

**Bangor University**

## **DOCTOR OF PHILOSOPHY**

**Economies of scale, economies of scope and the cost implications of hypothetical bank mergers in European banking.**

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**ECONOMIES OF SCALE, ECONOMIES OF SCOPE AND THE  
COST IMPLICATIONS OF HYPOTHETICAL BANK MERGERS  
IN EUROPEAN BANKING**

**A THESIS  
SUBMITTED TO THE UNIVERSITY OF WALES  
IN FULFILMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF  
DOCTOR OF PHILOSOPHY**

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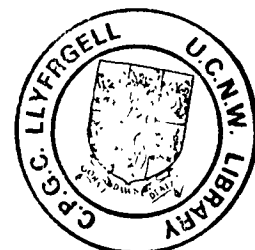
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## LIST OF ACRONYMS

AIC	Average Incremental Cost
ATC	Average Total Cost
ATM	Automated Teller Machine
BIS	Bank for International Settlements
CAD	Capital Adequacy Directive
CES	Constant Elasticity of Substitution
CD	Certificate of Deposits
CS	Consumer Surplus
DEA	Data Envelope Analysis
ECB	European Central Bank
EC	European Community
ECU	European Currency Unit
EEA	European Economic Area
EEC	European Economic Community
EFT	Electronic Funds Transfer
EFTPOS	Electronic Funds Transfer at the Point of Sale
EFTA	European Free Trade Association
EIB	European Investment Bank
EMI	European Monetary Institute
EMS	European Monetary System
EMU	European Monetary Union
EPSUB	Expansion Path Subadditivity
ERM	Exchange Rate Mechanism
ESCB	European System of Central Banks
ERM	Exchange Rate Mechanism
EU	European Union
FCA	Functional Cost Analysis
FDIC	Federal Deposit Insurance Corporation
GDP	Gross Domestic Product
GNP	Gross National Product
IBCA	International Bank Credit Analysis Ltd
IC	Incremental Cost
IEF	Institute of European Finance
IMF	International Monetary Fund
ISD	Investment Services Directive
LAC	Long-run Average Cost
LMC	Long-run Marginal Cost
MC	Marginal Cost
MES	Minimum Efficient Scale
METS	Minimum Efficient Technical Scale
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Squares
PSE	Partial Scale Economies
PSES	Product-specific Economies of Scale
RAC	Ray Average Cost
ROA	Return-on-Assets
ROE	Return-on-Equity

SAC	Short-run Average Cost
SC	Scope Economies
SE	Scale Economies
SEA	Single European Act
SEM	Single European Market
SMC	Short-run Marginal Cost
SMSA	Standard Metropolitan Statistical Area
SCP	Structure-Conduct-Performance
SUR	Seemingly Unrelated Regression
UCITs	Undertakings for Collective Investment in Transferable Securities
TC	Total Cost

## ABSTRACT

The purpose of this thesis has been to investigate evidence of economies of scale and scope in various European banking markets. The thesis has also examined the cost implications from hypothetical bank mergers both within the French, German, Italian and Spanish banking markets and cross-border in the EU. The analysis has been prompted by claims that substantial cost savings could be expected as the result of the EU's single market programme in the banking area. Economies of scale and scope, a substantial part of industrial organisations literature, have been widely examined in the US banking system, although little empirical work to date has been undertaken on European banking markets. This thesis aimed to rectify this imbalance in the literature by providing a detailed, in-depth and original analysis of scale and scope economies as well as investigating the cost implications of hypothetical bank mergers.

Overall, the results suggest noticeable differences in cost characteristics across European banking markets and strong evidence of economies of scale and scope at the plant (or branch) level in all but the Spanish market. Cost savings appear to occur mainly through the increased average size of established banks' branches rather than through adding new branches. The findings appear to indicate that scale and scope economies will be important in generating economic gains to EU banking markets under the Single Market programme.

The evidence from hypothetical mergers within the individual domestic banking markets appears to be that mergers between large banks can generate substantial cost savings or increases depending on the particular merger partners. In general, the results indicate that opportunities for cost saving mergers seem to be greater in Germany and Spain than in the French and Italian banking markets. The prospects for cost saving big-bank mergers in Italy, appear to be limited. The selective results for the hypothetical mergers between the 20 largest banks within domestic banking markets imply that substantial cost savings can be generated from mergers between top commercial banks in Germany. For the Italian banking market, the analyses shows that the majority of hypothetical mergers indicate an increase in predicted total costs. Moreover, the findings from Spain and France are less clear-cut.

The evidence from our analysis of hypothetical cross-border mergers in the EU indicates only limited opportunities for costs saving from big bank mergers and that such mergers are more likely to result in an increase in total costs.

# CHAPTER 1

## INTRODUCTION

### 1.1 Background to the Study

The Commission of the European Communities (1988) has stressed in its 1992 single market programme that substantial benefits would accrue to those sectors that can benefit from positive supply-side effects. In particular, "price reductions occasioned by competitive pressures will force firms to look actively for reduction in costs through the elimination of areas of low productivity or by a greater exploitation of scale economies" (European Economy 1988, p.162). This aforementioned study also concluded that important welfare gains could be attained by increases in competition which would accompany financial integration.

More recent studies, for example, Grilli (1989a) and (1989b), Neven (1990), Vives (1991) and Molyneux (1993) have suggested that unambiguous welfare gains may not necessarily result from the completion of the Single European financial services market. Important elements that impact on the effects of the single financial marketplace relate to competition, cost efficiency and changes in market structure.

Developments in the European financial services industry have been rapid and the level of competition has increased in recent years. New competitors have entered the industry as cross-border constraints have been abolished or decreased altogether and the demarcation lines between the various types of financial institutions (such as commercial banks, savings banks, finance companies and other non-bank intermediaries such as securities firms and insurance companies) have become increasingly blurred. Technological innovations have stimulated the deterioration of statutory and physical barriers between countries and sectors. The process of conglomeration (the merging of banks, securities firms and insurance companies into single institutions) has increased, posing new challenges, both for banks and regulatory authorities. To date, banking and other financial institutions in EU countries operate under conditions of freer price, than they did a few years ago. Product and territorial competition has also heightened as EU

countries domestic markets have been opened-up.

In the light of the aforementioned developments it is important to investigate scale and scope economies in European banking. Benston (1972) indicated that to examine the impact of deregulation on the financial industry, it is necessary to know the cost structure of the industry. Optimal firm size and product mix can be determined once the structure is known. In addition, for policy purposes, it is important to know how different types of banks will be affected by the increased competitive pressures associated with banks' expanded powers and foreign entry. Interest in the subject of scale and scope economies has been stimulated by the recent outbreak of mergers and proposals for mergers between banks in Europe. The case made for these mergers often rests heavily upon the presence (or assumed presence) of scale and scope economies. One reviewer of the British Monopolies Commission<sup>1</sup> reported that the proposed Barclays-Lloyds-Martins Bank merger went so far that "if economies of scale were the driving force then there would be a case for considering duopoly or even monopoly as a proper system of organisation" (Artis, 1968; p.135). In addition, it is also necessary for industry to estimate its own costs as the detection of marginal and average cost for each service could help management decision making.

Given the above factors and seeing that financial services market integration may lead to an increasingly competitive market outcome, with more cost efficient and larger banks, it is therefore of interest to investigate scale and scope economies in European banking.

## **1.2 Aims, Methodology and Structure Plan**

Despite the importance of economies of scope and scale, few studies have investigated cost characteristics in European banking and no studies, as far as we are aware, have provided cross-country comparisons. This thesis aims to redress this imbalance by using both the ordinary and hybrid translog cost function methodology to evaluate evidence

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<sup>1</sup>Monopolies Commission, Barclays Bank, Ltd., Lloyds Bank, Ltd., and Martins Bank, Ltd., A Report on the Proposed Merger (H.M.S.O., London 1968).



of scale and scope economies in four large EU banking markets: France, Germany, Italy and Spain. In addition, this thesis also examines the cost implications of hypothetical bank mergers within and across countries in the EU.

The present research seeks to establish whether banks in the EU have experienced economies of scale and scope in their operations, considering some of the current trends in markets and their significance in respect of bank expansion and cost structures. In particular, it will endeavour to answer the following questions:

1. Are there any economies or diseconomies of scale and scope in various European banking systems?
2. Do the structural features of the banking markets under study explain the evidence of cost economies?
3. Are there any cost synergies resulting from hypothetical big bank mergers within country?
4. Are there any cost synergies resulting from hypothetical big bank mergers cross-border within the EU?
5. Is there empirical evidence to support the view that there will be significant cost benefits resulting from the completion of the single European banking market?

This thesis is divided into ten chapters. Chapter 2 analyses the moves towards a single financial services market in the European Union. This chapter discusses the 1992 single market implications and regulatory environment in the European financial services industry. The chapter examines the economic aspects of a single market in financial services, and focuses on the findings of the Price Waterhouse (1988) study on EU financial sector integration after 1992. The Price Waterhouse (1988) study postulated that completion of the internal market would induce a series of integration effects which would promote the efficiency and competitiveness of European Union firms through two channels - namely through increased market size and heightened levels of competition.

The aforementioned study also noted that there would be lower costs resulting from economies of scale and learning, made possible by an associated larger volume of output and by restructuring processes. Hence, the Price Waterhouse methodology provides us with an important justification as to why it is useful to examine economies of scale and scope as well as the cost implications of hypothetical mergers in European banking markets.

Chapter 3 provides an analysis of current trends in European banking and financial systems. This chapter briefly analyses the main distinguishing characteristics of banking organisations, competition and structure in the European marketplace with particular attention to the four banking systems under study; France, Germany, Italy and Spain. The final part of the chapter focuses on mergers and acquisition as well as privatisation trends in European banking systems.

The following two chapters outline the theoretical background to economies of scale and scope studies and show how cost efficiency concepts are empirically evaluated. Chapter 4 provides the theoretical background to economies of scale and scope studies for financial institutions and Chapter 5 provides a literature review on the US and European empirical studies. In general, the majority of US studies on scale and scope economies tend to conclude that economies of scale do not appear for banks beyond \$100 million in deposits size. More recent studies, however, find that scale economies appear for much larger institutions. In addition, the results of the cost studies undertaken on European banking markets appear to suggest that economies of scale exist. There is, however, no consensus as to the level of output at which these economies are exhausted. The evidence of scope economies is more uncertain both in the US and European literature. Overall, the findings on economies of scale and scope in banking markets appear to show stronger empirical evidence for scale over scope economies.

Chapter 6 outlines the methodology this study adopts for evaluating economies of scale and scope in European banking. This study adopts the intermediation approach to calculate scale and scope economies in the French, German, Italian and Spanish banking markets using 1988 data. The ordinary translog and hybrid translog cost functions are

used to examine economies of scale and scope for banks with multiple inputs and outputs. Chapter 7 defines the variables which are used in the empirical analysis and Chapter 8 reports the results.

Overall, the results suggest noticeable differences in cost characteristics across European banking markets and strong evidence of economies of scale and scope at the plant (or branch) level in all but the Spanish market. Cost savings appear to occur mainly through the increased average size of established banks' branches rather than through adding new branches. The findings appear to indicate that scale and scope economies will be important in generating economic gains to EU banking markets under the Single Market programme. The cost advantages to be had through larger bank size (mainly by increasing the average size of established branches) could also further promote the consolidation trend leading to increased concentration in European banking markets.

Chapter 9 examines the evidence for evaluating cost efficiencies resulting from hypothetical bank mergers both within the French, German, Italian and Spanish banking markets and also across their national boundaries. The methodology for the within country mergers use the hybrid translog cost functions estimated in Chapter 8. For the hypothetical European cross border bank mergers a new cost function is estimated. The evidence from hypothetical mergers within the individual domestic banking markets appears to be that mergers between large banks can generate substantial cost savings or increases depending on the particular merger partners. In general, the results indicate that opportunities for cost saving mergers seem to be greater in Germany and Spain than in the French and Italian banking markets. The prospects for cost saving big-bank mergers in Italy, appear to be limited. In addition, the largest cost savings and cost increases result from hypothetical mergers (in most cases) between quite different banking organisations and such mergers may be unlikely in practice.

The selective results for the hypothetical mergers between the 20 largest banks within domestic banking markets imply that substantial cost savings can be generated from mergers between top commercial banks in Germany. For the Italian banking market, the analyses shows that the majority of hypothetical mergers indicate an increase in

predicted total costs. Moreover, the findings from Spain and France are less clear-cut. In Spain, cost savings appear to occur for hypothetical mergers between the largest and smallest banks from the top 20, that is say the 1st, 2nd, 3rd largest banks merging with, say the 18th, 19th or 20th largest. Finally, cost savings in France seem to result from hypothetical mergers between either the largest specialist institutions or second-tier medium-sized banks.

The analysis of hypothetical cross-border mergers between banks suggests only limited opportunities for cost savings from big bank mergers and that such mergers are more likely to result in increases in total costs. While there is a large variation in the simulated cost outcomes, the greatest opportunities for cost savings would appear to be generated by mergers between Italian and German banks. In contrast, mergers between French and German banks appear likely to result in substantial cost increases. The cost advantages brought about through hypothetical mergers cross-border do not appear to generate substantial benefits suggested by the EU in their study of the Single Market Programme.

Overall, these results indicate that mergers between large banks either within domestic banking markets or cross-border can create cost savings or cost increases depending on the merger partners chosen. The substantial variation of cost outcomes generated suggests that large banks seeking economies through domestic or cross-border mergers should select potential partners with great care.

Finally, Chapter 10 is the conclusion which also identifies limitations of this thesis and also tentatively suggests policy implications of the main findings.

## CHAPTER 2

### A SINGLE MARKET FOR FINANCIAL SERVICES IN THE EU

#### 2.1 Introduction

This chapter examines the moves towards a single financial services market in the EU. Section 2.2 briefly outlines the background to the single market in financial services and Section 2.3 notes the main barriers to the cross border provision of financial services which the EU legislation aims to abolish. Section 2.3 to 2.5 outlines the Single Market programme for banking services, securities business and insurance, respectively. Section 2.6 provides an overview of this legislation and concludes that its objective is to establish a single market for financial services by providing banks and other financial firms a 'single passport' to operate throughout the Union subject only, as a rule, to the supervision by the regulatory authority of their home member state. Section 2.7 is concerned with European Monetary Union (EMU) and its implications for the single financial services market. Section 2.8 examines the economic aspects of a single market in financial services, and focuses on the Price Waterhouse (1988) study on EU financial sector integration after 1992. Section 2.9 is concerned with the problems of creating the Single Market. Given differences in reserve requirements, tax treatments, cross-border payments systems and the flexibility to consolidate European Union law into national legislation it is shown that it is difficult to achieve a perfect single market in financial services. Finally, Section 2.10 is the conclusion.

#### 2.2 Background to the Single Market for Financial Services

The original Treaty of Rome establishing the European Union was signed in 1957. According to Article Two of the Treaty<sup>1</sup>:

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<sup>1</sup>Commission of the European Communities (1987), "*Treaties establishing the European Communities*" (abridged edition), Office for Official Publications of the European Communities, (Brussels:EU).

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.

Although the Treaty of Rome did not explicitly define the Common Market, its articles called for free internal trade, a common external tariff and free movement of services, people and goods within the European Economic Community. The signing of the Single European Act (SEA) in 1986 reaffirmed a solemn commitment to these original objectives of the Common Market by stating that an "internal market" was to be created by 1 January 1993, which would be, "an area without frontiers in which the free circulation of goods, services and capital is ensured in accordance with the provisions of this Treaty." (Servais, 1988 from Article 8a of the Treaty). The amendments to the Treaty of Rome enacted in the SEA were aimed principally at improving decision-making procedures within the Community and confirming in the Community's basic charter the underlying ideas of the White Paper (Servais, 1988). The preamble to the SEA spoke of a general commitment to a complete "European Union" (Note that from hereafter we will refer to the European Community as the European Union for ease of exposition and in line with the recent, late 1993, name change). However, the amendments to the Rome Treaty brought in by the SEA permitted, rather than required, the member states to further and establish a fuller economic and monetary union (see Holmes, 1992).

Over the last thirty years the European Union has adopted banking legislation aimed at harmonising regulations and fostering competition. In this regard, Baltensperger and Dermine (1990) identify three distinct regulatory time periods: (i) deregulation of entry to domestic markets from 1957 to 1973; (ii) attempts towards harmonisation of banking regulations, 1973-1983; and (iii) the recent European integration and "internal market" proposal of freedom of cross-border services, single banking license, home country control and mutual recognition.

Under the 1957 Rome Treaty, the internal market was viewed as one which allowed

"free movement of goods, people and services", and the aim was to transform segmented national markets into a common single market. In July 1965, the Commission proposed a Directive on Abolition of Restrictions on Freedom of Establishment and Freedom to Provide Services in Respect of Self-employed Activities of Banks and other Financial Institutions. This directive was adopted by the EU Council Ministers in 1973 and aimed to ensure the equal treatment of national and other firms of member states with regard to entry into domestic markets and the conditions under which banks are allowed to operate. Subsidiaries of non-member state banks were to be regarded as EU undertakings in every way. As Clarotti (1984) and Molyneux et al. (1994) noted, from 1973 onwards very little discrimination remained as to entry into member states although cross-border competition was still severely thwarted by capital restrictions. Moreover, there was no co-ordination of banking supervision, so banks operating in different member states were subject to different prudential requirements. This resulted in the second period of attempts to harmonise regulations.

Progress in harmonisations came in 1977 with the adoption of the First Directive on the Coordination Laws, Regulations and Administrative Provisions Relating to the Taking up and Pursuit of the Business of Credit Institutions (See Section 2.4). This directive established a definition of credit institutions and the principle of home country control, whereby supervision of credit institutions operating in several member states would be now the responsibility of the home country of the parent bank. A directive on the Supervision of Credit Institutions on a Consolidated Basis, was adopted in 1983, along with two other directives on a Uniform Format for Bank Accounts and on Consumer Protection in 1986. Baltensperger and Dermine (1990) indicate that, despite this legislation, European financial markets were still far from full integration. A bank wishing to operate in another member state still had to be authorised by the supervisors of the other member state. It remained subject to supervision by the host country and its range of activities may be constrained by host country laws. Moreover, most countries' bank branches had to be provided with earmarked endowment capital as if they were new banks. Finally, the supply of cross-border services was severely impaired by the restrictions on capital flows.

The difficulty encountered by full harmonisation of national regulations induced a new

approach towards European integration. In 1983 a draft Policy Paper on financial integration uttered clearly a renewed commitment to the Treaty of Rome and in 1985 the EU Commission<sup>2</sup> proposed through a White Paper, to establish guidelines for a single banking licence, home country control and mutual recognition. These principles were incorporated in 1988 proposals for a Second Banking Co-ordination Directive (89/646/EEC), which was adopted by the EU Council of Ministers in 1989. It set out to eliminate the remaining intra-EU barriers to freedom of establishment in the financial sector and provided for full freedom of financial services across intra European Union borders. The main objective of this legislation was to harmonise laws and rules for credit institutions so that they could establish and operate freely across the Union, subject to adequate supervision. In order to achieve this end the directive provided for minimum capital requirements, the monitoring and vetting of bodies that had substantial bank shareholdings, controls over banks' long-term participation in non-financial companies, and the establishment of a single banking licence to permit banking activity anywhere within the Union.

The principle of the single banking licence was of especial importance. Once a credit institution is authorised by its home supervisor it will have a licence to undertake business throughout the Union as long as there is prior harmonisation of essential supervisory rules (mutual recognition). A necessary reinforcing feature of the Second Banking Directive is the associated supervisory arrangements. The Own Funds Directive (1988) was formally passed by the EU Council Ministers in 1989, along with the Solvency Ratio Directive. Other directives harmonising regulations on accounting for foreign branches, reorganisation and winding-up procedures, and deposit insurance have also been adopted by the Commission. All the above legislation had been passed at EU level in time for the introduction of the single financial market from 1 January 1993.

The completion of the European-wide frontier-free market on 1 January 1993 and the improvements in its operation envisaged by the strategic programme will according to

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<sup>2</sup>See Commission of the European Communities, (1985), "Completing the internal Market: White paper from the Commission to the European Council", Document, (Luxembourg: Office for Official Publications of the European Communities).



the European Commission allow banks to benefit from economies of scale and scope, reduce their administrative and financial costs, have easier and more competitive access to private-sector and public-sector procurement, and cooperate more efficiently with one another (see Commission of the European Communities, 1993; p.57).

### **2.3 Barriers to Integration in Financial Markets**

The Single Financial Market implies both freedom to trade and freedom of location for firms in EU member countries. There should appear to be no government regulations obstructing neutrality between buying financial products and services from domestic institutions, foreign institutions located in the consumer's country, or on a cross-border basis. However, in reality there have always been economic and market barriers that exist which may have a significant impact on the integration of EU financial markets. Llewellyn (1992) has identified five main elements to a single market in financial services: (i) the freedom to locate anywhere in the market area whether by branches or incorporated subsidiaries; (ii) freedom to supply services anywhere in the market without the necessity of specific authorization; (iii) freedom of consumers to buy financial services from anywhere in the market and from any nationality of suppliers; (iv) the absence of exchange controls limiting the free movement of capital; and (v) a single securities market in that investors could issue and trade securities across national frontiers freely and without imposed hindrances.

Price Waterhouse (1988) have comprehensively investigated the barriers to cross-border provision of financial services in the European Union<sup>3</sup> prior to the implementation of the EU 1992 legislation. These findings are shown in Table 2.1 for banking, insurance and securities business respectively.

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<sup>3</sup>The study carried out by Price Waterhouse for the EU focused on eight member states namely Belgium, France, Italy, Luxembourg, Netherlands, Spain, United Kingdom and West Germany.

Table 2.1 Barriers to integration in financial markets

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<p><i>Barriers to establishment in banking</i></p> <ol style="list-style-type: none"><li>1. Restrictions on the legal form banks may adopt.</li><li>2. Limitations on the number of branches that may be established.</li><li>3. Restrictions on the takeover of domestic banks.</li><li>4. Restrictions of equity or other control of domestic banks.</li></ol> <p><i>Barriers to operating conditions in banking</i></p> <ol style="list-style-type: none"><li>1. The need to maintain separate capital funds.</li><li>2. Differences in the definition of "own capital" funds.</li><li>3. The need to maintain certain capital-asset ratios.</li><li>4. Exchange controls.</li></ol> <p><i>Barriers to competing for business in banking</i></p> <ol style="list-style-type: none"><li>1. Limitations on services offered.</li><li>2. Restrictions on local retail banking.</li><li>3. Restrictions on acquisition of securities and other assets.</li></ol>
<hr/> <p><i>Barriers to establishment in insurance</i></p> <ol style="list-style-type: none"><li>1. Lack of harmonisation of licensing procedures.</li><li>2. Lack of harmonisation in the constitution of technical reserves.</li></ol> <p><i>Barriers to operating conditions and competing for business in insurance</i></p> <ol style="list-style-type: none"><li>1. Direct insurance: restrictions on the placement of contracts with non established insurers.</li><li>2. Co-insurance: establishment of a permanent presence imposed on lead-insurers.</li><li>3. Custom and practice n government procurement policies.</li><li>4. Lack of harmonisation in the supervision of insurance concerns.</li><li>5. Re-insurance: compulsory or voluntary cessation of a percentage of contracts to a central pool or prescribed establishment.</li><li>6. Lack of harmonisation in the fiscal treatment of insurance contracts and premiums.</li></ol>
<hr/> <p><i>Barriers to establishment in securities</i></p> <ol style="list-style-type: none"><li>1. Membership of some stock exchanges limited to national citizens.</li><li>2. Constraints on the establishment of offices of solicit and carry out business in secondary markets.</li><li>3. Restrictions on the takeover of or equity participation in domestic institutions.</li><li>4. Limitations on the establishment of securities firms in a universal banking system.</li></ol> <p><i>Barriers operating conditions in securities</i></p> <ol style="list-style-type: none"><li>1. Exchange controls and other equivalent measures which prevent or limit the purchase of foreign securities.</li><li>2. Conflicting national prudential requirements for investors protection.</li><li>3. Discriminatory taxes on the purchase of foreign securities.</li></ol> <p><i>Barriers to competing for business in securities</i></p> <ol style="list-style-type: none"><li>1. Limited access to primary markets in terms of lead management of domestic issues.</li><li>2. Restricted access to secondary markets because of national stockbroker monopolies on some stock exchanges.</li><li>3. Restrictions on dealing with investing public.</li></ol>

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Source: Price Waterhouse, (1988), "The 'cost of non-Europe' in financial services, Research on the 'cost of non-Europe', Basic Findings, vol.9, (Brussels, EU), p. 62.

### **2.3.1 Barriers to the Cross-Border Provision of Banking Services**

In reviewing the legal and regulatory barriers to a non-domestic bank establishing in an EU member state, the general picture was that there was little by way of overt discrimination against non-domestic entities in the Union. However, the First Banking Co-ordination Directive provided a right of entry and establishment within the EU to credit institutions which had their head office in a member state. Non-national entities basically had to go through the same sort of procedure as domestic entities in order to establish a banking operation. Moreover, obtaining authorization for other than a representative office could be time consuming and costly in administrative terms. The Price Waterhouse (1988) report found that:

- All banking establishments had to conform to the prescribed legal forms of the country in which business was set up. These could vary from state to state.
- With the temporary exception of Spain, the entry and establishment rules for foreign banks were essentially the same as for domestic institutions.
- There were few problems in establishing representative offices; prior authorization was only required in some countries.
- There were licensing or prior authorization requirements for all EU banking countries wishing to establish branches within other member states.
- With the exception of the UK, all branches had to maintain their own minimum endowment capital; the definition of which would vary from state to state. This seemed to provide possibly one of the major obstacles to trade.
- Some countries required "comfort" letters. Such letters were essentially guarantees of support from the appropriate supervisory authority or parent institution and were not generally seen to be an onerous obligation. Yet, in Italy, a branch's operational activities were shortened if such a letter was not provided.

- There were no specific restrictions on the employment of foreign or EU nationals or special discriminatory rules in terms of professional qualifications or degrees of competence and management experience.
- Once certain conditions were met in relation to minimum capital requirements and the competence of personnel, there would appear to be no other obstacles to establishing subsidiaries other than in Spain and Italy.
- In Italy, France and Spain there were restrictions on foreign acquisitions or participation in indigenous banks; and in all EU states some prior authorization was required from the appropriate supervisory authority.
- With the exception of Spain and Italy, it would seem there was little in the way of significant, openly discriminatory rules on the extent and range of services that could be provided. It appeared to be the custom, however, that domestic banks lead-manage domestic bond issues in most of these countries.

Overall, it appeared that the barriers to trade in banking services lay not so much in overt, discriminatory rules and regulations, but rather in national practices that applied equally to both domestic and foreign- controlled banks. Differences in licensing, minimum capital requirements and other territorial restrictions could just make some member states less attractive than other's for foreign bankers.

### **2.3.2 Barriers to the Cross-Border Provision of Securities Services**

The Price Waterhouse (1988) study also identified the barriers to establishment and operation by foreign entities in securities markets within the EU. Since banks tend to dominate these markets (especially in the universal banking countries), many of the obstacles of establishment were included in the former section on banking. However, some of the main conclusions were as follows:

- The vital obstacle to establishing a presence in a foreign securities market appeared to be regulations banning foreigners from being licensed as brokers.

- Difficulties were encountered by non-banking firms which wished to establish themselves in a universal banking environment - as exists, for instance, in Germany or Belgium - where a full banking licence would not be granted to an institution that did not offer a full range of banking services. Countries were, however, adapting and beginning to offer more limited licences for trading in securities only.
- There were restrictions on the establishment of offices either to solicit secondary market business from individual or institutional investors, or to disseminate information about possible investments. Moreover, barriers were placed in the way of dealing directly with the public executing such orders.
- Regarding primary operations, discriminatory restrictions on the lead management of domestic issues existed in some states.
- In addition to exchange controls, there were other measures which, while not directly prohibiting operations in foreign securities, were designed to prevent or limit their purchase. In Spain, for instance, banks, insurance companies and collective investment companies were limited in the amount of foreign securities that might be held in their portfolios.
- A small number of member states imposed discriminatory taxes on the purchases of foreign securities. While these taxes did not in most cases discriminate against foreign entities, the increased cost of undertaking business could act as a disincentive for trading securities in a particular market.
- National prudential requirements were deemed to be a problem in relation to collective investment. Hence, in Germany, many foreign applicants reported difficulty in meeting local requirements. This was not seen to be discriminatory, but lack of harmonisation of rules on collective investments could make some European markets less attractive than others

### **2.3.3 Barriers to the Cross-Border Provision of Insurance Services**

Insurance appeared to be similar to the banking sector in that established foreign and domestic insurers were treated in a homogeneous manner, with there being little in the way of open discrimination. Lack of harmonisation of national laws and regulations appeared to present the major barrier to free trade, as it tended to make some member states inherently less financially attractive than others in terms of open competition. In addition, an area of major concern appeared to be the lack of harmonisation in the financial treatment of insurance contracts and premiums. The European Court of Justice at the time also noted concern about the discrimination exercised by some member states against non-established direct and co-insurers.

### **2.4 The Internal Market Programme for Banking Services**

The above gives us a broad indication of the barriers to the cross-border provision of financial services within the EU in the mid 1980s. The following aims to provide an overview of the EU legislation that has eliminated or lessened some of these obstacles and led to the introduction of the Single Financial Market from 1 January 1993 onwards.

As we know, the legislation that forms the cornerstone of the European Union's plan for the Single Banking Market came into effect on 1 January 1993. A critical aim of this legislation was to create the largest and most open banking market in the world with institutions competing on a so-called 'level playing field'. This means that minimum regulatory standards would be implemented so as to confer no competitive advantage for any domestic banks over foreign competitors within the EU. The following sections investigate these issues in more detail.

#### **2.4.1 The First Banking Directive**

The idea of the establishment of the integrated European financial market was one of the main objectives of the Treaty of Rome. Article 67 of the Treaty called for the abolition of the restriction on the movement of capital as well as the abolition of any

discrimination which depended upon the residence of the investor. However, despite the fact that the financial services industry is of substantial importance to the EU economy, (accounting for 3 per cent of the total employment and for 6.7 per cent of its total GDP (see Cecchini, 1988) in 1985), the unified European financial market was delayed for almost thirty years.

Before the 1985 EU White Paper the legal progress toward integrated financial markets was very limited. The Freedom of Establishment Directive (73/183/EEC) permitted equal treatment of home country financial firms and subsidiaries of firms from other member states on the part of national authorities. Moreover, subsidiaries of firms set up in Member States were to be considered in all respects as EU undertakings. The First Banking Coordination Directive was adopted by the Council in 1977 (77/80/EEC). The Directive established the ground rules for dealing with bank authorization and supervision. It detailed the minimum legal requirements banks had to meet in order to be authorised in other member states: such as to have adequate capital (not specified in the directive) and to be directed by at least two people of good repute and experience. If the bank met these requirements, the basic right to set up branches in other European Union member states was established. Branches, however, also needed to be established in accordance with host country regulations. Dixon (1991) argued that the First Banking Coordination Directive was an important first step, but the basic right of establishment did not create a free internal market. Vesala (1993) pointed out that host-country requirements for branch establishment after 1977 still translated into extra costs and time delays incurred by EU banks when they opened branches in other member states and thus sustained legal barriers to the free provision of banking services. These costs appeared to be burdensome if an institution operated in a number of European Union countries. For instance, foreign branches had to satisfy the prevailing domestic capital requirements and be supported by so called endowment capital rather than that by the capital of the main institution in all countries except in the UK. Home country's solvency requirements were placed on foreign branches, and the requirements varied markedly between the member states. Moreover, foreign bank branches were often limited, such as in Spain where the number of branches a foreign bank could open was three (See Canals, 1993; Bisigano, 1992). Furthermore, Baltensperger and Dermine (1990) also state that cross-border trade in banking services was substantially limited

by restrictions on capital flows.

While setting up ground rules, the First Bank Coordination Directive left much detail open to interpretation, and a more precise directive was obviously required for the freeing up of the cross-border provision of banking services. Before EU legislation and the 1992 bandwagon started rolling there was one other EU directive which concerned banking business. This was the 1983 Directive on Consolidated Supervision, which dealt with the supervision of consolidated accounts and the harmonisation of rules relating to annual accounts of banks. The directive extended the supervision of individual banks to banking groups, covering their domestics and foreign affiliates and their accumulated overall credit risk (European Documentation, 1989; p.27). However, this was restricted to important principals, leaving the member states free to decide whether this extended system of banking supervision should also encompass minority holdings in banks and holdings in credit institutions of a special nature, such as mortgage banks.

#### **2.4.2 The 1985 EU White Paper**

By far the most important progress towards the reducing of barriers to the cross-border provision of banking services was the 1985 Commission White Paper on the Completion of the Internal Market, drawn up Lord Cockfield at the request of the EU Council of Ministers. The White Paper contained a list of measures that had to be adopted before 1992 so that people, goods, capital and services could freely circulate in the European Union. It attempted to identify the measures to be taken to remove all physical, technical and tax barriers among the member states by the end of 1992, complete with a detailed timetable for adopting them. It also put forward over 300 legislative proposals required for their removal (see Commission of the European Communities, 1985, White Paper in Appendix of p.5-35; European Documentation, 1987, p.18).

Moreover, the White Paper also described what else remained to be undertaken in the field of capital movements and financial services in order to result in the Single European financial market and called for new and stricter criteria for application of the EU Treaty's safeguard clauses and closer monitoring of exchange controls. The main



proposals were classified into three broad groups: a) the removal of physical barriers; b) the removal of technical barriers; and c) the removal of fiscal barriers.

In terms of financial services, such as the free movement of financial products, the Commission planned a new policy. The exchange of financial products such as insurance policies, home-ownership savings contracts and consumer credit was to be organised by three important principles, namely: the minimum coordination of individual national rules, mutual recognition and home-country control. The Commission's approach was to produce legislation which guaranteed minimum standards in the areas of financial stability and prudential practice of financial institutions (see Palmer, 1989; Chapter 2, p.21-37). In addition, the White Paper stated that it would create an Union-wide market for investment, making finance available to business and industry from anywhere in the European Union. The objective was to provide greater competition on the basis of minimum guarantees of protection, with the prospect for individuals or industry being free to seek finance and financial services from any country within the Union.

The 1985 White Paper was the impetus for a significant amount of legislation which followed up until the 1992 watershed. Even though Pelkmans (1992) has recently noted that the original White Paper was not a good guide as many proposals have now been significantly altered, or more ambitious follow-up proposals have been made, it still provided the main force to the unity of new EU legislation which created a single market in banking services. It also lay at the core part of the project to give a new impetus to European integration.

### **2.4.3 The Second Banking Coordination Directive**

The Second Banking Coordination Directive (89/646/EEC) is the cornerstone of the Commission programme for a single market in banking. It was issued on 13 January 1988, and approved by the EU Council of Ministers on 18 December 1989 and came into effect on 1 January 1993.

By far the most important aspect of the Second Banking Directive was the provision for

a 'single passport' for banks and other financial firms to operate throughout the Union. This single passport allowed any banks which were authorised to act as such in a member state, to set up branches, or supply cross-border services, in other EU countries, without having to obtain further authorization from the host country. The list of services banks could engage in is provided in the Appendix to the Second Banking Directive, which is shown in Table 2.2. This confirms the "universal" banking model that the EU legislature had adopted. Llewellyn (1992) indicated that the list of activities shown in Table 2.2 was very broad covering the realities of the financial markets and the gradual breaking down of the traditional demarcation lines between commercial and investment banking. He also noted that the most important thing was that the list included all forms of securities transactions. This could have an important impact on those member states (such as in Italy, Spain, Greece, and Portugal) where various types of commercial banking and securities business have traditionally been separated.

Secondly, the Directive aimed to remove barriers to banking throughout the European Union by de-regulating the requirement for branches to maintain a minimum level of endowment capital. This was a wide-range obstacle to the free establishment of branches in various EU countries (Price Waterhouse, 1988; p.76).

Thirdly, in order to harmonise the financial system and increase competition, the Directive set out conditions for the free provision of banking services by adopting the White Paper's guidelines on mutual and home country control. According to Article 19 of the Directive, a bank wishing to establish a branch and sell services within the Union only need obtain permission from the regulatory authorities of its home country if it wishes to establish in another member country. Branches no longer need to hold endowment capital for business authorised within the European Union (Article 6 of Directive 89/646/EEC). Home country control implies that the EU member state that has granted the banking license (to a certain institution) also supervises its activities in the EU, wherever the institution operates. Put simply, the Second Banking Coordination Directive (89//646/EEC) implemented more fully the principle of home country control and introduced the single European banking passport. This Directive states that (see Official Journal of the European Communities, No L 386/1 30.12.89):

the approach that has been adopted is to achieve only the essential harmonization necessary and sufficient to secure the mutual recognition of authorization and of prudential supervision systems, making possible the granting of a single licence recognized throughout the Community and the application of the principle of home Member State prudential supervision;

Table 2.2 The list of services credit institutions one allowed to offer under the Second Banking Directive

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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: <ul style="list-style-type: none"><li>a. money market instruments</li><li>b. foreign exchange</li><li>c. financial futures and options</li><li>d. exchange and interest rate instruments</li><li>e. securities</li></ul>
8)	Participation in share issues and the provision of services related to such issues
9)	Money broking
10)	Portfolio management and advise
11)	Safekeeping of securities
12)	Credit reference services
13)	Safe custody services

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Source: Second Banking Coordination Directive, See Official Journal of the European Communities, No L 386/13, 30.12.89.

The banking authority of the home country will have responsibility for supervising the financial soundness of a bank and in particular its solvency including the application and monitoring of minimum standards of harmonisation, together with ensuring that there are good administrative, accounting and internal control mechanisms in place in foreign institutions' branches under their supervision. Overall, the Second Banking Directive provides for:

- a) the harmonisation of minimum capital standards for the authorization and continuation of banking business;

- b) supervisory control of major shareholders and banks participation in the non-banking sector;
- c) proper accounting and control mechanisms, and;
- d) standards on own funds, solvency ratios deposit protection legislation.

Finally, the Directive also allows for reciprocal access to the single market for banks from non-EU countries. Subsidiaries of non-EU country banks set up in the EU are considered to be European Union undertakings, and therefore, benefit from the Directive's provision for freedom of establishment and cross-border activities. The following two sections describe the important supporting directives to the Second Banking Directive.

#### **2.4.3.1 The Own Funds Directive**

The own Funds Directive (89/299/EEC) was issued by the Commission in September 1986 and was adopted on the 17 April 1989 (effective 1 January 1993). This directive defines what is meant by 'capital' for banks and is effectively the same as the Bank for International Settlements or 'Basle' requirements (Gardener, 1992).

The Directive includes various provisions outlining the items attributable to own funds, breaking own funds into two categories - original own funds and additional own funds of lesser status. Subject to a number of conditions put forward in the Directive, own-funds comprise paid-up capital reserves, revaluation reserves, funds for general banking risks, value adjustments, the commitments of the members of credit cooperatives, cumulative preferential shares and subordinated loan capital. Additional own funds must not exceed the amount of original own funds. (See Dixon, 1991) (Original own-funds are analogous to Tier 1 capital and additional own funds are analogous to Tier 2 capital in the Basle Regime).

#### **2.4.3.2 The Solvency Ratio Directive**

The Directive on Solvency Ratios (89/647/EEC) constrains the own funds of a credit institution to at least eight per cent of its risk-weighted assets (Article 10 of the

Directive 89/647/EEC in Commission of the European Communities, 1994; European Documentation, 1989, p.30). It is widely argued that the risk-adjusted approach to measuring banks' solvency is the most adequate and flexible one, since basic ratios do not distinguish between different degrees of risk (see Dixon, 1991; Gardener, 1992; Vesala, 1993). The capital adequacy requirements established by the Directive are in line with the Bank for International Settlements (BIS) proposals. For example, both regimes have similar categories of assets (four risk classifications) and identical weights associated with them; 0 per cent, 10 per cent, 20 per cent, 50 per cent, and 100 per cent respectively, (Dixon, 1991; p.71). The BIS Capital guidelines are, however, not legally enforceable as they are only recommendations for international banks. In contrast the EU's Second Banking Directive and attendant capital adequacy legislation is incorporated into EU and member country law and so is in fact legally enforceable.

### **2.4.3.3 Other Directives**

This section briefly focuses on other Council Directives which are important to the introduction of the single market for financial services sectors. These are as follows:

*The Money Laundering Directive.* Council Directive 91/308/EEC on the prevention of use of the financial system for the purpose of money laundering was adopted by the Council in June, 1991 and came into force on 1 January 1993 (*Official Journal of the European Communities*, No. L 166/77 28.6.91). The Directive was designed to prevent the Community financial area from being used for laundering the proceeds from criminal activities. Money laundering means the international handling of property knowing it to come from the commission of serious crime (in particular drug-related offenses, organised crime and terrorism). The offence also extends to the concealment or aiding and abetting of money laundering (*Official Journal of the European Communities*, No. L 166/77 28.6.91).

The Directive covers both credit and financial institutions, including life assurance companies. In brief, EU banks and financial institutions will be obliged to provide for a series of measures, such as the identification of customers and beneficial owners, the retention of documentary evidence and records of transactions, the disclosure to the

competent authorities of transactions suspected of involving money laundering and the obligation on the institutions concerned to introduce staff training programmes and internal control procedures (see Bull.EC, 6-1991). The Directive provides for a contact committee to be established. This committee would have the task contributing to the harmonised implementation of the Directive through regular consultations between representatives of the Member States and the Commission. It would also investigate the desirability of drawing up a list of professions and categories of enterprises whose activities could be used for money laundering purposes (Official Journal of the European Communities, No. L 166/79 28.6.91).

*The Large Exposures Directive.* Council Directive 92/121/EEC on monitoring and controlling large exposures of credit institutions was adopted by the Council on 21 December 1992 and will come into force by 1 January 1994 (Official Journal of the European Communities, No. L 29/1 5.2.93). The Directive is aimed at increasing the spread of risks incurred by banks in order to prevent default by one client from jeopardising the existence of such an institution (and having repercussions on the financial system in general). The Directive provides in particular for the large exposures of banks to be limited to 40 per cent of own funds during a transitional period and to 25 per cent thereafter, for large exposures to be reported to authorities as soon as they reach 10 percent of own funds, and for the combined total of such exposures to be limited to 800 per cent of own funds (See Official Journal of the European Communities, No. L 29/4 5.2.93).

*The Deposit-Guarantee Schemes.* The harmonisation of the deposit-guarantee schemes within the EU was not in effect from 1 January 1993. The Commission at the end of 1986 noted that it would be appropriate for the credit institutions of all member states to participate in a deposit guarantee scheme<sup>4</sup>. Deposit-guarantee schemes are intended to protect the interest of mainly retail depositors of an insolvent financial institution which faces financial difficulties and thus aims to guarantee the stability of the banking system as a whole. Under these schemes, the depositors are guaranteed compensation

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<sup>4</sup>Commission Recommendation of December 22, 1986 concerning the introduction of deposit-guarantee schemes in the Community (87/63/EEC).

or protection against losses. The draft directive on Deposit Guarantee schemes stated that Portugal and Greece must establish a guarantee scheme, and Spain, Belgium, Luxembourg, and Ireland increase the coverage up to the standard (ECU 20,000). France, the United Kingdom, Ireland and Belgium need to extend the protection to foreign exchange deposits. The organisation of deposit insurance schemes may differ among EU countries. For example, currently in Belgium, France, Germany and Italy deposit insurance schemes are privately organised by bankers' associations, while in the UK and Spain deposit insurance is administered by the Central Bank.

The Proposal for a Council Directive on deposit-guarantee schemes (93/C 178/14), adopted by the Commission on 7 June 1993, involves the fixing of the minimum guarantee amount at ECU 20000 and the recognition of certain alternative guarantee schemes, such as those introduced by credit cooperatives and savings banks in some countries, as being equivalent to traditional deposit-guarantee schemes (see Bull.EC, 6-1993).

## **2.5 The Single European Market programme for Securities and Insurance services**

### **2.5.1 Securities Legislation**

A Single European Financial Market without restrictions requires a single securities market where investors may issue and trade securities within the EU freely and without hindrance. Since 1979 the Commission has issued a series of important Directives in order to achieve the operation of a single securities market. The first step was the adoption on 5 March 1979 of a Directive (79/279/EEC) coordinating the conditions for the admission of securities to official stock-exchange listings. The Directive established the conditions that must be met by issuers of securities, including the minimum issue price, the company's period of existence, free negotiability, sufficient distribution and the provision of appropriate information for investors. The Council adopted another Directive, which is closely connected to the former, on 17 March 1980 (80/390/EEC) coordinating the requirements for the drawing up, scrutiny and distribution of the listing particulars to be published for the admission of securities to official stock-exchange listings (European Documentation, 1989).

The third step in 1982 was the Council Resolution on the Directive (82/121/EEC) on information to be published on a regular basis by companies whose shares were admitted to official stock-exchanges. According to this Directive companies listed on a stock-exchange must publish half-yearly reports on their activities and profits and losses.

By far the most important Directive aimed at creating an integrated European securities market, however, was taken by the Council on 18 November 1985 when it passed the Directive on the free marketing of units issued by investment funds (undertakings for collective investment in transferable securities) (see Vesala, 1993 in Section 1.2.4). This Directive introduced for the first time in the securities sector the 'new approach' (See European Documentation, 1989; p.40) which was called for in the 1985 White Paper on completing the internal market. The principles of mutual recognition and home country control were incorporated in this EU legislation to the structure of investment funds and their investment policy. Furthermore, the Council set out a Directive of 22 June 1987 (87/345/EEC) amending Directive 80/390/EEC coordinating the requirements for the drawing up, scrutiny and distribution of the listing particulars to be published for the admission of securities to official stock-exchanges. The goal of the Directive was to ensure that listing particulars complied in accordance with earlier Directives and approved in one Member State were automatically recognised on the stock exchanges of other EU members.

In this Directive an investment firm was described as 'any natural or legal person' whose business was related in one or more listed activities. These listed activities defined market-making, brokerage, underwriting, portfolio management, and providing investment advice, in connection with a range of financial instruments: transferable securities, money market instruments (including certificates of deposits and Eurocommercial paper), financial futures and options, and exchange and interest rate instruments.

The Commission took two further steps towards greater transparency and to complete the programme for the creation of a single European securities market. The first Directive (87/345/EEC) related to the information to be published when a major holding



in a listed company was acquired or disposed of. The goal of the Directive was to ensure that investors and the public were informed of major shareholdings, changes in holdings above or below certain ranges and changes in voting rights for listed companies in the EU. The requirements applied when a holding reached 10 per cent, 20 per cent, 1/3, and 50 per cent and 2/3 respectively. The EU may apply a single threshold of 25 per cent in place of the 20 per cent and 1/3 thresholds, and 75 per cent in place of the 2/3 threshold (European Documentation, 1989, p.41). The second step was that the Community established a Directive on 17 April 1989 (89/298/EEC) coordinating the requirements for the drawing up, scrutiny and distribution of the prospectus to be published when transferable securities were marketed to the public. This Directive was an important supplement to the above 1982 and 1987 Directives on transparency and investor protection in the securities markets.

The above directives aim to give an opportunity to investment companies to provide cross-border services on the same basis that the Second Banking Directive allows banks to operate in different EU countries. Barriers to the cross-border provision of investment services, however, have not been fully removed by the above Directives, and the EU aims to introduce two significant pieces of legislation - the EU's Investment Services Directive and its attendant Capital Adequacy Directive by the beginning of 1996. This will create a single investment licence for EU investment firms and will, it is hoped, do for the investment industry what the Second Banking Directive has done for the EU's banking sector.

#### **2.5.1.1 EU Investment Services Legislation**

The Investment Services Directive (ISD) and its attendant Capital Adequacy Directive (CAD) will come into effect on 1 January 1996 and it rests with the parliaments of EU member states to incorporate the directives into national laws by that date.

On 29 June 1992 both the ISD and CAD were agreed by the EU Council of Finance Ministers (Bull.EC, 6-1992; p.37). The aim of this legislation is to help establish freedom to provide services for investment firms by creating a single licence (the "European passport") on the basis of mutual recognition and home country control.

After achieving the European passport, an investment firm could carry out its activities throughout the European Union. Moreover, the aim of the CAD was to establish equivalent capital requirements for non-bank investment operators as those laid down in the Own Funds Directive for banks (89/299/EEC). Both the CAD and the ISD were scheduled to come into force by 1 January 1993, but this has not happened. Areas of disagreement on the ISD among Member States related to three main issues:

1. *Concentration.* Member States comprising, France, Italy, Spain, Portugal, Greece and Belgium (the so-called Club-Med group) wished, on the grounds of investor protection, that trading in all forms of equities and bonds should be conducted on a regulated market, whenever a trade involves an investor who is a resident of that particular Member State and relates to securities which are listed on a regulated market in that Member State. If the Concentration requirement were to be enforced by the Directive, this would have important implications for banks, since it is a non-regulated market on which many securities listed on the regulated markets of other Member States are traded. Opposition to the concentration view came from the UK, Germany, Ireland, Luxembourg and the Netherlands (or "Alliance" group) who argued that the concentration requirement was disproportionate to the stated goal of investor protection and would involve unacceptable limitations on the current flexible operations of unregulated (such as OTC) international securities markets (Financial Industry Monitor, 1993; Issue. 82).
2. *Reporting and publication issue.* The Club-Med group also insisted that all trades, both on regulated and unregulated markets, should be the subject of extensive reporting requirements. They also insisted on "immediate" publication of all trades (at least for the trades executed on the market). This latter requirement was vigorously opposed, especially by the UK authorities, who argued that it could restrict the proper functioning of markets.
3. *Direct bank access to stock exchanges.* Here the Club-Med group insisted the Member States should be allowed to require banks to incorporate separate subsidiaries in order to access local stock markets.

At the Council Ministers meeting on 29 June 1992, some of the above points which had delayed constructive discussion of the ISD were agreed upon. With regard to the concentration issue, various "opt-out" clauses were made, which means that if the ISD becomes law in 1995 there may be requirements for certain financial instruments to be traded on regulated markets, but that these requirements are not compulsory (Financial Industry Monitor, 1993; Issue. 82). The June agreement also calls for transitional provisions which allow member states to maintain their present regimes in relation to the direct access of banks to stock exchanges, at least until 1996 (Greece and Spain have derogations until 1999) (Bull.EC, 6-1992). It is, however, quite likely that these provisions may be extended and the whole area reviewed again in 1999.

Moreover, Council Directive 93/22/EEC on investment services in securities field adopted by the Council on 10 May 1993 (Bull.EC, 5-1993), complements that on the capital adequacy of investment firms and credit institutions, and authorises an investment firm in any Member State to conduct its activities throughout the Community on the basis of a single authorization ("European passport") issued by the home Member State. The Capital Adequacy Directive<sup>5</sup> (effective January 1996) applies risk-based capital requirements to (non-bank) investment firms and also introduces consolidated supervision for (non-bank) investment firms. Various Banking Directives will be modified so that banks have to carry capital on their 'trading book' calculated in the same manner as securities firms. (In other words, position and counter-party risk positions will need to be evaluated instead of the usual credit based bank evaluations.) This Directive will also bring in own funds requirements for securities firms similar to those for banks. In general the definitions of capital for banks and investment firms will be lined up with both types of firms being given the opportunity to gear up their regulatory capital to support trading positions. Combined with ISD this legislation harmonises the conditions governing authorization and business activity and will establish uniform rules for prudential supervision by the authorities of the home Member States in the investment services industry. Upon full implementation of the relevant banking and investment directives, both credit institutions and investment firms

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<sup>5</sup>Council Directive on Capital Adequacy of Investment Firms and Credit Institutions 93/6/EEC, (OJ 1993 L 141), 11/6/93.

will be able to carry out the whole gamut of investment business in capital markets which mutually recognises listing particulars and prospectuses, and which has an all-encompassing set of minimum standard harmonising rules relating to the running and regulation of investments firms and markets. The main objective is ultimately for the free flow of capital throughout the EU which should eventually lead towards a single integrated European capital market, rather than back to the traditional fragmented collection of separate national markets. As a result, investors doing business within Europe should have fewer obstacles to trade and this should lead eventually to a more competitive and efficient investment industry.

### **2.5.1.2 Proposed UCITs Directive**

On 9 February 1993 the European Commission submitted to the Council a proposal for a Directive to extend the scope of the 1985 Directive on undertakings for collective investment in transferable securities (UCITs) to money market funds and funds of funds (Bull.EC, 1/2-1993). The submission proposes that Member States amend their legislation and bring in the laws, regulations and administrative provisions necessary to comply with this Directive by 1 July 1994 at the latest (see Official Journal of the European Communities, No C 59/18, 2.3.93). The EFTA countries joining EU must set up necessary national legal basis for bringing the Directive on UCITs into force simultaneously with the EU Agreement (see Vesala, 1993; p.42). This could provide financial institutions with the opportunity to provide new fund management products in this area from mid-1994 onwards out of any EU centre.

In addition to this major amendment to the 1985 UCITs Directive, other amendments include issues relating to: depositaries (relating to the establishment and management of unit and investment trusts), the use of derivatives, risk spreading and technical consequences of including money market instruments and funds of funds. The proposal relating to derivatives should be of interest to financial institutions as it will enable them to create new investment products. The proposal states that UCITs will be allowed to invest in "financial derivative instruments provided that the exposures relating to these instruments are covered in the sense that UCITs must hold assets which may reasonably be expected to fulfil actual or potential obligations which exist or may arise as a result

of the derivatives themselves" (see Official Journal of the European Communities, No C 59/16, 2.3.93).

### **2.5.2 A Note on The Liberalization of Insurance Services**

Like the banking industry, as of the Treaty of Rome the European Union has also made noticeable movements to achieve the freedom to provide services in the field of insurance. Increasing regulation of the sector during the 1960s and 1970s had made it more difficult for insurance companies to operate throughout the EU and the number of foreign insurance firms operating cross-border in Europe has decreased significantly over the past 25 years (See Quelch and Hibbard, 1991, Chapter 4).

However, there has been a significant delay in harmonising EU insurance legislation because the Member States' have widely differing arrangements for insurance operations, supervision and consumer protection rules. In this sector, the liberalisation really began when the European Court of Justice delivered a significant judgment on 4 December 1986 (see European Documentation, 1989; p.33).

The European Court of Justice's judgment brought about a new momentum to the waning effort to achieve a free European insurance market. In response to the Commission's legal action against four Member States (Denmark, France, Germany and Ireland), the judges stated that the restrictions placed by these Member States on the authorization of insurance companies from other EU countries were in part illegal but also in part justified (European Documentation, 1989; p.35). This stimulated the way for further progress towards a deregulated insurance market.

