.66	3.22	2.31
staff costs	1.75	1.95	1.54	1.74	1.91	1.54	1.62	1.82	1.44
Net income (e=c-d)	1.65	1.82	1.14	1.66	2.00	1.19	1.45	1.49	1.05
Value adjustments, readj. and allocations to provisions (f)	0.76	0.30	0.78	0.62	0.32	0.69	0.57	0.25	0.72
Loan losses	0.63	0.28	0.68	0.49	0.31	0.49	0.42	0.26	0.59
Profit before tax (g=e-f)	0.89	1.52	0.36	1.04	1.67	0.50	0.88	1.24	0.32
Tax (h)	0.53	0.07	0.33	0.55	0.15	0.32	0.42	0.03	0.29
Net profit (g-h)	0.36	1.45	0.03	0.49	1.52	0.18	0.46	1.21	0.04

[a] Provisional.
Source: Bank of Italy, *Annual Report*, several issues and author's calculations.

Personnel expenses-to-total operating costs ratio and cost-to-income ratios are displayed in Table 3.20. On average credit co-operative banks also have lower cost ratios than other bank types.

Table 3.20 Italian Banks' Personnel Expenses and Cost/Income Ratios

BANKS	1992	1993	1994	1995	1996	1997
PERSONNEL EXPENSES/TOTAL OPERATING COSTS						
Popular	62.27%	60.62%	62.15%	61.11%	61.05%	61.94%
Credit co-op	60.00%	58.14%	59.34%	57.72%	56.68%	56.71%
All banks	63.97%	62.80%	64.78%	63.65%	64.38%	62.57%
COST/INCOME RATIO						
Popular	61.85%	57.93%	64.97%	63.36%	62.76%	64.65%
Credit co-op	59.08%	56.05%	65.10%	64.97%	62.64%	68.35%
All banks	65.68%	60.79%	68.56%	68.08%	66.89%	68.80%

Source: Bank of Italy, *Annual Report*, several issues.

There are several interpretations as to the likely reasons for the higher level of performance of very small mutual and co-operative banks in Italy [see, for instance, the recent studies by Cannari and Signorini (1997); Pittaluga (1998); Generale and Gobbi (1999)]. Most theories emphasise the importance of factors such as banks' localisation, their reputation, as well as the special relationship (usually long-term) that these banks have with retail and small business customers. Other theories refer to the expense preference and peer monitoring literature to demonstrate that the corporate governance of these banks has a fundamental role in explaining their better performance as opposed to banks with national branch networks.

With regard to the credit relationships between local banks and small businesses, it has been argued [see, for example, Pittaluga (1998)] that the local nature and, particularly, mutual ownership can give banks a comparative advantage with respect to large banks in screening and monitoring borrowers and hence in enforcing debt contracts, thereby allowing them to overcome the problems of asymmetries between borrowers and lenders. Similarly, co-operative and mutual banks are usually not subject to take-overs because their control is in the hands of directors, which in turn are elected by the Board. This is often seen as being a more suitable structure than joint-stock companies in order to maintain long-term customer relationships. Moreover, within co-operative banks members have more incentives to control one another (peer monitoring) and managers have less opportunity to overspend in order to maximise their own utility (expense-preference).[10]

So far most of the analysis presented in this chapter has focused on the financial characteristics of various bank types in the Italian market. Typically, attention has been paid to the accounting ratios and market structure information. While this provides an insight into the structure and performance characteristics of the market, an additional viewpoint is to consider the innovative capacity of the banking system. This is carried out in the following section.

3.5 Financial Innovation: the Use of New Payment Technologies

An important reflection of the innovative capability of Italian banks relates to developments in the domestic payments system. The process of change began in the late 1980s and was characterised by substantial co-operation, both at the national and international levels. As emphasised by Inzerillo *et al.* (1999), among technological innovations, changes in the payment system have had a major role in helping to reduce the degree of monopoly linked to geographical localisation.

Important technological applications include the development of ATMs (Automatic Teller Machines) and EFTPOS (Electronic Funds Transfer at Point-Of-Sale) systems. With the widespread diffusion of ATMs, the number of operating hours

[10] According to the expense preference approach, originally developed by Berle and Means (1932) and Coase (1937), the presence in an enterprise of individuals (such as shareholders, managers and lenders) with different preferences may result in a conflict of interest and in the pursuit of objectives different from profit maximisation. In such a context, it is possible that managers, while engaging in the objective of maximising their own utility, obtain a size greater than is optimal, resulting in increased expenses – such as personnel expenses – which result in distortions of the resource allocation process [see also Williamson (1963).

offered to bank customers has increased, while the development of EFTPOS permits the executions of on-premises commercial operations without the need for cash.

Table 3.21 shows the relative importance of cashless payment instruments as a percentage of total volume of cashless transactions for a select group of industrialised countries from 1988 to 1997.

Table 3.21 Relative Importance of Cashless Payment Instruments: International Comparison[a]

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
					CHEQUES					
Belgium	31.1	27.7	23.8	21.6	18.8	14.0	11.7	10.6	9.4	8.0
France	57.3	55.2	54.4	52.2	50.6	49.1	47.4	45.6	43.6	41.7
Germany	9.8	9.6	9.9	9.6	8.8	8.1	7.9	7.0	6.4	5.7
Italy	45.8	45.0	44.2	41.6	40.0	37.2	34.0	32.8	30.5	28.0
Netherlands	17.7	15.9	15.2	14.3	12.3	11.1	8.5	5.9	4.2	3.0
UK	56.0	54.0	51.0	48.5	45.4	43.0	40.2	36.7	33.1	30.5
US	83.5	83.6	81.9	81.6	80.5	79.6	78.1	76.5	74.8	73.2
					CARDS					
Belgium	7.9	9.1	11.0	13.3	15.6	17.1	18.0	19.7	21.3	23.4
France	10.5	12.4	13.1	14.5	15.0	15.7	16.2	17.6	18.3	19.5
Germany	0.7	1.2	1.5	1.8	2.1	2.6	3.1	3.6	4.2	4.1
Italy	1.0	1.6	2.4	3.1	3.7	4.1	5.2	6.6	8.6	11.2
Netherlands	0.3	1.0	1.6	1.8	2.6	3.1	6.1	11.3	15.1	18.2
UK	11.0	12.0	14.0	16.4	18.8	21.0	23.3	25.9	28.9	31.1
US	14.7	14.4	15.9	16.0	16.8	17.5	18.7	20.1	21.5	23.0
					CREDIT TRANSFERS					
Belgium	54.0	56.0	57.6	57.0	56.9	60.0	60.9	60.2	59.5	58.0
France	15.3	15.2	15.0	15.2	15.4	15.4	15.7	15.6	15.7	15.7
Germany	52.9	51.6	51.6	51.3	49.8	45.6	48.7	48.8	49.2	48.2
Italy	39.8	39.8	40.0	40.9	42.1	44.6	46.8	45.9	42.6	41.6
Netherlands	65.1	63.5	62.1	61.3	61.3	61.3	59.8	56.6	54.0	51.7
UK	22.0	22.0	21.0	20.9	20.6	20.4	20.1	19.7	19.9	19.6
US	1.2	1.3	1.5	1.6	1.8	1.9	2.1	2.3	2.4	2.5
					DIRECT DEBITS					
Belgium	7.0	6.9	7.6	8.2	8.8	8.9	9.4	9.4	9.7	9.8
France	8.8	9.1	9.4	9.3	10.2	10.6	11.2	11.3	11.8	12.1
Germany	36.6	37.6	37.0	37.3	39.3	43.7	40.3	40.6	40.2	42.0
Italy	2.1	2.6	3.1	3.8	4.1	4.4	4.7	5.4	7.3	8.6
Netherlands	16.8	19.6	21.1	22.6	23.9	24.4	25.6	26.3	26.8	27.1
UK	11.0	12.0	13.0	14.2	15.1	15.6	16.5	17.7	18.1	18.7
US	0.6	0.7	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.3

[a]Percentage of total volume of cashless transactions.

Source: Bank for International Settlement, *Statistics on Payment Systems in the Group of Ten Countries*, Basle, several issues.

From Table 3.21 it is possible to see that automated forms of payments have gradually replaced cheques although they still account for 28% of non-cash payments in the Italian system. Credit transfers are the most important form of non-cash payment in Italy accounting for 42% of total payments. The table also illustrates that despite substantial growth, both card and direct debit payments are still relatively underdeveloped.

As shown in Table 3.22, in Italy the use of electronic transfers has increased sharply over the last decade. The total number of ATMs grew by 17,709 units over the period 1989-97, and the corresponding population per machine decreased by 5,040. With regard to the number of Point of Sale (POS) terminals, the growth has been more significant (+271,286 units from 1989 to 1997); accordingly, the population per terminal decreased from 5,550 in 1989 to 204 in 1997.

Table 3.22 Growth of ATMs and POS Terminals in Italy

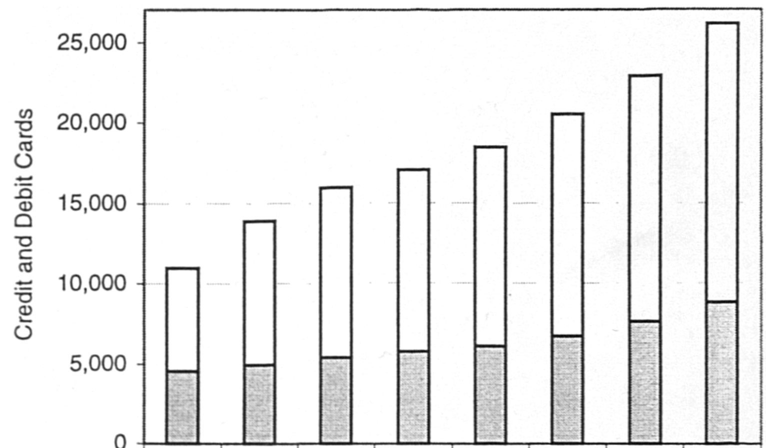
	ATMs			POS		
Years	Number of ATMs	Approx. annual % changes	Population per machine (millions)	Number of POS	Approx. annual % changes	Population per terminal (millions)
1989	7,791	-	7,295	10,240[a]	-	5,550
1990	9,770	25.4	5,893	22,185[b]	116.6	2,595
1991	11,571	18.4	4,996	45,711	106.0	1,265
1992	13,917	20.3	4,153	62,251	36.2	929
1993	15,227	9.4	3,756	77,206	24.0	741
1994	19,818	30.1	2,886	113,023	46.4	506
1995	21,670	9.3	2,644	153,752	36.0	373
1996	24,223	11.8	2,370	214,705	39.6	267
1997	25,500	5.3	2,255	281,526	31.1	204

[a] Based on a sample of credit institutions that account for about 75% of current account bank deposits.
[b] Based on a sample of credit institutions that account for about 80% of current account bank deposits.
Source: Bank of Italy, *Annual Report*, several issues.

While card payments still account only for 11.2% of cashless payments in 1997, there has been a substantial increase in their use during the 1990s. The number of credit and debit cards rose in total by almost 140% between 1990 and 1997: credit cards increased by 43%, while debit cards connected with the *bancomat*[11] increased by nearly 170%, as shown in Figure 3.16.

Figure 3.16 Growth of Credit and Debit Cards in Italy

Years	Total	Approx. annual % change
1990	10,975	-
1991	13,880	26.5%
1992	15,970	15.1%
1993	17,019	6.6%
1994	18,482	8.6%
1995	20,515	11.0%
1996	22,913	11.7%
1997	26,145	14.1%



	1990	1991	1992	1993	1994	1995	1996	1997
□ Debit Cards	6,422	8,948	10,606	11,295	12,396	13,824	15,270	17,317
□ Credit Cards	4,553	4,932	5,364	5,724	6,086	6,691	7,643	8,828

Source: Bank of Italy, ***Annual Report***, several issues.

More sophisticated cards, such as the "smart card" that functions as a "virtual" pocket computer, have so far not been introduced because of their high cost compared with traditional cards. Although operators are relying on the power of technology to

[11] Bancomat is an interbank system of ATMs distributed all over the country, which allows the owners of the bancomat card (debit card) to withdraw cash in any of the automatic machines set up by the banks using this system.

reduce their costs, and currently various trial programmes are being run by the main banks.

As shown in Table 3.23, between 1990 and 1997 the total number of payments made via the banking system rose sharply (+113.2%) and the value of these payments increased by approximately 23%. On the other hand, the number of cheques as a total (personal cheques and bankers draft) decreased over the period by nearly 25%, as did their total value (-5%).

Table 3.23 Italian Banks' Payment Instruments[a]

	NUMBER (thousands)				VALUE (billions of lire)			
Years	Personal cheques and bankers' drafts	Annual % change	Payment and collection orders	Annual % change	Personal cheques and bankers' drafts	Annual % change	Payment and collection orders	Annual % change
1990	654, 714	–	295,949	–	1,786,842	–	4,654,861	–
	(68.9)		(31.1)		(27.7)		(72.3)	
1991	647,486	-1.1	406,594	37.4	1,838,635	2.9	4,592,627	-1.3
	(61.4)		(38.6)		(28.6)		(71.4)	
1992	633,456	-2.2	420,934	3.5	1,886,591	2.6	4,829,332	5.2
	(60.1)		(39.9)		(28.3)		(71.7)	
1993	582,726	-8.0	427,568	1.6	1,799,811	-4.6	4,868,328	0.8
	(57.7)		(42.3)		(27.0)		(73)	
1994	529,758	-9.1	447,441	4.6	1,732,755	-3.7	4,975,193	2.2
	(54.2)		(45.8)		(25.8)		(74.2)	
1995	521,883	-1.5	483,390	8.0	1,788,640	3.2	5,314,710	6.8
	(51.9)		(48.1)		(25.2)		(74.8)	
1996	497,517	-4.7	526,758	9.0	1,651,873	-7.6	4,974,252	-6.4
	(48.6)		(51.4)		(24.9)		(75.1)	
1997	493,583	-0.8	631,005	19.8	1,700,427	2.9	5,731,629	15.2
	(43.9)		(56.1)		(22.9)		(77.1)	

[a] Percentage compositions in brackets.
Source: Bank of Italy, *Annual Report*, several issues.

Before concluding this chapter, it is relevant to emphasise the importance that new forms of banking, such as telephone and on-line PC banking, have achieved over the last decade. Recently, the European Central Bank [ECB (1999b)] published an extensive report on the use of IT in all EU banking markets. Overall, there seems to be a consensus that although these new ways of doing banking are presently used by a relatively low number of retail customers (especially in the case of on-line PC banking), different delivery systems are being developed rapidly in most banking systems. In Italy at the moment there is little data available on these new forms of banking. However, it is acknowledged that Internet banking is expected to have the highest future growth potential of all the automated channels (i.e. "remote banking"). In addition, investment in new banking technologies is expected to bring about significant reductions in the costs of processing various banking transactions and will lower overall operating costs.

3.6 Conclusions

This chapter provides an overview of structural and performance features of the Italian banking sector during the 1990s. The analysis has illustrated at an exploratory level the main strengths and weaknesses of the Italian banking industry. With a large number of institutions, an increasing number of branches and relatively high personnel costs, the sector is still amongst the most fragmented in Europe. However, the growth in the number of banking groups (+23.6% over 1990-97), the decline in mutual banks (-13% over 1993-97), and the government commitment towards the privatisation programme, has increased pressure for a more efficient use of real and financial resources within the system. Moreover, Italian banks have already improved their product offerings, developed securities business and established investment fund management companies able to compete with non-bank financial intermediaries. In the meantime, technological change has opened up new ways for participants in financial markets to carry out transactions in a more efficient and faster manner. Despite these developments, important structural factors still hinder the process of modernisation and restructuring of the system. Among these factors is the considerable decline in net income derived from traditional banking activities, the significant increase in loan losses, and the rigidity of the labour element within total banking costs. Lastly, the magnitude of the profit reduction and the persistence of poor profitability for some banks (especially for banks based in certain geographical areas of the country and for specific bank types), seems to suggest that the problems of Italian banks also stem from inefficient management behaviour.

Chapter 4

Efficiency Analysis in Banking: Theoretical Issues and Selected Literature

4.1 Introduction

The main objective of this chapter is to explain the rationale for examining cost efficiency in banking. Section 4.2 outlines the microeconomics of the banking firm and examines the debate about the input and output definition in banking. Section 4.3 covers relevant theoretical issues relating to economies of scale, scope and X-efficiency, while section 4.4 reviews the different methodologies used to estimate cost economies in banking. Sections 4.5.1 to 4.5.5 report select findings of US, European and Italian empirical research on bank efficiency. The final section 4.5.6 investigates the importance of including risk and output quality factors as arguments in the cost function. In addition, this section also reviews the literature relating to the calculation of potential correlates with estimated inefficiency measures. Section 4.6 is the conclusion.

4.2 The Microeconomics of Bank Production: Defining Inputs and Outputs

By definition, commercial banks are institutions whose operations consist mainly of granting loans and receiving deposits from the non-bank sector. Moreover, according to contemporary banking theory, the process of resource allocation is improved by financial intermediaries through the following functions that banks perform [Freixas and Rochet (1997)]: 1) offering access to a payment system; 2) transforming assets; 3) managing risk; and 4) processing information and monitoring borrowers. In this sense, banks are typically multi-product firms in that their activities include at least the supplying of deposits, loans and securities, which in turn can be divided into various classes and provided in geographically different markets. Moreover, many banking services are jointly produced so that certain kinds of costs are jointly related in the production of a variety of services.

While the multi-product nature of the banking firm is widely recognised, there is still no agreement as to the explicit definition and measurement of banking *inputs* and *outputs*. Usually, each definition carries with it a particular set of banking concepts, relating to the production characteristics of the industry. In other words, when evaluating bank efficiency, the way output is defined and measured may influence considerably the results obtained [Berger and Humphrey (1997)].

Two main approaches are generally used to measure the flow of services provided by financial institutions. In the "production" approach [see, for example, Bauer *et al.* (1993); Favero and Papi (1995); Berger *et al.* (1997); Resti (1997a)], banks are treated as firms that employ capital and labour to produce different types of deposit and loan accounts. Hence, their outputs are measured by the number of deposits and loan accounts or by the number of transactions performed on each type of product, whereas total costs are the operating costs used to produce these products. The underlying rationale is that depositors receive a service and banks employ resources to provide it: deposits are treated as outputs because in accepting deposits banks provide customers with value-added outputs in the form of clearing, record-keeping and security services.

It follows that only physical inputs, such as labour and capital and their costs should be included in the analysis.

Under the alternative "intermediation" approach [see, for example, Kaparakis *et al.* (1994); Mester (1993 and 1996); Allen and Rai (1996); Molyneux *et al.* (1996); Berger and Mester (1997)], banks are considered as intermediaries between liability holders and those who receive bank funds, rather than producers of loan and deposit account services. As a consequence, the values of loans and other assets are defined as bank outputs, while deposits and other liabilities (capital and labour) are inputs to the production process. It follows that operating costs and financial expenses (interest on deposits) are the relevant components of total costs. Originally, this was the view of Sealey and Lindley (1977) who developed a model consistent with the neoclassical theory of the firm within which they analysed the role of production and costs for depository financial institutions. Sealey and Lindley (1977) reckoned that the individual banking firm's decision-making process focused on the production of earning assets where "loanable funds" borrowed from depositors and serviced by the firm are inputs together with labour and capital.

Other approaches have also been used to define bank inputs and outputs. Some studies use the so-called value-added approach, where each category of assets or liabilities may be identified as an important output, intermediate product or input, according to whether they generate or destroy value [Berger and Humphrey (1990 and 1992a)]. In particular, Berger and Humphrey (1992a) found that deposits and loans should be considered as important outputs since they generate the largest share of value added.

Other efficiency studies employ the user-cost approach, which determines whether a final product is an input or an output on the basis of its net contribution to bank revenue. This means that a transaction is defined as an output if the financial return (asset) exceeds the opportunity cost of the funds, or else if the financial cost (liability) is less than the opportunity cost of those funds [Berger and Humphrey (1990)].

Another way to resolve the problem of output definition is to apply a dual approach according to which deposits can behave both as inputs and outputs. Hancock (1985) adopted this mixed solution which implies that demand deposits are outputs and time deposits are inputs to the production process. Similarly, Berger and Humphrey (1991) and Bauer *et al.* (1993) considered the interest paid on deposits as part of total costs while the rate paid is included as an input price.

Other researchers, such as Hughes and Mester (1991), empirically tested whether deposits should be treated as an input or output and found that they should be treated as inputs.[1] In an Italian study, Favero and Papi (1995) treated deposits first as inputs and then as outputs and, by comparing the results, they found that in this latter case average efficiency levels were higher.

The choice between the different input and output definitions cannot be a matter of indifference for researchers analysing the production characteristics of banking firms for several reasons. As argued by Forestieri (1993), banks that have, for instance, a large share of retail deposits and banks operating at the wholesale level are necessarily affected in different ways by this choice since interest costs may be more important for the former. Berger *et al.* (1997) maintain that under most circumstances, the intermediation approach is to be preferred for bank analyses because it is more inclusive and it captures the essence of a bank as a financial intermediary. Despite this, they reckon that in analyses at the branch level, the production approach may be more appropriate because branches act primarily as producers of depositor services on behalf of the bank which then invests the funds in various assets.

As discussed later in this chapter, many efficiency studies in banking adopt a cost function approach. The cost function implies that the minimum cost of producing bank output in a given period of time is a function of the quantity of bank output produced during that period. It follows that the actual measurement of output is a controversial

[1] The test formulated by Hughes and Mester (1991) involved the estimation of a translog variable cost function (VC) in which labour (P_1), capital (P_2) and other borrowed money (P_3) were treated as inputs, while uninsured deposits (U_D) and insured deposits (I_D) were entered as levels. Given that $VC = f(Q_i, S, K, P_1, P_2, P_3, D)$, where Q_i are the outputs, S is the average volume of non-performing loans and K is the financial capital, the sign of the first derivative of VC with respect to U_D and I_D will indicate whether deposits should be treated as inputs or outputs in the following way. If U_D and I_D are outputs, then these derivatives should be positive because the outputs can significantly be increased only if expenditures on inputs are increased. If U_D and I_D are inputs, then these derivatives should be negative because by increasing the use of some input, the expenditure on other inputs should decrease.

matter as well. This is because financial services firms' output cannot be measured simply by physical quantities because banks provide a wide array of services from low-risk assets to the running of investment portfolios and off-balance sheet activities.

Usually, for multi-product financial firms two possible ways of measuring output can be identified: *i*) a scalar measure aggregating different products; or *ii*) a disaggregated vector of outputs. As Forestieri (1993) emphasises, the main disadvantage of approach *i*) is that it allows a clearer definition and easier measurement of economies of scale, but it does not capture information on the relevant scope economies. In the latter case and in order for this approach to be feasible it is required that the number of products is small because of both the difficulties accounted with the estimation of the multi-product cost function, and the limitations on the quality of accounting cost data. For example, studies choosing the production approach use numbers of accounts as proxies for numbers of transactions, since numbers of transactions are often difficult to obtain [see for example Ferrier and Lovell (1990) and Ferrier *et al.* (1993)]. On the other hand, Resti (1997a, p. 224) observes that inputs and outputs should always be flow variables but, "since data on physical quantities [such as the number of checks cashed, or loans issued] are not always available, one can resort to stock variables such as the average amount of deposits and loans, since they continuously require [and therefore are a proxy for] the production of payment and liquidity services, and the monitoring of credit decisions".

To summarise, at present the definition and measurement of inputs and outputs in banking still represents a controversial matter. The problem of output definition will be further examined in Chapter 5 where the features of the intermediation approach – the output definition used in the empirical analysis – are discussed.

4.3 Cost Efficiency in Banking: Defining Economies of Scale, Economies of Scope and X-efficiencies

The study of bank efficiency is considered important for a number of contemporaneous policy issues. From the point of view of business strategy, it is clearly important for management to know and understand the factors determining cost efficiency in order to understand the firms' own profit maximising and/or growth conditions. Berger and Humphrey (1997) emphasise that the information obtained by separating those production units that by some standard perform well from those that perform poorly can be used either: *i*) to inform government policy by assessing the effects of deregulation, mergers, or market structure on efficiency; *ii*) to address research issues by describing the efficiency of an industry, ranking its firms, or checking how measured efficiency may be related to the different efficiency technique employed; or *iii*) to improve managerial performance by identifying *best practices* and *worst practices* associated with high and low measured efficiency, respectively, and encouraging the former practices while discouraging the latter.

Berger and Mester (1997) observe that for the purposes of public policy research and managerial performance, once the conceptual and measurement issues have been controlled for, it is important to explain the remaining differences in efficiency across banks. They argue that in a perfectly competitive or contestable market, efficient firms should drive out inefficient ones, so that there would be only a residual level of inefficiency across firms remaining at a given time. Therefore, an empirical finding of substantial inefficiencies raises the question as to whether inefficiencies will continue in a deregulated and more competitive context. Moreover, for antitrust and merger analysis it is important to know: *i*) the effects of market concentration and past mergers on banking efficiency; *ii*) whether one type of organisational form is more efficient than another; and *iii*) whether inefficiency manifests itself in the form of poor production decisions, risk management decisions, or both.

From a public policy perspective, concern about the economic efficiency of banks is also rationalised on the grounds that the efficiency of individual banks may affect "the stability of the banking industry and, in turn, the effectiveness of the monetary system" [Kolari and Zardkoohi (1987, p. 29)].

In practice, the possibility of a systemic risk is often suggested as a main motivation for regulation, and regulation in its turn can and does affect the efficiency with which banks produce financial services.[2] Therefore, this concern about banks' efficiency can also be explained by the fact that banks have always performed a special role in the economic system compared with other financial intermediaries and commercial firms. As discussed in Chapter 2, a fundamental question that arises in the study of banking is what distinguishes financial institutions, and especially banks, from commercial firms. That is why, for example, the failure of a large bank may have more serious effects on the economy than the failure of a large car producer [Saunders (1994)].

Various studies of mergers, agency problems, corporate governance, branching strategies, foreign ownership, etc. offer support for a number of explanations of banks' inefficiency. As will be discussed later in the following sections, one should distinguish between cost advantages resulting from the scale and scope of production and other important aspects of efficiency, such as X-efficiency and its decomposition into, for example, allocative and technical efficiency.

[2] The regulatory policies of the banking authorities are primarily concerned about bank "safety and soundness". Therefore, they influence bank's risk (variability of return) and return (profitability) position "by permitting banks to hold only a limited amount of fixed assets and requiring them to have both *adequate* liquidity and *adequate* capital" [Sinkey (1992, p. 40)]. In particular, capital adequacy is among the most important factors affecting the riskiness (variability) of overall measures of bank performance such as return on assets (ROA) and return on equity (ROE = ROA × EM). It is to note that EM represents the Equity Multiplier, which is the reciprocal of the capital-to-assets ratio and is often referred to as financial leverage (i.e. the use of deposit financing by a bank).

4.3.1 Economies of Scale

Economies of scale occur when a firm is able to reduce costs per unit of output as the firm gets bigger. Economies of scale are based on the shape of the average cost curve, which shows average costs at each level of output [Molyneux *et al.* (1996)]. In other words, scale economies occur when the average cost of production in the long run declines as output increases [(Sinkey (1992)]. In order to isolate the effect of scale on costs, all other factors (such as technological improvements) have to be held constant.

Potential sources of cost economies in banking are usually based on the following considerations [Forestieri (1993)]:

- Information Technology [Revell (1984); Humphrey (1985); Hunter and Timme (1986); Evanoff *et al.* (1990); Landi (1990)]. As the firm's size increases, IT allows for a greater efficiency because of: *i*) imperfect divisibility of investments; *ii*) high professional skills necessary to integrate complex technologies; *iii*) a more flexible production process which may reduce scale barriers; *iv*) a more general effect on efficiency associated with technological innovation.
- Specialised labour [Bell and Murphy (1968); Clark (1988); Muldur (1991)]. A larger bank in terms of size is able to employ more technical and managerial labour, thereby achieving a more efficient organisational form, while favouring expansion into innovative business.
- Information [Arrow (1965); Williamson (1975); Berger *et al.* (1987); Shaffer (1991); Humphrey (1991)]. Financial intermediaries have a fundamental role in mitigating the asymmetric distribution of information between borrowers and lenders. Therefore, as they grow in size and intensify their diversification, they can lower delegation costs.
- Strategic and organisational flexibility [Muldur (1990); Berger *et al.* (1987); Gilbert and Steinherr (1989); Litan (1987); Berger *et al.* (1998)]. The consequences of increased size may be: *i*) improved flexibility and greater cost minimisation; *ii*) fixed costs can be managed more efficiently; *iii*) the diversification of assets and liabilities can reduce income variability. On the other

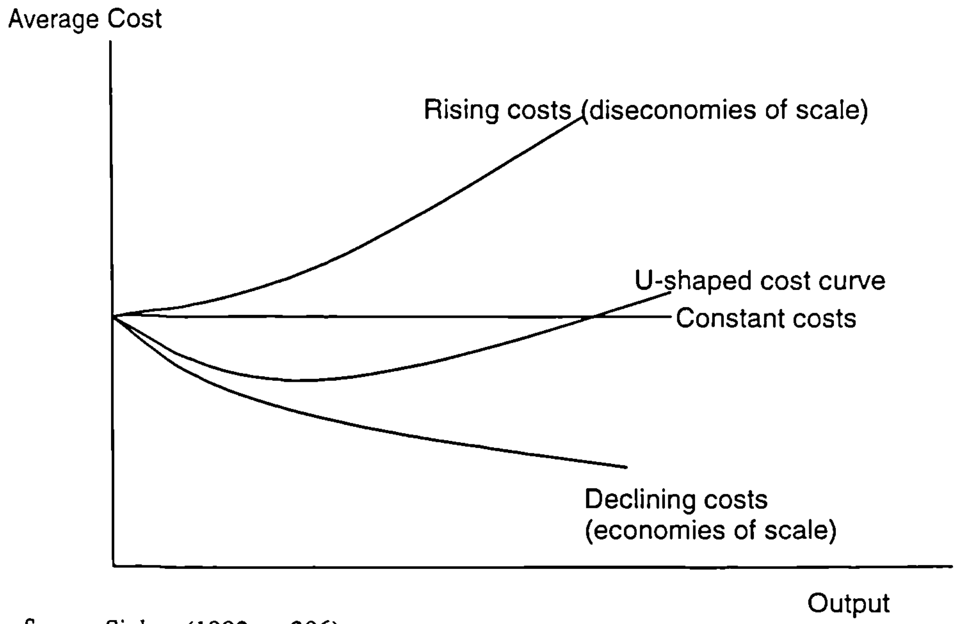
hand, drawbacks which are likely to be incurred as the firm grows larger include an increase in organisational complexity and wider diversification may actually aggravate risk since it may result in an entry into a business area in which the financial institution has no experience.

- Demand side benefits [Herring and Santomero (1990)]. If consumers have a "package-acquisition behaviour", demand side benefits may favour output diversification, thereby benefiting consumers through cost savings or in terms of the perception of a quality advantage from entertaining a global relationship.

Kolari and Zardkoohi (1987) divide the causes of increasing returns to scale into the following four categories: *i*) indivisibility, or unavoidable excess capacity of some inputs: for example, the cost of inventing a new technique is indivisible with respect to the level of output produced by using the technique. That is, a bank may have excess capacity of some inputs for most of the year, so that an increase in all outputs may not require a proportionate increase in all inputs for the entire year; *ii*) the inverse relationship between the productivity of some inputs and their cost per unit of productivity: that is, many inputs cost less when they are purchased on a larger scale; *iii*) specialisation of the production process: greater specialisation and reduction in per unit cost is possible with increases in size; and *iv*) a statistical property of large numbers: as a firm expands sales, the appropriate quantity of inventory to be maintained need not be increased proportionately, because the demand of goods is spread across a greater number of customers. In this sense, larger banks should incur lower costs of holding cash balances than do small banks.

A bank is said to be producing at constant returns to scale if, for a given mix of products, a proportionate increase in all its outputs would increase its costs in the same proportion; this is also the point where the average cost of production is minimised. A bank is operating with scale economies if a proportionate increase in its outputs would lead to a less than proportionate increase in cost – the bank could produce more efficiently by increasing its output level. On the other hand, scale diseconomies arise when a proportionate increase in bank outputs would lead to a more than proportionate increase in costs – the bank could produce more efficiently by reducing its output level. These alternative relationships between costs and output are shown in Figure 4.1. It should be noted that the U-shaped cost curve represents a cost function exhibiting all three of these cost characteristics.

Figure 4.1 Economies of Scale and the Shape of Average Cost Curves

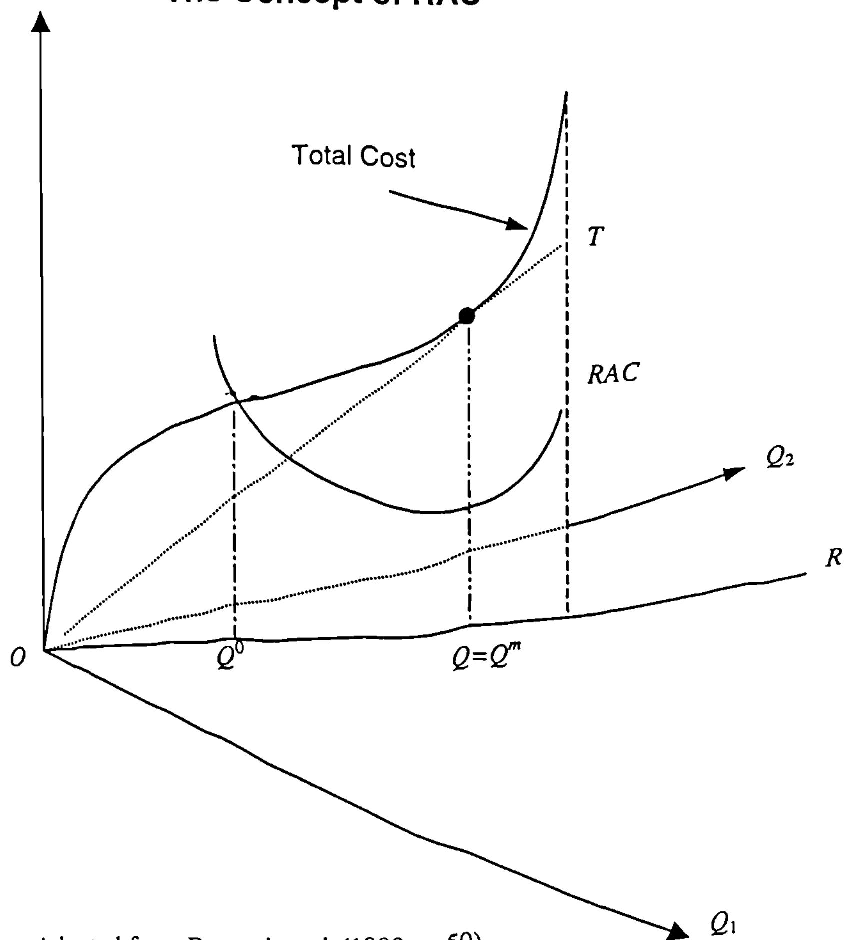


Source: Sinkey (1992, p. 306).

While the concept of economies of scale in a single product firm applies to the behaviour of total costs as output increases (and economies of scale exist if total costs increase less proportionately than output), for multi-product firms the concept of average cost is more complicated. Average cost is defined only for single-product firms, unless all products are aggregated into a single index [Sinkey (1992)]. Thus, in order to measure scale economies for financial services firms, it is necessary to refer to another notion of cost, the Ray Average Cost (RAC) which was introduced by Baumol *et al.* in 1982. It requires that firms expand all outputs at the same rate while mixing inputs optimally. In this case, economies of scale occur if the RAC of composite output decreases. As pointed out by Baumol *et al.* (1988), the term RAC refers to the geometry of the construct and it is essential that an arbitrary unit output along the ray is chosen. In this way, the average cost of a composite good can be defined as: $RAC = C(ty^0)/t$, where y^0 is the unit bundle for a particular mixture of outputs (the arbitrary bundle assigned the value 1) and t is the number of units in the bundle $y = t\,y^0$.

Figure 4.2 illustrates the concept of RAC for a multi-product firm in a three-dimensional diagram [Baumol *et al.* (1988)]. The ray average cost of producing the output vector $Q \neq 0$, denoted $RAC(Q)$ is as $TC(Q)/\sum_{i=1}^{n} Q_i$. Ray average cost is said to be increasing (decreasing) at Q if $RAC(tQ)$ is an increasing (decreasing) function of a scalar t, at $t = 1$. Ray average cost is said to be minimised at Q if $RAC(Q) < RAC(tQ)$, for all positive $t \neq 1$. It is important to note that the unit output along the ray is arbitrary. Geometrically, the concept of RAC is illustrated in Figure 4.2, which also shows the behaviour of total cost (TC) along the ray OR.

Figure 4.2 Economies of Scale for Multi-Product Firms: The Concept of RAC



Source: Adapted from Baumol *et al.* (1988, p. 50).

It is possible to see that *RAC* and *TC* intersect at the unit output level Q^0 and *RAC* reaches its minimum at the output $Q = Q^m$ at which the ray *OT* is tangent to the total cost surface in the hyperplane erected on *OR*. Therefore, if *e* is the elasticity of $RAC(tq)$ with respect to *t* at the output point *Q*, then, at *Q* scale economies over the entire product set (*SCALE*) $= 1/(1+e)$. It follows that it is possible to interpret *SCALE* as a measure of the percentage change of decline or increase of *RAC* with respect to output. Thus, returns to scale at the output point *Q* are increasing, decreasing or locally constant (*SCALE*>1, *SCALE*<1, *SCALE*=1, respectively) as the elasticity of *RAC* at *Q* is negative, positive or zero, respectively.

Economies of scale can also relate to overall and product- specific scale economies whilst holding the other factors constant. Overall economies of scale relate to cost savings resulting from an increase in all of a firm's output and can be detected by declining average costs as the firm increases production while keeping the product mix constant. If average costs rise with output, diseconomies of scale are present. More specifically, economies of scale are measured by the ratio of the percentage change in costs relative to the percentage change in output: when the scale economies ratio is less than one, scale economies exist, as average cost is falling. When the ratio is equal to one, no scale economies exist, as average cost is constant and, finally, when the ratio is greater than one, decreasing return to scale exist as average cost is rising.

Product- specific economies of scale refer to economies that arise from an increase in the production of individual products. For instance, they can be measured to determine whether the output of certain products should be increased, although it is difficult to change the output of one product while holding constant the output of other products.

Freixas and Rochet (1997) argue that the reason why borrowers do not engage in asset transformation is because there are economies in the intermediation process. These economies are brought about by the transaction costs associated with linking savers to borrowers. These include monetary transaction costs as well as search, monitoring and auditing costs. Moreover, if associated with a rational risk spreading, scale economies may result in lower loan rates, and may diminish the problems of information asymmetries and moral hazard with lenders (i.e. the so-called scale economies in the monitoring activity)

Kolari and Zardkoohi (1987) point out that scale economies do not continue indefinitely with the expansion of size. As the scale of operation increases, there comes a point at which limitations to efficient management set in and long run marginal costs tend to rise. This fact explains why many firms may find it necessary to decentralise operations in order to avoid the costs of organisational rigidity that largeness entails. Therefore, the firm (bank) may decide to decentralise functions by dividing its operations into separate branches to the point at which no cost gains are available from large-scale operations.

Finally, it is useful to mention that it is possible to distinguish between branch and firm level scale economies. In particular, a number of studies separate scale economies at the single branch office or plant level from those for all offices together [Benston *et al.* (1982) and Humphrey (1985)]. The importance of these approaches, comes from the fact that banks can expand their operations or output by either increasing services to existing branch networks in a given market, or adding new branches, which attract new accounts and deposits, in new market areas [Molyneux *et al.* (1996)].

4.3.2 Economies of Scope

Economies of scope refers to the case where the joint production of two (or more) products by a single firm is less costly than the sum of their separate production by two (or more) firms. For banks, this means that cost savings are available through the joint production of financial services.

Considering two goods, Q_1 and Q_2, economies of scope exist when the total costs (TC) of producing the two goods jointly is less than the combined cost of producing the same amounts of each good separately. That is:

$$TC(Q_1, Q_2) < TC_1(Q_1) + TC_2(Q_2) \tag{4.1}$$

Conversely, there are said to be diseconomies of scope if joint production is more costly than independent production.