The Council of Ministers issued the Second Council Directive (88/357/EEC) in June 1988 on the coordination of laws, regulations and administrative provisions relating to direct insurance other than life insurance (see Official Journal of the European Communities, No L 228/1, 11.8.92). This Directive introduced a single licensing system under which an insurance company with its head office in a Member State could establish branches across EU borders without being subject to authorization procedures in those countries. Non-life insurance Policy-holders would have access to the whole

range of products on offer in the European Union. According to the Directive (Article 57), the Member States had to adopt the laws, regulations and administrative provisions necessary for their compliance with this Directive before 1 January 1994 and bring them into force no later than 1 July 1994 (see Official Journal of the European Communities, No L 228/23, 11.8.92). The Directive also provides for the coordination of financial rules, i.e. in particular the rules governing the categories, diversification and localisation of assets used to cover technical provisions, required as a basis for the introduction of the single licensing system. There are also provisions relating to the law applicable to insurance contracts (see Bull.EC, 6-1992).

## 2.6 Overview of EU Financial Services Legislation

The EU's critical date of 1 January 1993 has passed and various important banking directives have come into force. Banks and financial institutions within the EU can now begin to see the framework which is to be applied and can consider their strategies. In brief, we have seen that there are eight main directives which will have a significant impact on the banking industry:

- *The Second Banking Coordination Directive*<sup>6</sup> (effective 1 January 1993). This directive, in conjunction with the Own Funds and Solvency Ratio Directives, gives EU incorporated banks the right to branch into, or provide services into, any other EU country.
- *The Own Funds Directive*<sup>7</sup> (effective 1 January 1993). This defines what is meant by 'capital' for banks and is effectively the same as the BIS requirements.

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<sup>6</sup>Second Council Directive 89/646/EEC of 15 December 1989 on the Coordination 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 1989 L 386/1).

<sup>7</sup>Council Directive on the Own Funds of Credit Institutions, 89/299/EEC and Council Directive 91/633/EEC of 3 December 1991 on Implementing Directive 89/299/EEC on the Own Funds of Credit Institutions.

- *The Solvency Ratio Directive*<sup>8</sup> (effective 1 January 1993). This establishes the amount of capital banks need to hold for regulatory purposes (related to their weighted risk assets similar to BIS methods).
- *The Consolidated Supervision Directive*<sup>9</sup> (effective 1 January 1993). This requires supervisors to look at banking groups on a consolidated basis, rather than only undertaking solo supervision.
- *The Money Laundering Directive*<sup>10</sup> (effective 1 January 1993). This imposes certain obligations on credit and financial institutions designed to prevent money laundering. (Money laundering means the international handling of property knowing it to come from the commission of serious crime, principally drug-related offenses, organised crime and terrorism).
- *The Large Exposures Directive*<sup>11</sup> (effective 1 January 1994). This places limits on the exposures to individual companies or groups which banks can take on (generally 25 per cent of capital).
- *The Deposit-guarantee Schemes*<sup>12</sup> (effective 1 January 1993). This proposes a Council Directive on minimum standards for deposit-guarantee schemes which would protect depositors in the event of bank failure.

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<sup>8</sup>Council Directive on a Solvency Ratio for Credit Institutions, 89/647/EEC.

<sup>9</sup>Council Directive 92/30/EEC of 6 April 1992 on the Supervision of Credit Institutions on a Consolidated Basis.

<sup>10</sup>Council Directive (91/308/EEC) on prevention of the use of the financial system for the purpose of money laundering adopted by the Council on 10 June, 1991 (OJ L166, 28/6/91).

<sup>11</sup>The Directive 92/121/EEC of 21 December 1992 on Monitoring and Controlling the Large Exposures of Credit Institutions.

<sup>12</sup>Amended Proposal for a Council Directive on Deposit-guarantee Schemes, 93/C 178/14, 7 June 1993.

- *The Investment Services Directive*<sup>13</sup> (effective January 1996). This is intended to give the same passport to (EU incorporated) non-bank investment service firms as the Second Banking Directive. It will become operational in conjunction with its associated Capital Adequacy Directive.
- *The Capital Adequacy Directive*<sup>14</sup> (effective December 1995). This implies risk-based capital requirements to investment firms and also purposes consolidated supervision for investment firms. This Directive will also bring in own funds requirements for securities firms similar to those for banks.

At the heart of the above legislation is the EU's objective to create a single market for financial services by providing banks and other financial firms a 'single passport' to operate throughout the Community subject only, as a rule, to the supervision of the competent (regulatory) authority of their home member state. Moves towards such a single market, however, are currently and will continue to be restricted by three main distortionary factors: Firstly, the freedom national authorities have in opting-out of EU legislation; secondly, tax obstacles; thirdly, the flexibility with which governments can incorporate EU law into national legislation and finally, different reserve requirements (This issues will be discussed in more detail in section 2.9 of this Chapter).

So far we have discussed the EU's objective of creating a single market for financial services but this is just part of the EU's broader objective of achieving European Monetary Union.

## **2.7 European Monetary Union (EMU) and Its Implications for the Single Financial Services Market**

On 11 December 1991 at the Maastricht Summit, the member states of the European

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<sup>13</sup>Council Directive on Investment Services in the Securities Field, 93/22/EEC, (OJ 1993 L 141), 11/6/93.

<sup>14</sup>Council Directive on Capital Adequacy of Investment Firms and Credit Institutions 93/6/EEC, (OJ 1993 L 141), 11/6/93.



Union adopted comprehensive amendments to the 1957 Treaty of Rome<sup>15</sup>. When ratified by all the EU countries, the amendments would extend the domain of the Union in many directions. In particular, the European Council agreed that monetary union would be established no later than 1 January 1999. Subject to ratification by EU member states, the fundamental point was that the decision to introduce EMU in the Union and to introduce the European Currency Unit as the Union's single currency would be put into place at the latest by 1999 (see Italianer et al., 1992). By then, exchange rates between the participating EU member states would have been fixed and the European Central Bank (ECB) would be ready to operate (Bank of England, 1992; p.64). The Maastricht Treaty also stated that EMU could be established before 1999 if a majority of member states (seven) have achieved a sufficient degree of economic convergence, as indicated by certain criteria. For purposes of business planning, the main issues of concern for financial institutions relate to (De Pecunia, 1992a; p.17):

- the timing of the move to EMU
- which countries will meet the economic convergence criteria
- the date on which a single currency will be introduced.

*Timetable and procedure.* Table 2.3 provides an overview of the three stages leading to EMU. The first stage of EMU began on 1 July 1990 with a view to promoting economic convergence. During this stage much greater attention was paid to multilateral surveillance of economic conditions in member states, to reinforce monetary policy coordination and to promote the role of the European Currency Unit (see Commission of the Economic Community, 1991; p.14). Thus, the European Council was required to examine on a yearly basis the prospects and policies in the Union as well as the effects the external economic environment had on the European Union. The process of monetary policy coordination was also supposed to be strengthened in Stage 1 (see Spagnolo, 1993; p.104).

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<sup>15</sup>Commission of the European Communities, (1992), "The Maastricht Agreement", *Briefing Note ISEC/B25/92*, 29 September.

Stage 2 of EMU began on 1 January 1994<sup>16</sup>, when the European Monetary Institute (EMI) would be established (see Commission of the European Communities, 1992; Briefing Note p.8). During this stage, there could be no 'monetary financing' or bailouts of public entities, and a procedure to eliminate excessive budget deficits would start to operate (Bank of England, 1992; p.67). The EMI should aim to strengthen cooperation among the central banks and the coordination of their monetary policies. This coordination would focus on price stability; include holding consultations on issues falling within the central bank's competence and affecting the stability of financial institutions and markets; involve monitoring the functioning of the EMS and, among other things, to promote the use of the ECU (see Commission of the European Communities, 1992; Briefing Note p.8). At the latest by 31 December 1996, the EMI should specify the regulatory, organisational and logistical framework necessary for the European System of Central Banks (ESCB) to perform its tasks. Just before Stage 3 commences, the European Central Bank (ECB) will be established and the EMI liquidated (Bank of England, 1992; p.67).

If by qualified majority vote, the member states agree that a majority of them meet the necessary convergence conditions they may, not later than 31 December 1996, set a date for the start of EMU. If they have not set a date by the end of 1997, EMU will start automatically on 1 January 1999 among those member states which it has been determined (by qualified majority vote before 1 July 1998) meet the convergence criteria (see Spagnolo, 1993; p.104).

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<sup>16</sup>"Report on economic and monetary union in the European Community", Committee for the Study of Economic and Monetary Union, April 1989.

Table 2.3 The three stages of EMU

Time Period	Objectives
Stage 1 Until 1 January 1994	Closer economic and monetary cooperation between member states within the existing institutional framework aimed at greater convergence of economic performance. It includes the completion of the Single Market and the strengthening in of Union competition policy.
Stage 2 January 1994 to no later than 1 January 1999	Will reinforce economic convergence beyond Stage 1, including the necessary institutional developments: setting up of the EMI, while still leaving ultimate responsibility for monetary policy with national authorities, will also involve technical preparation for Stage 3.
(It was agreed by member states at Maastricht that full EMU- known as Stage 3- should commence for those judged eligible to participate, no later than 1 January 1999. But if the heads of state of government decide, by qualified majority, they may set an earlier date for the start of Stage 3. Stage 3 could begin as early as 1997, or earlier if the necessary conditions are met.)	
Stage 3 1 January 1999 at the latest	Full EMU includes: <ul style="list-style-type: none"> <li>- irrevocable locking of exchange rates between participating currencies and a single monetary policy leading to the adoption of single currency in due course.</li> <li>- the European Central Bank (ECB) and European System of Central Banks (ESCB) will be responsible for issuing and managing the single currency- the ECU - that will replace national currencies.</li> <li>- the primary objective of the ECB and the ESCB in undertaking monetary policy will be to maintain price stability - they will also be required to support the general economic policies in the European Union.</li> </ul>

Note: For a detailed exposition of the three stages, see the Bank of England Quarterly Bulletin, February 1992, p. 66-68 and Bank of England Fact Sheet, May 1994, p.1-7.

*Convergence criteria.* The Maastricht agreement stipulates that the countries which enter Stage 3 of EMU must meet certain criteria of economic convergence. Country compliance will be monitored by the EMI. The EMU can be introduced as early as 1997 if a majority (now seven) of EC countries meet the following four main criteria (Bank of England, 1992; p.66):

1. High degree of price stability. Each country must attain an average rate of inflation, observed over a period of one year prior to admission, that does not exceed the average inflation rate of the three best performing member countries by more than one and one half percentage points (See also Crawford, 1993; p.88).
2. Sustainable government financial position. The ratio of government deficit to gross domestic product cannot exceed 3 per cent and the ratio of government

debt to gross domestic product cannot exceed 60 per cent (see Commission of the European Communities, 1992; Briefing Note p.10).

3. Long-term interest rates. In the year preceding EMU admission a country's average nominal long-term interest rate may not exceed the average of the three of the three best performing member countries by more than two percentage points (see Commission of the European Communities, 1992; Briefing Note p.10).
  
4. Participation in the narrow bands of the ERM. In the two years preceding admission to EMU the currency of each member country must have remained within the normal bands of fluctuations in the ERM without experiencing severe tension.

The main objective of these criteria is to establish an economic environment of sustainable low inflation in all the member countries and thus in the EMU. The fiscal criteria are aimed to reduce a potential source of inflation in the EMU, the monetisation of public debt. Together with the interest rate criteria, the fiscal guidelines are meant to prevent increasingly indebted countries exerting upward pressures on interest rates in the entire EMU.

Given the state of various EU economies at present, however, the likelihood of all the EU country achieving these convergence criteria is in some doubt. For example the EU Commission's Annual Economic Report for 1993 (p.3) makes sombre reading, both generally and in the context of the Maastricht Treaty objective of Economic and Monetary Union by 1 January 1999, or even earlier. On the first page of the Report the EU notes that, "the turmoil with the Exchange Rate Mechanism ... severely dented the credibility of the EMU timetable". Ratification of the Maastricht Treaty has taken place in the majority of EU countries by the end of 1993, yet in an increasing number of these countries, the convergence momentum seems to have become impeded by a general economic slow down. Uncertainties regarding political progress towards EMU, and the markets continued awareness of the unsustainable nature of various ERM exchange rates, has been a major factor behind the problems faced by the EMS.

Opponents of the treaty viewed the turmoil in the EMS exchange rate markets as demonstration of the impossibility of establishing a common monetary policy - and therefore a single currency- which well may be the case for those countries whose economies are still not convergent and are each faced with their own structural problems (see European Economy, 1990; Bank of England, 1994).

This outlook is supported, at first sight, by recent drifts away from the Maastricht criteria on the part of those countries regarded as constituting the hard core of the EMS. The only country that claimed to satisfy the criteria at the end of 1993 for monetary union was Luxembourg (although Luxembourg has an economic union with Belgium which does not meet the EMU criteria) (European Economy, 1993). France and Denmark met the criteria in 1990, but have since moved away from them. In addition, the possibility that the most divergent economies might reduce their respective gaps to the point at which they could participate in the third phase of EMU seems to have been deferred.

*The Single Currency.* The move towards a single currency will have the most immediate impact on the banking sector (see Praet, 1992). Stage 2 would be the preparatory period for implementing the single currency during which the newly established European Monetary Institute (the forerunner of the ECB and ESCB) will be required (see Commission of the European Communities, 1992; Briefing Note p.8):

- to facilitate the use of the ECU and oversee its development, including the smooth functioning of the ECU clearing systems;
- promote the efficiency of EU cross-border payments;
- to "consult" with central banks on issues affecting the stability of financial institutions and markets;
- to co-ordinate monetary policy between member states.

During this preparatory phase, banks will have to undertake many changes relating to the integration of the ECU which concern (see De Pecunia, 1992a; p.33-41):

- translation of accounting records and systems, monetary instruments,

- documentation of all kinds;
- drafting of legal rules in contracts;
- software conversion and adaptation;
- changes in hardware, to accept and distribute new ECU notes (ATMs and counting machines);
- training of bank staff;
- provision of information to customers.

These changes, as well as the cost of manufacturing, warehousing and distribution of ECU denominated notes and coins, will impose burdens on the banks and will undoubtedly cause confusion, given that there will be two legal tenders - the ECU and the national currency- in circulation at the same time (see Mayes, 1990). Management of notes and coins, in ECU and national currency will cause problems if a dual circulation system develops, this is especially the case if the demand for ECU currency by bank customers is negligible. Customers will only shift to ECUs if the benefits of using this currency outweighs the costs of using national currencies. Other potential cost to banks include the (see De Pecunia, 1992a; p.33-41):

- reduction in need for specialist currency teams to advise corporations on EU currency swap and forward transactions.
- the risk of having to undertake greater risk taking in order to make-up for lost income (the adverse selection problems);
- increased competition. At present no single bank has more than a 2 percent share of the overall European foreign exchange market and no one financial centre currently enjoys a significant competitive advantage;
- diversion of capital flows from outside the EU to intra-union transactions because of the lower risk and attractiveness of the larger single market;
- risks associated with financial instruments denominated in national currencies whose maturity dates exceed the conversion to single currency date;
- decline in business for banks who dominate the lead management and underwriting of issues denominated in their national currencies.

Many of the above factors will primarily affect the larger international banks, although

it is these banks that are more likely to benefit from the increased scope of ECU lending and investment opportunities throughout member states brought about by greater intra-EU trade and investment. Larger banks would be more inclined to undertake business throughout the EU, especially given that they are more inclined to undertake business in different EU currency denominations or to incur risk on an open foreign exchange position. The benefits accruing to these banks would clearly be closely related to the scale of cross-border provisions of services.

Moves towards a single currency will also require that efficient arrangements for cross-border payments and settlement are in place (see De Pecunia, 1992b). A discussion paper published by the European Commission in September 1990 called "Making payments in the internal market" noted that existing cross-border retail payments systems are deficient in transparency (consumers do not know which system is the best), speed, reliability and cost. In a paper presented to the Association for the Monetary Union of Europe by Sir John Quinton in May 1992, it was noted that, in the case of wholesale payments, the ECU Bankers' Association ECU clearing systems has been successful in facilitating the growth in the private use of the ECU, but with the increased volume of business envisaged in the run-up to EMU, and given the EMI's brief to develop clearing and settlement systems, it is uncertain as to whether new systems should be privately operated or run by the EMI or its successor the ECB. It might even be the case that two systems - one private and one public - evolve. It also needs to be considered as to who would have access and membership to such a system and who decides on these issues. Perhaps EU competition policy would have influence in determining some of these matters.

## **2.8 Economic aspects of a single market in financial services**

### **2.8.1 The Price Waterhouse/Cecchini's Report and its findings**

The previous section outlined the expected impact of EMU on the financial services industry. This section of the thesis examines the economic aspects of a single market

in financial services. The Cecchini study<sup>17</sup> was the first and most important empirical work to analyse comparative competitive conditions across EU banking and financial systems. This research set out to examine the economic consequences of completing the EU internal market, on various economic sectors. The microeconomic study of the financial services sector was carried out for Cecchini by Price Waterhouse Management Consultants (Dublin), whose results were published in detail by Price Waterhouse (1988). The following section investigates the sources of the economic gains from EU integration and then focuses on the main features of the Price Waterhouse (1988) study.

### **2.8.2 Sources of the Economic Gains from Integration - Competition, Efficiency and Scale and Scope Economies**

The Price Waterhouse (1988) study postulated that completion of the internal market would induce a series of integration effects which would promote the efficiency and competitiveness of European Union firms through two channels - namely through increased market size and heightened levels of competition. The expected economic effects could be grouped primarily into the following categories (see European Economy, 1988; p.104):

- (a) there would be lower costs resulting from economies of scale and learning, made possible by the associated larger volume of output and by restructuring processes;
- (b) the pressure of competition on prices should lead (mainly in the formerly protected sectors) to a reduction in price cost margins and to incentives for firms to increase their technical efficiency by minimising their costs (X-inefficiency) so as to maintain their margins;

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<sup>17</sup>See Price Waterhouse (1988), *The Cost of Non-Europe in Financial Services*, in *Research of the cost of non-Europe*, Vol. 9, (Brussels, EU); Commission of the European Communities (1988), *European Economy: The Economics of 1992*, No. 35, March, (Brussels, EU) and Cecchini, P., (1988), *The European Challenge in 1992: The Benefits of a Single Market*, (Aldershot: Gower).



- (c) increased competition should also have non-price effects, firms being encouraged to improve their organisation, the quality and range of their products and, in particular, to engage in process and product innovation. Moreover, the combined effects of these changes would be to increase the gross domestic product of the European Union as presented in figure 2.1.

The relationship between the single financial market and the possibility of utilising potential economies of scale and scope is often presented as a clear argument in favour of the internal market. The completion of the Community's financial integration was a uniquely important part of the internal market programme because of the extent of other effects on economy, even if their magnitude could not easily be measured (See Price Waterhouse, 1988). The completion of the internal market would be expected to bring an expansion of market size and hence the size of business, and this in turn would enhance scale and scope economies resulting in considerable reductions in costs. The term "scale and scope", used generally to explain the effects on size of costs, in fact covers a wide range of phenomena, from purely static economies of a technical nature to dynamic phenomena linked to experience. The exploitation of benefits from removing non-tariff barriers is crucially dependent upon fundamental reconstruction in many industries. This is largely based on achieving economies of scale, and by firms integrating activities in fragmented markets. Substantial benefits accruing from economies of scale and scope also implies that many European firms are too small (see Penketh, 1992; p.31).

True economies of scale, are said to exist when one large operation is worth more than the sum of its component parts. In financial services, the arguments are that there are large fixed costs to operating a network of branches or agents (Llewellyn, 1992). These may be scattered over many customers in large operations. Moreover, it is believed that another supposed economy derives from the benefits of scale in participating in capital markets. Unit transaction costs appear to be lower, the larger you are. Furthermore, consumer recognition is an advantage to the large firms who may expect to attract customers most easily. Finally, it also been argued that a large diversified institution can afford to cross-subsidise price wars which occur spasmodically and given that entry and exit cost something, large firms can ensure that they are not forced out of any

market (see Centre for Business Strategy, 1989).

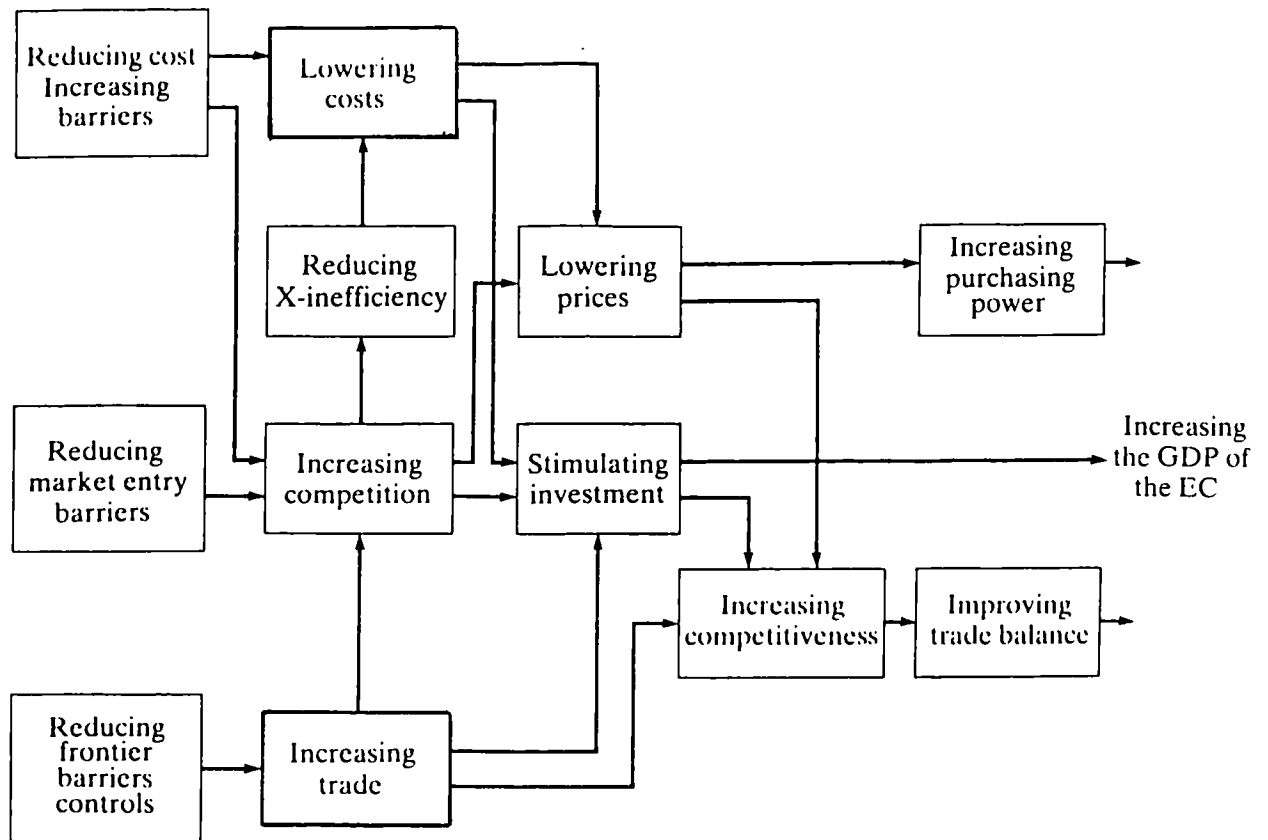


Figure 2.1 How the SEM increases the GDP of the EU

Source: Penketh (1992; p.28), in *European Economic Integration*, (ed.) McDonald, F. and S. Dearden, (London: Longman).

Economics of scale and scope are important concepts for the financial services industry. In theory financial institutions doing business in all major European marketplaces may find it more cost efficient to serve clients than similar sized institutions that are locally concentrated. In addition a large universal bank may be better placed to serve international clients, and would gain strategically valuable information about the range of markets from its dealings abroad (Steinherr, 1992, Bollenbacher, 1992).

According to Cecchini (1988), the elimination of (the remaining) cross-border barriers, such as frontier controls and different technical standards, should result in a reduction of costs, which can then be translated into either a widening of profit margins or a lowering of prices or a combination of both. The Cecchini study laid great emphasis on the scope for further economies of scale as learning economies. It referred to the minimum efficient technical scale (METS), and argued that in many sectors (including financial markets) the actual firm size is significantly smaller than the estimated METS (see European Economy, 1988; p.107-118). However, strong criticisms have been voiced about the benefits to be exploited from economies of scale and scope. The financial market is a multiproduct industry segmented structurally, both from the demand and the supply sides. This may perhaps be one of the reasons why past researchers have found it difficult to find strong evidence of economies of scale and scope in the financial service sectors (See Centre for Business Strategy, 1989; Vives, 1991 and Chapter 5 later in this thesis which provides a detailed review of the scale and scope literature in banking markets).

### **2.8.3 Aims and Methodology of the Price Waterhouse/ Cecchini's Report**

The main objective of the Price Waterhouse/Cecchini study was to estimate the economic impact of 1992 on the financial services sectors in eight EU countries (namely Belgium, France, Luxembourg, Netherlands, Spain, United Kingdom and West Germany) under the assumption that the law of one price prevailed. In other words, the principal assumption was that after 1992 EU prices would settle at (or at least move towards) some uniform level for each financial product/service, thereby bringing about economic gains from EU integration.

The Price Waterhouse study, firstly, investigated in detail the economic dimensions of the three main financial service sectors - (i) banking and credit business, (ii) insurance business and (iii) brokerage and securities business - across the eight EU countries under study. The study then focused on comparative price differences (obtained mainly by field survey) of sixteen financial products or services, spread over the banking and credit sectors, insurance and securities and brokerage sectors. This dataset was posited by Price Waterhouse to be representative broadly of three financial sectors and Table 2.4 illustrates the standard financial products and services they used in their analysis. From this "standard" set of (sixteen) financial products and services: prices were simulated to decrease to the average of the four lowest prices for each product/service. It is these hypothesised price falls that are the basis of the calculation of the economic gains from integration. These economic gains can be defined simply as the consumer surplus gains resulting from price falls generated by the hypothetical creation of a single market in financial services (see Table 2.5).

#### **2.8.4 Results of the Price Waterhouse/Cecchini's Report**

The results of the economic analysis (published in detail in the Price Waterhouse, 1988) show a broad indication of the kinds of competitive forces that may be released when the 1992 Single Market is completed. Table 2.6 presents the estimated price falls, hypothesised from completing the internal market, on the standard set of (sixteen) financial products as reported by the Price Waterhouse study. The estimated gains from 1992 are shown in the corresponding differences between the prices in individual countries compared with the level at which overall prices are estimated to fall when the Single Market is completed. Although the data are not forecasts and have been estimated subject to strong assumptions, they represent a heroic attempt to suggest possible post-1992 developments.

The theoretical, potential price reductions presented in Table 2.6 show the different competitive conditions that exist in the three main financial service (banking, insurance and securities) sectors for eight countries. It can be seen that price falls for banking services are expected to be the largest in West Germany, Spain, France and the United Kingdom. Section 2 adjusts the theoretical potential price reduction to reflect more

Table 2.4 List of standard financial services or products surveyed

"Standard" Service	Description of standard service
<i><u>Banking Services</u></i>	
Commercial Loans	Annual cost to a medium size firm of a commercial loan of 250,000 ECUs. Measured as excess over inter-bank rates.
Consumer Credit	Annual cost of consumer loan of 500 ECUs. Excess interest rate over money market rates.
Credit Cards	Annual cost assuming 500 ECU debit. Excess interest rate over money market rates.
Mortgage	Annual cost of home loan of 25,000 ECU. Excess interest rate over money market rates.
Commercial Draft	Cost to a large commercial client of purchasing a commercial draft for 30,000 ECUs.
Travellers Cheques	Cost for a private consumer of purchasing 100 ECU's worth of Travellers Cheques.
Current Cheque Account	Annual cost assuming 200 cheques P.A., 20 standing orders, 50 cash withdrawals, 20 credits.
Letter of Credit	Cost of letter of credit of 50,000 ECUs for three months.
<i><u>Insurance Services</u></i>	
Term Insurance	Average annual cost of term insurance.
Home Insurance	Annual cost of fire and theft cover for house valued at 70,000 ECUs with 28,000 ECUs contents.
Motor Insurance	Annual cot comprehensive insurance, 1.6 litre car, driver 10 years experience, minimum no claims bonus.
Commercial Fire and Theft	Annual cover for premises valued at 387,240 ECUs with stock and contents at 232,344 ECUs.
Public Liability Cover	Annual premium for Engineering company eighth 20 employees and annual turnover of 1.29 million ECUs. Includes employer liability cover.
<i><u>Brokerage Services</u></i>	
Private Equity Transactions	Commission costs cash bargain of 1,440 ECUs.
Private Gilts Transactions	Commission costs of cash bargain of 14,000 ECUs.
Institutional Equity Transactions	Commission costs of cash bargain of 288,000 ECUs.
Institutions Gilt Transactions	Commission costs of cash barging of 7.2 m ECUs.

Source: Price Waterhouse (1988, Table 5.1, p. 15).

accurately expected price falls and indicates that price falls for financial services as a whole are expected to be the largest in Spain, Italy, France and Belgium. These estimated price falls appear to be the largest in countries that have been historically more heavily regulated and hence less competitive (See Molyneux et al., 1994).

The price falls calculated by Price Waterhouse in Table 2.5 were then used to model the impact on value-added and the gains in consumer surplus that are hypothesised to

result from the law of one price assumption. Table 2.6 indicates the results and shows that the largest gains in consumer surplus, as a proportion of GDP, accrue to Spain (1.5 per cent), Luxembourg (1.2 per cent) and the United Kingdom (0.8 per cent). Overall, the gains in consumer surplus to the eight EC countries under study were estimated to amount, on average, to 0.7 per cent of GDP.

Table 2.5 Estimate of potential falls in financial product prices  
as a result of completing the internal market (%)

	B	D	E	F	I	L	NL	UK
<i>1. Theoretical, potential price reduction<sup>1</sup></i>								
Banking	15	33	34	25	18	16	10	18
Insurance	31	10	32	24	51	37	1	4
Securities	52	11	44	23	33	9	18	12
Total	23	25	34	24	29	17	9	13
<i>2. Indicative price reduction<sup>2</sup></i>								
All financial services								
Range	6-16	5-15	16-26	7-17	9-19	3-13	0-9	2-12
Centre of range	11	10	21	12	14	8	4	7

Source: European Economy, (1988; Table 5.1.4, p.91).

Notes: <sup>1</sup> These data show the weighted averages of the theoretical potential falls of selected financial product prices.

<sup>2</sup> Indicative price falls are based upon a scaling down of the theoretical potential price reductions, taking into account roughly the extent to which perfectly competitive and integrated conditions will not be attained, plus other information for each financial services, sub-sector, such as gross margins and administrative costs as a proportion of total costs.

B = Belgium, D = West Germany, E = Spain, F = France, I = Italy,  
L = Luxembourg, NL = Netherlands, UK = United Kingdom.

Table 2.6 Estimated gains resulting from the indicative price reductions  
for financial services (%)

	Average indicative price reduction (%)	Direct impact on value-added for financial services (mn ECU and as % of GDP)		Gain in consumer surplus as a result of average indicative price reduction <sup>1</sup> (mn ECU and as % of GDP)	
B	11	656	0.6	685	0.7
D	10	4442	0.5	4619	0.6
E	21	2925	1.4	3189	1.5
F	12	3513	0.5	3683	0.5
I	14	3780	0.7	3996	0.7
L	8	43	1.2	44	1.2
NL	4	341	0.2	347	0.2
UK	7	4917	0.8	5051	0.8
EUR 8	10	20617	0.7	21614	0.7

Source: European Economy, (1988; Table 5.1.4, p.91).

Notes: <sup>1</sup> Based on the assumption that the elasticity of demand for financial services is 0.75.

B = Belgium, D = West Germany, E = Spain, F = France, I = Italy,  
L = Luxembourg, NL = Netherlands, UK = United Kingdom.

### 2.8.5 Limitations of the Price Waterhouse/Cecchini Study

Various authors, such as Gardener and Teppett (1990) and (1991), Neven (1990) and Vives (1991) have examined the Price Waterhouse findings and the impact of European integration on the competitive conditions in banking and financial markets. The estimated results of the Price Waterhouse study have been called both too low (Baldwin, 1989) and too high (Centre for Business Strategy, 1989). While it is agreed that there are different competitive conditions existing across EU banking systems and that the Price Waterhouse study was a useful exercise, there are reservations about the methodology and assumptions used in the overall analysis.

Pelkmans (1992) has pointed out that there are two main points which should be made. Firstly, the external dimension (the impact on the rest of the world economy) of 1992 was not discussed in the report. Secondly, whatever the biases that one may believe to find in the exercise, the report surely underestimates the gains by excluding certain

aspects, such as the impact of integration on innovation (e.g. Geroski, 1988); the analysis of X-efficiencies in many services; and the incomplete coverage of the White Paper proposals concerning the removal of exchange controls and the proposals on property rights.

The microeconomic gains from completing the internal market are hypothesised to stimulate competition. They are also believed to incorporate cost reductions, increase efficiency in the financial sector industry, and promote a higher rate of financial innovation. These factors are then believed to have positive influences on important EU macroeconomic variables. This is an extremely positive picture of advantage for the Single Market Programme. There is an important major scepticism, however, relating to the microeconomic methodology which is used to model these effects.

The microeconomic approach adapted to estimate the economic gains from the internal market was strongly influenced by the study of Venables and Smith (1986) which, "had the advantage, alongside their academic respectability, of producing comparatively high welfare gains" (Gardener and Teppett, 1991; p.159). The marginal analysis adopted to evaluate the gains accruing to integration may be distorted, for instance, according to the relative speeds at which various countries adjust. For example, there is an implicit assumption in the analysis that price uniformity will be achieved by the establishment in high-price countries of institutions from low-price countries or by the delivery (offer) of cross-border services. This concept sounds straightforward and in full accord with economic theory, yet it begs many questions when one considers it as a practical process in the market.

Another criticism relating to the Price Waterhouse methodology focused on the role of economies of scale. The Centre for Business Strategy (1989) indicated that trade liberalisation of the type envisaged for 1992 had its primary effects on supply and not demand. This study cautioned that the scale economy argument was far from unambiguous, and they state (p.104):

It is puzzling that economies of scale are so widely touted as a source of competitive advantage when there is so little evidence of their significance.



and they continue to argue:

Successful operators in an integrated financial market will be those who correctly exploit the scale of scope economies that do exist without sacrificing the specialisation that can also be very important.

Moreover, the Centre for Business Strategy (1989) study was critical of Price Waterhouse for ignoring important factors such as consumer/customer behaviour, cultures, habits and strategic issues in their analysis. They also indicated that in the shorter-term other major environmental factors (such as different legal, regulatory and fiscal systems) would thwart financial sector integration - especially in the retail and lower segments of the corporate banking market.

Focusing on the specific methodology, a major undesirable characteristic of the overall analysis relates to the strong "upward bias" in the interpretation of economic gains. Gardener and Teppett (1991) imply the calculation of economic gains published in the report, exclude the cases where some financial products prices are hypothesised to rise. They argue that price rises for specific financial product suggest possible credit rationing and/or the existence of cross-subsidies. Under both of these scenarios, it is likely that price will rise under the law of one price assumption and "ignoring these possible price rises, therefore, may be unrealistic unless a strong, rigorous case can be made for this approach" (p.160). Llewellyn (1992) also noted that there are many factors other than lack of competition or financial regulation that might account for price differences. Price differentials may reflect the major differences in institutional structure rather than lack of competition, contestability or differences in basic efficiency. In this case, it could be misleading to associate differences in prices of individual products or services as evidence of the general lack of competition in certain markets, or to assume that competition would prove an equalisation of prices between EU member countries. Llewellyn (1992, p.118) notes that:

As there are also significant differences in prices for specific financial products within countries, it is unlikely the removal of regulatory and other imposed barriers would result in a single price throughout the EC.

The aforementioned author also argues that liberalisation does not necessarily increase competition enough to force price equalisation, and does not in itself guarantee that competitive conditions will be equalised between EU member states. Because of economic reasons such as entry cost and scale constraints, banking and financial markets could remain partially segmented (e.g. in the retail sector) without formal controls, regulation barriers, or imposed entry restrictions.

Gardener and Teppett (1991) also point out that the estimated economic gains are overstated because the findings downgrade estimates of the hypothesised losses in producers surplus. A short-term fall in firms profits could have more negative economic effects than were emphasised by the Price Waterhouse findings. For example, the calculation of economic gains, may be strongly influenced by the issue of corresponding producer losses<sup>18</sup>. While price decreases obviously increase consumer surplus gains, they have a corresponding negative impact on producer surpluses. The rationale for this, as indicated by Gardener and Teppett (1991, p.116-117) is that:

... producers may experience internal economies of scale leading both to inefficient small-scale production when the market is restricted within national boundaries, and to an oligopolistic market structure. Within a non-integrated Europe, therefore, average costs are unnecessarily high; the mark-up of prices over marginal costs is also higher than necessary to cover fixed costs. This economic perspective suggests the consequences of opening up trade are: (1) to lower unit costs by facilitating more use of the economies of scale, (2) and (probably) lower the mark-up of prices over marginal costs to the extent that oligopoly is weakened. Whilst the consumer will gain (increased consumer surplus); there will also be reductions in excess profits (reduced producer surplus).

McDonald (1992) summarises the criticisms of the Price Waterhouse analysis under

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<sup>18</sup>The methodology suggested to compute these producer losses, however, does not eliminate criticism. The Cournot-Nash oligopoly model was suggested by Price Waterhouse to compute the relevant producer-surplus losses. This approach included the use of a uniform elasticity of demand measure (as well as use in the consumer surplus only estimates) and a Herfindahl index. Both measures have been criticised for their crudity in accurately describing different demand and competitive market conditions, respectively.

three main headings: (i) the assumption that the legislative programme would not be completed before 1 January 1993; (ii) inadequacies in the legislative programme; (iii) the view that the non-tariff barriers are the main obstacles to free movement. The report has been also criticised because it ignored other certain key factors, such as the effects on member states and the effects resulting from the redistribution of income.

Despite the above limitations and the major data problems associated with such an analyses, the Price Waterhouse study was heroic attempt to include both international trade theory with industrial organisations theory, in a static framework, to provide us with the first step towards attempting to evaluate the benefits and costs of financial sector integration.

## **2.9 The Problems of Creating the Single Market**

It has been recognised that it is important to view the Single Market Programme as a dynamic process. It is also an incomplete process that requires constant surveillance and revision. In the evaluation of the Single Market the EU needs not only to fill in the gaps in the original programme but also to establish new rules where they are needed. Turner (1994, p.9) has indicated that, "despite the deadline being reached, the Internal Market has yet to be fully implemented."

The Commission of the European Community<sup>19</sup> noted that there has been much intensified progress in the march towards a single market in Europe. Over 90 per cent of the measures for eliminating borders have already been adopted by the Community institutions, and 75 per cent have been transposed into national law of the EU member states. However, the expectation of the business community is that there is still important work to be done to capture the full potential of the single market. Vesala (1993) has noted that certain legal discrepancies remain within the Single Market area that potentially distort the establishment of financial institutions and emerging trade

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<sup>19</sup>See the "Seventh Report of the Commission the Council and the European Parliament Concerning the Implementation of the White Paper on Completion of the Internal Market", 3 September 1992.

flows in banking services. The most important differences relate to the following areas:

- a) Reserve requirements;
- b) Taxation;
- c) Freedom for member states to alter EU legislation when incorporated in national law or/and use the "general good" opt out to avoid implementation of EU laws.

Vesala (1993) has noted that different reserve requirements of various EU banks systems has a distorting effect on banking competition within these country. Reserve requirements may result in a "regulatory gap" due to an existence of reserve-exempt offshore markets, for example Euro-currency markets in wholesale banking. Distortions in reserve requirements across countries can also act as a tax on high reserve requirement banking systems and they will also create competitive anomalies within the EU.

Taxation is another important area where the lack of harmonisation distorts competition within the EU. Molyneux (1993) has pointed out that there are two main types of tax obstacles which have traditionally stood in the way of the cross-border provision of financial services and which are unaffected by the EU single market directives:

- a) Tax provisions which directly affect 'foreign' EU financial firms providing cross-border services in another EU country. A clear example is the withholding tax<sup>20</sup>. Withholding tax applied to interest paid to the domestic lender will be fully set off against the corporation tax paid by the domestic lender on its profit margin (and any excess withholding tax refunded). In the case of the foreign lender, withholding tax is a final, non-refundable tax.
- b) Tax measures which are not specifically imposed on foreign EU financial institutions but make it more costly for domestic customers to do business with

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<sup>20</sup>See Commission of the European Communities, (1991), "Removal of tax obstacles to the cross-frontier activities of companies", *Bulletin of the European Communities*, Supplement 4/91.

foreign EU firms.

Dassesse (1993) indicated some important examples which are as follows:

- non-availability of tax relief or interest subsidy on mortgage capital on interest repayments, if the lender is based outside the jurisdiction.
- provisions whereby interest paid by local corporate borrowers to a foreign bank will not be treated as tax-deductible expenses if it exceeds a certain ceiling, whereas no such ceiling is applicable when the interest is paid to a local branch.
- non-deductibility for income tax (or as the case may be, corporation tax) purposes of life insurance or group insurance contribution if paid to a firm established outside the member state of the individual or company concerned.
- provisions whereby personal pension plans benefit from tax rebates on the condition that the plans are invested, at least for a minimum proportion, in local bonds and shares. This would exclude, for example, shares in mutual funds licensed in other member states under the 1985 UCITs Directive.

The above, by no means exhaustive, list indicates the tax disadvantages that EU financial firms may come up against by undertaking business cross-border. The situation is unlikely to alter enormously in the future given that member states jealously guard their rights on tax policy and any attempts to achieve wider coordination of EU tax laws would be highly problematic (Commissions of the European Communities, 1991). The EU Court appears to be sensitive to this risk and generally has been unwilling to find that it contravenes EU law for a tax system to discriminate against financial products supplied by foreign firms. Two recent rulings, however, have clouded the picture regarding EU Courts stance on national autonomy in taxation matters<sup>21</sup>.

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<sup>21</sup>The first was the European Court of Justice Ruling on *Bachmann v Belgium Tax Authorities* (Case 209/90, *Bachmann v. Belgium Tax Authorities*, 28 January 1992.). The second important tax ruling was the European Court of Justice Ruling on *Commerzbank v. UK Inland Revenue* (See *R. v. IRC ex parte Commerzbank AG*, Case

There is also significant freedom for national governments to act in derogation of the EU Single Market by using the concept of the "general good" opt-out allowed to member states. The European Court of Justice has resolved conflicts between EU and national laws intended to protect consumers of goods with the help of provisions in the Treaty of Rome which make exceptions to the principle of free movement of goods for reasons of public morality, public policy, public security or protection of health<sup>22</sup>. In cases regarding the freedom to provide services the Court has used the related concept of the "general good". The European Courts rulings in such cases have been studied in detail by Katz (1992) who shows that host state general good exceptions to the freedom to provide services have been justified when they are:

- i) not related to areas of law already harmonised by the EU
- ii) not duplicative of laws already applied by home states
- iii) applicable without discrimination to all persons and undertakings in the host country
- iv) necessary to protect the interest at stake and proportional to the protection of that interest

Molyneux (1993) notes that the above suggests that EU member states have been left an easy protectionist tool to assert national law over EU legislation in order to protect the so-called "general good". In addition, the aforementioned study also finds that as well as differences in tax treatment of financial firms and products across EU member countries and the opportunity to opt-out of EU legislation there is also the potential for different national implementation of EU directives. This may also provide state authorities with an additional degree of autonomy. Given differences in reserve requirements, tax treatments, cross-border payments systems and the flexibility to incorporate EU law into national legislation it is unlikely that we will ever achieve a perfect single market in financial services. The internal market programme, however,

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330/91, judgment delivered on 13 July, 1993).

<sup>22</sup>Treaty Establishing the European Economic Community, Article 36, 298 U.N.T.S 3 (1957).

has gone a long way towards harmonising market regulations and implementing minimum standards which should help to provide, a more competitive environment and efficient banking and financial system across the EU.

## **2.10 Conclusion**

The Single Market programme has substantially changed the regulatory environment for financial institutions operating within the European Union. The major features of change relate to the liberalisation of cross-border trade of banking and financial services and the right to establishment of EU financial institutions in other EU member states. The level of harmonisation of rules has advanced substantially since the 1985 White Paper although there are still some areas which require further legislation. The completion of the European-wide frontier-free market on 1 January 1993 and the improvements in its operation are envisaged to allow banks to benefit from economies of scale and scope. The analysis of the Price Waterhouse report has illustrated that different competitive conditions exist across European banking and financial markets and that consumer surplus gains resulting from the 1992 integration process would be substantial, although, more recent studies have shown that these economic gains may be overstated. The cost implications resulting from the completion of the Single European market are important to the efficiency outcomes generated by the breakdown in cross-border barriers in EU financial sectors. This clearly provides us with an important justification as to why it is useful to analyse economies of scale and scope across European banking markets.

It should be noted, however, that there are still major obstacles to the provision of a single banking market throughout the EU. Overall, it appears that some important the barriers to trade in banking services lay not so much in overt, discriminatory rules and regulations, but rather in national practices that are not applied equally to both domestic and foreign- controlled banks.

The following chapter examines the forces generating change and structural characteristics of European banking markets with specific focus on the four banking systems under study, namely France, Germany, Italy and Spain.

## CHAPTER 3

### RECENT CHANGES AND STRUCTURAL DEVELOPMENTS IN EUROPEAN BANKING SYSTEMS

#### 3.1 Introduction

For the past decade or more, EU governments (and indeed many other outside the EU area) have sought to continue economic reforms based on the proposition that open and efficient markets for goods and services, exposed to domestic and international competition, provide the crucial underpinnings for dynamic, high income economies. The agenda for reform of financial systems that emerges from this proposition is a many faceted one ranging over such areas as; freeing up international trade in goods and services as well as capital flows; introducing competition into previously segmented and regulated sectors - not least those dominated directly by governments; liberalising financial markets both domestically and internationally; reducing distortions to saving and investment, and improving the overall efficiency of financial systems.

The political and economic agenda throughout Europe in recent years has been marked by many of the above forces. The aim of this chapter is to outline the major forces of change and to show how they have impacted on European banking markets and the four countries under study, namely France, Germany, Italy and Spain. This chapter is organised as follows. Section 3.2 focuses on the main economic forces that have affected the structure of European banking markets. Section 3.3 concentrates on the structural developments; such as market size, branch numbers, concentration levels and the degree of competition in the aforementioned markets. Section 3.4 and 3.5 note the trends of universal and specialised banking and changes in the technological levels in European banking, respectively. Sections 3.6 to 3.8 examine the operating efficiency, performance, and ownership characteristics in the main European banking markets. Furthermore, sections 3.9 and 3.10 discuss mergers, acquisitions, cooperation agreements and privatisation in European banking during the 1990s. Finally, Section 3.11 is the conclusion.



### 3.2 An Overview of the General Macroeconomic Environment in the EU

In 1993, the output in the EU declined by about a quarter of a percentage point in real terms; only the second time in the 35-year history of the European Union that a real decline in GDP (see Table 3.1) was generated (see *European Economy*, 1994; p.7). Moreover, employment declined by a record amount -2.4 million jobs lost in the course of the year- and unemployment rose at a fast pace reaching a level of 10.9 per cent of the civilian labour force. However, most member countries showed a stagnating or falling GDP with the exception of the United Kingdom, which started to emerge from a very severe recession, as well as Ireland, Luxembourg and the Netherlands (although not shown in table 3.1). The most significant declines resulted in the Western part of Germany (-1.3 per cent). In addition, substantial falls in output (about one per cent) also occurred in France and Spain, whilst in Italy the contraction was about a quarter to half a percentage point. Positive rates of growth (about 2%) were registered in the United Kingdom, where the recovery took hold firmly (see *European Economy*, 1994; p.8).

Table 3.1 Growth of real GDP (Percentage changes from previous period)

	1988	1989	1990	1991	1992	1993	1994*	1995*
United States	3.9	2.5	1.2	-0.7	2.6	3.0	4.0	3.0
Japan	6.2	4.7	4.8	4.3	1.1	0.1	0.8	2.7
Germany	3.7	3.6	5.7	4.5	2.1	-1.3	1.8	2.6
France	4.5	4.3	2.5	0.8	1.2	-0.9	1.8	2.9
Italy	4.1	2.9	2.1	1.2	0.7	-0.7	1.5	2.6
United Kingdom	5.0	2.2	0.4	-2.2	-0.6	1.9	2.8	3.2
Canada	5.0	2.4	-0.2	-1.7	0.7	2.4	3.7	4.3
Spain	5.2	4.7	3.6	2.2	0.8	-1.0	1.2	2.7
Total OECD	4.4	3.3	2.5	0.8	1.7	1.2	2.6	2.9
OECD Europe	4.1	3.5	3.2	1.3	1.1	-0.2	1.9	2.8
EU	4.2	3.5	3.0	1.5	1.0	-0.4	1.9	2.8

\*Projections.

Source: Adopted from OECD, (1994b), *Economic Outlook*, No.55 (June), p.A4.

The weak trend in economic activity in 1993 has had counterparts in increasing overall unemployment and a further fall in inflation. The 1992-93 recession has resulted in a strong fall in employment and a marked increase in unemployment. Unemployment has

been a particularly severe problem in the EU countries (Table 3.2). This is due both to the severity of the decrease in economic activity and to the fact that employment trends have become more responsive to the economic cycle (see *European Economy*, 1994; p.10). In contrast to the early 1980s unemployment is now increasingly dominated by prime age (25 to 45-year-old) male workers (see BIS, 1994; p.17). Whilst female workers have generally found it easier to obtain jobs in the services sector, although in many cases as involuntary part-time workers.

Table 3.2 Unemployment rates (Per cent of total labour force)

	1988	1989	1990	1991	1992	1993
United States	5.5	5.3	5.5	6.7	7.4	6.8
Japan	2.5	2.3	2.1	2.1	2.2	2.5
Germany	7.6	6.9	6.2	6.7	7.7	8.9
France	10.0	9.4	8.9	9.5	10.4	11.7
Italy	12.1	12.1	11.5	11.0	11.6	10.4
United Kingdom	8.2	6.2	5.9	8.3	10.0	10.3
Canada	7.8	7.5	8.1	10.3	11.3	11.2
Spain	19.5	17.3	16.3	16.3	18.4	22.7
Total OECD	6.9	6.4	6.3	7.0	7.8	8.2
OECD Europe	9.3	8.6	8.1	8.6	9.6	10.7
EU	10.3	9.3	8.7	9.2	10.3	11.3
(Millions)						
North America	7.7	7.5	8.0	9.9	10.9	10.3
OECD Europe	16.8	15.5	14.8	16.5	18.5	20.4
EU	14.8	13.5	12.8	14.3	16.0	17.4
Total OECD	26.7	25.1	14.8	28.7	31.9	33.5

Source: Adopted from OECD, (1994b), *Economic Outlook*, No.55 (June), p.A23.

Against the backdrop of economic recession and record levels of unemployment public finances in many EU countries have significantly worsened in recent years. In particular the gross public debt/GDP ratio has increased in the main economies during recent years as shown in Table 3.3. The table also illustrates the large level of outstanding government debt in Italy compared with Germany, France and Spain. This has implications for the financial sector because in Italy the government has traditionally relied heavily on the banking sector to finance its deficits by holding government bonds. With increasingly liberalised and deregulated markets, banks find it less attractive to hold substantial government bonds, thus the financing of fiscal deficits becomes more problematic. This is one reason why the Italian and other governments have resorted

to widespread privatisation programmes in the financial and non-financial sectors to help reduce pressures on public finances (see IMI, 1994). The rapid growth in government debt combined with the substantial future pressure on government expenditure due to ageing populations has also dominated the debate about the appropriate fiscal policy stance of European governments. The BIS (1994) noted that the effectiveness of fiscal policy as an instrument to stabilise the economy has been in serious doubt since attempts at fiscal stimulus in the 1970s and early 1980s helped fuel inflation and generated rising debt/GDP ratios. It also pointed out that high government debt has been associated with a fall in worldwide saving, increasing real interest rates, the crowding-out of interest-sensitive private investment projects and a slowing growth. Dornbush (1991) has noted that the debt issue has resulted in two major reform policies. Firstly, increased government indebtedness has reduced the exchange-risk premia that there were in real interest rates, and secondly it has forced governments to reduce budget deficits. These two policies Dornbush argues are strongly complementary. Recent evidence illustrates the pressure on public indebtedness. For example, in 1993, none of the EU member countries, could significantly reduce their budget deficits (general government net borrowing, national accounts definition which includes central government, regional and local authorities and social security) as a percentage of GDP, due to the widespread heavy recession. Germany, Spain and France (as well as Denmark, Greece, Portugal and the UK) recorded considerable rises in their deficits (see Table 3.4). In Italy the deficit was contained by rigorous fiscal measures, whereas some member states, for example France, (and the UK and Denmark), took discretionary action to support demand (see European Economy, 1994; p.20).

Table 3.3 Gross public debt<sup>a</sup> (As a Percentage of nominal GDP)

	1988	1989	1990	1991	1992	1993
United States	52.7	53.2	55.4	58.9	62.0	63.9
Japan	70.6	70.6	69.8	67.7	71.1	74.7
Germany	43.2	43.2	44.0	41.7	44.4	48.5
France	40.6	40.6	40.2	41.2	45.5	52.5
Italy	97.9	97.9	100.5	103.8	108.3	113.9
United Kingdom	36.7	36.7	34.6	35.4	40.6	46.5
Canada	69.8	69.8	72.5	80.0	87.5	92.3
Spain	47.4	48.4	48.7	50.0	53.2	59.1
Total OECD	58.1	57.6	58.4	60.1	63.7	67.4
Europe	57.9	57.1	57.2	58.0	62.0	67.4

<sup>a</sup>Refers to general government debt. It should be noted that the definition of debt applied under the Maastricht Treaty differs from the National Accounts definitions used by the OECD.

Source: Adopted from OECD, (1994b), *Economic Outlook*, No.55 (June), p.A35.

As European governments have borrowed so have their households. For example, during the 1970s and 1980s, while household savings rates decreased or remained relatively stable, the real stock of consumer credit increased rapidly and the ratio of consumer debt to income rose in most major industrial countries. For instance, between 1980 and 1989 'total consumer credit in the United Kingdom increased from 4.75 per cent of GDP to 9 per cent, while in France loans to households by financial institutions, excluding real estate lending, rose from 2.25 per cent of GNP to 6 per cent' (IMF 1991, p.109). In the 1990s, although household sectors were generally net creditors to other sectors, financial stress has emerged in various cases where parts of the household sector have significantly increased their debt-to-income ratios (see OECD, 1993a, p.26). By the early 1990s household debt ratios remained well above their early 1980s levels. Stevenson (1986), however, has indicated that the increased indebtedness of consumers could be explained by the fact that household financial assets were growing faster than liabilities in the major European economies (during the early 1980s at least) and this trend, together with the increasingly more sophisticated demands of the retail bank customer and the change in individuals attitudes towards debt, have been important forces creating change in retail banking markets throughout Europe.