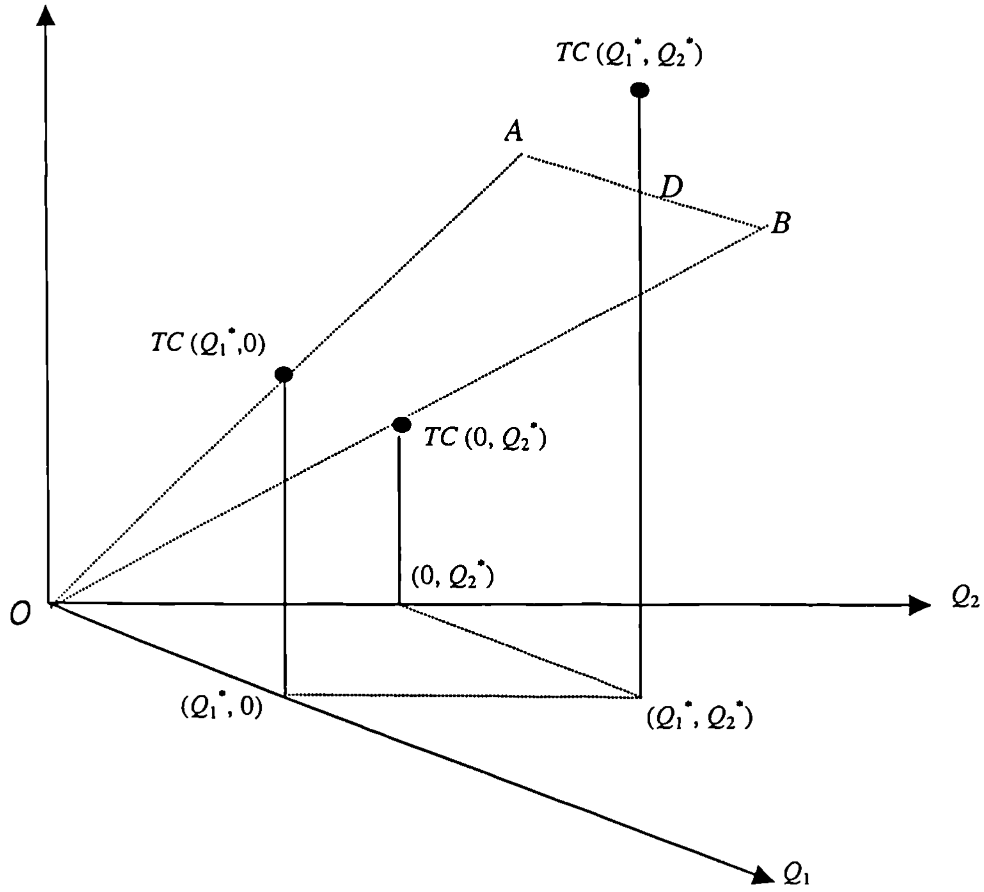
Following Baumol *et al.* (1988) the concept of economies of scope can be explained geometrically in Figure 4.3. The figure illustrates that the scope economies concept involves a comparison of $TC(Q_1^*, 0) + TC(0, Q_2^*)$, the sum of the height of the cost surface over the corresponding points on the axes, with $TC(Q_1^*, Q_2^*)$, the height of the cost surface at point (Q_1^*, Q_2^*), which is the vector sum of $(Q_1^*, 0)$ and $(0, Q_2^*)$. If $TC(Q_1^*, Q_2^*)$ lies below the hyperplane *OAB* which goes through the origin and points $TC(Q_1^*, 0)$ and $TC(0, Q_2^*)$, then the condition for scope economies is satisfied. Thus in Figure 4.3 the height of D, the point on plane *OAB* above (Q_1^*, Q_2^*) must equal $TC(Q_1^*, 0) + TC(0, Q_2^*)$ since the hyperplane is described by $TC = aQ_1 + bQ_2$ for some constants a, b. Therefore, $TC(Q_1^*, 0) = aQ_1^*$ and $TC(0, Q_2^*) = bQ_2^*$, and $TC(Q_1^*, Q_2^*)$ must be less than $aQ_1^* + bQ_2^*$ for scope economies to hold.

Given for example only two outputs Q_1 and Q_2, the degree of overall economies of scope can be measured as follows:

$$SCOPE = \frac{TC_1(Q_1, 0) + TC_2(0, Q_2) - TC(Q_1, Q_2)}{TC(Q_1, Q_2)} \tag{4.2}$$

where $SCOPE > 0$ indicates overall economies of scope and $SCOPE < 0$ indicates diseconomies of scope.

Figure 4.3 The Concept of Economies of Scope



Source: Adapted from Baumol *et al.* (1988, p. 72).

Global economies of scope are achieved when for a given product mix, the total costs from joint production of all products in the product mix are less than the sum of the costs of producing each product independently. On the other hand, product- specific economies of scope refer to economies that arise from the joint production of a particular product with other products. If by adding a particular product to a given product mix, the efficiency of production is improved, then there exist product- specific economies of scope. Such economies may result from joint production efficiencies with one or more products.

In order to determine which product pairs result in joint production efficiencies, cost complementarities between all pairs of products can also be computed. By definition, if the marginal cost of producing one product declines when it is produced jointly with another product, then a cost complementarity exists. In this context, Sinkey (1992), for instance, attributes the existence of economies of scope to interproduct or cost complementarities, which are defined as to the extent to which the cost of producing a particular financial service or product (e.g. deposits) may vary with the output levels of other products or services (e.g. loans). Nonetheless, the cost complementarities estimates reported by various authors have been extensively criticised for example by Berger *et al.* (1987) on the grounds that the conditions under which these imply scope economies are restrictive, especially when a translog cost function is specified.

Berger *et al.* (1987) developed two new scale and product mix measures – expansion path scale economies and expansion path subadditivity – which compare the cost effectiveness of firms that differ in both scale and product mix simultaneously. The expansion path measure examines competitive challenges from firms currently represented in the data, as opposed to the standard ray scale and scope economy measures, which examine competition from firms that all have the same product mix or firms that all specialise completely. Mester (1994) stressed the fact that not only are there a number of potential sources of scope economies (one is the sharing of inputs to produce several outputs) but, above all, there is an interconnection between scale and scope economies.

In addition, Berger *et al.* (1987, p. 503) point out that "costs may be saved *or* revenues improved by supplying joint output" due to the following: *i*) spreading fixed costs: if excess capacity exists, fixed or quasi fixed costs may be spread over an expanded product mix; *ii*) information economies: once information on customer's deposits and loans is gathered, it may be *reused* on other types of loans and services; *iii*) risk reduction: not only do banks carry out asset diversification and asset liability maturity matching, but they may also be willing to incur additional operating and interest costs in order to reduce risk; and *iv*) customer cost economies: if demand deposits, savings accounts, and loan services are situated jointly, it may be possible to reduce customer-incurred banking costs even if bank-incurred costs are increased, to the extent that revenues are raised.

Molyneux *et al.* (1996) identify two groups of potential economies of scope. Firms can realise internal scope economies through joint production and marketing, whereas consumers can realise external scope economies through joint consumption that arises when consumers save time and expenses by finding different products and services at a single location.

The main problems in estimating economies of scope are generally linked to the techniques adopted for their evaluation, the insufficiency of data on firms that specialise, and the risk of using data that are not on the efficient frontier, thus confusing scope economies and X-efficiencies. Berger, Hunter and Timme (1993) attempted to deal with these difficulties by introducing the concept of "optimal scope economies", based on the profit function, which examines whether it is optimal from a profitability standpoint, to produce all the products as opposed to specialising in one or more of them. The concept of optimal scope economies differs from standard scope economies because this latter compares the costs of joint versus specialised production of an observed output bundle without determining whether that bundle is optimal from the point of view of profit maximisation.

As far as the multi-product banking industry is concerned, the presence of significant economies of scope raises a twofold problem of public policy and business strategy [Forestieri (1993)]. More specifically, when economies of scope are prevalent in banking markets, there will be a trend toward concentration of the market in a few large well-diversified financial institutions. Moreover, the presence of economies of scope also represents an indispensable factor for the decision-makers in terms of strategies concerning the specialisation or diversification of financial firms. In addition, regulators may face the trade-off between the cost advantages potentially enjoyed by consumers and the possible negative consequences for the consumers of a process of concentration in the industry.

4.3.3 X-Efficiencies

Over the last decade many researchers, especially in the US, have focused their attentions on modelling technical and allocative efficiencies of individual firms as opposed to scale and scope economies. This is because the rapid changes in the banking market and the effects of deregulation have increased the importance of differences in managerial ability to control costs or maximise revenues. The concept of X-inefficiency was first introduced by Leibenstein (1966) who noted that, for a number of different reasons, people and organisations generally work neither as hard nor as effectively as they could.

Some fifteen years later, Leibenstein (1980, p. 27) stated that: "X-efficiency is not the same as what is frequently referred to as technical efficiency, since X-efficiency may arise for reasons outside the knowledge or the capability of managers attempting to do the managing. It may arise for reasons entirely outside the firm, or for reasons having to do with choices made by employees who are not themselves managers [...] By X-inefficiencies we have in mind *decisions* and processes of implementation, that are non-optimal, and which are an inherent part of organisational life. The basic point of the theory that has been developed around the concept of X-efficiency is that firms do not minimise costs and, indirectly, do not maximise profits".

Considering the two components of technical efficiency and allocative efficiency, X-efficiency relates to whether a firm is using its inputs, like labour and capital, in a cost-effective manner – that is, for a given level and mix of outputs, the bank is producing in the cheapest way possible. Otherwise, the bank is either wasting some of the inputs it has purchased, or it is using the wrong combination of inputs to produce its outputs. The allocative (or price) component refers to the ability to combine inputs and outputs in optimal proportions given the prevailing prices. In other words, an allocatively inefficient bank is operating on its production possibility frontier: that is, given the inputs it has chosen, it is producing as much output as possible, but the bank could lower its costs of producing that output by selecting a different input mix. In contrast, the technical (or physical) component refers to the ability to avoid waste by producing as much output as input usage allows, or by using as little input as output production allows. It follows that a bank that is technically inefficient is said to be operating within its "production possibility frontier", which delinates the maximum amount of output that can be produced with a given amount of inputs [Lovell (1993) and Mester (1994)]. It is obvious that a bank can be both technically and allocatively inefficient.[3]

The literature on frontier production, cost functions and the calculation of efficiency measures began with Farrell (1957). He suggested that technical efficiency could usefully be analysed in terms of realised deviations from an idealised, frontier isoquant. Farrell (1957, p. 254) investigated a firm employing two factors of production, x_1 and x_2, to produce an output flow y, under conditions of constant returns to scale. In Figure 4.4, the isoquant SS' represents the various combinations of the two factors that a perfectly efficient firm might use to produce unit output ($y=1$). The isocost AA' is obtained from the expression $C = w_1x_1 + w_2x_2$ where $\{w_1, w_2\}$ is the vector of exogenous prices of factor inputs x_1 and x_2.

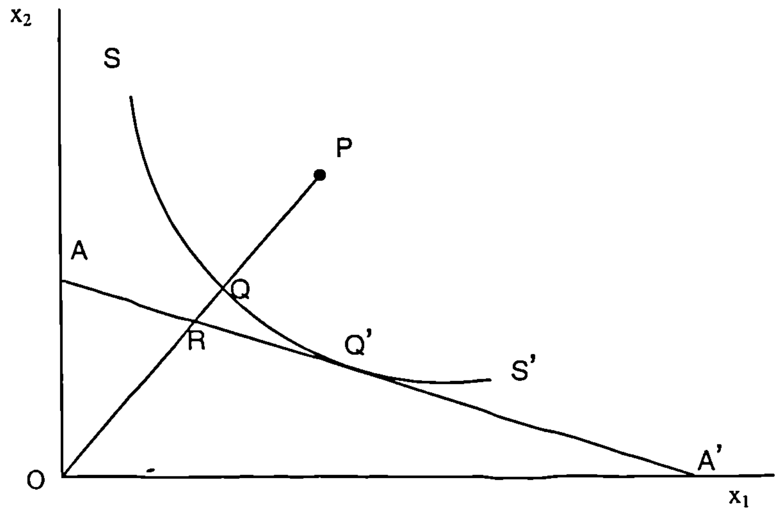
In Figure 4.4 the point Q represents a technical efficient firm using the two factors to produce output in the same ratio as P though it can be seen that it produces the same output as P using only a fraction OQ/OP as much of each factor. It could also be thought of as producing OP/OQ times as much output from the same inputs. The technical inefficiency of the firm P can be defined as OQ/OP. This ratio takes the value unity (or 100 per cent) for a perfectly efficient firm, and will become indefinitely small if the amounts of input per unit of output become indefinitely large. Moreover, so

[3] See also a recent study by Coelli *et al.* (1998). It is noteworthy that Berger Hancock and Humphrey (1993) in their first attempt to apply a profit function for calculating X-efficiencies also devised and implemented a new method of decomposing total X-inefficiency into allocative and technical components. They define allocative efficiency as the loss of profits from choosing a poor production plan, and model this as the effect of basing decisions on shadow prices instead of actual prices. On the other hand, technical inefficiencies are defined as the loss of profits from failing to meet this production plan. Other relevant studies on output allocative and technical efficiency are Aly *et al.* (1990) and English *et al.* (1993).

long as SS' has a negative slope, an increase in the input per unit output of one factor will, *ceteris paribus*, imply lower technical efficiency.

However, the point Q represents a technical efficient firm and not an allocatively efficient one because the conditions for cost minimisation are not observed. Therefore, the optimal method of production is now point Q' (where the technical rate of substitution equals the factor price ratio). The costs of producing at Q' will only be a fraction OR/OQ of those at Q. This ratio can be defined as the price (or allocative) efficiency of Q.

Figure 4.4 Farrell Measure of Technical Efficiency



Source: Adapted from Farrell (1957, p. 254).

Further, if the observed firm were to change the proportions of its inputs until they were the same as those represented by Q', while keeping its technical efficiency constant, its costs would be reduced by a factor OR/OQ, so long as factor prices did not change. It is therefore reasonable to let this ratio measure also the price efficiency of the observed firm P. This argument is not entirely conclusive as it is impossible to say what will happen to the technical efficiency of a firm as it changes the proportions of its inputs, but with this qualification it seems the best operational measure available. It also has the desirable property of giving the same price efficiency to firms using the factors in the same proportions. If the observed firm were perfectly efficient, both technically and in respect of prices, its costs would be a fraction OR/OP of what they in fact are. It is convenient to call this ratio the overall efficiency of the firm, and one may note that it is equal to the product of the technical and price efficiencies [Farrell (1957, p. 254)] and that it is an absolute measure and not a relative one of global efficiency.

By the mid-eighties, Humphrey (1987) added a new dimension to the existing literature on bank costs with his notion of cost dispersion. Humphrey noted that the observed variation in costs among banks could be divided into two components: *i*) scale or cost economies across different-sized banks and *ii*) cost differences between similarly-sized banks. He concentrated on the second type of variation and reported that the difference in average cost between banks with the highest costs and banks with the lowest costs was two to four times greater than the observed variation in average costs across bank size classes. The study reported the considerable cost dispersion that exists across similar size banks. Dispersion was greatest for the smallest classes of banks, and fell as banking groups became larger. Given these results, Humphrey concluded that "the existence of bank scale economies (or diseconomies) should have little competitive impact relative to those competitive effects which already exist as a result of large differences in cost levels" [Humphrey (1987, p. 24)]. In other words, Humphrey (1987) attempted to provide an explanation of X-efficiencies in US banking by examining the dispersion in average costs of banks within similar-sized banks. It should be noted that bank average cost (defined as total operating and interest expenses per dollar of assets) was computed for over 13,000 US banks in 1980, 1982 and 1984. (Data on these institutions were collected from the Consolidated Report of Condition and Report of Income and Dividends).

According to more recent studies, scale and scope economies in banking appear to be small compared with the level of X-efficiencies. Berger, Hunter and Timme (1993) emphasise that while scale and scope efficiencies account for nearly 5% of bank costs, average X-inefficiencies account for approximately 20% of costs (as a result of the application of parametric approaches) and may range from less than 10% to over 50% (in non-parametric approaches). In short, banking X-efficiencies may be over 400 percent more significant than corresponding scale and scope efficiencies. As shown in Chapter 2, reducing X-inefficiencies is among the core objectives in the process of European banking sector harmonisation. Moreover, as Leibenstein (1980, p. 33) stressed, "starting with high degrees of X-inefficiencies, competition creates pressures to reduce X-inefficiency [...]".

To summarise, X-inefficiencies represent the differences in managerial ability to control costs or maximise revenues. However, managerial inability is not the only source of X-inefficiency. Resti (1997a) suggests that observable production plans and cost levels usually do not follow from perfectly rational and efficient decisions; such factors as errors, lags between the choice of the plan and its implementation, inertia in human behaviour and distorted communications and uncertainty might cause X-inefficiencies to drive real data away from the optimum.

Finally, it is of interest to point out that it is also possible that bank management may have goals that differ from those of the bank's shareholders [for instance, Mester (1994)]. On the one hand, shareholders want to maximise the stock market value of the bank, and thereby its long-run profits; on the other hand, a bank's managers might be interested in something other than cost minimisation. For instance, managers may desire a larger staff because they think that it gives them more prestige within the banking community. Therefore, a bank might use an inefficient combination of inputs (in this case more labour than necessary) to produce its services. Such a situation is known as expense preference behaviour on the part of managers [see, for instance, Cebenoyan *et al.* (1993) on the agency-related inefficiency problems in the US thrift industry].

Despite the large volume of research on modelling X-inefficiencies since its introduction in the 1960s, up until recently, there has been relatively little research on the European banking market. Moreover, there is still no consensus as to the best method for evaluating X-inefficiencies. The next section focuses on the different techniques currently available to calculate cost efficiency in banking. The main literature is reviewed in section 4.5.

4.4 Different Approaches to Measuring Efficiency

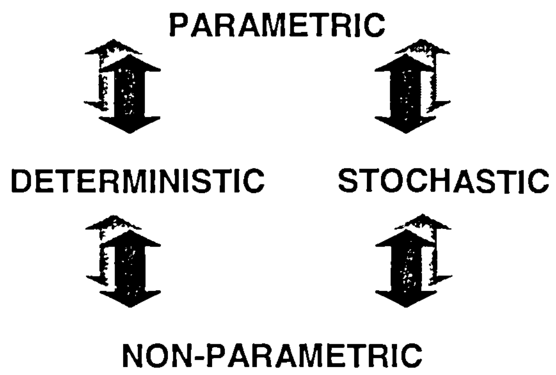
Over the last twenty years, a number of different methodologies and techniques have evolved for estimating cost efficiency in banking. This section examines these main approaches focusing on the most recent developments.

4.4.1 Parametric v. Non-Parametric and Deterministic v. Stochastic

Efficiency analysis has developed over the last twenty years mainly along two separate streams. On the one hand, econometric studies have aimed at improving the standard OLS estimates with the addition of an asymmetric structure for the residuals in order to account for the distance between empirical observations and the theoretical efficient frontier. On the other hand, linear programming algorithms have also been used for the evaluation of the relative efficiency of multi-product/multi-input firms [see, for example, Resti (1997a)].

As shown in Figure 4.5, these methodologies (that have been applied to many areas besides banking), fall roughly into four interrelated categories: parametric, non-parametric, deterministic and stochastic. Both the parametric and non-parametric techniques can be either deterministic or stochastic. Equally, deterministic and stochastic frontiers can be either parametric or non-parametric [for example, Simar (1997)].

Figure 4.5 Types of Frontiers



Parametric models are characterised by the fact that an explicit functional form that presupposes the shape of the frontier for the production function, cost function or profit function is assumed. For example, parametric frontiers have often been specified in the form of: Constant Elasticity of Substitution or CES [Arrow *et al.* (1961)] models; Cobb Douglas [Aigner and Chu (1968)]; Leontief [Diewert (1971)]; transcendental logarithmic (translog) [Christensen, Jorgenson and Lau (1973)].[4,5]

In contrast, with non-parametric models no functional form (other than linear interpolation between certain data points) is specified or estimated. With these methods, the best-practice banks are actually positioned on the frontier while the other banks are less efficient relative to them. These techniques include Data Envelopment Analysis (DEA) [Charner, Cooper and Rhodes (1978)] and the Free Disposal Hull (FDH) approach [Déprins, Simar and Tulkens (1984)].

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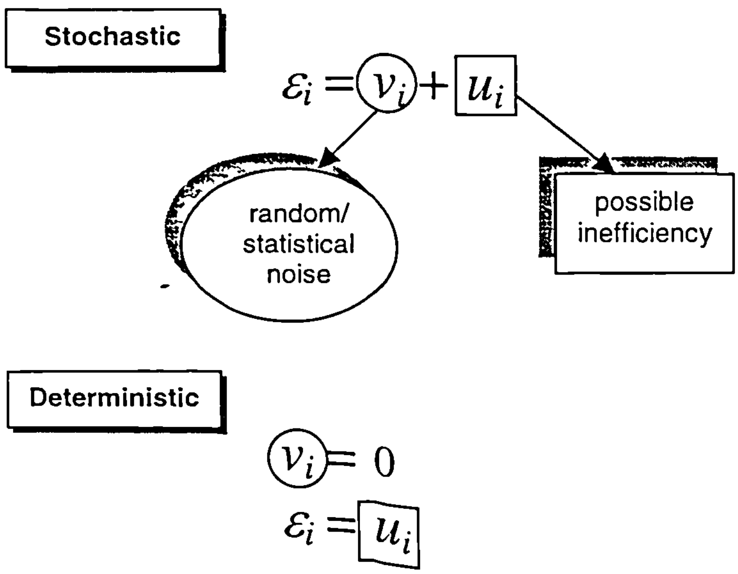
[4] Other functional forms have also been specified in the literature. Examples are: the Box–Cox transformations of the translog model [Clark (1984); Lanciotti and Raganelli (1988)]; Mester's (1992) estimation of a hybrid translog function [see also Molyneux *et al.* (1996)]; and the estimation of a Fuss normalised quadratic variable profit function by Berger, Hancock and Humphrey (1993).

[5] It should be noted that the Fourier-flexible is often referred to as semi-nonparametric because it combines a standard translog form with the non-parametric Fourier form [see Gallant (1981, 1982 and 1984)].

As mentioned above, both parametric and non-parametric frontiers may be specified in a deterministic or stochastic context. Figure 4.5 shows the differences between stochastic and deterministic frontiers: the former assumes that ε_i (the error term) is a two-component error term, the latter does not capture all the reality because the error term is one sided and no statistical noise can be inferred from the estimation.

The deterministic and stochastic parametric frontiers are employed in the literature to estimate parameters to be used to estimate economies of scale and scope. Moreover, the employment of the stochastic frontier allows for the measurement of X-efficiency levels. However, recent studies on scale and scope efficiency derived from deterministic frontiers have been criticised on the grounds that they should be estimated only on the X-efficient frontier where "they are properly defined" [Berger, Hunter and Timme (1993, p. 227)].

Figure 4.6 Deterministic v. Stochastic Frontiers (In Terms of ε_i)



At present the best-known parametric technique for deriving efficiency measures is probably the Stochastic Frontier Approach (SFA) (also known in the literature as Econometric Frontier Approach, EFA). Other parametric techniques include: *i*) the Thick Frontier Approach (TFA), which assumes that deviations from predicted costs within the lowest average-cost quartile of banks in a size class represent a random error, while deviations in predicted costs between the highest and the lowest quartiles represent inefficiency [Berger and Humphrey (1991 and 1992a), Bauer *et al.* (1993); Berger (1993)]; and *ii*) the Distribution Free Approach (DFA); which assumes that the efficiency differences are stable over time, while random error averages out over time [Berger (1993); Berger and Humphrey (1992b)]. DFA may be used when panel data are available because some distributional assumptions of the stochastic frontier can be relaxed (see the next section for more details).

Non-parametric techniques have also started to be widely applied to banking data. However, Kaparakis *et al.* (1994, p. 877) observed that, "non-parametric versions [of stochastic frontiers] remain in their embryonic stage and uncertainty surrounds the statistical properties of the obtained estimates. Parametric versions, on the other hand, are better developed and have an extensive track record".

The most common non-parametric methodologies applied for the derivation of productive efficiency levels in banking are DEA and the FDH approach. These methodologies are usually deterministic and this is often considered as a critical drawback. This is because while imposing less structure on the frontier, the non-parametric approach does not allow for random error. Only recently have stochastic non-parametric models been applied to estimate X-efficiencies in the banking industry [see, for instance, a simulated analysis with stochastic DEA by Resti (1997b)].

DEA dominates the non-parametric methodologies. It is called data *envelopment* analysis because the data on best practice banks literally 'envelop' the data for the rest of the banks in the sample. The DEA frontier is formed as a linear combination that connects a set of best-practice observations yielding a convex production possibility set. As discussed above, the DEA is a linear programming technique which generally assumes that there are no random fluctuations, so that all deviations from the estimated frontier represent inefficiency [Rangan *et al.* (1988); Ferrier and Lovell (1990); Elyasiani and Mehdian (1990)]. As a consequence, the estimates of inefficiency derived from non-parametric studies are usually higher (in the order of 20 to 50 percent) compared, for example, with stochastic frontier estimates.

The other main non-parametric approach is the FDH methodology, which can be defined as a special case of the DEA model where the hypothesis of convexity of the production possibility set is dropped. Since the FDH frontier is either congruent with or interior to the DEA frontier, it typically generates larger estimates of average efficiency than DEA [Déprins, Simar and Tulkens (1984) and Tulkens (1993)].

It is difficult to determine which of the two major approaches (parametric and non-parametric) dominates the other since the true level of efficiency is unknown. At present most studies use either stochastic parametric frontiers or deterministic non-parametric models to measure cost efficiency in banking. Several studies employ them both despite the fact that they have quite distinct methodological assumptions [see, for example, Ferrier and Lovell (1990); Bauer *et al.* (1993); Berger and Mester (1997); Resti (1997a); Casu and Girardone (1998)].

4.4.2 Efficiency Analysis and the Use of Panel Data

Another important issue in efficiency analysis concerns the choice of the model when data are available for several periods. The aim of this section is to give a brief overview of panel data analysis and to highlight the most important advantages of employing panel models in calculating efficiencies over time.

Panel data models refer to the pooling of observations of a number of firms i over t time periods. In other words, for each variable used the data concerns i banks, and for each bank there are t observations equal to the length of the period under study [see, for instance, Battese and Coelli (1988); Kumbhakar (1990); Cornwell *et al.* (1990); Greene (1993a); Baltagi (1995); Coelli *et al.* (1998)].

It is common to distinguish between fixed and random effect panel data. The fixed effect model generally assumes that differences across units can be captured in differences in the constant term. Therefore, as pointed out for example by Greene

(1993a), this is a reasonable approach when the differences between units can be viewed as parametric shift of the regression function. Otherwise, it might be more appropriated to view individual specific constant term as randomly distributed across cross-sectional units (random effect model). The component that represents the random disturbance characterising the *i*th observation is assumed to be constant through time. It should be noted that the random effect model typically requires the independence between the exogenous variables and the individual noise (in the present context, the level of inefficiency).

Several important advantages associated with the use of panel-data in production analysis are as follows [see Greene (1993a) and Baltagi (1995)]:

- Panel data give more informative data and more variability than time series and cross-sections because they have more observations. Thus, the estimated parameters tend to be more efficient since there are greater degrees of freedom and less collinearity among the variables.
- The use of panel data allows for a control on individual heterogeneity of the firms under study. In fact, when specifying a model it is possible to omit important variables for various reasons, such as difficulties in measurement.
- By repeating the observations on the same banks over time, it is possible to obtain further information that "compensates" the elimination of omitted variables when these variables are time-invariant.[6]
- The econometrics of panel data allows for taking into account possible unobserved effects, which are constant with time, but are different among banks (and which would produce distorted cross-sections).
- Panel data permit the simultaneous investigation of both technical change and technical efficiency change over time, given that technical change is defined by an

[6] These variables can therefore be included in the model as individual effects. If it is assumed that the individual effects are fixed, it is possible to obtain estimates for the parameters that are not distorted. If it is assumed that the individual effects are random, it is possible to achieve consistent estimates by using further hypotheses on the correlation structure between random effects and the regressors [Greene (1993a)].

appropriate parametric model and the technical efficiency effects in the frontier model are stochastic and have the specified distribution [Kumbhakar (1990); Hancock (1991); and Coelli *et al.* (1998)]. Moreover, technical efficiency is better studied and modelled with panels than purely cross-section or time-series data [see also, Baltagi and Griffin (1988); Cornwell *et al.* (1990); Kumbhakar (1990, 1991, 1993); Baltagi (1995)].

The use of panel data for measuring production relationships dates back to Mundlak (1961). Some twenty years later, Pitt and Lee (1981) suggested the use of panel data for the estimation of a stochastic frontier and thus for measuring the efficiency of firms. Specifically, Pitt and Lee (1981) specified the panel-data version of the Aigner, Lovell and Schmidt (1977) half-normal model.

Schmidt and Sickles (1984) defined systematically the link between the literature on stochastic frontier functional forms and panel data. Specifically, they focused on the advantages offered by panel data for the estimation of firm efficiency. These advantages relate to: *i*) the relaxation of *a priori* assumptions on the distribution of u; and *ii*) the possibility of obtaining a consistent estimator $\hat{u}_i$ for the individual inefficiencies.

In other words, the availability of panel data enables even the use of a standard model of fixed and/or random effects without the need to make any distributional assumption for the inefficiency term, as in the case of DFA.[7] As observed earlier, the DFA can be used when panel data are available because some distributional assumptions of the stochastic frontier can be relaxed. It follows that if the distribution of u is known *a priori*, then it is not possible to benefit from one of the advantages derived from the panel estimation listed above: that is the relaxation of the assumptions on $f(u_i)$. On the other hand, it becomes possible to carry out maximum likelihood estimations.

[7] There are, however, various limitations associated with the use of panel data. It has been argued [Berger and Mester (1997)] that the reasonableness of the assumptions about the error term components may depend crucially on the length of the period studied. For example, if too short a period is chosen, the random errors might not average out, in which case random error would be attributed to inefficiency. If too long a period is chosen the firm's core efficiency becomes less meaningful because of changes in management and other events (e.g. it might not be constant over the time period).

4.4.3 New Views on Bank Efficiency Analysis

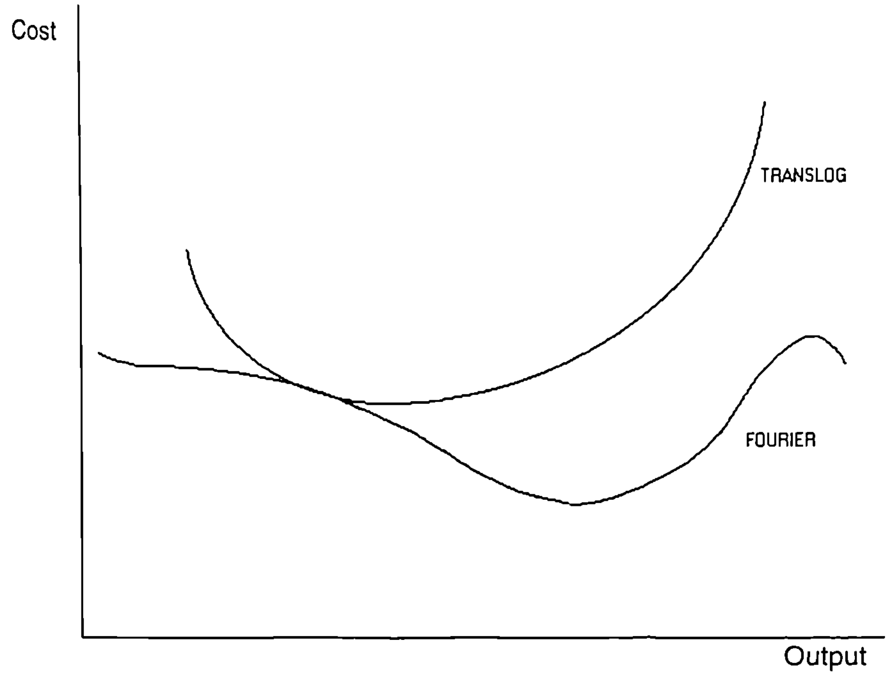
McAllister and McManus (1993) were among the first to suggest that most of the previous empirical literature on bank X-efficiency might be biased because of problems related to the statistical techniques used. Meanwhile, Berger, Hunter and Timme (1993a, p. 227) reckoned that the translog was: "insufficiently flexible to describe an industry with increasing returns to scale up to some point and constant returns thereafter, and seems to have difficulties when firms tend to change product mix significantly as they change scale."

Traditionally, the translog cost function had usually been employed in the bank cost literature on the grounds that it has two important advantages [Forestieri (1993)]: 1) it allows for a U-shaped average cost curve or, at least for a cost curve not uniform for all sizes; and 2) it dispenses from the ancillary hypothesis of an input elasticity equal to 1, typical of the Cobb-Douglas form, and from the constraints typical of the CES model.

The Fourier-flexible functional form, instead, combines the stability of the translog specification near the average of the sample data with the flexibility of the Fourier specification for observations far from the averages [see, for instance, Mitchell and Onvural (1996); Berger and De Young (1997); Berger *et al.* (1997); Berger and Humphrey (1997); Berger and Mester (11997) and Altunbas *et al.* (1999)].

Figure 4.7 shows the shape of cost functions that may be derived from the Fourier and U-shaped translog models.

Figure 4.7 Translog and Fourier-Flexible Functional Forms



Source: Adapted from McAllister and McManus (1993, p. 396).

Mitchell and Onvural (1996) studied scale and scope economies for US large banks, and they statistically rejected the translog in favour of the Fourier-flexible functional form, in which trigonometric terms are added to the ordinary translog. Both McAllister and McManus (1993) and Mitchell and Onvural (1996) showed that some of the differences in results on scale economies across studies might be due to the ill-fit of the translog function across a wide range of bank sizes. Also Berger and Humphrey (1997) argued that since the parametric approach imposes functional forms that restrict the shape of the frontier, the solution lies in adding more flexibility to the parametric approaches by using a Fourier approximation, which technically represents the unknown cost function using a Fourier series.

Berger and Humphrey (1997) have also pointed out the limitations of the non-parametric approach and they suggest that such approach should consider using a resampling technique, such as *bootstrapping*, in order to accommodate random error in the efficiency estimates. This technique, [Simar (1992); Simar and Wilson (1995)] appears to be a way of obtaining an empirical approximation to the underlying sampling distribution of DEA and FDH efficiency estimates.

However, these are not the only criticisms of previous research. In an important recent study, Bauer *et al.* (1997) argued that it is not necessary to have a consensus on what is the single best frontier approach for measuring efficiency for the efficiencies to be useful for regulatory analysis. Bauer *et al.* (1997, p. 3) propose a set of "consistency conditions" that efficiency measures derived from various approaches should meet to be most useful for regulators or other decision-makers. These consistency conditions note that:

(1) the efficiency scores generated by the different approaches should have comparable means, standard deviations and other distributional properties;

(2) the different approaches should rank the institutions in approximately the same order;

(3) the different approaches should identify mostly the same institutions as "best practice" and as "worst practice";

(4) all of the useful approaches should demonstrate reasonable stability over time;

(5) the efficiency scores generated by the different approaches should be reasonably consistent with competitive conditions in the market;

(6) the measured efficiency from all of the useful approaches should be reasonably consistent with ~~the~~ standard non-frontier performance measures, such as return on assets or cost/revenue ratio.

Consistency conditions (1), (2) and (3) may be thought of as measuring the degree to which different approaches are mutually consistent, while conditions (4), (5) and (6) may be thought of as measuring the degree to which the efficiency generated by the different approaches are consistent with reality or are believable. The former are more helpful in determining whether the different approaches will give the same answers to regulatory policy questions or other queries, and the latter are more helpful in determining whether these answers are likely to be correct [Bauer *et al.* (1997, p. 3)].

Finally, it is important to note another criticism of bank cost studies – ignoring the profit side of the banks' operations. Recently, studies employing profit functions or investigating both banks' cost and profit efficiency have gradually acquired greater importance. The rationale for these studies is that banks that show the highest inefficiency and incur the highest costs might be able to generate more profits than the more cost-efficient banks. Of the 130 studies on financial institutions' efficiency studies reviewed by Berger and Humphrey (1997) only nine analysed profit efficiency although there have been some recent additions to the list, such as Rogers (1998); De Young and Hasan (1998); Dietsch and Weill (1998) and Maudos *et al.* (1998).

4.5 Selected Literature Review on Cost Economies in Banking

4.5.1 Studies on Bank Costs in the US

Most early studies modelling cost efficiency have been undertaken on US banking. The earliest US research relied on banks' balance sheets and income statement data to calculate financial ratios relating to bank costs and their output. These studies can be broadly classified into two groups: (1) studies that measured output in terms of earning assets [Alhadeff (1954) and Horvitz (1963)]; and (2) studies that used total assets to measure output [Schweiger and McGee (1961) and Gramley (1962)].

Alhadeff (1954) was one of the first researchers to focus on the cost differences between banks of various sizes in the state of California. The years studied were 1938-50; output was measured as the ratio of loans and investments to total assets to reflect the used capacity to total capacity of the bank. Alhadeff's study found that branch banks could produce greater output per dollar resources compared with unit banks (represented, in turn, by the four largest branch bank organisations). Alhadeff also found increasing returns to scale for the smallest and largest banks in his sample and constant returns to scale for medium- sized banks. Later Horvitz (1963) produced similar results from a study on Kansas City banks for 1959, with average costs fairly constant for mid- sized banks and cost economies among larger banks. Horvitz also concluded that scale economies in banking were not high and that although small banks could not compete directly with large banks, they could survive in the market because at least for small loans they seemed to be cost efficient producers.

Studies by Schweiger and McGee (1961) and Gramley (1962) used total assets (and not only earning assets) to measure bank output. Schweiger and McGee (1961) found lower costs for large banks and concluded that these latter banks had a distinct cost advantage per unit of assets over small and medium- sized banks. In 1962, Gramley's findings suggested that larger banks could experience cost advantages (mainly from labour saving methods of operation) and small banks' costs were higher because they simply did not work as hard to control costs.

Subsequently, the empirical research in US banking can be divided into two main stages: (1) the cost studies dating back to the mid- 1960s and early 1970s, employing the Cobb-Douglas cost function (which can only be used to model linear relationships); and (2) the cost studies of the 1980s and early 1990s, which relied on the deterministic translog cost function (also with approximations such as Box-Cox) which allowed for the estimation of U-shaped average cost curves.

In 1965 two important studies by Benston (1965a,b) heralded a "new generation" in the US cost literature in banking: he employed a logarithmic Cobb-Douglas cost function to calculate scale economies using bank data obtained from the Functional Cost Analysis (FCA) programme of the Federal Reserve System. The results showed only slight economies of scale and suggested that bank size does not in itself provide a cost advantage. Benston also concluded that merging five banks into one unit bank would increase the costs significantly and that only banks with three or fewer branches actually experienced cost benefits.

Greenbaum (1967) using a similar approach to Benston found that banks with less than $10 million in assets were inefficient, and concluded that without regulation these banks would possibly disappear from the market. In 1967 Bell and Murphy tried to find out whether large banks could gain from greater economies of scale: they concluded that large banks tended to have lower costs because they used less-skilled labour. Both

Greenbaum (1967) and Bell and Murphy (1967) were cautious in reporting their results because they were expecting possible changes in the banking industry brought about by technological process.

Many studies during the 1970s attempted to extend the previous literature by taking into account technology and other trends in modern banking [for example, Murphy (1972); Daniel, Longbrake and Murphy (1973); Kalish and Gilbert (1973); Mullineaux (1975) and Mullineaux (1978)]. From these studies, mainly based on Cobb-Douglas cost function estimations, there appeared to be a consensus about the existence of economies of scale in banking, although these were not large enough to prevent small and medium- sized banks benefiting from viable competition. Moreover, several of these studies found the presence of U-shaped cost curves. Mullineuax (1978) for instance was the first to apply a combined translog/Cobb-Douglas profit function (although the Cobb-Douglas functional form could not be rejected).

Although widely used in the applied economics literature, the Cobb-Douglas cost function was soon replaced in bank cost studies by other functional forms because of the critical restrictions that were necessarily imposed on inputs and outputs, and because it only allowed the estimation of linear functions. However, the primary uncertainty expressed in the translog cost function literature was the location of the bottom of the average cost U-shaped curve – e.g. the scale efficient point or optimal bank size [see Humphrey (1990) and Berger, Hunter and Timme (1993)].

The translog deterministic functional form began to be used in virtually all studies, in order to allow for multiple product outputs and the jointness in cost. As shown later in this chapter, the use of the translog cost function yielded conflicting results compared with those derived from the Cobb-Douglas studies, namely that economies of scale seemed to be high for small to medium-sized banks, whereas diseconomies of scale appeared significant for larger banks. A review of US selected studies on scale and scope economies using the translog cost function can be found in Table A4.1 in the Appendix to this chapter.

One of the first studies to fit a translog cost function to banking data was Benston *et al.* (1983). This study also aimed to evaluate tests for jointness in the production of bank services. The results showed that scale economies prevailed for all sizes of branch offices except the largest, while their test on cost complementarities gave indecisive results. These results contrasted with those of Gilligan and Smirlock (1984) and Gilligan *et al.* (1984) who performed tests for the possible existence of scope economies and found evidence of scope economies (although without reporting the estimates) between demand and time deposits as well as between securities and loans. Similarly, Kolari and Zardkoohi (1987) reported evidence of jointness in bank production, and found that large banks did not appear to have cost advantages, in terms of scope economies, compared with small banks. Thus, again, no consensus was reached as to the issue on the jointness in producing bank services.[8]

In general, a summary of the main findings of the US cost studies undertaken during the 1980s is as follows. When the production approach was utilised, for banks smaller than $1 billion in total deposits most studies concluded that the optimum size of a bank was relatively small [Benston *et al.* (1982); Clark (1984); Kolari and Zardkoohi (1987)], and diseconomies appeared at all unit banks with deposits above $50 million [Gilligan and Smirlock (1984)], $100 million [Gilligan *et al.* (1984)], and $200 million [Benston *et al.* (1983)].

For those studies on scale economies for banks smaller than $1 billion in assets size, when the intermediation approach was used, Berger *et al.* (1987) found that branch banks showed slight economies of scale at the branch level and slight diseconomies at the level of the banking firm, whereas unit state banks showed significant diseconomies of scale for large banks. Moreover, this study concluded that there were diseconomies of scope in banking. Studies that examined the cost features of a wider range of sizes typically found average costs to be minimised between about $75 million and $300

[8] One of the main limitations of the translog cost function is its indeterminacy whenever one or more products are produced. The more products are specified and the more differentiated the behaviour of a financial firm, the more it becomes necessary to include in the sector analysis the assumption that one or more outputs equal zero for at least some firms [Forestieri (1993)]. The Box-Cox transformation of the translog function [Clark (1984)] or the hybrid translog [Kolari and Zardhooki (1987)] seemed able to solve the problem. A different solution often adopted for the calculation of economies of scope is the assignment of low but positive values (usually the minimum value observed in the sample) to the level of production of each service [for example, Benston *et al.* (1983); Kim (1986); Mester (1987); Cossutta *et al.* (1988)].

million assets size range [Berger *et al.* (1987); Ferrier and Lovell (1990); Berger and Humphrey (1991)].

When large US banks were included in the samples (>$1 billion assets), usually the minimum average cost point was found between $2 billion and $10 billion in assets size, and evidence of scope economies typically was not found [Hunter and Timme (1986); Shaffer and David (1986); Kim (1986); Hunter and Timme and Yang (1990); Noulas, Ray and Miller (1990)]. Hunter and Timme (1986), in particular, examined the nature of technical change in the banking industry and reported that it produced significant cost reductions for large banks. Conversely, diseconomies of scale were found by Noulas, Ray and Miller (1990) for banks with relatively large assets size (between $3 and $6 billion assets). These authors also concluded that the translog cost function was not a reliable function for assessing scope effects because of estimation error.

Overall, these results suggest that in US banking increasing returns to scale are typically found for only relatively small banks. Therefore, no consensus existed as to the optimal size of banks. Moreover, no clear evidence of economies of scope was found.

4.5.2 European and Italian Literature on Economies of Scale and Scope

Cost studies on European banking date back to the late 1970s when the issue of concentration in banking started to become a matter of interest both from a public policy and banking sector perspective. This period was also characterised by a process of internationalisation of the economy and by the very first attempts to deregulate the sector. It follows that most empirical work focused on national markets and cross-country European cost studies have been undertaken only relatively recently thanks also to the increasing availability of bank financial information. In addition, the importance of the European financial sectors "in achieving the overall economic gains sought by deregulation and 'free market solutions' in resource allocations within European economic systems" has increased the need for a greater empirical research into European banking efficiency [Molyneux *et al.* (1996, p. 256)].

In the 1970s the most active researchers in this field were French and Italian [for example Lévy-Garboua and Lévy-Garboua (1975) and Levy-Garboua and Renard (1977); Ruozi (1968) and Ciocca *et al.* (1974)]. In these studies the influence of the earlier US literature developed by Benston (1965a,b) and Bell and Murphy (1967) is apparent. The earliest European studies employ Cobb-Douglas cost functions to evaluate the cost characteristics of their banking sectors. From these early European cost studies, evidence of scale economies was generally found for small and medium-sized banks; although evidence of cost complementarities was often observed across a wide range of bank sizes, scope economies were more elusive.

In 1975, a study by Maes on Belgian banks suggested that significant diseconomies of scale existed for large banks. This result was then confirmed by a later study [Pacolet (1986)], which also demonstrated the existence of U-shaped cost functions for several bank types and in particular for commercial and saving banks.

Revell (1987 and 1989) surveyed the empirical research on banking efficiency in the context of an apparent movement towards bigger banks in Europe. Although both of these studies focused primarily on Spanish banks, Revell explored the extensive US literature and considered its relevance to the European banking sector. He concluded that scale economies existed under some conditions and in certain parts of banks' operations, but they were not so important as the arguments used in favour of mergers seemed to assume. Revell believed that mergers were generally far from being a quick and sure way of increasing efficiency; he noted that whenever scale economies could be proved to exist, the authorities should encourage more sharing of facilities and a kind of consortium approach among banks.

In Spain economies of scale were found by Fanjul and Maravall (1985), who also found constant returns to scale when the number of branches were included in the estimation. Evidence on scale and scope economies was also found for medium-sized Spanish savings banks, although not for large institutions [see for example Rodriguez, Alvarez and Gomez (1993)].

In the early 1990s, further studies on the French banking system, included the work of Dietsch (1990 and 1993) and Martin and Sassenou (1992). Overall, their results did not suggest any definite evidence of scale or scope economies in French banking. Little evidence on scale and scope economies has also been found for Swiss banks [Sheldon and Haegler (1993); Sheldon (1994)]. As to German banks, in contrast to Lang and Welzel (1996) who found no evidence of scale and scope economies, the recent study by Altunbas, Evans and Molyneux (1999) found substantial economies of scale for the German banking system.

In the UK, cost economy studies have focused on the building society sector, the findings tend to be conflicting because of the variety of methodologies used; evidence on economies of scale, for instance, was not found by Gough (1979) and Barnes and Dodds (1983), who both estimated linear cost functions. Other studies found evidence of economies of scale for societies with asset size less than £100 million [Cooper (1980)], £280 million [Hardwick (1989)], £5,500 million [Hardwick (1990)], and in the £120-500 million range [Drake (1992)]. Moreover, little evidence on scope economies has been observed in the building society sector [Hardwick (1990); Drake (1992); McKillop and Glass (1994)]. In particular, Drake (1995) extended his earlier (1992) analysis on the UK building societies and respecified the translog cost function by including an extra parameter for expense preference behaviour. The results of this study found little evidence of economies of scale and scope. McKillop and Glass (1994) employed a hybrid translog cost function to obtain econometric measures of overall and augmented economies of scale, product-specific scale economies and economies of scope. The data were obtained from the 1991 annual returns for a sample of 89 building societies, grouped into three categories – national, regional and local – depending on their consolidated asset size and number of branches. Scale and scope estimates were then calculated for each category of societies as well as the whole industry. Overall, McKillop and Glass (1994) found evidence of significant augmented economies of scale for both national and local societies, but only constant return to scale for those societies that are regionally based.

Gathon and Grosjean (1991) and Pallage (1991) employed a translog cost function to analyse scale and scope economies in the Belgian banking market. Gathon and Grosjean (1991) found decreasing returns to scale for the four largest Belgian banks and increasing returns to scale for all other banks. Pallage (1991) found economies of scale for small institutions and diseconomies of scale when size increases, thus confirming the results achieved in 1986 by Pacolet. However, evidence of economies of scope was found only for the largest banks. In Ireland, Glass and McKillop (1992) used the data from one of the largest banks, Allied Irish Bank, for the period 1972-1988, to estimate a hybrid translog model. They investigated the process of natural and non-natural technical change, overall scale economies, product-specific scale economies and scope economies and found that there was no evidence of economies of scale, with diseconomies holding for the period as a whole and the majority of the subperiods considered. Moreover, the bank was found to exhibit neither economies nor diseconomies of scope over the production of its two outputs. However, evidence of significant technical change was found.

In Italy, as in most other European countries, sophisticated econometric techniques started to be used in the late 1980s. The utilisation of the Cobb-Douglas cost function was soon replaced by the more appropriate translog functional form, whereby U-shaped cost curves could be estimated and a more precise measurement of banking output was facilitated.

Table 4.1 provides details on various Italian bank efficiency studies. The table shows that the approach to modelling efficiency in the Italian banking system varies considerably. In general terms, studies dating back to the 1980s and early 1990s tend to find evidence of increasing returns to scale at the branch level. This means that average costs were found to be decreasing until a "critical" branch size was achieved. Diseconomies were mainly due to the increase in the number of branches [see, for instance, Parigi (1989); Baldini and Landi (1990); Landi (1990); Cardani *et al.* (1991)]. Baldini and Landi (1990) and Landi (1990) found that the level of economies of scale at the firm level was higher for the smallest banks in their sample. Cossutta *et al.* (1988) concluded that evidence on scale economies at the branch level could be found for all bank sizes (and especially for large banks) whereas economies of scale at the firm level were found only for the largest banks.

Table 4.1 Italian Banks' Efficiency Studies

AUTHORS	SAMPLE DATA	OUTPUT	METHODOLOGY	FINDINGS
CIOCCA, GIUSSANI AND LANCIOTTI (1974)	Year: 1971 Sample: 194 commercial banks and 77 savings banks	Production approach • Total assets • Deposits	Cobb-Douglas log-linear cost function	Evidence of significant economies of scale at a branch level especially for commercial banks. Constant returns at a firm level.
COSSUTTA, DI BATTISTA, GIANNINI AND URGA (1988)	Year: 1984 Sample: 226 banks	Intermediation approach • Financial activities (loans, interbank accounts, securities) • Services	Deterministic translog cost function	Evidence of scale economies for all output levels, except the lowest, both at a plant and at a firm levels.
LANCIOTTI AND RAGANELLI (1988)	Year: 1984 Sample: 394 commercial banks Source: Bank of Italy	Specific aggregate measures of output. Use of flow variables.	Cobb-Douglas log-linear cost function Box-Cox transformation	Economies of scale increase with bank size. Mergers can increase efficiency if accompanied by a sound rationalisation of branch network.
PARIGI (1989)	Years: 1985-1986 Sample: 239 banks Source: Il Mondo	Production approach • Deposits • Loans • Services	Deterministic translog multi-product	Scale economies are present for all banks except large banks for all the outputs. Scale economies are always higher for medium banks with respect to other sizes. There is evidence of economies of scope.
BALDINI AND LANDI (1990)	Year: 1987 Sample: 294 banks Source: Prometeia	Production approach • Deposits • Loans • Services	Deterministic translog multi-product	Evidence of scale economies for any bank size when number of offices is fixed. Otherwise slight economies of scale for smallest banks only. Ambiguous results on cost complementarities due to collinearity problems.
LANDI (1990)	Year: 1987 Sample: 295 banks Source: Prometeia	Production approach • Deposits • Loans • Services	Deterministic translog multi-product	Evidence of economies of scale for all sizes. Decrease of the level of economies of scale with the increase in branches. Reduction of branches implies cost savings in terms of scope economies.
CARDANI, CASTAGNA AND GALEOTTI (1991)	Year: 1986 Sample: 94 banks Source: Centrale dei Bilanci	One aggregate measure of output. Gross interest and services income.	Translog stochastic cost frontier	Scale economies exist only for smallest banks which also show a good level of performance in terms of overall efficiency.

Continued Overleaf

Table 4.1 Italian Banks' Efficiency Studies (*continued*)

AUTHORS	SAMPLE DATA	OUTPUT	METHODOLOGY	FINDINGS
CONIGLIANI, DE BONIS, MOTTA AND PARIGI (1991)	Year: 1987 Sample: 256 banks (233 holding) Source: Bank of Italy	Intermediation approach • Financial activities (loans, interbank accounts, securities) • Services	Deterministic translog multi-product	Evidence of scale economies for all bank sizes especially for small banks. Not significant evidence of scope economies.
PARIGI, SESTITO AND VIVIANI (1992)	Years: 1983-1989 Sample: 245 banks Source: Bank of Italy	Intermediation approach • Loans • Securities • Services • Interbank accounts • Credit commitments	Deterministic translog multiproduct Panel data	Evidence of strong scale economies both at the single branch office and branch level. Scope economies seem to increase with the size of banks.
ALTUNBAS AND MOLYNEUX (1993)	Year: 1988 Sample: 244 Source: BankScope (Cross-country study)	Intermediation approach • Total loans • Total securities	Deterministic translog multi-product	Evidence of significant overall economies of scale. Augmented scale economies significant only for small banks (<$600 million assets). Scope diseconomies appear to be evident in Italian banking at all output ranges.
ALTUNBAS, MOLYNEUX, DI SALVO (1994)	Years: 1990-1992 Sample: average of 484 credit co-operative banks Source: Centrale dei Bilanci	Intermediation approach • Total loans • Total securities	Translog stochastic cost frontier	Inefficiency levels do not appear to be large compared to other studies. Median values ranging between 9.4% and 13.3% in 1990 (mean=13.1%), 12.3% and 15.8% in 1991 (mean=15.9%) and 13.8% and 17.6% in 1992 (mean=17%).
GOISIS (1994)	Years: 1988-1990 Sample: 75 banks divided according to the size.	Production approach • Deposits • Customer loans • Loans to other banks • Non-interest income	Deterministic translog multi-product	Evidence of scale economies for every bank size. Higher economies of scale when branches are considered fixed with respect to output. Scope economies exist at all output ranges.

Continued Overleaf

Table 4.1 Italian Banks' Efficiency Studies (*continued*)

AUTHORS	SAMPLE DATA	OUTPUT	METHODOLOGY	FINDINGS
FAVERO AND PAPI (1995)	Year: 1991 Sample:174 banks Source: Centrale dei Bilanci	Production approach • Loans • Investments in securities and bonds • Non-interest income Intermediation approach includes also • current accounts and savings deposits	Non-parametric DEA Note: financial capital considered as input.	Technical and allocative inefficiencies exist in the Italian banking system and this result appear to be robust to modifications in the specification of inputs and outputs suggested by the intermediation and the production approach (96% and 95% efficiency respectively). Size found to be an indication of higher efficiency of larger banks; it reduces significantly the efficiency of small and minor banks.
ALLEN AND RAI (1996)	Years: 1988-1992 Sample: 17 banks (+ 768 non-Italian banks) Source: Global Vantage (Cross-country study)	Intermediation approach • Loans • Investment assets	Translog stochastic cost frontier Distribution-free model	Small banks average inefficiency levels of 15%, whereas for large banks 20%.
DI BATTISTA, MORELLI, PITTALUGA AND RESTI (1996)	Year: 1994 Sample: 206 banks Source: Bilbank	Production approach • Loans • Deposits • Services	Deterministic translog multi-product	Evidence of a positive relationship between size and scale economies ratio. The economies of scale are significantly high even when the number of branches are included in the estimation.
MOLYNEUX, ALTUNBAS AND GARDENER (1996)	Years: 1988 Sample: 244 banks Source: BankScope (Cross-country study)	Intermediation approach • Total loans • Total securities	Hybrid translog cost function	Significant scale economies for Italian banks with asset sizes greater than $1 billion assets. Constant returns to scale at firm level. Scope economies are not statistically significant.
CASU (1997)	Years: 1992-96 Sample: 80 banks Source: BankScope	Intermediation approach • Total loans • Interest income • Non-interest income	Non-parametric DEA	Efficiency scores decrease on average over the period 1992-95 and seem to increase by 1996. Mean efficiency levels range between 78% and 98%. Quoted banks appear more efficient than their non-quoted counterparts in 1995.

Continued Overleaf

Table 4.1 Italian Banks' Efficiency Studies (*continued*)

AUTHORS	SAMPLE DATA	OUTPUT	METHODOLOGY	FINDINGS
EUROPEAN COMMISSION (1997)	Years: 1987-1994 Sample: 148 banks (on average) Source: BankScope (Cross-country study)	Production approach • Total loans • Total securities • Customer and short-term funding	Deterministic translog multi-product (scale and scope economies) Translog stochastic cost frontier	German, French, Italian and Spanish banking systems appear to benefit from greater economies of scale in the run-up to the implementation of the main single market legislation. Evidence of scope economies for larger banks across virtually all European banking markets. X-inefficiencies are found to be around 16% as an average of the period. The single market program did not have a relevant impact on increasing X-efficiencies.
RESTI (1997)	Years: 1988-1992 Sample: 270 banks Source: Bilbank	Production approach • Loans • Deposits • Non-interest income	Translog stochastic cost frontier Non-parametric DEA	The two methodologies have highlighted some common elements: the efficiency scores have a high variance; northern banks are the most efficient in the country; there is a direct relationship between productive efficiency and asset quality; the productive efficiency did not increase over the period under scrutiny. X-efficiencies range between 69.4% and 69.8% in 1992 for the stochastic frontier and between 66.5% and 75% for the DEA model.
CASU AND GIRARDONE (1998)	Year: 1995 Sample: 32 banking groups + 78 holding companies (110 obs.) Source: BankScope	Intermediation approach • Total loans • Other earning assets	Translog stochastic cost frontier Non-parametric DEA (deterministic translog for scale and scope economies)	Banking groups are more X-inefficient than bank parent companies and subsidiaries forming part of the groups according to both parametric and non-parametric methodologies. Bank size is not the main determinant of potential cost efficiency in Italian banking. Bank conglomerates can gain relatively greater scope benefits compared with the single banks forming the group.
INZERILLO, MORELLI AND PITTALUGA (1999)	Years: 1994-1997 Sample: 1195 (of which 147 Italian large banks) Source: BankScope (Cross-country study)	Production approach • Loans • Deposits • Non-interest income	Translog stochastic cost frontier	Common patterns between Italy, France and Germany: - Returns to scale increase with bank size. - Larger banks are more efficient than smaller banks Evidence of a trend toward the reduction in the number of less efficient banks.

Conigliani *et al.* (1991) found evidence of economies of scale in Italian banking across a wide range of bank sizes. However, when branches vary with outputs evidence of scale economies was found only for small banks. Also, Parigi *et al.* (1992) obtained strong evidence of scale economies in the Italian banking industry within a panel of data where changes in banking and monetary regulation, as well as other heterogeneous factors (such as the territorial location of banks), were taken into consideration. In particular, the authors pointed out that before structural change in the sector, scale economies could not be completely exploited, especially because of intense controls aimed at diminishing the degree of competition in the Italian banking market. Furthermore, both studies found little evidence of scope economies.

More recently, another empirical study by Di Battista *et al.* (1996) found evidence of significant economies of scale in the Italian banking system. What is more interesting, they found, in contrast to previous findings [for example, Conigliani *et al.* (1991); Baldini and Landi (1990) and Landi (1990)] that economies of scale were substantial even when the number of branches were included in the estimation.

Another study by Casu and Girardone (1998) investigated the cost efficiency of Italian banking groups by evaluating the cost characteristics of bank parent companies and bank subsidiaries that form part of these groups in 1995. Their results suggested that bank groups have been unable to exploit fully scale economies reductions, although bank conglomerates were found able to gain from greater scope benefits compared with the single banks forming the group.

As far as cross-country European cost studies are concerned, Altunbas and Molyneux (1993) tried to verify the existence of scale and scope economies in France, Germany, Italy and Spain. Using a translog cost function methodology, they found significant differences in cost characteristics across European banking markets, together with strong evidence of scale and scope economies at the branch level in France, Germany and Italy. These cost savings seemed to occur primarily through the increased average size of banks' branches (rather than the growth in the size of the overall banking firm).

Molyneux *et al.* (1996) applied a hybrid translog model to measure scale and scope economies in France, Germany, Italy and Spain: their results seem to differ significantly for the four examined countries. In particular, firm-level scale economies were found for all sizes of banks in Spain, whereas those countries which exhibited diseconomies (Germany) and constant return to scale (Italy and France) also exhibited relevant scale economies at the branch level. Economies of scope at the firm level were found only in France across all output ranges, and diseconomies were reported in Spain. Italian banks were characterised by strong scope economies at the branch level, and the smallest German, French and Spanish banks exhibited strong diseconomies. In another cross-country analysis published by the European Commission (1997), there appeared to be a trend in the German, French, Italian and Spanish banking systems to benefit from greater economies of scale in the run-up to the implementation of the single market legislation. In the case of Germany and France, these systems appeared to benefit from increasing economies up until 1994, whereas for Italy and Spain the cost characteristics of the banking industry appeared to have reverted back to constant and/or diseconomies of scale post-1991/92. Evidence of scope economies was found for the largest banks across virtually all European banking markets. There also appeared to be an increase in the level of scope economies for smaller banks in France Germany, Italy and Spain comparing the pre- and post-integration period.

In a recent study undertaken on a sample of large banks in Italy, France and Germany, Inzerillo *et al.* (1999) found that returns to scale tend to increase with bank size.

4.5.3 X-Efficiency Findings by Measurement Method

As discussed earlier in this chapter, in recent years researchers have tended to focus on modelling banks' X-efficiency levels. This has mainly been the result of two main factors: firstly, X-efficiency differences across banks are relatively large and appear to dominate both scale and scope efficiencies and secondly, leading researchers found that scope efficiencies had often been confounded with X-efficiency differences [Berger, Hunter and Timme (1993)].

Berger and Humphrey (1997) recently surveyed 130 such studies. These studies apply frontier efficiency analysis to banks/financial institutions in 21 countries and cover four types of financial institutions – banks, savings and loans (S&Ls), credit unions, and insurance firms. The survey is the first major attempt to make some tentative comparisons of average efficiency levels both across measurement techniques and across countries. The Berger and Humphrey survey found that of the 60 parametric applications, 24 used the Stochastic Frontier Approach (SFA), 20 the Distribution Free Approach (DFA) and 16 the Thick Frontier Approach (TFA). Moreover, out of 69 non-parametric applications, 62 were DEA and only 5 FDH, thus confirming an unequivocal predominance of DEA among this group.

Overall, efficiency estimates derived from parametric frontier models (SFA, TFA and DFA) are similar to those obtained from non-parametric (DEA and FDH) studies, although these latter usually produce slightly higher mean inefficiency levels and appear to exhibit greater dispersion than the results of the parametric models. Specifically, average efficiency levels in US banking over the last ten years were found to be in the order of 84 per cent for the parametric models (with a standard deviation of 0.06 and a range between 0.61-0.95). For studies on non-US banks average efficiency levels were found to average 0.76 with a standard deviation of 0.12. Estimates obtained from non-parametric models applied to US banking markets, have mean efficiency levels of 72% (standard deviation equals 0.17 and range 0.31-0.97), whereas for the non-US banking studies the overall mean efficiency was 75 per cent with a standard deviation of 0.14.

Over the last decade, the number of studies comparing the results derived from the application of multiple approaches (usually two efficiency methods) to a single set of data has increased [for example, Ferrier and Lovell (1990); Giokas (1991); Bauer *et al.* (1993); Ferrier *et al.* (1994); DeBorger *et al.* (1995); Berger and Mester (1997); Eisenbeis *et al.* (1996); Resti (1997a); Casu and Girardone (1998)]. Such investigations are particularly important because, as highlighted by Bauer *et al.* (1997, p. 1), in order to make informed policy decisions about financial institutions "regulators need to have fairly accurate information about the likely effects of their decisions on the performance of the institutions they regulate/supervise". Researchers seem to be more concerned at this time (compared with the past) about the degree of consistency among results derived from the application of different methodologies and techniques to the same dataset.

Meanwhile, cross-country studies in Europe have also recently increased in importance as a result of the harmonisation process that contributed to the creation of a more integrated and harmonised EU banking market [see, for example, Berg *et al.* (1993); Fetcher and Pestieau (1993); Bergendhal (1995); Ruthenberg and Elias (1996); Pastor *et al.* (1997); European Commission (1997); Inzerillo *et al.* (1999)]. These studies are important because they provide useful information about the relative efficiency and competitiveness of banks in different countries.

However, the majority of studies typically focus on national banking markets. This is explained by the fact that there are still many difficulties in performing and interpreting cross-country analyses. This is because of factors like different regulatory and economic environments across countries [Berger and Humphrey (1997)] and because it is important that all banks in the sample have access to the same frontier, as pointed out by Mester (1996).

As mentioned earlier, the objective of profit maximisation requires that goods and services be produced at minimum cost but also that the maximum volume of revenues are generated. A partial review of the profit efficiency studies can be found in Berger and Humphrey (1997) who surveyed nine such studies. Other relevant work includes Berger and Mester (1997) who used the concept of alternative profit efficiency (defined as when banks have market power to set prices) and standard profit efficiency (defined as when they behave as price takers) and, in line with most other studies, they found that profit efficiency is lower than cost efficiency; see also Maudos *et al.* (1998) for a cross-country study. Overall, the handful of studies that examine profit efficiency typically find that profit efficiency is lower than cost efficiency in banking markets. Table A4.2 in the Appendix, reviews some of the most relevant US and European studies employing stochastic cost frontiers [see also, the extensive surveys of Bauer (1990); Kaparakis *et al.* (1994); Berger and Humphrey (1997)].

As concerns the specific case of the Italian banking system, Table 4.1 above also reviews several Italian studies on efficiency in banking over the last decade. Overall, bank inefficiency levels appear to range between 15 and 20 per cent on average. For example, Altunbas *et al.* (1994) used a stochastic frontier analysis approach to explore possible inefficiency in the Italian credit co-operative sector between 1990 and 1992; their results suggest that inefficiency levels in this sector seem to be quite low compared with other studies. They argue that this might imply limited potential to improve substantially cost efficiencies through greater product diversification along the universal banking model lines. The European Commission (1997) cross-country EU study found that X-efficiency levels for most European banking markets covered in aggregate were around 20%. In particular, for the Italian banking market X-inefficiencies were found to be around 16% as an average for the period 1987-94. Resti (1997a) used both linear programming and stochastic cost frontier methodologies to examine cost efficiency in the Italian market. He found that the gap between the best and the worst banks in his sample was quite high; his study found that that northern-based Italian banks were more efficient than their southern counterparts and there appeared to be a direct relationship between productive efficiency and banks' asset quality. Resti also found that the efficiency of Italian banks did not increase over the period 1988-92.

Casu and Girardone (1998) compared the X-efficiency levels for bank groups with those of bank parent companies and subsidiaries forming part of the groups using both the econometric estimation and the linear programming method; they found that the two methodologies lead to a similar conclusion. Bank groups were found to be more X-inefficient than bank parent companies and subsidiaries forming part of the groups.

Finally, in their cross-country study on Italian, French and German banking markets Inzerillo *et al.* (1999) found that the largest banks in their sample were apparently more efficient than their smaller counterparts. Moreover, they found evidence of a trend towards the reduction in the number of less efficient banks.

4.5.4 *Risk and Quality Factors, Banks' Costs and Efficiency Correlates*

Over the last several years, the interest of researchers has also focused on the issue of banks' problem loans [Hughes and Mester (1991); Clark (1996); Mester (1996); Berger and Mester (1997); Resti (1997a); Berger and De Young (1997)]. This is of a particular concern because in theory, when comparing the efficiency of banks, output quality should be the same [Berger and Mester (1997)]. Nonetheless, there are in reality unmeasured differences in quality because the banking data do not completely take account of the heterogeneity in bank output.

A large proportion of NPLs may signal that a bank has used fewer resources than usual in the initial credit evaluation and monitoring of its loans. In other words, banks scrimping on credit evaluations or producing excessively risky loans might be found to be efficient when compared to banks spending more resources in order to ensure their loans are of higher quality [Mester (1996)].[9]

Moreover, as Berger and De Young (1997) emphasise, banks which are cost inefficient may have problems of loan performance for various reasons: *i*) because they have a poor senior management and thus they have problems in monitoring both their costs *and* their loan customers; *ii*) for events exogenous to the bank, such as regional economic downturns, which increase those expenses associated with NPLs (e.g. monitoring, negotiating workout arrangements, seizing and disposing of collateral, and so forth).

As stressed by Berger and Mester (1997) NPLs and loan losses would be exogenous if caused by negative economic shocks ("bad luck"), but they could be endogenous, either because management is inefficient in managing their loan portfolio ("bad management") or because managers have made a conscious decision to reduce short-run expenses by cutting back on loan origination and monitoring resources ("skimping"). However, Berger and Mester (1997, p. 909) also note that: "Even if the level of NPLs does reflect bank choice to some extent, it could still be appropriate to include it in the cost and profit functions if it is thought to reflect a less frequent decision on the part of the bank (e.g. credit policy) than production decisions [...]".

Another important aspect of efficiency measurement is the way financial capital is treated. As McAllister and McManus (1993) have noted, it is the nature of a financial

[9] Moreover, it seems that all research on the causes of bank failures found that failing institutions have large proportions of NPLs prior to failure and that asset quality is a statistically significant predictor of insolvency [see, for example, Whalen (1991)].

intermediary that requires that it hold capital sufficient to reduce the probability (to a minimal level) that it will default on its debt, although this financial capital is more costly than other sources of finance.

Since the insolvency risk of financial institutions depends on the availability of financial capital to absorb portfolio risk and losses, it should be considered when studying efficiency. As pointed out by Mester (1996, p. 1026), omitting the price and level of capital "makes sense on theoretical grounds only if it is assumed either that financial capital is not used to fund loans, or that its price is the same across all banks (or is perfectly correlated with another input price for all banks) *and* that banks use the cost-minimizing level of capital, none of which seems plausible". In fact, the problem is very much concerned with banks' risk preferences.[10]

Only a handful of studies have included financial capital in the calculation of bank efficiency [Hughes and Mester (1991); Hancock (1985); Clark (1996); Altunbas *et al.* (1999)]. Whether it is appropriate econometrically to include NPLs and loan losses in the bank's cost and profit functions depends on the extent to which these variables are exogenous.

To date, the risk and quality of banks' output has usually been measured by including them as arguments in the cost function in the following way: quality can be proxied by a variable measuring the ratio of non-performing loans to total loans, whereas the level of financial capital (the funding source for loans) can be measured as the average volume of equity capital for each of the years considered, like in Mester (1996). Table 4.2 reviews the bank efficiency studies that have considered risk and quality factors in the cost frontier specification. Overall, these studies found that controlling for risk and quality factors has some influence on bank cost efficiency levels.

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[10] Hughes and Mester (1993) find that US banks are risk-averse and they tend not to choose the cost minimising level of capital. This can be explained by the fact that a risk-averse bank might choose to fund its loans with a higher ratio of financial capital-to-deposits (i.e. with less debt) than a risk-neutral bank. As pointed out by Mester (1996), since financial capital is typically more expensive than deposits, it would be possible to conclude wrongly that the risk-averse bank was producing its output in an allocatively inefficient manner. Actually, though, it is banks' risk preferences that differ.

Table 4.2 Efficiency in Banking: Risk and Quality Studies

AUTHORS	SAMPLE DATA	OUTPUT	METHODOLOGY	FINDINGS
HUGHES AND MESTER (1991)	Year: 1990 Sample: 304 US banks operating in branch-banking states with assets >$1billion Source: Consolidated Reports of Condition and Income	Intermediation approach • Commercial real estate loans • Commercial loans • Consumer loans • Other loans • Securities, assets in trading accounts, total investment securities	Translog specification Quality of banks' outputs and bank risk included as arguments in the cost function: • average volume of NPLs • average volume of equity capital	Controlling for capital and quality significantly effects scale measures: constant returns to scale at the mean bank are found when capital/assets ratio and quality are accounted for. Otherwise increasing returns to scale are found. Global scope economies are not significant for the mean bank. Within-sample product-specific scope diseconomies are found for large banks.
BERG, FØRSUND AND JANSEN (1992)	Years: 1980-1989 Sample: 262 Norway banks (on average) Source: Bank Statistics	Value-added approach • Short-term loans • Long- term loans • Produced (non-bank) deposit	Non-parametric DEA Malmquist indices Loan losses (negative)	Most efficient banks belong to the smallest quartile of the sample. When including loan losses in the output vector, the estimated productivity growth of the average bank over the nine years decreases only slightly.
MCALLISTER AND MCMANUS (1993)	Years: 1984-1990 Sample: 1280 US banks Source: Call Report and Survey of Deposits	Value-added approach • Real estate loans • Commercial and industrial loans • Instalment loans • Demand deposits • Savings deposits	Various techniques used (deterministic translog/Fourier-flexible/kernel regression technique/linear spline).	Large banks realise a substantial cost advantage over small ones by virtue of being able to function with much less capital. Strong evidence of increasing returns to scale for banks up to $500 million in total assets and approximately constant returns for larger banks.

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Table 4.2 Efficiency in Banking: Risk and Quality Studies (*continued*)

AUTHORS	SAMPLE DATA	OUTPUT	METHODOLOGY	FINDINGS
MESTER (1996)	Years: 1991-1992 Sample: 214 banks of the Third Federal *Reserve District* Source: Consolidated Reports of Condition and Income	Intermediation approach • Real estate loans • Commercial and industrial *loans, lagricultural* loans, loans to depository institutions, acceptances of other banks, loans to foreign governments, obligations of states and political subdivisions, • Loans to individuals	Translog specification + Stochastic cost *frontier* Quality of banks' outputs and bank risk included as arguments in the cost function: • Average value of NPLs • Average volume of equity capital Logistic model	Evidence of a flat cost frontier (constant returns to scale) No evidence of scope economies or diseconomies Average X-inefficiency on the order of 6 to 9 percent *Among the most interesting significant relationships coming* from the logit technique: inefficient banks tend to have a higher percentage of their loans in construction and land development and in loans to individuals; there is a negative relationships between inefficiency and the capital/assets ratio.
BERGER AND DE YOUNG (1997)	Years: 1985-1994 Sample: US commercial banks Source: Consolidated Reports of Condition and Income	Production approach • Commercial loans • Consumer loans, real estate loans • Transaction deposits (demand deposits, NOW accounts, automatic transfer service accounts, telephone and pre-authorised transfer accounts) • Fee-based income (gross non-interest income less both service charges on deposit accounts and gains (losses) from securities and foreign exchange trading)	Fourier-flexible + Stochastic cost frontier approach NPLs not included in the cost function Granger-causality technique to test for the relationship between X-EFF and NPL Hypotheses: bad luck / bad management/ skimping behaviour/ moral hazard problems	The average bank is measured to be about 92 percent efficient over the entire sample period. Intertemporal relationships between loan quality and cost efficiency run in both directions.

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Table A4.4 Efficiency in Banking: Risk and Quality Studies (*continued*)

AUTHORS	SAMPLE DATA	OUTPUT	METHODOLOGY	FINDINGS
BERGER AND MESTER (1997)	Years: 1990-1995 Sample: approx. 6,000 US commercial banks Source: Consolidated Reports of Condition and Income	Intermediation approach • Consumer loans • Business loans • Securities Other variables: • Quality proxied as NPLs/total loans for the bank or for the state in which the bank is located • Financial capital (average volume of equity capital)	Various econometric models Fourier-flexible + Distribution free and stochastic cost and profit frontier approach Correlates with inefficiency: multiple egressions and single variable *regression.*	Three economic efficiency concepts used: cost, standard profit, and alternative profit. No positive correlation found between measures of profit and cost efficiency. Potential correlates had different relationship with the three different efficiency measures. The efficiency estimates are strikingly similar across the various specifications. Average efficiencies all within 1 percentage point of each other. Virtually identical dispersion and rank-order correlation over 99%. Failure to account for the equity position of a bank seems to yield a strong scale bias making large banks appear to be more efficient than small banks. Substantial unexploited cost scale economies are found (around 80 *percent) for the typical bank.*
RESTI (1997a)	Years: 1988-1992 Sample: 270 Italian banks Source: Bilbank	Production approach • Loans • Deposits • Non-interest income	Translog stochastic cost frontier Non-parametric DEA Bad Loans/Total Loans ratio used as non-discretionary variable in DEA model.	A direct rather than inverse relationship between productive efficiency and asset quality was found. This suggest that the presence of operating expenses above the minimum while increasing the social costs of financial intermediation, does not lead to a lower credit risk and a steadier banking system.
ALTUNBAS, LIU MOLYNEUX AND SETH (1999)	Years: 1993-1995 Sample: Japanese commercial banks (130 in 1993 and1994 and 121 in 1995) Source: BankScope	Intermediation approach • Total loans • Total securities • Off-balance sheet items (in nominal terms) Other variables: • NPLs/total loans • Financial capital • liquid assets/total assets Estimated impact of technical progress.	Fourier-flexible + Stochastic cost frontier Random effect panel data approach Quality of banks' outputs and bank risk included as arguments in the cost function in a second model:	Comparison between the models give these results: diseconomies of scale found when risk and quality factors are taken into account; inefficiency estimates are similar in the two models (ranging between 5 and 7 percent). Financial capital has the biggest influence in determining the optimal bank size.

Another way of accounting for the influence of risk and quality factors on bank efficiency involves undertaking a correlation analysis between banks' inefficiency levels derived from the estimation process, and independent variables explaining also banks' risk and output quality factors. Recently, this methodology has been applied for instance by Cebenoyan *et al.* (1993); Mester (1993 and 1996) and Altunbas *et al.* (1999). The regressions are usually linear, but Mester (1996) and Altunbas *et al.* (1999) use the logistic functional form rather than a linear regression model and include, among others, measures of banks' performance and measures of capital adequacy. Among the statistically significant relationships, one of the most interesting found by Mester (1993 and 1996) and Altunbas *et al.* (1999) is the negative relationship between inefficiency and the capital-to-assets ratio and bank performance indicators. Altunbas *et al.* (1999) also found that the level of non-performing loans is positively related to bank inefficiency.

4.6 Conclusions

In recent years, greater research attention has been paid to modelling cost characteristics in the banking industry. However, the studies have different statistical methodologies and also use various input and output definitions. As a consequence, many of the results on bank efficiency are difficult to compare. Given the importance of these studies for policy purposes, over the last few years leading researchers in the field have tried to find solutions to various methodological problems. Among the most important recent methodological developments have been: the substitution of the translog cost model by new and more flexible functional forms, such as the Fourier; the inclusion of bank risk and output quality terms in the cost function; the carrying out of consistency tests; relating cost efficiency estimates to bank profitability together with other correlates of bank inefficiencies. Most of these innovations will be undertaken in the empirical analysis of Italian banking that is presented in Chapter 5.

Chapter 5

Methodology, Variable Definitions and Data Sources

5.1 Introduction

The issue of measuring efficiency in banking has been extensively researched over the past decade, as discussed in the previous chapter. Different econometric methods have been employed in recent studies, but only a handful of them have focused on the estimation of managerial X-efficiencies in the Italian banking sector. Moreover, as far as the researcher is aware, none of previous studies on the Italian system have either employed a stochastic Fourier-flexible functional form, and/or included risk and output quality variables as arguments in the cost function specification.

In this thesis, we use the Fourier-flexible functional form to estimate X-efficiencies and scale economies for the Italian banking system. First, a standard cost frontier specification using the intermediation approach will be estimated and these results will then be compared with those derived from a frontier specification that controls for risk and quality factors. The approach will then proceed with the identification of Italian banks that are both cost and profit efficient, and with the evaluation of possible determinants of bank efficiency.

This chapter explains the researcher's methodology used to examine the cost efficiency of Italian banks over the period 1993-96. Specifically, this chapter illustrates the characteristics of the stochastic cost frontier (section 5.2.1); the main properties of the Fourier-flexible cost function (section 5.2.2); how to calculate X-efficiency and scale economy indexes once the frontier is estimated (sections 5.2.3 and 5.2.4, respectively); and the modifications to the cost frontier needed in order to be able to take into account risk and output quality factors in the calculation of cost efficiency (section 5.2.5).

Section 5.3 describes in detail the variables employed in the empirical analysis, and Section 5.4 outlines the methodology used for carrying out a profitability test on the sample banks. This test, suggested by Spong *et al.* (1995), is included in order to relate cost X-inefficiency measures to the relative profitability of banks. Section 5.5 focuses on the calculation of potential correlates with inefficiency and explains the logistic regression model used for carrying out the analysis. Finally, section 5.6 investigates the data sample and presents the descriptive statistics (section 5.6.1) of the variables employed followed by the conclusion in section 5.7.

5.2 The Methodology: Stochastic Fourier-Flexible Functional Form and Measures of Cost Efficiency

Researchers investigating bank cost efficiency postulate a relationship between costs, input prices and output quantity. This relationship is based on the duality concept between production and cost functions. The production function $Q = Q(X)$ summarises the technology of a firm: that is the existing relationship between inputs, X, and outputs, Q. The cost function $TC = TC(Q, P)$ shows the relationship between total production costs, TC, and the prices of variable inputs, under the assumption of no changes in technology. The duality condition between the production and the cost function ensures that they contain the same information about production possibilities and that there is a unique correspondence between both functions. More precisely, duality requires the cost function to satisfy certain regularity conditions on TC which are that it be non-negative, real-valued, non-decreasing, strictly positive for non-zero Q and linearly homogeneous and concave in P for each Q [see, for instance, Caves, Christensen and Tretheway (1979)].

5.2.1 The Stochastic Cost Frontier

One of the first methodological issues relates to the choice of the statistical approach used to estimate X-efficiencies. As discussed in the previous chapter, the established approaches (stochastic or econometric frontier, thick frontier, distribution-free, mathematical/linear programming approaches) differ primarily in the distributional assumptions used to disentangle X-efficiency differences from the random error that temporarily give decision-making units apparently high or low costs.

This study employs a stochastic cost frontier to generate estimates of X-efficiencies for each bank along the lines suggested by Aigner, Lovell and Schmidt (1977) and Meeusen and van den Broeck (1977).[1] For the ith firm, the single equation cost function model is represented in natural logs by:

$$\ln TC_i = \ln TC(Q_i, P_i; B) + \varepsilon_i \tag{5.1}$$

where TC_i is the observed total cost of production for bank i, Q_i is the vector of banking output for bank i, P_i is the vector of input prices for bank i, and B is a vector of parameters. $\ln TC(Q_i, P_i; B)$ is the predicted log cost function of a cost-minimising bank operating at (Q_i, P_i, B), and ε_i is a two-component error term.

The stochastic cost frontier model used in this empirical study implies that a banking firm's observed total cost will deviate from the cost-efficient frontier because of random noise, v, and possible inefficiency, u. For the ith firm:

[1] Among other important studies using the stochastic frontier are, for instance, Cebenoyan *et al.* (1993), Kaparakis *et al.* (1994), Allen and Rai (1996), Resti (1997a), Berger and Mester (1997) and Altunbas *et al.* (1999).

$$\varepsilon_i = v_i + u_i \tag{5.2}$$

where v_i is a two-sided error term representing statistical noise which is assumed to be independently and identically distributed; and u_i is a non-negative (or one-sided) random variable representing inefficiency and assumed to be distributed independently of the v_i. The inefficiency factor u_i incorporates both allocative inefficiencies, from failing to react optimally to relative prices of inputs, P_i, and technical inefficiencies, from employing excessive (or extra) inputs to produce the outputs Q_i. It is also assumed that the v_i are normally distributed with mean zero and variance σ_v^2, and the u_i are the absolute values of a variable that is normally distributed with mean 0 and variance σ_u^2 (i.e. a half-normal distribution). These are widely accepted assumptions employed in this kind of empirical model: see, for example, Cardani *et al.* (1991); Kaparakis *et al.* (1994); Allen and Rai (1996); Mester (1996) and Altunbas *et al.* (1999).

In the present study Italian banks' data over the period 1993-96 are organised in a panel. Specifically, we employ the Battese and Coelli model (1992) of a stochastic frontier function for panel data with firm effects which are assumed to be distributed as half-normal random variables (that is, with μ=0)[2] and are also permitted to vary systematically with time. Therefore, it is possible to express this model as $TC_{it} = x_{it}\beta + v_{it} + u_{it}$, [with i = (1,2, ..., N) and t = (1,2, ..., T)], where TC_{it} is the logarithm of the total costs for the i-th firm in the t-th time period; x_{it} is a k×1 vector of (transformations of the) input prices and output quantities of the i-th firm in the t-th time period; β is the vector of unknown parameters; and the v_{it} and u_{it} are defined as above, with u_{it} = {exp[$\eta(t-T)$]}, where η is an unknown scalar parameter to be estimated.[3] This latter represents the hypothesis about the evolution or steadiness of individual inefficiencies over the period under study: $\eta > 0$ when inefficiency decreases, $\eta < 0$ when inefficiency increases and $\eta = 0$ when inefficiency is steady (non-variable) over time.