Table 3.4 General government primary balance/general government net borrowing

	General government primary balance (excluding interest payments)			General government net borrowing		
	1991	1992	1993	1991	1992	1993
Belgium	3.9	4.3	3.7	-6.8*	-7.1*	-7.0*
Denmark	5.1	4.2	3.1	-2.2	-2.6	-4.4
Germany	-0.5	0.7	0.1	-3.2	-2.6	-3.3*
Greece	-3.5	0.4	-0.5	-16.3	-13.2	-15.5
Spain	-1.2	-0.4	-2.2	-5.2	-4.6	-7.2
France	1.0	-0.5	-2.2	-2.1	-3.8*	-5.5*
Ireland	5.6	4.9	4.2	-2.0	-2.3*	-2.3*
Italy	0.0	1.9	2.0	-10.2	-9.5	-9.4*
Luxembourg	-0.4	-1.9	-1.7	-1.0	-2.5	-2.5
Netherlands	3.6	2.7	2.3	-2.5	-3.5	-4.0
Portugal	1.7	4.3	-0.4	-6.6*	-3.3*	-7.1*
United Kingdom	0.3	-3.0	-4.5	-2.7	-6.3*	-7.6*
EU	0.4	0.4	-0.9	-4.6	-5.0	-6.0*

\*European Commission estimates of November 1993 except for the figures marked where more recent information has been included.

Source: European Economy (1994, p.22).

Closely related to the increased build up of debt has been the substantial changes in national savings and investment rates. National saving and investment rates in most European countries were generally lower in the 1980s than in the 1970s although inter country differences have remained large (Dean, et al., 1990). Table 3.5 illustrates that a fall in net national saving between 1970-79 and 1980-89 is evident in all the major industrial countries, with the largest fall in France (8.1 percentage points). The average decrease for the seven countries as a whole was 3.75 percentage points (see Hutchison, 1992; p.9). It is clear from this table that there was a continually wide variation of the level of national saving across countries. Out of the European countries shown in the table, savings levels are substantially higher in Italy, France and Germany than in the United Kingdom. This is not only apparent in net national saving but also in household savings rates. Various studies have examined the reasons for cross-country differences in savings rates (see Hayashi, Ito and Slemrad, 1988; Kauffman, 1991; Arrelli and

Micossi 1992). In the case of Italy, Rossi and Visco (1992) argue that it has been the relatively underdeveloped nature of its capital market and financial system which has encouraged high-levels of savings although household savings rates have fallen substantially between 1985 and 1993. A recent report by the Deutsche Bundesbank (1993) argues that the high level of German household savings is mainly attributable to the country's strong economic performance. The same article also notes that savings in the new Eastern-Germany, despite the much lower levels of disposable income (around 45% of W.German disposable income in 1993) are surprisingly similar to those in the western part of the country. A high savings level, with substantial investment income resulting, helps boost the level of financial assets available for intermediation or/and other forms of investment in the economy. Having said this, recent studies have shown that despite the broad array of investment opportunities available to European investors, the bulk of household financial assets are still intermediated through the banking system, although insurance companies, pension funds and unit trust are playing an increasingly important role especially in the 1990s (for example Revell, 1994). This trends is shown in Table 3.6 which illustrates the prosperity of households to intermediate through institutional investments has grown in all the major economies, although the importance of institutional investments is markedly less in Italy compared with the other countries.

Gardener and Molyneux (1990), amongst others, have indicated that the macroeconomic climate experienced by European banks throughout the 1970s and 1980s has been of a much more volatile nature than that characterised by the economic environment of the 1950s and 1960s. The increased variability of all macroeconomic variables such as interest rates, exchange rates, budget deficits and surpluses has resulted in a much more uncertain environment. The degree of uncertainty and inability of the banks to plan for cyclical downturns has been reflected in the performance of European banks in recent years during recessionary period.

After interest rates increased in late 1988 and early 1989, Europe went into recession, and the cost to the banking sector became apparent through extensive bad debts. The main impact of this recessionary period on the banking system, argue Morgan Stanley (1994) has been that European banking systems have become driven more by

profitability than by size. By the early 1994 European banks were operating under a favourable environment with low interest and inflation rates. Morgan Stanley (1994, p.1) argue that this new operating environment is characterised by:

- A de-emphasis on lending and banks have competed aggressively to retain core deposits. The overall impact has been that fee and commission income has become increasingly important for banks' earning capacities.
- The retail market has become driven increasingly by savings products, with mortgages the principal source of loan growth.
- An increasing proportion of income has and will continue to be obtained from trading activities.
- The financial services sector as a whole has become more efficient resulting from investment in technology, but this has generated substantial job losses (They forecast that up to 250000 jobs will be lost in the European banking industry up to year 2000).
- Managements have become more focused on cost and profitability than purely on size and market share.
- Capital standards have improved, resulting from the changed ( and changing) nature of business.
- The role of the state has fallen and will continue to diminish, particularly in the ownership of the banking industry.

In addition to the above trends it also important to note that demarcation lines between particular markets, intermediaries and lines-of business have also been rapidly eroding. The blurring of distinction between bank credit and securities, domestic and international paper, cash and derivatives products has helped to foster the integration of cross-border investment. The implication of the EU Second Banking Directive in

domestic banking legislation has also had the effect of establishing universal banking practice for credit institutions within EU countries rendering the old distinctions between different types of credit institutions obsolete.

Table 3.5 National savings rates in major industrial countries

Countries and periods	Gross National savings <sup>1</sup>	Net national saving	of which			Memo: General government net lending <sup>1</sup>	
			Public <sup>2</sup>	Private			
				Total	Households		Business enterprises <sup>3</sup>
as a percentage of national income							
US							
1970-79	19.4	9.1	-1.2	10.3	7.6	2.6	-1.2
1980-89	16.3	4.0	-3.8	7.8	6.0	1.9	-3.4
Japan							
1970-79	35.3	25.6	5.0	20.6	16.5	4.1	-1.7
1980-89	31.6	20.9	5.1	15.7	13.1	2.6	-1.4
Germany							
1970-79	24.3	15.2	3.7	11.5	9.7	1.7	-1.7
1980-89	22.5	11.6	1.5	10.1	8.9	1.2	-2.0
France <sup>4</sup>							
1970-79	25.8	17.0	2.7	14.4	11.9	2.5	-0.4
1980-89	20.4	8.9	-0.4	9.3	7.9	1.4	-2.1
UK							
1970-79	17.9	8.3	1.4	6.8	4.3	2.5	-2.6
1980-89	16.6	5.5	-0.8	6.3	3.7	2.6	-2.4
Italy							
1970-79	25.9	16.2	-5.2	21.4	21.3	0.1	-7.0
1980-89	21.9	11.0	-7.7	18.7	15.9	2.8	-11.1
Canada							
1970-79	22.9	13.1	1.4	11.7	6.0	5.6	-0.9
1980-89	20.7	9.9	-3.4	13.3	9.2	4.2	-4.8
Average <sup>5</sup>							
1970-79	23.4	13.6	0.8	12.8	10.1	2.7	1.7
1980-89	21.5	10.0	-0.9	10.9	8.8	2.1	3.2

<sup>1</sup> As a percentage of GNP.

<sup>2</sup> General Government.

<sup>3</sup> Includes public enterprises.

<sup>4</sup> Based on the old system of national accounts.

<sup>5</sup> Calculated using GDP weights and exchange rates in 1975 for the 1970-79 period and in 1988 for the 1980-89 period.

Source: Adopted from Hutchison (1992; p.9).



Table 3.6 The growth of institutional investors

Financial assets as percentages of household financial assets									
	Pension funds and life insurance			Collective investment institutions			Total		
	1980	1985	1990	1980	1985	1990	1980	1985	1990
France	8.0	11.2	14.7	2.7	12.4	21.7	10.6	23.6	36.3
Germany	19.4	24.2	27.1	3.2	4.8	8.1	22.6	29.0	35.1
Italy	1.6	0.9	3.2	na	2.1	2.9	na	2.9	6.1
United Kingdom	39.9	49.9	53.7	1.6	3.1	4.9	41.5	53.1	58.6
United States	17.8	21.1	23.5	2.2	5.0	7.7	20.0	26.0	31.2
Japan	13.8	16.6	20.8	1.8	3.6	5.6	15.6	20.2	26.4
Canada	19.4	23.3	26.7	1.0	1.6	3.0	20.4	24.9	29.7

Source: Bank for International Settlements, *Annual Report 1991/92*, p.194.

Notes: (1) Figures for Italy (book value) and UK refer to total assets.

(2) 1989 figures are used in 1990 column for UK and Italy.

### 3.3 Structural Developments

The trends of the 1980s, notably liberalisation, deregulation, innovation, internationalisation, institutional change and technological development, have left their marks on the financial services sectors in the EU. The structure of the EU banking industry has altered during the 1980s mostly as a reaction to domestic deregulation processes and in anticipation of EU-wide regulatory changes as illustrated in Chapter 2 of this thesis. Gual and Neven (1993) have pointed out that both structural and conduct deregulation have had a significant impact on the structure of the industry:

- (i) structural deregulation has stimulated changes by reducing entry barriers (both for domestic and foreign competitors). In addition, structural changes have generated the reduction of functional separation and the elimination of the compulsory specialisation of banking institutions. These developments have stimulated entry by many institutions on lines of business in which they could not previously compete;
- (ii) conduct deregulation and the prospect of increased competition has had an indirect effect on market structure. To the extent that these changes have led to increased rivalry and lower profitability. That is, through the link of conduct, the performance of institutions in a particular market is tied to the structure of the that market.

Gardener and Molyneux (1990, p.32) have shown that every banking market in Europe has a group of dominant or 'core banks' which are recognised by both the authorities and the general public. In most European banking markets, there has been a trend, however, for local and regional based banks to form groups that could effectively compete against the national 'core' banks. Those countries with a large number of mutual and co-operative banks, for instance France, Germany, Italy and Spain, tended to have a stronger regional focus than countries which have a small number of relatively large private banks. The strength of the mutual banks within the EU and especially the four systems under study in this thesis can be identified if we consider the various changes in structural characteristics shown in Table 3.7. Out of the four banking

markets under study in all apart from Germany, the total number of banks declined between 1987 and 1990. The sharp decline in France was a result of the halving of the number of savings banks from 364 to 186, reflecting the strong consolidation movement in this sector at that time (see Banque de France, 1992; p.49). There was a more modest decline in the number of banks in Italy over the period, mainly resulting from the fall in the number of state commercial banks and cooperative and rural banks through merger. Again the decline in the number of banks in Spain was most notable in the cooperative bank sector, as well as for savings banks. Clearly in banking systems under study there has been a fall in the number of mutual banks in each system apart from in Germany.

Despite a fall in the number of banks in France, Germany, Italy and Spain between 1987 and 1990 the number of bank branches appeared to increase during the period. In Germany, the number of branches increased by a staggering 16000 or so, by nearly 3000 in Italy and over 2000 in Spain. In France, the expansion of branch numbers was not so impressive compared with other banking markets. The main motive for the expansion of branch networks in Germany and Spain perhaps was to enable banks to compete for market share (a form of non-price competition). In Italy, branching restrictions had been removed in 1989 and this subsequently led to an increase in branch networks as market forces took over.

Finally, Table 3.7 reveals some interesting features about deposit market share during the late 1980s. Commercial banks' share of non-bank deposits fell in all the countries under study apart from in Germany where the share of this sector grew by 3.7% to 39.7% by 1990. German commercial banks increased their market share of households deposits at the expense of the cooperative and rural banks and postal giro offices. Savings banks in Germany (which are governed by a public law and can be regarded as public banks) held 36.1% of non-bank deposits in 1990. In France, Italy and Spain the commercial banks all controlled more than 50% of this market although in these markets they all lost market share to the mutual banks between 1987 and 1990.

Table 3.7 Institutional framework in banking markets of selected EU countries 1987 and 1990

Country	No. of Banks		No. of Branches		Market share (as % of deposits by the non-bank public)	
	1987	1990	1987	1990	1987	1990
<b>Belgium</b>						
Commercial Banks	86	87	3507	3487	67.54	64.30
Savings Banks	32	28	2300	3853	6.58	8.10
Public Credit Inst.	3	6	3277	2904	15.00	17.30
Post Office	1	1	3132	3208	10.88	10.30
Total	122	122	12216	13452	100.0	100.0
<b>Denmark<sup>1</sup></b>						
Commercial Banks	84	189	2114	2884	na	92.20
Savings Banks	143	na	1327	na	na	na
Cooperative Banks	36	33	93	na	na	0.40
Post Office	1	1	1293	1317	na	7.40
Total	264	223	4827	4201	na	100.0
<b>France</b>						
Commercial Banks	377	419	9939	10212	na	53.60
Savings Banks	364	186	4378	4307	na	3.40
Coop. & Rural Banks <sup>2</sup>	190	194	11175	11125	na	30.10
Post Office	1	1	17089	16967	na	12.90
Total	932	800	42581	42611	na	100.0
<b>Germany</b>						
Commercial Banks <sup>3</sup>	331	415	6643	7186	36.00	39.70
Savings Banks	598	781	18136	20128	36.70	36.10
Coop. & Rural Banks	3482	3384	19428	20819	21.80	19.60
Postal Giro Offices	13	14	17515	29193	5.50	4.60
Total	4424	4594	61722	77326	100.0	100.0
<b>Italy</b>						
Commercial Banks	164	153	7019	7940	57.30	56.40
Savings Banks	86	86	4169	4697	25.30	26.60
Coop. & Rural Banks	859	825	4177	5084	14.00	14.90
Post Office	1	1	13958	14441	3.40	2.10
Total	1110	1065	29323	32162	100.0	100.0
<b>The Netherlands</b>						
Commercial Banks	83	97	2338	2275	47.20	47.80
Savings Banks	58	54	1035	1027	4.30	3.60
Coop. & Rural Banks	926	1	2345	2144	23.50	25.50
Post Office	1	1	2705	2715	25.00	23.10
Total	1068	153	8423	8161	100.0	100.0
<b>Spain</b>						
Commercial Banks	138	154	16554	16835	58.56	52.60
Savings Banks	79	65	13482	15476	37.74	43.40
Cooperative Banks	129	107	3113	2919	3.70	4.00
Total	346	326	33049	35230	100.0	100.0
<b>United Kingdom</b>						
Authorised Banks	567	537	14994	14509	45.40	56.70
Buildings Societies	137	99	6967	6051	53.60	42.70
Post Office <sup>4</sup>	1	1	21211	20871	1.00	0.60
Total	705	637	43172	41431	100.0	100.0

<sup>1</sup>Since 1989 commercial and savings banks not reported separately, post giro has been transformed into a bank (Girobank) and it uses the branches of the Post office.

<sup>2</sup>Includes 21 "Casease de Credit Municipal" that have 76 branches.

<sup>3</sup>Commercial banks include mortgage banks, instalment sales financing institutions, banks with special functions and loan associations.

<sup>4</sup>National Savings bank Facilities are available at Post offices on agency basis.

Source: Adopted from Vesala (1993, p.185-186).

### 3.3.1 Market Size, Branching and Concentration

The previous section identified that in recent years the market for credit intermediation has resulted in a progressive homogenisation in the activities of credit institutions and to a narrowing of the operational differences between commercial banks and other types of banking firm (i.e. savings banks, co-operative banks, and public credit institutions) (see Masera, 1992; p.343).

Table 3.8 illustrates various size characteristics of European banking markets for 1987 and 1990. The table shows that the German, French, Italian and Spanish (as well as the UK) banking systems are by far the largest banking sectors in the EU. As illustrated in Table 3.8, the Italian banking system is relatively unsaturated. Many of the new branches set up after the abandonment of branching restrictions have also been "high-tech" or "light" branches selling only a few products and being staffed by only three or four employees, and the incremental cost of the expansion in Italian banks in the early 1990s has been relatively modest (European Economy, 1993). Between 1987 and 1990 in Germany, Italy and Spain, the number of inhabitants per branch gradually declined and the lowest figure was recorded by Spain (1110 inhabitants per branch in 1990). For France, however, the figure increased slightly from 2184 in 1987 to 2207 but it is still lower than for Italy<sup>1</sup> compared with other EU countries.

Table 3.8 also illustrates that the number of ATMs have increased sharply and as a result the number of inhabitants per ATM has noticeably declined in the four countries. In Italy, the number of inhabitants per ATM decreased by almost threefold, over 7000, by nearly 3000 in Germany and around 1000 in France. This indicates that the aforementioned four banking systems have invested in new technological development to improve their network systems. It also appears that the smallest average branch size in terms of both total assets and non-bank deposits (ECU millions), was in Spain followed by Germany.

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<sup>1</sup>European Economy (1993, p.157) noted that the situation has improved over the last three years with the opening of about 5000 new branches in the period 1990-92, which has declined the number of inhabitants per branch to 2770.

Table 3.8 The size of the banking systems of the EU (at the end the 1989)

	Number of Banks		Number of Branches		Total Assets Size (ECU mil.)		Number of ATMs		Number of inhabitants per Branch		Number of inhabitants per one ATM		Total Assets per Branch (ECU mil.)		Non-bank Deposit per Branch (ECU mil.)	
	1987	1990	1987	1990	1987	1990	1987	1990	1987	1990	1987	1990	1987	1990	1987	1990
B	121	10244	9084	10244	409234.2	479828.9	802	939	1086	973	12304	10614	45.05	46.84	14.11	15.64
DK	263	2884	3534	2884	109554.0	142296.6	570	1016	1452	1783	9000	5060	31.00	49.34	15.12	23.26
F	931	25492	25492	25569	1117059.4	1470473.2	11500	14428	2184	2207	4841	3910	43.82	57.51	14.05	21.62
D	4411	4580	44207	48133	1627701.7	2076939	7500	11300	1383	1314	8153	5596	36.82	43.15	19.90	22.46
I	1109	1064	15365	17721	65485630	866025.3	4367	9770	3731	3253	13128	5900	42.62	48.87	22.32	24.96
NL	1067	152	5718	5446	266630.3	426857.5	450	2700	2554	2727	32602	5537	46.63	78.38	23.54	37.04
E	346	326	33049	35230	346023.1	35533029.9	na	14000	1175	1110	na	2783	10.47	15.13	6.96	10.33
UK	704	636	21961	20560	1278349.8	1770627.2	12500	17000	2591	2792	4551	3377	58.21	86.12	48.98	69.08

Note: Post office was not included.

B = Belgium, DK = Denmark, D = West Germany, E = Spain, F = France, I = Italy,

L = Luxembourg, NL = Netherlands, UK = United Kingdom.

Source: Adopted from Vesala (1993, p.188-189).

Perhaps better indicators of market size are relative measures, such as the importance of banks capital in relation to GDP. Table 3.9 illustrates that the concentration of banking power and the number of banks which were listed in the Banker's (1992) top 1000, together with their assets size in 1992. The last column of table 3.9 indicates capital as a percentage of GDP. It is interesting to note the strong capital position in Spain, Italy and the Netherlands. Whereas, Germany has the lowest level of capital as a percentage of GDP, resulting from the hidden value of investments and property not included in published capital (Morgan Stanley, 1993).

In the majority of industrialised countries a large level of concentration appear to be evident, such that a core small number of banks represent a large proportion of banking sector assets and liabilities. It was observed that there has been a process of concentration in the banking industry, the main driving forces of which have been the need to maintain and expand market shares, economies of scale and economies of scope (OECD, 1992b). Table 3.10 shows the five-firm assets concentration ratio for EU banking markets for years 1987-90. It can be seen that Germany has one of the lowest levels of market concentration in the EU, whereas in 1990 the five-firm asset measure is around 40% in France Italy and Spain. One can also see that concentration ratios are markedly higher for the much smaller banking markets - with the noticeable exception of Luxembourg. The degree of concentration has increased most significantly in Spain, the Netherlands, France and Italy, as a result of domestic mergers and acquisitions (for example, in the Netherlands, France and Italy) and also in attempts to restore profitability, which perhaps eroded because of conduct deregulation and the breakdown of implicit agreements (Gual and Neven, 1993). OECD (1992b) has noted that many smaller banks did not expect to survive the opening up of borders, within the EU, on their own, and were looking for the best way out. Banque de France (1993; p.56) has noted that the French banking industry has moved to greater concentration, resulting from mergers and bank closures. Against a backdrop of increasing competition and economic slow down, both the supervisory authorities and the banking industry's representative bodies were in favour of absorbing or grouping together the smallest institutions.

Table 3.9 The number of banks in the top 1000 and their capital and asset size for selected EU countries in 1992

	No. of Banks in Top 1000	Assets (\$bn)	Avg. Assets per Bank (\$bn)	Capital (\$bn)	Avg. Assets per Bank (\$ m)	Capital as % of GDP
Belgium	10	407	40.7	11.4	1144	6.4
Denmark	12	178	14.8	9.8	815	8.6
France	27	2050	75.9	83.2	3080	7.7
Germany	87	2588	29.8	80.3	923	4.7
Ireland	2	54	26.8	2.6	1306	6.8
Italy	95	1589	16.7	85.7	902	10.4
Netherlands	12	577	48.1	27.7	2310	10.0
Spain	45	678	15.1	42.8	952	11.5
United Kingdom	34	1121	33.0	55.6	1635	7.2

Source: Adopted from Morgan Stanley (1993, p.7).

As it can be seen from the five-firm concentration ratios in Table 3.10, the EU banking industry appears to be characterised by a few large institutions and a substantial number of smaller, local and more specialised banks. Following Buigues and Jacquemin (1988)'s categorisation of structural environments, it could be argued that the European banking industry has characteristics common to both an environment where volume is the main feature and where specialism is also important. For instance, in the supply of traditional services, such as retail banking, size could be more important to compete efficiently. Alternatively, many of the functions of investment banking have some specialised aspects, which make the services non-homogeneous and the relation between lender and customer specific, in particular when the customer is a local small or medium sized institution.

### 3.3.2 Competition and Competitors

The opening of the EU banking markets has provided domestic banks and other financial services firms with an opportunity to expand their activities abroad but has also forced them to face increased foreign competition in their domestic marketplace. The important element in the process of financial deregulation has been the opening up of the European banking system to domestic and foreign competition. This move has



been important in shaping the current state of the European financial market place. For example, foreign banks in Spain were instrumental in introducing new financial services. They fostered the development of the interbank market, established investment banking, and introduced new technology in banking services (see Pastor, 1993; p.20). During the last decade or so, competition has increased rapidly in financial services markets, between banks as well as banks and other financial institutions (see Revell, 1989). This intense competitive environment has motivated banks and financial institutions of all kinds to broaden and improve the quality of their services and hence their customer bases (Gardener and Molyneux, 1990).

Table 3.10 Market concentration in the EU banking systems  
(Market share of the five largest banks, % of total assets)

	1987	1988	1989	1990
Belgium	58.2	57.5	57.9	54.9
Denmark	-	74.3	77.1	-
France	42.8	42.8	42.8	45.0
Germany	24.6	25.7	26.3	27.4
Greece	63.7	62.3	63.4	-
Italy	39.1	41.1	44.5	43.0
Luxembourg	25.4	26.8	25.9	24.7
Netherlands	86.8	90.4	83.7	84.1
Portugal	-	-	56.4	-
Spain	33.2	38.7	38.8	41.8
United Kingdom	-	29.0	29.1	27.8

Source: Gual and Neven (1993, p.166).

In order to gain sufficient mass to compete in more open markets banks have either merged or been acquired. Rationalisation and modernisation has especially affected savings banks. Arthur Anderson (1993) noted that saving banks were traditionally associated with retail banking and characterised by small size, limited geographical areas of operation, traditional products, weak management and management interference by local authorities. However, they have now become more profitable and one of the fastest growing segments across European banking markets.

Regulation has clearly heightened the level of competition in banking markets. In Italy, for instance, the 1989 Amato law allowed banks to operate in other sectors of the financial markets through subsidiaries owned by a central group holding company and provided banks with financial incentives to restructure in this way. Moreover, Italian banks were no longer restricted to operating in either the short-term or the medium to long-term borrowing and lending business, provided that the Bank of Italy's capital and risk ratios were maintained. Guiso et al. (1992) have also noted that during 1980s the easing of regulation in certain sectors, particularly in the insurance industry and the progress of the EU's Single Financial Services market programme has resulted in the increased competitive climate in banking markets. They argue that these changes have sharpened competition among lenders and insurance and credit firms.

Banque de France (1992) has noted that the concentration moves were the result of a systematic drive to reduce costs and optimise the size of institutions. Competition has been strengthened in France in recent years, and would become even keener with the effective completion of the single financial services market. As a result, Banque de France reported that the banking industry has been pressured to adapt their business and organisation so as to increase productivity and hence the level of competitiveness. Liberalisation has also heightened the degree of competition in the Spanish banking market, Banco de Espana (1993) reported that the years 1989-1992 was the culmination of the opening up and liberalisation of the Spanish banking system. The legal reserve and investment requirements have been eliminated, the only remnant being the Banco de Espana certificates which have begun to be redeemed in 1993; capital movements have been liberalised; new markets and alternative instruments to traditional banking ones have taken root. The overall outcome has been an increase in competition in the Spanish banking industry.

Schneider-Lenne (1993) has noted that most German banks have been universal banks that offer all possible types of banking services under one roof. The high degree of competition in German banking market was reflected in the total number of banks in Germany, where over 4000 banks registered with the Bundesbank with more than 45000. In addition, there is increasing competition from non-banks and near-banks like for instance credit card companies or insurance groups which offer an ever larger range

of financial products without being subject to the same regulation.

Most recently, Molyneux et al. (1994) have examined the competitive conditions in European banking between 1986 and 1989 and suggested that, other things being equal, competitive conditions in European banking have increased. The authors indicated that banks in Germany, France and Spain earned revenues as if under conditions of monopolistic competition in the period. In the case of Italy, they were consistent with banks having earned revenues as if under monopoly or conjectural variations short-run oligopoly conditions.

Overall, there has been a process of increased competition in European banking sectors, the main driving forces of which have been the need for banks to maintain and expand market shares, and profitability levels in a deregulating environment.

### **3.4 Universal versus Specialised Banking in Europe**

Another important feature of the financial scene over the last two decades or so has been a marked trend towards the universalisation of banking business. The EU's Second Banking Directive has helped promote this trend because it legislates for a universal banking market. Revell (1991), however, has noted that universal banks have been around for a long time, starting in the latter half of the nineteenth century in Germany. Universal banking does not have a clear definition, but it is most commonly accepted to describe a large commercial bank that undertakes corporate, wholesale, and retail banking, investment banking and securities business (Steinherr and Huveneers, 1990). Recently, large banks have also set up close links with insurance companies or even merged, and so nowadays the definition of universal banking could be expanded to contain also insurance business (see Revell, 1992).

The main factors why banks have diversified are numerous and have been widely analysed (see Gardener, 1990; Abraham and Lierman, 1991; Rybczynski, 1992; Cesarini, 1992; and Canals, 1993). In general the main reasons appear to be: (i) to utilise efficiently the existing network of branches, and to spread costs over a wider range of business areas so as to enhance profitability; (ii) because of the increased

capital standards to enter certain business areas; (iii) to reduce the variability of revenues; (iv) to reduce interest rate, credit and liquidity risks attached to banking activity; and (v) to benefit from substantial scope economies that are believed to be present in the provision of financial services.

While universal banks may benefit from both economies of scale and scope (see Steinherr and Huveneers, 1990), the concept of the universal bank has come under fire in recent years. Lohneysen et al. (1990a), for example, has argued for the dismantling of universal banks and their transformation into 'federal' (or 'federated') banks. The aforementioned study pointed out that the history of banks that form the core of universal banks has left them with a reliance on branches as the principal channel of distribution and thus with a generally low level of skill of among their staff. Increased competition, especially in the form of ever higher interest rates on deposits, together with the relative stagnation of retail markets in recent years, it is argued, has indicated that this type of organisation is no longer the most efficient form of banking organisation.

Revell (1992) points to the fact that the "new" competitors in European banking were mainly specialist operating in one of the separate areas of production, distribution or processing. [Mester (1990) has also indicated a related point showing that there are scope diseconomies for the traditional bank functions of originating and monitoring loans but not for the non-traditional ones of loan selling and buying].

Lohneysen et al (1990a) grouped the broad classes of specialised banking institutions, including also UCITs and money market funds, into three subclasses: (i) product, (ii) distribution and (iii) processing specialist. Product specialists utilised product differentiation opportunities, for instance in the mortgage and consumer loans areas. Other forms include substitutes for time and demand deposits; such as mutual funds and other forms of managed investment. Distribution specialists offer services to specified customers. Finally, processing specialists capitalise on scale economies in certain service areas such as credit card processing. In addition, it is argued that these specialised institutions can utilise further cost advantages by adopting more advanced technology and labour skills than universal banks.

Commentators such as Forestieri and Onado (1989), Gardener, (1990), Metais (1990), Shaw (1990), Abraham and Lierman (1991) and Revell (1992) have also emphasised the disadvantages of the universal banking model but, nevertheless, this is the model most large European banks are adopting in the light of EU legislation. Another major factor encouraging banks to adopt the universal banking model relates to the cross-selling opportunities and the supposed scope economies relating to such activity. In fact, scale and scope economies, incorporating cost management have been of primary importance justifying the rationale for the universal banking concept in European banking.

### **3.5 A Note on Technological Levels in European Banking Systems**

Over recent years, banking activities have been strongly affected by the implementation of advanced electronic information technology, both as regards the production of financial services and their distribution. OECD (1992b) has noted that there has been a rapidly increasing awareness that many activities in the markets for financial services meet in an almost ideal way the conditions for a successful introduction and application of information technology:

- Financial services activities involve increasingly standardised operations or processes which lead to automation;
- An important volume of traditional paperwork and paper storage could be replaced by computerised data entry and storage;
- There are many processes that are considerably complex with regard to the number of successive operations or variables involved, which could justify the use of computers;
- In most of banking activities the use of computers leads to significant time savings as compared with manual or mechanical machine procedures;
- The use of information technology improves the required standards and criteria of cost/benefit analyses because of the resulting time saving effects and the decrease in the number of processing errors.

In the financial service sector information technology could be used significantly in the following major areas (see OECD, 1992b; p.122):

- (i) General management of financial institutions;
- (ii) Payments services;
- (iii) Money market and foreign exchange market transactions;
- (iv) Securities market operations;
- (v) Operations in new financial instruments;
- (vi) Asset and liability management including portfolio management;
- (vii) Financial market information services.

The application of new technology to the financial services sectors, especially in the payments field has advanced considerably in all European countries. The use of ATMs, cash dispensers and bank cards, and the effecting of automatic transfer payment and retrieval of basic account information by individuals has also become substantially common in these countries. In addition, EFTPOS terminals and home banking developments have become important for retail banking. Meanwhile, these changes together with advanced computer technology and telecommunications have, some argue, resulted in economies of scale and scope in the financial services sector (OECD, 1992b).

A number of developments have progressed in the area of electronic payments system and fund transfers. The European Commission and Council of Ministers has been involved such matters as the standardisation of electronic payments systems in Europe, the efficient use of resources and the protection of consumers to Electronic Funds Transfers (EFT) and the privacy of electronically held data. The Commission has been concerned with the standardisation of electronic payments systems within Europe and has also encouraged agreement on common standards for the European payments industry.

Technological innovations during the 1980s have already had a significant impact on the activity of the financial services markets. New technology has been reducing cost in what traditionally has been a labour intensive high-cost business. The networking of computer systems has transformed the speed, accuracy and economies of both retail and wholesale payments and delivery systems. The rapid expansion of the ATM networks (see Table 3.8) and EFTPOS in all European countries implies an apparent rise in

technological levels. It can be seen from table 3.8 that ATM network instalments increased sharply in 1990 for all countries compared with the figures for 1987, however, there were still significant differences in ATM usage across countries. Table 3.11 reports the size of EFTPOS networks and transactions in various European countries for 1987 and 1990. The table reveals that the growth in EFTPOS terminals was substantial over these years although the German and Italian banking systems still tend to be relatively underdeveloped compared with their other European neighbours.

Table 3.11 EFTPOS network and transactions in selected European countries, 1987 and 1990

	Number of EFTPOS terminals		Number of inhabitants per one EFTPOS terminal	
	1987	1990	1987	1990
Belgium	15388	28253	641	353
Denmark	6246	15804	821	325
France	70000	180000	795	313
Germany	6663	23152	9177	2731
Italy	744	22185	77058	2598
Netherlands	385	2223	38106	6726
Spain	na	311900	na	125
the UK	13000	110000	4376	522

	Number of EFTPOS transactions (1000)		Number of EFTPOS transactions per capita	
	1987	1990	1987	1990
Belgium	40600	79040	4.11	7.93
Denmark	6600	61542	1.29	11.97
France	530000	1167300	9.52	20.69
Germany	4000	35000	0.07	0.55
Italy	200	5400	0.00	0.09
Netherlands	na	27000	na	1.81
Spain	na	79000	na	2.03
the UK	na	192000	na	3.34

Source: Adopted from Vesala (1993, p.193).

### 3.6 Operating Efficiency in the European Banking Markets

Salomon Brothers (1993; p.2) recently argued that cost management has become the most important strategic theme throughout the banking world, "European banks, hampered with asset quality problems, slim loan demand and the difficulty of building reliable noninterest income streams, have globally turned to cost reduction as one of the principal drivers of earning growth".

Operating efficiency in the production of the banking system can be defined as employed inputs per unit of output, which corresponds closely to the concept of productivity. While most banks depend heavily on internal productivity measures such as relating output to staff time, these figures are usually not available to the outside analyst, and even if available Salomon Brothers (1993) have noted that these indices would not necessarily be comparable between banks across borders. Most comparisons of cost efficiency usually use aggregate ratios relating cost to revenues or assets. These measures suffer from the limitation that they do not account for business mix or the risk profile of a banks' business. They also do not take into account the quality of service. Nevertheless, it is these measures which are most frequently drawn-up to use cross-country comparison of bank efficiency. For example, Table 3.12 illustrates the efficiency measures of the various European banking systems.

It can be seen that the figures in table 3.12 reveal large efficiency differences across European countries. Vesala (1993) argues that it is the low price competition in countries (such as Italy France, and Spain) where regulations persisted which has generated low levels of efficiency. When we compare the average figures for the period 1983-86 and 1987-90 there seems to be an overall improvement in the labour usage efficiencies with respect to total assets (apart from Spain), however, when we concentrate on the alterative measures which use non-bank deposits as the denominator then, for example Belgium, Denmark, France, Germany, and the Netherlands seem to experience a moderate decrease in efficiency. From these figures Vesala (1993) generally concludes that production in banking has become more capital intensive resulting from the adoption of new banking technologies, given that the share of non-staff operating costs has in most systems increased.



Table 3.12 Banks' aggregate operating efficiency in selected European countries, 1983-1990 (%)

	(Staff costs/Non-bank deposits)*100			(Non-staff operating costs/Non-bank deposits)*100		
	Average 83-86	Average 87-90	Average 83-90	Average 83-86	Average 87-90	Average 83-90
Belgium	3.22	2.66	2.88	1.60	1.47	1.53
Denmark	2.76	2.69	2.72	1.56	1.61	1.59
France	3.75	3.03	3.32	2.03	1.94	1.99
Germany	2.10	2.04	2.06	1.14	1.14	1.14
Italy	3.74	3.76	3.75	1.45	1.54	1.49
Netherlands	2.45	2.30	2.36	1.36	1.61	1.49
Spain	2.98	3.01	3.00	1.45	1.46	1.45

Source: Vesala (1993, p.196).

Notes: Staff costs include salaries and other employee benefits plus transfers to pension reserves. Non-staff operating expenses covers all non-interest expenses related to regular banking business including expenses for property and equipment and related depreciation expenses.

Table 3.13 presents operating costs for the French, German, Italian and Spanish banking markets during the 1980s and early 1990s. Operating costs as a percentage of total assets fell constantly in France over the period. Cost falls for Italy and Spain appeared greater between 1982-83 and 1986-87 then in the latter period 1990-91. The operation activity increased in Germany in 1986-87 but fell bank in 1990-91. In 1990-91 the cost ratios calculated by Conti and Maccarinelli (1993) all fell to around 60%, although they were lowest in Spain.

Table 3.13 Operating costs for the French, German, Italian and Spanish banking systems (%)

	Operating Expenses as a percentage of total assets			Operating Expenses as a percentage of gross income		
	1982-83	1986-87	1990-91	1982-83	1986-87	1990-91
France	2.18	1.91	1.58	67.5	67.5	66.9
Germany	2.13	2.28	2.05	61.4	65.6	64.9
Italy	3.89	3.04	2.99	65.5	66.3	63.3
Spain	3.18	3.02	2.99	66.1	63.2	57.6

Source: Adopted from Conti and Maccarinelli (1993, p.8 and p.10)

Salomon Brothers (1993) noted that within the cost categories, European banks predominantly focused on staff expenses, which have begun to decline in all countries with the exception for Italy (see Table 3.14). [The latter phenomena possibly being a

result of the lifting of branch expansion restrictions in 1989]. Despite the increase in staff numbers, competitive pressures have been forcing the Italian banks to reduce their costs, especially public banks. Italian banks have, up until recently, placed a low management priority on cost management focusing more on building national branch networks to get cheap customer deposit needed to sustain profitable asset growth. Once the preoccupation to build nationwide branches has been completed it is believed that all the main banks increasingly focus on cost reduction (Salomon Brothers, 1993). In addition, Banco de Espana (1993) has noted that in Spain the large banking institutions have launched market strategies to raise funds in the savings-account segment, as result there has been a further heightening of competition for deposits. This has made the typical financing of these institutions more sensitive to changes in short-term market rates and resulted in a reduction in operating margins by increasing the proportion of higher-yield liabilities (see Banco de Espana, 1993; p.48).

Table 3.15 shows banks' cost/income ratios for selected EU countries between 1988 and 1993. This ratio was calculated including the principal mainstream banks but excluding specialist institutions (see Morgan Stanley, 1994; p.7). The table demonstrates that there was potential to improve efficiency in a number of countries. In the five years to 1992, the most significant improvements appeared to be in Germany compared with France, Italy and Spain. Although the Spanish figures were the lowest throughout this period, the cost/income ratios increased from 51.9 in 1988 to 60.1 in 1992. Salomon Brothers (1993) have noted, however, that in the context of a deteriorating economy and intensified domestic competition, cost management was at the centre of strategy for the Spanish banks during these years. (Substantial obstacles to staff reductions may be the reason for the increased cost/income ratio trends together with overall economic recession during this period.) In Italy, the aforementioned study stated that cost management has been relatively less important for the banks compared with their European counterparts. The banks have focused on establishing national branch networks to capture the lucrative core customer deposits needed to sustain profitable asset growth. The cost/income ratio for Italy fell slightly over the period. For France, the cost/income ratio stayed at the same level for the years 1988 and 1992 at 69%.

Table 3.14 Staff costs for the French, German, Italian and Spanish banking systems (%)

	Staff expenses as a percentage of total assets			Staff expenses as percentage of operating costs		
	1982-83	1986-87	1990-91	1982-83	1986-87	1990-91
France	1.45	1.20	0.95	66.7	62.8	60.0
Germany	1.47	1.49	1.29	68.8	65.1	63.1
Italy	2.07	2.17	2.11	71.6	71.5	70.4
Spain	2.15	2.11	1.91	67.6	69.9	63.8

Source: Adopted from Conti and Maccarinelli (1993, p.8 and p.10)

Overall, the information available on cost and efficiency levels suggest that European banking markets have become more efficient and cost effective in recent years, with falls in cost-income ratios and other cost related measures in most markets. The aforementioned tables also indicate that in France and Italy, banking market which have traditionally had high levels of public ownership, cost levels do appear to be higher compared with in Germany and Spain.

Table 3.15 Cost/income ratios for selected EU countries, 1988-1993 (%)

	1988	1989	1990	1991	1992	1993*
Belgium	74.1	73.7	76.6	73.2	69.9	65.9
Denmark	53.2	69.8	70.6	62.5	76.6	49.5
France	69.0	68.5	72.9	70.8	69.0	67.5
Germany	67.2	66.6	68.1	67.2	64.9	61.3
Italy	69.1	65.4	63.6	65.8	65.3	65.0
Netherlands	67.5	66.6	69.2	67.7	67.1	66.3
Spain	51.9	52.7	56.9	60.9	60.1	61.8
United Kingdom	65.2	64.7	65.9	65.7	60.2	58.8

Source: Adopted from Morgan Stanley (1994, p.8).

Note: The ratios for each country are the arithmetical average for selected banks.

\*Morgan Stanley Research Estimates.

### 3.7 Performance Comparisons

A comparative analysis of banks' performance suffers from two methodological problems. The first relates to the choice of the appropriate measure of profitability. The second is concerned with the standardisation of data from different countries and, more generally, the need for an accurate reference point from which to compare the results

obtained. Gilbert (1984), Molyneux and Thornton (1992) and Canals (1993) (amongst others) have noted that the two indicators, Return-on-equity (ROE) and Return-on-Assets (ROA) are widely recommended for the comparison of profitability between different banks and banking systems. Despite the range and complexity of a bank's activities, its business may be classified broadly into two categories: incomes and expenses. These simple revenue and cost categories enable bank profitability and performance to be traced and allow meaningful operating comparisons between banks, both domestically and internationally.

In recent years as market conditions have become tougher and more competitive the focus of profitability management has tended to shift away from interest earnings towards fees and other income generated from sales of insurance, travel and other investments (see Shaw and Whitley, 1994). The OECD (1992b) has also identified to these trends by stating that the process of deregulation has influenced the profitability of banks, in particular by putting considerable pressure on their interest margins and forcing them to concentrate on fee income and cost reduction. The main reasons for increasing pressure on interest margins are:

- the removal of administrative constraints when fixing interest rates on customer deposits which has caused negative repercussions on the cost of funding in many countries;
- the elimination of the remaining protectionist barriers in place with regard to foreign market participants and the liberalisation of capital movements which have prompted growth in competition, specifically in lending to large corporations;
- the move of banks toward disintermediation resulting from the greater opportunities for large corporations to access capital markets directly;
- the removal of the still existing limitations on the opening of new branches which has brought about an erosion of monopolistic earnings which various small and medium-sized credit institutions had enjoyed in local markets.

Table 3.16 shows trends in net interest margins between 1987 and 1991 for the world's main banking systems. Between 1986/87 and 1990/91 margins fell in all systems apart from in Italy (+0.27%), Spain (+0.16%), Switzerland (+0.08%), Finland (+0.18%) and the US (+0.16%). Margins appear to be high in Italy and Spain, which may be a possible reflection of the highly regulated nature of both systems. In fact, Spain has tended to be a high margin banking system, even though the country had its worst recession between 1991-1993, margins at levels of around 4% were still being achieved (Morgan Stanley 1994).

At the end of the 1980s, Arthur Anderson (1993) noted that the performance of the French banking industry compared favourably with those of other EU countries. More recently, however, French banks have suffered from the effects of Europe's deteriorating economy. In addition, interest margins have been under severe pressure resulting from increased competition and disintermediation, including the increasing preference of French investors for higher-yielding money-market funds over bank deposits.

Table 3.16 Interest margins (%)

	Interest Margin as % of Total Asset					
	1982-83	1986-87	1990-91	D1	D2	D3
France	2.69	2.41	1.82	-0.28	-0.59	-0.87
Germany	2.58	2.44	2.10	-0.14	-0.34	-0.48
Italy	3.17	3.21	3.48	0.04	0.27	0.31
Spain	3.93	3.83	3.99	-0.10	0.16	0.06
UK	3.18	3.18	2.96	0.00	-0.22	-0.22
Belgium	1.66	1.56	1.35	-0.10	-0.21	-0.31
Netherlands	2.33	2.37	1.94	0.04	-0.43	-0.39
Switzerland	1.30	1.30	1.38	0.00	0.08	0.08
Finland	1.88	1.42	1.60	-0.46	0.18	-0.28
Norway	3.41	2.81	2.63	-0.60	-0.18	-0.78
Sweden	2.13	2.55	2.08	0.42	-0.47	-0.05
Japan	1.53	1.24	1.01	-0.29	-0.23	-0.52
US	3.15	3.35	3.51	0.21	0.16	0.37

Source: Conti and Maccarinelli (1993, p.5)

Note: D1 = Absolute change between 1986/87 and 1982/83

D2 = Absolute change between 1990/91 and 1986/87

D3 = Absolute change between 1990/91 and 1982/83

Table 3.17 illustrates the decline in importance of interest income as proportion of total income in banks business across Europe. The only EU banking system that experienced

an increase in the relative percentage of interest income between 1986/87 and 1990/91 was in Italy. In the other EU banking systems there was clearly a move to generate increased fee and commission income as proportion of total income over this period. A trend which in fact is continuing to the present (Arthur Anderson, 1993; p.53-58).

Finally, table 3.18 reports the pre-tax return on assets and return on equity for selected European countries between 1982 and 1991. Over the years the drop in profitability appeared to be evident if measured by both ROA or ROE. Viewing the ROA figures for the largest European banking markets, one can see that over the period the largest profits improvements were experienced by banks operating in the Spanish and Italian market. Returns to German banks appear to be relatively stable over the period. A fall in overall profitability levels during the period were recorded by banks operating in the UK and French market. Although it is difficult to point out precise conclusions from these figures, one may tentatively suggest that the marked difference in variability of performance of banks across country may result from one or more of the following factors: markedly different operating conditions; varying difficult competitive environments; profit activities in same banking systems. The size and number of foreign banks may add to the variability of foreign bank performance of banking systems returns. (see Gardener and Molyneux, 1990; of Chapter five).

Table 3.17 Interest incomes as a percentage of gross incomes

	1982-83	1986-87	1990-91	D1	D2	D3
France	83.4	85.2	77.3	1.8	-7.9	-6.1
Germany	74.2	70.2	66.7	-4.0	-3.5	-7.5
Italy	71.8	70.1	73.6	-1.7	3.6	1.9
Spain	81.6	80.1	77.0	-1.5	-3.2	-4.6
UK	66.9	63.2	60.2	-3.7	-3.1	-6.7
Belgium	77.2	73.7	76.0	-3.5	2.3	-1.2
Netherlands	76.6	75.1	71.0	-1.5	-4.1	-5.6
Switzerland	52.3	49.4	48.7	-2.9	-0.8	-3.6
Finland	48.6	41.4	48.9	-7.2	7.5	0.3
Norway	72.9	70.3	74.1	-2.6	3.8	1.2
Sweden	70.2	68.0	73.8	-2.2	5.8	3.6
Japan	85.7	77.7	83.1	-8.0	5.4	-2.6
US	74.3	69.9	66.4	-4.4	-3.6	-8.0

Source: Conti and Maccarinelli (1993, p.7)

Note: D1 = Absolute change between 1986/87 and 1982/83

D2 = Absolute change between 1990/91 and 1986/87

D3 = Absolute change between 1990/91 and 1982/83

Table 3.18 reports the ROE figures across large European banking markets between 1982 and 1991. It can be seen that the highest figures for ROE, on average, were for Italian and Spanish banks, with 1990/91 values over 10%, whilst the lowest ratios were for the French banking system, below 6%. This is a general reflection of reasonable profitability yet low levels of capital held by the state French banks during this period. For Germany, ROE rose rapidly in the first half of the 1980s then decreased and overall improved slightly.

Table 3.18 Pre-tax return on assets and return on equity for selected European countries

	Return of assets					
	1982-83	1986-87	1990-91	D1	D2	D3
France	0.36	0.35	0.27	-0.01	-0.08	-0.09
Germany	0.57	0.71	0.61	0.14	-0.10	0.04
Italy	0.80	1.01	1.21	0.21	0.20	0.40
Spain	0.62	0.91	1.55	0.29	0.64	0.93
UK	0.82	0.74	0.56	-0.09	-0.17	-0.26
Belgium	0.34	0.41	0.32	0.07	-0.09	-0.02
	Return on equity					
France	7.94	8.84	5.90	0.89	-2.93	-2.04
Germany	5.58	7.17	6.31	1.89	-0.86	0.73
Italy	8.72	8.57	10.46	-0.15	1.88	1.73
Spain	5.69	7.78	10.36	2.09	2.58	4.67
UK	12.68	7.75	6.72	-4.93	-1.03	-5.95
Belgium	7.96	8.45	6.88	0.49	-1.57	-1.08

Source: Adopted from Conti and Maccarinelli (1993, p.15)

Note: D1 = Absolute change between 1986/87 and 1982/83

D2 = Absolute change between 1990/91 and 1986/87

D3 = Absolute change between 1990/91 and 1982/83

A major factor impacting on bank profitability is asset quality. As can be seen from the following table, the asset quality varies among the regulatory environments. Table 3.19, Loan Quality Figures by Country shows loan quality figures for the major EU banking countries (namely France, Germany, Italy, Spain) and United States. The ratios in the table focus on two kinds of measures of asset quality. The first group, which was most readily available, depends on the loan-loss provisions banks make. The classes are: 'Loan Loss Provision' and 'Loan Loss Reserves/ Gross Loans'. The second group included actual losses or past due loans. The major difference between these two kinds

Table 3.19 Loan quality figures by country for the period 1987-90

Country	1987	1988	1989	1990
<b>France</b>				
Write-off /Average Loans	0.01 %	0.03 %	0.01 %	0.01 %
Loan Loss Provision	0.54 %	0.38 %	0.42 %	0.29 %
Past Due Loans/Gross Loans	0.32 %	0.87 %	0.72 %	0.76 %
Loan Loss Reserve/Gross Loans	0.83 %	0.70 %	0.52 %	0.41 %
Loans to Customer:	2799339	3588542	4879021	5447563
Loan Growth Rate	n/a	28.16 %	35.96 %	11.65 %
<b>Germany</b>				
Write-off /Average Loans	n/a	n/a	n/a	n/a
Loan Loss Provision	0.51 %	0.35 %	0.53 %	0.63 %
Past Due Loans/Gross Loans	0.00 %	0.00 %	n/a	n/a
Loan Loss Reserve/Gross Loans	n/a	n/a	n/a	n/a
Total Loans	2135827	2355401	2560387	2818538
Loan Growth Rate	n/a	10.28 %	8.70 %	10.08 %
<b>Italy</b>				
Write-off /Average Loans	0.00 %	0.00 %	0.00 %	0.00 %
Loan Loss Provision	0.72 %	0.81 %	0.96 %	0.91 %
Past Due Loans/Gross Loans	0.70 %	0.69 %	0.62 %	0.72 %
Loan Loss Reserve/Gross Loans	2.99 %	2.59 %	2.50 %	2.56 %
Total Loans	400134	508026	610784	691912
Loan Growth Rate	n/a	26.96 %	20.23 %	13.28 %
<b>Spain</b>				
Write-off /Average Loans	0.97 %	1.10 %	0.74 %	0.52 %
Loan Loss Provision	1.65 %	1.27 %	1.01 %	1.12 %
Past Due Loans/Gross Loans	2.90 %	3.29 %	3.46 %	3.17 %
Loan Loss Reserve/Gross Loans	3.32 %	3.15 %	2.95 %	3.02 %
Bills and Loans, Net:	23696995	31576476	36150118	45110086
Loan Growth Rate	n/a	33.25 %	14.48 %	24.79 %
<b>United Kingdom</b>				
Write-off /Average Loans	0.30 %	0.65 %	0.83 %	0.93 %
Loan Loss Provision	0.45 %	1.04 %	0.70 %	0.88 %
Past Due Loans/Gross Loans	0.59 %	0.49 %	0.26 %	0.41 %
Loan Loss Reserve/Gross Loans	2.72 %	3.38 %	2.93 %	3.10 %
Total Loans Net:	493104	608169	738562	749428
Loan Growth Rate	n/a	23.33 %	21.44 %	1.47 %
<b>United States</b>				
Write-off /Average Loans	1.15 %	1.22 %	1.47 %	1.83 %
Loan Loss Provision	2.44 %	0.84 %	1.70 %	1.63 %
Past Due Loans/Gross Loans	3.69 %	3.32 %	3.34 %	4.01 %
Loan Loss Reserve/Gross Loans	3.07 %	2.67 %	2.90 %	2.84 %
Total Loans	1160721	1349789	1596309	1539177
Loan Growth Rate	n/a	16.29 %	8.14 %	5.45 %

Source: Adopted from Bollenbacher, G.M., (1992), "Bank Strategies For the 1990s", (Dublin, Lafferty Publications Ltd), p.90-92.

of measures are that the provisions data is based on the banks' estimates of potential loan losses, while the other figures rely on actual data. It can be seen from table 3.19, the 'Loan Loss Provision' figures ranged from 0.29% of loans for France to 1.63% in



the US for 1990. Moreover, when we examine actual reserves, by 'Loan Loss Reserve/Gross Loans' the 1990 figures appeared to be similar for the UK, US, Spain and Italy. France, experienced the lowest loan-loss provisions of 0.41% (Germany has n/a for all years).

### **3.8 Ownership and Efficiency in European Banking**

Recently, there has been concern about the effect of ownership on the efficiency of banks. Generally, there has been worry about the incentives for managers to efficiently allocate resources under different ownership arrangements. In other words, if owners do not have the incentive or capability to monitor the activity of management, then agency problems and subsequent costs are thought to increase.

In Europe, this concern covers the effect of mutual and government ownership on banks efficiency. There are questions about how the benefits of competition are going to be passed on to consumers if substantial segments of the banking sector do not have incentives to be efficient nor do they fear the possibility of a takeover. This is the environment in the European Union where the "single passport" gives banks the apparent ability to do business in any country, but growth through acquisition across country may be severely limited because of the large size of the mutual sector and the public ownership of large segments of various banking systems (most noticeably in Italy and France). Thus, an important method of entry and stimulation of competition by outside institutions is effectively thwarted.

In an analysis of the ownership and performance characteristics of top banks in the EU between 1985 and 1987, Molyneux (1989) notes that an important feature distinguishing Continental European banking systems from British-based systems was that publicly controlled banks (whether by central or local government) were much more important in EU countries. Table 3.20 illustrates that out of the 162 EU banks listed in the 1987 Banker "Top 500", 69 were privately owned and 67 publicly owned. The mean performance figures for the public banks appeared marginally worse than those for private banks, however, both sectors displayed remarkably similar characteristics, apart from the average number of employees. The average public bank employed half as

many staff as the private banks. Molyneux (1989) noted that the reason for this were not clear, but it could be the case that central management costs and staffing levels of some public banks were hidden in government accounts.

Table 3.20 Statistical summary of the ownership characteristics of top banks in the EU, 1987 (Arithmetic means and standard deviations)

No. of EU banks in Bankers Top 500	Assets \$ m.	PTP	PTP/Assets	PTP/CAP (%)	CAP/Assets	NINT/Assets	Employees	
Private	69	37601 (1.15)	207.2 (1.61)	0.77 (0.89)	16.36 (0.80)	4.81 (0.48)	3.01 (0.59)	15948 (1.36)
Public (Central & local govt)	67	31133 (1.09)	158.9 (1.43)	0.61 (1.10)	14.30 (0.66)	3.70 (0.54)	2.14 (0.60)	7261 (1.48)
Co-operative	14	41402 (1.36)	242.8 (0.95)	0.892 (0.60)	17.31 (0.40)	5.16 (1.36)	0.06 (0.62)	12124 (1.69)
Mutuals	12	10421 (0.50)	77.5 (0.64)	0.81 (0.46)	14.78 (0.52)	6.14 (0.39)	3.99 (0.29)	4419 (0.56)

Source: Gardener and Molyneux (1990, p.35).