[2] There are many variations on this assumption in the literature [for details, see Greene (1993b) and Coelli *et. al* (1998)].

[3] It follows that when t=T, u_{it}=u_i since the exponential function will take the value 1.

Moreover, the parameterisation of Battese and Corra (1977) is employed. They replaced σ_v^2 and σ_u^2 with $\sigma^2 = \sigma_v^2 + \sigma_u^2$ and $\gamma = \sigma_u^2 / \left(\sigma_v^2 + \sigma_u^2\right)$.[4] As recently emphasised by Coelli *et al.* (1998), the γ-parameterisation has an advantage in seeking to obtain the maximum likelihood estimates because the parameter space for γ can be searched for a suitable starting value for the iterative maximisation algorithm involved. In particular, a value of γ of zero indicates that the deviations from the frontier are due entirely to statistical noise, while a value of one would indicate that all deviations are due to inefficiency.

5.2.2 Specification of the Functional Form

The second methodological issue concerns the choice of the functional form for the cost function. In recent years, flexible functional forms have been widely applied to the empirical analyses of the cost structure of credit institutions in order to calculate cost efficiencies, including X-efficiencies and scale economies.[5]

This study employs a Fourier-flexible form because it is a global approximation that dominates the commonly specified translog form [see, for example, Spong *et al.* (1995); Mitchell and Onvural (1996) and Berger *et al.* (1997)]. Specifically, the Fourier-flexible functional form augments the translog by including Fourier trigonometric terms.

4 In the literature, the likelihood function has often been expressed in terms of the two variance parameters $\sigma^2 = \sigma_v^2 + \sigma_u^2$ and $\lambda \equiv \sigma_u^2 / \sigma_v^2$ [see, Aigner, Lovell and Schmidt (1977) and Jondrow *et al.* (1982)]. Battese and Corra (1977) and Coelli *et al.* (1998) suggested that the γ parameter should be used because it has a value between 0 and 1 whereas the λ can be any non-negative value.

5 Many recent studies by leading researchers also used these functional forms to estimate profit efficiency. On the US banking system, for example, Berger, Hancock and Humphrey (1993) derived both input and output inefficiencies, and Berger and Mester (1997), calculated standard and alternative profit efficiency measures.

Several studies have discussed the merits associated with using the Fourier-flexible form [see, for instance, Gallant (1981, 1982 and 1984)] for cost frontier estimation problems. Given various technical limitations and the advantages associated with employing this functional form, recent researchers appear to agree with Gallant (1981) who suggested that a Fourier series representation of an unknown function can achieve a given level of approximation error with few trigonometric terms (i.e. a truncated Fourier series) when it includes a second-order polynomial in the explanatory variables.[6] It follows that if the dependent and explanatory variables are expressed in natural logarithms, the second-order polynomial is the well-known translog form.

The resulting mixed cost function, including a full translog and all first-, second- and third- order trigonometric terms as well as X-efficiency and random error terms, can be written as:

$$
\begin{aligned}
\ln TC = \quad & \alpha_0 + \sum_{i=1}^{m} \alpha_i \ln Q_i + \sum_{j=1}^{n} \beta_j \ln P_j + \\
& + 1/2 \left[\sum_{i=1}^{m} \sum_{j=1}^{m} \delta_{ij} \ln Q_i \ln Q_j + \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij} \ln P_i \ln P_j \right] + \\
& + \sum_{i=1}^{m} \sum_{j=1}^{n} \rho_{ij} \ln Q_i \ln P_j + \sum_{i=1}^{m} \left[\lambda_i \cos z_i + \theta_i \sin z_i \right] + \qquad (5.3) \\
& + \sum_{i=1}^{m} \sum_{j=1}^{m} \left[\lambda_{ij} \cos(z_i + z_j) + \theta_{ij} \sin(z_i + z_j) \right] + \\
& + \sum_{i=1}^{m} \sum_{j \geq i}^{m} \sum_{\substack{k \geq j \\ k \neq i}}^{m} \left[\lambda_{ijk} \cos(z_i + z_j + z_k) + \theta_{ijk} \sin(z_i + z_j + z_k) \right] + \varepsilon_i
\end{aligned}
$$

where TC is a measure of the costs of production, comprising operating costs and financial costs (interest paid on deposits); the Q_i ($i = 1,2,\ldots,m$) are output quantities,

[6] Otherwise, as pointed out by Mitchell and Onvural (1996), the exact representation of a function should require a Fourier series to have an infinite number of trigonometric terms. Thus, the coefficients of these terms could only be estimated with a dataset having an infinite number of observations.

the P_j ($j = 1,2,\ldots,n$) are input prices; the z_i are adjusted values of the natural log of output $\ln Q_i$ so that they span the interval $[.1\cdot 2\pi,.9\cdot 2\pi]$; and ε_i is as defined in (5.2). The formula for z_i is $(.2\pi - \mu\cdot a + \mu\cdot \ln Q_i)$ where $[a,b]$ is the range of $\ln Q_i$ and $\mu \equiv (.9\cdot 2\pi - .1\cdot 2\pi)/(b-a)$.[7]

Moreover, standard symmetry has to be imposed on the translog portion of the function: $\delta_{ij} = \delta_{ji}$ and $\gamma_{ij} = \gamma_{ji}$, where $(i = 1,2)$ and $(j = 1,2,3)$, and the following linear restrictions on (5.3) are necessary and sufficient for linear homogeneity in factor prices: $\sum_{j=1}^{n} \beta_j = 1$; $\sum_{i=1}^{n} \gamma_{ij} = 0$ and $\sum_{j=1}^{n} \rho_{ij} = 0$.

The Fourier terms are included only for the outputs, leaving the input price effects to be described solely by the translog term [see, for instance, Berger *et al.* (1997) and Altunbas *et al.* (1999)]. The input prices also show very little variation, thereby providing greater justification for our methodological approach.

In this research the parameters of the stochastic frontier cost function, defined by (5.3), are estimated using the Maximum-Likelihood (ML) approach. For instance, the ML estimates of β, σ_S^2 and γ are obtained by finding the maximum of the log-likelihood function as specified in Coelli *et. al* (1998). The nature of the log-likelihood function of the model given the distributional assumptions on v and u can be also found in Battese and Coelli (1993) and Coelli *et al.* (1998).

[7] The Fourier-flexible is a global approximation because the terms such as $\cos z_i$, $\sin z_i$, $\cos 2z_i$, $\sin 2z_i$ are mutually orthogonal over the $[0,2\pi]$ interval, so that each additional term can make the approximating function closer to the true path wherever it is most needed. Moreover, by restricting the z_i to span the interval $[.1\cdot 2\pi,.9\cdot 2\pi]$, the approximation problems arising near the endpoints are reduced [Gallant (1981)].

5.2.3 Prediction of Firm-Level X-efficiency Measures

Once the model is estimated, bank level measures of X-efficiencies can be calculated using the residuals and are usually given by the mean of the conditional distribution of u_i given ε_i, which can be written as $\hat{E} = (u_i|\varepsilon_i)$. The mean of the density function for u_i given ε_i can be found in Battese and Coelli (1992). For the half-normal stochastic model this $\hat{E} = (u_i|\varepsilon_i)$ is a consistent estimator for the individual efficiency measure [see also Jondrow *et al.* (1982)].

These individual bank X-efficiency measures (netting out the stochastic disturbance) are generally defined as the estimated cost needed to produce a bank *i*'s output vector if the bank were as efficient as the best-practice bank in the sample, divided by the actual cost of bank *i*, adjusted for random error [for example, Resti (1997a)]. This ratio between the minimum and the actual cost of bank *i* can be expressed in the form:

$$Cost\ EFF_i = \frac{TC_{\min}}{TC_i} \tag{5.4}$$

where TC_i is the actual cost of the *i*th firm, $TC_{\min}$ is the minimum cost estimated from the fitted cost frontier, and *Cost* EFF_i is defined as $\exp(-u_i)$. This expression relies upon the value of the unobservable u_i being predicted and is achieved by deriving expressions for the conditional expectation of these functions of the u_i conditional upon the observed value of ε_i $(=v_i+u_i)$.

The cost efficiency ratio may be thought of as the proportion of costs or resource that are used efficiently. For example, a bank with *Cost EFF* of 0.80 is 80 per cent efficient or equivalently wastes 20 per cent of its costs relative to a best practice firm facing the same conditions.

5.2.4 Calculation of Economies of Scale

A natural way to express the extent of scale economies is the proportional increase in cost resulting from a small proportional increase in the level of output: that is the elasticity of total cost with respect to output.

The degree of scale economies (*SCALE*) used here is given by:[8]

$$SCALE = \sum_{i=1}^{m} \frac{\partial \ln TC}{\partial \ln Q_i} \tag{5.5}$$

where $\sum_{i=1}^{m} \frac{\partial \ln TC}{\partial \ln Q_i}$ represents the sum of individual cost elasticities and can be rewritten as:

$$\begin{aligned} SCALE = & \sum_{i=1}^{m} \alpha_i + \sum_{i=1}^{m}\sum_{j=1}^{m} \delta_{ij} \ln Q_j + \sum_{i=1}^{m}\sum_{j=1}^{n} \rho_{ij} \ln P_j + \sum_{i=1}^{m} [\lambda_i \sin(z_i) - \theta_i \cos(z_i)] + \\ & + \sum_{i=1}^{m}\sum_{j=1}^{m} [\lambda_{ij} \sin(z_i + z_j) - \theta_{ij} \cos(z_i + z_j)] \\ & + \sum_{i=1}^{m}\sum_{j \geq i}^{m}\sum_{\substack{k \geq j \\ k \neq i}}^{m} [\lambda_{ijk} \sin(z_i + z_j + z_k) - \theta_{ijk} \cos(z_i + z_j + z_k)] \end{aligned} \tag{5.6}$$

where there are economies of scale if $SCALE < 1$, constant returns to scale if $SCALE = 1$, and diseconomies of scale if $SCALE > 1$.[9]

[8] As pointed out by Greene (1993b), different measures of economies of scale are used in different studies [see, for instance, Baumol *et al.* (1982); Mester (1987) and Resti (1997a)]. It is important to point out that we will always refer to economies of scale for what is the value of point estimates of scale elasticities [see for more details, Evanoff and Israilevich (1995)].

[9] It should be noted that the definition given here is the reciprocal of the definition that was given in the previous chapter (section 4.3.1).

5.2.5 Variations to the Cost Frontier

Following Mester (1996), the cost frontier will be estimated a second time in order to take into account risk and output quality factors, as discussed before in this chapter. Both the financial capital (K) and the asset quality (S) variables are specified in first- and second- order logged terms [ln$K$ and ½(ln$K$)^2] and [ln$S$ and ½(ln$S$)^2].

The variation to the cost frontier can be seen in (5.7) below [see also (6.2) in the next chapter]:

$$\ln TC_i = \ln TC(Q_i, P_i, K_i, S_i; B) + u_i + v_i \tag{5.7}$$

where K_i is the level of financial capital at bank i, and S_i is a proxy of quality given by the non-performing loan to total loan ratio. The degree of economies of scale used here will be given by:

$$\begin{aligned} SCALE = & \sum_{i=1}^{m}\alpha_i + \sum_{i=1}^{m}\sum_{j=1}^{m}\delta_{ij}\ln Q_j + \sum_{i=1}^{m}\sum_{j=1}^{n}\rho_{ij}\ln P_j + \sum_{i=1}^{m}\alpha_{ik}\ln K + \sum_{i=1}^{m}\alpha_{is}\ln S \\ & + \sum_{i=1}^{m}[\lambda_i \sin(z_i) - \theta_i \cos(z_i)] + \sum_{i=1}^{m}\sum_{j=1}^{m}[\lambda_{ij}\sin(z_i + z_j) - \theta_{ij}\cos(z_i + z_j)] + \\ & + \sum_{i=1}^{m}\sum_{j\geq i}^{m}\sum_{\substack{k\geq j \\ k\neq i}}^{m}[\lambda_{ijk}\sin(z_i + z_j + z_k) - \theta_{ijk}\cos(z_i + z_j + z_k)] \end{aligned} \tag{5.8}$$

The inefficiency and scale economy measures derived from the estimation of (5.7) and (5.8) will be then compared with those derived from the standard cost function, in order to investigate the impact of risk and quality variables on Italian banks' cost characteristics. Other variations to the cost frontier are the next two specifications: (1) include only K; and (2) include only S.

Structural tests will also be undertaken, in order to identify what model provides the best data fit. Specifically, the structural test used in this analysis is the likelihood ratio test, which is calculated as $-2\{\ln[L(H_0)]-\ln[L(H_1)]\}$, where $L(H_0)$ and $L(H_1)$ are the values of the likelihood function under the null and the alternative hypotheses, H_0 and H_1, respectively.

5.3 Definition of Variables

As discussed in the previous Chapter 4, choosing the appropriate definition of bank output is a problem that continues to challenge all bank costs studies. Following leading researchers like Mester (1996) and Berger and Mester (1997), the approach to output definition used in this study is the intermediation approach. This approach posits that total loans and total securities are outputs, whereas deposits are inputs to the production process of banking firms.

Table 5.1 gives the definitions of all the variables specified in the cost function estimations and for all model specifications. The variables' input prices, P_i, comprise the price of labour, interest rates on customer deposits and other non-interest expenses. Expenditures on these inputs include the majority of all banking costs. On the other hand, the variable outputs Q_i cover customer loans and securities, the latter being measured as other earning assets. Finally, quality is proxied by a variable measuring the non-performing loans to total loans ratio and the level of financial capital is measured as the average volume of equity capital (for each of the years considered).

Table 5.1 Variables Definition

VARIABLE	SYMBOL	DEFINITION
TOTAL COSTS		Personnel expenses
(dependent variable)	TC	+ Other non-interest expenses
		+ Interest paid
OUTPUTS	Q_1	Total customer loans
	Q_2	Other earning assets
INPUT PRICES	P_1	Personnel expenses / Average number of personnel
	P_2	Interest expenses / Total customer deposits
	P_3	Other non-interest expenses / Total fixed assets
FINANCIAL CAPITAL	K	Volume of equity capital
ASSET QUALITY	S	Non-performing loans / Total loans

5.4 Profitability Test

One criticism of the above approach [see, for example, Berger, Hunter and Timme (1993) and Berger and Mester (1997)], however, is that cost X-inefficiency estimates neglect the revenue earning capacity and/or profitability of banks under study. For instance, a seemingly cost inefficient bank might be offsetting higher expenses with higher revenues. In order to handle this we follow the profitability test methodology suggested by Spong *et al.* (1995).

In their study of US banks, Spong *et al.* (1995) split cost X-efficient and profitable banks into an "efficient bank category", while banks with low X-efficiency and low profitability are grouped into "less efficient categories". We follow this same approach for the Italian banking sector, which is summarised in Table 5.2.

Table 5.2 Most Efficient and Inefficient Groups

• MOST EFFICIENT GROUP Banks that rank in the upper quartile of Italian banks on the cost efficiency estimates and rank in the upper half in term on return on assets
• LEAST EFFICIENT GROUP Banks that rank in the bottom quartile of Italian banks on the cost efficiency estimates and rank in the bottom half in term of return on assets

Source: Adapted from Spong *et al.* (1995).

Efficient and inefficient banks will therefore be analysed by comparing their major sources of income (i.e. interest received and non-interest income) and expenses (i.e. personnel expenses and fixed assets) and their balance sheet components (i.e. loans and deposits).

As Spong *et al.* (1995) emphasise, the combination of both a cost efficiency and a profitability test provides a means of rating banks by both their ability to use resources effectively in producing banking products and services (cost efficiency), and their skill at generating income from these goods and services (profitability). This profitability test provides an alternative to some of the consistency conditions suggested recently by Bauer *et al.* (1997). Moreover, a number of financial characteristics that separate some of the most efficient banks from the least efficient banks will be examined in order to explore the actual factors influencing efficient bank operations (like the level of NPLs, level of equity and interest margin).

5.5 Potential Correlates of Inefficiency

The last part of this empirical analysis on the Italian banking industry aims to evaluate the determinants of Italian bank inefficiencies. The analysis considers both bank- and industry-specific factors, as well as other exogenous influences that may explain efficiency differences among banks [Berger and Mester (1997) and Berger and

DeYoung (1997)]. Following the approach suggested by Mester (1996), we use a logistic regression model with cost inefficiency as the dependent variable and a range of independent variables that are expected to impact on X-inefficiency. These include variables such as banks' size, market characteristics, geographic position, capital, performance and retail activities [see also Berger and Mester (1997) and Altunbas *et al.* (1999)]. The full list is shown in Table 5.3.

Table 5.3 Variables Employed as Potential Correlates of Inefficiency[a]

Factors	Symbol	Definition
Size	ASSETS	Total assets
	QUOTED	1 if bank is quoted and 0 if bank is not quoted
Competition in the market	MARGIN	Interest margin / total assets
Market concentration	BRANCHES	Number of bank offices
Retail banking business	RETAIL	(Loans + deposits) / Total assets
Organisational form	COM	Type of bank
	SAV	(Dummies for commercial,
	POP	savings and popular)
Territorial location	NORTHWE	Bank location
	NORTHEA	(Dummies for north-west,
	CENT	North-east and centre)
Ownership	OWNERS	1 for private bank and 0 for public bank
Assets quality	NONPERF	Non-performing loans/total loans
Performance	PERFORM	Net income / equity
Capital	CAPITAL	Equity / total assets

[a] The correlations between the explanatory variables were investigated to identify any likely multicollinearity. The results did not suggest that multicollinearity would be a problem.

ASSETS and QUOTED control for the overall size of the bank; MARGIN measures the degree of competition in the market as a proxy of the mark-up; BRANCHES and OWNERS are included to account for organisational and regulatory structure; RETAIL is included to measure the influence of retail banking activities and is proxied as customer deposits plus customer loans divided by total assets; type of banks (COM, SAV and POP) and geographical areas (NORTHWE, NORTHEA and CENT) are included to see if inefficiency differs by bank category and location, respectively; NONPERF accounts for output quality; PERFORM is a performance measure (higher efficiency should be correlated with better performance); CAPITAL is the financial capital ratio and this should be inversely related to inefficiency on the grounds that banks with low inefficiency will have higher profits.

A logistic functional form rather than a linear regression model is used to estimate the efficiency correlates because the values of the inefficiency estimates, $\hat{E} = (u_i|\varepsilon_i)$, range between 0 to 1 [for applications of this technique in the banking system, see, for example, Mester (1993); Mester (1996) and Altunbas *et al.* (1999)].

The general form of this regression equation is:

$$\hat{E} = (u_i|\varepsilon_i) = \frac{\exp(X_i'\gamma)}{1+\exp(X_i'\gamma)} + \xi_i \tag{5.9}$$

where X_i is a vector of independent variables for the ith firm, γ is the parameter vector, and ξ_i is a normally distributed error term [see, for more technical details, Greene (1993b)].[10]

It should however be emphasised that logistic regressions provide information on correlation and not causality [see Mester (1993); Mester (1996) and Altunbas *et al.* (1999)]. Finally, it is important to note that in the logistic model we use standard X-inefficiencies and not those derived from the risk and quality-adjusted model. The choice of using only the inefficiency scores from the estimation of Model I is justified by the fact that we want to avoid the problem of including the NPL variable twice in the analysis presented later in Chapter 6.

[10] The computer programming for the estimation of (5.9) is provided in Appendix A5.6 to this chapter.

5.6 The Data

The data used to construct the estimates for the cost function parameters are derived from *Bilbank*, an Italian database of the Associazione Banche Private Italiane. For the present study the sample comprises an unbalanced panel of 1,958 bank observations distributed in the following way: 545 banks in 1993, 523 banks in 1994, 466 in 1995 and 424 banks in 1996. The sample excludes: *i*) banks that are subsidiaries of foreign banks; *ii*) the central institutes for each category of banks; and *iii*) special credit institutions (medium- and long- term banks).[11] The choice of using an unbalanced panel is important because it allows us to investigate the impact on cost efficiency of the restructuring process that has taken place in Italy during the years under study.

From a numerical point of view, the degree of coverage of the panel is outlined in Table 5.4 for each of the years under study. Overall, the panel is representative of the whole Italian banking system having an average coverage in terms of number of banks over the four years of nearly 50 per cent.

Table 5.4 Sample Size Relative to Total Population (Number of Banks)[a]

	Total number of banks	Sample size (number of banks)
1993	1037	52.5% (545)
1994	1002	52.2% (523)
1995	970	48.0% (466)
1996	937	45.3% (424)

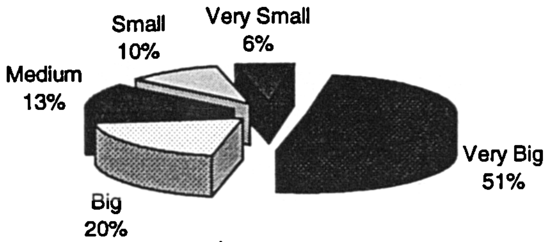
[a] In brackets the number of banks included in the sample.
Source: Bank of Italy, *Annual Report*, various years and author's calculations.

[11] It should be pointed out that since the program FRONTIER 4.1 does not tolerate missing values, banks with incomplete accounting data are also not included in the samples.

In addition, the coverage of our sample in terms of total assets with respect to the sample used by the Bank of Italy is, as an average for the years 1993-96, more than 90%.

Figure 5.1 shows the total assets share of each bank class for the sample.

Figure 5.1 Total Assets Share for Each Bank Size Class (1993-96)



Source: Bilbank and author's calculations.

The year-by-year composition of the panel is shown in detail in Table 5.5.

Table 5.5 Year-by-Year Composition of the Panel[a,b]

	MEAN ASSETS (L. bn)	1993	1994	1995	1996
Very big	140,206.2	8	8	8	8
Big	36,397.4	12	12	12	12
Medium	12,583.4	25	25	22	21
Small	3,735.0	67	62	60	58
Very small	365.9	433	416	364	325

[a] This classification follows the official definitions that the Bank of Italy adopted in 1994.
[b] See Table 5.6 for the distribution of sample banks by average assets for each of the years under study.

Table 5.6 shows the size breakdown of banks in our sample and illustrates that the differences in banks' size among the five classes are notably high. This is especially true for the group of very big banks: these have approximately 400 times the average assets of the very small banks, and 40 times the average assets of small banks.

Table 5.6 Distribution of Sample Banks by Average Assets (1993-96)[a]

	1993	1994	1995	1996
Very big	141,816.2	140,645.1	142,232.2	136,131.1
Big	35,360.8	34,875.7	37,597.1	37,755.9
Medium	11,717.8	12,000.9	12,770.4	13,844.6
Small	3,849.2	3,528.9	3,708.9	3,853.0
Very small	364.1	342.4	365.0	392.2

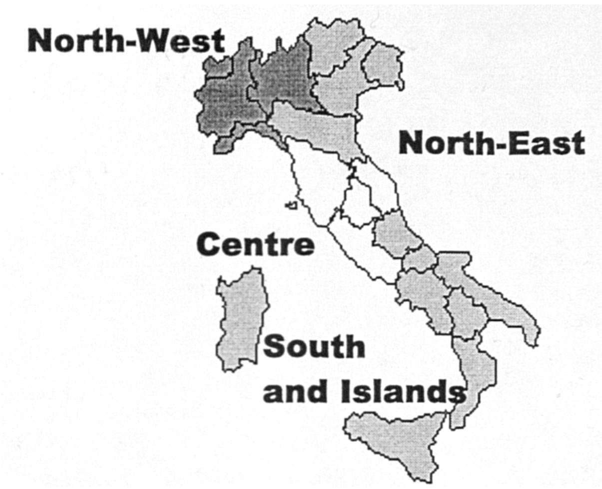
[a] Billions of lire.

Moreover, the average skewness for the four years is 7.42 per cent, thus confirming what Resti (1997, p. 244) stressed as an important characterisation of the Italian banking industry that: the presence, beside a limited number of big institutions, of a wide layer of small and very small subjects makes the distribution of banks highly skewed.

It should be noted that for the purposes of the logistic model described in section 5.5, sample banks will be divided into two groups: large banks (which includes very big, big, medium and small), and very small banks (as previously defined). In this way, these latter (minor co-operatives, usually covering limited areas with very few branches) can be examined separately from other institutions.

The following Figure 5.2 illustrates the different macro-areas in which the country has been divided as well as the specific regions that are included in the different areas.

Figure 5.2 Macro-Regions in Italy



North-West:	**Liguria, Lombardia, Piemonte, Valle d'Aosta.**
North-East:	**Emilia-Romagna, Friuli-Venezia Giulia, Trentino Alto Adige, Veneto.**
Centre:	**Lazio, Marche, Toscana, Umbria.**
South+Islands:	**Abruzzo, Basilicata, Calabria, Campania, Molise, Puglia, Sardegna, Sicilia.**

Table 5.7 shows the number of sample banks by macro area for each of the four years under study. A bank is assigned to a given region if it has its head office in that area over the four years under study. From Table 5.7 one can see that most banks in the sample have their head office in the north-eastern region, whereas the centre has fewer banks compared with the others. Moreover, it is clear that the number of banks has fallen in all regions over the period 1993-96 and especially in the south (-31%). Interestingly, when data are pooled for the four years, the centre appears to have a higher average size of banks, thus suggesting the high presence of very small banks in the north-eastern region.

Table 5.7 Number of Sample Banks by Macro-Areas

Macro-area	1993	1994	1995	1996	Assets size (mean values and pooled data)[a]
North-west	135	129	118	110	7,945.3
North-east	169	164	145	138	2,560.0
Centre	101	96	87	79	6,484.9
South and Islands	140	134	116	97	2,138.3

[a] Billions of lire.

As noted in Chapter 3, the official definition the Bank of Italy uses for short-term banks includes: joint-stock companies, subsidiaries of foreign banks, popular banks, credit co-operative banks and central institutes for each category of banks. For the purposes of the present research we adopt the traditional separation between savings, popular banks and credit co-operative banks with all remaining institutions falling under the category commercial banks (Table 5.8). This is done in order to evaluate efficiency and performance of former commercial and savings banks over the years of major transformation in the Italian banking system.

Table 5.8 Number of Different Bank Types in the Sample

	1993	1994	1995	1996
Commercial banks (*Banche commerciali*)	83	79	67	55
Saving banks (*Casse di risparmio*)	63	60	56	54
Popular banks (*Banche popolari*)	81	72	64	58
Credit co-operative banks (*Banche di credito cooperativo*)	318	312	279	257

Lastly, Table 5.9 shows the number of commercial, popular, savings and credit co-operative banks for each geographical area as an average in each of the four years studied.

In terms of average number of banks over the four years, the sample shows a wide coverage across regions for each category of bank.

Table 5.9 Type of Banks in Different Geographical Areas (Averages 1993-96)

	Commercial	Savings	Popular	Credit Co-op.
North-west	27	11	15	71
North-east	12	21	23	99
Centre	13	20	10	48
South	20	7	21	74

As already observed, the number of credit co-operative banks (i.e. very small banks) is particularly high in the north-eastern region compared with other regions.

5.6.1 Descriptive Statistics

Table 5.10 provides a selection of descriptive statistics on the variables that will be included in the cost function estimation as inputs and outputs as an average for the years 1993-96. Year-by-year tables are available in the Appendix to this chapter (Tables A5.1-A5.4). All monetary aggregates are expressed in 1996 prices.

Table 5.10 **Summary Statistics on Cost, Output Quantities, Input Prices and Risk and Quality Variables (Pooled Data 1993-96)[a,b]**

	MEAN	ST.DEV.	MIN.	MAX
TC	371.45	1528.15	1.30	20,900.45
Q_1	2,125.31	9,356.59	3.78	136,015.68
Q_2	1,957.93	7,980.86	4.13	95,569.43
P_1	0.09826	0.01276	0.01039	0.24075
P_2	0.07019	0.01338	0.01173	0.16559
P_3	1.06819	1.38826	0.08576	21.31176
K	293.85	1,081.28	0.70	11,723.99
S	5.53	5.16	0.05	70.36

[a] TC = total costs (billions of lire); Q_1 = total loans (billions of lire); Q_2 = other earning assets (billions of lire); P_1 = personnel expenses/average number of personnel; P_2 = interest expenses/total customer deposits; P_3 = other non-interest expenses/total fixed assets; K = level of equity (billion of lire); S(%) = non-performing loans/total loans.
[b] Number of observed banks: 1,958.

As shown in the table, the mean bank over the four years under study was approximately 2,000 billion lire each in both total loans and other earning assets (mainly securities), nearly 300 billion lire volume of equity capital and around 5.5 per cent of NPLs as a proportion of total loans.

Table 5.11 illustrates the statistics of the variables included in the regression model carried out in order to check for possible correlates with inefficiencies. It is important to recall that in order to investigate possible determinants of bank efficiency, firm-specific measures of inefficiency derived exclusively from Model I will be regressed on a set of independent variables relevant to the banking business. In this table the data are pooled together for the four years under study for a total of 1,958 banks.

Table 5.11 Summary Statistics on the Variables Employed for the Correlates with Inefficiency (Pooled Data 1993-96)[a,b]

1993-1996	MEAN	STDEV	MIN	MAX
ASSETS	4,536.0	19,306.6	12.7	254,043.9
MARGIN	0.0449	0.0101	0.0067	0.0987
BRANCHES	42	125	1	1276
RETAIL	0.9783	0.1203	0.4704	1.5102
OWNERS°	-	-	0	1
NONPERF	5.58	5.58	0.05	70.36
PERFORM	0.0555	0.3168	-8.4122	4.4821
CAPITAL	0.0979	0.0342	0.0266	0.3491
QUOTED°	-	-	0	1
NORTHWE°	-	-	0	1
NORTHEA°	-	-	0	1
CENT°	-	-	0	1
COM°	-	-	0	1
SAV°	-	-	0	1
POP°	-	-	0	1

[a] ASSETS = total assets; MARGIN = interest margin/total assets; BRANCHES = number of branches; RETAIL = (customer loans + customer deposits)/total assets; OWNERS = 1 for private bank and 0 for public; NONPERF = non-performing loans/total loans; PERFORM = net income/equity; CAPITAL = equity/total assets; QUOTED = 1 for quoted banks and 0 for not quoted; NORTHWE = dummy for north-western banks; NORTHEA = dummy for north-eastern banks; CENT = banks located in the centre; COM = commercial banks; SAV = saving banks; POP = popular banks. °indicates dummy variables.
[b] Number of banks: 1,958.

5.7 Conclusions

This chapter summarised the methodological approach that will be taken to estimate cost efficiency in the Italian banking system between 1993 and 1996. It also describes the variables and the dataset used for the empirical analysis. The Fourier-flexible functional form will be used to estimate X-efficiencies and scale economies for the

Italian banking system. First, a standard cost frontier specification using the intermediation approach will be estimated and these results will then be compared with those derived from a frontier specification that controls for risk and quality factors. The approach then goes on to identify Italian banks that are both cost and profit efficient, evaluates the possible determinants of bank efficiency and then examines how efficiency varies across various geographical regions and bank sizes. The second part of this chapter undertook an exploratory data analysis of the sample. The following Chapter 6 reports the empirical results.

Chapter 6

Cost Efficiency in the Italian Banking Industry

6.1 Introduction

In this chapter the cost efficiency of the Italian banking sector is empirically analysed for the years 1993 to 1996 using the methodology summarised in the preceding chapter. The chapter is set out as follows: section 6.2 illustrates the functional forms used and describes the maximum likelihood estimates for both Model I, the standard cost frontier specification (section 6.2.1); and Model II, the standard cost frontier specification including variables that control for risk and output quality factors (section 6.2.2); section 6.3 reports the results of the relevant structural tests.

Cost X-efficiency results are discussed in section 6.4 and those for economies of scale are reported in section 6.5. Most of these results are grouped according to bank size classes (i.e. very big, big, medium, small, and very small), types of bank (i.e. commercial, savings, popular, and credit co-operative), and geographical areas (i.e. north-west, north-east, centre, and south and islands).

Section 6.6 reports the findings of the profitability test carried out in order to check for specific financial characteristics of efficient and inefficient banks, and section 6.7 examines potential correlates of the inefficiency measures by using a logistic regression model. Section 6.8 is the conclusion.

6.2 The Cost Function Estimates

6.2.1 Standard Cost Frontier Specification: Model I

Maximum-likelihood estimates for Model I are obtained by estimating a multiproduct Fourier-flexible cost equation in a stochastic context as in (6.1) below:

$$
\begin{aligned}
\ln TC = \quad & \alpha_0 + \sum_{i=1}^{2} \alpha_i \ln Q_i + \sum_{j=1}^{3} \beta_j \ln P_j + \\
& + 1/2 \left[\sum_{i=1}^{2} \sum_{j=1}^{2} \delta_{ij} \ln Q_i \ln Q_j + \sum_{i=1}^{3} \sum_{j=1}^{3} \gamma_{ij} \ln P_i \ln P_j \right] + \\
& + \sum_{i=1}^{2} \sum_{j=1}^{3} \rho_{ij} \ln Q_i \ln P_j + \sum_{i=1}^{4} \left[\lambda_i \cos z_i + \theta_i \sin z_i \right] + \\
& + \sum_{i=1}^{2} \sum_{j=1}^{2} \left[\lambda_{ij} \cos(z_i + z_j) + \theta_{ij} \sin(z_i + z_j) \right] + \\
& + \sum_{i=1}^{2} \sum_{j \geq i}^{2} \sum_{\substack{k \geq j \\ k \neq i}}^{2} \left[\lambda_{ijk} \cos(z_i + z_j + z_k) + \theta_{ijk} \sin(z_i + z_j + z_k) \right] + \varepsilon_i
\end{aligned}
\tag{6.1}
$$

with the following restrictions:

SYMMETRY	$\delta_{ij} = \delta_{ji}$	$\gamma_{ij} = \gamma_{ji}$	
HOMOGENEITY	$\sum_{j=1}^{3} \beta_j = 1$	$\sum_{i=1}^{3} \gamma_{ij} = 0$	$\sum_{j=1}^{3} \rho_{ij} = 0$

where [$(i = 1, 2)$ and $(j = 1, 2, 3)$] and (see also Chapter 5, Table 5.1):

TC = normalised costs of production;
Q_1 = total loans;
Q_2 = total securities;
P_1 = normalised price of labour;
P_2 = normalised price of deposits;
P_3 = price of capital;
ε_i = stochastic error term;
z_i = adjusted values of $\ln Q_i$ so that they span the interval $[.1 \cdot 2\pi, .9 \cdot 2\pi]$
$\alpha, \beta, \delta, \gamma, \rho, \lambda, \theta$ = parameters to be estimated.

In accordance with the assumed constraint of linear homogeneity in prices, TC, P_1 and P_2 are normalised by the price of capital, P_3 [see for example, Greene (1993a); Kwan and Eisenbais (1994); Berger and Mester (1997)]. It is also important to mention that consideration of input share equations embodying Shephard's Lemma restrictions is excluded in order to allow for the possibility of allocative inefficiency [see, for example Berger and Mester (1997)].[1] Moreover, the Fourier terms for the input prices are also excluded in order to conserve the limited number of Fourier terms for the output quantities used to measure scale efficiencies [see Berger *et al.* (1997)]. Also Mitchell and Onvural (1996) did not impose restrictions on the trigonometric input price coefficients; however, Gallant (1982) has shown that this should not prevent an estimated Fourier-flexible cost function from closely approximating the true cost function. (In this way, the input price effect is defined entirely by the translog terms and the problem of imposing homogeneity restrictions on trigonometric price terms is avoided).

As pointed out in the previous Chapter 5, in this empirical analysis most computer routines are carried out using FRONTIER 4.1 and TSP 4.0. The estimated parameters are shown in Table 6.1.

[1] Likewise, the Battese and Coelli (1992) model was originally developed without including these auxiliary demand equations based on Shephard's lemma.

Table 6.1 Maximum Likelihood Parameter Estimates (Model I and Model II)[a,b,c]

Variables	Name	Parameters	MODEL I	MODEL II
Intercept	b0	α_0	1.4594***	1.4534***
			(.1144)	(.120)
$\ln Q_1$	b1	α_1	.3874***	.3724***
			(.0455)	(.0523)
$\ln Q_2$	b2	α_2	.4715***	.4685***
			(.0399)	(.0456)
$\ln P_1$	b3	β_1	.1126**	.1258**
			(.0463)	(.0523)
$\ln P_2$	b4	β_2	.8448***	.8218***
			(.0524)	(.0573)
$\ln Q_1 \ln Q_1$	b5	δ_{11}	.1678***	.1559***
			(.0151)	(.0183)
$\ln Q_2 \ln Q_2$	b6	δ_{22}	.1319***	.1289***
			(.0164)	(.0211)
$\ln Q_1 \ln Q_2$	b7	δ_{12}	-.1479***	-.1520***
			(.0146)	(.0162)
$\ln P_1 \ln P_1$	b8	γ_{11}	.1867***	.1692***
			(.0204)	(.0205)
$\ln P_2 \ln P_2$	b9	γ_{22}	.1495***	.1294***
			(.0283)	(.0287)
$\ln P_1 \ln P_2$	b10	γ_{12}	-.1758***	-.1589***
			(.0224)	(.0226)
$\ln Q_1 \ln P_1$	b11	ρ_{11}	.0412**	.0326*
			(.0173)	(.0202)
$\ln Q_2 \ln P_1$	b12	ρ_{21}	-.0008	-.0358*
			(.0185)	(.0214)
$\ln Q_1 \ln P_2$	b13	ρ_{12}	-.0566**	-.0460**
			(.0176)	(.0202)
$\ln Q_2 \ln P_2$	b14	ρ_{22}	.0166	.0477**
			(.0189)	(.0213)
$\cos(z_1)$	b15	λ_1	-.0865**	-.1013**
			(.0412)	(.0411)
$\sin(z_1)$	b16	θ_1	.0904**	.1064**
			(.0397)	(.0396)
$\cos(z_2)$	b17	λ_2	.0464*	.0552**
			(.0286)	(.0291)
$\sin(z_2)$	b18	θ_2	-.2039***	-.1639***
			(.0362)	(.0360)
$\cos(z_1+z_1)$	b19	λ_{11}	-.0818**	-.0855**
			(.0303)	(.0307)
$\sin(z_1+z_1)$	b20	θ_{11}	-.030	-.0183
			(.034)	(.0338)
$\sin(z_2+z_2)$	b22	θ_{22}	.1701**	.1679**
			(.0611)	(.0601)
$\cos(z_1+z_2)$	b23	λ_{12}	-.0362	-.0434*
			(.0286)	(.0289)

Continued Overleaf

(continued)

Variables	Name	Parameters	MODEL I	MODEL II
$\sin(z_1+z_2)$	b24	θ_{12}	-.1472*** (.0344)	-.1422*** (.0339)
$\cos(z_1+z_1+z_2)$	b25	λ_{112}	.0281** (.0159)	.0297** (.0158)
$\sin(z_1+z_1+z_2)$	b26	θ_{112}	.1114*** (.0181)	.1189*** (.0180)
$\cos(z_1+z_2+z_2)$	b27	λ_{122}	-.0306*** (.0153)	-.0293** (.0153)
$\sin(z_1+z_2+z_2)$	b28	θ_{122}	-.0952*** (.0181)	-.0973*** (.0183)
lnKlnK	b29	τ_{KK}	–	-.0452** (.0239)
$\ln Q_1 \ln K$	b30	α_{1K}	–	.0217* (.0156)
$\ln Q_2 \ln K$	b31	α_{2K}	–	.0133 (.0180)
$\ln P_1 \ln K$	b32	β_{1K}	–	.0474** (.0216)
$\ln P_2 \ln K$	b33	β_{2K}	–	-.0448** (.0209)
lnSlnS	b34	τ_{SS}	–	.0043** (.0024)
$\ln Q_1 \ln S$	b35	α_{1S}	–	.0152** (.0049)
$\ln Q_2 \ln S$	b36	α_{2S}	–	-.0055 (.0055)
$\ln P_1 \ln S$	b37	β_{1S}	–	.0352*** (.0078)
$\ln P_2 \ln S$	b38	β_{2S}	–	-.0351*** (.0075)
lnKlnS	b39	τ_{KS}	–	-.0041 (.0052)
lnK	b40	τ_K	–	.0011 (.0449)
lnS	b41	τ_S	–	-.0342** (.0148)
sigma-squared	b42	σ^2	.0322*** (.0023)	.0299*** (.0025)
gamma	b43	γ	.9357*** (.0064)	.9336*** (.0071)
eta	b44	η	.0318*** (.0088)	.0507*** (.0094)

*, **, *** means statistically significant at the 10%, 5% and .1% respectively.

[a] Asymptotic t-ratios distributed as N(0,1). Model I: Log-likelihood =2492.6. Adjusted R^2 of the pooled OLS model=99.8%. LR test of the one-sided error= 1323.7. Model II: Log-likelihood =2541.8. Adjusted R^2 of the pooled OLS model=99.9%. LR test of the one-sided error= 1152.1. Estimates based on the Davidson-Fletcher-Powell algorithm using the FRONTIER 4.1 software [see Coelli (1996) and Coelli *et al.* (1998)]. Standard errors in brackets.

[b] See the Appendix to Chapter 5 for the computer programming.

[c] Model I = standard cost function estimates; Model II = cost function estimates with risk and output quality variables.

From Table 6.1 it is clear that all the elasticities around the means have the expected sign and are statistically significant. The model has zero μ (that is, half-normal disturbances) since the same model with $\mu \neq 0$ (truncated normal) was rejected by the data at the 10% level.[2] Besides, the value of η is always positive and significantly different from zero, therefore inefficiencies tend to decrease with time over the four years under study. However, if $\eta = 0$ (time-invariant model), the individual inefficiencies tend to be very similar to those where $\eta \neq 0$ (time-varying efficiencies). The Spearman correlation coefficient between the average of the inefficiencies estimated over the four years with the time-varying model and those derived from the time-invariant model is equal to 99.87%.

Given the stochastic assumptions on the error term, the estimates for σ^2 and γ are also provided. In particular, the estimate γ has a value of 0.936 (with a standard error of 0.006). These values suggest that the majority of residual variation is due to the inefficiency effect u_i and that the random error is less than 10 per cent. Moreover, the one-sided generalised likelihood-ratio test, which tests the null hypothesis that there are no technical inefficiency effects, under the null hypothesis, $H_0: \gamma = 0$ provides a statistic that considerably exceeds the 5 per cent critical value of 2.71: thus the null hypothesis is

[2] Technically, the truncated model is also known as the Stevenson model [Stevenson (1980) and Coelli *et al.* (1998)] and it has been applied to the Italian banking sector by Cardani *et al.* (1991), together with the half-normal model in an attempt to compare the respective results. Cardani *et al.* (1991) found that the half-normal model provided a better fit to the Italian data. For other studies on banks' efficiency that use the half-normal specification to test for inefficiency differences between banking institutions, see also Kaparakis *et al.* (1994), Allen and Rai (1996) and Mester (1996). For an extensive review of different distributions used in the frontier literature, see Bauer (1990) and Greene (1993b).

rejected.[3] (Table A6.1 in the Appendix reports the other parameters, such as the values for the last input P_3 and the related cross products together with their asymptotic standard errors, which are computed from the restrictions of homogeneity reported in equation 6.1).

6.2.2 Cost Frontier Including Risk and Quality Variables: Model II

Model II relates to the cost frontier model including risk and quality variables. The description of variables and parameters are essentially the same as in (6.1) plus the following variables:

K	=	level of equity capital;
S	=	ratio of non-performing loans to total loans;
τ	=	parameters to be estimated.

Model II is simply Model I, plus the additional restrictions: $\sum_{i=1}^{3} \beta_{jk} = 0$ and $\sum_{i=1}^{3} \beta_{js} = 0$ as shown in (6.2) below:

[3] The generalised likelihood-ratio test requires the estimation of the model under both the null and alternative hypotheses $H_0 : \gamma = 0$ and $H_1 : \gamma > 0$. As explained in Coelli *et al.* (1998), if H_0 is true, this test statistic is usually assumed to be asymptotically distributed as a chi-square random variable with degrees of freedom equal to the number of restrictions involved. Nonetheless, because of difficulties arising when testing the null hypothesis of $\gamma = 0$, the calculation of the critical value for a test of size α is $\chi_1^2(2\alpha)$, so that the critical value for a test of size, α =0.05 is 2.71 rather than 3.84.

$$
\begin{aligned}
\ln TC = \quad & \alpha_0 + \sum_{i=1}^{2} \alpha_i \ln Q_i + \sum_{j=1}^{3} \beta_j \ln P_j + \tau_k \ln k + \tau_s \ln s + \\
& + 1/2 \left[\sum_{i=1}^{2}\sum_{j=1}^{2} \delta_{ij} \ln Q_i \ln Q_j + \sum_{i=1}^{3}\sum_{j=1}^{3} \gamma_{ij} \ln P_i \ln P_j + \tau_{kk} \ln K \ln K + \tau_{ss} \ln S \ln S \right] + \\
& + \sum_{i=1}^{2}\sum_{j=1}^{3} \rho_{ij} \ln Q_i \ln P_j + \sum_{i=1}^{2} \alpha_{ik} \ln Q_i \ln K + \sum_{j=1}^{3} \beta_{jk} \ln P_j \ln K + \\
& + \sum_{i=1}^{2} \alpha_{is} \ln Q_i \ln S + \sum_{j=1}^{3} \beta_{js} \ln P_j \ln S + \tau_{ks} \ln K \ln S + \\
& + \sum_{i=1}^{4} [\lambda_i \cos z_i + \theta_i \sin z_i] + \sum_{i=1}^{2}\sum_{j=1}^{2} [\lambda_{ij} \cos(z_i + z_j) + \theta_{ij} \sin(z_i + z_j)] + \\
& + \sum_{i=1}^{2}\sum_{j \geq i}^{2}\sum_{\substack{k \geq j \\ k \neq i}}^{2} [\lambda_{ij} \cos(z_i + z_j + z_k) + \theta_{ij} \sin(z_i + z_j + z_k)] + \varepsilon_i
\end{aligned}
\tag{6.2}
$$

As for Model I, balance sheet data were included in the panel for the four years under study and, given the stochastic assumptions on the error term, the estimates for σ^2 and γ are provided.

As displayed in Table 6.1, as far as the outputs and input prices are concerned, the elasticities around the means have the expected sign and are statistically significant. With particular reference to the estimates for non-performing loans (S) and equity level (K), while the former is statistically significant at the 10 per cent level, the same cannot be found for the latter, which according to the two-tailed t-test is insignificantly different from zero. An explanation could be found from the fact that there is a multicollinearity problem between total cost and equity, which is possibly influencing the variance of the equity estimate. Nevertheless, most second order coefficients involving the equity variable are found to be significant even if multicollinearity among variables are likely to inflate their estimated variances (as is common with second order approximations) [see also Resti (1997a)].[4]

It is also important to observe that as for Model I, μ=0. Moreover, the value of η is again positive and significantly different from zero, thus confirming that over the four years 1993-1996 the inefficiency levels are generally decreasing. As for Model I, when the restriction $\eta = 0$ (time-invariant model) is added, the distribution of individual inefficiencies is virtually unchanged with respect to those where $\eta \neq 0$ (time-varying efficiencies). The Spearman correlation coefficient between the average of the inefficiencies estimated over the four years with the time-varying model and those derived from the time-invariant model is equal to 99.62%. Furthermore, the estimate γ has a value of 0.934 (with a standard error of 0.071), thereby suggesting again that the majority of residual variation is due to the inefficiency effect u_i.

Finally, the one-sided generalised likelihood-ratio test of $\gamma = 0$ (no technical inefficiency effects) provides a statistic that considerably exceeds the 5 per cent critical value of 2.71, thus rejecting the null hypothesis (see, for details, earlier footnote 3).

6.3 Structural Tests

Structural tests are undertaken to see if the cost function including the risk and output quality variables (Model II) differs significantly from the following: (1) the standard cost frontier specification (Model I); (2) the translog form; (3) the model including the individual risk variable; and (4) the model including the individual output quality variable.

[4] We also estimated the cost function using different specifications without significantly changing the results obtained. Among other specifications, we tried: the Battese and Coelli (1995) model, in which environmental variables explaining various banks characteristics are added directly in the cost function, and Berger and Mester's (1997) model with fixed netputs specified in the cost function (namely, physical capital and financial equity capital) and normalisation by equity for all variables.

The likelihood ratio statistics is calculated as $-2\{\ln[L(H_0)] - \ln[L(H_1)]\}$ where $L(H_0)$ and $L(H_1)$ are the values of the likelihood function under the null and the alternative hypotheses, H_0 and H_1, respectively. The results are reported in Table 6.2.

Table 6.2 Structural Test Results

Test Performed [versus Model II]	Test Statistics	Degrees of Freedom	Critical Value $\chi^2_{.01}$	Outcome
(1) Model I	98.4	k = 13	27.69	Rejected
(2) Translog Form[a]	120	k = 14	29.14	Rejected
(3) NPL/L only (*S* only)	23	k = 7	18.48	Rejected
(4) Equity only (*K* only)	83.4	k = 7	18.48	Rejected

[a]The translog form used here includes risk and quality variables.

Overall, Model II (the cost frontier including risk and quality variables simultaneously) gives the best fit to the data.

With regard to the choice of the functional form for the cost function, the translog model (2) was rejected at the 0.01 per cent level, thus supporting the choice of the Fourier-flexible function. Similarly, the models excluding individual risk (3) and quality (4) variables were all rejected against Model II at the 0.01 per cent level.

It is useful to note that for the aims of the present research, some of the results derived from the two models including individual risk and output quality variables are reported later on in this chapter for comparison purposes along with those derived from Model II.

6.4 Efficiency Levels

Table 6.3 reports the average values of X-efficiency levels for both Model I (M1) and Model II (M2), with banks grouped by size classes as defined by the Bank of Italy's ranking criteria.

Although differences are not very large, the most efficient banks seem to be the big, medium and very small banks using either model specification. With regards to the inclusion of risk and quality variables, the efficiency estimates are strikingly similar across the two specifications and there does not seem to be any significant differences among the values derived from the estimations [for similar findings, see Berger and Mester (1997) for a US bank study, and Altunbas *et al.* (1999) for a study on Japanese banks].

Table 6.3 Average Values of X-Efficiencies Grouped by Bank Size Classes[a,b,c]

	1993		1994		1995		1996	
	M1	M2	M1	M2	M1	M2	M1	M2
Very big	81.2%	83.2%	81.8%	84.0%	82.3%	84.7%	82.8%	85.4%
Big	85.2%	85.1%	85.6%	85.8%	86.1%	86.4%	86.5%	87.1%
Medium	85.9%	85.6%	86.3%	86.2%	87.0%	87.2%	87.0%	87.5%
Small	81.6%	81.1%	82.3%	82.0%	82.8%	82.8%	83.3%	83.5%
Very small	85.4%	85.2%	86.1%	86.2%	86.7%	87.0%	87.1%	87.6%

[a] M1 = Model I (standard cost function estimates); M2 = Model II (cost function estimates with risk and output quality variables).
[b] The non-parametric Kruskal-Wallis test was carried out to check for the hypothesis H_0 of equality of mean X-efficiencies across bank size. The null hypothesis has always been rejected at the 5% level.
[c] Results from the non-parametric Mann-Whitney test show that the null hypothesis H_0 of equality of medians between the efficiency scores derived from M1 and M2 for each bank size group can never be rejected at the 5% level.

The results are confirmed in Table 6.4 that summarises the descriptive statistics of the results of year-by-year X-inefficiency levels. Average inefficiency levels range between approximately 13 and 15 per cent. Similar figures can be found in several recent studies of Italian banks [see, for instance, European Commission (1997), and Resti (1997a)]. It is also possible to observe that even in terms of mean and median values, the effects on the inefficiency levels derived from the inclusion of risk and quality variables in the cost function do not seem to be materially important.

Table 6.4 Statistics for Inefficiency Levels[a]

	MEAN		MEDIAN		STDEV		MINIMUM		MAXIMUM	
	M1	M2	M1	M2	M1	M2	M1	M2	M1	M2
1993	15.1%	15.3%	14.7%	15.2%	0.077	0.075	0.45%	0.43%	51.2%	51.5%
1994	14.4%	14.4%	14.0%	14.1%	0.073	0.070	0.43%	0.41%	35.1%	33.4%
1995	13.9%	13.6%	13.5%	13.4%	0.071	0.067	0.42%	0.39%	34.2%	32.0%
1996	13.5%	13.0%	13.1%	12.8%	0.066	0.062	0.41%	0.42%	32.2%	30.7%

[a] M1 = Model I (standard cost function estimates); M2 = Model II (cost function estimates with risk and output quality variables).

The efficiency scores were further analysed in order to test the null hypothesis that the means of the populations obtained from the estimation of Model I and II are the same against the alternative hypothesis that they are different. According to the non-parametric Kruskal-Wallis test, the null hypothesis cannot be rejected at the 90 per cent confidence interval for each of the four years under study. Moreover, the non-parametric Mann-Whitney test was used for testing the null hypothesis that the central locations of the two populations were the same against the one sided alternative hypothesis that the central location of Model I is higher than that of the results derived from Model II. Again, the results show that the null hypothesis cannot be rejected at a 95 per cent confidence interval for all the years under study.

In Table 6.5 below, the findings on productive efficiency have been grouped according to banks operating in different geographical areas. It should be noted that a bank is assigned to a given region (north-west, north-east, centre, south and islands) if it has its head office in that area over the years under study (see, for details on the macro-areas in Italy, Table 5.7 and Figure 5.2 in the previous chapter).

Table 6.5 Average Values of X-Efficiencies Grouped by Geographical Regions[a,b,c]

	1993		1994		1995		1996	
	M1	M2	M1	M2	M1	M2	M1	M2
North-west	87.2%	86.4%	88.1%	87.6%	88.3%	88.0%	88.4%	88.4%
North-east	85.7%	84.9%	86.3%	85.8%	87.2%	87.0%	87.4%	87.4%
Centre	83.2%	83.6%	84.0%	84.5%	84.2%	85.0%	84.2%	85.3%
South and Islands	82.9%	83.5%	83.6%	84.4%	84.1%	85.2%	85.0%	86.1%

[a] M1 = Model I (standard cost function estimates); M2 = Model II (cost function estimates with risk and output quality variables).
[b] The non-parametric Kruskal-Wallis test was carried out to check for the hypothesis H_0 of equality of mean X-efficiencies across bank regions. The null hypothesis has always been rejected at the 5% level.
[c] Results from the non-parametric Mann-Whitney test show that the null hypothesis H_0 of equality of medians between the efficiency scores derived from M1 and M2 for each bank region can never be rejected at the 5% level.

The X-efficiency measures are always higher for banks located in the northern part of the country, whereas the lowest efficiency scores are found for banks from the centre and the south, thus confirming the existence of significant disparities between banks operating in different macro-regions in Italy.

Table 6.6 illustrates the average efficiencies according to different type of banks (commercial, popular, savings and credit co-operative). It is possible to observe that on average the better performing banks are the credit co-operatives together with popular banks, possibly reflecting the greater homogeneity of the co-operative banking sector.

Table 6.6 Average Values of X-Efficiencies Grouped by Type of Banks[a,b,c]

	1993		1994		1995		1996	
	M1	M2	M1	M2	M1	M2	M1	M2
Commercial	80.7%	80.5%	81.8%	81.8%	82.2%	82.6%	82.6%	83.2%
Savings	82.4%	82.3%	83.0%	83.2%	83.6%	84.1%	84.3%	85.0%
Popular	83.9%	84.1%	85.3%	85.6%	86.1%	86.6%	86.6%	87.1%
Credit co-op	86.7%	86.4%	87.2%	87.1%	87.6%	87.7%	87.8%	88.2%

[a] M1 = Model I (standard cost function estimates); M2 = Model II (cost function estimates with risk and output quality variables).
[b] The non-parametric Kruskal-Wallis test was carried out to check for the hypothesis H_0 of equality of mean X-efficiencies across bank types. The null hypothesis has always been rejected at the 5% level.
[c] Results from the non-parametric Mann-Whitney test show that the null hypothesis H_0 of equality of medians between the efficiency scores derived from M1 and M2 for each bank type can never be rejected at the 5% level.

Tables 6.7 and 6.8 provide the pooled efficiency scores from the estimation of the two models in relation to each asset-based quartile in order to check whether size can effectively be considered as a determinant of potential cost reductions for Italian banks.

Table 6.7 Bank Size and Efficiency Scores (Model I)

	ASSETS RANGE[a,b]	MEAN	MEDIAN	STDEV	MIN	MAX
QUARTILE 1	12.7-106.8 (58.8)	87.8%	88.0%	0.066	65.4%	99.0%
QUARTILE 2	106.9-290 (188.9)	85.4%	85.5%	0.070	64.0%	99.5%
QUARTILE 3	290.1-1410.2 (653.9)	86.0%	86.6%	0.077	64.0%	99.6%
QUARTILE 4	1410.3-254043.9 (17226.5)	83.6%	82.9%	0.071	66.7%	99.6%

[a] Mean values in brackets.
[b] Values in billions of lire.

Table 6.8 Bank Size and Efficiency Scores (Model II)

	ASSETS RANGE[a,b]	MEAN	MEDIAN	STDEV	MIN	MAX
QUARTILE 1	12.7-106.8 (58.8)	87.7%	87.7%	0.065	65.5%	99.2%
QUARTILE 2	106.9-290 (188.9)	85.7%	85.6%	0.069	65.2%	99.5%
QUARTILE 3	290.1-1410.2 (653.9)	86.2%	86.5%	0.073	65.2%	99.6%
QUARTILE 4	1410.3-254043.9 (17226.5)	83.7%	83.0%	0.066	69.7%	99.6%

[a] Mean values in brackets.
[b] Values in billions of lire.

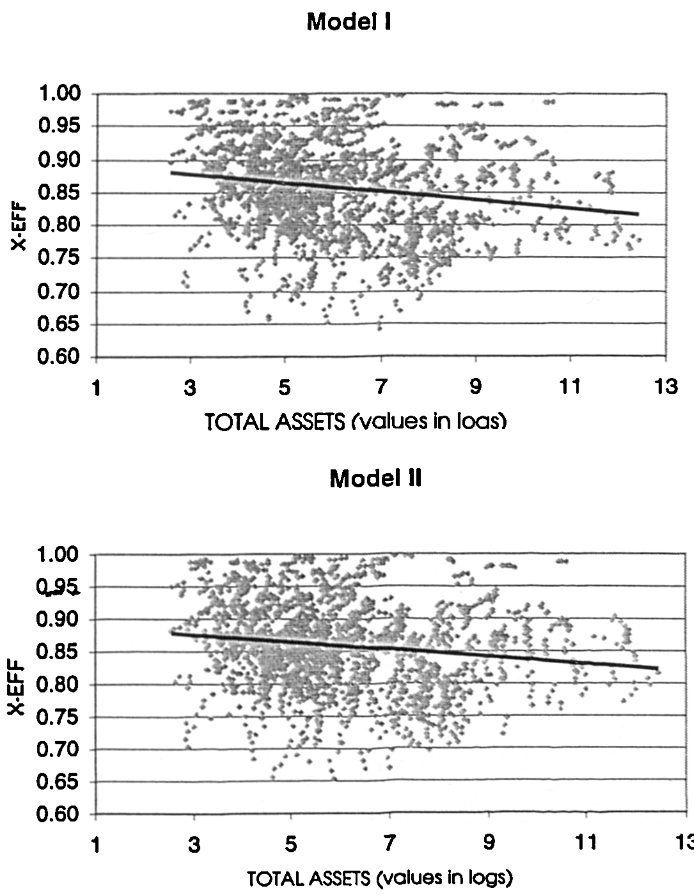
From the tables above it appears that both the mean and the median of firm-specific X-efficiency estimates tend to decrease from Quartile 1 to Quartile 4.[5] This suggests that, on average, larger banks deviate more from their respective cost-efficient frontier than do smaller banks. Relatively speaking, the smallest banks appear to be less inefficient than their larger counterparts. Altunbas, Evans and Molyneux (1999) found similar results for German banks and they argued that credit co-operative banks seem to

[5] As shown in Tables 6.7 and 6.8, Quartile 1 (4) contains the smallest (largest) firms.

have a lower cost of funds than other types of banks due, for instance, to their (possible) local monopolies.

The same data (assets in logarithms) are reported in the scatter diagrams below (Figure 6.1). The charts show similar patterns and they both suggest that the dispersion of the efficiency scores for the two panels and for each model is very high, thus implying that in many cases similar-sized banks have different efficiency levels and, supposedly, different costs.

Figure 6.1 Efficiency and Size



From a general viewpoint, a slight inverse trend between total assets and productive efficiencies seems to prevail (that is, the higher the efficiency the lower the amount of assets). The factual statistical significance of the relationship between assets and inefficiency measures is tested later in this chapter with the application of a logistic functional form (in section 6.7 of this chapter).

For comparison purposes, Table 6.9 shows the influence on X-inefficiencies of the levels of equity and the NPLs to total loans ratio calculated using different cost function specification. The related maximum likelihood estimates are reported in Table A6.2 in the Appendix.

Table 6.9 X-Inefficiency Measures. Cost Function Estimates Including Equity (*K*) Only and Non-Performing Loans/total loans (*S*) Only [a,b,c]

	1993		1994		1995		1996	
	K only	S only	K only	S only	K only	S only	K only	S only
Very big	18.5%	14.5%	17.9%	13.7%	17.3%	12.9%	16.7%	12.2%
Big	14.9%	14.2%	14.4%	13.4%	14.0%	12.6%	13.5%	11.9%
Medium	14.2%	13.7%	13.7%	13.0%	13.0%	11.9%	12.9%	11.5%
Small	18.4%	18.1%	17.6%	17.0%	17.1%	16.1%	16.5%	15.3%
Very small	14.7%	14.4%	13.8%	13.3%	13.2%	12.4%	12.6%	11.8%
All banks	15.1%	14.8%	14.4%	13.7%	13.8%	12.9%	13.3%	12.2%

[a] *K* only = including equity only; *S* only = including non-performing loans/total loans only.
[b] The non-parametric Kruskal-Wallis test was carried out to check for the hypothesis H_0 of equality of mean X-efficiencies across bank size. The null hypothesis has always been rejected at the 5 % level.
[c] Results from the non-parametric Mann-Whitney test show that the null hypothesis H_0 of equality of medians between the efficiency scores derived from the cost function including *K* and the efficiency scores derived from the cost function including *S* for each bank size group can always be rejected at the 5% level.

If one excludes the ratio of NPLs over total loans from the cost function, there appears to be a tangible effect on the X-inefficiency results (although, as discussed above, this effect appears not to be relevant when both *S* and *K* are included in the cost frontier estimation simultaneously). In fact, the inefficiency levels are always higher on average for any bank size over the four years under study, and these differences seem to be especially important for very big banks. This suggests that capitalisation (K) has the most noticeable influence on the X-inefficiency results. To summarise:

- Model II that includes risk and output quality variables in the cost function specification, fits better the data sample according to the Likelihood Ratio Test. Moreover, with regard to the choice of the functional form for the cost function, the rejection of the translog model supports the choice of the Fourier-flexible function.
- Between 1993 and 1996, average X-inefficiency levels range between 13 and 15 per cent of total costs and they tend to decrease over time for all bank sizes. The most X-efficient banks appear to be big, medium and very small institutions located in the north of the country. Co-operative banks seem to be less inefficient than other bank types.
- There does not appear to be any significant difference between the results derived from Model I and Model II. This is in line with recent studies on the US and Japanese banking [Berger and Mester (1997) and Altunbas *et al.* (1999), respectively] who found efficiency estimates strikingly similar across the different specifications. Nonetheless, when risk and output quality variables are included in the cost function estimation individually (that is, in the two cases where only K is included and only S is included, respectively), there appears to be a larger impact on the results. The average X-inefficiency range changes to 12-19 per cent, being especially high when only the level of capitalisation (K) is incorporated individually in the cost function.
- Firm-specific X-efficiency estimates show quite a high degree of dispersion in terms of individual institutions' total assets. This means that in many cases similar-sized banks have different efficiency levels and different costs. Lastly, a slight inverse trend between total assets and X-efficiencies seems to prevail (that is, the smaller the bank, the higher the level of efficiency).

6.5 Economies of Scale

Economies of scale are calculated for each year to examine the relative change in total costs associated with an incremental change from a particular output level and to see if there were significant differences between the results derived from the two models. As discussed in the methodological chapter, we will always refer to scale economies for what is the value of point estimates of scale elasticities. The degree of scale economies is computed by using the mean values of output and input prices for Model I, and using the mean values of output, input prices and risk and output quality variables for Model II [see section 5.2 for the formula used to calculate scale economies given equations (5.3) and (5.7) and Table A5.8 in the Appendix for details of how the standard errors were calculated]. Table 6.10 shows the degree of scale economies for each year and for both models together with their significance levels.

Table 6.10 Scale Economies (by Bank Size)[a,b,c]

	1993		1994		1995		1996	
	M1	M2	M1	M2	M1	M2	M1	M2
Very big	1.039	1.078	1.049	1.078	1.011	1.057	1.029	1.062
	(.087)	(.087)	(.085)	(.085)	(.090)	(.090)	(.088)	(.088)
Big	.756**	.823*	.785**	.849*	.745**	.805**	.814*	.874
	(.104)	(.102)	(.105)	(.104)	(.106)	(.104)	(.105)	(.103)
Medium	.762**	.821**	.751**	.806**	.767**	.818**	.744**	.800**
	(.086)	(.084)	(.088)	(.087)	(.087)	(.085)	(.090)	(.088)
Small	.925	.980	.917	.967	.951	1.002	.866**	.913
	(.072)	(.072)	(.071)	(.071)	(.071)	(.071)	(.072)	(.072)
Very small	.754***	.767***	.761***	.771***	.779***	.784***	.844***	.847***
	(.045)	(.045)	(.044)	(.045)	(.044)	(.045)	(.044)	(.045)
All banks	.779***	.801***	.784***	.802***	.803***	.819***	.844***	.859***
	(.037)	(.037)	(.037)	(.037)	(.037)	(.036)	(.036)	(.036)

*, **, *** means statistically significant at the 10%, 5% and .1% respectively.

[a] If *SCALE* >, < or = 1 then there are diseconomies, economies of scale or constant returns to scale respectively.

[b] In this case the standard error in brackets refers to the hypothesis $H_0=1$.

[c] M1 = Model I (standard cost function estimates); M2 = Model II (cost function estimates with risk and output quality variables).

The results above suggest that very big banks did not have potentially realisable scale economies in the years under consideration and appear to exhibit constant returns to scale. Big and medium banks show high and significant economies of scale over the four years in the majority of cases. In contrast, small banks show significant scale economies only in 1996, whereas very small show substantial scale economies over the whole period under study.

Overall, the results suggest that over the 1993-96 period economies of scale are present and significant in the Italian banking system considered as a whole. Nonetheless, if we look at the change in output required to produce at the most efficient scale (i.e. the minimum average cost, where elasticity equals one), the findings also suggest that, with the exception of very big and small banks, most institutions are still not operating at optimal scale size since they are in the area surrounding the increasing returns portion of the cost frontier.[6] These are quite important results if we consider that over 1993-96 the process of consolidation and restructuring of the system was aimed at gradually increasing Italian banks' size and in many cases inefficient banks experiencing crises had to leave the market.

Our results, in line with the findings of Altunbas *et al.* (1999), also show that scale economy estimates appear to be more sensitive when risk and quality factors are included in the cost function specification.

Table 6.11 reports the results on scale economies according to the different bank types. The category of banks showing the greatest degree of scale inefficiency is credit co-operative banks; whereas the saving banks show the closest values to unity, that is constant returns to scale. Scale elasticity measures are also significantly different from unity for popular and commercial banks over all the years under study, although the estimated scale inefficiencies are less than those for the credit co-operative banks.

[6] It should be noted that here we assume that scale inefficiency is linearly related to the scale elasticity measure, i.e. equal to one minus the elasticity measure.

Table 6.11 Scale Economies (by Bank Type)[a,b,c]

	1993		1994		1995		1996	
	M1	M2	M1	M2	M1	M2	M1	M2
Commercial	.864**	.908**	.871**	.911**	.880**	.920*	.891**	.928*
	(.047)	(.046)	(.047)	(.046)	(.049)	(.048)	(.054)	(.053)
Savings	.907*	.963	.914*	.964	.932	.981	.901*	.945
	(.062)	(.062)	(.062)	(.062)	(.062)	(.062)	(.064)	(.064)
Popular	.864**	.915**	.854**	.901**	.857**	.905**	.857**	.904**
	(.050)	(.049)	(.050)	(.050)	(.051)	(.050)	(.053)	(.053)
Credit co-op	.710***	.712***	.721***	.721***	.747***	.743***	.820***	.815***
	(.052)	(.052)	(.050)	(.050)	(.049)	(.049)	(.048)	(.049)

*, **, *** means statistically significant at the 10%, 5% and .1% respectively.

[a] If *SCALE* >, < or = 1 then there are diseconomies, economies of scale or constant returns to scale respectively.

[b] In this case the standard error in brackets refers to the hypothesis H_0=1.

[c] M1 = Model I (standard cost function estimates); M2 = Model II (cost function estimates with risk and output quality variables).

With regard to scale economies according to different geographical areas, Table 6.12 shows the related findings for each category of banks. It partly confirms the results presented before in this section and it also reveals some other interesting patterns. The group of commercial banks appears to show high and significant scale economies everywhere in the country, and especially in the north.

Savings banks are on average the bank category that seems to be the least able to exploit significant reductions in average costs associated with increase in output in virtually all regions. However, savings banks traditionally pursue objectives such as: *i)* encouraging savings among the public; *ii)* promoting developments in the local economy; *iii)* supporting social works; and *iv)* operating in the best interests of their members [Revell (1989)].

Table 6.12 **Scale Economies (by Bank Type and Geographical Region)[a,b,c]**

	1993		1994		1995		1996	
	Commercial banks							
	M1	M2	M1	M2	M1	M2	M1	M2
North-west	0.821***	0.859***	0.829***	0.864***	0.835***	0.872**	0.832**	0.878**
	(0.040)	(0.040)	(0.040)	(0.040)	(0.042)	(0.042)	(0.050)	(0.050)
North-east	0.846**	0.891**	0.845**	0.889**	0.877**	0.922*	0.870**	0.906**
	(0.052)	(0.051)	(0.053)	(0.052)	(0.057)	(0.056)	(0.057)	(0.056)
Centre	0.895**	0.944	0.910**	0.952	0.886**	0.925*	0.926*	0.962
	(0.052)	(0.051)	(0.052)	(0.051)	(0.052)	(0.051)	(0.056)	(0.055)
South	0.895**	0.940	0.901**	0.941	0.915*	0.955	0.910*	0.944
	(0.052)	(0.052)	(0.053)	(0.052)	(0.055)	(0.055)	(0.056)	(0.055)
	Savings banks							
	M1	M2	M1	M2	M1	M2	M1	M2
North-west	0.915*	0.970	0.922*	0.972	0.930	0.980	0.939	0.983
	(0.055)	(0.055)	(0.054)	(0.054)	(0.054)	(0.054)	(0.056)	(0.056)
North-east	0.887*	0.943	0.892*	0.943	0.915	0.966	0.868**	0.914
	(0.067)	(0.067)	(0.067)	(0.067)	(0.068)	(0.069)	(0.070)	(0.070)
Centre	0.926	0.979	0.938	0.985	0.951	0.997	0.923	0.964
	(0.062)	(0.061)	(0.062)	(0.062)	(0.062)	(0.061)	(0.064)	(0.064)
South	0.898*	0.966	0.895*	0.957	0.929	0.981	0.879**	0.933
	(0.068)	(0.068)	(0.068)	(0.068)	(0.066)	(0.066)	(0.068)	(0.068)
	Popular banks							
	M1	M2	M1	M2	M1	M2	M1	M2
North-west	0.830**	0.890*	0.830**	0.882*	0.844**	0.897*	0.805**	0.856**
	(0.075)	(0.074)	(0.075)	(0.074)	(0.074)	(0.073)	(0.075)	(0.074)
North-east	0.871**	0.928*	0.867**	0.917*	0.876**	0.926*	0.893**	0.937
	(0.052)	(0.051)	(0.053)	(0.053)	(0.053)	(0.053)	(0.054)	(0.054)
Centre	0.880**	0.928*	0.826***	0.870**	0.820***	0.865**	0.834***	0.882**
	(0.046)	(0.046)	(0.044)	(0.044)	(0.043)	(0.043)	(0.044)	(0.044)
South	0.869**	0.914**	0.867**	0.910**	0.861**	0.905**	0.876**	0.920*
	(0.047)	(0.046)	(0.046)	(0.046)	(0.045)	(0.045)	(0.048)	(0.048)
	Credit co-operative banks							
	M1	M2	M1	M2	M1	M2	M1	M2
North-west	0.798***	0.828***	0.754***	0.765***	0.776***	0.783***	0.874***	0.882**
	(0.037)	(0.036)	(0.045)	(0.046)	(0.045)	(0.045)	(0.046)	(0.046)
North-east	0.712***	0.712***	0.737***	0.736***	0.755***	0.752***	0.847**	0.844**
	(0.051)	(0.051)	(0.049)	(0.050)	(0.048)	(0.049)	(0.050)	(0.051)
Centre	0.672***	0.676***	0.677***	0.677***	0.709***	0.706***	0.775***	0.775***
	(0.056)	(0.057)	(0.054)	(0.055)	(0.053)	(0.053)	(0.051)	(0.052)
South	0.710***	0.700***	0.698***	0.686***	0.733***	0.716***	0.760***	0.740***
	(0.061)	(0.062)	(0.061)	(0.061)	(0.060)	(0.061)	(0.062)	(0.063)

*, **, *** means statistically significant at the 10%, 5% and .1% respectively.

[a] If *SCALE* >, < or = 1 then there are diseconomies, economies of scale or constant returns to scale respectively.

[b] In this case the standard error in brackets refers to the hypothesis H_0=1.

[c] M1 = Model I (standard cost function estimates); M2 = Model II (cost function estimates with risk and output quality variables).

As a matter of fact, savings banks have become more demand-oriented only in recent years. It has been argued [IEF (1998)] that with the increased competition all over the EU banking markets, savings banks are gradually changing their objectives, and they are becoming increasingly cost and profit efficiency orientated. Nonetheless, in the case of Italy, public-owned foundations still prevail and savings bank legal *status* is still unclear from a regulatory point of view.

Finally, from Table 6.12 it appears that popular and credit co-operative banks having their head office in any region of the country have higher potential savings in average costs. Table 6.12 also reveals that in many cases the inclusion of risk and output quality factors in the cost function seems to reduce the level and/or the significance of the scale elasticity estimates.

Table 6.13 illustrates the influence that individual risk and output quality variables have on scale economies when estimating separate frontiers (the related maximum likelihood estimates are in Table A6.2 in the Appendix to this chapter). These results show that the inclusion of either individual K or S always has an impact on the estimated scale elasticity levels. In general, including the quality variable (the ratio of NPLs to total loans) results in estimates of scale elasticities which are higher than the estimates obtained by including financial capital in the cost function. For all categories of banks except very big banks, this has the effect of reducing estimated scale inefficiencies (since the scale elasticities are closer to 1.0). This is similar to the results in Table 6.9 where mean X-inefficiencies are generally lower when the output quality variable is included in the cost function, than when financial capital is included.

Table 6.13 Scale Economies – Cost Function Estimates Including Equity (*K*) Only and Non-Performing Loans/total loans (*S*) Only[a,b,c]

	1993		1994		1995		1996	
	K only	S only	K only	S only	K only	S only	K only	S only
Very big	1.017	1.056	1.027	1.065	.997	1.035	1.014	1.050
	(.087)	(.088)	(.086)	(.086)	(.091)	(.092)	(.089)	(.089)
Big	.786**	.818**	.816**	.847*	.778**	.809**	.849*	.880
	(.104)	(.105)	(.106)	(.106)	(.107)	(.108)	(.105)	(.106)
Medium	.821**	.848**	.809**	.836**	.828**	.855*	.805**	.832**
	(.086)	(.087)	(.088)	(.089)	(.087)	(.087)	(.090)	(.091)
Small	.995	1.017	.988	1.001	1.023	1.045	.940	.961
	(.073)	(.073)	(.071)	(.072)	(.071)	(.072)	(.073)	(.074)
Very small	.784***	.791***	.794***	.802***	.809***	.818***	.876**	.885**
	(.045)	(.046)	(.045)	.045)	(.045)	(.045)	(.045)	(.045)
All banks	.815***	.826***	.822***	.833***	.840***	.852***	.883**	.896**
	(.038)	(.038)	(.038)	(.039)	(.038)	(.038)	(.037)	(.038)

*, **, *** means statistically significant at the 10%, 5% and .1% respectively.
[a] If *SCALE* >, < or = 1 then there are diseconomies, economies of scale or constant returns to scale respectively.
[b] In this case the standard error in brackets refers to the hypothesis $H_0=1$.
[c] *K* only = equity only; *S* only = non-performing loans/total loans only.

Overall, the results on X-efficiencies and economies of scale in Italian banking seem to suggest that our sample of very small banks, usually in the form of co-operatives, are the most cost efficient in the system and they have a high potential for savings in average costs. These bank types still benefit from the advantages of operating in niche markets where they usually enjoy local monopolies. Other important elements that have often been put forward to explain the specialness of these banks include their localisation, reputation, and the special (long-term) relationships they tend to have with their retail and small and medium enterprises (SME) customers. Moreover, within co-operative banks members have more incentives to control one another (so-called peer monitoring) and managers have less opportunity to overspend to maximise their own utility (expense-preference theory). These factors may also explain why co-operative banks (i.e. popular and credit co-operatives) are more profitable than other bank types (see Chapter 3), despite the comparatively higher operating expenses in relation to total assets. However, in contrast to the results on X-efficiencies, the scale economies findings suggest that despite their high potential, these very small-sized banks are still not operating at optimal scale size, since they are in the area surrounding the increasing returns portion of the cost frontier.

Cost efficiency levels, both in terms of X-efficiencies and economies of scale, increased over the 1993-96 period for all bank types, very big banks included, although for the latter the potential benefits deriving from economies of scale appear to be soon exhausted. Moreover, the fact that we use an unbalanced panel allows us to conclude that most probably the increase of M&A activities and the privatisation process that characterised the years under study have had positive effects on the overall efficiency of the system (see for example the results on X-efficiencies for big and medium banks), although these institutions seem to be operating at a non-optimal scale size. As for the group of very big banks the positive effects of the new deregulated and competitive environment will probably be felt more over the longer term, because these banks had to bear high operating and fixed costs related to the acquisition of banks in crises and the formation (through acquisitions) of big banking groups. Also, large investments in new banking technologies represented important costs, the benefits of which will not feed through until a later date.

6.6 Profitability Test Results

Following Spong *et al.* (1995), we subject our cost efficiency measures derived from the Fourier model to a profitability test. This is undertaken in order to identify banks that are both cost – and profit – efficient and it provides an alternative to some of the consistency conditions suggested recently by Bauer *et al.* (1997).

This approach is taken because the cost side may provide inaccurate rankings of efficiency; a seemingly cost inefficient bank, for example, might be offsetting higher expenses with higher revenues. It follows that bank's which do well on both cost efficiency and profitability tests will comprise the most efficient bank category; banks that fare poorly on the two tests will be grouped in the least efficient category.

In this way, a broader concept of efficiency is used, because the combined tests identify the ability of banks to use their resources efficiently both in producing banking products and services and in generating profits. Moreover, a number of financial characteristics (concerning cost and revenue composition and general balance sheet structure) that separate some of the most efficient banks from the least efficient banks are discussed in order to provide an insight into the factors behind efficient bank operations.

This test was applied to the results derived from the estimates of both Model I (standard cost frontier specification) and Model II (cost frontier including risk and output quality variables). The results are reported in Tables 6.14 for Model I and 6.15 for Model II.

Table 6.14 Profitability Test: Model I[a]

		Number of banks	Cost efficiency (averages) %	ROA (averages) %
1993	Most efficient banks	82	94.7	1.61
	Least efficient banks	87	74.4	-0.10
1994	Most efficient banks	86	94.4	1.32
	Least efficient banks	100	75.7	-0.05
1995	Most efficient banks	76	95.0	1.83
	Least efficient banks	91	76.6	0.07
1996	Most efficient banks	64	95.0	1.82
	Least efficient banks	81	77.5	0.26

[a] The two groups of the most efficient and the least efficient banks is created in the following way: 1) most efficient group: banks that rank in the upper quartile of Italian banks on the cost efficiency test and in the upper half on ROA; and 2) least efficient group: banks that rank in the bottom quartile on the cost efficiency measure and in the bottom half on ROA.

Table 6.15 Profitability Test: Model II[a]

		Number of banks	Cost efficiency (averages) %	ROA (averages) %
1993	Most efficient banks	79	94.4	1.65
	Least efficient banks	79	74.4	-0.05
1994	Most efficient banks	82	94.6	1.35
	Least efficient banks	96	76.1	-0.02
1995	Most efficient banks	72	94.9	1.85
	Least efficient banks	84	77.3	0.12
1996	Most efficient banks	68	94.8	1.79
	Least efficient banks	75	78.5	0.33

[a] See note to Table 6.14.

As an average for the four years under study, a total of 77 banks for Model I and 75 banks for Model II satisfy the selection criteria for the most efficient group. On the other hand, an average of 90 banks for Model I and 84 banks for Model II meet the standards for the least efficient group.

The average bank in the least efficient group has a cost efficiency of only 0.76 in both Models, which indicates that an average bank in this group could have produced the same amount of output with only 76% of their cost if they operated as efficiently as the best practice banks. On the other hand, the average cost efficiency level for the most efficient banks is approximately 0.94, thus indicating much less of a disparity with the "best" bank in the sample. Moreover, as an average for the four years, the ROA for the most efficient banks was equal to 1.64% for Model I and 1.66% for Model II.

Table 6.16 shows a comparison between the major sources of income and expenses, as well as several other financial ratios, for the most recent available year using the results derived from Model II. It reveals how efficient and inefficient banks differ, and also, to what extent they show similar features. The table shows the main financial characteristics for the two samples "all banks" and "large banks only". This latter group includes the following bank size: very big, big, medium and small (see, for the distribution of sample banks by average assets, Table 5.6 in the previous chapter). This choice of such a sub-sample is motivated by the fact that the interpretation of some of the results could be affected by the inclusion of a large number of very small banks in the sample "all banks".[7]

Table 6.16 Sample Bank Information (Group Averages – 1996 Data and Model II)[a]

	ALL BANKS		LARGE BANKS ONLY	
	MOST EFFICIENT	LEAST EFFICIENT	MOST EFFICIENT	LEAST EFFICIENT
Number of banks	68	75	31	29
Cost X-efficiency	0.95	0.79	93.1	76.9
Roa	1.79	0.33	0.72	0.18
Interest received	9.63	9.11	8.90	9.01
Non-interest income	0.19	0.71	0.78	0.76
Interest paid	5.26	5.04	4.94	5.02
Operating costs	2.98	4.0	2.98	4.1
Staff expenses/operating costs	56.7	61.9	61.45	62.51
Staff expenses[b]	1.69	2.46	1.84	2.54
Other non-interest expenses	1.13	0.81	1.14	1.53
Loans	40.7	43.6	46.29	41.0
Deposits	54.7	54.2	44.48	52.3
Securities	13.4	11.8	14.5	13.5
Equity	11.3	8.50	11.0	8.16
Fixed assets	1.44	2.62	2.32	2.51
Interest margin	4.40	4.10	3.99	4.01
Npls/total loans	4.42	6.70	4.41	7.98

[a] Unless otherwise stated, values are expressed as percentage of total assets.
[b] Staff expenses includes the following: salaries and benefits; social security contributions; severance indemnities and pensions.