Note: a) Classification after Revell (1987). Large German savings banks are controlled by local government organisations and therefore are classified as public rather than mutual organisations.

b) Figures in parentheses are standard deviations/means.

c) PTP - pre-tax profits, CAP = Capital, NINT = net interest income.

In the aforementioned analysis, credit co-operatives were found, on average, to be larger than their public and private bank counterparts, and this was because they represented central institutions that did business on behalf of very large groups of smaller institutions. The mutual institutions (savings banks) tended to be smaller in size, although their ROA (return on assets) and ROC (return on capital) figures were comparable with those of private and public banks. Molyneux (1989) also noted that of the top 162 banks in the EU, 93 were not operated for a commercial profit or to satisfy the requirements of private shareholders. These institutions may not be acquired through hostile takeover. Since Molyneux's (1989) study, however, various countries, such as Italy, France and Spain have established legislation enabling mutual and public banks to convert to corporate status and achieve stock-exchange listings.

A more recent empirical study by Molyneux and Thornton (1992) has investigated the relationship bank performance and state ownership in European banking. The study found a statistically significant positive relationship between state ownership and bank

profitability, suggesting that state-owned banks generated higher returns on capital than their private sector competitors. The authors argued that the results may not be so surprising because state-owned banks generally maintain lower capital ratios (because the government implicitly underwrites their operations) than their private sector counterparts.

### **3.9 Mergers, Acquisitions and Cooperation Agreements in the 1990's**

Since the early 1980s, EU member countries have experienced a continued expansion of operations by foreign banks in their markets. This development can be illustrated by various factors. Firstly, EU member countries continued to deregulate their financial markets and foreign exchange controls over this period (especially after 1985 EU White Paper), which broadened the area of activities for internationally operating banks. Secondly, in general, member countries have accepted or reverted to a policy of adopting a more favourable attitude towards the new entry of foreign financial institutions. Thirdly, banks have been expanding their operations abroad by cross-border mergers and acquisitions.

The financial integration of Europe has been generating a powerful boost to the opening-up of banking systems. This has been seen in the increase in banking activity carried out on international markets and in the creation of a broad network of connections among financial institutions in various European countries. Meanwhile, technological improvements have had an important impact on the way in which financial services are provided. New technologies have enabled institutions to operate or compete in new markets, by reducing the cost of entry. These rapid developments coupled with the powerful regulatory forces outlined in Chapter 2 of this thesis have generated merger or acquisition business in Europe in the run-up to 1993. Table 3.21 shows that within the European Union there was a significant increase in both the number of domestic bank mergers and acquisitions of minority holdings during the late 1980s and early 1990s. After the peak for 1990, the number of acquisitions of majority holdings including merger and of cross-border operations in particular decreased noticeably. Since both Union and international operations were exceptionally numerous in 1990, it could be that in many cases acquiring firms acted in anticipation of the Merger Control

Regulation.<sup>2</sup> It can be seen from the table that the banking and insurance industry were far less open towards foreign takeovers and domestic acquisitions were the most important. Over this period, the insurance sector appeared to be relatively more open towards cross-border deals as compared with the banking industry.

Commission of the European Community (1992c, p.426) has noted that large-scale takeovers by EU firms were strongly concentrated in the banking sector, while more limited operations occurred in other sectors (see Table 3.22). The aforementioned study also indicated that in the banking sector, acquisitions were mainly concentrated in France, Germany and Italy. In terms of the number of deals domestic takeovers were predominantly in Germany and Italy, with 34 out of 51 takeovers, concerning largely savings banks and cooperative banks. Takeovers by foreign banks, and in particular EU banks, occurred above all in France.

Table 3.21 also reveals that cross-border operations are generally, dominated by acquisition of minority holdings in financial service firms. In the banking industry, minority acquisition were mainly concentrated in France, Spain and Italy, with very few operations in other EU countries (see Commission of European Communities, 1992c; p.415-428).

In the process of the Single Market Programme, the Cecchini Report (1988) pointed out that regulation in domestic retail markets was largely responsible for preventing price competition, the economic cost of which was passed on to consumers. By removing restrictive regulations, the Report predicted that the single market would be created for banks to compete in foreign markets that were previously closed to them. This was expected to have the effect that when a bank became a target of an unfriendly takeover from a foreign banks they may be encouraged combine with other domestic banks as a defense against the external large predator institution (see Revel, 1991).

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<sup>2</sup>See Commission of European Communities, (1992c), *XXIst Report on Competition Policy 1991*, Office for Official Publications of the European Communities, (Brussels, EU).

Market forces, especially those fostered by the single market programme, have been encouraging banks to compete for retail business on an EU basis. Various forms of cross-border banking activity has spread rapidly throughout the EU (Molyneux, 1991; Bank of England, 1993). However, it is important to identify that the restructuring in domestic banking markets and the consequent degree of concentration could stimulate further cross-border activity. In other words, markets which are concentrated offer relatively limited opportunities either to new entrants or to existing organisations. *Ceteris paribus*, banks in such markets would possibly focus on merger or acquisition abroad. For example, the banking markets which appear to be less concentrated (and have relatively small banks compared with the top institutions from France, Germany and UK) were those of Italy and Spain. In Italy this seemed to make little difference however, to the number of domestic and cross-border merger and acquisition deals which were broadly equal, whilst in Spain there was more domestic merger activities than cross-border (Bank of England, 1993).

The most noticeable characteristic of cross-border activity in European banking has been the lack of any sizeable bank merger. Salomon Brothers (1990) have identified that cross-border acquisitions so far have involved large banks acquiring much smaller banks. There have, of course, been various large bank domestic mergers<sup>3</sup>. As a result, it could be argued that the deregulation of the internal market has resulted in greater concentration and less competition in domestic markets since domestic banking firms have merged in order to improve their competitive position relative to potential EU foreign competitors. Countries such as Spain and Italy has seen a number of mergers of major domestic banks: in Germany, the small co-operative and savings banks have been restructuring through merger, in response to domestic competition.

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<sup>3</sup>In Spain, Banco de Vizcaya and Banco de Bilbao merged into Banco Bilbao Vizcaya in October 1989. In May 1991 the Spanish authorities merged all state banking operations to create the country's largest bank Argentaria (now part-privatised). In the same year, Banco Central and Banco Hispano Americano, the fourth and sixth largest banks (by assets) announced that they merged to form the country's second largest bank, Banco Cental Hispano Americano. The most recent merger was between Banco Santander and Banesto in May 1994. Argentaria, the partly privatised bank had also hoped to purchase Banesto according to the Economist (1994). In Italy, Banco di Santo Spirito combined with Cassa do Risparmio Roma in 1989 and later on August 1, 1992 merged with Banco di Roma and name changed to Banca di Roma.

Table 3.21 Bank acquisitions of majority holdings (including mergers) and minority holdings in the European Union

	Banking	Insurance	Total
<u>Domestic</u>			
1987-88	53	14	67
1988-89	51	15	66
1989-90	65	16	81
1990-91	51	15	66
<u>Union</u>			
1987-88	12	14	26
1988-89	16	8	24
1989-90	23	18	41
1990-91	13	7	20
<u>International</u>			
1987-88	13	12	25
1988-89	16	10	26
1989-90	25	12	37
1990-91	11	6	17
<u>Total</u>			
1987-88	78	40	118
1988-89	83	33	116
1989-90	113	46	159
1990-91	75	28	103
<u>Acquisition of minority holdings</u>			
<u>Domestic</u>			
1987-88	38	8	46
1988-89	32	9	41
1989-90	40	13	53
1990-91	28	4	32
<u>Union</u>			
1987-88	15	4	19
1988-89	19	13	32
1989-90	33	24	57
1990-91	21	12	33
<u>International</u>			
1987-88	28	7	35
1988-89	11	7	18
1989-90	23	7	30
1990-91	8	8	16
<u>Total</u>			
1987-88	81	19	100
1988-89	62	29	91
1989-90	96	44	140
1990-91	57	30	87

Source: Adopted from Commission of European Communities, (1992c), "XXIst Report on Competition Policy 1991", Office for Official Publications of the European Communities, (Brussels, EU), p.426-427.

Molyneux (1991) and the Bank of England (1993) have analysed and documented the type of corporate restructuring taking place across banking markets. Molyneux (1991) examined the type of cross-border activity being undertaken by the world's top 150 banks between January 1989 and April 1991. Molyneux pointed out that the majority of cross-border activities was taking place in Europe and that banks tended to build-up majority holdings in market in which they had past experience. The Bank of England (1993) conducted a similar study which extended Molyneux's (1991) work by using a sample of 247 cross-border alliances in banking and financial services in the EU single market between 1987 and 1993. The study suggested that French banks have been by far the most active, initiating 74 transactions, out of 247 instances identified and UK, German, and Spanish banks initiated respectively 36, 35, and 33 alliances, respectively. This study, however, said nothing about the impact of bank mergers within a European context.

Gual and Neven (1993) examined extensively the type and scale of private acquisitions (which included mergers, acquisition with controlling interest and minority holdings) activity between banks, insurance companies and other financial intermediaries in both intra and extra-EU for the period from 1984 to June 1991. Table 3.22 summarises their findings. The study revealed the following findings:

- There was little restructuring activity in Greece, Portugal, Ireland and Luxembourg;
- The majority of private acquisitions were of a domestic nature (70 per cent of the deals in the data) and there was no apparent decline over time in the relative importance of domestic deals either;
- In Belgium and Spain around 40% to 45% of the acquisitions of domestic firms involved domestic institutions. Moreover, this proportion increased to about 70% for the rest of the large banking systems. As for the acquisitions undertaken by domestic institutions, they were mostly domestic in Italy, the United Kingdom, and Germany, but much less so in France and Spain.
- In terms of absolute numbers, France, the UK and Italy were the main bidding markets in cross-border deals. The main target markets for cross-border activity were France, Italy and Spain, and to a lesser extent Germany. This was in

accordance with predictions at least for Spain and France where deregulation has undertaken on a relatively large scale.

Overall, Gual and Neven (1993) found that most of the cross-border merger and acquisition activity has been undertaken in southern Europe (in Italy and Spain) and the acquirers have generally been firms from the northern EU countries (including France).

Furthermore, the single market process is still in its infancy levels and will not cover securities institutions until 1996 (Turner, 1994). The process of reviewing and then implementing strategies to respond to the opportunities of the single market by financial institutions is these an on-going process. The approach of the single market has been an important factor which banks have considered in their strategies, however, it is still very difficult to measure the extent to which cross-border activity has been stimulated by the approach of single market. On the other hand, the strategic decisions of banks have been influenced by a number of other important factors, for instance, market deregulation, increased competition, new technology and the economic environment. Also, a number of future developments such as the implementation of further single market measures (the Capital Adequacy Directive, the Investment Services Directive and the Insurance Directives), further deregulation in national markets (e.g. the privatisation of state-owned financial services firms), progress towards the integration of European economies and economic and monetary union, will affect banks' strategic policies. It could still be argued that the expected benefits of the single market programme (e.g. lower costs to consumers through more open markets and increased competition as indicated in the Cecchini's (1988) report) have yet to be fully achieved. Nevertheless, financial services firms are continuing to engage in substantial domestic and cross-border restructuring.



Table 3.22 The number of deals of intra and extra-EU private acquisitions for the period 1984 to June 1991

Target Country	B	DK	D	GR	E	F	IRL	I	L	NL	P	UK	Non-EU	NA	Total	% domestic
B	14	0	1	0	4	7	0	1	0	3	0	1	1	0	32	44
DK	0	24	1	0	0	0	0	0	0	1	0	1	9	0	36	67
D	0	1	67	0	1	5	0	5	0	5	0	3	12	0	99	67
GR	0	0	0	1	1	0	0	0	0	1	0	1	0	0	4	25
E	0	0	1	0	19	19	0	6	0	5	2	4	8	0	64	42
F	6	0	2	0	3	72	1	14	1	1	1	8	8	1	118	61
IRL	0	0	0	0	0	1	3	0	0	0	0	4	1	0	9	33
I	0	0	3	0	1	14	0	140	0	1	0	5	17	5	186	75
L	4	0	0	0	0	2	0	1	0	1	0	1	3	0	12	
NL	4	0	1	0	0	3	1	0	1	38	0	2	3	0	53	72
P	0	0	0	0	1	2	0	0	0	0	0	1	0	0	4	
UK	0	0	2	0	1	2	0	1	0	1	0	185	10	0	202	92
Non-EU	0	1	7	0	0	9	0	1	0	2	0	4	252	1	277	
NA	2	2	5	0	1	6	3	7	2	5	0	5	17	0	55	
Total	30	18	90	1	32	142	8	176	4	64	3	225	341	7	1151	
% domestic	47	86	74		59	51	38	80		59		82				

Source: Gual and Neven (1993, p.167).

### 3.10 Privatisation and Restructuring

The motivation for privatising banks varies by country, from the fiscal needs of deficit-burdened governments to growing political discomfort with anything affiliated to market socialism. It is said that whatever the motivation, however, the transfer of ownership to private hands will increase the competitiveness of the banking sector and will subsequently enhance its efficiency. Essentially the general arguments for the privatisation of state activities are concerned with raising efficiency, both static and dynamic. Static efficiency gains relate to producing any given output at a lower cost. Costs can be above their feasible minimum because inputs are being used in the wrong proportions, given their marginal productivity and prices; and/or too little output is being produced from a given set of inputs. Dynamic efficiency gains are more focused on longer term benefits in terms of product innovation and improvements in the process by which services are produced (Parker, 1994). The argument goes that Privatisation could eliminate or reduce the distortions which occur where the public and private sectors co-exist in a number of European countries, such as in Italy and France. The degree of a state's influence on its own banks varies throughout the European Union, however, there is evidence of cases in which banks have provided finance that would not be justified on normal commercial banking criteria (Morgan Stanley, 1994).

Table 3.23 shows a list of financial institutions that are privatised or potential privatisation candidates over the next few years. The motivation for the rapid privatisation of the Italian financial system is strongly driven by the parlous state of budget finances (see Morgan Stanley, 1994). Proceeds of sell-off are channelled into reducing public indebtedness, helping to prevent an increase in the deficit and interest payments.

The Banco di Napoli was the first public sector bank to have a stockmarket floatation. In November 1991, it issued 100 million new ordinary shares, corresponding to around 20% of its capital. The Banca San Paolo was the next candidate. On 16 March 1992 it

floated 125 million ordinary shares to a value of about L1525 billion, 20% of its stock.<sup>4</sup>

In Italy, the Amato law aimed to restructure the Italian banking market. The Amato law allowed the major public law banks such as San Paolo di Torino and Monte dei Paschi di Siena, and savings institutions such as Cariplo, to transform themselves from foundations into limited companies with share capital and subsequently to obtain stock exchange quotations (see Morgan Stanley, 1992; p.31). The shareholder base of the former public law banks that have been transformed into limited companies continued to broaden in 1993. Of the 77 savings banks, all of them now limited companies, only 23 are still wholly owned by their respective foundations (see Bank of Italy, 1994; p.142).

Investors' interest in the Italian banking industry was fully evident on the occasion of the privatisation of three large banks. The public offers for the sale of Credito Italiano, IMI and Banca Commerciale Italiano drew applications for 8.8 billion shares, compared with the 1.6 billion offered. The proceeds aggregated to L6.87 trillion, equivalent to roughly one third of total net share issues in 1993 (Bank of Italy, 1994).

The Istituto Mobiliare Italiano (IMI), the treasury-controlled financial services group was privatised in February 1994 (Morgan Stanley, 1994). A third of IMI's capital was offered which involved selling 200 million shares. As a result, the combined public-sector stake in the bank fell to about 25% from more than 60% previously. At the time of issue it was announced that the state's remaining shares in IMI would be sold in the next two years.

The privatisation of Credito Italiano and Banca Commerciale Italiana hailed as very successful at the time have since become the centre of a political controversy (see European Banker, 1994). Objections have been raised about the composition of their board members which appeared to be heavily weighted in favour of the influential

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<sup>4</sup>See Banking Yearbook 1994, *International Financial Law Review* at July 1 1994, p.81-87.

investment bank, Mediobanca. Criticism was fiercest in political circles, especially from the new government who felt that Mediobanca had been too influential in the privatisation process. It is further suggested that anger had been roused because the Italian privatisation programme has been dominated by one investment bank (see *European Banker*, 1994; No:102, p.1). Possible future prospects for privatisation include Banca Nazionale de Lavora and Cassa di Risparmio Verona. It is expected that, market conditions permitting, there will be continued consolidation within and share issues from the savings banks sector (Bank of Italy, 1994).

In Spain, the state has gradually reduced its involvement in the banking industry through the privatisation of state-owned institutions; the main example of which had been the privatisation of part of the government's stake in Argentaria announced on January 21, 1993<sup>5</sup>. *Retail Banker International* (1993) noted that the privatisation was a landmark event among the Spanish large banks, prompting an influx of private shareholders whose total investment reached Pta450 billion (\$3.3 billion). The banking sector has undergone an unprecedented process of competition and change in recent years. The major banks have become increasingly differentiated in areas that were critical to their future development, such as the weight of international business, investment banking and capital market strategies, mutual funds management, strategy *vis-a-vis* industrial holdings and policies of strategic alliances. Morgan Stanley (1993 and 1994) has stated that Argentaria has gradually been rationalised so that it will be ready for full privatisation when the government deems the timing appropriate.

As with other continental European banking markets the privatisation programme is well under way in the French system. The Banque Nationale de Paris (BNP) privatised in October 1993 (see *European Banker*, 1993; no:95, p.8) and the following institutions have all been cited by government as potential targets: Banque Harvet, Marseillaise de Credit and insurers Assurances Generales de France (AGF), Groupe Assurances Nationale (GAN) (and its affiliate, Credit Industriel et Commercial - CIC, is to be privatised separately), Union des Assurances de Paris (UAP), Caisse Centrale de Reassurance and Caisse Nationale de Prevoance. After Credit Lyonnais recorded the

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<sup>5</sup>See Oxford Analytica Daily Brief, (1993), "Bank Privatisation", January 26.

losses of Fr6.9 billion (\$1.28 billion) for 1993, however, the privatisation process was halted and according to recent Morgan Stanley (1994; p.10) reports, it is unrealistic to expect further privatisation before 1997.

In Germany, the public banks (mainly savings banks) have traditionally played a more important role both at the federal government and regional levels. Arthur Anderson (1993), however, has noted that the concept of privatisation has not been discussed so intensively as, for example, in France or Italy. The German Savings Banks Association has stated that the privatisation of savings banks would disturb the balance between the public and private sector in the banking industry, leading to distortion of competition, but pressures for privatisation of savings banks is growing, because the government has estimated that it could raise funds of DM150 billion (\$93.7 billion) (see *European Banker*, 1993; no:95, p.4) which would help in funding the restructuring of Eastern Germany. The most likely candidate for privatisation in short term appears to be Postbank, the Bonn-based postal bank which operates via the post office network. Although the Postbank management was strongly in favour of privatisation, the government appears to be reluctant to proceed with the plan because of the large number of staff cuts which would inevitably follow (see *European Banker*, 1993, no:92).

The overall privatisation programme may be good business for European banks. They can be active in the distribution of shares and also have advisory and corporate finance roles. Increased bank privatisation may also raise liquidity in bank securities which could help trading. Moreover, the privatised institutions would have greater managerial freedom to manage their businesses which should lead to increased efficiency. Table 3.23 provides a snapshot of recent bank privatisation in the French, Italian and Spanish banking markets.

Table 3.23 Selected recent bank privatisation in the French, Italian and Spanish banking markets

Country/Bank	Comment
<b>France</b>	
- Credit Local de France (Jun 1993)	The privatisation process in France has begun. Early candidates included the two largest banks in domestic market as well as in Europe.
- BNP (Oct 1993)	
- Credit Lyonnais (early 1997)	
<b>Italy</b>	
- Banca di Napoli (Nov 1991)	The motivation for the rapid privatisation of the Italian financial system is strongly driven by the parlous state of budget finances. Privatisation also helps rationalisation of the financial sector.
- San Paolo di Torino (Jan 1993)	
- Credito Italiano (Dec 1993)	
- BCI (Feb 1994)	
- IMI (Feb 1994)	
<b>Spain</b>	
- Argentaria (Late 1994)	The state aims to reduce its involvement in the banking industry through the privatisation of its only state-owned bank, Argentaria and to adopt an unprecedented process of competition and change.

Source: Financial Times various; Morgan Stanley (1994; p.10).

### 3.11 Conclusions

This chapter has examined the forces generating change and structural developments in the European banking marketplace with specific focus on the French, German, Italian and Spanish banking systems. The implantation of the EU Second Banking Directive in domestic banking legislation has had the effect of establishing universal banking practice for credit institutions within EU countries, rendering the old distinctions between different types of credit institutions obsolete. The blurring of distinctions between bank credit and securities, domestic and international paper, cash and derivatives and so on, has helped foster cross-border investment. These forces continue to shape European banking business and increase the competitive threat between banks and non-banks alike. The financial integration of Europe is generating a powerful boost

to the opening-up of banking systems. In recent years as market conditions have become more competitive the focus of profitability management has tended to alter. Macroeconomic recession coupled the on-going process of deregulation has influenced the profitability of banks, in particular, by putting considerable pressure on their interest margins and focusing them to concentrate on areas such as fee income and cost reduction.

This chapter also indicates that, despite various obstacles, there has been substantial restructuring of the industry reflected by the significant amount of cross-border merger and acquisition activity in European financial market in recent years. In addition, privatisation programmes in various countries, coupled with the political will to liberalise banking systems in line with EU legislation, continues to re-shape the structural characteristics of European banking markets. Given these developments, and considering that there is a trend towards larger bank size, it is important that the cost characteristics of banking systems are investigated so as to evaluate the potential efficiency implications and opportunities from some of these structural changes.

The following two chapters examine the theoretical basis of scale and scope economies and illustrate how cost efficiencies are empirically evaluated. Chapter 4 focuses on the theory of economies of scale and scope relating to studies of the banking industry and Chapter 5 demonstrates how economies of scale and scope have been empirically evaluated in banking markets.

## CHAPTER 4

### THE THEORY OF ECONOMIES OF SCALE AND SCOPE RELATING TO STUDIES OF THE BANKING INDUSTRY

#### 4.1 Introduction

This chapter aims to examine the theory behind economies of scale and scope studies for financial institutions. Section 4.2 focuses on the definition of economies of scale and scope and analyses the effects of technology on bank costs. Section 4.3 examines the importance of the shape of average costs to firm decision-making. Section 4.4 explains the sources of scale and scope effects and their implications for the banking firm and section 4.5 contains a brief discussion of the relationship between the production and cost functions. The following section discusses conceptual problems associated with evaluating scale and scope economies in the banking industry. This section is also concerned with the problem of endogeneity in the measurement of scale and scope economies. Section 4.7 provides an overview of the functional forms of various cost functions used in the economies of scale literature and section 4.8 outlines recent approaches to estimating efficiency in banking markets. Finally, the conclusions are presented in section 4.9.

#### 4.2 Definition of Economies of Scale and Economies of Scope

##### 4.2.1 Economies of Scale

The concept of scale economies, or returns to scale, refers to the rate at which output changes as all factor quantities are varied. Scale economies are based on the shape of the average cost curve, which illustrates average costs at each level of output. Figure 4.1 displays the long-run average cost (*LAC*) curve and the long-run marginal cost (*LMC*) curve with a series of short-run average cost (*SAC*) and short-run marginal cost (*SMC*) curves. The average cost curve shows the average cost per unit of output at different levels of output, and the marginal cost, the additional cost incurred when producing a very small increment of output, which is similar to the rate of change in



average cost. The long-run curves allow for simultaneous changes in all inputs of production whereas the short-run cost curves also represent cost changes as output increases but not all inputs are changeable. The long-run average cost is declining at outputs up to  $Q_m$ , beyond which point the long-run average cost begins to rise. At the minimum point  $Q_m$  the  $LMC$  intersects the  $LAC$ . Economies of scale (or increasing returns to scale) are illustrated up to the output level  $Q_m$ , where the long-run marginal cost curve lies below the long-run average cost curve, and diseconomies of scale (decreasing returns to scale) thereafter, where the  $LMC$  lies above the  $LAC$  curve. Figure 4.1 shows the conventional U-shaped cost curve, which is used for ease of exposition, although the above exposition would still hold if the curve were flat-bottomed, with constant returns to scale, over a large range of output. In this case the long-run marginal cost would be equal to the average cost since average cost per unit of output is not changing.

The existence of scale economies means that the average cost of producing a product, in the long run, *ceteris paribus*, decreases as more of the output is produced. Thus, economies of scale are measured by the ratio of the percentage change in output. Since a firm expands its scale of operations, economies of scale arises if it reduces the average cost of output, holding all other factors constant. Hence economies of scale can be defined either in terms of the firms' production function or its corresponding cost function, since scale economies are the inverse of increasing returns to scale. As a result, it is said that there are constant costs, when the production function presents constant return to scale, scale economies when the production function presents increasing returns to scale and diseconomies of scale when the production function presents decreasing returns to scale. In other words, if the scale economies ratio is smaller than one, economies of scale arises, as average long-run cost is declining. If the ratio is equal to one, no scale economies is present, as average cost is constant and when the ratio exceeds one, diseconomies of scale exist, as average cost is increasing. Figure 4.1 shows these three alternative relationships between average cost and output.

The concept of scale economies in the single product firm applies to the behaviour of total costs as output increases, and economies of scale exists if total cost increase less proportionately than output. Given the following total cost function,  $TC = f(Q)$  where

Q is an output then average cost can be derived as  $ATC = f(Q)/Q$  and marginal cost can be shown as  $\partial TC/\partial Q$ . As average cost will decline as long as marginal cost lies under average cost, so scale economies are simply as follows:

$$SE = \frac{ATC}{MC} = \frac{f(Q)}{Q \frac{\partial TC}{\partial Q}} \quad (1)$$

which is simply the elasticity of cost with respect to output. Therefore, when  $SE \geq 1$ ,  $SE = 1$  and  $SE \leq 1$ , we experience increasing, constant, or decreasing returns to scale, as the derivative of average cost with respect to output is negative, zero or positive, respectively.

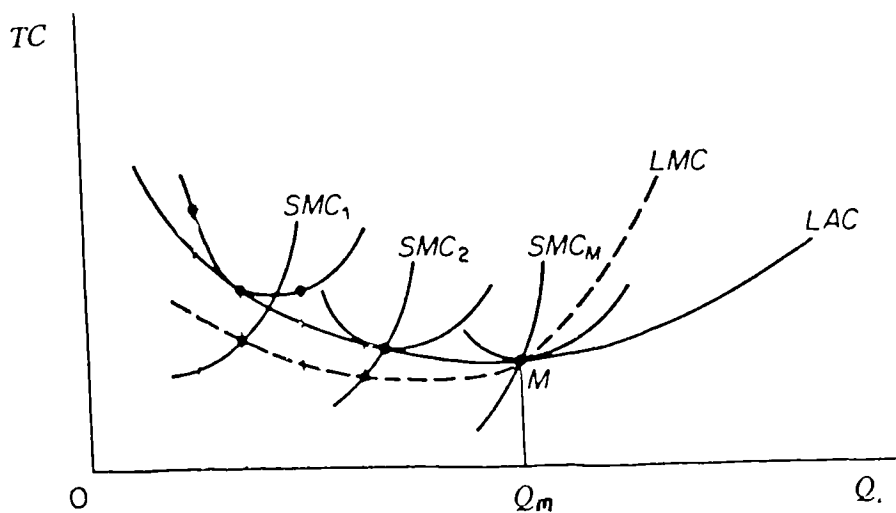


Figure 4.1 Economies of Scale and the Average and Marginal Cost Curves Shapes

(Source: Adopted from Koutsoyiannis, 1979).

#### 4.2.1.1 Minimum Efficient Scale

The shape of long-run average cost curves are important not only because of their implications for scale decisions, but also because of their effects on the potential level of competition in the marketplace. Although *U*-shaped cost relations are quite commonly reported in the industrial economics literature, they may not always apply universally. It may be the case that firms in manufacturing encounter first increasing, then constant returns to scale (Scherer, 1980). In such instances, an *L*-shaped long-run average cost curve emerges, and very large organisations are at no relative cost disadvantage compared with smaller institutions. Typically, the number of competitors and ease of entry will be greater in industries with *U*-shaped long-run average cost curves than those with *L*-shaped or continuously downward-sloping long-run average cost (See Geroski, 1991). Minimum efficient scale is explained as the output level at which long-run average costs are first minimised (Sawyer, 1985). Therefore, minimum efficient scale will be found at the minimum point on a *U*-shaped long-run average cost curve (output  $Q_m$  in Figure 4.1) and at the corner of an *L*-shaped long-run average cost curve. Firms are not usually at an output level below MES, because that increases their costs and squeezes their profits (Shepherd, 1985).

In general, the number of competitors will be large and competition will tend to be most intense within industries in which the minimum efficient size is small relative to total industry demand because of correspondingly small barriers to entry, namely those relating to capital investment and very specialised labour requirements (See Scherer, 1980). Competition can be less intense when minimum efficient size is large relative to total industry output, because barriers to entry tend to be correspondingly substantial, limiting the number of potential competitors (Hay and Morris, 1991). Overall, Shepherd (1985) states that the barrier-to-entry effects of minimum efficient scale depend on the size of the minimum efficient scale institution relative to total industry demand as well as the slope of the long-run average cost curve at points of less than minimum efficient scale-size operations.

The exposition above has primarily focused on the costs associated with a single product firm. For the multiproduct firm, the concept of average cost is more complicated. Here

the approach is to focus on the concept of Ray Average Cost developed by Baumol (1977). According to this approach, output quantities are varied proportionally but input quantities follow the least cost expansion path.

#### 4.2.2.2 Ray Average Cost (RAC)

Following Baumol, Panzar and Willig (1988), ray average cost are an extension of the concept of single product scale economies and imply the behaviour of cost as the production levels of a given output bundle, change proportionately. This relationship is referred to as ray average cost. Ray average costs are a natural generalisation of single product average cost and are defined as follows:

$$RAC(Q) = \frac{TC(Q)}{\sum Q_i} = \frac{TC(tq^0)}{t} \quad (2)$$

where  $q^0$  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  $tq^0 = Q$  (Baumol, Panzar and Willig, 1988). This is the average cost of the composite commodity whose unit is the vector  $q^0$  and whose scale output is given by the scalar  $t$ .

The ray average cost of producing the output vector  $Q \neq 0$ , indicated  $RAC(Q)$ , is defined to be as:

$$\frac{TC(Q)}{\sum_{i=1}^m Q_i} \quad (3)$$

Ray average cost is said to be increasing (decreasing) at  $Q$  if  $RAC(Tq)$  is an increasing (decreasing) function of scalar  $t$ , at  $t = 1$ . Moreover, ray average cost is said to be minimised at  $Q$  if  $RAC(Q) < RAC(Tq)$ , for all positive  $t \neq 1$ . This is illustrated in Figure 2, which also shows the behaviour of total cost along that ray,  $OR$ . It can be seen that ray average cost and total cost have the usual relationships. Hence, they intersect at the unit level of output,  $q^0$ , and RAC reaches its minimum at the output  $Q = Q^0$  at which the ray  $OT$  is tangent to the total cost surface in the hyperplane erected on  $OR$ .

Figure 4.2 shows the concept of ray average cost for a multiproduct firm as a three dimensional diagram. The lower part of diagram is the output space for total loans and total securities, that are produced in the proportion given by the vector or ray called  $OR$ . The term ray illustrates why the production cost are called ray average cost. In terms of figure 4.2, the output vector moves along the ray,  $OR$ . The point of minimum RAC, the output bundle  $q^0$ , corresponds to the most efficient scale (size) for the firm producing loans and securities in the proportion specified by the ray  $QR$ . Thus, the degree of scale economies at  $q^0$  are defined as the elasticity output with respect to cost which is equal to  $1/(1-e)$ , where  $e$  is the elasticity of relevant average cost curve. This variable (the degree of scale economies) is greater than, less than, or equal to one as returns to scale are locally increasing, decreasing, or constant and as the ray average cost curve's slope (derivative) is negative, positive, or zero, respectively.

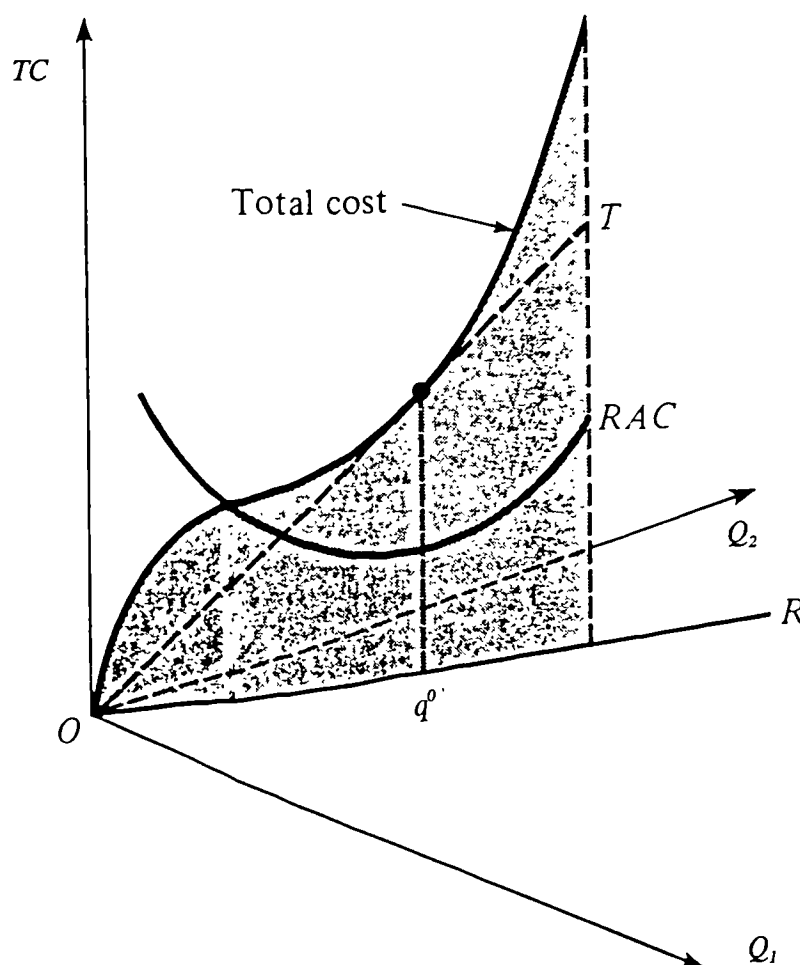


Figure 4.2 Economies of Scale for Multiproduct Firms: The Concept of Ray Average Cost

(Source: Adapted from Baumol, Panzar and Willig, 1988, p.50)

#### 4.2.2.3 Product-specific Economies of Scale

The concept of multiproduct economies of scale explains the behaviour of costs as output increases or reduces along a given ray, but it may not explain the full behaviour of costs as output bundles change. Panzar and Willig (1977a) show how total costs change as the output of one commodity changes which is called product specific economies of scale. As was shown in the previous section, the concepts of RAC and multiproduct scale economies refer to proportional changes in the quantities in the entire product set. However, another important way in which the magnitude of a firm's operations could change is through variation in the output of one product, holding the quantities of other products constant. To analyse the cost of such output variation it is useful to define the incremental cost of product  $i$  as the addition to the firm's total cost caused by the given output of product  $i$ . That is, it is the firm's total cost with given vector of outputs, minus what that total cost would be if production of output  $i$  were abandoned, all other output remaining unchanged.

In order to calculate the measure of product-specific economies of scale, it is necessary to define the average cost concept: the average incremental cost ( $AIC$ ) that is defined as the extra cost of adding the production of that given product at a specific level of output as compared with not producing it at all, divided by the output of that product (Willig, 1979).

The incremental cost of the product  $i$  elements  $m$  at  $Q$  is shown as (Baumol, Panzar and Willig, 1988):

$$IC_i(Q) = TC(Q) - TC(Q_{m-i}) \quad (4)$$

where  $Q_{m-i}$  is a vector with a zero component in place of  $Q_i$  and components equal to those of  $Q$  for the remaining products. Hence, we can show the average incremental cost of output  $i$  as follows:

$$AIC_i(Q) \equiv \frac{IC_i(Q)}{Q_i} \quad (5)$$

Thus, for instance, the average incremental cost curve of a particular output (such as

total loans or total securities) can be expressed as:

$$AIC(Q_1) = \frac{TC(Q_1, Q_2) - TC(0, Q_2)}{Q_2} \quad (6)$$

Then, the degree of product-specific returns to scale  $i$  at output vector  $Q$  is measured by:

$$PSES_i(Q) = \frac{IC_i(Q)}{Q_i TC_i} = \frac{AIC_i}{\frac{\partial TC}{\partial Q_i}} \quad (7)$$

Thus, the average incremental and marginal cost curves are interrelated in the same way as are single product average and marginal costs (Willig 1979). Thus,  $PSES \geq 1$ ,  $PSES = 1$  and  $PSES \leq 1$  show decreasing, constant, or increasing returns to scale with respect to output  $i$ .

"Although measures of product-specific scale economies partially reflect the effect of the output mix upon costs, they necessarily do so only in a partial manner since they measure the effect on cost of a *ceteris paribus* change in one output type. Thus, to capture fully the effect of changes in the composition of output on cost, more global measures are needed." (Bailey and Friedlaender 1982, p.1031). Further the theoretical discussion and proofs on this issue can be seen in the study undertaken by Baumol, Panzar and Willig (1988).

#### 4.2.3 Economies of Scope

Economies of scope generate cost savings from delivering multiple goods and services jointly through the same organisation rather than through specialized providers. These potential cost savings are to be differentiated from economies of scale, which refers to lower costs per unit of a single good or service as total output of that good or service rises.

Two groups of potential economies of scope should be characterised. Firms can realise internal scope economies through joint production and marketing, whilst consumers can

realise external scope economies through joint consumption. On the production side, scope economies seem to be available where facilities devoted to one objective or to serving a single market are not fully utilised and are capable of being deployed simultaneously to serve other targets and other markets. On the consumption side, whereas scope economies exist where providing multiple products or services at a single location or through a single firm saves consumers the time and expense of searching for and purchasing these items through specialised providers.

Willig (1979) states that there are two fundamental reasons to study multiproduct firms. Firstly, casual empiricism indicates that there are virtually no single product firms. Secondly, the technological characteristic which is named economies of scope may force firms industry equilibrium to produce more than one good.

Panzar and Willig (1975, 1981) suggested that economies of scope are said to exist if the cost of producing outputs jointly is less than the total cost of producing the same outputs separately. That is, considering two outputs,  $Q_1$  and  $Q_2$ , and their separate cost function,  $TC(Q_1)$  and  $TC(Q_2)$ . If the joint cost of producing the two outputs is expressed by  $TC(Q_1, Q_2)$  then economies of scope are present if:

$$TC(Q_1, Q_2) < TC(Q_1) + TC(Q_2) \quad (8)$$

There are said to be diseconomies of scope if the inequality is reversed.

The concept of scope economies can be explained geometrically in Figure 4.3. The figure illustrates that the scale economies concept involves a comparison of  $TC(Q_1^*, 0) + TC(0, Q_2^*)$ , the sum of the heights 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 achieved. 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 defined by  $TC = aQ_1 + bQ_2$  for some constants  $a, b$ . Hence  $TC(Q_1^*, 0) = aQ_1^*$  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 (Baumol, Panzar, and Willig, 1988).



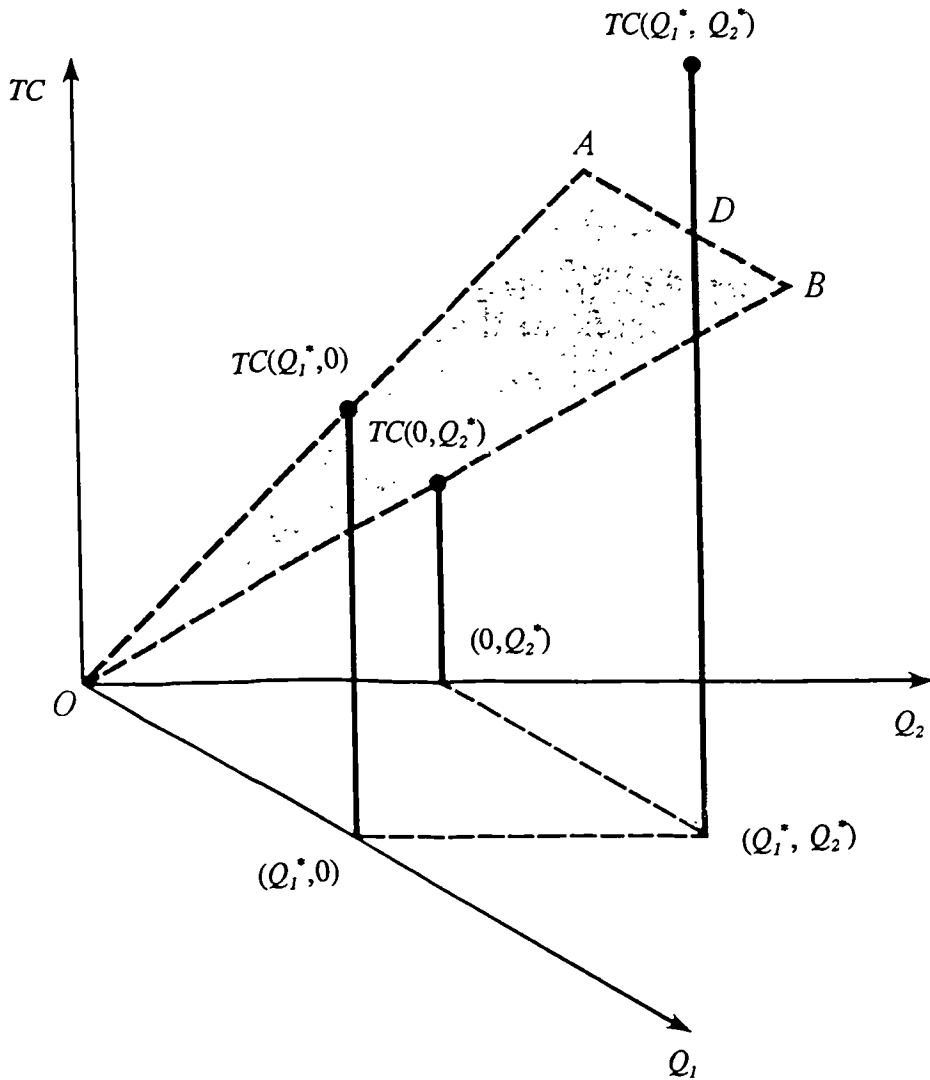


Figure 4.3 The Concept of Scope Economies

(Source: Adapted from Baumol, Panzar, and Willig, 1988, p.72)

According to Panzar and Willig (1975, p.3) "it is clear that the presence of economies of scope will give rise to multiproduct firms" and also "with economies of scope, joint production of two goods by one enterprise is less costly than the combined costs of production of two specialty firms" (Willig 1979, p.346). The degree of economies of scope can be measured as follows:

$$SC = \frac{TC(Q_1) + TC(Q_2) - TC(Q_1, Q_2)}{TC(Q_1, Q_2)} \quad (9)$$

Baumol, Panzar, and Willig (1988) indicated that when the firm produces many

products, even where ray average costs decline everywhere, the absence of economies of scope may prevent natural monopoly. For example if there are no economies of scope, a multiproduct institution can be split up into several specialised firms without any increase in cost. Economies of scope, and the concepts related to it, play an important role in the analysis of the banking firm given its multiproduct industry structure.

#### **4.2.4 Technical Change and Economies of Scale and Scope**

Firms (or banks) have production functions which embody the present state of technology. The bank usually has some scope for choice - among the inputs, and the level of output. In addition, the optimal choice depends upon the prices of the inputs and the outputs. The underlying technology of the productions function, however, determines the way in which services are produced.

Technology determines two levels of operation, plant level and firm level. Economies of scale may be gained at either the plant- or multiplant-level or both (Humphrey, 1985). Both production and cost functions are estimated under the assumption of constant technology. In other words, the cost curve assumes no changes in technology. Technical changes deal with the processes and consequences of shifts in the production function because of the adoption of new advanced techniques.

"Technical change is said to result when the maximum of efficient output that can be produced from any given set of inputs increases over time due to such factors as experience, increased knowledge, new innovations, and better production techniques." (Hunter and Timme 1986, p.153) That is, technical change arises when a given set of inputs is capable of producing a larger maximum output.

Revell (1983) has argued that technical change in banking has mainly occurred on two fronts: (i) the development of electronic funds transfer systems and (ii) advances in back-room computer operations. He argues that the early computer technologies were highly involved record-keepers of customer accounts. However, the effect of technological changes, *i.e.* the cheapening of computers and the development of new

information networks, has led to a sharp reduction in the average cost of electronic information processing. Advances in new technologies, have also reduced the entry barriers to the financial marketplace.

In addition, Revell (1983) also suggested that technological advances could bring about greater scope economies as well. Small financial institutions could offer the same range of products and services to customers as larger banks, by sharing or using new technology.

The effects of greater technological advances on bank average costs should be visible. For instance, the *U*-shaped average curve should become flatter because of technological effects reducing the average cost. Overall, technological changes generally reduce the ratio of inputs to outputs, thereby achieving a genuine increase in economic efficiency and a reduction in costs.

#### **4.3 The Importance of The Shape of Average Costs in Decision-Making**

Knowledge of cost functions is important for optimal decision-making by firms and by regulatory bodies. It also said that an understanding of short-run costs is important for pricing and output decisions while long-run costs provide useful information for planning growth and investment policies of firms.

Cost curves have been widely studied by various authors, such as Bresnahan and Reiss (1990), Farrell and Shapiro (1990), Gilbert (1989), Baumol, Panzar and Willig (1988), Tirole (1988), Demsetz (1982), Rowley (1973) and Williamson (1968); these studies observe the following important reasons why cost functions deserve empirical investigation.

*Cost and price-output decisions* - Cost are one of the main determinants of price in all market structures and in all models relating to the explanation of the behaviour of the firm (See Scherer, 1980; Koutsoyiannis, 1979). Costs are one of the determinants of price and output, both in the short-run and the long-run, since the profit maximising objective of the firm is defined by the marginalistic approach (that is, marginal cost

equals marginal revenue) (See Varian, 1984).

*Costs and barriers to entry* - Costs, either in the form absolute cost advantages or in the form of the minimum efficient scale of output, have been stated as being the most important determinants of barriers to entry in many industries (see Scherer, 1980; Demsetz, 1982; Office of Fair Trading, 1994). The way that scale economies could be a barrier to entry when fixed costs are sunk. In other words, scale economies, together with some sunk costs, may establish a barrier to entry that allows long-run extra profits which are not based on superior efficiency (see Baumol, Panzar and Willig, 1988).

*Costs and market structure* - Costs determine, to a large extent, the market structure. It is said that given the size of the market, the greater economies of scale, the smaller the number of optimal firms in the market. Hence, industry which exhibit substantial scale economies may result in an oligopolistic market structure in the long run. If scale economies are not important it seems that there may be a large number of firms in the market (see Scherer, 1980).

*Costs and growth policy of the firm* - The growth of firms result mainly from cost considerations, given market size. Moreover, if firms are faced with U-shaped average cost curves and the market is stagnant, firms will probably diversify their business by merging into other markets (See, Scherer, 1980). In addition, if scope economies are present, firms may expand their activities by adding new products in established markets (Litan, 1987). Merger and acquisition may be based on mainly cost considerations (Rhodes, 1985). If cost advantages are predicted from say vertical integration of the production process, this would create a strong incentive for firm to adopt such policies.

*Cost and the regulation of markets* - Knowledge of costs is important for the regulation of markets by the government. Regulatory authorities require detailed information on the cost of bank mergers in consideration of anti-trust matters. If regulators believe that there are too many small banks in an industry (in which scale economies are substantial), then the government may issue a policy aimed at increasing the size of firms (see Revell, 1987, 1991). If economies of scale are not important and

the market is highly concentrated, however, the government may discourage mergers on anti-competitive grounds.

Cost functions have been the subject of a significant amount of investigation in the financial industry and the reasons specified by Benston (1972) are as follows:

1. *Regulation* - entry, merger, branching and some prices in the finance industry are regulated, requiring regulators to estimate the cost consequences of their decisions;
2. *Importance to the finance industry* - if firms understand their costs better, they may be more efficiently managed and make decisions more rationally;
3. *Economic understanding* - knowledge of the relationship between cost and output is basic to microeconomics, industrial economics. The study of the finance industry should provide empirical estimates that are relevant to theory.

#### **4.4 Sources of Economies of Scale and Scope**

Various authors (such as Scherer, 1980; Pratten, 1971; Robinson, 1958; Benston, 1965; Bell and Murphy, 1968) have argued that there are many sources of cost reductions brought about through the expansion of output. Firstly, economies of scale are the effect of a more efficient use of some or all inputs with an increasing volume of output. Firms may have excess capacity of some inputs so that an increase in output cannot require a proportionate increase in all inputs over the entire production period. Specifically, some inputs might be, as a whole or partly indivisible by output. The existence of indivisibility may help reduce costs per unit of output as the output level is increased.

Secondly, increased size could allow a more efficient organisation of resources. For instance, in small banks, where volume cannot permit specialisation, the same machines and workers must often be employed for a variety of tasks, say, tellers may also be assigned to sorting cheques and auditing accounts part-time. Large banks, however, may divide tasks so that employees and machines can be used in one facet of their operation. Thus, the productivity between both capital and labour arises with the scale

of operations. Specialisation could also result in a more economical use of materials purchased by the bank.

Thirdly, some types of technological innovations, such as computers, may be economically more feasible for large banks. Thus, according to asset size, banks could employ different compositions of inputs with varying efficiencies.

Fourthly, Kolari and Zardkoohi (1987) state that the law of large numbers accounts for certain scale economies. Large banks do not need to hold cash balances in the same proportion as smaller banks. Since holding cash balances is costly, larger banks should lower cost of holding cash balances than their smaller counterparts, to the extent that the law of large numbers smooths transactions demands. Moreover, larger banks are seemingly better able to diversify their assets and reduce risk as well as to offer various services to customers.

Benston (1972) indicated that the sources of economies of scale are characteristic to the use of lower skilled labour, use of fewer processing and administrative officers, and shifts in new technology available to larger scale operations. Bell and Murphy (1968) examined the sources of economies of scale in the US banking industry, and suggested that for the processing of chequing accounts economies of scale arise partly from the use of different kinds of equipment and partly from the specialisation of labour and machines.

Cost savings can also be achieved through scope economies, that is, cost savings resulting from the simultaneous production of several different outputs in a single firm. Possible sources of scope have been indicated by Baumol, Panzar, and Willig (1988, p.75-79), Bailey and Friedlaender (1982, p.1026-1028), Berger, Hanweck and Humphrey (1987, p.503-504), and Mester (1987a, p.17-18). Adar et al., (1975) and Panzar and Willig (1977b) also illustrate that interdependence results in the joint use of the inputs by many products. In banks, jointness in production is evident in the joint use of information by different divisions, for example, in evaluating a loan application of a depositor. For the banking firm, costs can be saved or revenues improved by supplying joint products which result in:

- i. *Spreading Fixed Costs.* If banks possess excess capacity, fixed or quasi-fixed brick-and-mortar branch costs, data processing costs, or loan officer and teller expenses could be spread over an expanded product mix (Berger et al., 1986).
- ii. *Information Economies.* Arrow (1971) and Williamson (1975) showed that there are high costs to obtaining new information in the first place as well as organisational and strategic impediments to market transfer of information. In the case of the banking firm, information generated from servicing a customer's deposits and loans can be used as a costless input in dealing with an instalment or mortgage loan for the depositor at the same bank. Larger financial firms, for example, can develop standardised procedures as skills increase such as credit assessment, market information, documentation and collection methods. Thus, it may be less expensive for a depositor's bank to provide them with loans than for other banks to provide the same type of service.
- iii. *Risk Reduction.* Asset diversification across different asset groups may reduce portfolio and interest rate risks. Regulators often impose concentration limitations, such as loan limits to a single borrower or less formal restrictions, for example, discouraging loan concentrations to certain industries and/or in loan categories that seem excessive.
- iv. *Customer Cost Economies.* Customers may reduce their transactions costs by doing business in a wide range of products and services at the same branch. Therefore, bank profits may be maximised by attempting to minimise both the sum of bank-incurred and customer-incurred costs, through large balances, or increased market share (Berger et al., 1987).

## 4.5 Bank Production and Cost Function Technology

### 4.5.1 The Bank Production Function

A production function is a technical relation that connects factor inputs and outputs. In other words, the production transformation is a mathematical expression for a process that transforms inputs into outputs. An important concept of the theory of production is the choice to produce particular quantities of output. The use of words 'choice' indicates that there are some alternatives available, there is some flexibility in the use of inputs and in the quantity produced.

As with other firms, the production function for banks implies certain alternative methods of transforming inputs such as labour and capital to produce financial products and services (i.e. total loans and total securities). A formal development of the theory of production has been shown by Shephard (1970), Diewert (1973) and Fuss and McFadden (1980). Properties of the production technology set and production function are indicated in these works which can be consulted for proofs and further formal development of relevant theory.

It is important to know how much output can be produced with certain combinations of inputs, given the existing state of technology. The cost of these inputs are the salaries and benefits and the occupancy and capital expenses. Banks are multiproduct firms but in the simplest case of the production function they produce only one homogeneous output,  $Q$ . Using the most efficient technology and holding it as constant, the production function is single-valued, continuous and twice differentiable which can be written as:

$$Q = f(L, K) \quad (10)$$

where  $f(.)$  denotes the functional form of the production function. The interpretation of (10) is simple: given a flow of inputs,  $L$  (labour),  $K$  (capital), the flow of output  $Q$  is produced, using existing technology. The production function is a microeconomic concept which is a purely technical relation and may be constructed without any reference to market conditions or prices.



The notion of economies of scale, in other words returns to scale, relates to the rate at which output changes as all input quantities are varied. Simply, the concept of returns to scale, indicates that when the increase in output is proportionate to the increase in the quantities of factors of production, returns to scale are said to be constant. If, for instance, a organisation doubles the quantity of its inputs and its output doubles, then its production technology is said to show constant returns to scale. If output increases by less than 100 percent, decreasing returns to scale (or diseconomies of scale) exist, and if by more than 100 percent, increasing returns to scale (or scale economies) are present. The returns to scale relationship may be shown using the following formula:

$$f(kL, kK) = k^{\nu} f(L, K) = k^{\nu} Q \quad (11)$$

where  $k$  represents some constant by which inputs are increased and the power  $\nu$  of  $k$  denotes what is called the degree of homogeneity of the production function and is a measure of the returns to scale:

If  $\nu = 1$  the production function shows constant returns to scale and is sometimes called a linear homogeneous production function;

If  $\nu < 1$  the production function shows decreasing returns to scale;

If  $\nu > 1$  the production function shows increasing returns to scale.