[7] As discussed in Chapter 5, since the Italian banking industry is characterised by the presence besides a limited number of big institutions, of a wide layer of small and very small banks, the distribution of banks is highly skewed. On the liabilities side a small bank operating successfully in local markets can enjoy a wide funding basis (and more generally speaking, a broad retail banking basis) at a low price; on the other hand, a better knowledge of the productive system of their regions can make small banks more effective in collecting information on the potential borrowers thereby enabling them to serve some regions of the risk/return curve that would be too risky for big "outside" banks [Resti (1997a)].

On the earnings side, the advantages held by the most efficient banks seem to be usually in terms of income generating capacity and, as expected, expenses control. Focusing on the sample "all banks" the most efficient group has, for instance, an advantage over inefficient banks in terms of higher interest received on assets. On the other hand, the most inefficient banks have relatively high non-interest revenues compared with the most efficient banks, thus suggesting that there might be some differences in the way the two groups generate income. However, these results are different if the very small banks are excluded from the sample, thereby suggesting a higher importance of non-interest income for the most efficient group. As concerns the expense side, the most efficient and least efficient banks show similar interest expenses. This means that the most efficient banks do not have important advantages in funding costs, and therefore they are achieving their performance by other means, other factors being equal. Furthermore, it seems apparent that efficient banks are more effective in controlling operating costs, and particularly staff expenses.

With regard to their balance sheet structure, in 1996 the most efficient banks hold more securities and had higher levels of equity than their inefficient counterparts, thus suggesting a higher level of protection to their customers. Moreover, the most efficient banks have better asset quality, thus implying that they are assigning more attention and resources to loan origination, monitoring and other credit judgement activities.

Overall, from these findings it is possible to infer that, at least in 1996, the main differences between the most efficient and least efficient banks operating in Italy relate to the efforts of bank management to control their staff expenses and to ensure thorough credit risk management practices.

6.7 Correlates with Inefficiency

In order to investigate possible determinants of bank efficiency, firm-specific measures of inefficiency derived exclusively from Model I are regressed on a set of independent variables relevant to the banking business. The choice of using only the inefficiency scores from the estimation of Model I is justified by the fact that we want to avoid the problem of including the output quality and capital variables twice in the analysis presented later in this section.

As discussed in the methodological section, logistic regression provides information on correlation and not causality [see Mester (1993)]. As stressed also by Mester (1996), the findings are intended mainly to indicate where banks might look for clues toward increasing their efficiency.

The results derived from the estimation of the logistic model are displayed in Table 6.17. The data have been pooled over the four years and calculations have been undertaken for all banks, large banks and very small banks (Table 6.17). In this way, the determinants of very small banks' efficiency can be tested separately from the other institutions. Since the results for all banks suggest several differences between macro-regions and type of banks, separate logistic regressions by geographical areas and bank types were run (see Table 6.18 and 6.19, respectively, below).

With reference to the classifications employed earlier in this chapter, here large banks include the following asset size: very big, big, medium and small. For details on the variables used and for the specification of the functional form employed for this analysis see Table 5.3 and the Appendix to Chapter 5.

Table 6.17 Correlates with Inefficiencies – Logistic Regressions (All Banks, Large Banks and Very Small Banks)[a,b]

PARAMETER	ALL	LARGE	VERY SMALL
INTERC	-3.002***	-2.9196***	-2.9505***
	(.1344)	(.2752)	(.1826)
ASSETS	.0004	.0019	-.2884***
	(.0017)	(.0016)	(.0648)
MARGIN	7.6265***	12.6647**	5.1413**
	(1.4751)	(3.7472)	(1.7116)
BRANCHES	.0446*	.0319	2.0613***
	(.0282)	(.0280)	(.2512)
RETAIL	.9974***	1.5393***	.7914***
	(.1133)	(.2281)	(.1297)
OWNERS°	-.0721	-.1558**	.0855
	(.0557)	(.0681)	(.0944)
NONPERF	.0093***	.0011	.0132***
	(.0019)	(.0031)	(.0025)
PERFORM	-.0072	-.0193	-.0206
	(.0337)	(.0427)	(.0467)
CAPITAL	-1.5664**	-1.6798*	-1.2127**
	(.4301)	(1.0626)	(.4706)
QUOTED°	-.1835**	-.2691***	–
	(.0594)	(.0611)	
NORTHWE°	-.2158***	-.1027*	-.2430***
	(.0415)	(.0722)	(.0509)
NORTHEA°	-.1568***	-.2887***	-.0709*
	(.0368)	(.0736)	(.0422)
CENT°	-.0041	-.0476	.0467
	(.0362)	(.0676)	(.0420)
COM°	.4331***	-.2029	.3662***
	(.0381)	(.1653)	(.0487)
SAV°	.2832***	-.3682**	.1728*
	(.0637)	(.1706)	(.1141)
POP°	.2128***	-.4417**	.1431**
	(.0359)	(.1610)	(.0510)

[a] ASSETS = total assets; MARGIN = interest margin/total assets; BRANCHES = number of branches; RETAIL = (customer loans + customer deposits)/total assets; OWNERS = 1 for private bank and 0 for public; NONPERF = non-performing loans/total loans; PERFORM = net income / equity; CAPITAL = equity / total assets; QUOTED = 1 for quoted banks and 0 for not quoted; NORTHWE = dummy for north-western banks; NORTHEA = dummy for north-eastern banks; CENT = banks located in the centre; COM = commercial banks; SAV = saving banks; POP = popular banks. ° indicates dummy variables.

[b] All banks: number of obs. 1,958 – log-likelihood function 2,606.08.
Large banks: number of obs. 420 – log-likelihood function 627.16.
Very small banks: number of obs 1,538 – log-likelihood function 2,057.24.

Table 6.18 Correlates with Inefficiencies – Logistic Regressions (North-West, North-East, Centre and South)[a,b]

PARAMETER	NW	NE	CE	SO
INTERC	-4.1861***	-3.1918***	-2.1251***	-2.8880***
	(.2817)	(.3107)	(.2994)	(.2200)
ASSETS	-2.71E-05	-.0495**	.0024	-.0121
	(.0030)	(.0183)	(.0029)	(.0108)
MARGIN	14.2369**	16.1254***	4.9961*	1.4201
	(4.3364)	(3.1688)	(3.5254)	(2.3092)
BRANCHES	.0801	.5164**	.0066	.1479
	(.0608)	(.1674)	(.0411)	(.1314)
RETAIL	1.2623***	.7282**	.6070**	.9819***
	(.2563)	(.2298)	(.2580)	(.2047)
OWNERS$^{\circ}$	-.0523	.0870	-.3849**	.1704
	(.0853)	(.1510)	(.1351)	(.1279)
NONPERF	.0530***	.0024	.0185**	.0104**
	(.0070)	(.0032)	(.0053)	(.0041)
PERFORM	-.0179	-.2288	.0037	-.0044
	(.0857)	(.2161)	(.1082)	(.0523)
CAPITAL	-1.0305	-2.7996**	-1.8961**	-.9042
	(.9996)	(.8289)	(.9525)	(.8034)
QUOTED$^{\circ}$	-.2932**	-.0361	-.2467*	-.4066**
	(.0821)	(.2336)	(.1480)	(.1874)
COM$^{\circ}$	.7961***	.270**	.0295	.5231***
	(.0691)	(.0957)	(.0976)	(.0729)
SAV$^{\circ}$	.5669***	.293*	-.1436	.4826***
	(.1121)	(.1691)	(.1450)	(.1046)
POP$^{\circ}$	.6370***	-.1736**	.1396*	.4332***
	(.1062)	(.0733)	(.078)	(.0626)

[a] See note to Table 6.17.

[b] NW banks: number of obs. 492 – log-likelihood function 711.5.
NE banks: number of obs. 616 – log-likelihood function 885.7.
CE banks: number of obs. 363 – log-likelihood function 517.4.
SO banks: number of obs. 487 – log-likelihood function 602.2.

Table 6.19 Correlates with Inefficiencies – Logistic Regressions (Commercial, Savings, Popular and Credit Co-operative Banks)[a,b]

PARAMETER	COM	SAV	POP	CC
INTERC	-2.933***	-2.5953***	-3.9186***	-2.8836***
	(.2719)	(.3286)	(.3716)	(.1712)
ASSETS	.0018	-.006	-.0559**	-.4350**
	(.0020)	(.0048)	(.0210)	(.1241)
MARGIN	.593	15.4948**	13.4078***	7.3878**
	(3.3253)	(4.9997)	(3.2427)	(2.2089)
BRANCHES	.0287	.1233*	.6069**	5.8736***
	(.0348)	(.0793)	(.1755)	(1.0284)
RETAIL	1.2661***	.1395	2.1769***	.6110***
	(.2644)	(.3168)	(.3661)	(.1448)
OWNERS°	.0017	–	–	–
	(.065)			
NONPERF	.0388***	.0309**	-.0021	.0099**
	(.0066)	(.0076)	(.0040)	(.0028)
PERFORM	.0635	.0127	.4267	-.0757
	(.0512)	(.0640)	(.5478)	(.0558)
CAPITAL	-.1226	.1608	-4.3320**	-1.3229**
	(.9503)	(1.1733)	(1.0874)	(.6352)
QUOTED°	-.1474**	–	-.5104**	–
	(.0791)		(.1531)	
NORTHWE°	-.0159	-.0215	-.0101	-.3700***
	(.0982)	(.1192)	(.1448)	(.0610)
NORTHEA°	-.1492*	-.1134	-.5290***	-.0547
	(.1098)	(.1242)	(.0944)	(.0486)
CENT°	-.1258	.0494	-.2038**	.1378**
	(.0989)	(.0925)	(.0909)	(.0486)

[a] See note to Table 6.17.

[b] COM banks: number of obs. 284 – log-likelihood function 367.1.
SAV banks: number of obs. 233 – log-likelihood function 355.5.
POP banks: number of obs. 275 – log-likelihood function 375.6.
CC banks: number of obs. 1,166 – log-likelihood function 1,641.7.

The estimates suggest that different variables significantly correlate with inefficiencies in the Italian banking sector. First of all, in accordance with Mester's findings (1993 and 1996), inefficiencies are always inversely correlated with financial capital (CAPITAL). This is quite predictable since banks with low inefficiency will tend to have more profits as they will be able (holding dividends constant) to retain more earnings as capital. However, this result should not be interpreted as saying that if a bank increases its capital-to-asset ratio, then its inefficiency will decrease. As Mester (1996, p. 1043) points out, this could also be explained as an indication that higher capital ratios may prevent moral hazard because: "as an institution's capital level decreases it has an increasing incentive to take on excessive risk, since it keeps any upside gain and loses only the amount of capital it has invested in the bank if the risk does not pay off". Moreover, inefficiencies are usually inversely correlated with bank performance (PERFORM) variables, although in most cases the relationship is insignificantly different from zero.

With regard to the coefficient for the level of NPLs, when significant it is always positively related to bank inefficiency. In fact, higher efficiency is expected to be correlated with better credit risk evaluation [see also Mester (1996); Altunbas *et al.* (1999); Berger and DeYoung (1997)]. Inefficient banks also tend to have on average a higher number of branches, a higher interest margin-to-assets ratios and a higher intensity of retail banking business than efficient banks. This latter variable has been found significant even when only the subgroup of the largest banks has been tested.

The results concerning the relationship between total assets size and bank efficiency are mixed. The coefficient is not significantly different from zero for all, large, north-west, commercial and savings banks. These findings are quite important because they essentially show that there is no statistical evidence that larger banks are more or less X-efficient than smaller banks. In fact, from the results it is possible to see that an inverse relationship between assets size and inefficiency appears only to hold *within* a specific bank category (i.e. popular and credit co-operative), and bank size group (i.e. very small banks).

There are few other statistically significant relationships concerning, where available, the dummy variables for private and quoted banks. The significance and negative sign of the dummy for private banks suggests that, at least large private banks tend to have lower levels of inefficiency. From the results, it is also possible to infer that quoted banks seem to be on average more efficient than non-quoted banks.

6.8 Conclusions

This chapter provides an empirical analysis of the cost efficiency of the Italian banking system over the 1993-96 period. We found that mean X-inefficiency levels range between 13 and 15 per cent of their total costs and they tend to decrease over time and for all sizes of banks. Similarly, economies of scale (the value of point estimates of scale elasticities) appear present and significant in the Italian banking system when considered as a whole. Nonetheless, if we look at the change in output required to produce at the minimum efficient scale (e.g. the minimum average cost, where elasticity equals one), the findings also suggest that most institutions are still not operating at optimal scale size since they are in the area surrounding the increasing returns portion of the cost frontier. These are quite important results if we consider that during 1993-96 the process of consolidation and restructuring of the system has aimed at gradually increasing banks' size.

In line with recent findings by Berger and Mester (1997) and Altunbas *et al.* (1999), the results also show that X-efficiency estimates appear insensitive to different cost function specifications. In contrast, the level and significance of scale economy estimates seem to be affected by the inclusion of risk and output quality factors in the cost function.

The data sample has also been subject to a profitability test (in order to check for specific financial characteristics of efficient and inefficient banks), and potential correlates of the inefficiency measures were calculated by using a logistic regression model. Following the profitability test as suggested by Spong *et al.* (1995), the main differences between the "most efficient" and "least efficient" bank seem to be mainly related to staff expenses. In the context of important technological improvements in banks' productive processes, this suggests an urgent need for greater labour market flexibility and the consequent substitution of labour for capital. Moreover, inefficient banks always appear to have lower levels of equity/assets, and higher levels of non-performing loans.

Finally, the data were pooled to carry out a logistic regression model in order to examine bank- and market-specific factors that influence banks' efficiency. Confirming

Mester (1993 and 1996), inefficiencies appear to be inversely correlated with capital and positively related to the level of non-performing loans. This latter finding suggests that efficient banks are assigning more attention and resources to loan origination, monitoring and other credit judgement activities. Interestingly, over the period under study inefficient banks also tended to have (on average) higher interest margins, more branches and a greater retail banking orientation compared with their efficient counterparts. The analysis also shows that there is no clear relationship between assets size and bank efficiency. However, from the results it is possible to infer that quoted banks, on average, appear to be more efficient than their non-quoted counterparts.

Chapter 7

Conclusions and Limitations of the Research

7.1 Introduction

Banking has experienced dramatic changes over the last fifteen years. Deregulation, financial innovation and automation have been major forces impacting on the performance of the banking sectors of most Western European countries. In such a context, banks are more concerned about controlling and analysing their costs and revenues, as well as measuring the risks taken to produce acceptable returns. Therefore, the issues of bank efficiency and optimal dimension (size, business mix and respective strategies) have become increasingly important for modern banking firms.

This thesis provides an overview of the recent developments in the Italian banking system and investigates banks' performance, profitability and efficiency. The empirical analysis focuses on the 1993-96 period, which is deemed to be interesting because many environmental transformations – especially those induced by the EU's and national government's commitment to deregulate – had a strong impact on the Italian banking system.

7.2 Liberalisation and Performance of the Italian Banking System

The issuing of important Banking Directives and Laws at the EU level has encouraged the processes of structural deregulation and supervisory re-regulation in virtually all EU Member States. In Italy, the departure from the principles laid down in the 1936 Banking Law (banks' specialisation; separateness between bank and industry; structural controls; and the state dominance within the banking sector) represented a fundamental change in the regulation of the Italian banking system.

As illustrated in Chapter 2, the reforms undertaken since the late 1980s have liberalised significantly the banking system thanks to progressive deregulation on the bank branching restrictions, the liberalisation of foreign bank establishment and the abolition of specialisation requirements. Moreover, the introduction of the universal bank model and the possibility given to public sector banks to convert into joint-stock companies has represented key factors in the modernisation of the system.

Despite these developments, however, during the 1990s the Italian banking sector has experienced a dramatic fall in profitability brought about by a fall in interest margins and persistently high levels of staffing costs. In addition, the same period witnessed a decline in the comparative importance of traditional intermediation activity, while low inflation and high competition gradually reduced the differential between lending and borrowing rates (Chapter 3).

Italian banks have found it difficult to adjust to the new environment not least because of the relative inflexibility in the factors of production, in particular labour costs. Italian banks appear to have too high a proportion of staff costs-to-income compared with their European peers. High staff costs, together with the significant increase in the number of branches, have affected overall bank costs.

From a macroeconomic point of view, adverse conditions have also led to a substantial increase in NPLs, especially for banks located in specific geographical areas of the country. Chapter 3 examines the increase in the level of NPLs, which in the south reached a dramatic 24.2% of total loans in 1996 (21.8% in 1997), a ratio that is more than twice the national average [Bank of Italy (1998)]. On the other hand, the level of capital does not seem to have been affected by the deterioration in quality of bank loan portfolios.

The achievement of more competitive conditions in the output market has brought about situations of crisis for various banking firms. During the 1993 to 1996 period, the main banks in the south of Italy experienced a substantial fall in their net interest income and were no longer able to cover the excessively high operating expenses and loan losses. As a consequence, these banks had to reduce their size and/or were acquired by healthier banks.

A major response of the system to these pressures has been a substantial consolidation movement resulting in a reduction in the total number of banks, an increase in the number of banking groups, and a widespread privatisation programme. Meanwhile, the fall in banks' interest margin has been partially offset by the growing importance of non-interest income derived from securities trading and other services.

7.3 What are the Main Determinants of Italian Banks' Efficiency?

Bearing the aforementioned developments in mind a primary aim of this research was to provide an empirical analysis of the cost efficiency of the Italian banking sector over the period 1993-96 taking into account the risks associated with banks' operations. Chapter 4 explains the most important theoretical and empirical issues in efficiency analysis, and discusses the various methodologies used for cost efficiency measurement. The chapter also reports select findings on the efficiency of US and European banking systems. Details of the methodological approach used for the present empirical research are provided in Chapter 5, which also describes the variables and data used.

The most recent research criticises the use of the translog cost function, mainly on the grounds that it is insufficiently flexible to describe the cost characteristics of the banking industry. As a result, we chose the stochastic Fourier-flexible functional form. As far as we are aware, this latter model has not been applied before to analyse the cost efficiency of the Italian banking system. Moreover, the choice of testing an unbalanced panel of banks is quite important because it allows us to make inferences on the impact on cost efficiency of the restructuring process that has taken place in Italy during the years under study. The data used to construct the estimates for the cost function parameters are derived from Bilbank, an Italian database of the Associazione Banche Private Italiane. For the present study the sample comprises 1,958 bank observations distributed in the following way: 545 banks in 1993, 523 in 1994, 466 in 1995 and 424 in 1996.

The main inferences that can be drawn from the results of the empirical research carried out in this thesis can be summarised as follows. Over the 1993-96 period cost efficiency levels, both in terms of X-efficiencies and economies of scale, increased for all bank types, very big banks included, although for the latter potential benefits deriving from economies of scale seem to be soon exhausted. Therefore, the increase of M&A activities and the privatisation process during the 1993-96 period had a relatively strong impact on the overall efficiency of the system which proved to be especially beneficial for small- and medium-sized banks. Nonetheless, for the largest banks of the Italian banking system, the positive effects of the new deregulated and competitive environment will probably be felt more over the longer term. During the period under study, many large banks have had to bear high operating and/or fixed costs relating, for example, to the acquisition of banks in crises and to the formation of big banking groups. In addition, large investments in new banking technologies have represented considerable costs, the benefits of which will not feed through until a later date. These new investments in IT are expected to bring about significant reductions in the costs of processing various banking transactions and will lower overall operating costs.

Another important finding is related to the efficiency levels of very small banks, particularly co-operative and mutual banks. It appears that these bank types still benefit largely from the advantages of being small or very small and of operating in niche markets where they usually enjoy local monopolies. Various elements have often been put forward to explain their specialness, like: their localisation, their reputation, as well as the special relationship (usually long-term) that these banks often (and typically) establish with retail and small business customers. Other theories demonstrate that the corporate governance of these banks has a fundamental role in explaining their better performance as opposed to banks with national branch networks. All of these factors help to explain why the co-operatives tend to be more profitable and better capitalised than other bank types.

The empirical analysis carried out in this thesis also investigates the influence different cost function specifications have on the efficiency results. In particular, we introduce two additional variables to the standard cost function: the ratio of non-performing loans to total loans and the level of equity capital. This is done because, as pointed out for example by Mester (1996, p. 1026): "Unless quality and risk are controlled for, one might easily miscalculate a bank's level of inefficiency; e.g. banks scrimping on credit evaluations or producing excessively risky loans might be labelled as efficient when compared to banks spending resources to ensure their loans are of higher quality". In addition, the results on X-efficiencies and economies of scale derived from the model including risk and quality factors are then compared with those derived from the standard cost function.

In line with recent findings by Berger and Mester (1997) and Altunbas *et al.* (1999), the X-efficiency estimates appear similar across the two different cost function specifications. In contrast, the level and significance of scale economy estimates seem to be affected by the inclusion of risk and output quality factors in the cost function.

The findings from the profitability test [Spong *et al.* (1995)] confirm that the main differences between the most efficient and least efficient banks operating in Italy relate to the efforts of bank management to control their staff expenses. With regard to the balance sheet structure, the most efficient banks appear to hold more securities and have higher levels of equity than their inefficient counterparts, thus providing a potentially higher level of protection to their customers. The most efficient banks also have a much better asset quality, thereby implying that they are assigning more attention and resources to loan origination, monitoring and other credit judgement activities.

Finally, we find that the level of NPLs, the number of branches and an over-emphasis on retail banking activities seem to be major factors explaining overall inefficiency in the Italian banking market. On the other hand, and confirming Mester's (1993 and 1996) results for US banks, Italian banks' inefficiencies appear to be correlated inversely with financial capital and usually with bank performance variables (although in this case this latter is insignificantly different from zero). Moreover, the significance and negative sign on the dummy variable for private banks suggest that at least large privately quoted banks tend to have lower levels of inefficiency. From the results it is also possible to infer that quoted banks seem to be, on average, more efficient than their non-quoted counterparts.

Overall, during the period 1993-96 the general trend seems quite positive for Italian banks, because not only has there been a reduction in their average level of X-inefficiency, but also there is evidence of high potential savings in average costs for the banking system. This means that the structural evolution of the banking sector in Italy has gradually set forth the necessary conditions for a competitive environment so as to facilitate domestic banks competing effectively at an international level. Nonetheless, several problems remain. These include a high rigidity of the labour factor, a too slow privatisation process, a and the persistence of poor profitability and efficiency especially for banks located in specific geographical areas of the country. Such problems seem to hinder the process of modernisation and restructuring of the system and need to be solved rapidly if domestic banks want to survive the challenges of a future of profit-maximising banks operating in highly technological and globalised markets.

7.4 Limitations of the Study

Although this study employs the most up-to-date methodology in the field of parametric frontier efficiency analysis, different techniques such as Distribution Free Approach [Allen and Rai (1996); Berger and Mester (1997); Berger *et al.* (1997)] and Thick Frontier Approach [Berger and Humphrey (1991 and 1992a); Bauer *et al.* (1993); Berger (1993)] could be included in the study. A comparison of the results would provide a stronger support to our findings while suggesting some insights on the advantages and drawbacks of the different models. Likewise, and in line with several international and Italian studies [see Eisenbeis *et al.* (1996); Resti (1997a) and Casu and Girardone (1998)], it could be of interest to employ the non-parametric Data Envelopment Analysis (DEA) to the same data set of Italian banks. Such a comparative analysis would help overcoming one of the typical drawbacks of the parametric models, that is the assumptions concerning the shape of the frontier for the cost function.

Furthermore, other recent international studies [see for example Berger and Mester (1997); Maudos *et al.* (1999)] point to the importance of estimating an alternative profit function along with a cost function to the same set of data. In this study, instead of estimating a profit function, we considered it more appropriate to carry out a profitability test [see Spong *et al.* (1995)], which also provides an alternative to some of the consistency conditions suggested recently by Bauer *et al.* (1997).

Various efficiency studies also include measures of economies of scope to calculate whether there are cost synergies in the banking systems. This research does not include such calculations because of the limitations associated with scope estimates. For instance, the main problem in estimating economies of scope concerns the complexity of the estimation techniques used, insufficient data on firms that specialise, and the risk of using data that are not on the efficient frontier, thus confusing scope economies and X-efficiencies [see for example, Berger, Hunter and Timme (1993].

Another shortcoming of the present study may relate to the time period considered for the empirical analysis. The early 1990s was characterised by substantial environmental transformations that were expected to have a relatively immediate effect on the Italian banking system. It might be interesting to carry out the same research over the second half of the 1990s to verify whether the increase in productive efficiency over the period 1993-96 has endured over the following years.

In addition, bank efficiency studies are also subject to limitations related to the number of observations included in the data sample. Although our sample does not cover the whole universe of the Italian banking system, the percentage coverage is reasonably high and thus fairly reliable, accounting for approximately 50% in terms of number of banks and more than 90% in terms of total assets.

While the cost efficiency model has advantages over traditional measures of efficiency, it must also be regarded as an imperfect measure. Because of data limitations, some of the variables in the model specification are only proxies or incomplete measures of bank inputs and outputs. In fact, it is not possible to include every item or dimension of a bank's output in the model, and banks that are producing a wide range of outputs or providing specialised services could, therefore, be judged less efficient than they really are. In fact, while the multi-product nature of the banking firm is widely recognised, there is still no agreement as to the explicit definition and measurement of banking inputs and outputs. Usually, each definition carries with it a particular set of banking concepts, relating to the production characteristics of the industry and in bank efficiency studies, the way output is defined and measured may influence considerably the results obtained [Berger and Humphrey (1997)]. Following leading researchers like Mester (1996) and Berger and Mester (1997), the approach to output definition used in this study is the intermediation approach that posits that total loans and total securities are outputs, whereas deposits are inputs to the production process of banking firms. Berger *et al.* (1997) maintain that under most circumstances, the intermediation approach is to be preferred for bank analyses because it is more inclusive and it captures the essence of a bank as a financial intermediary. However, other approaches to input and output definition, such as the well-known production approach, could have been used for comparison purposes.

Bibliography

Aigner D.J. and S.F. Chu (1968), "On Estimating the Industry Production Function", *American Economic Review*, Vol. 58, No. 4, pp. 826-839, September.

Aigner D.J., Lovell C.A.K. and P. Schmidt (1977), "Formulation and Estimation of Stochastic Frontier Production Function Models", *Journal of Econometrics*, No. 6, pp. 21-37.

Albareto G. and M. Trapanese (1998), "La politica bancaria negli anni cinquanta", in Cotula F. (Ed.), *Stabilità e sviluppo negli anni '50*, Bari, Laterza.

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

Allen L. and A. Rai (1996), "Operational Efficiency in Banking: An International Comparison", *Journal of Banking and Finance*, Vol. 20, No. 4, pp. 655-672.

Altunbas Y., Evans L. and P. Molyneux (1999), "Bank Ownership and Efficiency", *Journal of Money, Credit and Banking*, forthcoming.

Altunbas Y., Liu M.H., Molyneux P. and R. Seth (1999), "Efficiency and Risk in Japanese Banking", *Journal of Banking and Finance*, forthcoming.

Altunbas Y., Maude D. and P. Molyneux (1995), "Efficiency and Mergers in the UK (Retail) Banking Market", Institute of European Finance, Bangor, upublished.

Altunbas Y. and P. Molyneux (1993), "Scale and Scope Economies in European Banking", *Research Papers in Banking and Finance*, Institute of European Finance, Bangor, No. 11.

Altunbas Y., Molyneux P. and R. Di Salvo (1994), "Inefficiency in the Italian Credit Co-operative Banking Sector. A Stochastic Frontier Analysis", Institute of European Finance, Bangor, unpublished.

Aly H.Y., Grabowski R., Pasurka C. and N. Rangan (1990), "Technical, Scale and Allocative Efficiencies in Banking: An Empirical Investigation", *The Review of Economics and Statistics*, No. 72, pp. 211-218, May.

Arrow K.J. (1965), *Essays in the Theory of Risk-Bearing*, Amsterdam, North-Holland.

Arrow K.J., Chenery H.B., Minhas B. and R.M. Solow (1961), "Capital-Labour Substitution and Economic Efficiency", *The Review of Economics and Statistics*, No. 43, pp. 225-250.

Arthur Andersen (1993), *European Banking and Capital Markets: A Strategic Forecast*, Research Report, London, The Economist Intelligence Unit.

Associazione Nazionale Banche Private (1997), *Struttura e dimensione dei gruppi bancari*, Servizio Documentazione, updated 10/06/1997.

Baldini D. and A. Landi (1990), "Economie di scala e complementarietà di costo nell'industria bancaria italiana", *L'industria*, No. 1, pp. 25-45.

Baltagi B.H. (1995), *Econometric Analysis of Panel Data*, Chichester, John Wiley & Sons.

Baltagi B.H. and J.M. Griffin (1988), "A General Index of Technical Change", *Journal of Political Economy*, Vol. 96, No. 1, pp. 20-41.

Bank of Italy, *Annual Report*, several issues.

Bank of Italy (1994), "Testo Unico delle leggi in materia bancaria e creditizia/The 1993 Banking Law", *Quaderni di ricerca giuridica della consulenza legale*, No. 33, April.

Bank of Italy (1998), *Summary Reports on Economic Developments in the Italian Regions in 1997*, Rome.

Barnes P. and C. Dodds (1983), "The Structure and Performance of the UK Building Society Industry 1970-1978", *Journal of Business, Finance and Accounting*, Vol. 10, No. 1, pp. 37-56.

Battese G.E. and T.J. Coelli (1988), "Prediction of Firm-Level Efficiencies with a Generalised Frontier Production Function and Panel Data", *Journal of Econometrics*, No. 38, pp. 387-399.

Battese G.E. and T.J. Coelli (1992), "Frontier Production Functions, Technical Efficiency and Panel Data: With Application to Paddy Farmers in India", *Journal of Productivity Analysis*, No. 3, pp. 153-169.

Battese G.E. and T.J. Coelli (1993), "A Stochastic Frontier Production Function Incorporating a Model for Technical Inefficiency Effects", *Working Paper in Econometrics and Applied Statistics*, Department of Econometrics, University of New England, Armidale, No. 69.

Battese G.E. and T.J. Coelli (1995), "A Model for Technical Inefficiency Effects in a Stochastic Frontier Production Function for Panel Data", *Empirical Economics*, No. 20, pp. 325-332.

Battese G.E. and G.S. Corra (1977), "Estimation of a Production Frontier Model: With Application to the Pastoral Zone of Eastern Australia", *Australian Journal of Agricultural Economics*, No. 21, pp. 169-179.

Bauer P.W. (1990), "Recent Developments in the Econometric Estimation of Frontiers", *Journal of Econometrics*, No. 46, pp. 39-56, October/November.

Bauer P.W., Berger A.N., Ferrier G.D. and D.B. Humphrey (1997), "Consistency Conditions for Regulatory Analysis of Financial Institutions: A Comparison of Frontier Efficiency Methods", *Finance and Economics Discussion Series*, Federal Reserve Board, No. 50.

Bauer P.W., Berger A.N. and D.B. Humphrey (1993), "Efficiency and Productivity Growth in US Banking", pp. 386-413, in Fried H.O., Lovell C.A.L. and S.S. Schmidt (Eds.), *The Measurement of Productive Efficiency: Techniques and Applications*, Oxford, Oxford University Press.

Baumol W.J., Panzar J.C. and R.D. Willig (1982), *Contestable Markets and the Theory of Industry Structure*, San Diego, Harcourt Brace Jovanovich.

Baumol W.J., Panzar J.C. and R.D. Willig (1988), *Contestable Markets and the Theory of Industry Structure*, Revised Edition, San Diego, Harcourt Brace Jovanovich.

Bell F.W. and N.B. Murphy (1967), "Bank Service Charges and Costs", *National Banking Review*, No. 4, pp. 449-457, June.

Bell F.W. and N.B. Murphy (1968), "Economies of Scale and Division of Labour in Commercial Banking", *Southern Economic Journal*, No. 35, pp. 131-139, October.

Benston G.J. (1965a), "Economies of Scale and Marginal Costs in Banking Operations", *National Banking Review*, Vol. 2, No. 4, pp. 507-549, June.

Benston G.J. (1965b), "Branch Banking and Economies of Scale", *Journal of Finance*, No. 20, pp. 312-331, May.

Benston G.J., Berger A.N., Hanweck G.A. and D.B. Humphrey (1983), "Economies of Scale and Scope", *Proceedings of a Conference on Bank Structure and Competition*, Federal Reserve Bank of Chicago, May.

Benston G.J., Hanweck G.A. and D.B. Humphrey (1982), "Scale Economies in Banking: A Restructuring and Reassessment", *Journal of Money, Credit and Banking*, Vol. 14, No. 4, Part 1, pp. 435-456, November.

Berg S.A., Førsund F.R., Hjalmarsson L. and M. Suominen (1993), "Banking Efficiency in the Nordic Countries", *Journal of Banking and Finance*, Vol. 17, pp. 371-388, April.

Bergendahl G. (1995), "DEA and Benchmarks for Nordic Banks", *Working Papers*, Gothenburg University, Gothenburg, December.

Berger A.N. (1993), "Distribution-Free Estimates of Efficiency in the US Banking, Industry and Tests of the Standard Distributional Assumptions", *Journal of Productivity Analysis*, No. 4, pp. 261-292, September.

Berger A.N. (1995), "The Profit-Concentration Relationship in Banking – Tests of Market Power and Efficient-Structure Hypothesis", *Journal of Money, Credit and Banking*, Vol. 27, No. 2, pp. 404-431, May.

Berger A.N., Demsetz R.S. and P.E. Strahan (1998), "The Consolidation of the Financial Services Industry: Causes, Consequences, and Implications for the Future", *Staff Report*, Reserve Bank of New York, No. 55, December.

Berger A.N. and R. De Young (1997), "Problem Loans and Cost Efficiency in Commercial Banks", *Journal of Banking and Finance*, No. 21, pp. 849-870.

Berger A.N., Hancock D. and D.B. Humphrey (1993), "Bank Efficiency Derived from the Profit Function", *Journal of Banking and Finance*, Vol. 17, pp. 317-347.

Berger A.N., Hanweck G.A. and D.B. Humphrey (1987), "Competitive Viability in Banking: Scale, Scope and Product Mix Economies", *Journal of Monetary Economics*, Vol. 20, No. 3, pp. 501-520, January.

Berger A.N., Hunter W.C. and S.G. Timme (1993), "The Efficiency of Financial Institutions. A Review and Preview of Research Past, Present and Future", *Journal of Banking and Finance*, Vol. 17, pp. 221-249, April.

Berger A.N. and D.B. Humphrey (1990), "Measurement and Efficiency Issues in Commercial Banking", *Finance and Economics Discussion Series Paper*, Federal Reserve Board, No. 151, December.

Berger A.N. and D.B. Humphrey (1991), "The Dominance of Inefficiencies Over Scale and Product Mix Economies in Banking", *Journal of Monetary Economics*, Vol. 28, No. 1, pp. 117-148, August.

Berger A.N. and D.B. Humphrey (1992a), "Measurement and Efficiency Issues in Commercial Banking", pp. 245-279, in Griliches Z. (Ed.), *Output Measurement in the Service Sectors*, National Bureau of Economic Research, Chicago, University of Chicago Press.

Berger A.N. and D.B. Humphrey (1992b), "Megamergers in Banking and The Use of Cost Efficiency as an Antitrust Defense", *Antitrust Bulletin*, No. 37, Fall, pp. 541-600.

Berger A.N. and D.B. Humphrey (1997), "Efficiency of Financial Institutions: International Survey and Directions for Future Research", *Finance and Economics Discussion Series*, Federal Reserve Board, No. 11.

Berger A.N. and L.J. Mester (1997), "Inside the Black Box: What Explains Differences in the Efficiencies of Financial Institutions?", *Finance and Economics Discussion Series*, Federal Reserve Board, No. 10.

Berger A.N., Leusner J.H. and J. Mingo (1997), "The Efficiency of Bank Branches", *Journal of Monetary Economics*, Vol. 40, No. 1, pp. 141-162.

Berle A. and G. Means (1932), *The Modern Corporation and Private Property*, New York, MacMillan.

BIS (Bank for International Settlements) (1988), *International Convergence of Capital Measurement and Capital Standards*, Committee on Bank Regulation and Supervisory Practices, Basle.

BIS (Bank for International Settlements), *Statistics on Payment Systems in the Group of Ten Countries*, Basle, several issues.

Bisoni C. and R. Ferretti (1993), "The Amato Act and the Recapitalisation of Italian Banks", *Research Papers in Banking and Finance*, Institute of European Finance, Bangor, No. 3.

Bongini P., Morelli P. and G.B. Pittaluga (1997), "Il controllo dei costi e degli organici nelle banche italiane: il contesto attuale e le prospettive", in Resti A. (Ed.) and Sintel Consulting, *La sfida della redditività bancaria: opportunità e minacce verso il 2000*, Bologna, Il Mulino.

Brown R.S., Caves D.W. and L.R. Christensen (1979), "Modelling the Structure of Cost and Production for Multi-Product Firms", *Southern Economic Journal*, Vol. 46, No. 1, pp. 256-273, July.

Brown Z.M. and E.P.M. Gardener (1995), "Bankassurance and European Banking Strategies: An Exploratory Analysis Using DEA of the Concept and Treatment of Relative Efficiency", *Research Papers in Banking and Finance*, Institute of European Finance, Bangor, No. 20.

Bruni F. (1993), "Financial Re-Regulation: The Italian Case", pp. 241-267, in Dermine J. (Ed.), *European Banking in the 1990s*, 2nd ed., Oxford, Basil Blackwell.

Canals J. (1993), *Competitive Strategies in European Banking*, Oxford, Clarendon Press.

Cannari L. and F. Signorini (1997), "Rischiosità e razionamento: un'analisi dell'efficienza allocativa delle banche di credito cooperativo e dei divari nord-sud", in Cesarini F., Ferri G. and M. Giardino (Eds.), *Credito e sviluppo*, Bologna, Il Mulino.

Cardani A.M., Castagna M. and M. Galeotti (1991), "La misurazione dell'efficienza economica: un'applicazione al sistema bancario italiano", *Ricerche Economiche*, No. 1, pp. 57-77.

Casu B. (1998), "Un'analisi sull'efficienza del sistema bancario italiano nel periodo 1992-1996", *Vita e Pensiero*, Problemi di Gestione dell'Impresa, Raccolta di studi e ricerche, Università Cattolica del Sacro Cuore, Milan, No. 24.

Casu B. and C. Girardone (1998), "An Analysis of the Efficiency of Italian Banking Conglomerates", *Research Papers in Banking and Finance*, Institute of European Finance, Bangor, No. 3.

Caves D.W., Christensen L.R. and W.M. Tretheway (1979), "Flexible Cost Functions for Multi-Product Firms", *The Review of Economics and Statistics*, pp. 477-481, September.

Cebenoyan A.S., Cooperman E.S., Register C.A. and S.C. Huddgins (1993), "The Relative Efficiency of Stock versus Mutual S&Ls: A Stochastic Cost Frontier Approach", *Journal of Financial Services Reserve*, No. 7, pp. 151-170.

Cecchini P. (1988), *The European Challenge. 1992. The Benefits of a Single Market*, Wilwood House, England.

Centro Europa Ricerche (1998), *Rapporto Banche*, Supplemento, Rome, July.

Charnes A., Cooper W.W. and E. Rhodes (1978), "Measuring the Efficiency of Decision-Making Units", *European Journal of Operational Research*, No. 2, pp. 429-444.

Christensen L.R., Jorgenson D.W. and L.J. Lau (1971), "Conjugate Duality and Trascendental Logarithmic Production Functions" (abstract), *Econometrica*, Vol. 3, No. 4, pp. 255-256, July.

Christensen L.R., Jorgenson D.W. and L.J. Lau (1973), "Transcendental Logarithmic Production Frontiers", *The Review of Economics and Statistics*, Vol. 55, No. 1, pp. 28-45, February.

Christensen L.R., Jorgenson D.W. and L.J. Lau (1975), "Trascendental Logarithmic Utility Functions", *American Economic Review*, Vol. 65, No. 3, pp. 367-383.

Ciocca P., Giussani C.A. and G. Lanciotti (1974), "Sportelli, dimensioni e costi: uno studio sulla struttura del sistema bancario italiano", *Quaderni di Ricerche*, Ente Einaudi, No. 15.

Clark J.A. (1984), "Estimation of Economies of Scale in Banking Using a Generalised Functional Form", *Journal of Money, Credit and Banking*, Vol. 16, No. 1, pp. 53-68, February.

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, No. 73, pp. 16-33, September/October.

Clark J.A. (1996), "Economic Cost, Scale Efficiency and Competitive Viability in Banking", *Journal of Money, Credit and Banking*, Vol. 28, No. 3, pp. 342-364.

Coase R. (1937), "The Nature of the Firm", *Economica*, No. 4, pp. 368-405.

Coelli T.J. (1996), "A Guide to FRONTIER Version 4.1: A Computer Program for Stochastic Frontier Production and Cost Function Estimation", *Working Paper*, Centre for Efficiency and Productivity Analysis, No. 7.

Coelli T.J., Prasada Rao D.S. and G. Battese (1998), *An Introduction to Efficiency and Productivity Analysis*, Norwell, Kluwer Academic Publishers.

Conigliani C., De Bonis R., Motta G. and G. Parigi (1991), "Economie di scala e di diversificazione nel sistema bancario italiano", *Temi di Discussione*, Banca d'Italia, No. 150, February.

Cooper J.C.B. (1980), "Economies of Scale in the UK Building Society Industry", *Investment Analysis*, Vol. 55, pp. 31-36.

Cornwell C., Schmidt P. and R.C. Sickles (1990), "Production Frontiers with Cross-Sectional and Time-Series Variation in Efficiency Levels", *Journal of Econometrics*, No. 46, pp. 185-200.