Generally, the production function is homogeneous of degree  $\nu$  if, when inputs increase by the constant  $k$ , output increases by the constant  $k^{\nu}$ . As a consequence, if  $\nu = 1$ , then  $k = k^{\nu}$ , if  $\nu > 1$ , then  $k < k^{\nu}$ , and if  $\nu < 1$  then  $k > k^{\nu}$ .

The concept of returns to scale can be seen with help of Figure 4.4. The horizontal axis measures inputs. The vertical axis measures outputs. The three curves in figure 4.4 show the three output-input relations for returns to scale. This diagram displays three types of separate returns: increasing returns to scale, constant returns to scale and decreasing returns to scale.

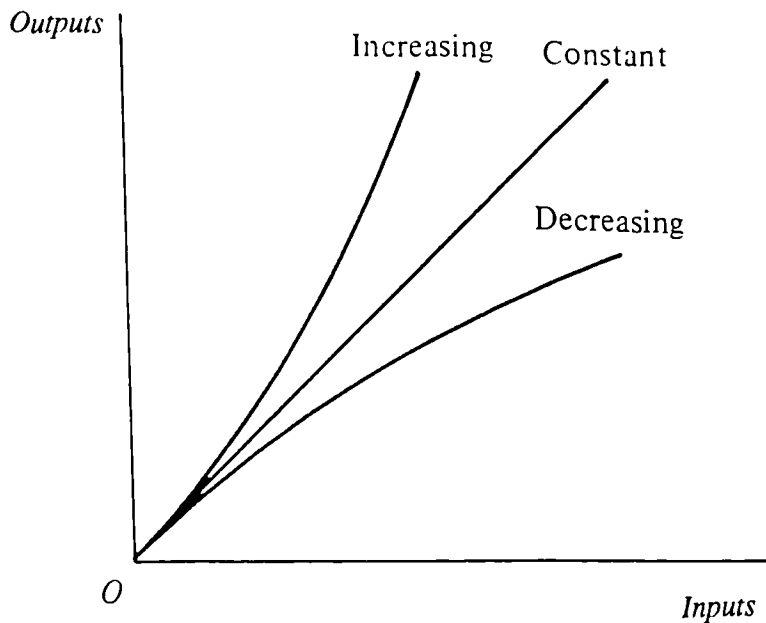


Figure 4.4 Returns to Scale

#### 4.5.2 The Nature of Production Costs

The cost function is derived from the production function, which describes the available efficient methods of production in one time period. Diewert (1992) indicates that the use of the cost function has the advantage over production functions in that statistical estimation of the unknown parameters are simpler. In addition, the cost function parameters, which characterise production technology, can be estimated much more accurately using various cost function techniques. Simply, total cost is a multivariable function which is determined by many explanatory factors. Where total cost is determined as the sum of expenditures on all inputs, however, the value of cost can be specified as a function of the level of output and the prices of all inputs. We refer to this function as the cost function. In other words, we can show that the bank's total cost

which is the sum of quantities of inputs employed,  $X = (x_1, x_2, \dots, x_n)$ , multiplied by their factor prices,  $P = (p_1, p_2, \dots, p_n)$ . Specifically, the total cost, say  $TC$ , of producing output equation (10) is simply as follows:

$$TC = p_1L + p_2K \quad (12)$$

where  $p_1$  and  $p_2$  are the input prices for labour and capital. Consequently, we can derive the average total cost ( $ATC$ ) from total cost ( $TC$ ) by simply dividing by output ( $Q$ ). Thus  $ATC$  can be shown as:

$$ATC = \frac{TC}{Q} \quad (13)$$

Then  $TC$  can be expressed in terms of the following formula:

$$TC = ATC * Q = \frac{p_1L + p_2K}{Q} f(L, K) \quad (14)$$

The equation implies that total costs are a function of inputs,  $L$  and  $K$ , input prices,  $p_1$  and  $p_2$  and the quantities of outputs produced,  $Q$ . If we hold the input price constant, the properties of the production function will be exhibited by the cost function.

The cost function,  $TC$ , can be derived from the production function  $f(\cdot)$  under certain conditions outlined in the following paragraph. It also provides an alternative and equivalent description of the technology of the production process (See Shephard, 1953 and 1970).

Following Jorgenson (1986), the theory of production yields certain properties for the cost function:

- i. *Positivity*. The cost function has to be positive for positive input prices and a positive level of production.
- ii. *Homogeneity*. The cost function is homogeneous of degree one in input prices.
- iii. *Monotonicity*. The cost function is increasing in the input prices and in the level of output.

iv. *Concavity*. The cost function is concave.

Given differentiability of the cost function, we can define the cost shares of all inputs as elasticities of the cost function with respect to the input prices:

$$S_i = \frac{P_i x_i}{TC} = \frac{\partial \ln TC}{\partial \ln P_i}, \quad 1 \leq i \leq n \quad (15)$$

Moreover, the returns to scale can be defined as the elasticity of the cost function with respect to the level of output:

$$v_{Q_i} = \frac{\partial \ln TC}{\partial \ln Q_i} \quad 1 \leq i \leq m \quad (16)$$

Using the notion of Jorgenson (1986), we can refer to this elasticity as the "cost flexibility". Furthermore, since the cost function  $TC$  is homogeneous of degree one in input prices, the cost shares must sum to unity.

Diewert (1974) has shown through the application of duality theory that given certain regularity conditions, cost and production functions are dual to each other. Therefore, the structure of production can be analysed empirically taking either a production function or a cost function. "Direct estimation of the production function is attractive when the level of output is endogenous. Estimation of the cost function is more attractive, however, if the level of output is exogenous" (Christensen and Greene 1976, p.658).

Binswanger (1974) argued that there are several advantages of the use of a cost function rather than a production function. He said that first, it is not necessary to impose homogeneity of degree one on the production function to evaluate the estimation equations. Cost functions are homogeneous in prices regardless of the homogeneity properties of the production function, since a doubling of all prices will double the cost but will not change factor ratios. Second, the estimation equations have prices as explanatory variables rather than input quantities. Managers make decisions on input use according to exogenous prices, that makes the input levels endogenous decision variables. Finally, high multicollinearity in the production function estimations between

the input variables brings about econometric problems. As there is usually little multicollinearity between input prices, this problem may not arise in cost function estimations.

#### **4.6 Analysing Scale and Scope Economies In Banking Markets**

A fundamental difficulty with analysing banking technology and its characteristics (*i.e.* economies of scale and scope) is the specification of an appropriate measure of output. No general consensus exists as to the precise definition of what a bank produces or how one can measure this product. Financial firms, however, provide services rather than readily identifiable physical products, and it is not clear how to measure service outputs. The definition and measurement of bank output and costs in the empirical analyses varies between studies. In addition, there are also problems associated with; analysing scale economies at the branch or firm level, the source of data used as well as the exogeneity of bank output.

##### **4.6.1 Bank Output Measures- The Production and Intermediation Approaches**

Researchers have considerable difficulties in the definition and measurement of the concept of bank output. This section seeks to identify conceptual difficulties regarding bank output and how it can be measured. Unlike the outputs of manufacturing firms, services firms outputs cannot be measured by physical quantities. In addition, banks provide a wide array of services. They provide customers with low risk assets, credit and payments services, and play an important role as intermediaries in channelling funds from savers to borrowers as well as arranging non-monetary services such as the protection of valuables, accounting services and the running of investments portfolios. Not all services are charged for directly. Baltensperger (1980) and Kinsella (1980) have stated that banks are multiproduct institutions; many of their services are joint or independent (*i.e.* economies of scope) and banking is subject to government regulations that may affect costs, prices or levels of output.

Studies that examine the cost structure of banking markets usually take one of the two approaches, either the 'production' or the 'intermediation' approach (See Chapter 5;

OECD, 1992; Clark, 1988; and Gilbert, 1984). In the 'production approach', banks are treated as firms which employ capital and labour to produce different types of deposit and loan accounts. Outputs are measured by the number of deposits and loans account or number of transactions performed on each type of product, while total costs are the operating costs used to produce these products. The production approach, which mainly characterised the literature up until the early 1980s, views a bank as defined as a producer of two types of services: an acquirer of funds and user of funds (Humphrey, 1985). Under this approach, the appropriate measurement of output is the number of accounts of each type of service provided. Based on the production approach, operating costs are taken into account excluding interest expenses in the empirical analysis.

In the alternative 'intermediation approach', banks are viewed as intermediators of financial services rather than producers of loan and deposit account services. The values of loans and investments are taken as output measures; labour, capital and deposits are generally inputs to this process, thus operating costs and financial expenses (interest cost) are the relevant items indicated in total cost measures. The intermediation approach considers the intermediation role of banks. That is, banks produce intermediation services through the collection of deposits and other liabilities and the transfer of these funds to interest earning assets namely loans, securities and other investments (Colwell and Davis, 1992). In this approach, deposits are included as a third input along with capital and labour. As a result, operating costs, as well as interest cost are taken into account in the production process.

#### **4.6.2 Consequences of Bank Output Measures**

The problem relating to the definition of a financial firms output is concerned with the measurement unit employed. In banking, the question of economies of scale has been evaluated by primarily analysing bank's cost functions. The cost function implies that the minimum cost of producing bank output in a given time period is a function of the quantity of bank output produced during that period. This begs the question as to what is the appropriate measurement of bank outputs: the number and/or the value of accounts? Again, the lack of consensus of the definition of output leads to a diversity of measures of output employed in the economies of scale literature.

Studies that consider the relevant output measure as the number of deposit accounts serviced, focus on the following arguments. Firstly, depositors receive benefits (*e.g.* security and liquidity) from deposit accounts. Secondly, by providing to depositors these services, banks incur expenses. Bell and Murphy (1967, p.2) pointed out "The servicing of demand deposits accounts is a distinct production line operation. Associated with this function are the receiving and processing of cheques, involving sorting, tabulating and many other detailed operations. Many kinds of equipment are employed to process or 'produce' a demand deposits account". The primary problem with this definition is that although this approach alleviates the problem of the homogeneity of bank output, it ignores the multiproduct nature of commercial bank output and also the jointness of production of various bank activities. On the first point, it has been criticised that just because depositors receive benefits does not make them buyers, this is a voluntary transaction and both sides may expect and receive benefits. For the second point, it has been argued that both deposit and non-deposit funds are utilised to make loans and to acquire other assets. They are substitutes. This measure, also, ignores any relationship which might exist between account size and cost. It is argued that although the value of account may affect to some extent the cost of processing it, the operating costs are determined by the number of accounts outstanding during an operating period or by the total number of transactions which occur in the that period.

Sealey and Lindley (1977) suggested that using deposits as an output was incorrect, and they argued that the major confusion originated through the failure to distinguish between technical and economic aspects of production in financial institutions. The technical process of production deals with the transformation of inputs into other goods or services as output. The output of financial firms in a technical sense is the financial services provided to depositors and creditors. Economic production creates a product which has higher value than the original inputs and then this value must be measured at market prices. Hence, all of the technical outputs are not necessarily economic outputs such as the services received by depositors of financial firms. That is, these services reflect partial payment for the use of funds from depositors. Indeed, deposits do not create value until they are transformed into earning assets. Therefore, deposits are treated as inputs along with capital and labour to produce the final outputs of the bank that are the earning assets in the bank portfolio. As a result, earning assets are the

primary source of revenue and they may therefore represent bank output.

Shaffer and David (1986) argue that deposits should be treated as an input in the production process of financial firms. They pointed out that there are two main reasons why this should be the case: first, deposits generate positive cost and do not produce revenue until deposits are intermediated into loans and other assets. Second, deposits are substitutes for other sources of funds in the production of loans and other assets.

Since returns to scale are a property of the production function, the most obvious way to gauge economies or diseconomies of scale in financial firms lies in studying the production process. Therefore, the definition of output can make a difference when one examines economies of scale using cost functions. Berger, Hanweck and Humphrey (1987) indicated that while all deposits such as demand deposits, saving deposits and time deposits are employed as inputs, economies of scale may be higher than when they are included in output, as loans expand more than proportionately with deposits. Consequently, output tends to grow rapidly when deposits are excluded from output and used as inputs. The aforementioned study also indicated that purchased funds grow faster than loans when financial firms became larger, and thus, purchased funds inclusion in output results in higher estimates of scale economies. Whereas, investment securities increase more slowly than loans so that their inclusion in output produces lower scale economies.

Kolari and Zardkoohi (1987) use the dollar value of accounts to measure bank output for three reasons: firstly, banks compete to increase their market share regarding dollar amounts, as opposed to the number of accounts. Secondly, the use of number of accounts as the measure of output is correct unless all accounts have the same cost. For instance, an active demand deposits account might be more costly than a time deposits account. Furthermore, large accounts may be more costly than small accounts since they tend to be more active. Applying the dollar value of accounts alleviates this problem, as in a competitive environment, competition among banks, to attract more dollars in the form of low cost accounts, raises their relative costs. That is, in equilibrium, the marginal cost per dollar of accounts across all deposits accounts is the same. Lastly, as long as the banks produce many services, dollar measurement is the



only common denominator i.e. securities, investments cannot be measured in number of accounts.

Studies employing the production approach assume that the main function of a bank is intermediation, that is, bringing together deficit and surplus units. Benston (1965) argues, "The operations costs incurred are a function of the services. Since these services are related primarily to the number of deposits accounts and loans processed rather than the dollars loaned, economies of scale should be measured against this concept of output" (p.287). That is, two accounts, one of \$10000 and another of \$1 million, should have the same operating cost. Benston et al. (1982a, p.10) stated that "banks do not incur operating costs directly as a function of the number of dollars of deposits or loans they process. ...the key cost causing output variable is the number and types of pieces of paper and electronic signals processed". This flow concept eliminates some of the problems of the intermediation approach by removing the inflation bias. It also permits numbers of accounts and average size of accounts to have differential effects on costs. The number of studies based on the production approach have included the average size of accounts as an output measure, because the dollar value of accounts may play some role in affecting operating cost. However, using average size of accounts results in various econometric problems, such as multicollinearity among the explanatory variables (e.g between the number accounts and the size of accounts). Since the number and the size of accounts may be correlated, then their joint use may result in inefficient estimates of the cost function parameters. This approach also suffers from the lack of a method of weighting the contribution of each service to total output.

The above argument suggests that what matters for a bank is not the number of accounts but the dollar value of accounts. The market evaluates a bank in terms of dollar value and no longer by the number of accounts managed by that bank. Mester (1987a, p.19) indicated that "The intermediation approach has an advantage over the production approach in that it includes the total costs of banking and doesn't make a distinction between a bank's purchasing deposits from other institutions or producing its own deposits". However, Humphrey (1985, p.756) indicted "But this conflict becomes a moot point if it can be shown that regardless of the definition used, the same general scale economy conclusions apply." Moreover, Berger et al. (1986, p.22) stated

that "The appropriate choice between the production and intermediation approaches to banking depends upon the question being asked. ... However, for questions related to the economic viability of banks, the intermediation approach is preferred because it is more inclusive of the total costs of banking. ... From the view point of an optimising banker, interest and operating costs are functionally equivalent."

Banks with different ratios of asset and liabilities, however, could exhibit different degrees of scale economies (Revell, 1987). Large banks, for example, have higher ratios of purchased funds than small banks. Therefore, they should exhibit greater scale economies as long as purchased funds are included in the output measure. If purchased funds, however, are employed as inputs, then the studies should estimate lower scale economies (See Kolari and Zardkoohi, 1987; Noulas et al., 1990 for example).

Colwell and Davis (1992) have also commented that none of the bank output measurements take into account risk factors. Risk is an additional feature of bank loans, a bank may be able to boost output in terms of the balance sheet by increasing risk. They suggested that perhaps it may be more appropriate to use some ex-post revenue measure, covering losses over the cycle, with provisions as negative output. Charnes et al. (1990) alternatively suggested that provisions and actual loan losses could be counted as inputs. Colwell and Davis (1992) have indicated that the various measures do not permit for intertemporal relationships that are crucial in banking.

There have been various output measures which have been widely used in the economies of scale literature such as total assets, total deposits, demand deposits, the number of loan and deposits accounts, gross operating income, and a divisia index (See Chapter 5). Indeed, one of the major problems in the theory of the financial firm is the specification of appropriate measures of outputs and inputs. The problem is compounded when financial firms, especially commercial banks, are treated as multiproduct firms. It is then not only necessary to devise the measurement of output but also to consider the multiproduct characteristics of the financial firm. In general, the earliest cost studies of banking used very simple models which resembled ratio based analysis. However, each study applied a different indicator of banking output. This problem of output definition has persisted since the earliest studies and has

continued to present problems to researchers as the banking literature developed over the last three decades.

#### **4.6.3 Operating Versus Total Bank Cost**

This section is concerned with the definition of cost that has been applied in the empirical studies of economies of scale and scope. There is also no consensus as to what cost figures (*i.e.* only operating cost or both operating and interest cost) should be used for the empirical analysis of the cost structure of banks. It is assumed that a bank could utilise all inputs appropriately to minimise its cost or maximise its profits. In general, according to two alternative definitions of bank output (the production approach and intermediation approach), there are two corresponding definitions of bank average costs: cost per accounts and cost per value of accounts, which have been used to analyse economies of scale and scope.

The views of the production approach advocates suggest that one should define average cost as only operating costs per account while the intermediation approach generates operating plus interest costs per value in the account. As a result, the intermediation approach always adds purchased funds when costs are showed per dollar value in the accounts (see Humphrey, 1985; Kolari and Zardkoohi, 1987). Operating cost can be specified to include, wages, material costs, fringe benefits, expenses for physical capital, occupancy, along with management fees and data processing expenses paid to the holding company and other entities. Many studies (See Chapter 5) use only operating cost, on the grounds that they are interested in the production process, for instance, Benston et al. (1982b), Gilligan, Marshall and Smirlock (1983), Hunter and Timme (1986). Benston et al. (1982a, p.9) indicated that "while interest is an important outlay to the bank, it is determined by market forces that reflect alternative investments available to depositors. Thus, interest is not an operating expense for purposes of measuring banks' efficiency". As far as operating cost is concerned, there are two main arguments for not including interest expenses in the measurement of bank cost. Firstly, the inclusion of interest cost moves the focus from the ability of banks to produce output using internal resources and management to that of producing with purchased funds. Secondly, other impediments against using interest cost is that the price used is

an average not a marginal cost of funds. As far as marginal cost differs from average cost, the estimation of the cost function parameters will be biased. However, the average interest rates could be a good proxy for marginal costs in a deregulated environment.

More recent studies have employed total cost to investigate economies of scale and scope in banking markets. Total costs are calculated by adding interest expenses on purchased funds and core deposits to operating costs. "The interest expenses are large and exceed operating costs since they comprise around 35 and 40 percent, respectively of total cost (Humphrey, 1990, p.39)". Applying only operating cost can lead to biased estimation since, when banks get larger, the proportion of assets funded with non-deposits accounts increases (for example purchased funds). As mentioned earlier, the operating cost of non-deposits accounts is small, while their interest expense is higher. Since both demand deposit and non-deposit accounts are substitutes, using operating cost is biased toward finding greater scale economies for large banks when scale economies might be not present (Humphrey, 1985). Moreover, operating cost per dollar of assets is seen to fall more rapidly than total costs per dollar of assets. Thus if only operating costs are used in a statistical analysis of bank costs, as some researchers have done, economies of scale will be over estimated (Humphrey, 1990).

#### **4.6.4 Scale Economies at the Branch (Plant) versus the Firm Level**

The cost function of an individual branch may be considerably different from the cost function for the bank as a whole. This is generally referred to as the difference between plant (branch) level economies and firm level economies. Since optimal plant and firm sizes will be identical only when multiplant economies are negligible, the magnitude of such influences should be carefully considered in evaluating the effect of scale economies. Both branch level and firm level economies can have an important effect on the minimum efficient firm size.

Cost studies in banking markets have used various approaches to analyse the effects of branching on the cost structure of banking institutions. When analysing the scale and scope economies for banks with branch networks it is important to separate two issues,

the size of branches and the number of branches. There could be scale and scope economies in larger branches from which smaller branches may not benefit, and this could become more evident as bank services are extended. Put simply, there may be cost savings which could be generated by increasing the output of established branches (plant level economies) but not by adding new branches (firm level economies).

Different results have been reported according to the way branch variables are used in the cost function. Early studies examined cost differences between unit bank and branch banks in the US separately (i.e. Alhadeff, 1954; Horvitz, 1963). These studies did not distinguish between scale economies at the single branch office or plant level from those (for all the branch network) at the firm level. However, some of the early studies did use dummy variables to distinguish between branch and unit banking (i.e. Benston, 1965; Bell and Murphy, 1968) (see Chapter 5). In order to measure scale economies at the branch and the firm level, later studies included branch variables in the cost function. Branch level scale economies were calculated by holding the number of branches constant during the estimation. To estimate scale economies at the firm level, both the number of branches and outputs are allowed to vary.

Since economies of scale, in general, shows how average costs are affected as output expands, for unit banks, output can only be increased by producing more of various banking services at a single branch. In the case of US unit banks, this single branch also represents the entire unit banking institutions, economies of scale at the firm or the plant level are same. However, for branch banks, economies of scale at the branch level could be different than those for the entire institution (at the firm level scale economies).

Banks can expand their operations or output by either: (a) increasing services to existing branch networks in given markets; or (b) adding new branches, which attract new accounts and deposits, in new market areas. Early studies focused on the first method of output expansion which could be appropriate only for unit banks and banks with very few branches. In the case of banks with large branch network, it seems that the second method of output expansion may be more important. Scale economies at the plant or branch level are calculated assuming that expansion of output occurs with no increase

in the number of branches, while scale economies at the firm level are calculated assuming that output expansion is accompanied by branch expansion.

#### **4.6.5 The Source of Data in US Banking Studies**

Most of the US studies dealing with economies of scale and scope have generally used data from two main sources: the Functional Cost Analysis (FCA) programme of the Federal Reserve System and banks own Call and Income Reports. The Federal Reserve's Functional Cost Analysis Programme is a voluntary programme conducted by the twelve US Federal Reserve Banks for commercial banks and savings banks in their districts (See Humphrey, 1985). The data has the advantage of providing standardised format and detailed information, notably the number of accounts for each service. However, there are some drawbacks to using the FCA data source. The major drawback is the size distribution of banks in the sample (Humphrey, 1985). The FCA data excludes large banks with deposits above one billion dollars, which therefore limits the usefulness of the analysis because it is difficult to extrapolate the results of the analysis beyond the size distribution of banks found in the sample. In other words, forecasting about the cost structure of large banks on the basis of such samples is a critical extrapolation.

Heggstad and Mingo (1977) investigate the FCA programme, finding that banks in the FCA programme have lower expense ratios, and that the influence of banks size on cost is different for FCA banks. Furthermore, from a policy point of view, it is of no great matter whether economies of scale are exhausted for very small unit banks, in the sense that a merger between two small banks does not rise serious regulatory questions, since no danger of monopoly power could be suspected. The important interest concerns the cost of the large banks because mergers amongst the latter could have a significant impact on market shares and the competitive environment. Another problem that arises with the FCA data is that the sample is not random since the programme is voluntary (Noulas et al, 1990). Moreover, the FCA data made available to the public has some information masked to protect the confidentiality of the participating institutions (Gropper, 1991).

Recently, various US studies have used data from the Call and Income Reports of individual banks. These data cover both balance sheet and income statement items that are used in cost function estimation. The problem with these data is that they do not provide detailed service based cost information (Gropper, 1991). It is impossible for example to identify the individual cost and levels of cross-substitution between different product lines and services.

The source of data is also questionable for European studies which generally use various balance sheet and income statements data from publicly available accounts. This limits the analysis of scale and scope economies to bank level evaluations rather than more micro-level product line cost studies.

#### **4.6.6 The Exogeneity of Bank Outputs**

The modelling of cost functions requires the exogeneity of the explanatory variables which means that they are autonomous, or predetermined. That is, regression analysis requires that the relationship between dependent variable and explanatory variables be one-way, or unidirectional. However, many studies in the banking literature are plagued by the fact that the independent variables are endogenous. For example, Benston, Hanweck and Humphrey (1982b) reported that larger banks produce more deposit services as well as payroll, cash management, various funds transfer services per deposit account than smaller banks. This may lead to some bank outputs being endogenous since they simultaneously affect bank operating costs. The earlier studies undertaken by Benston (1965) and Bell and Murphy (1967) argued that, given the US banking institutions, the exogeneity of the output could be an acceptable assumption. Their argument is that since the regulatory authority imposed geographical limits to banking activities, the banks (*e.g.* unit banks) were in a situation of local monopoly, and that their output was mainly determined by the local demand, thus exogenous to the bank. However, this argument becomes unclear when the authorities deregulate the market. The solution, which Benston, Hanweck and Humphrey (1982a) introduced, is to include an explanatory variable measuring average account size to adjust the number of accounts for bank size. Kolari and Zardkoohi (1987), however, have argued that the inclusion of account size in the model does not necessarily resolve the problem of

endogeneity since the number of accounts and average size of accounts are highly correlated.

Kim (1985) provides a theoretical solution for the endogeneity of some outputs, which showed that the joint estimation of a equation system consisting of a translog cost function, a cost-share equation, and a revenue-share equation along with the proper parameter restrictions, (to ensure linear homogeneity in factor prices of one and symmetry), is the solution for obtaining consistent estimates with endogenous outputs.

Kolari and Zardkoohi (1987) indicated that Kim's procedure may not be totally necessary. They argue that firstly, the endogeneity problem for estimating the cost function parameters in banking is no more or less serious than cost estimations in other industries. Secondly, Kim's (1985) approach takes into account only the supply side of the market, without covering the demand side.

Given the above problems associated with studying scale and scope economies in banking markets the following section examines the nature of multiproduct cost functions which are used to estimate scale and scope economies in the banking markets.

#### **4.7 Functional Forms for the Multiproduct Cost Function**

The total cost of production for a firm can be shown as  $TC(Q, P)$ , where  $Q$  is a  $m$  dimensional vector of output quantities,  $P$  is a  $n$  dimensional vector of input prices. Provided that  $TC$  satisfies regularity conditions, (that is, nonnegative, real valued, nondecreasing, strictly positive for nonzero  $Q$ , and linearly homogeneous and concave in  $P$  for each  $Q$ ) it is said to be dual to the transformation function that can be written as  $f(Q, X)$ , where  $X$  is a  $n$  dimensional vector of input quantities. The duality between cost function and transformation function ensures that they incorporate the same information about production properties. Thus, there is a duality between cost and production functions in the sense that either of these functions can be used to describe the technology of the firm equally well in certain circumstances.



#### 4.7.1 The Cobb-Douglas Cost Function

Cobb-Douglas cost and production functions are linear in logarithms and both can serve as first-order approximations to arbitrary production or cost function in logarithms in the absence of uncertainty. It is necessary for the Cobb-Douglas production functions to be linearly homogeneous and strictly quasiconcave and the elasticity of substitution in inputs to be one. In addition, costs are positive for any nonnegative produced output and input prices are given parametrical to any firm, with conditions of cost minimising and a competitive input market (Diewert, 1992).

Under the restriction that there exists a dual relationship between the production function and cost function, the total cost of production is defined for the two inputs case as (See Nerlove, 1963; Heathfield and Wibe, 1987; Kolari and Zardkoohi, 1987):

$$TC = p_1L + p_2K \quad (17)$$

where  $P_1$  and  $P_2$  are the prices of labour and capital.

The first widely used production function that allows substitution is the Cobb-Douglas (1928) production function which for a bank looks like the following:

$$Q = A L^{\alpha_1} K^{\alpha_2} \quad (18)$$

where  $Q$  is output per period;  $A$  represents fixed inputs, including the effect of technology;  $L$  is labour input;  $K$  is capital input;  $\alpha_i$  are elasticity of  $Q$  with respect to inputs.

The conditions of cost minimising for banks indicates the marginal productivity conditions and these can be formulated as follows:

$$\frac{p_1L}{\alpha_1} = \frac{p_2K}{\alpha_2} \quad (19)$$

Using equation (17), (18) and (19), the Cobb-Douglas cost function can be simplified as:

$$TC = \gamma Q^{\left(\frac{1}{r}\right)} P_1^{\left(\frac{\alpha_1}{r}\right)} P_2^{\left(\frac{\alpha_2}{r}\right)} \quad (20)$$

where  $\gamma = r(A\alpha_1^{\alpha_1}\alpha_2^{\alpha_2})^{-1/r}$ ;  $V = u^{-1/r}$ ;  $r = \alpha_1 + \alpha_2$ . The parameter  $r$ , that is the equal to the sum of output elasticities with respect to inputs (*i.e.*  $K, L$ ), shows the degree of returns to scale.

The cost function equation can be transformed into the logarithmic form to achieve the linear relationship as:

$$\ln TC = \ln \gamma + \left(\frac{1}{r}\right)\ln Q + \left(\frac{\alpha_1}{r}\right)\ln P_1 + \left(\frac{\alpha_2}{r}\right)\ln P_2 \quad (21)$$

As the duality condition requires that factor prices be homogeneous of degree one, that is, the exponents of  $P_1$  and  $P_2$  must sum to unity. In other words,  $\alpha_1/r + \alpha_2/r = 1$ . This means that doubling prices will always exactly double costs. Thus the Cobb-Douglas cost function must homogeneous of degree one in input prices. Under this restriction, equation (21) can be rewritten as:

$$\ln TC - \ln P_2 = \ln \gamma + \left(\frac{1}{r}\right)\ln Q + \left(\frac{\alpha_1}{r}\right)(\ln P_1 - \ln P_2) \quad (22)$$

Finally, economies of scale can be computed deriving equation (22). However, the Cobb-Douglas cost function allows only to estimate increasing, decreasing or constant cost curves which does not allow  $U$ -shaped cost curves. Although this functional form defined by (21) is used a great deal in the applied economics literature, unfortunately, its use is not recommended because it imposes serious restrictions on the a priori admissible pattern of substitution between inputs and outputs. Moreover, the Cobb-Douglas function constrains the elasticity of substitution between inputs to equal unity.

#### 4.7.2 The CES Cost Function

The next advance in functional forms for production functions came when Arrow, Chenery, Minhas and Solow (1961) developed the constant elasticity of substitution (CES) function. The constant elasticity of substitution function is more general than the

Cobb-Douglas function and it permits any degree of substitutability among inputs. That is, the CES production function also constrains the value of substitution to be constant, but not necessarily equal to one. The CES production function is shown:

$$Q = A[\beta L^{-\gamma} + (1-\beta)K^{-\gamma}]^{-\frac{z}{\gamma}} \quad (23)$$

where  $L$  and  $K$  are two inputs and  $z$  is the degree of homogeneity which can also represent measure of scale economies. Thus, the measure of elasticity of substitutions between inputs for the CES is  $\sigma = 1/(1+\gamma)$ , which is constant but not necessarily equal to one. When  $\gamma = 1$ , the CES production function reduces to the Cobb-Douglas functional forms. The cost function that is the dual of the production function and shows total costs in terms of output and input prices can be defined as:

$$TC = Q^{\frac{1}{z}} A^{-\frac{1}{z}} \left[ \beta^{\frac{1}{(1+\gamma)}} P_1^{\frac{\gamma}{(1+\gamma)}} + (1-\beta)^{\frac{1}{(1+\gamma)}} P_2^{\frac{\gamma}{(1+\gamma)}} \right]^{\frac{(1+\gamma)}{\gamma}} \quad (24)$$

Arrow et al. (1961) indicated that the CES production function provides better results for analysis of production with one output and two inputs of production. The CES functional form is more general than the Cobb-Douglas one, and is perfectly adequate in the two input case, however, its generalisations to the three or more input case imposes unreasonably severe constraints on the substitution possibilities. Uzawa (1962) has demonstrated that constancy of elasticities of substitutions and transformation is highly restrictive for more than one output or more than two inputs. Overall, as its name requires, the production function permits the elasticity of substitution between pairs of inputs to differ from unity, however, it has been shown that the CES function does force the elasticities between each pair of inputs to be the same. The CES function is a step in the right direction but still seems too restrictive.

Consequently, these constraints resulted in the growth of the so-called "flexible" functional forms, such as the generalised Leontief functional form introduced by Diewert (1971) and the transcendental logarithmic functional form introduced by Christensen, Jorgenson and Lau (1973). These functional forms share the common characteristics of linearity in parameters and the ability of providing second order approximations to any arbitrary functions (Lau, 1986). Moreover, these functional

forms also include the linear terms, quadratic and interaction terms in the independent variables.

#### 4.7.3 The Generalised Leontief Function

This function, introduced by Diewert (1971) is a flexible form, which can be defined for prices of  $n$  inputs as  $P_i$ , ( $i= 1, \dots, n$ ), the  $n$  input quantities,  $X_i$ , total costs  $TC$ , and output  $Q$  as follows:

$$TC = h(Q) \sum_{i=1}^n \sum_{j=1}^n \beta_{ij} P_i \quad (25)$$

It assumes that  $P_i$  and  $Q$  are exogenous, however, the  $X_i$  and  $TC$  are endogenous. The generalised Leontief cost function can be rewritten for the simple two input case as:

$$TC = h(Q) \left[ \beta_{11} P_1 + 2 \beta_{12} P_1^{\frac{1}{2}} P_2^{\frac{1}{2}} + \beta_{22} P_2 \right] \quad (26)$$

where without loss of generality  $\beta_{ij} = \beta_{ji}$ . Lau (1986) demonstrated that the generalised Leontief cost function is flexible. To obtain equations that are amenable to estimation, it is generally convenient to employ Shephard's Lemma, which indicates that the optimal, cost minimising demand for input  $i$  can simply be derived by differentiating the cost function with respect to  $P_i$ . Therefore, optimal factor demands are derived by differentiating the cost equation with respect to  $P_1$  and  $P_2$ , yielding:

$$\frac{\partial TC}{\partial P_1} = \hat{x}_1 = h(Q) \left[ \beta_{11} + \beta_{12} \left( \frac{P_1}{P_2} \right)^{\frac{1}{2}} \right] \quad (27)$$

$$\frac{\partial TC}{\partial P_2} = \hat{x}_2 = h(Q) \left[ \beta_{22} + \beta_{12} \left( \frac{P_1}{P_2} \right)^{\frac{1}{2}} \right]$$

where  $\hat{x}_1$  and  $\hat{x}_2$  are the cost minimising levels of input of  $X_1$  and  $X_2$ . Using (27) to eliminate  $(P_1/P_2)$  we get:

$$\left[ \frac{X_1}{h(Q)} - \beta_{11} \right] \left[ \frac{X_2}{h(Q)} - \beta_{22} \right] = \beta_{12}^2 \quad (28)$$

From this we can obtain some idea of the possible range of isoquants of the production

function dual of (26). Thus for example when  $\beta_{12} = 0$ :

$$X_1 = h(Q) \beta_{11}, \quad X_2 = h(Q) \beta_{22} \quad (29)$$

which is the Leontief fixed coefficient case with rectangular isoquants.

When  $\beta_{11}, \beta_{22}$  and  $\beta_{12} > 0$  as  $[X_1/h(Q)] \rightarrow 0, X_2 \rightarrow \infty$  and vice versa. Hence the isoquants are convex to the origin with asymptotes  $\beta_{11}$  and  $\beta_{22}$  for  $X_1$  and  $X_2$  respectively.

When  $\beta_{11} < 0, \beta_{22}$  and  $\beta_{12} > 0$  the asymptote of  $X_1$  is a negative quantitative and thus the isoquant will intersect the  $X_2$  axis. Finally, when  $\beta_{11}$  and  $\beta_{22} < 0$  and  $\beta_{12} > 0$  the isoquants intersect both axes.

Finally, we express one important theoretical justification for the Diewert (Generalised Leontief) cost function: it can be viewed as a second-order (local) approximation to an arbitrary cost function.

#### 4.7.4 The Quadratic Cost Function

An alternative flexible functional form developed by Baumol and Braunstein (1977) is the quadratic cost function which can be written as:

$$TC = g(P) \left[ F + \sum_i^m \alpha_i Q_i + \frac{1}{2} \sum_i^m \sum_j^m \alpha_{ij} Q_i Q_j \right] \quad (30)$$

where  $F \geq 0$  and  $\alpha_{ij} = \alpha_{ji}$ ;  $g(P)$  is a linearly homogeneous, concave, and nondecreasing function. This functional form is a quadratic in the magnitudes of the outputs, augmented by linear terms and  $F$  is the fixed cost parameter. In this functional form,  $P$  and  $Q$  are separable which also requires all inputs demands to vary with outputs in the same fashion. For instance, input ratios and cost shares are assumed to be independent of output levels, and input demand elasticities with respect to each output become equal and independent of prices ( $P$ ). Baumol, Panzar, and Willig (1988) indicated that they ignored the role of input prices  $P_i$  and simply took  $F, \alpha_i$ , and  $\alpha_{ij}$  to be unspecified functions of the vector  $P$ , in order to see clearly the effects of changes in outputs. The marginal costs are obtained by differentiating the quadratic total cost

function with respect to outputs as shown:

$$\frac{\partial TC}{\partial Q_i} = \alpha_i + \sum_j^m \alpha_{ij} Q_j \quad (31)$$

and these must be constrained to nonnegative values throughout. Baumol, Panzar, and Willig (1988, p.453-459) showed that the relevant functional form satisfies all the cost function properties. To our knowledge, however, this functional form has not been used to estimate the cost structure of banks. Moreover, one of the shortcoming of the Quadratic function is also the absence of any explicit theoretical foundation to justify its use in preference to any other functional form.

We turn next to the translog functions. This cost function's structure is considerably more flexible than the above functional forms.

#### 4.7.5 The Translog Cost Function

Another example of a more flexible functional form for a cost function is the transcendental logarithmic functional form which was developed for a single output technology by Christensen, Jorgenson and Lau (1971, 1973); the multiple output case was defined by Burgess (1974) and Diewert (1974). The translog production function is a second order approximation in logarithms for arbitrary deterministic functions and more flexible functional forms (Diewert, 1974; and Lau, 1974) which required that the own and cross-price derivatives (or equivalently the elasticities) of demand for inputs or commodities be free to attain any set of theoretically consistent values (*i.e* the restrictive constraints *a priori* such as homotheticity, constancy of the elasticity of substitution, additivity). The functional form is also easily adaptable to include multiple outputs and multiple inputs. The general form of the translog production function can be expressed as:

$$\ln Q = \alpha_0 + \sum_{i=1}^n \alpha_i \ln X_i + \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^n \alpha_{ij} \ln X_i \ln X_j \quad (32)$$

where  $\alpha_{ij} = \alpha_{ji}$  for all  $i, j$  and  $X_i$  are  $n$  the quantities of inputs.

Following from the duality principle that cost functions can be obtained directly from production functions (for a formal proof of duality principles, see Diewert, 1975, 1982; Fuss and McFadden, 1980; and Nadiri, 1982) the following translog cost functional form can be derived:

$$\begin{aligned} \ln TC = & \alpha_0 + \sum_{i=1}^m \alpha_i \ln Q_i + \sum_{i=1}^n \beta_i \ln P_i + \\ & \frac{1}{2} \left[ \sum_{i=1}^m \sum_{j=1}^m \delta_{ij} \ln Q_i \ln Q_j + \sum_{i=1}^n \sum_{j=1}^n \gamma_{ij} \ln P_i \ln P_j \right] + \\ & \sum_{i=1}^n \sum_{j=1}^m \rho_{ij} \ln P_i \ln Q_j \end{aligned} \quad (33)$$

where  $TC$  is total cost,  $Q_i$  is the level of output,  $P_i$  the price of inputs. There are  $m + 1$  independent  $\alpha_i$  parameters,  $n$  independent  $\beta_i$ ,  $m(m + 1)/2$  dependent  $\delta_{ij}$  parameters since it is assumed that  $\delta_{ij} = \delta_{ji}$  for  $1 \leq i < j \leq m$ ,  $n(n + 1)/2$  independent  $\gamma_{ij}$  parameters since it is assumed that  $\gamma_{ij} = \gamma_{ji}$  for  $1 \leq i < j \leq n$ , and  $mn$  independent  $\rho_{ij}$  parameters in the translog cost function defined by (33). However, if the constraint of the homogeneity of degree one in the input prices on the cost function  $TC$  defined by (33) is imposed, we will require that the following restrictions on the parameters hold:

$$\begin{aligned} \sum_{i=1}^n \beta_i = 1; \quad \sum_{i=1}^n \gamma_{ij} = 0; \quad 1 \leq j \leq n \\ \sum_{i=1}^n \rho_{ij} = 0 \quad 1 \leq j \leq m \end{aligned} \quad (34)$$

In general, the translog cost function defined by (33) will not satisfy the appropriate regularity conditions (see Diewert, 1982, p.554) globally. Lau (1974), however, shows that the translog cost function may provide a good local approximation to an arbitrary twice differentiable linearly homogeneous in input prices, cost function. This gives the translog function a flexible functional form.

However, the derived demand for an input or cost share of input,  $x_i$ , is calculated by partially differentiating the cost function with respect to the input prices,  $P_i$  (See Shephard, 1953 and 1970; Christensen, Jorgenson and Lau, 1973). Given differentiability of the cost function, we can show the cost shares of the inputs as elasticities of the cost function with respect to the input prices:

$$S_i = \frac{\partial \ln TC}{\partial \ln P_i} = \frac{\partial TC}{\partial P_i} \frac{P_i}{TC} = \frac{P_i X_i}{TC} \quad 1 \leq i \leq n \quad (35)$$

where  $S_i$  are the share of the  $i$ th inputs in the total costs. Thus, for the translog functional form defined by (33) and the cost share equations defined by (35) can be rewritten following the duality theory and referred to as Shephard's Lemma (Christensen, Jorgenson and Lau, 1973):

$$\frac{P_i X_i}{TC} = \beta_i + \sum_{j=1}^n \gamma_{ij} \ln P_j + \sum_{j=1}^m \rho_{ij} \ln Q_j \quad (36)$$

Note that since the sum of the cost shares is equal to unity, however, only  $n-1$  of the  $n$  equations defined by (35) can be statistically independent.

Overall, the translog cost function shown in equation 33 must have the following properties if production and cost function theories are to be fully integrated. Jorgenson (1986) notes that the function must have:

1. *Homogeneity.* The cost function TC defined by (33) is homogenous of degree one in the input prices.
2. *Cost exhaustion.* The sum of cost shares is equal to unity. Cost exhaustion requires that the value of the  $i$  inputs is equal to total cost.
3. *Symmetry.* A necessary and sufficient condition for symmetry is that the second-order outputs and inputs parameters must be symmetric, that is, for instance, in the cost function defined (33),  $\delta_{ij} = \delta_{ji}$  for  $1 \leq i < j \leq m$ , and  $\gamma_{ij} = \gamma_{ji}$  for  $1 \leq i < j \leq n$ , respectively.
4. *Nonnegativity.* The cost shares and the cost elasticities must be nonnegative. Since the translog cost function is quadratic in the logarithms of input prices and the output levels, we cannot impose restrictions on the parameters that indicates nonnegativity of the cost shares and the cost elasticities.
5. *Monotonicity.* The cost function is increasing in the input prices and in the level of output.



#### 4.7.6 The Hybrid Translog Cost Function

A major criticism of the conventional translog cost methodology is that it does not allow us to evaluate scope economies and product specific economies of scale when one of the outputs becomes zero. To avoid the problem of zero output, the hybrid translog cost function developed by Caves, Christensen and Tretheway (1980), and Fuss and Waverman (1981) can be used as a generalisation of the translog cost function, that is the logarithm of the output ( $\ln Q_i$ ) is replaced by a Box-Cox (1964) transformation:

$$\begin{aligned} Q_i^* &= \frac{(Q_i^\lambda - 1)}{\lambda} & \lambda \neq 0 \\ &= \ln Q_i & \lambda = 0 \end{aligned} \quad (37)$$

when  $\lambda$  approaches zero, the hybrid cost function approaches the translog cost function. When  $\lambda$  equals one, the cost function becomes semilog. The hybrid cost function can be shown, using the Box-Cox transformation as follows:

$$\begin{aligned} \ln TC &= \alpha_0 + \sum_{i=1}^m \alpha_i Q_i^* + \sum_{i=1}^n \beta_i \ln P_i + \\ &\frac{1}{2} \left[ \sum_{i=1}^m \sum_{j=1}^m \delta_{ij} Q_i^* Q_j^* + \sum_{i=1}^n \sum_{j=1}^n \gamma_{ij} \ln P_i \ln P_j \right] + \\ &\sum_{i=1}^n \sum_{j=1}^m \rho_{ij} \ln P_i Q_j^* \end{aligned} \quad (38)$$

where  $\delta_{ij} = \delta_{ji}$  and  $\gamma_{ij} = \gamma_{ji}$ . In this cost function, it is clear that costs will not be zero even if some output is zero.

Like the translog cost function, since the duality theorem requires that the cost function must be linearly homogeneous in input prices, the following conditions must be restricted on the input price parameters:

$$\begin{aligned} \sum_{i=1}^n \beta_i &= 1; \sum_{i=1}^n \gamma_{ij} = 0; \quad 1 \leq j \leq n \\ \sum_{i=1}^n \rho_{ij} &= 0 \quad 1 \leq j \leq m \end{aligned} \quad (39)$$

In practice, these kind of restrictions, in general, are imposed explicitly in the process

of estimation. Baumol, Panzar, and Willig (1988) showed that the hybrid translog is substantively flexible at least to some degree. For instance, if  $\gamma > 0$ , then RAC becomes *U*-shaped; if  $\gamma < 0$ , then RAC cost curves have inverted *U*-shapes. They also indicated that the functional form can exhibit economies or diseconomies of scope, product specific economies of scale, and cost complementarities (or their opposite) as well as other properties of the cost function.

Baumol, Panzar, and Willig (1988) also note that like the translog forms, the property of the hybrid translog which makes them especially convenient for estimation is the statistically tractable set of equations which can be obtained with the aid of Shephard's Lemma for the shares of total cost efficiently expended on the inputs. These equations can be expressed as:

$$\frac{P_i X_i}{TC} = \beta_i + \sum_{j=1}^n \gamma_{ij} \ln P_j + \sum_{j=1}^m \rho_{ij} Q_j^* \quad (40)$$

where  $X_i$  is the quantity of their  $i$ th input. In fact, the cost parameter values are estimated by fitting the system of equations simultaneously to the relevant data, whilst imposing the relevant restrictions on the equations.

#### 4.7.7 Limitations of The Translog Functional Form

The translog cost function was developed as a local approximation to some unknown 'true' underlying cost function. Interest in the approximation was motivated by the fact that it does not require restrictions on elasticities at the point of approximation. In practice, the translog functional form usually give poor approximations to the true underlying cost function as one moves away from the point of approximation (Barnett and Lee, 1985). In other words, the statistical methodology which depends on extrapolating a local approximation to fit globally may behave poorly when the global behaviour of the function differs from its local behaviour. Thus, in its application, the translog functional form is potentially subject to misspecification (McAllister and McManus, 1993; and Lau, 1986). Lau (1986) states that when global theoretical consistency fails, however, there is still a set of prices of inputs over which theoretical consistency holds, this set may be large enough for all practical purposes.

A major problem involving the ordinary translog cost functional form arises when one computes measures of product specific economies of scale and global economies of scope. One of the desirable characteristics of a multiproduct cost function is that it allows for one or more outputs to be zero (Caves, Christensen and Tretheway, 1980). In the ordinary translog functional form, however, all of the outputs enter in logarithmic form; thus the function has no finite representation if any output has a zero value. Baumol, Panzar and Willig (1988) note that the cost functional form should yield a reasonable cost figure for output vectors that involve zero outputs of some products. To remedy this drawback the ordinary translog functional form can be modified in order to redefine zero outputs. Simply, the logarithm of the output is replaced by using Box-Cox's (1964) transformation in the translog cost function. The resulting functional form, the hybrid translog cost function, was suggested by Caves, Christensen and Tretheway, (1980) and Fuss and Waverman (1981), as a generalisation of the translog function. However,  $\lambda$  is usually estimated to be close to zero, which again yields properties similar to the ordinary translog cost functional form (See Pully and Humphrey, 1991).

The translog functional form also has large a number of parameters (Diewert, 1992) which may result in multicollinearity between explanatory variables. Moreover, Guilkey and Lovell (1980) criticise the translog form by showing, with a Monte Carlo simulation, that the translog cost function slightly overstates economies of scale and that the simultaneous estimation (SUR) of the translog cost function, together with input share equations, does not achieve better results relative to a single equation estimation.

Although there are possible limitations, the translog functional form still remains attractive to other functional forms.

#### **4.7.8 Desirable Features of Multiproduct Cost Functions**

What properties should a multiproduct cost function possess? What is the desirable form of a multiproduct cost function? Or what are some of the criteria that could be used to help the ex ante selection of an algebraic functional form for a multiproduct cost function? Over the years, a number of criteria have evolved and developed. These can

be broadly grouped in to five categories (See Lau, 1986):

(a) *Theoretical consistency*; This means that the algebraic functional form chosen must be capable of possessing the theoretical properties required of the cost function of a cost minimising firm. It must be homogeneous of degree one, nondecreasing and concave in the prices of inputs and nondecreasing in the quantity of output (Jorgenson, 1986). Thus, any multiproduct functional form selected to represent a cost function must be capable of possessing these properties for an appropriate choice of the parameters at least in a neighbourhood of the prices of inputs and quantity of output of interest. Fortunately, many functional forms will satisfy the test of theoretical consistency, at least locally.

(b) *Domain of applicability*; This refers to the set of values of the independent variables over which the algebraic functional satisfies all the conditions for theoretical consistency (Lau, 1986). For example, Lau (1986) shows that under the necessary and sufficient restrictions for global theoretical consistency on their parameters both the generalized Leontief cost function and the translog cost function lose their flexibility. Both functional forms can be globally valid only under relatively stringent restrictions on the parameters, however, they can be locally valid under relatively less stringent restrictions. Lau (1986) also concludes that both the generalised Leontief and the translog cost functions cannot be globally theoretically consistent for all choices of parameters. However, even when global theoretical consistency fails, there is still a set of input prices over which theoretical consistency holds and these set may be large enough for all practical purposes.

(c) *Flexibility*; The concept of flexibility, first introduced by Diewert (1973, 1974), refers to the ability of the functional form to approximate arbitrary but theoretically consistent behaviour through an appropriate choice of the parameters. In other words, the cost function should be a flexible functional form that is, a form that requires no restrictions on the values of the first and second partial derivatives (Baumol, Panzar and Willig, 1988). Lau (1986) notes that flexibility of a functional form is desirable because it allows the data the opportunity to provide information about parameters. Lau (1986) shows that the translog cost function is flexible.

(d) *Computational facility*; The computational facility of a functional form requires the following properties. First, unknown parameters of cost functions are straightforward to estimate from the data, this is known as "Linearity-in-parameters"

(Diewert, 1992). Secondly, the functional form should be represented in explicit closed form (Lau, 1986). Thirdly, the number of parameters in the functional form should be the minimum possible number. In other words, the cost function should not imply estimation of the values of an excessive number of parameters. In most cases, the number of observation is relatively small and conservation of the degrees of freedom is an important consideration (Diewert, 1992).

(e) *Factual conformity*; which implies consistency of the functional form with known empirical facts.

For the analysis of a multiproduct industry, the cost function should generate reasonable cost estimates for output vectors when there are zero outputs of some products. The majority of functional forms; such as the Cobb-Douglas function, the CES function, the translog cost function, and the generalised Leontief cost function violate this property.

Overall, as it is shown by Baumol, Panzar and Willig (1988), the hybrid translog cost function satisfies our desiderata fairly well and it has already been employed in empirical studies of bank costs. This thesis uses both the ordinary translog and hybrid translog cost function to estimate scale and scope economies in European Banking markets.

#### **4.8 Recent Approaches to Estimating Efficiency in Banking Markets**

Most studies of bank cost structures have concentrated on the cost advantages resulting from the scale and scope of production. There are, however, other aspects of efficiency which researchers have just begun to examine such as technical and allocative efficiency. Productive efficiency implies optimising behaviour with respect to output and inputs. The economic theory of the firm assumes that production takes place in an environment where managers attempt to maximise profits by operating in the most efficient manner possible (Fare, Grosskopf and Lovell, 1985). The competitive model also implies that firms which fail to do so will be driven from the market by more efficient ones. However, when natural entry barriers or regulation reduce the degree of competition, inefficient firms could continue to prosper (Evanoff and Israilevich, 1991).

The cost function approach has been widely used to model the technology of a firm operating in regulated environments, such as the banking industry (See Chapter 5). Outputs of banking firms are assumed to be exogenous. Since input prices are also deemed to be exogenous under the competitive factor market assumptions, we can obtain consistent parameter estimates by using cost function estimates. However, a problem associated with estimating cost functions is that it is assumed that banks are operating in an efficient manner. In other words, the only error in this type of methodology is noise and possible model misspecification (Beckers and Hammond, 1987).

#### **4.8.1 Parametric Approach: Stochastic Costs Frontiers**

In recent years there has been a substantial growing interest in the estimation of efficiency in production. Although the basic idea of measuring efficiency goes back to Farrell (1957), econometric estimation of stochastic frontier models were developed by Aigner et al. (1977) and Meeusen and van den Broeck (1977). In the frontier methodology, efficiency of an individual production unit is measured by comparing its performance to a standard, that is, either the cost, profit or the production frontier. Forsund et al (1980) specified the cost frontier as the minimum cost function for a given level of output and input prices. Similarly, the profit frontier is the maximum profit function given input and output prices. Moreover, the production frontier is the locus of maximum output levels given the level of inputs. The notion of these frontiers is consistent with the optimising behaviour of producers where concepts of maximality (i.e. in the production function and profit function) and minimality (in the cost function) are emphasised (Kumbhakar, 1991).

The traditional cost function is specified to the extent that a cost-minimising firm cannot produce a given level of output with given input prices at a minimum cost if technical and allocative inefficiencies exist. Thus, sources of errors in the estimated of cost or production functions can be defined as: (i) technical inefficiency, which relates to the failure to produce the maximum possible output, given inputs of production, (ii) allocative inefficiency, resulting from the sub-optimal choice of input-proportions, given input prices, and (iii) statistical standard noise (random errors), representing

exogenous shocks, such as 'luck factors'. The last component, which is randomly distributed about the relationship, can also cover approximation error. As a result, the residuals in the cost function must represent these three types of errors. These result in the following definition of the cost function using the translog functional form:

$$\ln TC = \ln TC^* + \epsilon \quad (41)$$

where  $\ln TC$  is log of total cost,  $\ln TC^*$  is log of minimum cost which reflects the cost frontier including the statistical standard noise, and  $\epsilon$  equals to  $\ln C_\tau + \ln C_\alpha + \ln C_\nu$ . Where  $\ln C_\tau$  and  $\ln C_\alpha$  refer to the increase in log cost resulting from technical and allocative inefficiencies respectively.  $\ln C_\nu$  is the statistical standard noise which could increase or decrease costs. Both  $\ln C_\tau$  and  $\ln C_\alpha$  should be non-negative since technical and allocative inefficiencies increase costs.