Cossutta D., Di Battista M.L., Giannini C. and G. Urga (1988), "Processo produttivo e struttura dei costi nell'industria bancaria italiana", in Cesarini F., Grillo M., Monti M. and M. Onado (Eds.), *Banca e Mercato*, Bologna, Il Mulino.

Costi R. (1994), *L'ordinamento bancario*, Bologna, Il Mulino.

Daniel D.L., Longbrake W.A. and N.B. Murphy (1973), "The Effect of Technology on Bank Economies of Scale for Demand Deposits", *Journal of Finance*, No. 28, March.

De Bandt G. (1998), "EMU and the Structure of the European Banking System", paper presented at the SUERF Conference *The Euro: Challenge and Opportunity for Financial Markets*, 15-17 November, Frankfurt.

De Young R. and I. Hasan (1998), "The Performance of De Novo Commercial Banks: A Profit Efficiency Approach", *Journal of Banking and Finance*, Vol. 22, No. 5, pp. 565-587, May.

Di Battista M., Morelli P.L., Pittaluga G.B. e A. Resti (1996), "La sfida tecnologica per l'industria bancaria e i riflessi occupazionali", in CER-IRS, *Più tecnologia, più concorrenza*, Bologna, Il Mulino.

DeBorger B., Ferrier G. and K. Kerstens (1995), "The Choice of a Technical Efficiency Measure on the Free Disposal Hull Reference Technology: A Comparison Using US Banking Data", *Working Paper*, University of Arkansas.

Delors Report (1989), *Report on European and Monetary Union in the EC, Committee for the Study of European and Monetary Union*, Brussels, 12 April.

Dèprins D., Simar L. and H. Tulkens (1984), "Measuring Labour-Efficiency in Post Offices", in Marchand M., Pestieau P. and H. Tulkens (Eds.), *The Performance of Public Enterprises: Concepts and Measurements*, Amsterdam, North-Holland.

Dietsch M. (1990), "Returns to Scale and Returns to Scope in the French Banking Industry", paper presented at the Third Franco-American Seminar, *National Bureau for Economic Research*, July.

Dietsch M. (1993), "Economies of Scale and Scope in French Commercial Banking Industry", *Journal of Productivity Analysis*, No. 1.

Dietsch M. and L. Weill (1998), "Banking Efficiency and European Integration: Productivity, Cost and Profit Approaches", paper presented at the SUERF Conference *The Euro: Challenge and Opportunity for Financial Markets*, 15-17 November, Frankfurt.

Diewert W.E. (1971), "An Application of the Shephard Duality Theorem: A Generalised Leontief Production Function", *Journal of Political Economy*, No. 79, pp. 481-507.

Dixon R. (1993), *Banking in Europe*, London, Routledge.

Drake L. (1992), "Economies of Scale and Scope in UK Building Societies: An Application of the Translog Multi-Product Cost Function", *Applied Financial Economics*, Vol. 2, pp. 211-219.

Drake L. (1995), "Testing for Expense Preference Behaviour in UK Building Societies", *The Service Industry Journal*, Vol. 1, No. 15, pp. 50-65.

Eisenbeis R.A., Ferrier G.D. and S.H. Kwan (1996), "An Empirical Analysis of the Informativeness of Programming and SFA Efficiency Scores: Efficiency and Bank Performance", *Working Paper*, University of North Carolina, Chapel Hill NC, April.

Elyasiani E. and S. Mehdian (1990), "A Non-Parametric Approach To Measurement of Efficiency And Technological Change: The Case of Large US Commercial Banks", *Journal of Financial Services Research*, Vol. 4, No. 2, pp. 157-168.

English M., Grosskopf S., Hayes K. and S. Yaisawarng (1993), "Output Allocative and Technical Efficiency of Banks", *Journal of Banking and Finance*, No. 17, pp. 349-366.

European Central Bank (ECB) (1999a), "Possible effects of EMU on the EU banking systems in the medium to long term", *European Central Bank*, Frankfurt, February.

European Central Bank (ECB) (1999b), "The Effect of Technology on the EU Banking Systems", *European Central Bank*, Frankfurt, July.

European Commission (1985), "Completing the Internal Market: White Paper From the Commission to the Council", COM (85) 310 final, Office for Official Publications of the EC, Luxembourg.

European Commission (1995), Green Paper on the practical arrangements for the introduction of the single currency, COM (95) 333, May, Office for Official Publications of the EC, Luxembourg.

European Commission (1997), *Credit Institutions and Banking*, Vol. 3, Subseries II, Impact on Services, The Single Market Review, London, Kogan Page.

Evanoff D.D. and P.R. Israilevich (1991), "Productive Efficiency in Banking", *Economic Perspectives*, Federal Reserve Bank of Chicago, pp. 11-32, July.

Evanoff D.D. and P.R. Israilevich (1995), "Scale Elasticity versus Scale Efficiency in Banking", *Southern Economic Journal*, Vol. 61, No. 4, pp. 1036-1046, April.

Evanoff D.D., Israilevich P.R. and R.C. Merris (1990), "Relative Price Efficiency, Technical Change and Scale Economies for Large Commercial Banks", *Journal of Regulatory Economics*, pp. 281-298.

Fanjul O. and F. Maravall (1985), "La eficiencia del sistema bancario español", *Alianza University*, Madrid.

Farrell M.J. (1957), "The Measurement of Productive Efficiency", *Journal of the Royal Statistical Society*, Series A, Vol. 1203, pp. 253-281.

Favero C.A. and L. Papi (1995), "Technical and Scale Efficiency in the Italian Banking Sector: A Non-Parametric Approach", *Applied Economics*, No. 27, pp. 385-395.

Fazio A. (1999), "Indagine conoscitiva sui più recenti sviluppi del processo di ristrutturazione del sistema bancario italiano", *Senato della Repubblica*, VI Commissione Permanente, Rome, April.

Ferri G. and F. Mattesini (1997), "Finance, Human Capital and Infrastructure: An Empirical Investigation of Post-War Italian Growth", *Temi di Discussione*, Banca d'Italia, No. 321, November.

Ferri G. and M. Messori (1998), "Relazioni banca-impresa ed efficienza allocativa nel nord-est-centro e nel mezzogiorno", in Masciandaro M. and A. Porta (Eds.), *Le sofferenze bancarie in Italia*, Collana ABI Economia e Gestione, Rome, Bancaria Editrice.

Ferrier G.D., Grosskopt S., Hayes K. and S. Yaisawarng (1993), "Economies of Diversification in the Banking Industry: A Frontier Approach", *Journal of Monetary Economics*, Vol. 31, No. 2, pp. 229-249.

Ferrier G.D., Kerstens K. and P. Venden Eeckaut (1994), "Radial and Non-radial Technical Efficiency Measures on a DEA Reference Technology: A Comparison Using Banking Data", *Researches Economiques de Louvain*, No. 60, pp. 449-479.

Ferrier G.D. and C.A.K. Lovell (1990), "Measuring Cost Efficiency in Banking: Econometric and Linear Programming Evidence", *Journal of Econometrics*, No. 46, pp. 229-245.

Fetcher F. and P. Pestieau (1993), "Efficiency and Competition in OECD. Financial Services", in Fried H.O., Lovell C.A.K. and S.S. Schmidt (Eds.), *The Measurement of Productive Efficiency: Techniques and Applications*, Oxford University Press, UK.

Focarelli D., Panetta F. and C. Saleo (1999), *Why Do Banks Merge: Some Empirical Evidence from Italy*, Banca d'Italia, mimeo.

Forestieri G. (1993), "Economies of Scale and Scope in the Financial Services Industry: A Review of Recent Literature", pp. 63-124, in OECD, *Financial Conglomerates*, Paris.

Førsund F.R., Lovell C.A.K. and P. Schmidt (1980), "A Survey of Frontier Production Functions and of their Relationship to Efficiency Measurement", *Journal of Econometrics*, No. 13, pp. 5-25.

Freixas X. and J.C. Rochet (1997), *The Microeconomics of Banking*, London, The MIT Press.

Gallant A.R. (1981), "On the Bias in Flexible Functional Forms and an Essentially Unbiased Form: The Fourier Flexible Form", *Journal of Econometrics*, No. 15, pp. 211-245.

Gallant A.R. (1982), "Unbiased Determination of Production Technologies", *Journal of Econometrics*, No. 20, pp. 285-324.

Gallant A.R. (1984), "The Fourier Flexible Form", *American Journal of Agricultural Economics*, Vol.66, No.2, pp.204-208, May.

Gardener E.P.M. (1991), "Capital Adequacy in the New Europe", *Research Papers in Banking and Finance*, Institute of European Finance, Bangor, No. 13.

Gardener E.P.M. (1992), "Capital Adequacy After 1992: The Banking Challenge", *Research Papers in Banking and Finance*, Institute of European Finance, Bangor, No. 11.

Gardener E.P.M. (1994), "Bank Marketing, Organisation and Performance", pp. 59-78, in Revell J. (Ed.), *The Changing Face of European Banks and Securities Market*, Basinstoke, Macmillan.

Gardener E.P.M. (1995), "Banking Efficiency: Principles and Practice", *Paper read at IRCEL Conference* "Deregulation and Scale Economies in Banking: the Case of Credit Co-operative Banks in Italy", Rome, 23-24 February.

Gardener E.P.M. (1997), "The Challenge of Deregulation for European Banks", *Research Papers in Banking and Finance*, Institute of European Finance, Bangor, No. 3.

Gardener E.P.M. and P. Molyneux (1990), *Changes in Western European Banking: An International Banker's Guide*, London, Unwin Hyman.

Gathon H. and F. Grosjean (1991), "Efficacité productive et rendement d'échelle dans les banques belges", *Cahiers Economiques de Bruxelles*, No. 3, pp. 145 -160.

Generale A. and G. Gobbi (1999), "Corporate Governance and Bank Profitability: Empirical Evidence from the Italian Experience", pp. 34-54, in Bank for International Settlement (BIS), *The Monetary and Regulatory Implications of Changes in the Banking Industry*, Monetary and Economic Department, Basle, Vol. 7, March.

Gilbert R.A. (1984), "Bank Market Structure and Competition: A Survey", *Journal of Money, Credit and Banking*, Vol. 16, No. 4, pp. 617-644, November.

Gilbert P.L. and A. Steinherr (1989), "The Impact of Financial Market Integration on the European Banking Industry", *Cahiers BEI*, European Investment Bank Papers, March.

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, pp. 67-77, March.

Gilligan T.W., Smirlock M.L. and W. Marshall (1984), "Scale and Scope Economies in the Multi-Product Banking Firm", *Journal of Monetary Economics*, Vol. 13, pp. 393-405.

Giokas D. (1991), "Bank Branch Operating Efficiency: A Comparative Application of DEA and the Loglinear Model, Omega International", *Journal of Management Science*, Vol. 19, No. 6, pp. 549-557.

Glass J. C. and D.C. McKillop (1992), "An Empirical Analysis of Scale and Scope Economies and Technical Change in an Irish Multi-Product Banking Firm", *Journal of Banking and Finance*, No. 16, pp. 423-437.

Goisis G. (1994), "Le economie di scala e di scopo nel settore bancario: alcune verifiche relative al caso italiano", *Economia e diritto del terziario*, No. 3.

Goodhart C., Hartmann P., Llewellyn D., Rojas-Suárez L. and S. Weisbrod (1998), *Financial Regulation*, London, Routledge.

Gough T.J. (1979), "Building Society Mergers and the Size-Efficiency Relationship", *Applied Economics*, Vol. 11, pp. 185-194.

Gramley L.E. (1962), "A Study of Scale Economies in Banking", *Monograph*, Research Department Federal Reserve Bank of Kansas City, November.

Greenbaum S.J. (1967), "Banking Structure and Costs: A Statistical Study of the Cost-Output Relationship in Commercial Banking", *National Banking Review*, pp. 415-434, June.

Greene W.H. (1993a), *Econometric Analysis*, 2nd ed., London, Prentice Hall Int.

Greene W.H. (1993b), "The Econometric Approach to Efficiency Analysis", pp. 68-119, in Fried H.O., Lovell C.A.K. and S.S. Schmidt (Eds.), *The Measurement of Productive Efficiency: Techniques and Applications*, Oxford, Oxford University Press.

Gropper D.M. (1991), "An Empirical Investigation of Changes in Scale Economies for the Commercial Banking Firms 1976-1986, *Journal of Money, Credit and Banking*, Vol. 23, No. 4, pp. 718-727, November.

Gual J. and D. Neven (1993), "Deregulation of the European Banking Industry", *European Economy/Social Europe*, Reprints Series No. 94/2, No. 3, pp. 153-183.

Hancock D. (1985), "The Financial Firm Production with Monetary and Non-Monetary Goods", *Journal of Political Economy*, Vol. 93, No. 5, pp. 859-879, October.

Hancock D. (1991), *A Theory of Production for the Financial Firm*, Boston, Kluwer Academic Publishers.

Hardwick P. (1989), "Economies of Scale in Building Societies", *Applied Economics*, Vol. 21, No. 10, pp. 1291-1304.

Hardwick P. (1990), "Multi-Product Cost Attributes: A Study of UK Building Societies", *Oxford Economic Papers*, Vol. 42, No. 2, pp. 446-461.

Heffernan S. (1996), *Modern Banking in Theory and Practice*, London, John Wiley and Sons.

Herring R.J. and A.M. Santomero (1990), "The Corporate Structure of Financial Conglomerates", *Journal of Financial Services Research*, pp. 471-497.

Hjalmarsson L. and F.R. Førsund (1990), "Deterministic Parametric and Non-Parametric Estimation of Efficiency in Service Production. A Comparison", *Journal of Econometrics*, No. 46, pp. 213-227.

Hoenig T.M. (1996), "Rethinking Financial Regulation", *Economic Review*, Federal Reserve Bank of Kansas City, April-June.

Horvitz P.M. (1963), "Economies of Scale in Banking", pp. 1-54, in *Private Financial Institutions*, NJ, Englewood Cliffs, Prentice-Hall.

Howells and Bain (1998), *Money, Banking and Finance. A European Text*, Singapore, Longman Limited.

Hughes J.P. and L. Mester (1991), "A Quality and Risk-Adjusted Cost Function for Banks: Evidence on the 'Too-Big-To-Fail' Doctrine", *Working Paper*, Federal Reserve Bank of Philadelphia, No. 21.

Hughes J.P. and L. Mester (1993), "Accounting for the Demand for Financial Capital and Risk-Taking in Bank Cost Functions", *Working Paper*, Federal Reserve Bank of Philadelphia, No. 17, June.

Humphrey D.B. (1985), "Costs and Scale Economies in Bank Intermediation", in Aspinwall R. and R. Eisenbeis (Eds.), *Handbook for Banking Strategy*, New York, John Wiley and Sons.

Humphrey D.B. (1987), "Cost Dispersion and the Measurement of Economies in Banking", *Economic Review*, Federal Reserve Bank of Richmond, No. 73, pp. 24-37, May/June.

Humphrey D.B. (1990), "Why Do Estimates of Bank Scale Economies Differ?", *Economic Review*, Federal Reserve Bank of Richmond, No. 76, pp. 38-50, September/October.

Humphrey D.B. (1991), "Productivity in Banking and Effects from Deregulation", *Economic Review*, Federal Reserve Bank of Richmond, pp. 16-26, March/April.

Hunter W.C. and S.G. Timme (1986), "Technical Change, Organisational Form and the Structure of Bank Production", *Journal of Money, Credit and Banking*, Vol. 18, No. 2, pp. 152-166, May.

Hunter W.C. and S.G. Timme (1995), "Core Deposits and Physical Capital: A Re-Examination of Bank Scale Economies and Efficiency with Quasi-Fixed Inputs", *Journal of Money, Credit and Banking*, Vol. 27, No. 1, pp. 165-185, February.

Hunter W.C., Timme S.G. and W.K. Yang (1990), "An Examination of Cost Subadditivity and Multi-Product Production in Large US Banks", *Journal of Money, Credit and Banking*, Vol. 22, No. 4, pp. 504-525, November.

IEF (Institute of European Finance) (1998), *Challenges and the Future of Savings Banks in the Single Financial Market of the EU*, Management Report, University of Wales, Bangor.

Inzerillo U., Morelli P. and G.B. Pittaluga (1999), "Deregulation and Changes in European Banking Industry", in CEPS – CSC, *Regulatory Reform for the Better Functioning of Markets*, forthcoming.

Jagtiani J. and A. Khanthavit (1996), "Scale and Scope Economies at Large Banks: Including Off-Balance Sheet Products and Regulatory Effects (1984-1991)", *Journal of Banking and Finance*, Vol. 20, No. 7, pp. 1271-1287.

Jondrow J., Lovell C.A.K., Materov I.S. and P. Schmidt (1982), "On the Estimation of Technical Inefficiency in the Stochastic Frontier Production Function Model", *Journal of Econometrics*, No. 19, pp. 233-238, July.

Kalish L. and R.A. Gilbert (1973), "An Analysis of Efficiency of Scale and Organisational Form in Commercial Banking", *Journal of Industrial Economics*, No. 21, pp. 293-307, July.

Kaparakis E.I., Miller S.M. and A.G. Noulas (1994), "Short-Run Cost Inefficiency of Commercial Banks: A Flexible Stochastic Frontier Approach", *Journal of Money Credit and Banking*, Vol. 26, No. 4, pp. 875-893, November.

Kim H.Y. (1986), "Economies of Scale and Scope in Multi-Product Financial Institutions: Further Evidence from Credit Unions", *Journal of Money, Credit and Banking*, Vol. 18, pp. 220-226.

Kolari J. and A. Zardkoohi (1987), *Bank Costs, Structure and Performance*, Lexington, Lexington Books.

Kopp R.J. and W.E. Diewert (1982), "The Decomposition of Frontier Cost Function Deviations Into Measures of Technical and Allocative Efficiency", *Journal of Econometrics*, No. 19, pp. 319-331.

Kopp R.J. and J. Mullahy (1990), "Moment-Based Estimation and Testing of Stochastic Frontier Models", *Journal of Econometrics*, Vol. 46, No. 1, pp. 165-183.

Kumbhakar S.C. (1990), "Production Frontiers, Panel Data, and Time-Varying Technical Inefficiency", *Journal of Econometrics*, No. 46, pp. 201-211.

Kumbhakar S.C. (1991), "Estimation of Technical Inefficiency in Panel Data Models with Firm- and Time Specific Effects", *Economic Letters*, Vol. 36, No.1, pp. 43-48.

Kumbhakar S.C. (1993), "Production Risk, Technical Efficiency and Panel Data", *Economic Letters*, No. 41, pp. 11-26.

Kwan S.H. and R.A. Eisenbeis (1995), "An Analysis of Inefficiencies in Banking", *Journal of Banking and Finance*, Vol. 19, No. 3, pp. 733-734, June.

Lanciotti G. and T. Raganelli (1988), "Funzioni di costo e obiettivi di efficienza nella produzione bancaria", *Temi di discussione*, Banca d'Italia, No. 99.

Landi A. (1990), *Dimensioni, costi e profitti delle banche italiane*, Bologna, Il Mulino.

Lang G. and P. Welzel (1996), "Efficiency and Technical Progress in Banking. Empirical Results for a Panel of German Co-operative Banks", *Journal of Banking and Finance*, No. 20, pp. 1003-1023, July.

Lawrence C. (1989), "Banking Costs, Generalised Functional Forms, and Estimation of Economies of Scale and Scope", *Journal of Money, Credit and Banking*, No. 21, pp. 368-379, August.

Lawrence C. and R. Shay (1986), "Technology and Financial Intermediation in a Multi-Product Banking Firm: An Econometric Study of I.S.S. Banks, 1979-1982", in Lawrence C. and R. Shay (Eds.), *Technological Innovation, Regulation and the Monetary Economy*, Cambridge, Massachusetts, Ballinger.

Leibenstein H. (1966), "Allocative Efficiency Versus 'X-Efficiency'", *American Economic Review*, Vol. 56, No. 3, pp. 392-415, June.

Leibenstein H. (1980), *Inflation, Income Distribution and X-Efficiency Theory*, Croon Helm, London.

Lévy-Garboua L. and V. Lévy-Garboua (1975), "Les coûts opératoires des banques françaises: une étude statistique", *Revue d'Economie Politique*, No. 80.

Lévy-Garboua L. and F. Renard (1977), "Une étude statistique de la rentabilité des banques en France en 1974", *Cahiers Economiques et Monétaires*, No. 5.

Litan R.E. (1987), *What Should Banks Do?*, Washington, Brookings Institution.

Llewellyn D.T. (1986), *The Regulation and Supervision of Financial Institutions*, London, The Institute of Bankers.

Lovell C.A.K. (1993), "Production Frontiers and Productive Efficiency", in Fried H.O., Lovell C.A.K. and S.S. Schmidt (Eds.), *The Measurement of Productive Efficiency: Techniques and Applications*, Oxford, Oxford University Press.

Maes M. (1975), "Les économies de dimension dans le secteur bancaire belge", *Tijdsschrusft voor het Bankwezen*, No. 4.

Martin F. and M. Sassenou (1992), "Cost Structure in French Banking: A Re-examination based on a Regular CES-quadratic Form", *Caisse des Depôts de Consignation*, Paris, May.

Maudos J., Pastor J.M., Pérez F. and J. Quesada (1998), "Cost and Profit Efficiency in European Banks", paper read at the Annual Conference of the European Association of University Teachers in Banking and Finance, Université la Sorbonne, Paris, 2-6 September.

Maudos J., Pastor J.M., Pérez F. and J. Quesada (1999), "The Single European Market and Bank Efficiency: The Importance of Specialisation", paper read at the

Annual Conference of the European Association of University Teachers in Banking and Finance, Universidade Nova de Lisboa, Lisbon, 3-4 September.

McAllister P.H. and D. McManus (1993), "Resolving the Scale Efficiency Puzzle in Banking", *Journal of Banking and Finance*, No. 17, pp. 389-406, April.

McKillop D.G. and C.J. Glass (1994), "A Cost Model of Building Society as Producers of Mortgages and Other Financial Products", *Journal of Business, Finance and Accounting*, Vol. 21, No. 7, pp. 1031-1046, October.

Meeusen W. and J. van den Broeck (1977), "Efficiency Estimation from Cobb-Douglas Production Functions with Composed Error Term" *International Economic Review*, No. 18, pp. 435-444.

Mester L.J. (1987), "A Multiproduct Cost Study of Savings and Loans", *Journal of Finance*, Vol. 42, No. 2, pp. 423-445, June.

Mester L.J. (1992), "Traditional and Nontraditional Banking: An Information-Theoretic Approach", *Journal of Banking and Finance*, Vol. 16, No. 3, pp. 545-566.

Mester L.J. (1993), "Efficiency in the Savings and Loan Industry", *Journal of Banking and Finance*, No. 17, pp. 267-286.

Mester L.J. (1994), "How Efficient Are Third District Banks?", *Business Review*, Federal Reserve Bank of Philadelphia, pp. 3-18, January/February.

Mester L.J. (1996), "A Study of Bank Efficiency Taking into Account Risk Preferences", *Journal of Banking and Finance*, Vol. 20, No. 6, pp. 1025-1045.

Mitchell K. and N.M. Onvural (1996), "Economies of Scale and Scope at Large Commercial Banks: Evidence from the Fourier Flexible Functional Form", *Journal of Money, Credit, and Banking*, Vol. 28, No. 2, pp. 178-199, May.

Molyneux P., Altunbas Y., and E.P.M. Gardener (1996), *Efficiency in European Banking*, Chichester, John Wiley and Sons.

Morelli P.L. and G.B. Pittaluga (1998), "Le sofferenze bancarie: tendenze e previsioni", in Masciandaro D. and A. Porta (Eds.), *Le sofferenze bancarie in Italia*, Collana ABI Economia e Gestione, Rome, Bancaria Editrice.

Morgan Stanley (1995), "Italy: A Long Road Ahead", *European Banking Commentary*, April.

Morgan Stanley (1996), "Getting Up to Speed on the Italian Banking Sector", *European Banking Commentary*, May.

Muldur U. (1990), "Jalons pour une analyse microéconomique des restructurations bancaire", in Humbert M. (Ed.), *Investissements internationaux et dynamique de l'économie mondiale*, Paris.

Muldur U. (1991), "Echelle et gamme dans les marchés bancaires nationaux et globaux", Rapport Fast/Monitor, EEC Bruxelles.

Mullineaux D.J. (1975), "Economies of Scale of Financial Institutions", *Journal of Monetary Economics*, No. 1, pp. 233-240.

Mullineaux D.J. (1978), "Economies of Scale and Organisational Efficiency in Banking: A Profit Function Approach", *Journal of Finance*, Vol. 33, pp. 259-280.

Mundlak Y. (1961), "Specification and Estimation of Multiproduct Production Functions", *Journal of Farm Economics*, Vol. 43.

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*, No. 7, pp. 2097-2106, December.

Murray J.D. and R.W. White (1983), "Economies of Scale and Economies of Scope in Multi-product Financial Institutions: A Study of British Columbia Credit Unions", *Journal of Finance*, No. 28, June.

Nakamura L.I. (1991), "Commercial Bank Information: Implications for the Structure of Banking", *Working Paper*, Federal Reserve Bank of Philadelphia, No. 1, December.

Neven D.J. (1993), *Structural Adjustment in Retail Banking*, pp. 163-192, in Dermine J. (Ed.), *European Banking in the 1990s*, 2nd ed., Oxford, Basil Blackwell.

Norton J.J. (1992), "The Multidimensions of the Convergence Processes Regarding the Prudential Supervision of International Banking Activities. The Impact of the Basle Supervisors Committee's Effort Upon, Within and Without the European Community", *Research Papers in Banking and Finance*, Institute of European Finance, Bangor, No. 8.

Noulas A.G., Miller S.M. and S.C. Ray (1993), "Regularity Conditions and Scope Estimates: The Case of Large-Sized US Banks", *Journal of Financial Services Research*, Vol.7, No.3, pp. 235-248, September.

Noulas A.G., Ray S.C. and S.M. Miller (1990), "Returns to Scale and Input Substitution for Large US Banks", *Journal of Money, Credit and Banking*, Vol. 22, No. 1, pp. 94-108, February.

OECD (1997), *Banks Profitability/Rentabilité des Banques*, Organisation for Economic Co-operation and Development, Paris.

Onado M. (1996), *La banca come impresa. Manuale di gestione bancaria*, Bologna, Il Mulino.

Pacolet J. (1986), "Analyse d'économie sectorielle du marché des banques d'épargne", in Van Put A. (Ed.), *Les banques d'épargne belges*, Tielt, Lannoo.

Pallage S.J. (1991), "An Econometric Study of the Belgian Banking Sector in Terms of Scale and Scope Economies", *Cahiers Economiques de Bruxelles*, No. 130, pp. 126-143.

Parigi B.M. (1989), "Una nota sulle economie di scopo e sulle economie di scala nel sistema bancario italiano", *Note Economiche*, No. 3, pp. 576-590.

Parigi G., Sestito P. and U. Viviani (1992), "Economie di scala e diversificazione nell'industria bancaria: ruolo dell'eterogeneità tra imprese", *Temi di Discussione*, Banca d'Italia, No. 174, July.

Pastor J.M., Pérez F. and J. Quesada (1997), "Efficiency Analysis in Banking Firms: An International Comparison", *European Journal of Operational Research*, No. 98, pp. 395-407.

Pitt M.M. and L.F. Lee (1981), "The Measurement and Sources of Technical Inefficiency in the Indonesian Weaving Industry", *Journal of Development Economics*, Vol. 9, No. 1, pp. 43-64.

Pittaluga G.B. (1996), *Economia Monetaria*, Milan, Hoepli.

Pittaluga G.B. (1998), "La specificità della banca locale cooperativa e i connessi problemi di corporate governance", *Cooperazione di Credito*, Vol. 50, April/September.

Rangan N., Grabowski R., Aly H. and C. Pasurka (1988), "The Technical Efficiency of US Banks", *Economic Letters*, Vol. 28, pp. 169-175.

Resti A. (1997a), "Evaluating the Cost Efficiency of the Italian Banking Market: What Can Be Learned from the Joint Application of Parametric and Non-Parametric Techniques", *Journal of Banking and Finance*, Vol. 21, No. 2.

Resti A. (1997b), "How Should we Measure Bank Efficiency? A Comparison of Classic and Recent Techniques Based on Simulated Data", *Quaderni del Dipartimento di Matematica, Statistica, Informatica e Applicazioni*, Università degli Studi di Bergamo, No. 16.

Resti A. (1998), "Can Mergers Foster Efficiency? The Italian Case", *Journal of Economics and Business*, Vol. 50, No. 2, pp. 157-169, March/April.

Revell J. (1984), "Banking and Electronic Fund Transfers: A Study of the Implications", OECD, Paris.

Revell J. (1987), "Mergers and the Role of Large Banks", *Research Monographs in Banking and Finance*, Institute of European Finance, Bangor, No. 2.

Revell J. (1989), "The Future of Savings Banks: A Study of Spain and the Rest of Europe", *Research Monographs in Banking and Finance*, Institute of European Finance, Bangor, No. 8.

Revell J. (Ed.) (1995), "Deregulation and Bank Efficiency: The Case of the Italian Credit Co-operative Banks", *Research Monographs in Banking and Finance*, Institute of European Finance, Bangor, No. 1.

Rhoades S.A. (1998), "The Efficiency Effect of Bank Mergers: An Overview of Case Studies of Nine Mergers", *Journal of Banking and Finance*, No. 22, pp. 273-291.

Rodriguez J.R.O., Alvarez A.A. and P.P. Gomez (1993), "Scale and Scope Economies in Banking: A Study of Saving Banks in Spain", *Universidad de la Laguna*, Tenerife.

Rogers K.E. (1998), "Non-Traditional Activities and the Efficiency of US Commercial Banks", *Journal of Banking and Finance*, No. 22, pp. 467-482.

Ruozi R. (1968), "Le economie di scala nelle aziende di credito italiane", *Il Risparmio*, Vol. 16, No. 7, pp. 1124-1197, July.

Ruthenberg D. and R. Elias (1996), "Cost Economies and Interest Rate Margins in a Unified European Banking Market", *Journal of Economics and Business*, No. 48, pp. 231-249.

Rybczynsky T.M. (1988), "Financial System and Industrial Restructuring", *National Westminster Bank Quarterly Review*, No. 63, pp. 131-139.

Salomon Brothers (1996), "Investing in Italian Banks: The Return on Equity Puzzle", *European Equity Research*, Salomon Brothers Inc., September.

Santomero A.M. (1984), "Modelling the Banking Firm", *Journal of Money, Credit and Banking*, Vol. 16, No. 4, pp. 576-616, November.

Saunders A. (1994), *Financial Institutions Management. A Modern Perspective*, Richard Irwin Inc.

Schmidt P. and R.C. Sickles (1984), "Production Frontiers and Panel Data", *Journal of Business and Economic Statistics*, No. 2, pp. 367-374.

Schuster L. (Ed.) (1996), *Banking Cultures of the World*, Frankfurt, Fritz Knapp Verlag.

Schweiger I. and J.S. McGee (1961), "Chicago Banking", *Journal of Business*, Vol. 34, No. 3, pp. 203-289.

Sealey C.W. and J.T. Lindley (1977), "Inputs, Outputs and a Theory of Production and Cost at Depository Financial Institutions", *Journal of Finance*, Vol. 32, No. 4, pp. 1251-1266.

Seiford L.M. and R.M. Thrall (1990), "Recent Developments in DEA: The Mathematical Programming Approach to Frontier Analysis", *Journal of Econometrics*, No. 46, pp. 7-38.

Shaffer S. (1991), "Potential Mergers Synergies among Large Commercial Banks", *Working Paper*, Federal Reserve Bank of Philadelphia, October.

Shaffer S. (1993), "Can Megamergers Improve Bank Efficiency?", *Journal of Banking and Finance*, No. 17, No. 2, pp. 423-436.

Shaffer S. and E. David (1986), "Economies of Superscale and Interstate Expansion" *Research Paper*, Federal Reserve Bank of New York, November.

Shaffer S. and E. David (1991), "Economies of Superscale and Interstate Expansion", *Applied Economics*, No. 23, pp. 283-293.

Sheldon G. (1994), "Economies, Inefficiency and Technical Progress in Swiss Banking", paper presented at the Société Universitaire Européenne de Recherches Financière, Colloquium on the Competitiveness of Financial Institutions and Centres in Europe, 19-21 May, Dublin.

Sheldon G. and U. Haegler (1993), "Economies of Scale and Scope and Inefficiency in Swiss Banking", pp. 103-134, in Blattner N., Genberg H. and A. Swoboda (Eds.), *Banking in Switzerland*, New York, Weidelberg.

Shephard R.W. (1953), *Cost and Production Functions*, Princeton N.J., Princeton University Press.

Shephard R.W. (1970), *Theory of Cost and Production Functions*, Princeton N.J., Princeton University Press.

Simar L. (1992), "Estimating Efficiencies from Frontier Models with Panel Data: A Comparison of Parametric, Non-Parametric and Semi-Parametric Methods with Bootstrapping", *Journal of Productivity Analysis*, No. 3, pp. 171-203.

Simar L. (1997), "Efficiency Analysis: The Statistical Approach", *Quaderni del Dipartimento di Matematica, Statistica, Informatica ed Applicazioni*, Università degli Studi di Bergamo.

Simar L. and P. Wilson (1995), "Sensitivity Analysis of Efficiency Scores: How to Bootstrap in Non-Parametric Frontier Models", *Discussion Paper*, Université Catholique de Louvain, No. 9503.

Sinkey Jr. J.F. (1992), *Commercial Bank Financial Management in the Financial Services Industry*, 4th ed., London, Macmillan.

Spong K., Sullivan R.J. and R. De Young (1995), "What Makes a Bank Efficient? A Look at Financial Characteristics and Bank Management and Ownership Structure", *Financial Industry Perspectives*, Federal Reserve Bank of Kansas City, December.

Steinherr A. (1992), *The New European Financial Marketplace*, London and New York, Longman.

Stevenson R.E. (1980), "Likelihood Functions for Generalised Stochastic Frontier Estimation", *Journal of Econometrics*, No. 13, pp. 57-66.

Sutcliffe A. (1996), *An Economic and Social History of Western Europe. Since 1945*, London, Longman.

The Banker (1997), "Top European Banks Listing", September, pp. 35-45.

Tulkens H. (1993), "On FDH Efficiency Analysis: Some Methodological Issues and Applications to Retail Banking, Courts and Urban Transit, *Journal of Productivity Analysis*, No. 4, pp. 183-210.

van Damme E. (1994), "Banking: A Survey of Recent Microeconomic Theory", *Oxford Review of Economic Policy*, Vol. 10, No. 4, pp. 14-33, winter.

van den Broek J., Førsund F.R., Hjalmarsson L. and W. Meeusen (1980), "On the Estimation of Deterministic and Stochastic Frontier Production Functions", *Journal of Econometrics*, No. 13, pp. 117-138.

Whalen B. (1991), "A Proportional Hazard Model of Bank Failure: An Examination of Its Usefulness as an Early Warning Tool", *Economic Review*, Federal Reserve Bank of Cleveland, Quarter 1.

Williams J. (1996), "Italy", pp. 155-177, in Financial Times Publishing, *Banking in the EU, Switzerland and Norway*, FT London.

Williamson O.E. (1963), "Managerial Discretion and Business Behaviour", *American Economic Review*, December, Vol. 53, No. 5, pp.1032-1057.

Williamson O.E. (1975), *Markets and Hierarchies: Analysis and Antitrust Implications*, New York Free Press.

Zadra G. (1998), "Le sofferenze bancarie in Italia: cause ed effetti su intermediari ed imprese", *Bancaria*, Vol. 54, No. 9, September.

73/183/EEC, Council Directive of 28 June 1973 on the abolition of restrictions on freedom of establishment and freedom to provide services in respect of self-employed activities of banks and other financial institutions (*OJ L 194, 16.07.73*).

77/780/EEC, Council Directive of 12 December 1977 on the co-ordination of laws, regulations, and administrative provisions relating to the taking up and pursuit of the business of credit institutions (*OJ L 332, 17/12/77*) as amended by Directives 85/345/EEC (*OJ L 183, 16/7/85*) 89/646/EEC (*OJ L 386, 30/12/89*) 95/26/EC (*OJ L 168, 18/7/95*) and 96/13/EC (*OJ L 16/3/96*).

86/635/EEC, Council Directive of 8 December 1986 on the annual accounts and consolidated accounts of banks and other financial institutions (*OJ L 372, 31/12/86*).

89/299/EEC, Council Directive of 17 April 1989 on the own funds of credit institutions (*OJ L 124, 5/5/89*) as amended by Directives 91/633/EEC (*OJ L 339, 11/12/91*), 92/16/EEC (*OJ L 75, 21/3/1992*), and 92/30/EEC (*OJ L 110, 28/4/92*).

89/646/EEC, Second Council Directive of 15 December 1989 on the co-ordination of laws, regulations, and administrative provisions relating to the taking up and pursuit of the business of credit institutions and amending Directive 77/780/EEC (*OJ L 386, 30/12/89*) as amended by Directive 92/30/EEC (*OJ L 110, 28/4/92*).

89/647/EEC, Council Directive of 18 December 1989 on a solvency ratio for credit institutions (*OJ L 386, 30/12/89*) as amended by Directives 92/30/EEC (*OJ L 110, 28/4/92*), 95/15/EC (*OJ L 125, 8/6/95*), and 96/10/EC (*OJ L 85, 3/4/96*).

30/7/1990, L. 218 Disposizioni in materia di ristrutturazione e integrazione patrimoniale degli istituti di credito di diritto pubblico (*G.U. 6/8/1990, n. 182*).

10/10/1990, L. 287 Norme per la tutela della concorrenza e del mercato (*G.U. 13/10/1990, n. 240*).

20/11/1990, D.lgs. 356 Disposizioni per la ristrutturazione e per la disciplina del gruppo creditizio (decreto di attuazione della L. 30/7/1990, n. 218) (*Suppl. ord. G.U. 3/12/1990, n. 382*).

2/1/1991, L. 1 Disciplina dell'attività di intermediazione mobiliare e disposizioni sull'organizzazione dei mercati mobiliari (*G.U. 4.1.1991, n. 3*)

91/308/EEC, Council Directive of 10 June 1991 on the prevention of the use of the financial system for the purpose of money laundering (*OJ L 166, 28/6/91*).

5/7/1991, L. 197 Conversione in legge, con modificazioni , del DL 3.5.1991, n. 143, contenente provvedimenti urgenti per limitare l'uso del contante e dei titoli al portatore nelle transazioni e prevenire l'utilizzazione del sistema finanziario a scopo di riciclaggio (testo coordinato) (*G.U. 6/7/1991, n. 157*).

92/30/EEC, Council Directive of 6 April 1992 on the supervision of credit institutions on a consolidated basis (*OJ L 110, 28/4/92*) as amended by Directive 93/6/EEC (*OJ L 141, 11/6/93*).

14/12/1992, D.lgs. 481 Attuazione della direttiva CEE 89/646, relativa al coordinamento delle disposizioni legislative, regolamentari e amministrative riguardanti l'accesso all'attività degli enti creditizi e il suo esercizio e recante la modifica della direttiva CEE 77/780 (*Suppl. Ord. G.U. 17/12/1992, n. 296*).

93/6/EEC, Council Directive of 21 December 1992 on the monitoring and control of large exposures of credit institutions (*OJ L 141, 11/6/1993*).

1/9/1993, D.lgs. 385 Testo unico delle leggi in materia bancaria e creditizia (*Suppl. ord. G.U. 30.9.1993, n. 230*).

94/19/EC, European Parliament and Council Directive of 30 May 1994 on deposit guarantee schemes (*OJ L 135, 31/5/94*).

30/7/1994, L. 474 Conversione in legge, con modificazioni, del DL 31/5/1994, n. 332, recante norme per l'accelerazione delle procedure di dismissione di partecipazioni dello Stato e degli enti pubblici in società per azioni (*G.U. 30/7/1994, n. 177*).

23/12/1998, L. 461 Delega al Governo per il riordino della disciplina civilistica e fiscale degli enti conferenti, di cui all'art. 11, comma 1, del D.lgs. 20.11.1990, n. 356, e della disciplina fiscale delle operazioni di ristrutturazione bancaria (*G.U. 7.1.1999, n. 4*).

98/2866EC, Council Regulation of 31 December 1998 on the conversion rates between the Euro and the currencies of the Member States adopting the Euro (*OJ L 359, 31/12/98*).

Appendix to Chapter 3

Table A3.1 Characteristics of Major Italian Banks (1996)[a]

	TOTAL ASSETS	CUSTOMER LOANS	CUSTOMER DEPOSITS	PERSONNEL EXPENSES	NPLS/TOTAL LOANS	EQUITY	NUMBER OF PERSONNEL	NUMBER OF BRANCHES	WORLD RANKING
Istituto Bancario San Paolo	222,580.9	99,176.9	66,813.5	2,698.0	3.65	9,568.2	20,988	1,253	52
Banca di Roma	154,584.2	80,417.5	41,615.7	2,518.2	9.4	10,400.8	22,347	1,261	159
BNL	152,138.4	83,451.3	42,693.5	2,240.5	2.59	8,872.5	20,478	652	82
COMIT	144,848.4	67,294.3	47,772.4	2,236.3	1.98	7,854.5	18,908	890	76
CARIPLO	136,563.2	69,431.2	38,882.4	1,867.4	4.63	10,190.4	14680	740	70
Credito Italiano	107,370.5	41,363.3	33,031.3	1,665.7	2.86	5,407.4	14,829	649	80
Banca Monte Dei Paschi	99,704.6	46,629.9	31,537.4	1,740.0	5.47	5,500.1	14,068	782	NA
Banco di Napoli	71,258.8	37,917.0	25,190.5	1,567.8	14.63	2,707.8	12,118	762	178

[a] Billions lire.
Source: BankScope and *The Banker* (1997, p. 45).