The stochastic frontier approach modifies a standard cost function and allows for inefficiencies to be included in the error term. The predicted value of a standard cost function is assumed to define the frontier, while any inefficiencies enter through the error component, which is by construction orthogonal to the predicted frontier. This assumption forces any measured inefficiencies to be uncorrelated with the explanatory variables or the scale or product mix economies derived linearly from these variables (Ferrier and Lovell, 1990). It also assumes that the inefficiencies are drawn from an asymmetric half-normal distribution and the statistical standard noise is drawn from a symmetric normal distribution (Jondrow et al, 1982). Greene (1990) and Stevenson (1980), however, have indicated that the half-normal is rather inflexible and it embodies an implicit assumption that most of the observations are clustered near full efficiency, with higher degrees of inefficiency being decreasingly likely. Berger and Humphrey (1991) and Caves and Barton (1990) point out that the half-normal assumption for inefficiencies is violated for many US banks and manufacturing industries.

#### 4.8.2 Nonparametric Approach: Data Envelope Analysis (DEA)

DEA methodology, first introduced by Charnes et al (1978), has been used to measure the empirically derived relative efficiency (e.g Technical efficiency) of non-profit-making organisation, where profit measures are difficult to calculate (particularly in the

public sector) (Sueyoshi, 1991). Moreover, DEA can measure the relative efficiency of a group of organisations in their use of multiple inputs to produce multiple outputs, in which the efficient production function is not known or easily specified.

There are many permutations to the DEA approach, however, the fundamental objective is to "envelope" the data by producing a piecewise linear fit via linear programming techniques. In other words, instead of using regression methodology to fit a smooth relationship, a piecewise linear surface is produced which encompasses the observations (See Evanoff and Israilevich, 1991).

The technique derives a frontier for each organisation in the sample based on the output and input utilisation of all institutions in the sample. DEA does this by comparing several organisations' (denoted  $p$ ) actual outputs ( $Q_{jp}$ ) and inputs ( $X_{ip}$ ). DEA identifies the relatively more efficient best practice subset of organisations and the subset of institutions which are relatively inefficient (and the magnitude of their inefficiencies) compared with the best practice organisations (Colwell and Davis, 1992). In other words, following Colwell and Davis (1992), we maximise:

$$E_p = \frac{\sum_{j=1}^m u_j Q_{jp}}{\sum_{i=1}^n v_i X_{ip}} \quad (42)$$

subject to  $E_p \leq 1$  for all  $p$  and weights  $v_i, u_j > 0$ .

The above model is computed repetitively with each organisation appearing in the objective function in order to derive individual efficiency ratings. Colwell and Davis (1992) also note that each firm will either have a derived efficiency rating either of  $E = 1$ , which indicates relative efficiency, or  $E < 1$ , which indicates relative inefficiency. It is noteworthy that  $E = 1$  is a best practice unit, which is not necessarily efficient but that is not less efficient compared with other organisations. As a result, DEA provides us with a relative efficiency measure not an absolute estimate.

A major drawback of DEA, however, is that it assumes no statistical noise and all the



error term in the estimation is attributed to inefficiency (Mester, 1993; Sueyoshi, 1991). In addition, DEA estimates give only an upper bound to efficiency measures (see Schmidt, 1986), so that it is difficult to use DEA to compare efficiency amongst firms. Another major disadvantage, pointed out by Colwell and Davis (1992), is that the DEA frontier is defined on the outlier rather than on the whole sample and is thereby particularly susceptible to extreme observations and measurement error. Moreover, application of DEA to the private sector may not be justifiable because of the presence of freedom to redeploy resources to another industry. Berg and Kim (1991) also indicated that the nonparametric DEA cannot take into account market structure and that this is important given their findings that efficiency scores are not independent of market structure characteristics. Moreover, inadequacies in data or sample size could vitiate DEA results.

Using either the stochastic frontier or DEA approach, the objective is to generate an accurate frontier. However the two techniques use significantly different approaches to achieve this objective. Because the parametric approach generates a stochastic cost frontier and the DEA approach generates a production frontier one may expect differences in the efficiency projections of either technique.

The parametric technique for generating cost relationships implies information on factor prices and other exogenous variables, knowledge of the proper functional form of the frontier and the one-sided error structure, and an adequate sample size to evaluate reliable statistical inferences. The DEA technique utilises none of this information and as a result less data is required, fewer assumptions have to be made and a smaller sample can be utilised (Evanoff and Israilevich, 1991). However, statistical inferences cannot be made using the DEA approach.

Another principal difference is that the parametric approach uses a random error term around the frontier, while the DEA approach does not. Thus, the DEA technique will account for the influence of factors such as; regional factor price differences, regulatory differences, luck, bad data, and extreme observations as 'inefficiency'. One would expect the DEA approach to produce greater measured levels of inefficiency than the stochastic frontier approach (See Evanoff and Israilevich, 1991).

## 4.9 Conclusions

This chapter outlines the theoretical underpinnings of the empirical economies of scale and scope studies. Firstly this chapter provides a definition of economies of scale and scope and then it focuses on the theoretical problems relating to analysing scale and scope in the banking industry. It is shown that banks are defined as multiproduct, multi-plant and multi-input firms. Since they engage in the production of various services utilising factors of production as diverse as labour, capital equipment and deposits, empirical studies face various problems when they examine the cost structure of these firms. Such problems relate to; the definition of output and bank total cost; the cost concept of multiproduct firms; the functional form of the cost functions; the problem of bank output endogeneity and the effects of technological change.

The cost function approach is an efficient way to model the structure of costs and production for a multiproduct firm. The approach does not require any arbitrary *a priori* constraints on the model of the cost function or production function. Economies of scale are estimated directly from the estimated joint cost function. For a single output firm, the concept of economies of scale exists if output increases and simultaneously total cost increases less proportionately than output. Of course, economies of scale may change over time depending on technological advances. The interpretation of economies of scale becomes complicated for multiproduct firms, since in the case of such firms more than one output is produced and no single physical measure of output is possible. Moreover, for multiproduct firms, economies of scope exist if the cost of producing joint outputs are less than the total cost of producing outputs separately. Therefore, the multiproduct firm may achieve cost reductions through both economies of scope and economies of scale. This is believed to be the common case in banking firms.

This chapter has illustrated that the translog cost function is one of the more flexible and suitable cost functions for analysing the concept of economies of scale and economies scope in the banking industry. However, a limitation of the translog form is that it does not allow us to estimate the degree of economies of scope when one or more outputs becomes zero. Thus, the hybrid translog cost function has been developed to avoid this problem of zero outputs. The following chapter shows how these functions

have been used to empirically investigate economies of scale and scope in the banking industry.

## **CHAPTER 5**

### **A REVIEW OF THE EMPIRICAL LITERATURE ON ECONOMIES OF SCALE AND SCOPE IN BANKING**

#### **5.1 Introduction**

Many studies investigating economies of scale and scope have been undertaken on banking markets over the last thirty years. The subject addressed in these mainly US studies has been concerned with various questions; such as whether or not an increase in bank output could lead to lower average cost?, whether costs vary for different institutions of the same size? and whether cost reductions brought about through increased output could be higher for specialised unit banks or branch bank operations?

This chapter reviews the economies of scale and scope studies that have examined the cost characteristics of US and European banking markets. The majority of studies on the cost structure of banking markets have focused on US banks, although more recently an increasing number of researchers have examined European banking systems?

In this chapter, sections 5.2 and 5.3 examine the scale and scope economies studies undertaken on US banking markets. Section 5.4 evaluates the European studies and various methodological limitations are analysed in Section 5.5. Section 5.6 evaluates the most recent approaches which have used parametric and non-parametric techniques to identify efficiencies in various banking markets. The final section is the conclusion.

#### **5.2 The Early Cost Studies in US Banking**

In this section we describe the earliest US economies of scale studies. The earliest studies can be distinguished according to the different definitions of bank output used. Section 5.2.1 reviews studies which apply earning assets as the measure of output. Section 5.2.2 reviews studies which use total assets as the measure of output. Finally, section 5.2.3 reviews studies which use total revenue as the measure of output.

### 5.2.1 Earning Assets As The Measure of Bank Output

The first major systematic study of banking cost was undertaken by Alhadeff (1954). Alhadeff compared costs of California branch and unit banks of different sizes for the years 1938-1950. The branch bank series were obtained from the data for four large branch banks in California and the unit bank figures were drawn from data published by the Federal Reserve Bank of San Francisco. Output was defined as the ratio of loans plus investments to total assets. Inputs were deposits on which interest was paid, labour and miscellaneous costs (i.e overhead and depreciation on building and equipment, legal costs, etc). Moreover, the banks were divided into eight groups according to their size as measured by total deposits. Alhadeff's analysis of scale economies can be summarised in the very simple cost function as follows:

$$C = f(Q) \quad (1)$$

where  $Q$  (earning assets) are loans and investments, and  $C$  (total costs) includes interest, wage and miscellaneous costs. Scale economies occur if average costs ( $C/Q$ ) decline as output size increases. Alhadeff did not develop any systematic theory or model in order to estimate economies of scale.

Alhadeff (1954) found that there are economies of scale in banking; increasing returns for small banks, constant returns for the middle range and increasing returns for the largest banks. In other words, average cost declined for small (up to \$5 million of asset size) and large banks (above \$275 million of asset sizes) but remained constant for medium sized banks. He also reported that branch banks had higher average costs than unit banks.

Horvitz (1963) generated results which supported most of Alhadeff's findings. Horvitz used data obtained from available Annual Reports of the Federal Deposits Insurance Corporation for the years 1940 to 1960. He analysed the cost structure using earning assets (loans plus investments) as the output measure. Cost was also defined similar to Alhadeff's study. The study concluded that average cost decreased from the smallest banks to the largest in every year and economies of scale were observed for small and large banks and constant returns for medium sized banks. The study also reported that

the difference in the average cost between small and large banks declined from 1940 to 1960. Moreover, Horvitz noted that for any given size and time deposit ratio, the average cost of branch banks was generally higher than that of unit banks. Above all, the results were in basic agreement with Alhadeff's earlier findings.

### 5.2.2 Total Assets As The Measure of Bank Output

A major criticism of the Alhadeff (1954) and Horvitz (1963) studies was that if one uses earning assets as the measure of bank output then this has the potential deficiency of excluding other assets (such as trust operations) in the total output variable. Therefore, this might tend to exaggerate the average unit costs of large banks. In order to avoid this potential bias, Schweiger and McGee (1961) and Gramley (1962) in their studies used total assets as a measure of bank output.

Schweiger and McGee (1961) focused on the Seventh Federal Reserve District (where Chicago is located) and there was a secondary focus on the Federal Reserve member banks as a whole. Their sample used 6233 Federal Reserve member banks in 1959. They also divided banks into unit and branch banks, but branch banks in that study were more generally defined than in Alhadeff's. Costs were specified broadly to include wages, interest paid, taxes, depreciation costs and spending on furniture and equipment. They estimated equations separately for branch and unit banks. Multiple regression analysis was employed in their study to account for many of the factors that affect costs rather than bank size. The model they used was based on the following cost function:

$$C = f(Q, i, D, E_j, d_j) \quad (2)$$

where  $C$  (total cost) is wage costs plus interest costs and taxes,  $Q$  is the deposits size class (*e.g.* nine classes),  $i$  is an indicator of whether the bank is a branch or unit bank,  $D$  is a weighting factor of the ratio of time deposits to total deposits,  $E_j$  are weighting factors of various types of loans to total assets and  $d_j$  are demographic weighting factors. The authors found that there were economies of scale for all banks, very considerable for the smallest banks (up to \$50 million in deposits), and decreasing but not disappearing as bank size increases. In other words, they observed that the average cost fell as the size of the bank increased, with the reduction being obvious for banks

with above \$200 million in assets. Consequently, Schweiger and McGee concluded that large banks have a cost advantage over small and medium sized banks. It was also pointed out that banks with higher proportions of industrial and commercial loans, instalment loans, and time deposits had higher average costs. This finding implied that the output mix played an important role in determining bank costs.

Another important early study on banking costs was conducted by Gramley (1962), who also employed total assets as a measure of bank output. He used a sample of 270 small unit banks, over the period 1956 to 1959, obtained from the banks of the Tenth Federal Reserve District (the Plains and Southern Rocky Mountain states). The cost variables included, wages and salaries, interest on deposits, taxes and recurring depreciation. Bank size was specified as the natural logarithm of total assets. Using multiple regression analysis, with fifteen variables to control for output mix, economies of scale were found for all sizes of banks in the sample as well as a negative relationship between size and average cost. Average cost decreased as bank size increased and therefore, larger banks were found to have a cost advantage over small banks. Gramley argued that small banks may not control their costs as carefully as large banks. However, unable to find a pattern in the cost dispersion between the two sizes of banks, he summarised that 'real' economies of scale were responsible for the negative relationship between unit cost and bank size.

### **5.2.3 Total Revenue As The Measure of Bank Output**

A different approach to the measurement of cost was analysed by Greenbaum (1967). He admitted that using an aggregate measure for output assumes that all items included in that aggregate carry the same weight, which cannot be true. In an effort to address this problem, he developed a weighted output index. He chose current operating revenue as the financial statement account on the grounds that this, "most closely related to the social output concept of Gross National Product". He noted that a bank's gross income is a function of market conditions in its location. Data were drawn from the Fifth and Tenth Federal Reserve Districts for 413 and 745 banks. Total cost was specified as the dependent variable. Greenbaum found evidence of a *U*-shaped average cost curve, indicating that average cost declined for small-sized banks, but increased

for large banks. The study emphasised that branch bank operating costs were higher than unit bank costs.

Another study undertaken by Haslem (1968), investigated the correlation between measures of bank profitability and deposit size. Haslem used 64 operating ratios computed for 1963 and 1964 for each Federal Reserve member bank, classified into eight deposit size groups from less than \$1 million to \$100 million in deposits. Haslem found that profitability was significantly affected by management, size and location. The results implied that the most favourable size category (in terms of net return on capital) is neither the largest nor the smallest. Of eight sizes of banks the seventh largest, \$50-100 million total deposits, is most favourable to high profitability. At the other extreme the least profitable bank size was that containing the smallest banks (\$1 million and under in total deposits).

Powers (1969) used data obtained from the Report of Condition and the Report of Income and Development in the Seventh Federal Reserve District in 1962 to evaluate evidence of economies of scale for banks in the Chicago area. The data were grouped between branch and unit banks, by using location and product mix characteristics. Like Greenbaum, Powers applied a similar regression analysis approach, in that total revenue was used as a measure of bank output, the cost measure was the same as that used by Greenbaum (1967). Generally, the results showed evidence of U-shaped or constant average costs, with scale economies for the smallest banks. Moreover, the main result of this study was that branch banks had higher costs than unit banks.

Comparing the above studies, the following conclusions can be made. First, studies that use assets as the measure of output tended to find relatively high unit costs for small banks. Secondly, the two studies conducted by Alhadeff and Horvitz which employed earning assets as the measure of output indicated constant unit cost for medium sized banks (\$5-50 million in assets) and lower average cost for larger banks. On the other hand, the two studies conducted by Schweiger-McGee and Gramley which applied total assets as the output measure showed declining average cost for all ranges of output size. It can be seen that even in the earliest studies of cost economies of the US banking market there was conflicting evidence as to whether scale economies existed or not.



### **5.3 Post-1965 - Multiproduct Cost Studies in US Banking**

The studies discussed in the previous section used simple statistical models resembling ratio-based analyses, to examine economies of scale in the banking industry. Later studies apply more sophisticated econometric methods. Furthermore, the earliest studies, as illustrated above, use only one measure of bank output whereas later studies consider multiple outputs.

In this section, US cost studies are classified according to the different cost functions used. Section 5.3.1 reviews the studies which used the Cobb-Douglas cost function. Then, section 5.3.2 reviews studies that use the translog cost function.

#### **5.3.1 The Cobb-Douglas Cost Function Studies in US Banking**

Table 5.1 summarises the results of a number of empirical studies in banking for the US market using the Cobb-Douglas cost function. The results for these studies show generally that economies of scale exist for small to medium-sized banks, whereas diseconomies of scale are present for larger banks. These studies also show that branch banks have higher average costs than unit banks. This is because branch banks are producing different product mixes and not necessarily because of technological differences (Benston, 1965b; Bell and Murphy, 1968).

Benston (1965a) was the first to use a Cobb-Douglas cost function to investigate economies of scale in banking. The data used was for small New England banks over the years 1959-1961, with most banks being unit or branch banks with less than 5 branches. The banks ranged from \$3.4 to \$55 million in total assets size. The bank outputs were defined as demand deposits, time deposits, mortgage loans, instalment loans, business loans and securities. Costs were grouped into direct and indirect costs, with direct costs allocated to an individual output, and indirect costs allocated to output as a whole. Direct costs consist of wages and miscellaneous costs (e.g supplies, collection expenses and credit reports), whereas the indirect costs, included administrative expenses, business promotion expenses and occupancy expenses. Moreover, interest costs were excluded from costs (i.e both direct and indirect costs).

Table 5.1 Cobb-Douglas cost function studies in US banking

Authors	Country and Data	Output	Other control variable	Findings
Benston (1965a)	USA. Data obtained from the FCA programme of the Federal Reserve Bank of Boston for the period 1959-1961. The size of banks ranged from \$3.4 to \$55 m. in total assets.	Bank outputs are defined as demand deposits, time deposits, mortgage loans, instalment loans, business loans and securities which are measured the number of accounts.	Cobb-Douglas cost function was used. Average account sizes, branching and merger dummies, prices and Total assets.	<ul style="list-style-type: none"> <li>- Significant economies of scale exist for demand deposits and mortgage loans.</li> <li>- Time deposits and Instalment loans show significant diseconomies of scale.</li> <li>- Branch banks have higher operating costs than unit banks.</li> </ul>
Benston (1965b)	USA. Data sample as in Benston (1965a) above	The same as Benston's (1965a). Separate cost curves estimated for unit and branch banks.	The same as Benston's (1965a).	-Economies of scale exist for branch banks.
Bell and Murphy (1968)	USA. Data derived from the FCA programme of the Federal Reserve Banks of New York, Philadelphia and Boston for 283 banks. The banks range from \$2.8 to \$801 m. in total assets.	The same as Benston's (1965a)		<ul style="list-style-type: none"> <li>- Economies of scale exist for demand deposits and real estate loans.</li> <li>- Slightly diseconomies of scale exist for time deposits and instalment loans.</li> <li>- Branch banks have higher operating cost than unit banks.</li> </ul>
Schweitzer (1972)	USA. Data derived from the banks in the 9th Federal Reserve District for 1964.	Lending output index: measured as total loan revenues plus revenue from other sources.	Dummy variables: location, bank holding company and Federal Reserve membership.	<ul style="list-style-type: none"> <li>- There is a U-shaped cost curve.</li> <li>- Economies of scale exist for banks with total assets of less than \$3.5 m.</li> <li>- Banks with assets between \$3.5-25 m. show constant returns to scale and above \$25 mil appear to have diseconomies of scale.</li> </ul>
Murphy (1972)	USA. FCA data for the year 1968 on 967 banks	Same approach as Bell and Murphy's (1968).		-Banks is characterised by constant returns to scale.

Authors	Country and Data	Output	Other control variable	Findings
Kalish and Gilbert (1973)	USA. FCA data for 898 banks in 1968.	Similar approach Schweitzer's (1972).		- The cost curve is U-shaped. - Unit banks have the lowest operating cost followed in turn by affiliated banks and branch banks.
Daniel, Longbrake and Murphy (1973)	USA. Cross-section of 967 banks from FCA programme in 1968.	Number of demand deposits accounts.	Similar variables use as Bell and Murphy's (1968). Average size variable , annual wage rate, rental rate, number of branches.	- Larger banks improve operating efficiency by using computer technology.
Longbrake and Haslem (1975)	USA. FCA data for 967 banks in 1968.	Same approach as Daniel, Longbrake and Murphy's (1973).		- In general, unit banks have the lowest average operating cost. - The number of branches operated by a branch banks have a small effect on average operating costs per dollar of demand deposits.
Mullineaux (1975)	USA. FCA data for 1970 from the Federal Reserve Bank of Boston, New York and Philadelphia.	Similar approach as Benston's (1965) and Bell-Murphy's (1968).	Dummy variables for branching.	- The larger economies of scale are found for unit banks rather than branch banks.

Benston excluded the interest costs because he argued that they were closely related to the dollar value of deposits. The outputs were measured in terms of number of accounts. Benston argued that the reason for using the number of accounts to measure output was to avoid the confusion between the cost efficiency in the production of large accounts and the cost efficiency of operations. In addition, he also indicated that services are primarily related to the number of accounts, therefore, operating costs are more closely related to number of accounts rather than the dollar value of accounts. The estimating cost function can be shown as:

$$\ln C = f[\ln N_i, \ln A_i, b_j, m_j, d_j, \text{win}_p(N_i/N), p_i, TA] \quad (3)$$

where  $C_i$  is the allocated cost,  $N_i$  is the number of accounts,  $A_i$  is the average account

size,  $b_j$  are the branching dummies,  $m_j$  are the merger dummies,  $d_j$  are the demographic variables,  $win_i$  is the activity measure,  $N_i/N$  is the ratio of accounts,  $P_i$  is the output price, and  $TA$  is total assets.

The results indicated that economies of scale were present, but small, for all banking services. Moreover, Benston concluded that size was not an important factor in determining efficient operations. Banks with three or less branches were found to have cost benefits. After three branches, costs increased and outweighed the benefits of larger size.

Following on from his earlier study, Benston (1965b) concentrated on the issue of the relative cost efficiency of branch and unit banks. He mentioned that there were two differences in operating costs between branch and unit banks. First, branch banks could be more costly to operate than unit banks of equal size. Secondly, branch banks may be able to grow larger than unit banks and take advantage of economies of scale that might come from large scale operations. He used the same regression model as in his previous study. He reported that the positive branching dummy figures indicated economies of scale with additional costs for branch bank operations. However, he concluded that branch banks had large additional occupancy expenses, so that it was more expensive to operate branch banks rather than unit banks.

The next major study of economies of scale in US banking markets, also used a Cobb-Douglas cost function, and was undertaken by Bell and Murphy (1968). The main differences between Benston and Bell and Murphy was that the latter use a larger sample of banks, a more comprehensive technique and provide much more detailed results. Bell and Murphy used data from the Functional Cost Analysis Programme of the Federal Reserve Banks of New York, Philadelphia, and Boston for 283 banks. The variables employed by Bell and Murphy were similar to the ones used by Benston. Costs were computed using salaries and fringe benefits for all employees plus capital goods and materials costs. Interest cost were excluded from total cost as in the Benston study. All outputs except for securities were measured as the number of accounts. Dummy variables were employed to distinguish between branch and unit banking.

Bell and Murphy found economies of scale for most bank services such as demand deposits and business and mortgage loans. On the other hand, branching operations were more costly than unit banking operations. In addition, at the firm level, economies of scale were not found in most services, and they found that the marginal additional cost of branching was \$5.04 for each account. Moreover, they also reported that a one-dollar increase in marginal direct cost of processing a demand deposit accounts increased services charges by around 32 cents. In other words, service charges responded to cost changes but in an inelastic fashion.

Schweitzer (1972) examined a large sample of relatively small banks in the Ninth (Minneapolis) Federal Reserve District for the year of 1964 from Call and Income data. He focused on holding companies in his study because there were no branch banks in his sample. Bank output was defined as lending output, exactly following Greenbaum's earlier definition. He employed two dummy variables for holding company status, two dummy variables for location and a dummy variable for Federal Reserve membership. Schweitzer calculated cost as total operating expenses less service and exchange charges on deposit accounts, which includes interest cost. Using duality theory, Schweitzer computed a Cobb-Douglas cost function in lending output and dummy variables as follows:

$$\ln C = f(\ln Q, \ln ld_j, \ln hcd_k, \ln frd) \quad (4)$$

where  $C$  is cost,  $Q$  is the lending output,  $ld_j$  are the location dummy variables,  $hcd_k$  are the holding company dummies, and  $frd$  is the Federal Reserve membership dummy variable. Economies of scale were calculated from the coefficient on the output variable in the regression.

Schweitzer concluded that there was a  $U$ -shaped average cost curve. That is, economies of scale exist but were exhausted at low output levels. The optimum bank size was less than \$50 million in loans. Banks with assets between \$3.5 and \$25 million were grouped by constant returns to scale. Accordingly, banks with assets above \$25 million appeared to have diseconomies of scale. He also indicated a significant negative relationship between organisational form and costs. In other words, affiliated banks were found to have lower costs. Thus, the form of organisation affected the cost

function.

Murphy (1972) updated previous studies by using Functional Cost Analysis data for the year 1968 for 967 banks. He found that the coefficients for outputs were not significantly different from unity in general using Cobb-Douglas regression analysis. He pointed out that banking was characterised by constant return to scale, a conclusion which differed with his previous work with Bell.

Kalish and Gilbert (1973) examined how size and organisational form effect bank efficiency using 1968 Functional Cost Analysis data for 898 US banks. Their study stated that the cost curve was *U*-shaped, confirming Schweitzer's (1972) results. Moreover, unit banks had the lowest operating cost followed in turn by affiliated banks and branch banks. It was found that at lower output levels, banks affiliated with holding companies had greater cost efficiency. At higher output levels, the reverse was true (i.e banks affiliated with a holding company had higher average costs at higher levels of output).

Daniel, Longbrake and Murphy (1973), using data provided by a cross-section of 967 banks from the Federal Reserve's Functional Cost Analysis Programme in 1968, focused on the effects of technology on bank economies of scale for demand deposits. The sample consisted of mainly small or medium size banks. In this study, they applied a cost function similar to that of Bell and Murphy:

$$\ln C = f[\ln N_i, \ln p, \ln r, \ln win_i, (N_i/N), B] \quad (5)$$

where  $C_i$  is the operating cost which excluded interest cost,  $N_i$  is the number of demand deposits accounts,  $A_i$  is the average size variable,  $p$  is the average annual wage rate,  $r$  is rental rate for capital,  $win_i$  is the activity measures,  $N_i/N$  is the case the ratio regular checking accounts to total checking accounts,  $B$  is the number of offices.

They found that it was more efficient for banks with less than 10,600 accounts to use conventional accounting systems, whereas the operating efficiency of larger banks was improved by using computer technology.

Further research undertaken by Longbrake and Haslem (1975) investigated the effects of bank size and organisational form on the cost of producing demand deposits services, using data on 967 banks from the Functional Cost Analysis for 1968. In general, they found unit banks had the lowest average costs, but this finding was reversed as the number of accounts per office and average deposit size increased, with the lowest average overall performance for large banks. Among their findings it was shown that the number of offices operated by a branch bank had a small effect on average operating costs per dollar of demand deposits. In addition, the average cost declined for all banks except for unit banks that were not affiliated with holding companies.

Mullineaux (1975) used Functional Cost Analysis data for 1970 from the Federal Reserve Districts of Boston, New York and Philadelphia to estimate Bell and Murphy style equations for unit and branch banks. The model estimated was as follows:

$$\ln C = f[\ln N_i, \ln A_i, b_j, hc_j, d_j, win_i, (N_i/N), P_i, TA] \quad (6)$$

where  $C_i$  is the operating cost,  $N_i$  is the number of accounts,  $A_i$  is the average account size variable,  $b_j$  are the branching dummies,  $hc_j$  are the holding companies dummies,  $d_j$  are the demographic variables,  $win_i$  is the activity measure,  $N_i/N$  is the larger measure ratio of accounts,  $P_i$  is the output price, and  $TA$  are total assets. The demographic variables included a wage index and a concentration index. Mullineaux found that there were economies of scale for unit banks, but that economies were small for the branch banks. Mullineaux explained the estimated higher costs of branch banks. In the high interest rate periods of the 1960's, much of the observed increase in banking was no doubt related to the interest prohibitions on demand deposits and restriction on interest paid on time and savings deposits.

In general, the Cobb-Douglas studies indicate that there are economies of scale for most of the individual services offered by banks. There are various limitations, however, to the above studies. First, this analyses has been undertaken primarily on small banks, mainly institutions with less than one billion dollars in deposits. Secondly, these studies employed the Cobb-Douglas functional form which does not allow for a *U*-shaped cost curve (See Chapter 4 which addresses the limitations of this methodology). Thirdly, the cost function is heavily restricted and therefore does not allow us to examine evidence

of economies of scope.

The major conclusion that can be drawn from the Cobb-Douglas cost function studies of the 1960's was that economies of scale appeared to be present in US banking, since most of the studies report a decreasing average cost curve over a relatively large range of bank outputs. The studies in the 1970's, however, show a different pattern, indicating that in general scale economies exist but are only very small.

### **5.3.2 The Translog Cost Function Studies in US Banking**

In this section we survey US banking cost studies which employed the translog cost function methodology in the 1980s. These studies can be divided into two broad groupings according to the definition of bank output used (See Chapter 4). Section 5.3.2.1 reviews studies which apply the production approach to the definition of output and section 5.3.2.2 reviews those studies which take the intermediation approach.

#### **5.3.2.1. Production Approach**

The first study to use the translog cost function methodology to estimate scale economies was undertaken by Benston, Hanweck and Humphrey (1982b). They used a measure of output, a Divisia index, specified as the weighted average of the number of accounts of outputs. Five outputs were aggregated in this index: demand deposits, time and savings deposits, real estate loans, instalment loans and business loans. The weights depended on the number of accounts of each type of output by their proportionate share in total operating cost. The model was estimated using data drawn from the Federal Reserve's Functional Cost Analysis Programme from 1975 to 1978. Furthermore, homogeneity variables for holding company affiliation, state branching status and average account size were included in the model.

Their findings indicate that there was a evidence of the existence of *U*-shaped cost curves. They found that unit banks with above \$50 million in deposits recorded diseconomies of scale, while banks in branching states experienced small economies of scale. This study concluded that the optimum size of a bank was relatively small,



between \$10 and \$25 million in deposits, and they also showed that holding company affiliation had no effect on operating costs.

Benston, Berger, Hanweck and Humphrey (1983) used five different banking outputs: demand deposits, time and savings deposits, real estate loans, commercial loans and instalment loans, in their translog estimation of bank costs. Data for 852 banks were drawn from the Federal Reserve's Functional Cost Analysis Programme for 1978. Total costs corresponded to the sum of all operating expenses, excluding interest payments. The cost function estimated in this study can be summarised as follows:

$$\ln C = f[\ln q_i, \ln p_i, (\ln p_i \ln p_j), (\ln q_i \ln q_j), (\ln q_i \ln p_j), \ln A_i, (\ln A_i \ln q_i), \ln B, (\ln B \ln q_i), H, (h \ln B)] \quad (7)$$

where  $q_i$  are the outputs (demand deposits, time and savings deposits, real estate loans, instalment loans and commercial loans),  $p_i$  are input prices (labour and capital),  $A_i$  is a weighted average of deposits or loan sizes,  $B$  is the number of branches and  $H$  is a binary variable for holding company status.

The authors found evidence of economies of scale at the branch level for all deposit size classes, although these were not statistically significant for the largest banks. In addition, for unit banks, economies of scale were reported for banks up to \$75-100 millions in deposits size whereas diseconomies of scale appeared at all unit banks with more than \$200 millions in deposits.

Benston, Berger, Hanweck and Humphrey also attempted to estimate economies of scope, however, because of limitations of the translog methodology, they were not able to obtain evidence of economies of scope. Consequently, inter product cost complementarities were tested and the results indicated that for unit banks there was some evidence of pair-wise cost complementarities.

Clark (1984) estimated scale economies in the US commercial banking industry by using a Box-Cox transformation of the translog function. The data employed in estimation of the cost function was obtained from the Report of Income and the Report of Condition for 1,205 unit banks published by the Board of Governors of the Federal

Reserve System, for 1972-1977. The total cost of the respective banks was defined as the average of total operating expenditures over the sample period. Bank output was measured as earning assets. Clark concluded that economies of scale existed for relatively small sized banks. The estimates of output elasticity of cost also seemed to be rather insensitive to the choice of a measure of bank output.

The following two studies were undertaken by Gilligan, Smirlock and Marshall (1984) and Gilligan and Smirlock (1984) who focused on the multiproduct nature of the banking firm. Gilligan, Smirlock and Marshall estimated bank cost functions that took into account the multiproduct nature of the banking firm. Bank outputs were defined as the number of deposits accounts and loans accounts serviced. Moreover, the average dollar amount of deposits and loans, input prices of labour and capital were included in their model. Thus, because of the nature of the production approach which was taken, operating costs were employed by the authors to examine the existence of economies of scale and scope. Gilligan, Smirlock and Marshall (1984) used data from the Federal Reserve's Functional Cost Analysis Programme for the year 1978 which included 714 banks less than \$1 billion in assets size. They found that bank output was characterised by scope economies. They also concluded that the cost benefits of expansion were achieved for small banks with less than \$25 million deposits but diseconomies beyond \$100 million deposits. Moreover, the authors attempted to determine a numerical value for scope economies, and their calculation suggested that there was a saving of 17 percent for unit banks and 29 percent for branch banks that produce deposits and loans jointly as opposed to separately. (It should be pointed out that no standard errors for these scope economy findings were provided and so the statistical significance of these results should be treated with caution.)

Gilligan and Smirlock (1984) examined economies of scale and scope by using data from Call Reports of Income and Condition by the Federal Reserve Bank of Kansas City for more than 2700 unit states banks for the years from 1973 to 1978. Bank output was defined using two different measures in terms of either liabilities or assets: (1) dollar amount of demand deposits and time deposits; (2) dollar amount of loans and securities. They found that there were slight economies of scale for banks with less than \$10 millions deposits and diseconomies above \$50 millions deposits, applying both

output approaches.

One potential difficulty of the Gilligan and Smirlock's study was that they assumed that input prices were constant. In other words, input prices do not effect the marginal cost of outputs differently when the level of price changes. Given this drawback, the input price variables were not included in the translog model.

Using a different approach, Lawrence and Shay (1986) analysed the effects of computer technology upon economies of scale and scope as well as the elasticities of substitution between inputs (labour, capital and computers), applying a translog cost function to an extensive data base taken from the Functional Cost Analysis Programme from 1979 to 1982. They used four outputs: the dollar value of deposits, loans, investments and non-balance sheet items. They utilise three input prices: an interest rate, a wage rate and computer rental rate. They also used the control variables of average loan size, average deposit size and the number of branches. Total cost was defined as operating cost plus interest expenses. The functional form they estimated can be summarised as follows:

$$\ln C = f[\ln q_i, \ln p_i, (\ln p_i \ln p_j), (\ln q_i \ln q_j), (\ln q_i \ln p_j), \ln B, ALOANS, ADEPS] \quad (8)$$

where  $C$  is total costs (operating cost plus interest expenses),  $q_i$  are the outputs (deposits, loans, investments and fee-based banking activities),  $p_i$  are the input prices (interest rate, wage rates and computer rates),  $B$  is the number of branches,  $ALONS$  is the logarithm of average loans size, and  $ADEPS$  is the logarithm of average deposit size.

The findings indicated that the samples for 1979 to 1982 showed constant returns to scale, but when the analysis was undertaken by quartile (according to deposits size) there were significant economies of scale. Lawrence and Shay (1986) also found that branch banks had major and significant scale economies at all size levels, for all years 1979-1982, whereas only the smallest unit banks have significant economies of scale in general. Furthermore, significant scope economies were found between deposits and loans as well as deposits and investments, however, significant diseconomies of scope

were reported between investments and loans.

Kolari and Zardkoohi (1987) focused on the issue of scale and scope economies for a sample of banks data drawn from the Functional Cost Analysis Programme of the Federal Reserve over the period 1979-1983 using three different models which represent three different stages of bank production and a new definition of economies of scope. Model I defined output as the dollar value of demand and time deposits. Model II specified output as the dollar value of loans and securities, and Model III specified output as the dollar value of loans and total deposits.

One of the main conclusions of their statistical analyses was that cost curves were *U*-shaped. In other words, significant economies of scale were indicated for US banks with up to \$50 million in deposits size, whereas diseconomies appeared beyond the level of \$50 to \$100 million in deposits size, except in 1983.

Based on their measurement of the degree of economies of scope, Kolari and Zardkoohi (1987) found evidence of scope economies, yet their results showed that large banks did not appear to have a cost advantage compared to small banks in terms of joint production. The study also indicated that unit banks had somewhat greater scope economies than branch banks in the US market and;

"These finding are not sufficient to conclude that small banks are at no disadvantage relative to large banks, because it is possible that large banks can reap relatively greater scope benefits than small banks can from the joint production of multiple bank services (p.123)".

Kolari and Zardkoohi (1987) also pointed out that banks had competitive advantage over financial service institutions that produce only either deposit services or loans services. In general, their results indicated that banks can reduce the cost of expansion by 30 percent to 50 percent by increasing outputs jointly than increasing outputs separately. Moreover, large banks do not have a cost advantage over small banks with respect to expanding outputs at the same time.

Kolari and Zardkoohi also examined economies of scale and scope (in all models) for unit banks and branch banks for 1970, 1980 and 1982, respectively. Their results implied that unit banks had cost curves that were flat and branch banks had *U*-shaped or upward-sloping cost curves in general. Models I and III indicated either economies or diseconomies, Model II implied that there were scale economies up to about \$200 million in deposits size. In general, branch banks showed *U*-shaped average cost curves, with minimum costs occurring in the range of \$50 million to \$200 million in deposits.

Their tests on different groups of US banks (farm banks, city banks, wholesale banks, retail banks) reported the following. Farm banks (which have high proportions of agricultural loans) consistently showed flat cost curves for all models. The other groups showed *U*-shaped cost curves, although in some years, the curves were either *L*-shaped or upward-sloping. However, the scope findings indicated that joint production of banking services can reduce costs considerably, in comparison to separate production therefore showing the extent to which large banks can find ways to improve their scale efficiency in the future. They concluded that in the US, "The banking industry could become more prone to dominance by large banks" (p.146).

Overall, the results of the translog studies suggest that there are *U*-shaped average cost curves in the US banking market. These studies conclude that economies of scale exist but at relatively low levels of output, somewhere between \$25-200 million in deposit size, and there is little consensus as to the optimal size of the banking firm. These studies exclude the concept of global scope economies and only focus on cost complementarities, where they find evidence of product complementarity. There are, however, important limitations to the use of these results for public policy prescriptions since the FCA data used in the estimates ignore large banks and concentrate on smaller institutions (Hunter *et al*, 1990).

### **5.3.2.2 Intermediation Approach**

#### **5.3.2.2.1 Studies Using the FCA Database and Other Samples of Small US Banks**

Murray and White (1983) examined the production technology facing credit unions in

Canada (although clearly not a US banking study we classify it in this section because of its relative importance as a translog intermediation approach evaluation of scale and scope economies). Using the data generated from a survey of Canadian credit unions in 1977, the study tested for economies of scale, economies of scope, and other production characteristics in a multiproduct context. Following Sealey and Lindley (1977), outputs were defined to be the dollar value of mortgage loans, other loans and investments in excess of reserve requirements. Input prices were identified as; wages for labour, capital, the price for fixed capital, and interest paid on demand deposits and time deposits. Moreover, incremental information on wage rates, rental processes, hours worked, and organisational structure were obtained through a separate questionnaire. There were also three control variables, namely the number of branches, risk and growth. The Murray and White formulation can be expressed as follows:

$$\ln C = f[\ln q_i, \ln p_i, (\ln p_i \ln p_j), (\ln q_i \ln q_j), (\ln q_i \ln p_j), \ln B, RISK, GROWTH] \quad (9)$$

where  $C$  is total costs which were calculated for all labour and real capital expenses, plus the interest and dividends paid to depositors and shareholders,  $q_i$  are the outputs (mortgage and other loans and investments),  $p_i$  are input prices (for interest on demand and time deposits, labour and capital),  $B$  is the number of branches,  $RISK$  - the dollar value of doubtful accounts divided by dollar value of total assets to proxy for risky loans- and  $GROWTH$  -the logarithm of the dollar value of total assets in 1977 divided by 1976 values to eliminate the effects of aberrant disequilibrium costs- are included as control variables.

The study found that economies of scale existed in most of the credit unions studied. The results imply that credit unions in Canada experienced significant increasing returns to scale as they expanded their level of output. The authors reported that there were also strong evidence of cost complementarity or jointness in production between mortgage and other lending activities. Moreover, the findings indicated that large, multiproduct credit unions were more cost efficient than small, single-product credit unions.

Berger, Hanweck and Humphrey (1987) formulated two new multiproduct economy

measures, expansion path scale economies and expansion path subadditivity (See Chapter 6). They attempted to re-examine the ambiguities of scope economies in some of the previous studies for depository financial institutions. The study defined bank output in the same way as in Benston, Berger, Hanweck and Humphrey (1983) and this analysis used both the production and intermediation approaches. A translog cost function was fitted to the data from the 1983 Functional Cost Analysis of Federal Reserve Banks' System for 413 branching state banks and for 214 unit state banks (separately). The study introduced new measures in evaluating product mix and scope economies and it did not based on pairwise cost complementarities. Expansion path subadditivity was used to measure whether are presentative bank of a specific size class produced a combination of output but in smaller size. The results of this test showed that two banks produce a given bundle of output more cost effectively than one bank at the levels of \$10 million up to \$1 billion in deposits.

The results indicated that there was evidence of scale economies but in general, these results were substantially different for branch and unit state banks in the US. Branch banks showed slight scale economies at the branch level and slight diseconomies of scale at the level of the banking firm. Whereas unit state banks showed large scale diseconomies for large banks. These diseconomies for large unit state banks, combined with data indicating substantially higher costs than similarly sized branch banks in the US, suggested that these banks were not competitively viable.

In measuring scope economies, the authors modified the translog cost function by substituting levels of output for logarithms of output. To estimate such a function for specialty firms, the study was used the following procedure. Firstly, the number of accounts and average size of the accounts that was produced were set to zero. Secondly, the direct cost of the product that was not produces was set to zero. Thirdly, the total level of output provided was held constant by setting the number of branches for each firm created ot the number for the current non-specialised firm.

Moreover, scope economies were evaluated for two cases. The first one, the deposit function was separated from the loan function; and the second one, each product was assigned to a specialty firm. The study concluded that there were diseconomies of scope

in banking; that is, output mix was determined for reasons other than cost considerations, including risk diversification, customer convenience, and joint demand of products.

Gropper (1991) examined the direction and magnitude of the possible shifts in the structure of banks costs, using data from the period 1979 to 1986 from the Functional Cost Analysis programme of the Federal Reserve System. The study focused particularly on economies of scale for smaller and medium-sized banks. The study found that economies of scale existed beyond small levels of outputs for the years prior to 1982 and also significant scale economies present in later years for branch banks and unit states banks. The study also pointed out that the degree of scale economies increased over the 1979-86 time period.

In general, studies in the 1980s used new econometric techniques, that is, the translog methodology, and examining scale and scope economies. The banking industry in the US was generally specified by a *U*-shaped average cost curve. As we have seen, the empirical studies based on the translog methodology so far, were concerned with banks smaller than one billion in total deposits. Therefore, these studies are not especially useful for estimating the effects on operating costs of banks with total deposit over one billion. The implications from these results are that small US banks are inefficient because they operate under increasing returns to scale, and inefficiencies could exist for banks over \$100-200 million in deposits. These findings would appear to be in conflict with recent merger activity in the US (See Moynihan, 1991). Like the translog production approach the intermediation studies also indicate evidence of economies of scale for relatively small banks. Overall, the conclusion is that evidence of economies of scale exist for US banks with less than \$50 million in deposits size. Until very recently, cost studies on the US banking market have excluded large institutions. Rhoades (1985) pointed out that larger banks are most active in merger activity and most vocal about expanded product and geographic expansion powers. The following more recent studies focus on large US banks with deposits size of over one billions dollars.



### 5.3.2.2.2 Studies Using Data Samples on Large US Banks

Hunter and Timme (1986) examined the nature of technical change in the banking industry, and investigated its influence on bank scale economies. They analysed data obtained for 91 large US bank holding companies located in 20 different states over the period 1972-1982 for a total of 1001 observations. Bank outputs were defined as the dollar volume of all loans, securities and deposits. The empirical results implied that technical change produces significant cost reductions for banks. Hunter and Timme reported significant economies of scale when total cost was specified as just operating cost, whereas when interest expenses were included in total cost they found constant returns to scale. They concluded that the inclusion of interest expenses, derived with increased competition in an increasingly deregulated and inflationary market had offset the scale and technical change cost benefits.

Shaffer and David (1986) analysed data from June 1984 obtained from the Call and Income Reports for the 100 largest US banks with assets size over \$1 billion. The authors used a hedonic translog cost function to correct for heterogeneity across banks and also attempted to quantify the benefits of diversification. Bank output was defined only by the asset side of the balance sheet and the dollar value of assets was used to measure bank output. Deposits were taken as inputs, however, the price of deposits was not included as an explanatory variable in the model in order to capture any relationship between risk and diversification. Shaffer and David (1986) stated that:

"Theoretically, larger banks should be able to attain lower risk through diversification, all else being equal. This benefit of diversification should manifest itself as a lower cost of uninsured deposits, all else equal. If total expenses are defined to include interest expenses, then this scale-related benefit would be reflected in the cost variable. However, for this effect to be measured, it is essential that we do not include the price of funds as an additional regressor. Otherwise, the interest savings of a more diversified bank would be 'explained away' by the price variable (p.5)."

Dummy variables were employed to account for unit and branch banking. The study concluded that scale economies existed for US banks up to \$37 billion in assets size.

Shaffer and David (1986) and Hunter and Timme's (1986) methodologies, however are subject to criticism because they used a vector as a single composite commodity. This forced the proportions of the various outputs that result in the composite to be fixed, so that only constant changes in outputs could be considered. The relative marginal cost of any two outputs was imposed to be independent of input prices (*i.e.* the cost function is separable in output). Although both studies indicated economies of scale for large banks, this result may have been a result of aggregation bias. Kim (1986) has implied that there existed increasing returns to scale at the branch level and constant returns to scale at the firm level for large US banks when no such aggregation was forced. When aggregation was imposed, the estimated economies of scale showed increasing returns to scale at the banking firm level. Hence Kim (1986) concluded that aggregation bias was significant (*i.e.* aggregation bias resulted in specification errors).

Hunter *et al.* (1990) investigated the subadditivity of costs for a sample of the 311 largest commercial banks in the US, using a multiproduct translog cost function. Firstly, the study analysed the production and product mix economies of large banks (average asset sizes \$4 billion). Secondly, the study examined an extension of the grid approach to examining cost subadditivity developed by Evans and Heckman (1984). The grid approach imposes product mix constraints that are derived directly from the product mixes observed between the sample banks. Thirdly, the study also evaluated the traditional ray scale economies as well as the expansion path scale economies and expansion path subadditivity of costs - which were introduced by Berger, Hanweck, and Humphrey (1987). The authors results suggested that the cost functions of large multiproduct banks were not subadditive, and hence, there were not measurable cost complementarities in multiproduct production among large banks. However, Hunter *et al.* (1990) found opposing results which suggested that large banks would not be better off if they broke up production into groups of specialist banks. That is, they found no strong evidence that costs were subadditive.

Noulas *et al.* (1990) examined scale economies for large US banks with assets in excess of \$1 billion. They estimated a translog variable cost function using four outputs, four variable inputs, and a quasi-fixed input, which was applied to evaluate economies of scale. The study found that banks with assets between \$1-3 billion exhibit scale

economies; diseconomies set in between \$3-6 billion and continued through larger bank class sizes.

Continuing the trend of examining scale and scope economies for large US banks, Noulas *et al.* (1993) focused on economies and diseconomies of scope for US banks with assets in excess of \$1 billion by using ordinary and hybrid translog cost functions. The major conclusions of their study was that the ordinary translog cost function provided unreliable measures of scope effects and subsequently the results could not be regarded robust; scope estimates changed in size and magnitude considerably dependent on whether one used the ordinary or hybrid translog methodology. They found that economies of scope did not appear to exist. This study also concluded that existing empirical work on scope effects derived from the translog cost function could be limited because of estimation error.

In general, the results from the studies that have focused on large US banks differ from the bulk of the literature which has focused on small US banks. While the majority of studies, which use data from small US banks, show that economies of scale do not appear beyond \$100 million in deposits size, the larger US bank studies find that scale economies appear for much larger institutions. For example, Shaffer and David (1986) find scale economies up to \$37 billion in assets size and Noulas *et al* (1990) indicate that banks with assets between \$1-3 billion exhibit scale economies. The evidence clearly suggest that scale advantages exist well beyond the \$100-200 million in the deposits size range. These findings appear to indicate that economies of scale results from the smaller bank studies cannot be applied to larger banks. In contrast to the scale economy results for large banks, none of these studies find evidence of scope economies. The most important conclusions from the studies using data for larger banks is that potential gains from altering scale via internal growth or merger activity can be substantial.

#### **5.3.2.2.3 Humphrey's Approach: Cost Dispersion**

A study undertaken by Humphrey (1987) marked a new dimension to examining scale economies by investigating cost dispersion amongst banks of a similar size. Humphrey

indicated that variations in cost among banks came from two sources: scale or cost economies across different sized banks and cost differences across similar sized banks. Humphrey concentrated on the second type of variation given that the first item had already been extensively studied. Publicly available balance sheet and cost data on 13,959 banks in the US over three years, 1980, 1982 and 1984 were drawn from the consolidated report of condition and Report of Income and Dividends. Humphrey divided his bank data into 13 size classes and also grouped banks into quartiles according to their average costs. Table 5.2 reveals the average costs by size class and cost quartile for both branch and unit bank in the US market. The study found that estimated cost economies were dominated by differences in average cost levels. Especially, Humphrey found that 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. The results suggested that banks did not lie on the same cost curves over time and that, at any point in time, only a few cases were on the same curve across size classes. The study, therefore showed considerable cost dispersions across similar sized banks. Dispersion was greatest for the smallest classes of banks and fell as banking groups became larger. The important result was that banks of similar size had substantially different average costs per dollar of total assets. Given these results, the analysis 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" (p.24).

Humphrey (1987) also examined asset cost elasticities for each of the 13 size groups for the years 1980, 1982, and 1984. To measure the elasticities, Humphrey estimated the following simple quadratic translog equation:

$$\ln TC = f[\ln TA, (\ln TA \ln TA)] \quad (10)$$

where  $\ln TC$  shows the logarithm of total cost,  $\ln TA$  is the logarithm of total assets. On the basis of 1984 data, the study indicated cost economies in banking, however, only for higher-cost and/or smaller banks. Thus, the analysis concluded that these cost economies did not confer competitive advantages for large banks over small institutions.

Table 5.2 Average cost by size class and cost quartile  
for branch and unit banks, 1984

Average Cost Quartiles (\$)					
Size Classes (\$)	1	2	3	4	All Banks (\$)
<b>Branch Banks</b>					
1. 1m-10m	.085	.099	.108	.126	.105
2. 10m-25m	.089	.098	.105	.124	.104
3. 25m-50m	.088	.097	.102	.115	.100
4. 50m-75m	.089	.096	.101	.114	.100
5. 75m-100m	.089	.097	.101	.114	.100
6. 100m-200m	.089	.097	.101	.118	.101
7. 200m-300m	.089	.097	.101	.113	.100
8. 300m-500m	.089	.097	.103	.118	.102
9. 500m-1b	.088	.098	.103	.117	.102
10. 1b-2b	.089	.099	.104	.117	.102
11. 2b-5b	.089	.098	.103	.124	.104
12. 5b-10b	.088	.094	.098	.114	.099
13. > 10b	.090	.096	.099	.117	.102
<b>All Banks</b>	<b>.088</b>	<b>.097</b>	<b>.103</b>	<b>.118</b>	<b>.102</b>
<b>Unit Banks</b>					
1. 1m-10m	.085	.101	.110	.130	.106
2. 10m-25m	.089	.099	.106	.120	.103
3. 25m-50m	.088	.096	.101	.112	.100
4. 50m-75m	.088	.095	.100	.108	.098
5. 75m-100m	.088	.095	.099	.107	.097
6. 100m-200m	.088	.095	.099	.107	.097
7. 200m-300m	.086	.093	.099	.107	.096
8. 300m-500m	.086	.093	.097	.106	.096
9. 500m-1b	.088	.094	.098	.108	.097
10. 1b-2b	.090	.096	.101	.109	.100
11. 2b-5b	.087	.091	.096	.102	.095
12. 5b-10b	.094	.096	.099	.110	.100
13. > 10b	.082	.092	.100	.104	.097
<b>All Banks</b>	<b>.088</b>	<b>.097</b>	<b>.103</b>	<b>.116</b>	<b>.101</b>

Source: Adopted from Humphrey, (1987, p.28-29).

## **5.4 Studies of Scale and Scope in European Banking Markets**

Compared with the US literature, the much smaller number of cost studies on European banking appear to reveal greater evidence of scale and, to a lesser extent, scope economies for larger banks. This literature will now be discussed. Section 5.4.1 analyses cost studies which focus on the larger European banking markets, and the following section covers those that have investigated smaller European banking markets. The third section considers recent cross-border European cost studies.

### **5.4.1 Cost Studies for Large European Banking Markets**

In this section, we discuss cost studies undertaken on the French, German, Italian, Spanish and the UK banking markets.

The earliest study on economies of scale in the European banking markets was by Levy-Garboua and Renard (1977) who examined the French banking market. Using a sample of 94 banks for 1974, their methodology combined the production and intermediation approach and their results suggested evidence of increasing returns to scale. These results for French banking were confirmed in two later studies undertaken by Dietsch (1988, 1993). Dietsch (1988) adopted the intermediation approach for a cross-sectional analysis of 243 banks in 1986. Using the translog methodology this study concluded, that as far as ray economies of scale were concerned, the elasticity of total costs with respect to bank output was close to unity (0.97). This study seemed to indicate that overall scale economies was rather limited, however further analysis of costs associated with individual bank outputs suggested that there was significant potential scale economies to be had (i.e. the partial elasticities of cost with respect to credits and deposits were equal to 0.56 and 0.23, respectively). Martin and Sassenou (1992) used a *CES*-Quadratic function to model a two-output cost function for French banks for 1987. Their main finding suggests that small banks benefit from large economies of scale and scope. Bigger banks incur relatively large diseconomies of scale depending on their output scale and their degree of specialisation.

Dietsch (1993) extended his previous analysis and examined both economies of scale

and scope in the French banking markets. Using a sample of 343 banks for 1987, he found strong evidence of economies of scale in the banking industry across all output ranges, whereas economies of scope were not observed at a high level for all combinations of outputs (i.e the cost complementarity coefficient for loans and investments was 0.093). Dietsch (p.17) stated that "For the French banking industry, our results tend to demonstrate that universal banking gives an advantage compared to specialisation and that competition between banks in the future must be analysed on the ground of the imperfect competition theory".

Cossutta *et al.* (1988), Baldini and Landi (1990) and Conigliani *et al.* (1991) have analysed the cost structure in the Italian banking industry. Generally, these recent studies suggest that there are economies of scale in this banking system. Cossutta *et al.* concludes that, at the plant level, economies of scale exist throughout all size ranges and the smallest banks are characterised by constant returns to scale. However, at the firm level, increasing returns to scale were reported only for big and major banks, while other groups showed constant returns to scale. Moreover, Cossutta *et al.* uncovered evidence of scope economies only for larger banks. Baldini and Landi using a sample of 294 banks for 1987 stated that scale economies at the plant level increase as bank size becomes larger. At the firm level, scale economies become small and they tend to decrease with the increase in banks' asset size, almost disappearing for the largest banks. This result is confirmed in Conigliani *et al.* (1991) who indicate evidence of scale economies at the plant level and only for the smaller banks at the firm level. These studies do not find scope economies in Italian banking.

The Spanish banking market has been studied by Fanjul and Maravall (1985) who employ a simple Cobb-Douglas functional form, using cross sectional data for 83 commercial and 54 savings banks in 1979. They find significant cost economies with respect to accounts per branch and deposits per account yet there appear to be constant returns to scale relating to the number of branches. Rodriguez *et al.* (1993) estimate scale and scope economies for 64 Spanish savings banks using a hybrid translog model. The results for 1990 reveal both scale and scope economies for medium-sized savings banks and diseconomies of scale and scope for larger institutions.

Cost economies studies in the UK have focused on the building society sector mainly because of the limited number of domestic commercial banks with similar business profiles. Hardwick (1987a, 1987b) and Drake (1992) have analysed the cost structure and nature of production in the building societies sector. The data for both of Hardwick's (1987a, 1987b) studies were taken from the 1985 annual returns of a sample of 97 building societies, ranging from the largest, with assets over £20 billion to the smallest, with assets of less £3 million. Both of these studies adopt the translog methodology. Drake (1992) obtained the data for his analysis from the 1988 annual accounts for a sample of 76 building societies of varying assets sizes. Hardwick (1987a) uses a single output model and finds statistically significant economies of scale for societies with assets under £280 million and diseconomies of scale for societies with assets over £1,500 million. Hardwick (1987b) using a two-output model indicates that there are statistically significant scale economies for societies with assets under £5,500 million yet there is no evidence of scope economies. Drake (1992), using the same methodology but a different data sample (76 building societies in 1988) indicates mild economies of scale for societies in the £120 million to £500 million assets size range but finds no evidence of economies of scope.

Overall, the studies, which we surveyed for the large European banking markets, suggested that substantial economies of scale exist generally for small and medium sized banks while evidence of economies of scope is more uncertain. Despite the importance of economies of scale and scope evaluations, as far as we are aware, no study has been undertaken for the German banking industry.

### **5.2.2 Cost Studies for Smaller European Banking Markets**

Kolari and Zardkoohi (1990), using accounting data for cooperative and saving banks in 1983 and 1984, provide empirical evidence on the cost structure of cooperative and savings banks operating in Finland. They use a translog model and their results indicate that cost curves for both cooperative and saving banks tend to be *L*-shaped at the plant level and *U*-shaped at the firm level. They find diseconomies of scope in the joint production of advances and bills and conclude that mergers among smaller banks ought to be preferred to mergers among larger banks.



Glass and McKillop (1992) use the data from one of the largest Irish banks, the Bank of Ireland, for the period 1972-1990, to estimate a hybrid translog model. They investigate the process of natural and non-natural technical change, overall scale economies, product specific scale economies and scope economies. Their results show that apart from the sub-period 1975-1978, the bank was characterised by overall diseconomies of scale; whereas product-specific scale economies were reported to be decreasing for investments and increasing for loans. Also the estimated cost function showed diseconomies of scope over the production of two outputs. The estimated parameters reflected technical change in the Bank of Ireland, which was both natural and non-natural in character (the average annual overall rate being 4.96%). Additionally, a positive interaction between scale economies and technical change are indicated.

More recently, Fields, Murphy and Tirtiroglu (1993) examined the fundamental cost-production relationships in a developing country, Turkey, which, they argued, could provide "useful information in understanding the potential effect of globalising financial markets" (p.112). The study used data for national commercial banks, of which there were 28 usable observations during 1986 and 27 for 1987. The study indicated no significant evidence of scale economies for either 1986 or 1987. The authors reported that the structure of the relationship between cost and output are similar to those of earlier studies based on different time periods, samples, estimation techniques and types of countries.

#### **5.4.3 Cross-Country European Cost Studies**

The most recent studies on cost efficiency in European banking have established global cost functions using data from a range of countries. Vennet (1993) uses a translog cost function approach to investigate a sample of 2600 credit institutions operating in the *EU* for the year 1991. Vennet concludes that the optimal scale is situated in \$ 3 billion to \$ 10 billion assets range. "Above this size level breaking up the bank and/or relative specialisation seems to be the optimal strategy from a cost perspective" (p.34). In addition, this study also finds that scope economies seem to be related to the nature of banks' financial assets. Allen and Rai (1993) have advanced this approach by utilising

the hybrid translog approach to test for the existence of scale and scope in international banking using a sample of European, US and Japanese banks. Their results for 1988 to 1991 show that significant economies of scale exist, mainly for small banks in all markets and for medium-sized banks in countries with regulations that prohibit universal banking. Efficiency measures, obtained from stochastic cost frontiers indicate banks operate less efficiently in separated as opposed to universal banking countries.

Overall, the results of cost studies undertaken on large and small European banking markets show that economies of scale exist, however, there is no consensus as to at what level of output these economies are exhausted. It is also uncertain as to whether these economies occur at the branch or firm level. The concept of economies of scope has been investigated by very few studies and it is difficult to draw any conclusion from these results. For instance, in the French banking market, economies of scope have been reported for medium-sized banks by Martin and Sassanou (1992), while Dietsch (1993) found no such evidence. The literature on the Italian banking industry, have not found any evidence of economies of scope. In comparison, Rodriguez *et al.* (1993) find evidence of scope economies for medium-sized Spanish savings banks and diseconomies of scope for larger institutions. In the UK, Hardwick (1987b) and Drake (1992) indicate that there is no evidence of scope economies for building societies. Yet, in the cross-country studies, Vennet (1993) concludes that scope economies seem to be related to the nature of banks' financial assets.

### **5.5 The Synthesis of Economies of Scale and Scope Studies**

Table 5.3 summarises the analytical issues which have generated change in the US (as well as influenced European) cost literature. The survey of the earlier studies reveals the following two main findings: firstly, economies of scale exist and are statistically significant for institutions; secondly, the degree of scale economy for bank services generally lie between 0.80 and 1.00. That is cost elasticities result in savings of up to 20 percent from scale factors.

The earliest studies such as those undertaken by Alhadeff (1954) suggested that economies of scale existed for large and small banks but only constant returns to scale

for medium sized banks. Other studies, such as Schweiger and McGee (1961) and Gramley (1962) found economies of scale for all sizes of banks. Studies in the late 1960's that used total revenue as the measure of output, for example Greenbaum (1967), tended to report evidence of *U*-shaped cost curves. The output definition varies from study to study: loans plus investments for Alhadeff (1954) and Horvitz (1963), time deposits and loans for Schweiger and McGee (1961) and effectively total assets for Gramley (1962). However, these studies include interest costs, use dollar values as measures and allow a wide variety in the product mix. Moreover, these studies reports that economies of scale exist for small banks whereas diseconomies of scale are present for larger banks. These studies also show that branch banks have higher average costs than unit banks, and this is explained by the fact that branch banks are producing different product mixes and not necessarily because of technological differences.

The studies undertaken by Greenbaum (1967), Powers (1969) and Schweitzer (1972) which employed revenues as the bank output measure could be taken as the flip side of the Benston and Bell and Murphy studies which used number of accounts for the measurement of output. Furthermore, studies that used Cobb-Douglas cost functions with Functional Cost Analysis data in the 1970's discovered either small scale economies or constant returns to scale, *i.e* Benston (1965), Bell and Murphy (1968), Mullineaux (1975).

Later studies tend to use the translog cost function methodologies and estimate both scale and scope economies. The results from these studies imply that (mainly the US) banking industry is characterised by *U*-shaped average cost curves. Although the earlier studies concluded that scale economies were exhausted at relatively low output ranges, later studies pointed to more mixed results. For example, Benston *et al.* (1983) (for branch banks), Clark (1984), Lawrence and Shay (1986), Hunter and Timme (1986), Berger *et al.* (1987), Cossutta *et al.* (1988) conclude that economies of scale exist but at relatively low levels of output. They also indicate decreasing average cost curves, without specifying any particular size constraints. On the other hand, other studies report *U*-shaped cost curves, that is, scale economies for small banks and diseconomies of scale for larger banks *i.e* Benston *et al.* (1982), Benston *et al.* (1983) (for unit banks), Gilligan, Smirlock and Marshall (1984), Gilligan and Smirlock (1984), Berger

*et al.* (1987), Kolari and Zardkoohi (1987) (for unit banks). The most recent studies find strong evidence of economies of scale for large US banks.

A distinguishing feature of the translog studies is the testing for jointness between two or more bank outputs (economies of scope). For instance, Gilligan, Smirlock and Marshall (1984), Gilligan and Smirlock (1984), and Lawrence and Shay (1986) found evidence of significant economies of scope whereas Benston *et al.* (1983), Berger *et al.* (1987), Baldini and Landi (1990) found no evidence of economies of scope but rather diseconomies. Strong evidence of economics of scope in banking markets is considerably less evident even than scale economy findings.

Overall, the results on scale and scope economies in banking markets suggest stronger empirical evidence for scale over scope economies. There also appears to be no strong consensus to optimal cost levels in US as well as European banking markets.

Table 5.3 The analytical issues that have resulted in changes in the US scale and scope economies literature

Issue	Early Studies <sup>1</sup>	Recent Studies <sup>2</sup>
Cost Methodology used to evaluate scale and scope economy values	Cobb-Douglas methodology - is able to reveal scale economies, constant costs, or scale diseconomies; cannot show all three (i.e., cannot reveal a 'U-shaped' average cost curve. Assumes that scale economies are the same for all size groups of banks and equal to the average scale economy value estimated. Also, Cobb-Douglas model cannot show scope economies.	<p>Translog methodology - both the conventional and hybrid translog cost function can reveal all three cost curve relationships, giving a 'U-shaped' cost curve if it exists in the data.</p> <p>The conventional translog model only allows us to measure cost complementarities, whereas the hybrid translog cost model can show scope economies or scope diseconomies.</p> <p>Allows scale and scope economies to vary across different size classes of banks.</p> <p>Stochastic cost frontier and Data Envelopment Analysis (DEA) methodology - can evaluate the relative efficiency of a set of institutions in their use of multiple inputs to produce multiple outputs. However, DEA cannot measure efficiency in an absolute sense and also there is no random error and all variations are taken as reflecting inefficiencies.</p>
Confusion between plant (branch)- and firm level scale economies.	Did not characterise scale economies at the single branch office from those for the firm as a whole.	Distinguishes branch from unit banks and separates plant- from firm-level scale economies.
Inclusion of larger banks in the sample.	Mainly concentrated on data containing small banks.	Generally includes a greater size dispersion of banks - larger banks are included in data sets or are analysed separately.
Measurement of bank output and specification of total costs.	<p>Generally banks are taken as firms which use capital and labour to produce different types of deposits and loans accounts.</p> <p>Outputs are measured by the number of these accounts or number of transactions carried out on each type of product, while costs are all operating costs.</p>	Banks are treated mainly as intermediators of financial services rather than producers of loan and deposit account services. The value of loans and investments are employed as output measures, while the relevant costs are measured operating and interest costs.

<sup>1</sup> Early studies range between Adhaleff (1954) and Benston, Hanweck and Humphrey (1982).

<sup>2</sup> Later Studies are from Benston, Berger, Hanweck and Humphrey (1983) onwards.

## 5.6 Recent Approaches to Estimating Efficiency in Banking Markets

In Section 4.8 of Chapter four we outlined the recent theoretical developments related to evaluating efficiency in banking markets. These 'new' approaches use either stochastic or programming techniques to evaluate cost efficiency. In this section, we will briefly review these studies which use stochastic cost frontier and Data Envelopment Analysis to examine the cost structure of financial institutions. The principal focus in this section is to identify the methodological issues and the main results of this literature.

Berger and Humphrey (1991) analysed inefficiencies for all US banks in 1984. Inefficiencies were measured relative to a 'thick frontier' cost function and were found to dominate measured scale and product mix economies. The study revealed that most inefficiencies were operational in nature, involving the overuse of physical inputs, rather than financial, involving overpayment of interest. Moreover, the authors suggested that their results showed that competitive pressures in banking from deregulation would be focused on banks to cut costs substantially, so that banks could merge with more efficient banks, or exit from the market.

Mester (1993) investigated the efficiency of mutual and stock S&Ls using 1991 data on US S&Ls. The study applied the stochastic econometric cost function approach which allows both the cost frontier and error structures differ between S&Ls of these two ownership forms. The results suggested that, on average, stock S&Ls are less efficient than mutual S&Ls. It also suggested that deregulation of interest rates and increased competition may have had the predicted effect of curtailing agency problems in mutual S&Ls.

Cebenoyan *et al.* (1993) focused on whether agency-related inefficiency problems exist in the thrift industry, and, thereby, to infer whether the recent structural shift to stock ownership could be expected to yield efficiency gains for the industry. The authors used a multiproduct, translog stochastic cost frontier methodology to examine inefficiency scores for 559 S&Ls operating in the Atlanta Federal Home Loan Bank District in 1988. The results of the study were as follows: (i) the mutual and stock S&Ls in the

sample had similar cost structures, allowing the pooling of S&L data; (ii) S&Ls have a large range of inefficiency scores, with mean 16% implying that the average S&L may produce its output with only 84% of the inputs actually used; and (iii) operating efficiency was not significantly correlated to form of ownership.

Sherman and Gold (1985) were the first to apply *DEA* to banking by conducting an analysis on 14 branches of a US savings banks. The study adopted the production approach for measuring bank output and assessed the efficiency of 17 transactions. The inputs monitored were labour, office space and supply costs. The results showed that six of the fourteen branches were relatively inefficient. A major limitation of this study, however, was that the very small sample size probably had a negative effect on the discriminatory power of the analysis.

Parkan (1987) employed the *DEA* technique to 35 branches of a major Canadian Chartered Bank in Calgary. This study also applied the production approach to measure output. Parkan constrained the number of output and inputs to six by applying a weighting scheme to aggregate some of the initially proposed variables and eliminating others. This was because *DEA* provides a better contrast in comparing branches with respect to their efficiency when the number of branches is significantly larger than the sum of the number of inputs and outputs. The findings revealed that eleven of the thirty-five branches were found to be relatively inefficient.

Vassiloglou and Giolis (1990) conducted a similar study to Parkan (1987) and found that only nine from twenty branches of the Commercial Bank of Greece in 1987 had a maximum efficiency rating. Tulkens (1990) conducted a larger scale study, applied the *DEA* and Free Disposed Hull (*FDH*) techniques, (an approach which avoids the *DEA* assumption of convexity) to 773 branches of Belgian public bank and 911 branches of a private bank in the same country. Tulkens found that using the *DEA* approach less than 6% of the branches were efficient; whereas 74.6% of the public bank's branches are on the *FDH* frontier compared to 57.8% of the private bank's branches.

The above studies have employed the *DEA* techniques to analyse branch networks of single banks; other studies have extended the application across banks. For example,

Rangan *et al.* (1988) sought to break down the inefficiencies of 215 independent US banks into those originating from pure technical inefficiency and scale inefficiency (*i.e.* operating at non-constant returns to scale). Unlike the single banks studies, Rangan *et al.* used the intermediation approach to output measurement, that is, the dollar value of three kinds of loans and two types of deposits; whilst the inputs employed in the study were labour, capital and purchased funds. The results revealed that the average value of efficiency for the sample was 0.70. This indicated that on average the banks in sample could have produced the same amount of output by using 70% of the inputs. Thus, in general, the study showed that a significant amount of inefficiency appeared to be present, almost all of which seemed to be result from pure technical inefficiencies. These findings could be compared to that of Elyasiani and Mehdiian (1990a) who examined technical and scale inefficiencies on a random sample of 144 US banks in 1985, using a deterministic statistical form of frontier analysis. Unlike Rangan *et al.* (1988), Elyasiani and Mehdiian (1990a) found that scale inefficiency was the important factor.

Rangan *et al.* (1990) extended their earlier work using a sample composed of both unit and branch bank data. The study investigated whether unit or branch banks organisational forms influenced the efficiency measures. In order to analyse this issue, the sample was grouped into two sub-samples of banks- those banks allowed to operate branches and those that are not. The study found that there was no sizable differences in efficiency between the two types of banks.

One of the recent UK studies undertaken by Field (1990) employed the *DEA* methodology to a cross section of 71 British building societies in 1981. The study found that 86% of the sample were inefficient, mainly due to scale inefficiencies. The contrast between US results and Field's result is that the US studies indicate that the technical efficiency measure is positively related to bank size, and thus the dispersion in firms' efficiency seemed to be accounted for by their size. On the other hand, Field (1990) showed that the overall technical efficiency was negatively correlated with firm size. This could be possibly related to cartelised and oligopolistic market conditions among UK building societies in 1981. Moreover, Drake *et al.* (1991) undertook a study which had contrasting results to those of Field. Applying *DEA* to building societies after



deregulation in 1988. The study found 37% to show overall efficiency- a marked increase and this overall efficiency was positively correlated to size.

Elyasiani and Mehdiian (1990b) applied the non-parametric DEA approach to measure the rate of technological change (*RTC*) for a sample of 191 large US banks based on 1980 and 1985 data. The findings of the study revealed that the frontier had shifted inward due to technological advancement to the extent that the banks may have produced the same level of output in 1980 with 90% of the inputs they actually used.

More recently, Berg *et al.* (1993) has examined banking efficiency in the Nordic countries using Data Envelopment Analysis techniques. Using a sample of 503 Finnish, 150 Norwegian and 126 Swedish banks in 1990, they found that efficiency differences between banks were most important in Finland and Norway and least important in Sweden. Comparing the best practice frontiers of the three banking markets they found the highest share of the banking industry on the frontier was in Sweden and the lowest in Finland. Most of banks on the Nordic best practice frontier were Swedish. These conclusions, however, are mainly independent of whether the authors assume variable or constant returns to scale along the efficiency frontier.

## **5.7 Conclusions**

This chapter has examined the empirical literature on economies of scale and scope in banking markets. In general, one can conclude that statistical studies of scale and scope economies reveal the existence of optimal cost levels, whose presence stands out more sharply the better is the quality of the data and methodology employed. The bulk of these studies investigate the cost structure in US banking markets, and they appear to report different results depending on the size of banks used in their data samples. The majority of US empirical studies, have used data from small US banks, and these studies tend to conclude that economies of scale do not appear for banks with more than \$100 million in deposits. Studies that use data samples of larger US banks find that scale economies appear for these institutions. The results of the cost studies undertaken on European banking markets appear to suggest that economies of scale are evident, although there is no consensus as to at what level of output these economies are

exhausted.

The concept of economies of scope has been analysed by fewer studies from which it is difficult to draw any general conclusions. Overall, the findings on economies of scale and scope in banking markets appear to show stronger empirical evidence for scale over scope economies. There also appears to be potential cost gains which can be generated from altering scale via internal growth or merger activity and this may be significant in the banking industry.

The findings of the above studies suggests various public policy reasons as to why it is useful to undertake more research in the area of European bank cost structures. With the advent of the single European banking market, it is of interest to evaluate evidence of economies of scale and scope so one can evaluate how market structure and bank costs may alter in the new broader markets and in markets linked by common competitors from 1993 onwards. The following chapters aim to evaluate these features by empirically investigating evidence of economies of scale and scope in the French, German, Italian and Spanish banking markets. The thesis also extends the analysis by evaluating the cost implications of hypothetical bank mergers both within these countries and cross-border.

## CHAPTER 6

### ECONOMIES OF SCALE AND SCOPE IN EUROPEAN BANKING - THE METHODOLOGY

#### 6.1 Introduction

The purpose of this chapter is to outline the methodology which is to be used to estimate scale and scope economies in various European banking markets. The first section outlines the functional form of the models that are to be used. Both the ordinary and hybrid translog cost functions are analysed. Sections 6.3 and 6.4 discuss how to measure scale and scope economies respectively. Section 6.5 and 6.6 examine the concepts of expansion path subadditivity and input elasticity of substitution. Particular attention will be given to describing the various hypothesis tests performed in Section 6.7 and the following section 6.8 outlines the estimation procedures. Finally, section 6.9 is the conclusion.

#### 6.2 The Functional form of the Model

This study, adopts the intermediation approach to calculate scale and scope economies in the French, German, Italian and Spanish banking markets using 1988 data. The ordinary translog and hybrid translog cost function is used to examine economies of scale and scope for banks with multiple inputs and outputs. The model assumes that banks aim to minimise costs. We define the banks' cost function by a given vector of outputs,  $Q = (Q_1, Q_2, \dots, Q_m)$ , using a range of variable inputs,  $X = (X_1, X_2, \dots, X_n)$ , their input prices  $P = (P_1, P_2, \dots, P_n)$ , and the number of branches ( $B$ ). The following function describes the best production process of multi product banks:

$$Q = h(X, B) \quad (1)$$

The solution to the problem of minimising the cost of producing a specified output rate given a set of input prices produces the cost-minimising set of input demands:

$$X_n = X_n(Q, P) \quad (2)$$

The total cost of production is give by the cost function

$$TC = \sum_{i=1}^n p_i x_i(Q,P) = TC(Q,P) \quad (3)$$

With profit maximising behaviour, this results in the corresponding dual cost function of multi product banks:

$$TC = f(Q_1, \dots, Q_m; P_1, \dots, P_n; B) \quad (4)$$

The cost function must satisfy the duality condition developed by Shephard (1953, 1970) and Diewert (1974), that there is unique correspondence between the production function and the cost function.

The ordinary translog cost function developed by Christensen, Jorgenson and Lau (1973) is a second order Taylor expansion series in output quantities, input prices and control variables. Using this methodology the cost structure of multi product financial institutions can be modelled with maximum flexibility, giving explicit recognition to each of the outputs. The cost function enables us to estimate overall scope and scale economies and allows us to test for additional restrictions such as non-jointness, homotheticity, and for the Cobb-Douglas functional form.

A major criticism of the conventional translog cost methodology is that it does not allow us to evaluate scope economies when one of the outputs becomes zero. Therefore, the hybrid translog cost function developed by Caves, Christensen and Tretheway (1980) and Fuss and Waverman (1981) is used to avoid this limitation. In the case of the hybrid translog functional form, the logarithms of outputs in the cost function and share equations are replaced with Box-Cox (1964) transformations. The Box-Cox hybrid transformation methodology evaluates a translog functional form where the output levels undergo a nonlinear transformation, so as a result the function can be defined at zero output levels. That is,

$$Q^* = \frac{(Q_i^\lambda - 1)}{\lambda} \quad \lambda \neq 0$$

$$= \ln Q_i \quad \lambda = 0$$
(5)

As  $\lambda$  approaches zero, the hybrid functional form approaches the translog cost function. When  $\lambda$  equals one, the cost function becomes semi-logarithmic.

We employ the ordinary translog and the hybrid translog form as a quadratic approximation to banks' cost functions. For the banking industry, four models are estimated. Models A and C relate to the ordinary and hybrid translog cost function at the branch (plant) level, whilst Models B and D are at the firm level. Model A and C estimate the cost functions at the branch level by holding the number of branches constant. Models B and D estimate at the firm level by allowing the number of branches to change, where branches are a function of output. In our models, we use Shephard's Lemma to derive the associated cost shares and our estimated system includes both the cost function and the cost share equations.

### 6.2.1 The Ordinary Translog Cost Function

Following Noulas et al (1990), the ordinary translog cost function for Model A in this study can be viewed as follows:

$$\ln TC = \alpha_0 + \sum_{i=1}^2 \alpha_i \ln Q_i + \sum_{i=1}^3 \beta_i \ln P_i + \lambda_b \ln B +$$

$$\frac{1}{2} \left[ \sum_{i=1}^2 \sum_{j=1}^2 \delta_{ij} \ln Q_i \ln Q_j + \sum_{i=1}^3 \sum_{j=1}^3 \gamma_{ij} \ln P_i \ln P_j + \lambda_{bb} \ln B \ln B \right] +$$

$$\sum_{i=1}^3 \sum_{j=1}^2 \rho_{ij} \ln P_i \ln Q_j + \sum_{i=1}^2 \lambda_{bi} \ln B \ln Q_i + \sum_{i=1}^3 \tau_{bi} \ln B \ln P_i + \epsilon$$
(6)

where

$\ln TC$  = the natural logarithm of the total costs (Operating and Financial cost);

$\ln Q_i$  = the natural logarithm of bank outputs (*i.e.* Total loans and Total securities);

$\ln P_i$  = the natural logarithm of *i*th input prices (*i.e.* Wage rate, Interest rate and Capital price);

$\ln B$  = the natural logarithm of the number of branches; and  
 $\alpha, \beta, \delta, \gamma, \rho, \lambda$  and  $\tau$  are coefficients to be estimated.

Since the duality theorem requires that the cost function must be linearly homogeneous in input prices, the following restrictions have to be imposed on the parameters of the cost function in equation (6):

$$\begin{aligned} \sum_{i=1}^3 \beta_i &= 1; & \sum_{i=1}^3 \gamma_{ij} &= 0 \text{ for all } j; \\ \sum_{i=1}^3 \tau_{bi} &= 0; & \sum_{i=1}^3 \rho_{ij} &= 0 \text{ for all } j. \end{aligned} \quad (7)$$

Furthermore, the second order parameters of the cost function in equation (6) must be symmetric, that is,

$$\begin{aligned} \delta_{ij} &= \delta_{ji} \text{ for all } i, j; \\ \gamma_{ij} &= \gamma_{ji} \text{ for all } i, j. \end{aligned} \quad (8)$$

The derived demand for an input or cost share of input,  $X_i$ , is calculated by partially differentiating the cost function with respect to the input prices,  $P_i$ . This follows from duality theory and is referred to as Shephard's Lemma (Christensen, Jorgenson and Lau, 1973), so;

$$S_i = \frac{\partial \ln TC}{\partial \ln P_i} = \frac{\partial TC}{\partial P_i} \frac{P_i}{TC} = \frac{P_i X_i}{TC} \quad (9)$$

where  $S_i$ , is the share of the  $i$ th input in the total cost. Thus, the cost share equations in the model can be generated by the cost function equation (6) as:

$$S_i = \sum_{i=1}^3 \beta_i + \sum_{i=1}^3 \sum_{j=1}^3 \gamma_{ij} \ln P_j + \sum_{i=1}^3 \sum_{j=1}^2 \rho_{ij} \ln Q_j + \sum_{i=1}^3 \tau_{bi} \ln B + \epsilon_i \quad (10)$$

However, Model B which indicates the ordinary translog cost function at the firm level, can be shown as:

$$\ln TC = \alpha_0 + \sum_{i=1}^2 \alpha_i \ln Q_i + \sum_{i=1}^3 \beta_i \ln P_i + \frac{1}{2} \left[ \sum_{i=1}^2 \sum_{j=1}^2 \delta_{ij} \ln Q_i \ln Q_j + \sum_{i=1}^3 \sum_{j=1}^3 \gamma_{ij} \ln P_i \ln P_j \right] + \sum_{i=1}^3 \sum_{j=1}^2 \rho_{ij} \ln P_i \ln Q_j + \epsilon \quad (11)$$

It can be seen that Model A differs from Model B in that Model B has the following additional restrictions:

$$\lambda_b = 0, \quad \lambda_{bb} = 0, \quad \lambda_{bi} = 0, \quad \tau_{bi} = 0 \quad \text{for all } i. \quad (12)$$

### 6.2.2 The hybrid Translog Cost Function

Using the Box-Cox transformation, the hybrid translog cost function for Model C at the branch level in this study can be viewed as follows:

$$\ln TC = \alpha_0 + \sum_{i=1}^2 \alpha_i Q_i^* + \sum_{i=1}^3 \beta_i \ln P_i + \lambda_b \ln B + \frac{1}{2} \left[ \sum_{i=1}^2 \sum_{j=1}^2 \delta_{ij} Q_i^* Q_j^* + \sum_{i=1}^3 \sum_{j=1}^3 \gamma_{ij} \ln P_i \ln P_j + \lambda_{bb} \ln B \ln B \right] + \sum_{i=1}^3 \sum_{j=1}^2 \rho_{ij} \ln P_i Q_j^* + \sum_{i=1}^2 \lambda_{bi} \ln B Q_i^* + \sum_{i=1}^3 \tau_{bi} \ln B \ln P_i + \epsilon \quad (13)$$

where

$\ln TC$  = the natural logarithm of the total costs (Operating and Financial cost);

$Q_i^*$  = the output of products with the Box-Cox transformation (i.e. Total loans and Total securities);

$\ln P_i$  = the natural logarithm of  $i$ th input prices (i.e. Wage rate, Interest rate and Capital price);

$\ln B$  = the natural logarithm of the number of branches; and

$\alpha, \beta, \delta, \gamma, \rho, \lambda$  and  $\tau$  are coefficients to be estimated.

Like the ordinary translog, the symmetry conditions imply the following:

$$\delta_{ij} = \delta_{ji} \text{ for all } i, j; \quad (14)$$

$$\gamma_{ij} = \gamma_{ji} \text{ for all } i, j.$$

Moreover, linear homogeneity of the cost function in input prices requires:

$$\begin{aligned} \sum_{i=1}^3 \beta_i = 1; \quad \sum_{i=1}^3 \gamma_{ij} = 0 \text{ for all } j; \\ \sum_{i=1}^3 \tau_{bi} = 0; \quad \sum_{i=1}^3 \rho_{ij} = 0 \text{ for all } j. \end{aligned} \quad (15)$$

By Shephard's Lemma, we can obtain expression from (6)  $S_i$ , the share of the  $i$ th input in the total cost. Thus, the cost share equations in the model can be shown as follows:

$$S_i = \sum_{i=1}^3 \beta_i + \sum_{i=1}^3 \sum_{j=1}^3 \gamma_{ij} \ln P_j + \sum_{i=1}^3 \sum_{j=1}^2 \rho_{ij} Q_j^* + \sum_{i=1}^3 \tau_{bi} \ln B + \epsilon_i \quad (16)$$

Furthermore, the hybrid translog cost function at the firm level can be expressed using the same conditions which are defined for the translog case:

$$\begin{aligned} \ln TC = \alpha_0 + \sum_{i=1}^2 \alpha_i Q_i^* + \sum_{i=1}^3 \beta_i \ln P_i + \\ \frac{1}{2} \left[ \sum_{i=1}^2 \sum_{j=1}^2 \delta_{ij} Q_i^* Q_j^* + \sum_{i=1}^3 \sum_{j=1}^3 \gamma_{ij} \ln P_i \ln P_j \right] + \\ \sum_{i=1}^3 \sum_{j=1}^2 \rho_{ij} \ln P_i Q_j^* + \epsilon \end{aligned} \quad (17)$$

Using the above cost functions, we can estimate cost function parameters jointly with the input cost share equations and standard cost function restrictions employing the iterative Seemingly Unrelated Regression (*SUR*) estimation technique. To make the model operational, we must impose the restrictions (symmetry and linear homogeneity of the cost function in input prices) and solve the problem of singularity of the disturbance covariance matrix of the share equations. Since input cost share equations sum to unity, one cost share equation is omitted from the estimated system of equations (see Barten, 1969: p.24-27; Berndt et al., 1974) because Zellner's iterative *SUR*



technique will only be made operational by deleting one of the cost share equations.

### 6.3 Economies of Scale

#### 6.3.1 Overall Economies of Scale

Following Mester (1987b) and Noulas et al. (1990), to estimate overall economies of scale we calculate the elasticity of cost with respect to output, holding the product mix and non-output variables constant. A measure of overall economies of scale ( $SE$ ) is given by the following cost elasticity, obtained by differentiating both the ordinary and hybrid cost function with respect to output. This gives us the ordinary translog form as follows:

$$SE = \sum_{i=1}^2 \alpha_i + \sum_{i=1}^2 \sum_{j=1}^2 \delta_{ij} \ln Q_j + \sum_{i=1}^3 \sum_{j=1}^2 \rho_{ij} \ln P_i + \sum_{i=1}^2 \lambda_{bi} \ln B \quad (18)$$

In addition, scale economies are estimated from the hybrid cost function as follows:

$$SE = \sum_{i=1}^2 \frac{\partial \ln TC}{\partial Q^*} = \sum_{i=1}^2 \alpha_i + \sum_{i=1}^2 \sum_{j=1}^2 \delta_{ij} Q_j^* + \sum_{i=1}^3 \sum_{j=1}^2 \rho_{ij} \ln P_i + \sum_{i=1}^2 \lambda_{bi} \ln B \quad (19)$$

At the expansion point values of data series for all models, we can write:

$$SE = \sum_{i=1}^2 \alpha_i \quad (20)$$

If  $SE < 1$  then we have increasing returns to scale, which implies economies of scale;

If  $SE = 1$  then we have constant returns to scale;

If  $SE > 1$  then we have decreasing returns to scale, implying diseconomies of scale.

Estimated overall scale economies can be derived for each bank size by evaluating equation (18) and (19) to examine how changes in scale affect total cost. We calculate the overall scale economies using the different mean values of data series for output, the number of branches and input prices for each bank group.

### 6.3.2 Partial Scale Economies

Partial scale economies (*PSE*) indicate the elasticity of total cost with respect to any specific output when other outputs and input prices are held constant. In addition, partial scale economies show each output's contribution to overall scale economies.<sup>1</sup>

In terms of the hybrid translog cost function, partial scale economies can be obtained as follows;

$$PSE_i = \frac{\partial \ln TC}{\partial Q_i^*} = \alpha_i + \sum_{j=1}^2 \delta_{ij} Q_j^* + \sum_{i=1}^3 \rho_{ij} \ln P_i + \lambda_{bi} \ln B \quad (21)$$

Gilligan, Marshall and Smirlock (1984), however, have argued that the technique for measuring partial scale economies is suspect because the *i*th output is only one output in a vector of outputs; it is common to find  $PSE_i > 1$  even where there are diseconomies of scale. This may result when the production process is characterised by cost complementarities.

### 6.3.3 Product Specific Economies of Scale

Product specific economies of scale are evaluated using the average incremental cost (*AIC*) concept, that calculates how much total cost increases when an output is produced at a specific level rather than not being produced at all. Following Baumol, Panzar and Willig (1988), the measurement of product specific economies of scale for product *i* at output vector *Q*, is calculated by the ratio of the average incremental cost of the product (*AIC<sub>i</sub>*) to its marginal cost ( $\partial TC / \partial Q_i$ ) and is given by:

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<sup>1</sup>As sum of the partial scale elasticities determines the overall scale economies.

$$PSES_i = \frac{AIC_i}{\left(\frac{\partial TC}{\partial Q_i}\right)} = \frac{IC_i}{\epsilon_{TC(Q_i)} TC} \quad (22)$$

where  $IC_i$  is the incremental cost of product  $i$  and is defined as equation (23) and  $\epsilon_{TC(Q_i)}$  is the cost elasticity of the  $i$ th output.

$$IC_i = TC(Q_1, Q_2) - TC(0, Q_2) \quad (23)$$

Product-specific economies of scale are said to exist when the value is greater than one, while values smaller than one imply product specific diseconomies of scale. In other words, returns to scale of product  $i$  at  $Q$  is said to be increasing, decreasing or constant as  $PSES_i$  are greater than, less than or equal to unity, respectively.

Comparing both the partial scale economies and product specific economies of scale methodology, the first method takes into account how costs behave when an output increases, whereas the second is concerned with how costs behave when one output is produced at a specific level compared to when it is not. Thus, the first approach evaluates the cost implications of an increase in output or not. The second methodology takes into account the cost implications of producing a new output.

In this study, using only the hybrid translog cost function (since it allows for zero levels of outputs), product specific economies of scale at the expansion point where  $Q_i = P_i = B = 1$  are calculated as follows:

$$PSES_i = \frac{\exp(\alpha_0) - \exp\left\{\alpha_0 - \frac{\alpha_i}{\lambda} + \frac{\delta_{ii}}{2\lambda^2}\right\}}{\alpha_i \exp(\alpha_0)} \quad (24)$$

#### 6.4 Economies of Scope

An appropriate local test for the existence of economies of scope is to examine pair-

wise cost complementarities. Baumol, Panzar and Willig (1988) have illustrated that a sufficient, but not essential, condition for overall economies of scope is the presence of cost complementarities between outputs. Cost complementarities exist if the marginal cost of producing one output decreases when the production of other outputs increase. This can be shown by the following expression:

$$\frac{\partial^2 TC}{\partial Q_i \partial Q_j} < 0 \quad 1 < i, j \leq 2 \text{ for } i \neq j \quad (25)$$

In equation (25), pair-wise cost complementarities are expressed at the mean values of the data series as:

$$\delta_{ij} + \alpha_i \alpha_j < 0 \quad \text{for all } i, j. \quad (26)$$

A problem with this calculation, however, is that the test for cost complementarities is a local test at the mean data point. Berger, Hanweck and Humphrey (1986, 1987) report that in the case of translog cost functions it is impossible to have cost complementarities at every data point. In other words, at all levels of output, this condition cannot hold.

A more appropriate indicator of economies of scope has been suggested by Willig (1979), who indicates the degree of economies of scope by considering two outputs,  $Q_1$ , and  $Q_2$ , and their separate cost functions,  $TC(Q_1)$  and  $TC(Q_2)$ . The joint cost of producing the two outputs is expressed by  $TC(Q_1, Q_2)$  and the degree of economies of scope is shown as:

$$SC = \frac{TC(Q_1, 0) + TC(0, Q_2) - TC(Q_1, Q_2)}{TC(Q_1, Q_2)} \quad (27)$$

$SC > 0$  or  $SC < 0$  indicates overall economies or diseconomies of scope respectively.

### 6.5 Expansion Path Subadditivity

If the mix of outputs of an industry can be produced at a lower cost by a single monopoly firm than by any combination of smaller firms then the industry cost function is subadditive. Baumol, Panzar and Willig (1988) have shown that a cost function is

subadditive for a particular output vector  $Q$  when  $Q$  can be produced more cheaply by a single firm than by any combination of smaller firms. However, there is no straightforward mechanical criterion which permits us to test whether or not a particular function is subadditive. If  $Q_i$  represent different vectors of the same products such that;

$$\sum_{i=1}^m Q_i = Q \quad (28)$$

then subadditivity implies:

$$TC(Q) < \sum_{i=1}^m TC(Q_i) \quad (29)$$

where each  $i$  represents a different firm. For two products and two firms subadditivity can be indicated as follows:

$$TC(Q) < TC(Q_1^A, Q_2^C) + TC(Q_1^A, Q_2^C) \quad (30)$$

where  $A$  and  $C$  are two firms,  $Q = (Q_1, Q_2)$ , and  $Q = (Q_1^A + Q_2^C, Q_1^A + Q_2^C)$ .

Cost subadditivity is a measure of the relative efficiency of large and small firms and takes account of both scale and scope economies simultaneously. Baumol, Panzar and Willig (1988) note that the difficulty of testing for subadditivity is that the concept is a global not a local one. To determine the subadditivity of a cost function at the same output vector  $Q$ , it is essential to have information about the value of the cost function for every possible output vector smaller than  $Q$ . Secondly, information about the cost function throughout the region is sufficient to determine whether the cost function is subadditive at  $Q$ . Additionally, the sufficient condition for cost subadditivity to hold is the presence of decreasing average incremental cost and scope economies up to  $Q$ , implying subadditivity at  $Q$  (decreasing average incremental cost implies that the product line must be monopolised if industry cost is to be minimised).

Berger, Hanweck and Humphrey (1986, 1987) propose the concept of expansion path subadditivity, and examine whether a bank of a given size can produce a combination of outputs more effectively than two banks which produce the same combination of outputs but in smaller size. Figure 6.1 describes an output plane for a banking

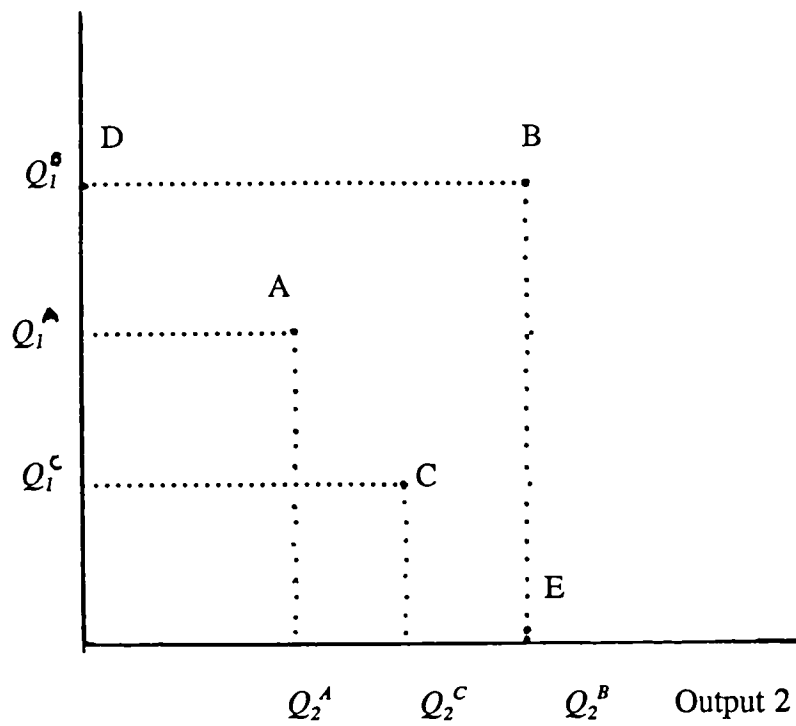
institution with two outputs,  $Q_1$ ,  $Q_2$  and two sizes of bank, banks  $A$  and  $C$  which are small and bank  $B$  which is large.

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Figure 6.1 Expansion Path Subadditivity

Output 1



Expansion path subadditivity examines whether the large bank at point  $B$  is more cost effective than the two smaller banks represented by points  $A$  and  $C$ . Expansion path subadditivity can be measured as follows:

$$EPSUB(Q^B) = \frac{TC(Q^A) + TC(Q^C) - TC(Q^B)}{TC(Q^B)} \quad (31)$$

where  $EPSUB(Q^B)$  shows cost changes resulting from the breaking of large bank  $B$  into smaller banks  $A$  and  $C$ .<sup>2</sup>

The measurement of economies of scope is a special case of expansion path subadditivity where smaller banking firms specialise at points  $D$  and  $E$  in Figure 6.1. From this diagram, it can be seen that economies of scope are present when:

$$TC(Q_1^B, 0) + TC(0, Q_2^B) - TC(Q^B) > 0 \quad (32)$$

According to various commentators<sup>3</sup>, expansion path subadditivity is a more appropriate method than traditional scope economy measures for examining the cost structure of banking markets.<sup>4</sup> Although equation (32) is a special case of equation (31), both equations provide us with different information. Equation (31) suggests whether cost effective multi-product firms should be large or small, (*e.g.* point  $A$ ,  $C$  or  $B$ ). Equation (32) suggests whether the firms should specialise in production (*e.g.* points  $D$  and  $E$ ).

<sup>2</sup> $EPSUB(Q^B)$  can also equivalently be thought of as the proportional increase in costs from operating the existing small bank  $A$  plus setting up a new small bank  $C$ , instead of simply expanding bank  $A$  to the size of the larger firm at  $B$ . Hence, if  $EPSUB(Q^B) > 0$  then one large bank  $B$  is preferable, on cost grounds, to having two small banks,  $A$  and  $C$ .

<sup>3</sup>See Berger, Hunter and Timme (1993), Noulas, Miller and Ray (1993), Hunter, Timme and Yang (1990) and Berger, Hanweck and Humphrey (1986, 1987).

<sup>4</sup>One reason is because expansion path subadditivity methodology, avoids the problem of having to evaluate a translog cost function when the one of outputs becomes zero.

## 6.6 Elasticities of Substitution

In various empirical studies, the elasticities of input substitution and own price elasticities of demand are calculated. The elasticity of substitution measures the degree to which a more expensive input can be substituted for a less expensive one in the production process. This is very important for the firm to be able to hold costs as low as possible. For the translog methodology, the elasticities of substitution are particularly simple to compute once the cost function parameters have been estimated. Following Binswanger's (1974) study the Allen-Uzawa elasticities of substitution ( $\sigma_{ij}$ ) between inputs can be computed as:

$$\sigma_{ij} = 1 + \frac{\gamma_{ij}}{S_i S_j} \quad \text{for } i \neq j \quad (33)$$

and

$$\sigma_{ii} = \frac{\gamma_{ii} + S_i(S_i - 1)}{S_i^2} \quad (34)$$

where  $S_i$  represent input cost shares.

Several comments can be made concerning these substitution elasticity estimates. Firstly, in general the estimated elasticities will vary across observations (Anderson and Thursby 1986). It is common to compute them at some central point such as the mean values of the data series (Krinsky and Robb, 1986; Toevs, 1980). Second, since the parameter estimates and shares have variances and covariances, the estimated substitution elasticities also have stochastic distributions. However, these elasticities are highly nonlinear functions of the estimated  $\gamma$ 's and  $S$ 's, which has made it difficult to obtain estimates of the variances of the estimated elasticities (Anderson and Thursby 1986).

Using  $\sigma_{ij}$ , the own and cross-partial elasticities ( $\epsilon_{ij}$ ) of the conditional input demand can be calculated as follows:



$$\epsilon_{ij} = \sigma_{ij} S_j \quad \text{for } i \neq j; \quad \epsilon_{ii} = \sigma_{ii} S_i. \quad (35)$$

## 6.7 Hypothesis Tests

Various recent studies (e.g. Noulas et al 1993 and 1990; Venet, 1992; Gopper, 1991; Mester, 1987b and Berger et al, 1987) estimate for different variants of the cost function model in order to test various hypotheses about production technology in the banking industry. For the purpose of this thesis, the hypotheses tested will be: (i) that production technology is homothetic (the most tractable case of an input-output separable functional form); (ii) that the cost function does not have a Cobb-Douglas functional form; and (iii) that there is evidence of varying types of nonjointness between outputs. Tests for these hypotheses are constructed as follows.

### 6.7.1 Homotheticity Hypothesis

The homothetic function is some transformation of a homogeneous function. The production function is homothetic if the ratio of marginal products of inputs does not change with any proportionate change in inputs (*i.e.* labour, capital). In other words, marginal rates of substitution in production are independent of scale effects and depend only on relative prices.

The homotheticity hypothesis can be investigated by testing whether there is separability of the cost function in the outputs and all other variables. The separability specification substantially restricts the structure of technology and therefore the possible functional form of the production function. On the other hand, separability permits the use of aggregate data when desegregated data are unavailable or of poor quality. Separability is consistent with decentralisation in decision making or equivalently, optimisation by stages (Denny and Fuss, 1977). For the translog cost function to be homothetic it is necessary and sufficient that (in terms of the model)  $\rho_{ij} = 0$  and  $\lambda_{bi} = 0$  for all  $i$  and  $j$ . Rejection of the homotheticity restrictions shows that the unspecified transformation function underlying the cost function is not separable in outputs and all other variables.

Consequently, aggregation of outputs into a single index is not possible. Any empirical study of economies of scale using the translog procedure must account for the multiproduct nature of the firm.

### 6.7.2 The Cobb-Douglas Functional Form Hypothesis

The Cobb-Douglas form which is nested within the translog function can also be tested. The null hypothesis tested will be that production technology is Cobb-Douglas, which requires all second order parameters to be zero. Therefore, the Cobb-Douglas form can be tested for by imposing the following restrictions:

$$\delta_{ij} = \gamma_{ij} = \rho_{ij} = \lambda_{bb} = \lambda_{bi} = \tau_{bi} = 0 \quad \text{for all } i, j, b. \quad (36)$$

### 6.7.3 Non-jointness Hypothesis

The non-jointness condition is necessary, but not sufficient, for scope economies to be present if the production of outputs is joint. In the case of two outputs, they are said to be non-joint if the marginal cost of one output is not based on the level of production of the other output. In other words,

$$\frac{\partial^2 TC}{\partial Q_i \partial Q_j} = 0 \quad (37)$$

For the translog cost function, the formula can be expressed as follows:

$$\begin{aligned}
\frac{\partial^2 TC}{\partial Q_i \partial Q_j} &= \frac{\partial}{\partial Q_j} \left( \frac{\partial \ln TC}{\partial \ln Q_i} \frac{TC}{Q_i} \right) = \\
\frac{1}{Q_i} \frac{\partial \ln TC}{\partial \ln Q_i} \frac{\partial TC}{\partial Q_j} + \frac{TC}{Q_i} \frac{\partial^2 \ln TC}{\partial \ln Q_i \partial \ln Q_j} &= \\
\frac{1}{Q_i} \frac{\partial \ln TC}{\partial \ln Q_i} \frac{\partial \ln TC}{\partial \ln Q_j} \frac{TC}{Q_j} + \frac{TC}{Q_i} \frac{\partial^2 \ln TC}{\partial \ln Q_i \partial \ln Q_j} \frac{\partial \ln Q_j}{\partial Q_j} &= \\
\frac{TC}{Q_i Q_j} \left[ \frac{\partial \ln TC}{\partial \ln Q_i} \frac{\partial \ln TC}{\partial \ln Q_j} + \frac{\partial^2 \ln TC}{\partial \ln Q_i \partial \ln Q_j} \right] &= 0
\end{aligned} \tag{38}$$

Since all outputs and the total cost are positive, equation (36) is zero if:

$$\frac{\partial^2 \ln TC}{\partial \ln Q_i \partial \ln Q_j} = - \frac{\partial \ln TC}{\partial \ln Q_i} \frac{\partial \ln TC}{\partial \ln Q_j}. \tag{39}$$

The equation (37) indicates that at the point of approximation where all variables equal one in terms of our models, and applying equation (37), the following non-jointness restriction then is shown as:

$$\delta_{ij} = - \alpha_i \alpha_j \tag{40}$$

## 6.8 Estimation Procedures

So far, there has been great interest in the development and estimation of so-called "flexible" functional forms, such as the translog methodology, to represent production technology. These forms have been used primarily as vehicles for testing hypotheses on functional separability, functional forms, nonjointness and to examine scale and scope economies of production structures.

The cost function can simply be estimated by ordinary least squares subject to the restrictions implied by linear homogeneity in input prices (7). However, it has been argued that an increase in efficiency in the estimates of the parameters can be achieved if the cost function is estimated jointly with cost share equations (10), since cost share

equations are included but no new parameters need to be estimated because of cross-equation restrictions (see Christensen and Greene, 1976; Guilkey and Lovell, 1980; Guilkey, Lovell and Sickles, 1983).

Furthermore, even for a modest number of inputs of production, the translog cost function creates a large number of explanatory variable. Therefore, multicollinearity among the explanatory variables is a serious problem, which can be addressed by incorporating the extra information which can be obtained from the restricted cost equations (Christensen and Greene, 1976).

We aim to estimate the coefficients of a system of regression equations, comprising the cost function and a set of cost input share equations. Using observations obtained from a particular banking market and year, the effects of variations across banking markets are reflected in the stochastic disturbance term of each equation. These disturbances are assumed to possess all properties in the classical linear regression model; in addition, however, it is possible to allow for the disturbances to be correlated across equations. These equations generate a system of seemingly unrelated regression (*SUR*) equations (Parikh and Bailey, 1990). We therefore estimate the cost function and cost share equations as a multivariate regression system. Including the cost share equations in the estimation procedure has the effect of adding various additional degrees of freedom without adding any unrestricted regression coefficients. As a result, this generates more efficient parameter estimates than the single equation estimates obtained using the cost function alone. This estimator, (Zellner's iterative Aitken Estimator) can be obtained by natural extension of Zellner's procedure (Zellner, 1962). Further discussion can be found in Kmenta and Gilbert (1968), Ruble (1968) and Dhrymes (1971) who demonstrate that the iterated *SUR* estimator is derived by adding the assumption that the random disturbances are obtained from a multivariate normal population and then applying the maximum likelihood principle. Moreover, Kmenta and Gilbert (1968) note that without the assumption of normality this estimator can be regarded as a least generalised residual variance estimator since most properties of this estimator do not depend on normality.

We assume the cost function and the input cost share equations have additive

disturbance terms. Since the input cost share equations are generated by differentiation, they do not contain the disturbance term from the cost function. Hence the disturbance terms are assumed to come from a joint normal distribution with non-zero correlation for a particular bank, but impose zero correlations across different banks. The estimated covariance matrix of disturbances required to implement Zellner's iterative seemingly unrelated regression technique (*SUR*) is singular because the disturbances on the share equation must sum to zero for each firm. Zellner's technique is made operational by dropping one of the share equations from the system of equations. However, the estimates are not invariant to which equation is dropped (Brendt et al, 1974; Barten, 1969).

### 6.8.1 Ordinary Least Squares (OLS) and Seemingly Unrelated Regression (SUR) Estimation

In this section, it is shown how is system of equations can be estimates, using both ordinary least squares, and seemingly unrelated regression estimation.

Consider a set of equation, which can be written in matrix notation:

$$\begin{aligned}
 y_1 &= x_1 \beta_1 + u_1 \\
 y_2 &= x_2 \beta_2 + u_2 \\
 \cdot &\quad \cdot \quad \cdot \\
 \cdot &\quad \cdot \quad \cdot \\
 \cdot &\quad \cdot \quad \cdot \\
 y_M &= x_M \beta_M + u_M
 \end{aligned} \tag{41}$$

where  $y_m$  is a  $TXI$  vector of observations on the dependent variable in the  $m$ 'th equation ( $m=1, \dots, M$ );  $X_m$  is a  $TXK_m$  matrix of observations of  $K_m$  regressors,  $\beta_m$  is a  $K_mXI$  vector of regression coefficients; and  $u_m$  is a  $TXI$  vector of random disturbances.

The system of equation can conveniently be written as follows:

$$\begin{pmatrix} y_1 \\ y_2 \\ \cdot \\ \cdot \\ \cdot \\ y_M \end{pmatrix} = \begin{bmatrix} X_1 & 0 & \dots & 0 \\ 0 & X_2 & \dots & 0 \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ 0 & 0 & \dots & X_M \end{bmatrix} \begin{pmatrix} \beta_1 \\ \beta_2 \\ \cdot \\ \cdot \\ \cdot \\ \beta_M \end{pmatrix} + \begin{pmatrix} u_1 \\ u_2 \\ \cdot \\ \cdot \\ \cdot \\ u_M \end{pmatrix} \quad (42)$$

or

$$y = X \beta + u \quad (43)$$

where

$y$  is a  $MT \times 1$  vector of observations of each of the  $M$  dependent variables.