Table A3.2 Comparative Size of Leading Italian Banking Groups (1996)[a]

	TOTAL ASSETS	CUSTOMER LOANS	CUSTOMER DEPOSITS	PERSONNEL EXPENSES	NPLS/TOTAL LOANS	EQUITY	NUMBER OF PERSONNEL	NUMBER OF BRANCHES
Gruppo San Paolo	264,529.9	132,316.6	71,157.1	3,033.8	3.16	7,516.6	24,066	1,447
Gruppo Cariplo	192,717.2	104,500.5	55,789	3,013.6	6.53	9,860.5	24,270	1,397
Gruppo Banca Commerc. Italiana	176,704.2	85,218.7	59,828.3	2,996.6	3.28	8,368.3	28,554	1,339
Gruppo Credito Italiano	175,067.2	82,042.9	65,008.9	2,817.8	3.21	5,941.6	25,243	1,412
Gruppo Banca Naz. Lavoro	172,739.4	104,051.1	46,585.1	2,629.3	2.82	8,615.6	24,807	727
Gruppo Monte dei Paschi Siena	142,616.2	67,903.2	50,735.6	2,801.1	5.11	4,798.6	22,524	1,193
Gruppo Banco di Napoli	71,300.6	37,926	25,139.9	1,598.3	14.63	2,732.1	12,494	762
TOTAL TOP 7 GROUPS	1,195,674.7	613,959	374,243.9	18,890.5	5.53	47,833.3	161,958	8,277
Other Groups (43 groups)	786,449.2	386,741	294,870.2	14,459.6	5.82	45,293.2	128,772	10,089
TOTALS (50 groups)	1,982,123.8	1,000,700.2	669,114.2	33,350	4.75	93,126.5	290,730	18,366

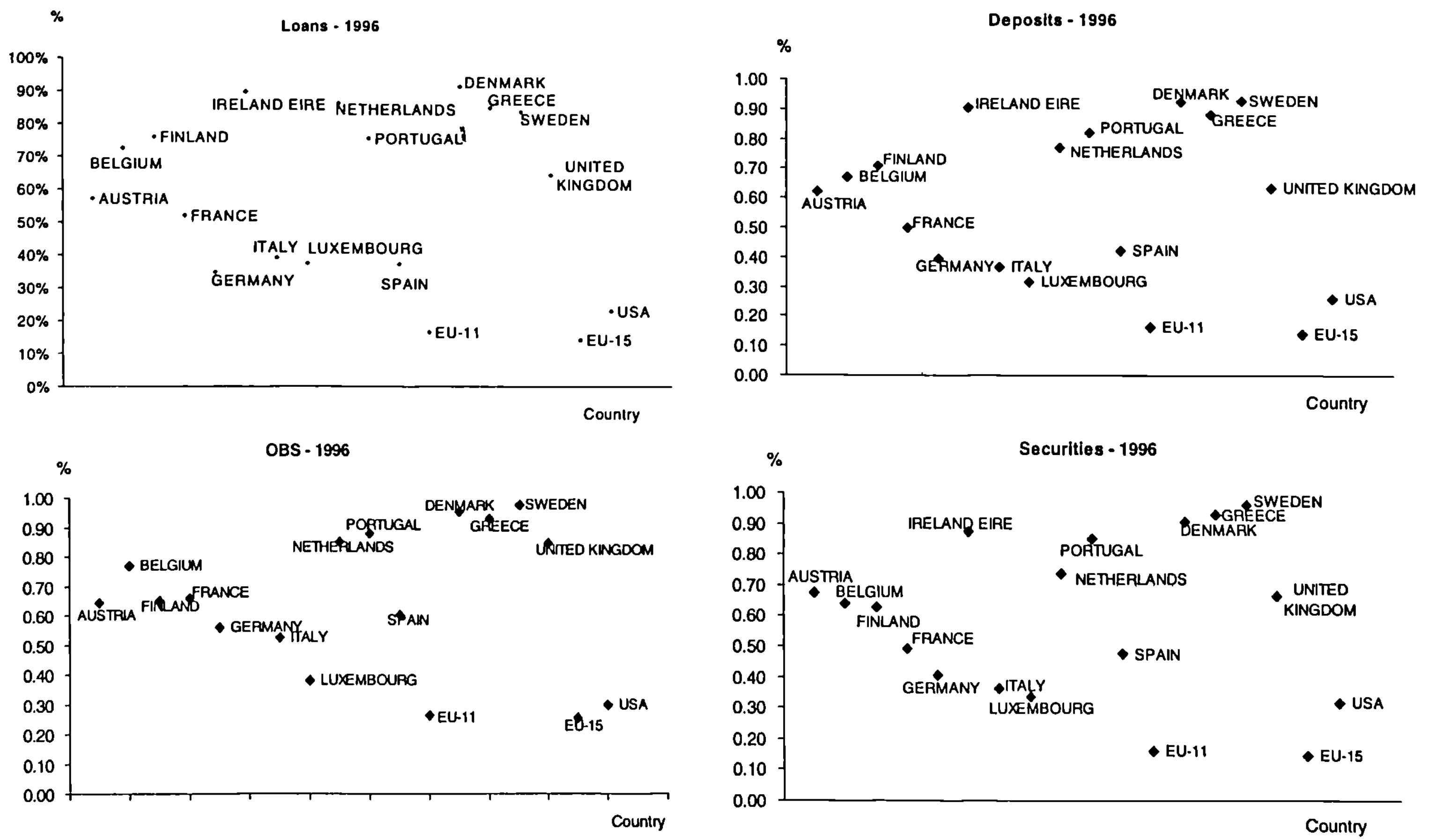
[a] Billions lire.
Source: BankScope and author's calculations.

Table A3.3 European and US Banks: Sample Information[a]

Countries	NUMBER OF BANKS	NUMBER OF BANKS (OBS ITEMS)
Austria	34	34
Belgium	35	34
Denmark	13	12
Finland	3	3
France	167	165
Germany	468	465
Greece	9	8
Ireland	9	2
Italy	117	117
Luxembourg	54	53
Netherlands	19	17
Portugal	10	10
Spain	92	91
Sweden	10	10
United Kingdom	44	37
United States	395	290

[a] The sample includes banks with unconsolidated total assets > $1,000 billions (that is, "large banks", according to BankScope definitions).
Source: BankScope and author's calculations.

Figure A3.1 Market Concentration in European and US Banking (1996 – Loans, Deposits, OBS and Securities)[a,b]



[a] Share of the 5 largest institutions.
[b] The size of the banking market was calculated from the BankScope database.
Source: BankScope and author's calculations.

Appendix to Chapter 4

Table A4.1 Review of Selected US Studies on Scale and Scope Economies Using the Translog

AUTHORS	SAMPLE DATA	OUTPUT	METHODOLOGY	FINDINGS
BENSTON, HANWECK AND HUMPHREY (1982)	Years: 1975-78 Sample: 742 to 852 US banks (assets>$1 billion) Source: FCA programme	Production approach • Demand deposits • Time and savings deposits • Real estate loans • Instalment loans • Business Loans	Deterministic translog cost function Other Variables: holding companies, state branching status and average account size.	A U-shaped cost curve. Unit banks with above $50 million in deposits showed diseconomies of scale. Banks in branching state experienced small economies of scale.
BENSTON, BERGER, HANWECK AND HUMPHREY (1983)	Year: 1978 Sample: 852 US banks Source: FCA programme	Production approach • Demand deposits • Time and savings deposits • Real estate loans • Instalment loans • Commercial Loans	Deterministic translog cost function Dummy variables included for holding company status.	Economies of scale exist at the branch level for all deposit size classes and they are not statistically significant for the largest banks. Economies of scale for banks up to $75-100 million in deposit size; diseconomies of scale for all unit banks with more than $200 million in deposits. No evidence of scope economies.
MURRAY AND WHITE (1983)	Year: 1977 Sample: Data generated from a survey of Canadian credit unions in 1977.	Intermediation approach • Mortgage loans • Other Loans • Investments in excess of reserve requirements	Deterministic translog cost function Control variables: branches and risk.	Found scale economies for most of the credit unions studied and strong evidence of cost complementarity between mortgage and other lending activities. Large multi-product credit unions more cost efficient than small single-product credit unions.
CLARK (1984)	Years: 1972-77 Sample: 1205 banks Source: Report of Condition and Income	Production approach. • Total earning assets • Deposits	Box-Cox transformation of the translog function.	Economies of scale exist for relatively small-sized banks.
GILLIGAN, SMIRLOCK AND MARSHALL (1984)	Year: 1978 Sample: 714 banks Source: FCA Programme	Production approach • Number of deposit account • Number of loan accounts	Deterministic translog cost function	Evidence of scale economies for banks with less than $25 million, and diseconomies beyond $100 million. Found that bank output was characterised by scope economies.

Continued Overleaf

Table A4.1 **Review of Selected US Studies on Scale and Scope Economies Using the Translog (*continued*)**

AUTHORS	SAMPLE DATA	OUTPUT	METHODOLOGY	FINDINGS
GILLIGAN AND SMIRLOCK (1984)	Years: 1973-78 Sample: 2,700 banks Source: Report of Income and Condition by the Fed Reserve Bank of Kansas City	Production and Intermediation approach. Model I • Demand deposits • Time deposits Model II • Loans • Securities	Deterministic translog cost function	Found slight economies of scale for banks with less than $10 million deposits and diseconomies above $ 50 million.
HUNTER AND TIMME (1986)	Years: 1972-82 Sample: Large US bank holding companies located in 20 different states	Production approach • Loans • Securities • Deposits	Deterministic translog cost function	The technical change produces significant cost reductions. Significant economies of scale were found when total cost was considered as operating cost. Constant returns to scale found when interest expenses were included in total cost.
LAWRENCE AND SHAY (1986)	Years: 1979-82 Source: FCA Programme	Production approach. • Deposits • Loans • Investments • Non-balance-sheet items. Three input prices: an interest rate, a wage rate and computer rental rate.	Deterministic translog cost function Control variables: average loan size, average deposit size and branches.	Analysed the effects of computer technology upon economies of scale and scope as well as the elasticities of substitution between inputs; they found constant returns to scale. When the analysis was undertaken by quartiles according to deposit size, there were significant economies of scale especially for the smallest unit banks. Significant scope economies found between deposits and loans, and deposits and investments. Diseconomies of scope reported between investments and loans.
SHAFFER AND DAVID (1986)	Year: 1984 Sample: 100 largest US banks (assets >$1 billion) Source: Call and Income Reports	Intermediation approach. • Loans • Securities	Deterministic translog cost function Dummy employed to account for unit and branch banking.	Scale economies existed for US banks up to $37 billion in asset size.

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Table A4.1 Review of US Studies on Scale and Scope Economies Using the Translog Cost Function (*continued*)

AUTHORS	SAMPLE DATA	OUTPUT	METHODOLOGY	FINDINGS
BERGER, HANWECK AND HUMPHREY (1987)	Year: 1983 Sample: 413 branching state banks and for 214 unit state banks (separately) Source: FCA Programme	Production approach and intermediation approach. The same definition of output as in Benston *et al.* (1983).	Deterministic translog cost function	Branch banks showed slight scale economies at the branch level and large diseconomies of scale at the level of the banking firm. Unit state banks showed large diseconomies of scale for large banks. The study concluded that there was evidence of diseconomies of scope in banking.
HUMPHREY (1987)	Year: 1980, 1982, 1984 Sample: 13,959 banks Source: Report of *Condition and Report of* Income and Dividends	Cost dispersion (cost differences among similar sized banks)	Bank data divided into 13 size classes and also grouped into quartile. Also: calculation of asset cost elasticities.	The difference in average costs between banks with the highest cost and banks with the lowest costs was two to four times greater than the observed variation in average cost across bank size classes. Cost economies were not found to confer competitive advantages for large banks over small ones.
KOLARI AND ZARDKOOHI (1987)	Years: 1979-83 Source: FCA Programme Years: 1970, 1980, 1982 Source: FCA Programme	Model I • Demand and time deposits Model II • Loans and securities. Model III • Loans and total deposits.	Deterministic translog cost function	Unit banks have flat cost curve. Branch banks have U-shaped cost curves. Significant scale economies for banks up to $50 million in deposits; diseconomies appeared beyond $50-100 million in deposits (except in 1983). They also found evidence of scope economies. Unit banks had greater scope economies than branch banks.
GROPPER (1991)	Year: 1979-86 Source: FCA programme	Intermediation approach • Loans • Securities	Deterministic translog cost function	Economies of scale existed beyond small levels of output before 1982. The degree of scale economies increased over the 1979-86 period.

Table A4.2 Selected Stochastic Frontier Studies

AUTHORS	SAMPLE DATA	OUTPUT	METHODOLOGY	FINDINGS
FERRIER AND LOVELL (1990)	Year: 1984 Sample: 575 US banks Source: FCA program	Production approach • Demand deposit accounts • time deposits accounts • real estate loans • instalment loans • commercial loans	Translog stochastic cost frontier Non-stochastic production frontier	Modest scale economies give a potential cost advantage to large banks. Inefficiencies (technical and allocative) of around 26% on average (stochastic frontier) and 21% (non-stochastic frontier). Not relevant allocative efficiency. The two approaches give different technical efficiency rankings of banks.
BAUER, BERGER AND HUMPHREY (1993)	Years: 1977-1988 Sample: 683 large US branching state banks (over $100 million in assets) Source: Call Report	Production approach • Demand deposits • Small time and savings deposits • Real estate loans • Commercial and industrial loans • Instalment loans	Translog stochastic cost frontier Thick frontier approach	The average inefficiency of all banks with the two approaches was found very similar (on the order of 15%) although they ranked individual banks quite differently. These inefficiencies were also found to be sufficiently large to dominate scale economy effect of 5% or less.
BERGER, HANCOCK AND HUMPHREY (1993)	Years: 1984-1989 Sample: US commercial banks. Three panels (384 to 599 observations) Source: Call Report	Intermediation approach • Business loans • Consumer loans (commercial and industrial) • Real estate loans • Instalment loans	Profit function Distribution free approach	Calculation of both input and output inefficiencies, as well as allocative and technical inefficiencies. The industry appears to lose about half of its potential variable profits to inefficiency. Technical inefficiencies dominate allocative. Larger firms are substantially more X-efficient on average than smaller firms.
CEBENOYAN, COOPERMAN, REGISTER AND HUDDGINS (1993)	Year: 1988 Sample: 559 US mutual and stock S&Ls Source: Federal Home Loan Bank Board	Intermediation approach • Construction loans • Permanent mortgage loans • Mortgage-backed pass-through securities • Other loans • Other securities	Translog stochastic cost frontier	In an attempt to analyse whether organisational factors might improve the overall performance of the industry, found a mean inefficiency score of 15% for mutual S&Ls and 17% for stock organisations. That is, the average S&L could produce its output with only 84% of the inputs actually used if operated efficiently. Operating efficiency was not found significantly related to the form of ownership.

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Table A4.2 Selected Stochastic Frontier Studies (*continued*)

AUTHORS	SAMPLE DATA	OUTPUT	METHODOLOGY	FINDINGS
KAPARAKIS, MILLER AND NOULAS (1993)	Year: 1986 Sample: 5,548 banks with total assets > $50 million Source: Call Report	Intermediation approach • Loans secured by real estate • Commercial and industrial loans • Federal funds sold, securities, total securities and assets held in trading accounts	Translog stochastic cost frontier	Average inefficiencies ranging from 9% to 17%. Banks generally become less efficient with increasing size, except for banks between $5 and $10 billion in assets. For banks over $10 billion in assets, the average inefficiency measure is 17%, which is more than 70% higher than the average for all banks combined (that is 9.8%).
MESTER (1993)	Year: 1991 Sample: 1,015 US mutual and stock S&Ls Source: Statements of Condition and Statements of Operations.	Intermediation approach • Mortgage loans • Other loans (including commercial loans and consumer loans) • Securities and other investments.	Translog stochastic cost frontier	Stock S&Ls are on average less efficient than mutual S&Ls. Average inefficiency is in the 8%-10% range for mutual S&Ls and in the 12-16% range for stock S&Ls.
ALTUNBAS, MAUDE AND MOLYNEUX (1995)	Years: 1993 Sample: UK banks and building societies Source: BankScope	Intermediation approach • Total earning assets • Total loans	Translog stochastic cost frontier	UK banks and building societies are quite efficient because most of them lie close to the best-practice cost frontier. Mean inefficiency levels: 6.3%
KWAN AND EISENBAIS (1995)	Years: 1986-1991 Sample: 254 US large bank holding companies (semiannual data) Source: FED's Commercial bank and bank holding companies Database	Intermediation approach • Investment securities • Real estate loans • Commercial and Industrial loans • Off-balance sheet	Translog stochastic cost frontier	Evidence that substantial X-inefficiencies exist in banking averaging between 10 and 20% of total costs. On average smaller bank holding companies deviate more from their respective cost-efficient frontier than do larger bank holding companies. The mean bank shows a clear decline in efficiency in the period under study.

Continued Overleaf

Table A4.2 Selected Stochastic Frontier Studies (*continued*)

AUTHORS	SAMPLE DATA	OUTPUT	METHODOLOGY	FINDINGS
SPONG, SULLIVAN AND DEYOUNG (1995)	Years: 1990-1994 Sample: 1,439 banks in the Tenth Federal Reserve District Source: Federal Deposit Insurance Corporation	Production approach • Commercial and agricultural production loans, consumer loans and real estate loans • Transaction and liquidity services (transaction deposits is used as a proxy) • Fee-based activities (total fee income)	Fourier-flexible stochastic cost frontier Profitability test	Cost efficiency index for the average bank in the most efficient group was 94% whereas for the average bank in the least efficient group has a cost efficiency index of 71%.
ALLEN AND RAI (1996)	Years: 1988-1992 Sample: 785 world banks Source: Global Vantage database	Intermediation approach • Traditional banking assets (loans) • Investment assets	Stochastic cost frontier Distribution free model	With the application of the stochastic cost frontier, they found average inefficiencies of 18%. With the application of the distribution free model, they found average inefficiencies of 68%. Scale diseconomies are found for large banks in different countries as well as the largest measure of input inefficiency amounting to 27.5% of total cost. All other banks have X-inefficiency levels ranging in the area of 15% of total costs. Slight diseconomies of scale found for small banks.
MOLYNEUX, ALTUNBAS AND GARDENER (1996)	*Year: 1988* Sample: 850 European banks Source: BankScope	*Intermediation approach* • Total loans • Total securities	*Hybrid translog* cost function	Noticeable differences in cost characteristics across European banking markets. Strong evidence of economies of scale and scope at the branch level in all but the Spanish market. Cost savings appear to occur mainly through the increased average size of banks' branches rather than through the size of the banking firm.

Continued Overleaf

Table A4.2 Selected Stochastic Frontier Studies *(continued)*

AUTHORS	SAMPLE DATA	OUTPUT	METHODOLOGY	FINDINGS
BERGER, LEUSNER AND MINGO (1997)	Years: 1989-1991 Sample: US commercial bank branches (761 for intermediation approach and 769 for production approach) Source: Call Reports	Intermediation approach • Consumer transaction accounts • Consumer non-transactions accounts • Business transaction accounts • Business non-transaction accounts Production approach • Deposit accounts • Debits • Credits • Accounts opened • Accounts closed	Fourier-flexible stochastic cost frontier Distribution free panel data approach Thick frontier	Empirical results mutually consistent between production and intermediation approach. Most branches are considerably smaller than efficient scale (there are about twice as many branches as are needed to minimise bank costs). The cost of overbranching quantified in 3.3% of total branching costs (intermediation approach) and 13.9% (production approach). X-efficiency are about 5% to 10% of total branching costs and they dominate scale effects.
EUROPEAN COMMISSION (1997)	Years: 1987-1994 Sample: on average 1046 European banks Source: BankScope	Production approach • Total Loans • Total securities • Customer and short-term funding	Deterministic translog multiproduct (scale and scope economies) Translog stochastic cost frontier	In all countries there is evidence of economies of scale for small banks (especially in Germany and France). For larger banks, economies of scale appear to emerge in years of relatively low effective demand. Economies of scope are found for French, German, Italian and Spanish banks in the size range ECU1,000 to ECU9,999 million. X-inefficiency levels fell on average between 1990-94 from 27% to 23%.
ALTUNBAS, EVANS AND MOLYNEUX (1999)	Years: 1989-96 Sample: 942 German banks (average) Source: Bankscope	Intermediation approach • Loans • Securities • OBS	Fourier-flexible stochastic cost frontier	Privately owned banks more efficient than their mutual and public sector counterparts. Private, public and mutual have slight cost and profit advantages over their private commercial banking counterparts. Technical progress also appear to have made important contributions to cost reductions in Germany.

Appendix to Chapter 5

Table A5.1 Summary Statistics on Cost, Output Quantities, Input Prices and Risk and Quality Variables: 1993[a,b]

	MEAN	ST.DEV.	MIN.	MAX.
TC	361.36	1,539.63	1.30	19,008.01
Q_1	1,883.52	8,646.58	3.94	113,929.90
Q_2	1,880.34	7,965.81	5.57	80,672.27
P_1	0.09132	0.01108	0.01039	0.15375
P_2	0.07828	0.01376	0.04147	0.16559
P_3	1.11277	1.67697	0.10910	21.31176
K	266.65	1,026.28	0.70	11,723.99
S	5.22	4.73	0.07	33.85

[a] TC = total costs (billions of lire); Q_1 = total loans (billions of lire); Q_2 = other earning assets (billions of lire); P_1 = personnel expenses/average number of personnel; P_2 = interest expenses/total customer deposits; P_3 = other non-interest expenses/total fixed assets; K = level of equity (billion of lire); S(%) = non-performing loans/total loans.
[b] Number of observed banks: 545.

Table A5.2 Summary Statistics on Cost, Output Quantities, Input Prices and Risk and Quality Variables: 1994[a,b]

	MEAN	ST.DEV.	MIN.	MAX
TC	325.05	1346.83	1.52	14900.77
Q_1	1941.33	8661.88	3.78	95151.18
Q_2	1844.66	7845.73	4.13	87789.87
P_1	0.09634	0.01130	0.01473	0.15050
P_2	0.06673	0.01165	0.01173	0.12314
P_3	1.04457	1.24662	0.08576	11.73529
K	280.87	1051.92	0.77	11128.39
S	5.85	5.78	0.06	70.36

[a] See note to Table A5.1.
[b] Number of observed banks: 523.

Table A5.3 Summary Statistics on Cost, Output Quantities, Input Prices and Risk and Quality Variables: 1995[a,b]

	MEAN	ST.DEV.	MIN.	MAX
TC	401.16	1674.56	1.60	20900.45
Q_1	2325.57	10406.30	4.44	136015.7
Q_2	1955.32	7803.92	5.84	89135.46
P_1	0.10181	0.01259	0.05978	0.24075
P_2	0.06807	0.01276	0.03898	0.13058
P_3	1.03118	1.15507	0.14428	12.85294
K	306.44	1113.10	1.13	10899.43
S	5.57	5.02	0.05	41.79

[a] See note to Table A5.1.
[b] Number of observed banks: 466.

Table A5.4 Summary Statistics on Cost, Output Quantities Input Prices and Risk and Quality Variables: 1996[a,b]

	MEAN	ST.DEV.	MIN.	MAX
TC	408.98	1558.60	1.63	17101.42
Q_1	2442.95	9848.10	3.85	99176.93
Q_2	2200.26	8371.45	9.32	95569.43
P_1	0.10565	0.01134	0.04863	0.13969
P_2	0.06639	0.01093	0.0474	0.11427
P_3	1.08069	1.38220	0.15306	9.93902
K	331.00	1150.83	1.77	10400.78
S	5.49	5.02	0.12	25.54

[a] See note to Table A5.1.
[b] Number of observed banks: 424.

Table A5.5 TSP 4.0 Program for Transformation of Banks' Data

```
SET NOBS=545;
SMPL 1 NOBS;
? READ MICROSOFT EXCEL 4.0 FILE WITH BANKS DATA
READ (FILE='DATA.XLW');
? VARIABLES TRANSFORMATION
GENR LTC=LOG(TC/P3); LQ1=LOG(Q1); LQ2=LOG(Q2);
LP1=LOG(P1/P3);LP2=LOG(P2/P3);
LK=LOG(K); LS=LOG(S);
? CREATE CROSS PRODUCTS
GENR LQ1Q1=LQ1*LQ1/2; LQ2Q2= LQ2*LQ2/2; LQ1Q2= LQ1*LQ2;
LP1P1=LP1*LP1/2; LP2P2=LP2*LP2/2; LP1P2=LP1*LP2;
LQ1P1=LQ1*LP1;LQ1P2=LQ1*LP2; LQ2P2=LQ2*LP2; LQ2P1=LQ2*LP1;
LKK=LK*LK/2; LQ1K=LQ1*LK; LQ2K=LQ2*LK;
LP1K=LP1*LK; LP2K=LP2*LK;
LSS=LS*LS/2;LQ1S=LQ1*LS;LQ2S=LQ2*LS;
LP1S=LP1*LS;LP2S=LP2*LS;LKS=LK*LS;
? TRANSFORMATION OF LQ1 AND LQ2 FOR FOURIER TERMS
MSD(ALL)LQ1;
SET B1=@MAX;
SET A1=@MIN;
GENR BA1=(B1-A1);
SET PI=3.141592654;
GENR M1= 0.2*PI+(LQ1-A1)*((0.8*2*PI)/(BA1));
MSD(ALL)LQ2;
SET B2=@MAX;
SET A2=@MIN;
GENR BA2=(B2-A2);
SET PI=3.141592654;
GENR M2= 0.2*PI+(LQ2-A2)*((0.8*2*PI)/(BA2));
```

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(continued)

```
? CREATE FOURIER TERMS
GENR CM1=COS(M1);SM1=SIN(M1);
CM2=COS(M2);SM2=SIN(M2);
GENR CM1M1=COS(M1+M1);SM1M1=SIN(M1+M1);
CM1M2=COS(M1+M2);SM1M2=SIN(M1+M2);
CM2M2=COS(M2+M2);SM2M2=SIN(M2+M2);
GENR CM1M1M2=COS(M1+M1+M2);SM1M1M2=SIN(M1+M1+M2);
CM1M2M2=COS(M1+M2+M2);SM1M2M2=SIN(M1+M2+M2);
? CREATE A FILE WITH NEW VARIABLES IN EXCEL 4.0
WRITE (FILE='VARS.XLW')
LTC LQ1 LQ2 LP1 LP2
LQ1Q1 LQ2Q2 LQ1Q2 LP1P1 LP2P2 LP1P2 LQ1P1 LQ2P1 LQ1P2 LQ2P2
CM1 SM1 CM2 SM2 CM1M1 SM1M1 CM1M2 SM1M2
CM2M2 SM2M2 CM1M1M2 SM1M1M2 CM1M2M2 SM1M2M2
LKK LQ1K LQ2K LP1K LP2K LSS LQ1S LQ2S LP1S LP2S LKS
LK LS;
STOP;
```

Table A5.6 Estimation of Cost Function (FRONTIER 4.1 Input file)[a]

```
1                 1=ERROR COMPONENTS MODEL, 2=TE EFFECTS MODEL
vars.txt          DATA FILE NAME
vars.out          OUTPUT FILE NAME
2                 1=PRODUCTION FUNCTION, 2=COST FUNCTION
y                 LOGGED DEPENDENT VARIABLE (Y/N)
545               NUMBER OF CROSS-SECTIONS
4                 NUMBER OF TIME PERIODS
1958              NUMBER OF OBSERVATIONS IN TOTAL
41                NUMBER OF REGRESSOR VARIABLES (Xs)
n                 MU (Y/N) [OR DELTA0 (Y/N) IF USING TE EFFECTS MODEL]
y                 ETA (Y/N) [OR NUMBER OF TE EFFECTS REGRESSORS(Zs)]
n                 STARTING VALUES (Y/N)
                  IF YES THEN        BETA0
                                     BETA1 TO
                                     BETAK
                                     SIGMA SQUARED
                                     GAMMA
                                     MU                [OR DELTA0
                                     ETA               DELTA1 TO
                                                       DELTAP]

                       NOTE: IF YOU ARE SUPPLYING STARTING VALUES
                       AND YOU HAVE RESTRICTED MU [OR DELTA0] TO BE
                       ZERO THEN YOU SHOULD NOT SUPPLY A STARTING
                       VALUE FOR THIS PARAMETER.
```

[a] See Coelli (1996) and Coelli *et al.* (1998) for details on the FRONTIER 4.1 Program.

Table A5.7 Loading Output File from FRONTIER 4.1 to TSP 4.0 [a]

```
SMPL 1 45;
? COEFFICIENT VALUES [FRONTIER 4.1 PROGRAM]
READ BETA;
1.4534 .3724 .4685 .1258 .8218 .1559 .1289 -.1520          [...];
? VARIANCE/COVARIANCE MATRIX [FRONTIER 4.1 PROGRAM]
READ (NROW=45,TYPE=SYM) VARB;
 .01440
-.00323 .00273
-.00178 -.00706 .00208                                      [...];
? PRINT NAMES, COEFFICIENT VALUES + STANDARD ERRORS & T-STATISTICS
TSTATS (NAMES=(B0-B44)) BETA VARB;
? ACTUAL VARIABLES SAVED IN EXCEL 4.0 WORKBOOK [SEE TABLE A5.5]
READ (FILE='VARS.XLW');
SMPL 1 545;
? CREATE SCALARS WITH MEAN VALUES FOR EACH VARIABLE
MSD (NOPRINT) LQ1;
COPY @MEAN LQ1B;
MSD (NOPRINT) LQ2;
COPY @MEAN LQ2B;
MSD (NOPRINT) LP1;
COPY @MEAN LP1B;
[...];
? END OF PROGRAM
STOP;
```

Table A5.8 Calculation of Economies of Scale in TSP 4.0

```
? THIS CALCULATIONS FOLLOW TABLE A5.7
? DEFINE EQUATION FOR ECONOMIES OF SCALE
FRML SE B1+(B5*LQ1B)+(B7*LQ2B)+(B11*LP1B)+(B13*LP2B)
+(B15*SM1B)-(B16*CM1B)+(B19*SM1M1B)-(B20*CM1M1B)
+(B23*SM1M2B)-(B24*CM1M2B)+(B25*SM1M1M2B)-(B26*CM1M1M2B)
+(B27*SM1M2M2B)-(B28*CM1M2M2B)+(B30*LKB)+(B35*LSB)
+B2+(B6*LQ2B)+(B7*LQ1B)+(B12*LP1B)+(B14*LP2B)
+(B17*SM2B)-(B18*CM2B)+(B21*SM2M2B)-(B22*CM2M2B)
+(B23*SM1M2B)-(B24*CM1M2B)+(B25*SM1M1M2B)-(B26*CM1M1M2B)
+(B27*SM1M2M2B)-(B28*CM1M2M2B)+(B31*LKB)+(B36*LSB);
? SAMPLE SIZE [BETAS]
SMPL 1 45;
? FIND T-RATIOS OF ECONOMIES OF SCALE [H0=0]
ANALYZ (COEF=BETA,NAMES=(B0-B44), VCOV=VARB) SE;
COPY @COEFA SCALE;
? FIND T-RATIOS OF ECONOMIES OF SCALE [H0=1]
SET TRATIO=(@COEFA-1)/@SESA;
PRINT TRATIO;
? TITLE
IF SCALE>1; THEN; TITLE 'SCALE DISECONOMIES FOR SAMPLE 1-545';
ELSE;TITLE 'SCALE ECONOMIES FOR SAMPLE  1-545';
? END THIS SUBROUTINE
STOP;
```

Table A5.9 Calculation of Variance Components and of all Variables Related to the Last Input P_3 in TSP 4.0

```
? THESE CALCULATIONS FOLLOW TABLE A5.7
? EQUATIONS FOR VARIANCE COMPONENTS (VU) AND (VV)
FRML VU (B42*B43);
FRML VV (B42-(B42*B43));
? EQUATIONS FOR VARIABLES RELATED TO THE LAST INPUT P3
FRML LP3     1-B3-B4;
FRML LP1P3  -B8-B10;
FRML LP2P3  -B10-B9;
FRML LP3P3   B8+B9+2*B10;
FRML LQ1P3  -B11-B13;
FRML LQ2P3  -B12-B14;
FRML LP3LK  -B32-B33;
FRML LP3LS  -B37-B38;
? SAMPLE SIZE
SMPL 1 45;
? SIGNIFICANCE TEST FOR VARIANCE COMPONENTS
ANALYZ (COEF=BETA,NAMES=(B0-B44), VCOV=VARB) VU;
ANALYZ (COEF=BETA,NAMES=(B0-B44), VCOV=VARB) VV;
? SIGNIFICANCE TEST FOR P3 VARIABLE + CROSS-PRODUCTS
ANALYZ (COEF=BETA,NAMES=(B0-B44), VCOV=VARB) LP3;
ANALYZ (COEF=BETA,NAMES=(B0-B44), VCOV=VARB) LP1P3;
ANALYZ (COEF=BETA,NAMES=(B0-B44), VCOV=VARB) LP2P3;
ANALYZ (COEF=BETA,NAMES=(B0-B44), VCOV=VARB) LP3P3;
ANALYZ (COEF=BETA,NAMES=(B0-B44), VCOV=VARB) LQ1P3;
ANALYZ (COEF=BETA,NAMES=(B0-B44), VCOV=VARB) LQ2P3;
ANALYZ (COEF=BETA,NAMES=(B0-B44), VCOV=VARB) LP3LK;
ANALYZ (COEF=BETA,NAMES=(B0-B44), VCOV=VARB) LP3LS;
? VARIANCE FOR HALF-NORMAL MODEL
SET PI=3.141592654;
FRML VARU ((PI-2)/PI)*SQRT(B42*B43);
ANALYZ (COEF=BETA,NAMES=(B0-B44), VCOV=VARB) VARU;
? END THIS SUBROUTINE
STOP;
```

Table A5.10 Logistic Functional Form Estimation in TSP 4.0

```
? READ FILE IN MICROSOFT EXCEL 4.0
READ (FILE='VARS.XLW');
? SAMPLE DEFINITION
SMPL 1 1958;
? DEFINITION OF THE LOGISTIC FUNCTIONAL FORM
FRML LIT INEFF=
   (EXP (INTERC+ASSETS*LAST+MARGIN*MUP+BRANCHES*LBRA
            +RETAIL*RET+OWNERS*OWN+NONPERF*NPL
            +PERFORM*ROE+CAPITAL*CAP
            +QUOTED*QUOT+NORDWE*NO+NORDEA*NE+CENT*CE+COMMERC*COM
            +SAVIN*SAV+POPUL*POP)) /
  (1+EXP (INTERC+ASSETS*LAST+MARGIN*MUP+BRANCHES*LBRA
            +OWNERS*OWN+NONPERF*NPL
            +RETAIL*RET+PERFORM*ROE+CAPITAL*CAP
            +QUOTED*QUOT+NORDWE*NO+NORDEA*NE+CENT*CE+COMMERC*COM
            +SAVIN*SAV+POPUL*POP));

? DEFINITION OF PARAMETERS
PARAM INTERC ASSETS MARGIN BRANCHES
OWNERS NONPERF RETAIL PERFORM CAPITAL QUOTED
NORDWE NORDEA CENT COMMERC SAVIN POPUL;

? NON-LINEAR OLS TO ESTIMATE EQUATION "LIT" [MESTER (1993 AND 1996)]
LSQ LIT;

? END OF PROGRAM
STOP;
```

Appendix to Chapter 6

Table A6.1 Maximum Likelihood Parameter Estimates (Other Parameters)[a,b,c]

Variables	Parameters	MODEL I	MODEL II
lnP_3	β_3	.043*	.052**
		(.028)	(.030)
lnP1lnP3	γ_{13}	-.011	-.010
		(.011)	(.011)
lnP_2lnP_3	γ_{23}	.026**	.030**
		(.011)	(.011)
lnP_3lnP_3	γ_{33}	-.015**	-.019**
		(.007)	(.007)
lnQ_1lnQ_3	ρ_{13}	.015**	.013*
		(.007)	(.009)
lnQ_2lnP_3	ρ_{23}	-.016**	-.012*
		(.008)	(.009)
lnP_3lnK	β_{3k}	–	-1E-04
			(.003)
lnP_3lnS	β_{3s}	–	-.003
			(.010)
Vu	σ_u^2	.030***	.010***
		(.002)	(.001)
Vv	σ_v^2	.002***	.028***
		(8.7E-05)	(.003)
Varu	var[u]	.011***	.002***
		(.001)	(8E-05)

*, **, *** means statistically significant at the 10%, 5% and .1% respectively.

[a] Asymptotic *t*-ratios distributed as N(0,1). Model I: Log-likelihood =2492.6. Adjusted R^2 of the pooled OLS model=99.8%. LR test of the one-sided error= 1323.7. Model II: Log-likelihood =2541.8. Adjusted R^2 of the pooled OLS model=99.9%. LR test of the one-sided error= 1152.1. Estimates based on the Davidson-Fletcher-Powell algorithm using the FRONTIER 4.1 software [see Coelli (1996) and Coelli *et al.* (1998)]. Standard errors in brackets.

[b] See the Appendix to Chapter 5 for the computer programming.

[c] For the half-normal model the variance of u is $Var[u] = [(\pi - 2)/\pi]\sigma_u^2$ and not σ_u^2, this latter being the variance of the normal distribution of which u represents a truncation for the sole positive values [see, for instance, Battese and Coelli (1992) and Greene (1993a)].

Table A6.2 Maximum Likelihood Parameter Estimates [Equity (*K*) Only and Non-Performing Loans (*S*) Only][a,b]

Variables	Parameters	K only	S only
Intercept	α_0	1.498*** (.120)	1.427*** (.114)
$\ln Q_1$	α_1	.374*** (.052)	.379*** (.045)
$\ln Q_2$	α_2	.463*** (.046)	.471*** (.040)
$\ln P_1$	β_1	.149** (.052)	.073* (.047)
$\ln P_2$	β_2	.809*** (.057)	.879*** (.053)
$\ln Q_1 \ln Q_1$	δ_{11}	.155*** (.018)	.167*** (.015)
$\ln Q_2 \ln Q_2$	δ_{22}	.132*** (.021)	.132*** (.016)
$\ln Q_1 \ln Q_2$	δ_{12}	-.148*** (.016)	-.146 (.014)
$\ln P_1 \ln P_1$	γ_{11}	.183*** (.020)	.176*** (.020)
$\ln P_2 \ln P_2$	γ_{22}	.150*** (.029)	.138*** (.028)
$\ln P_1 \ln P_2$	γ_{12}	-.174*** (.022)	-.166*** (.022)
$\ln Q_1 \ln P_1$	ρ_{11}	.030* (.020)	.047** (.017)
$\ln Q_2 \ln P_1$	ρ_{21}	-.026 (.021)	-.005 (.018)
$\ln Q_1 \ln P_2$	ρ_{12}	-.046** (.020)	-.060*** (.017)
$\ln Q_2 \ln P_2$	ρ_{22}	.041** (.021)	.018 (.019)
$\cos(z_1)$	λ_1	-.090** (.042)	-.105** (.041)
$\sin(z_1)$	θ_1	.088** (.040)	.112** (.039)
$\cos(z_2)$	λ_2	.044* (.029)	.068** (.028)
$\sin(z_2)$	θ_2	-.196*** (.036)	-.173*** (.036)
$\cos(z_1+z_1)$	λ_{11}	-.085** (.031)	-.080** (.030)
$\sin(z_1+z_1)$	θ_{11}	-.029 (.034)	-.023 (.034)
$\cos(z_2+z_2)$	λ_{22}	.133** (.056)	.128** (.054)
$\sin(z_2+z_2)$	θ_{22}	.167** (.060)	.180** (.061)
$\cos(z_1+z_2)$	λ_{12}	-.042* (.029)	-.032 (.028)

Continued Overleaf

(continued)

Variables	Parameters	K only	S only
$\sin(z_1+z_2)$	θ_{12}	-.144*** (.034)	-.155*** (.034)
$\cos(z_1+z_1+z_2)$	λ_{112}	.033** (.016)	.024* (.016)
$\sin(z_1+z_1+z_2)$	θ_{112}	.111*** (.018)	.120*** (.018)
$\cos(z_1+z_2+z_2)$	λ_{122}	-.036** (.015)	-.023* (.015)
$\sin(z_1+z_2+z_2)$	θ_{122}	-.095*** (.018)	-.103*** (.018)
lnKlnK	τ_{KK}	-.031* (.024)	–
$\ln Q_1 \ln K$	α_{1K}	.020 (.016)	–
$\ln Q_2 \ln K$	α_{2K}	.002 (.018)	–
$\ln P_1 \ln K$	β_{1K}	.041** (.022)	–
$\ln P_2 \ln K$	β_{2K}	-.040** (.021)	–
lnSlnS	τ_{SS}	–	.005** (.002)
$\ln Q_1 \ln S$	α_{1S}	–	.012** (.004)
$\ln Q_2 \ln S$	α_{2S}	–	-.007* (.005)
$\ln P_1 \ln S$	β_{1S}	–	.035*** (.008)
$\ln P_2 \ln S$	β_{2S}	–	-.034*** (.007)
lnK	τ_K	.011 (.045)	–
lnS	τ_S	–	-.023* (.014)
sigma-squared	σ^2	.030*** (.002)	.025*** (.002)
gamma	γ	.931*** (.006)	.920*** (.009)
eta	η	.037*** (.010)	.063*** (.009)

*, **, *** means statistically significant at the 10%, 5% and .1% respectively.

[a] Asymptotic t-ratios distributed as N(0,1). Log-likelihood for noequity=2500.1; for nonpls=2530.3 LR test of the one-sided error for *S* only=1279.1; *K* only =1181. Estimates based on the Davidson-Fletcher-Powell algorithm using the FRONTIER 4.1 software [see Coelli (1996) and Coelli *et al.* (1998)].

[b] Model I = standard cost function estimates; Model II Cost function estimates with risk and output quality variables.