$X$  is a  $MT \times K$  matrix of observations of independent variables for each of the  $M$  equations.

$\beta$  is a  $K \times 1$  vector of regression coefficients for each of the  $M$  equations.

$u$  is a  $MT \times 1$  vector of errors for each of the  $M$  equations.

$K = \sum_{(m=1)}^M K_M$  is a the total number of regression coefficients.

For ordinary least squares estimation, the following assumption are required:

i)  $E(u_m) = 0$ ;

ii)  $E(u_i u'_m) = \sigma_{mm} I_T$  if  $i=m$   
 $= 0_T$  if  $i \neq m$

or

$$E(uu') = \Sigma \otimes I_T \quad \text{where,}$$

$$\Sigma = \begin{pmatrix} \sigma_{11} & & & 0 \\ & \cdot & & \\ & & \cdot & \\ & & & \cdot \\ 0 & & & \sigma_{MM} \end{pmatrix} \quad (44)$$

and  $\otimes$  represents the Kronecker product, an operation which involves multiplying each element of  $\Sigma$  by a  $T \times T$  identity matrix to create a new matrix of dimensions  $MT \times TM$ .  
 iii)  $X_m$  is non-stochastic and such that  $X'_m X_m$  is non-singular.

Under these assumptions, the OLS estimator, obtained by choosing  $\hat{\beta}$  which minimises  $\hat{u}'\hat{u}$  where  $\hat{u} = y - X\hat{\beta}$  is  $\hat{\beta} = (X'X)^{-1}X'y$ . The Gauss-Markow theorem ensures that  $\hat{\beta}$  is the Best Linear Unbiased Estimator of  $\beta$  *i.e.* of all estimators which are unbiased and linear in  $Y$ ,  $\hat{\beta}$  has the minimum variance.

For the OLS estimator  $\hat{\beta}$  also to be interpreted as the maximum likelihood estimator of  $\beta$  we also require a 4th assumption:

iv)  $u$  follows a multinomial normal distribution.

If (iv) is satisfied, the likelihood function can be written as:

$$L = (2\pi)^{-\frac{TM}{2}} |\Sigma \otimes I|^{-\frac{1}{2}} \exp\left\{-\frac{1}{2}(y - X\beta)'(\Sigma^{-1} \otimes I)(y - X\beta)\right\} \quad (45)$$

and since  $\Sigma^{-1} \otimes I$  is a diagonal matrix, maximisation of this expression yields the same expression for  $\hat{\beta}$  as above.

If  $\hat{\beta}$  is interpreted as the maximum likelihood estimator, then no other estimator exists which is asymptotically more efficient than  $\hat{\beta}$  (*i.e.*  $\hat{\beta}$  is globally efficient in large samples).

For generalised least squares estimation, the procedure appropriate for the seemingly unrelated regression model, assumption (ii) is adopted as follows to allow for possibility of correlation between the error of different equations:

$$(ii)' E(u_i u'_m) = \sigma_{mm} I_T \text{ or}$$

$$E(uu') = \Sigma \otimes I_T \quad \text{where,}$$

$$\Sigma = \begin{pmatrix} \sigma_{11} & \dots & \sigma_{1m} \\ \cdot & & \cdot \\ \cdot & & \cdot \\ \cdot & & \cdot \\ \sigma_{M1} & \dots & \sigma_{MM} \end{pmatrix} \quad (46)$$

If such correlation is present, the information which the correlation continues can be expected to improved the efficiency of the estimation procedure.

Under assumptions (i), (ii)' and (iii), the generalised least squares estimator of  $\beta$  is as:

$$\tilde{\beta} = (x'(\Sigma^{-1} \otimes I)(x'(\Sigma^{-1} \otimes I)y) \quad (47)$$

If (iv) is also satisfied, the expression for the likelihood function is the same as before, but with the revised expression for  $\Sigma$  replacing the original expression.  $\Sigma^{-1} \otimes I$  is no longer diagonal, and maximisation of this expression now, yields  $\beta \sim$  (and not  $\hat{\beta}$  as before).

As it stands,  $\beta \sim$  cannot be calculated because the error covariance matrix  $\Sigma$  is unknown. However, the following procedure can be implemented, involving estimation of  $\Sigma$  initially using the residuals from an OLS estimation of the system of equations. The steps are:

1. Obtain the OLS estimator  $\hat{\beta}$  and OLS residuals  $\hat{u} = y - x\hat{\beta}$ .
2. Obtain an estimated error covariance matrix,

$$\hat{\Sigma} = \begin{pmatrix} \sigma_{11} & \dots & \sigma_{1m} \\ \cdot & & \cdot \\ \cdot & & \cdot \\ \cdot & & \cdot \\ \sigma_{M1} & \dots & \sigma_{MM} \end{pmatrix} \quad (48)$$

where,



$$\hat{\sigma}_{im} = \frac{1}{T} \sum_{t=1}^T \hat{u}_{it} \hat{u}_{mt}; \quad (49)$$

$\hat{u}_{it}$  and  $\hat{u}_{mt}$  are the OLS residuals from the  $i$ 'th and  $m$ 'th equations,

3. Calculate the feasible GLS estimator

$$\tilde{\beta} = (x' \hat{V}^{-1} x)^{-1} (x' \hat{V}^{-1} y) \quad (50)$$

where,

$$\hat{V}^{-1} = \hat{\Sigma}^{-1} \otimes I_T. \quad (51)$$

4. Optionally, the residuals from the feasible GLS estimator can be calculated  $\tilde{u} = y - x\tilde{\beta}$  and steps 2 and 3 can be repeated a number of times, until  $\tilde{\beta}$  converges. The value which it converges to is the maximum likelihood estimator of  $\beta$ .

The resulting maximum likelihood estimator is, under general conditions, consistent, asymptotically efficient, and asymptotically normally distributed with the following variance (Kmenta and Gilbert, 1968):

$$As. Var(\tilde{\beta}) = (X' V^{-1} X)^{-1} \quad (52)$$

### 6.8.2 Test of Linear Restriction on the Regression Coefficients and Confidence Intervals

Any set of  $n$  restrictions on the coefficients of the system of equations can be expressed in matrix form as follows:

$$R(\beta) - r = 0 \quad (53)$$

where  $R$  is an  $n \times k$  matrix of constants

and  $r$  is an  $n \times 1$  vector of constants.

Following Dhrymes (1978) and Cramer (1986), the lagrangian functions for the maximisation of the likelihood function subject to the constants can be written as

follows:

$$\mathcal{L} = (2\pi)^{-\frac{TM}{2}} |\Sigma \otimes I|^{-\frac{1}{2}} \exp \left\{ -\frac{1}{2} (\mathbf{y} - \mathbf{X}\beta)' (\Sigma^{-1} \otimes I) (\mathbf{y} - \mathbf{X}\beta) \right\} - \lambda' (R\beta - \mathbf{r}) \quad (54)$$

where  $\lambda$  is an  $n \times 1$  vector of Lagrange Multipliers.

Solution of the constrained optimisation problem yields an alternative set of coefficient estimates,  $\hat{\beta}^R$  or  $\tilde{\beta}^R$ , for OLS and SUR estimation respectively. Test of  $H_0 : R\beta - \mathbf{r} = 0$  against  $H_0 : R\beta - \mathbf{r} \neq 0$  are based either on the unrestricted estimation results (See Section 6.8.1), or the restricted estimation results, or on a comparison of the two. A convenient test procedure is the Wald test, which is based exclusively on the unrestricted model. The Wald test statistic is

$$W = (R\hat{\beta} - \mathbf{r}) [R \hat{Var}(\hat{\beta}) R']^{-1} (R\hat{\beta} - \mathbf{r}) \quad (55)$$

Under  $H_0$ ,  $W$  is distributed chi-square with  $r$  degrees of freedom.

The standard likelihood ratio statistic is defined in the form  $-2 \ln LRT$ ,  $LRT = -T/2 \ln |\hat{\Sigma}/\hat{\Sigma}_R|$ , where  $\hat{\Sigma}_R$  is the covariance matrix of the errors of the regressions with the restrictions imposed. Wilks (1938) showed that when the errors are distributed normally that  $-2 \ln LRT$  is distributed as  $\chi^2_n$ , where  $n$  is the number of restrictions in the null hypothesis ( $n$  degrees of freedom). However, the likelihood ratio test statistic is:

$$\begin{aligned} -2 LRT &= 2 \left( -\frac{T}{2} \ln |\hat{\Sigma}| \right) - 2 \left( -\frac{T}{2} \ln |\hat{\Sigma}_R| \right) \\ &= T \ln |\hat{\Sigma}_R| - T \ln |\hat{\Sigma}| \\ &= T \ln ( |\hat{\Sigma}_R| / |\hat{\Sigma}| ) \end{aligned} \quad (56)$$

which can be calculated with reasonable ease and where  $\hat{\Sigma}$  and  $\hat{\Sigma}_R$  are the maximum likelihood estimators of  $\Sigma$  which impose and ignore the restrictions in  $H_0$  respectively (see Harvey, 1981; p.165)

A limitation of previous studies has been the failure to compute the standard errors of estimated parameters obtained from the cost function. Because some parameters are

non-linear functions of the estimated coefficients exact, standard errors cannot be calculated (see Fields and Murphy, 1989; and Mester, 1987). We therefore estimate standard errors following Fuller's (1962) approach. The standard errors are calculated using the variance covariance matrix  $D\Sigma D'$ , where  $\Sigma$  is the variance covariance matrix of parameters and  $D$  is a  $n$  by  $r$  matrix defined as follows:

$$D = \begin{bmatrix} \frac{\partial Z_1}{\partial a_1}, & \dots, & \frac{\partial Z_1}{\partial a_r} \\ \cdot & & \cdot \\ \cdot & & \cdot \\ \cdot & & \cdot \\ \frac{\partial Z_n}{\partial a_1}, & \dots, & \frac{\partial Z_n}{\partial a_r} \end{bmatrix} \quad (57)$$

In this expression,  $a_1, a_2, \dots, a_r$ , are estimated parameters and  $Z_1, Z_2, \dots, Z_n$  are variables. In this study, the coefficient of economies of scale, economies of scope and elasticity of substitutions are the  $Z_n$ , and the cost function parameters are indicated by the  $a_r$ .

## 6.9 Conclusions

This chapter examines the ordinary translog and hybrid translog methodologies that will be used to evaluate scale and scope economies in the European banking market. The chapter firstly outlines the various functional forms that enable us to estimate economies of scale and scope in banking markets. The relevant hypothesis tests which are needed to be undertaken in order to arrive at consistent estimates of the cost function and production process are later explained. Finally the last part of the chapter provides an exposition of the seemingly unrelated regression (*SUR*) model estimation procedure which is the estimation procedure used to calculate the cost functions and cost share components. The following chapter provides a brief analysis of the data to be used in the empirical analysis of cost efficiencies for the French, German, Italian and Spanish banking markets for 1988.

## CHAPTER 7

### THE DATA AND DEFINITION OF VARIABLES

#### 7.1 Introduction

This brief chapter describes the variables used in the analysis to investigate scale and scope economies in the French, German, Italian and Spanish banking markets for 1988. Section 7.2 describes the data sources used. Section 7.3 describes the variables used in the cost function estimates undertaken in Chapter's 8 and 9. Section 7.4 presents the descriptive statistics for all our sample data for 1988 and finally, section 7.5 is the conclusion.

#### 7.2 Source of the European Bank Data

One of the main reasons for the paucity of cost studies on European banking markets relates to data availability problems. In this study we use banks' balance sheet and income statement data, for 1988, obtained from the London-based International Bank Credit Analysis Ltd (IBCA) database<sup>1</sup>. Accounting data was available for 201 French banks, 196 German banks and 244 Italian banks. According to IBCA Ltd, the accounting data for the European banks will be broadly comparable with their annual accounts, although spreadsheet data is standardised so more useful comparisons can be made. IBCA provide instruction manuals to describe how spreadsheet items are defined, but no documentation exists as to the rationale behind these definitions. In the case of Spain, the data on 209 banks was taken from *Anuario Estadístico De La Banca Právida* (1988) and *Blanaces y Cuenta De Resultados De Las Cajas De Ahoro* (1988). So as to maximise our sample size, we include commercial and savings banks in our Spanish sample.

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<sup>1</sup>IBCA Ltd, Eldon House, Eldon Street, London EC2M 7LS

### **7.2.1 The French and German Bank Data**

The sample data for France and Germany were obtained from the IBCA database. For France the IBCA database included 201 banks, compared with 305 banks reporting to official French authorities and cited in *Comptes Annuels Des Etablissements De Credit* (1988). The German bank sample includes 196 commercial banks for 1988. The sample for both French and German banks contains mainly commercial banks. Other relevant information which was not available in the IBCA database, such as the number of bank branches, was obtained from the following sources. The data on branch numbers for French banks was gathered from *Comptes Annuels Des Etablissements De Credit* (1988) and for German banks from *The Bankers' Almanac* (1990). Overall, the sample represents around 95 per cent of the French banking industry and around 80 per cent of the German banking industry in asset terms. Unfortunately we could not obtain full information on the number of employees from these sources. Therefore, we define the labour price variable in our analysis per branch instead of per employee (see Section 7.3 in this Chapter).

### **7.2.2 The Italian Bank Data**

Year-end balance sheet and income statement data for Italy were also extracted from the *IBCA* database, and other relevant data, such as information on the number of branches and number of employees, were obtained from the Italian Bankers Association. Sample data for the year 1988 were collected on 244 banks out of more than three hundred banks reporting to the IBCA. Overall, however, the sample represents around 90% of the Italian banking system in terms of total assets.

### **7.2.3 The Spanish Bank Data**

The balance sheets and income statements data for Spanish banks were taken from *Anuario Estadístico De La Banca Privada* and *Balances y Cuenta De Resultados De Las*

Cajas De Ahorro for 1988<sup>2</sup>. The economies of scale and scope estimates are calculated for the whole banking system (commercial banks, savings banks and foreign banks). It must be noted that the data on commercial banks comprises 98% of total commercial banking assets in Spain, whereas the combined data for commercial, saving and foreign banks account for 95% of total banking sector assets.

### 7.3 Definitions of Variables

The empirical approach to output definition used in this study is supported theoretically by Sealey and Lindley's (1977) model of production in depository financial institutions. Bank outputs are measured as total loans and securities, in accordance with Kolari and Zardkoohi (1987) and most other European studies. Given the chosen intermediation approach, we use two categories of outputs, three variable inputs and the number of branches as a control variable in our model. Output can be defined as:

$Q_1$ ; Total loans, which include all classes of loans;

$Q_2$ ; Total securities;

Variable inputs can be defined as:

$X_1$ ; Number of employees (labour);

$X_2$ ; Interest bearing total deposits;

$X_3$ ; Capital input which consists of physical capital goods, buildings, furniture, equipment and computers.

For Italy and Spain, the input price of labour is calculated by dividing staff expenses by total number of reported employees, whereas for France and Germany, it is obtained by dividing staff expenses by the total number of branches, since we could not obtain full information on the number of employees for individual banks from these sources. Therefore, input prices are defined as follows:

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<sup>2</sup>This was because this database had a substantially larger number of banks than the IBCA database and also included branch and staff number information.

$P_1$ ; The average annual wage per employee (average price of labour) in the models for Italy and Spain; and the average annual wage per branch in the models for France and Germany.

$P_2$ ; The average interest cost per dollar of interest bearing total deposits (average price of deposits or interest rate).

$P_3$ ; the average price of capital, which is calculated by summing the capital expenses and dividing by total fixed assets.

The dependent variables include total cost ( $TC$ ) and cost shares ( $S_i$ ). Total cost comprises both operating costs and financial costs (interest paid on the total deposits). The cost shares are specified as follows: wages, salaries and employee benefits per dollar of total costs (the cost share of labour,  $S_1$ ); interest paid on the interest bearing total deposits per dollar of total cost (the cost share of deposits,  $S_2$ ); and expenses on capital per dollar of total costs (the cost share of capital,  $S_3$ ).

Finally, the number of branches ( $B$ ), is included as a control variable to capture the influence on cost changes in the structure of the banking markets. The number of branches has been added to the explanatory variables in order to take into account the possibility of expanding output by increasing operations in existing branches and by opening new branches (Humphrey, 1985). Simply, banks with branches may increase output either through the same number of branches or by opening new branches. The effect on cost is likely to be different between these two methods.

#### 7.4 Descriptive Statistics

Table 7.1 provides a breakdown of banks assets sizes for each country which are used in our analyses. The sample data includes both small and large banking institutions for all countries. It can be seen that the German sample has the greatest number of large banks with assets size over \$1 billion in 1988, followed by France, Spain and Italy. It appears that the majority of banks in the samples generally fall between \$100 million and \$3 billion in total assets size. The German sample consists of 128 banks which have

more than \$1 billion in total assets, compared with 88 banks in France, 85 in Spain and 71 in Italy. The Italian data set also has considerably more smaller banks than the data sets of the other three countries.

Table 7.1 Total assets distribution of sample banks

Total Assets Sizes (\$ mil)	Number of French Banks	Number of German Banks	Number of Italian Banks	Number of Spanish Banks
0 - 100	17	4	32	20
100 - 300	33	16	56	26
300 - 600	40	25	48	42
600 - 1000	23	23	37	36
1000 - 3000	39	60	43	55
3000 - 5000	12	20	7	12
5000 <	37	48	21	18
All	201	196	244	209

Tables 7.2 to 7.5 provide descriptive statistics on the variables outlined in the previous section. It can be seen that in 1988, banks in the French sample had the largest average values of total assets and total cost, followed by banks in the German, Italian and Spanish samples respectively. In all cases, the mean values of interest shares are considerably larger than the mean values of the labour and capital shares. Overall the mean interest share is the highest for Spain (70 per cent) followed by France, Germany and Italy. The mean labour share is greatest in Italy (24 per cent), but the labour shares are quite similar in all markets. The mean capital share for Spain appears to be noticeably smaller than for other markets.



Table 7.2 Descriptive statistics for France

Variable	Mean	Std. Errors	Minimum	Maximum
$Q_1$	3993.6	14962.0	3.00	144600
$Q_2$	1149.5	3362.5	1.00	23620
$P_1$	2.00	95.30	0.18	1020.3
$P_2$	0.0707	0.0494	0.0112	0.4103
$P_3$	1.9436	1.7447	0.0038	11.50
$B$	83.00	470.41	1.000	5780.0
$TC$	668.50	2501.1	2.60	21420
$S_1$	0.1838	0.1279	0.0007	0.9837
$S_2$	0.6734	0.2416	0.0392	1.2972
$S_3$	0.1571	0.1559	0.0047	1.3064
$TA$	8185.3	29090.0	33.00	242000

$Q_1$  = Total Loans (\$mil);  $Q_2$  = Total Securities (\$ mil);

$P_1$  = Average Price Labour;  $P_2$  = Average Price Deposits;  $P_3$  = Average Price Capital;  $B$  = Number of Branches;  $TC$  = Total Cost (\$ mil);

$S_1$  = Cost Share of Labour (%);  $S_2$  = Cost Share of Deposits (%);  $S_3$  = Cost Share of Capital(%);

$TA$  = Total Assets (\$ mil).

The mean output levels (loans and securities) are by far the largest in Germany, followed by France, Italy and Spain respectively. As mentioned earlier, the banks in Spain and Italy are relatively small in comparison with their counterparts in Germany and France. The average values of total loans and total securities and their standard deviations are also similar for both Italy and Spain.

Table 7.3 Descriptive statistics for Germany

Variable (\$ mil)	Mean	Std. Errors	Minimum	Maximum
$Q_1$	4657.5	13157.0	5.00	107237
$Q_2$	640.3	1406.6	2.00	11136
$P_1$	3.306	10.287	0.124	73.200
$P_2$	0.0480	0.0221	0.00796	0.1603
$P_3$	1.5838	2.4369	0.0110	23.00
$B$	52.47	190.08	1.000	1900.0
$TC$	439.30	1272.4	3.90	11463
$S_1$	0.2006	0.1171	0.0097	0.9334
$S_2$	0.6571	0.1963	0.0159	1.4566
$S_3$	0.1423	0.1031	0.0044	0.4974
$TA$	7291.4	19713.0	22.00	167133

Table 7.4 Descriptive statistics for Italy

Variable (\$ mil)	Mean	Std. Errors	Minimum	Maximum
$Q_1$	1414.4	4884.4	7.40	37660
$Q_2$	385.52	1089.5	0.10	10390
$P_1$	0.0495	0.0065	0.025	0.0865
$P_2$	0.0748	0.0249	0.0437	0.2338
$P_3$	0.9602	0.5256	0.2222	4.500
$B$	46.06	97.181	1.000	577.00
$TC$	289.21	973.84	1.80	8492.0
$S_1$	0.2429	0.0480	0.0800	0.3739
$S_2$	0.5770	0.0735	0.3807	0.8400
$S_3$	0.1800	0.0477	0.0733	0.3459
$TA$	3102.5	10385	19.40	76339

Table 7.5 Descriptive statistics for Spain

Variable (\$ mil)	Mean	Std. Errors	Minimum	Maximum
$Q_1$	985.90	2328.7	0.100	20281
$Q_2$	278.78	866.38	0.020	9547.8
$P_1$	0.0412	0.0487	0.0138	0.6389
$P_2$	0.2293	0.3846	0.0100	3.5256
$P_3$	0.6662	1.5324	0.0070	17.737
$B$	138.9	320.61	1.000	2447.0
$TC$	181.07	416.83	0.500	3637.1
$S_1$	0.1836	0.1036	0.0029	0.9725
$S_2$	0.7003	0.1449	0.0110	0.9860
$S_3$	0.0760	0.0413	0.0027	0.2318
$TA$	2174.0	5200.0	6.000	45951

## 7.5 Conclusions

This chapter briefly describes descriptive statistics for the data sets which we shall use to investigate scale and scope economies for four European banking markets. The IBCA data represent a reasonable percentage of the number of banks operating in these countries (France, Germany and Italy), and the banks in each sample account for more than 80 per cent of total banking sector assets. Out of the four European markets the interest cost shares are the lowest in Italy, where the labour cost shares are the highest. Capital cost shares are relatively small in Spain in comparison with the other three markets. The descriptive statistics also indicate that the highest sample mean value of total loans is for banks operating in Germany, and that the highest sample mean value of total cost is for French banks.

Overall, the descriptive statistics illustrate the heterogenous nature of European banking markets, although, there are some similarities between the French and German samples,

as well as between the Spanish and Italian samples. The following chapter utilises these data to further investigate the presence scale and scope economies in those four banking markets.

## CHAPTER 8

### ECONOMIES OF SCALE AND SCOPE IN EUROPEAN BANKING - THE EMPIRICAL RESULTS

#### 8.1 Introduction

This chapter examines the empirical evidence of scale and scope economies in the French, German, Italian and Spanish banking markets for 1988. Estimates of both the ordinary and hybrid translog models outlined in Chapter Six are undertaken using the data which was examined in the previous chapter. The first section of this chapter provides the results on various structural tests regarding the functional form of the estimated cost functions. Section 8.3 reveals the results of overall scale economies together with partial and product-specific scale economies. Section 8.4 examines the evidence of economies of scope. This section also reports the results on cost complementarities between outputs. Section 8.5 illustrates the results on expansion path subadditivity and section 8.6 displays findings on elasticities of substitution between inputs, as well as on own and cross elasticities of inputs. Finally, section 8.7 is the conclusion.

Overall, the results suggest noticeable differences in cost characteristics across European banking markets and strong evidence of economies of scale and scope at the plant (or branch) level in all but the Spanish market. Cost savings appear to occur mainly through increasing the average size of existing banks' branches rather than through adding new branches.

#### 8.2 Structural Test Results

The ordinary and hybrid translog cost function parameters are estimated using the *SUR* procedure for the cost function together with the two input cost share equations, whilst imposing the linear homogeneity and symmetry restrictions. Since the input cost share equations sum to unity, the capital cost share equation was deleted from the estimated system of equations (see Berndt et al. 1974) because Zellner's iterative *SUR* technique

can only be made operational by dropping one of the cost share equations<sup>1</sup>. Both the ordinary and hybrid translog models are estimated at the branch and firm level. Throughout this chapter we will refer to models *A* and *C*, which are the branch level estimates; and models *B* and *D* which are the firm level estimates. The cost functions for branch and firm level estimations are broadly similar; however, to estimate at the firm level the restrictions  $\lambda_b = 0$ ,  $\lambda_{bb} = 0$ ,  $\lambda_{bi}=0$  and  $\tau_{bi} = 0$ , for all  $i$ , must be imposed. This simply holds the number of branches constant in the estimation, *ceteris paribus*.

A maximum likelihood procedure was used to estimate the parameters of the system of equations. The results for each country at both the plant level and firm level are shown in Appendix 1 and 2. Tables A1.1 to A1.8 show the results for the translog form at both levels, while Tables A2.1 - A2.8 report the results for the hybrid model. The majority of the parameter estimates are statistically significant at the 5 percent level. In addition, to calculate the maximum likelihood estimate of the Box-Cox parameters used for the translog estimation, a grid search was carried out using values of  $\lambda$  between 0 and 1. The value of  $\lambda$  that produced the lowest residual sum of squares provides the maximum likelihood estimate of  $\lambda$ .<sup>2</sup>

Tables 8.1 and 8.2 report the structural tests for homotheticity, Cobb-Douglas functional form and non-jointness for the translog and hybrid models, respectively. Homotheticity, which implies separability of the cost function in outputs and all other variables, is rejected at the 5 percent level for all country equations for both models. The rejection of the homotheticity constraint shows that the unspecified transformation function underlying the cost functions are not separable in outputs, input prices and other control variables. Therefore, the empirical study of economies of scale using the

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<sup>1</sup>Therefore, we can avoid the problem of a singular contemporary covariance matrix of disturbances. However, the estimates are not invariant to which equation is dropped (Christensen and Greene, 1976).

<sup>2</sup>The estimated results of the Box-Cox parameters are reported in table A2.9 in Appendix 2. Moreover, tests for linearity and log-linearity in all the data were undertaken using a likelihood ratio statistic which yielded strong evidence of log-linearity and linearity, with the chi-squared values exceeding the critical 1 per cent significant level in all cases.

translog procedure should account for the multi-product, multi-input nature of banks. The test for Cobb-Douglas functional form is decisively rejected in all cases. For the translog form, the non-jointness hypothesis is rejected both at the branch and firm levels for France and Germany, whereas it is not rejected at the firm level in Italy or at the branch level in Spain. This suggests that the marginal cost of one output depends on the level of production of the other outputs in the French, German, and Italian banking systems at the branch level. The same can be stated for the Spanish estimates at the firm level. Finally, for the hybrid model, the non-jointness hypothesis is rejected both at the plant and firm levels for France, Germany, Italy (at the branch level only) and Spain. This suggests that the marginal cost of one output depends on the level of production of the other outputs in these cases<sup>3</sup>. Rejection of the non-jointness hypothesis generally indicates that the outputs are joint, suggesting the outputs are either cost complements or cost substitutes.

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<sup>3</sup>However, the non-jointness test based on the cost function is a local test and does not necessarily imply absence of global jointness (Berger, Hanweck and Humphrey, 1987).

Table 8.1 Structural test results using the ordinary translog cost function

Test Performed	Test Statistic		Degrees of Freedom		Crit. Val. $\chi^2$ at 0.05		Decision	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
<u>France</u> : Homotheticity Cobb-Douglas Non-jointness	3247.80	666.28	8	6	15.5	12.6	rejected	rejected
	3191.50	1145.10	21	15	32.7	25.0	rejected	rejected
	28.78	5.96	1	1	3.84	3.84	rejected	rejected
<u>Germany</u> : Homotheticity Cobb-Douglas Non-jointness	4081.60	623.24	8	6	15.5	12.6	rejected	rejected
	4263.30	1038.30	21	21	32.7	25.0	rejected	rejected
	22.41	5.75	1	1	3.84	3.84	rejected	rejected
<u>Italy</u> : Homotheticity Cobb-Douglas Non-jointness	576.70	878.95	8	6	15.5	12.6	rejected	rejected
	1254.20	1150.60	21	15	32.7	25.0	rejected	rejected
	9.94	2.35	1	1	3.84	3.84	rejected	not rejected
<u>Spain</u> : Homotheticity Cobb-Douglas Non-jointness	811.99	972.28	8	6	15.5	12.6	rejected	rejected
	1618.60	1437.20	21	15	32.7	25.0	rejected	rejected
	2.13	4.65	1	1	3.84	3.84	not rejected	rejected



Table 8.2 Structural test results using the hybrid translog cost function

Test Performed	Test Statistic		Degrees of Freedom		Crit. Val. $\chi^2$ at 0.05		Decision	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
France Homotheticity Cobb-Douglas Non-jointness	3250.50	667.65	8	6	15.5	12.6	rejected	rejected
	3190.70	1145.1	21	15	32.7	25.0	rejected	rejected
	30.88	7.67	1	1	3.84	3.84	rejected	rejected
Germany Homotheticity Cobb-Douglas Non-jointness	4614.50	572.68	8	6	15.5	12.6	rejected	rejected
	4836.30	1081.5	21	21	32.7	25.0	rejected	rejected
	21.77	8.25	1	1	3.84	3.84	rejected	rejected
Italy Homotheticity Cobb-Douglas Non-jointness	577.92	879.15	8	6	15.5	12.6	rejected	rejected
	1255.00	1150.30	21	15	32.7	25.0	rejected	rejected
	9.57	2.60	1	1	3.84	3.84	rejected	not rejected
Spain Homotheticity Cobb-Douglas Non-jointness	643.51	653.57	8	6	15.5	12.6	rejected	rejected
	1407.80	1330.0	21	15	32.7	25.0	rejected	rejected
	14.75	12.37	1	1	3.84	3.84	rejected	rejected

### 8.3 Economies of Scale

Scale economies can be estimated for each bank size band by evaluating equations (18) and (19) (reported in Chapter 6) to examine how changes in scale affect total cost. The estimated overall scale economies can be computed using the mean values of output, the number of branches and input prices for banks in each size band.

Overall economies of scale and the approximate standard errors of these coefficients are reported for both the ordinary and hybrid model in tables 8.3 and 8.4, respectively. The translog cost function estimates shown in Table 8.3 indicate that overall economies of scale exist in the French, German, Spanish and Italian banking markets (except for small Italian banks with assets of less than \$300 million) at the branch level. Significant scale economies only appear to exist for small Spanish banks with assets of less than \$100 million at the firm level. In general firm-level estimations appear to reveal constant returns to scale for the French, Italian and Spanish banking market. Diseconomies of scale seem to exist at the firm-level for German banks across all output ranges.

The hybrid model estimates in Table 8.4 indicate that overall economies of scale exist in the French, German, Italian and Spanish banking markets at the plant level. Moreover, the estimated scale economies are significantly different from one except in the following cases: the largest French banks with assets of more than \$ 5 billion; small Spanish banks with assets of less than \$1 billion; German banks with assets of between \$100 and \$300 million; and German banks with assets of more than \$5 billions. In Italy, the coefficients for all size banks are between zero and one; however, overall scale economies are only statistically significant at the branch level for large banks with assets of more than \$ 1 billion. At the firm level, overall economies of scale are evident in the Spanish banking market across all output ranges, yet there are significant diseconomies of scale for German banks for all size bands. The results for French and Italian banks indicate that there are constant returns to scale at the firm level across all size bands. Overall, these results indicate a prevalence of scale economies at the branch level but not at the firm level.

Table 8.3 Overall economies of scale using the ordinary translog cost function\*

Total Assets Sizes (\$ mil)	France		Germany		Italy		Spain	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	0.5628* (0.0913)	0.9165 (0.1317)	0.7234** (0.1265)	1.6931* (0.1094)	1.0015 (0.1025)	1.0191 (0.3412)	0.7528*** (0.1328)	0.6308* (0.1390)
100 - 300	0.5887* (0.1073)	1.0134 (0.1627)	0.5009* (0.1368)	1.7458* (0.0943)	0.8208 (0.1224)	1.0395 (0.5316)	0.6732*** (0.1882)	0.9193 (0.2918)
300 - 600	0.5472* (0.1200)	1.0326 (0.1919)	0.5785* (0.1504)	1.9254* (0.0873)	0.7758*** (0.1382)	1.0555 (0.6532)	0.6180*** (0.2203)	1.0485 (0.3633)
600 - 1000	0.6123* (0.1288)	1.0814 (0.2115)	0.5753* (0.1638)	2.0465* (0.0857)	0.7147** (0.1372)	1.0606 (0.7354)	0.6056*** (0.2399)	1.1098 (0.4456)
1000 - 3000	0.6856** (0.1484)	1.1327 (0.2114)	0.5993** (0.1766)	2.0789* (0.0943)	0.6080* (0.1449)	1.0729 (0.8154)	0.5711*** (0.2489)	1.1961 (0.5123)
3000 - 5000	0.6965*** (0.1626)	1.1716 (0.2699)	0.6533*** (0.1959)	2.1387* (0.1068)	0.5354* (0.1460)	1.0843 (0.9441)	0.5237*** (0.2537)	1.3337 (0.6017)
5000 <	0.6897*** (0.1714)	1.2655 (0.3382)	0.5859** (0.2088)	2.1818* (0.1150)	0.4126* (0.1564)	1.1044 (1.1569)	0.4838** (0.2997)	1.4492 (0.6979)
All	0.6192* (0.1364)	1.0958 (0.2243)	0.5999** (0.1738)	2.0426* (0.0906)	0.3996** (0.2454)	1.0520 (0.6768)	0.6088** (0.1565)	1.0857 (0.4225)

\* Approximate standard error in parentheses.  
\* Significantly different from one at 0.01 level.  
\*\* Significantly different from one at 0.05 level.  
\*\*\* Significantly different from one at 0.10 level.

Table 8.4 Overall economies of scale using the hybrid translog cost function<sup>a</sup>

Total Assets Sizes (\$ mil)	France		Germany		Italy		Spain	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	0.5685* (0.0892)	0.8927 (0.1220)	0.8446 (0.1256)	2.8531* (0.0905)	0.9741 (0.1901)	0.9899 (0.3224)	0.3820* (0.0673)	0.4273* (0.0600)
100 - 300	0.6094* (0.1050)	0.9776 (0.1511)	0.7048** (0.1407)	3.0548* (0.0819)	0.8162 (0.1985)	0.9980 (0.5051)	0.3225* (0.1663)	0.4089* (0.0742)
300 - 600	0.5583* (0.1180)	0.9886 (0.1788)	0.7571 (0.1540)	3.1461* (0.0791)	0.7789 (0.2034)	1.0068 (0.6232)	0.3518* (0.2305)	0.4742* (0.0824)
600 - 1000	0.6393* (0.1266)	1.0288 (0.1975)	0.7327 (0.1672)	3.2885* (0.0799)	0.7300 (0.2172)	1.0056 (0.7034)	0.3513** (0.3096)	0.5304* (0.0928)
1000 - 3000	0.6992** (0.1470)	1.0721 (0.2305)	0.7207 (0.1808)	3.3058* (0.0878)	0.6306*** (0.2201)	1.0113 (0.7822)	0.3859 (0.3993)	0.6021* (0.1038)
3000 - 5000	0.7062*** (0.1619)	1.1047 (0.2543)	0.7022 (0.2012)	3.3171* (0.0985)	0.5706*** (0.2409)	1.0132 (0.9093)	0.4481 (0.4750)	0.7318* (0.1206)
5000 <	0.6939 (0.2021)	1.1792 (0.3213)	0.6269*** (0.2155)	3.4478* (0.1061)	0.4520** (0.2680)	1.0194 (1.1230)	0.4345 (0.6126)	0.7387*** (0.1425)
All	0.6323* (0.1350)	1.0416 (0.2104)	0.7052*** (0.1783)	3.2929* (0.0853)	0.7421 (0.2308)	1.0007 (0.6478)	0.3695* (0.3072)	0.5357* (0.0921)

<sup>a</sup> Approximate standard error in parentheses.

\* Significantly different from one at 0.01 level.

\*\* Significantly different from one at 0.05 level.

\*\*\* Significantly different from one at 0.10 level.

Table 8.5 summarises the main features of the two sets of estimation results for the ordinary and hybrid translog cost functions (reported in Tables 8.3 and 8.4). Overall, the ordinary translog estimates find evidence of branch level economies of scale everywhere. For both the ordinary and hybrid models the firm level estimates are similar for all countries apart from Spain, where economies of scale are found in the hybrid estimation but not in the ordinary version.

If one adopts the ordinary translog cost function to examine scale and scope economies, the results suffer from various weaknesses associated with this approach. Banking firms which provide more services have higher measured cost, so average costs tend to be higher for firms which produce superior services. If we examine only the effect of size on the production process, this effect is likely to distort the results for larger banks, so that they appear to be less efficient. Production efficiency or cost reduction can also arise from the joint production of outputs or synergies in production between inputs and outputs. A major limitation of the ordinary translog function is that it does not allow for the advantages of jointness of production between multiple outputs. In short, it is important to investigate the scope effects in the banking firm.

Another limitation is that the translog cost function is derived from a local approximation to the 'true' function. It can be expected to give poor approximations to the true underlying cost function as one moves away from the point of approximation (Barnett and Lee, 1985). The translog may not hold up as a reasonable global approximation because it forces large and small firms to be on a symmetric U-shaped ray average cost curve and disallows other possibilities, such as an average cost curve that falls up to some level and remains constant thereafter.

Given the limitations of the ordinary translog model (see Section 4.7.8 of Chapter 4 for a further critique of the approach) the rest of this chapter will only discuss results obtained from estimation of the hybrid translog cost function. However, the results obtained from the ordinary translog cost function are generally consistent with the hybrid model, and are reported in Appendix 3.

Table 8.5 A Comparison of the economies of scale results using  
the ordinary and hybrid translog methodologies

Ordinary Translog Form		Hybrid Translog Form
Branch Level	Results	Results
France	Economies of scale at all outputs	Same apart from output > \$5 bil.
Germany	Economies of scale at all outputs	Economies of scale for biggest banks > \$5 bil. and \$100-300 mil.
Italy	Economies of scale at all outputs	Economies of scale for largest banks over \$1 bil.
Spain	Economies of scale at all outputs	Economies of scale up to \$ 1 bil. and constant scale after
Firm Level	Results	Results
France	Constant returns to scale everywhere	Constant returns to scale everywhere
Germany	Diseconomies of scale everywhere	Diseconomies of scale everywhere
Italy	Constant returns to scale everywhere	Constant returns to scale everywhere
Spain	Constant returns to scale everywhere	Economies of scale everywhere

### 8.3.1 Partial Scale Economies

Partial scale economies (*PSE*) show each output's contribution to the overall scale economies, since the sum of the partial scale elasticities specifies the overall scale economies. Tables 8.6a to 8.6d reveal partial scale economies estimates, together with the approximate standard errors for the French, German, Italian and Spanish banking markets respectively. Partial economies of scale for both outputs, total loans and total securities, are generally significant for all countries at the branch and firm levels. Total securities ( $Q_2$ ) have a lower cost elasticity than total loans ( $Q_1$ ) for all size bands (except for German banks with assets of more than \$5 billion) at both the firm and branch level. It is also noteworthy that for total securities the values of the partial scale economies increase with bank size, especially for larger Spanish and French banks. This may be because larger Spanish and French banks invest more heavily in government and corporate securities than their smaller counterparts (Lafferty Business Research, 1993).

Table 8.6a Partial economies of scale for French banks<sup>a</sup>

Total Assets Sizes (\$ mil)	Branch		Firm	
	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>1</sub>	Q <sub>2</sub>
0 - 100	0.4815* (0.0853)	0.0870 (0.0643)	0.6030* (0.0687)	0.2896* (0.0847)
100 - 300	0.5026* (0.0923)	0.1068 (0.0689)	0.5711* (0.0800)	0.4065* (0.0926)
300 - 600	0.4365* (0.0980)	0.1217 (0.0779)	0.5849* (0.0920)	0.4037* (0.1036)
600 - 1000	0.5083* (0.1055)	0.1311 (0.0832)	0.6079* (0.1008)	0.4209* (0.1121)
1000 - 3000	0.4929* (0.1096)	0.2063** (0.0948)	0.5633* (0.1192)	0.5088* (0.1263)
3000 - 5000	0.4821* (0.1156)	0.2241** (0.1039)	0.5616* (0.1325)	0.5431* (0.1376)
5000 <	0.4553* (0.1370)	0.2386*** (0.1300)	0.6096* (0.1719)	0.5696* (0.1701)
All	0.4735* (0.1059)	0.1589*** (0.0882)	0.5858* (0.1081)	0.4558* (0.1173)

<sup>a</sup> Approximate standard error in parentheses.

\* Significant at 0.01 level.

\*\* Significant at 0.05 level.

\*\*\* Significant at 0.10 level.

Q<sub>1</sub> = Total Loans

Q<sub>2</sub> = Total Securities



Table 8.6b Partial economies of scale for German banks<sup>a</sup>

Total Assets Sizes (\$ mil)	Branch		Firm	
	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>1</sub>	Q <sub>2</sub>
0 - 100	0.7071* (0.1136)	0.1375 (0.0989)	2.0217* (0.0873)	0.8314* (0.0875)
100 - 300	0.6221* (0.1260)	0.0827 (0.1093)	2.2056* (0.0661)	0.8491* (0.0780)
300 - 600	0.6406* (0.1317)	0.1165 (0.1161)	2.1480* (0.0583)	0.9982* (0.0690)
600 - 1000	0.6011* (0.1394)	0.1317 (0.1248)	2.2002* (0.0501)	1.0882* (0.0664)
1000 - 3000	0.4618* (0.1427)	0.2588*** (0.1344)	2.2040* (0.0477)	1.1018* (0.0701)
3000 - 5000	0.3362** (0.1530)	0.3659** (0.1488)	2.1734* (0.0493)	1.1437* (0.0805)
5000 <	0.2271 (0.1666)	0.3997** (0.1611)	2.3314* (0.0611)	1.1164* (0.0832)
All	0.4482* (0.1449)	0.2570*** (0.1342)	2.2213* (0.0466)	1.0716* (0.0683)

<sup>a</sup> Approximate standard error in parentheses.

\* Significant at 0.01 level.

\*\* Significant at 0.05 level.

\*\*\* Significant at 0.10 level.

Q<sub>1</sub> = Total Loans

Q<sub>2</sub> = Total Securities

Table 8.6c Partial economies of scale for Italian banks<sup>a</sup>

Total Assets Sizes (\$ mil)	Branch		Firm	
	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>1</sub>	Q <sub>2</sub>
0 - 100	0.8265 <sup>*</sup> (0.2119)	0.1476 (0.2073)	0.8556 <sup>*</sup> (0.1076)	0.2302 <sup>***</sup> (0.1243)
100 - 300	0.6774 <sup>*</sup> (0.2433)	0.1388 (0.2724)	0.8545 <sup>*</sup> (0.2021)	0.1435 (0.3099)
300 - 600	0.6320 <sup>**</sup> (0.2617)	0.1469 (0.3157)	0.8357 <sup>*</sup> (0.2670)	0.1711 (0.3621)
600 - 1000	0.6119 <sup>**</sup> (0.2825)	0.1180 (0.3462)	0.8522 <sup>*</sup> (0.3114)	0.1535 (0.3979)
1000 - 3000	0.5503 <sup>***</sup> (0.3038)	0.0804 (0.3762)	0.8803 <sup>**</sup> (0.3553)	0.1311 (0.4330)
3000 - 5000	0.5319 (0.3362)	0.0387 (0.4250)	0.9031 <sup>**</sup> (0.4265)	0.1101 (0.4899)
5000 <	0.4403 (0.3816)	0.0117 (0.5066)	0.9015 <sup>**</sup> (0.5468)	0.1178 (0.5857)
All	0.6273 <sup>**</sup> (0.2729)	0.1148 (0.3254)	0.8584 <sup>*</sup> (0.2804)	0.1423 (0.3731)

<sup>a</sup> Approximate standard error in parentheses.

<sup>\*</sup> Significant at 0.01 level.

<sup>\*\*</sup> Significant at 0.05 level.

<sup>\*\*\*</sup> Significant at 0.10 level.

Q<sub>1</sub> = Total Loans

Q<sub>2</sub> = Total Securities

Table 8.6d Partial economies of scale for Spanish banks<sup>a</sup>

Total Assets Sizes (\$ mil)	Branch		Firm	
	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>1</sub>	Q <sub>2</sub>
0 - 100	0.2812* (0.0552)	0.1008 (0.0708)	0.3163* (0.0467)	0.1110*** (0.0669)
100 - 300	0.2511* (0.0954)	0.0715 (0.1032)	0.2489* (0.0513)	0.1599** (0.0706)
300 - 600	0.2614** (0.1247)	0.0944 (0.1307)	0.2658* (0.0543)	0.2084* (0.0733)
600 - 1000	0.2691*** (0.1623)	0.0822 (0.1668)	0.2760* (0.0583)	0.2544* (0.0775)
1000 - 3000	0.2769 (0.2057)	0.1091 (0.2096)	0.2882* (0.0624)	0.3139* (0.0828)
3000 - 5000	0.2893 (0.2425)	0.1588 (0.2469)	0.3255* (0.0687)	0.4063* (0.0918)
5000 <	0.2855 (0.3092)	0.1491 (0.3158)	0.2953* (0.0773)	0.4434* (0.1041)
All	0.2678* (0.1612)	0.1016 (0.1656)	0.2773* (0.0580)	0.2584* (0.0772)

<sup>a</sup> Approximate standard error in parentheses.

\* Significant at 0.01 level.

\*\* Significant at 0.05 level.

\*\*\* Significant at 0.10 level.

Q<sub>1</sub> = Total Loans

Q<sub>2</sub> = Total Securities

### 8.3.2 Product Specific Economies of Scale

Product specific economies of scale are evaluated by using the average incremental cost (*AIC*) concept, which involves calculation how much total cost increases when an output is produced at a specific level rather than not being produced at all. Product-specific economies of scale exist when the calculated value is greater than one, while values smaller than one imply product specific diseconomies of scale. Alternatively, returns to scale of product *i* (i.e.  $Q_i$ , Total Loans) are said to be increasing, decreasing or constant as  $PSES_i$  are greater than, less than or equal to unity, respectively.

Following Baumol, Panzar and Willig (1988), table 8.7 shows the hybrid translog estimates of product specific scale economies for both products (total loans and total securities) for the French, German, Italian and Spanish banking markets at the branch and firm levels. Apart from Italian banks, the coefficients for both loans and securities at both the branch and firm levels are greater than unity, suggesting increasing returns to scale specific to both products. These results imply that banks in France, Germany and Spain would gain, from a cost standpoint, by increasing their output of loans and securities simultaneously. The findings appear to be consistent with those of Glass and McKillop (1992), who find increasing returns to specific loans for Irish banking firms. Moreover, Mester (1987b) found evidence of increasing returns to scale for loans for *US* Saving and Loans Associations.

Table 8.7 Product specific economies of scale

Products	France		Germany		Italy		Spain	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
Total Loans	1.3633	1.8002	1.3006	1.5666	1.2701	0.8645	2.4113	2.1357
Total Securities	3.2431	3.2086	2.6253	2.2572	0.5323	0.4311	2.3931	2.6112

## 8.4 Economies of Scope

An appropriate local test for the existence of economies of scope is to examine pair-wise cost complementarities as explained in Section 6.4 of Chapter 6. To reiterate, following Hall (1973), nonjointness implies that the cost of an output vector may be specified as the sum of separate functions of individual outputs and common input price vectors. Individual outputs could be treated as independent production processes, so that the change in cost for the total output vector of varying one output depends only on that output. If the production technology is nonjoint, the marginal cost of each output is independent of the level of any output. Table 8.8 displays the pair-wise cost complementarity measures at both the branch and firm level for countries, France, Germany, Italy and Spain. If the value is negative, then cost complementarities are said to be present implying economies of scope; a positive value indicates diseconomies of scope; a value equal to zero suggests cost independence. Table 8.8 suggests that pairwise combinations of outputs (Total loans and Total securities) are found to be cost substitutes both at the branch and firm levels for all countries. That is, an increase in the level of one output results in the marginal cost of the other output increasing. Diseconomies of scope therefore appear to be evident across the four banking markets in 1988.

A problem with this calculation, however, is that the test for cost complementarities is a local test at the mean data point. Berger, Hanweck and Humphrey (1987) report that in the case of translog cost functions it is impossible to have cost complementarities at every data point. In other words, at all levels of output, this condition cannot hold.

A more appropriate indicator of economies of scope has been suggested by Willig (1979), who indicates the degree of economies of scope by considering two outputs,  $Q_1$ , and  $Q_2$ , and their separate cost functions,  $TC(Q_1)$  and  $TC(Q_2)$ . The joint cost of producing the two outputs is expressed by  $TC(Q_1, Q_2)$  and the degree of economies of scope can be seen in equation (27) of Chapter Six.  $SC > 0$  or  $SC < 0$  indicates overall economies or diseconomies of scope respectively.

Table 8.8 Pairwise cost complementarities<sup>a</sup>

	Branch	Firm
France	0.1856* (0.03341)	0.0808* (0.02915)
Germany	0.2627* (0.05631)	0.2639* (0.09191)
Italy	0.1582* (0.05114)	0.0453 (0.02807)
Spain	0.0641* (0.02914)	0.0710* (0.02018)

<sup>a</sup> Approximate Standard error in parentheses.

\* Significant at 0.01 level.

\*\* Significant at 0.05 level.

Using Willig's (1979) approach, the evidence of overall scope economies in the four banking markets at the branch and firm is reported in table 8.9. The results are noticeably different both at the branch and firm levels as well as between countries. In the case of French banks, scope estimates are significantly positive both at the plant and firm levels for the larger banks. This means that joint production of loans and securities is less costly than production by different institutions. Small French banks, on the other hand, exhibit significant diseconomies of scope at the branch level. For the German banks there is a mixed picture, with evidence of diseconomies of scope for small and medium sized banks and economies of scope for large banks. For Italian banks, the scope economies estimates are positive and significant only at the branch level. Finally, the findings for Spanish banks indicate that scope coefficients are positive in the small size bands (for banks with assets of less than \$1 billion) but significantly negative for large banks, suggesting diseconomies of scope at this size level.

Table 8.9 Overall economies of scope<sup>a</sup>

Total Assets Sizes (\$ mil)	France		Germany		Italy		Spain	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	-0.3701 (0.4372)	1.8243* (0.5195)	-0.8953*** (0.6260)	-0.8977 (0.8201)	8.3849* (0.2852)	0.4170 (0.4938)	0.4594* (0.1551)	0.4601* (0.1585)
100 - 300	-0.6742 (0.5077)	2.2477* (0.6265)	-0.8485 (0.7642)	-0.9290 (0.9109)	9.0663* (0.4502)	0.8455 (0.9689)	0.6085* (0.1779)	0.6443* (0.1426)
300 - 600	0.8970 (0.5913)	2.8848* (0.7476)	-0.8396 (0.8508)	-0.9697 (0.9537)	21.8734* (0.6810)	1.1869 (1.4515)	-0.6208* (0.2169)	0.6985* (0.1673)
600 - 1000	1.2431*** (0.6605)	3.5653* (0.8333)	-0.7669 (0.9561)	-0.9851 (0.9959)	51.4163* (0.8285)	1.5015 (1.8133)	-0.6628* (0.2571)	-0.7926* (0.1947)
1000 - 3000	3.1460* (0.7525)	3.9012* (1.0461)	-0.7269 (1.0758)	-0.8251 (1.0362)	70.4244* (0.9810)	1.8550 (2.2069)	-0.6657* (0.3050)	-0.8561* (0.2330)
3000 - 5000	8.1490* (0.8365)	4.4159* (1.2137)	-0.2200 (1.2347)	0.2967* (0.1251)	27.0547* (1.2837)	2.4859 (2.9473)	-0.5553*** (0.3424)	-0.9174* (0.3657)
5000 <	12.8940* (1.1051)	6.5692* (1.7577)	4.9881* (1.3806)	0.3797* (0.1839)	97.9571* (1.9765)	3.6811 (4.4636)	-0.6950*** (0.4461)	-0.9431* (0.4783)
All	1.1651*** (0.6910)	3.6018* (0.9146)	-0.6246 (1.0771)	-0.5642 (1.0342)	44.1704* (0.6921)	1.3016 (1.5318)	-0.6837* (0.2511)	-0.7854* (0.1893)

<sup>a</sup> Approximate standard error in parentheses.

\* Significant at 0.01 level.

\*\* Significant at 0.05 level.

\*\*\* Significant at 0.10 level.

## 8.5 Expansion Path Subadditivity

The measurement of the expansion path subadditivity (Berger, Hanweck and Humphrey, 1986, 1987) is a special case of economies of scope which examines whether a bank of a given size can produce a combination of outputs more effectively than two smaller banks which together produce the same combination of outputs. As pointed out in Section 6.5 of Chapter 6, cost subadditivity appears if a single firm could produce at lower cost than any combination of smaller firms. Cost subadditivity is a measure of the relative efficiency of large and small firms and considers both scale and scope economies simultaneously. According to various commentators<sup>4</sup>, expansion path subadditivity is a more appropriate method than traditional scope economy measures for examining the cost structure of banking markets.<sup>5</sup>

Table 8.10 shows the expansion path subadditivity results for the hybrid translog cost function forms, for both branch and firm level estimates. Negative values indicate that a break up of large banks into smaller banks brings about lower costs, whilst positive values suggest the opposite.

In our case, following Berger, Hanweck and Humphrey (1986, 1987), we divide the output of the representative bank in each group into two smaller banks. The size of the first bank is calculated by taking the mean value of bank outputs in the size band immediately below the size band of the representative bank. The size of the second bank is the difference between the size of the first bank and the size of the representative bank. It can be seen that with the exception of the smaller Spanish banks, the estimated coefficients for expansion path subadditivity are positive, implying that breaking large banks into smaller banks results in higher costs. These results are in line with the findings of Hunter et al. (1990) who has shown that costs are subadditive for the largest *US* banks and Noulas et al. (1993) who found that the break up of medium

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<sup>4</sup>See Berger, Hunter and Timme (1993), Noulas, Miller and Ray (1993), Hunter, Timme and Yang (1990) and Berger, Hanweck and Humphrey (1986, 1987).

<sup>5</sup>One reason is because expansion path subadditivity methodology, avoids the problem of having to evaluate a translog cost function when the one of outputs becomes zero.



size *US* banks (in the asset range between \$ 3 and \$ 6 billion) resulted in higher costs, suggesting that there is an incentive for banks to become large.

Table 8.10 Expansion path subadditivity (%)

Total Assets Sizes (\$ mil)	France		Germany		Italy		Spain	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	0.0399	0.0635	0.0282	0.3328	0.4935	0.5132	-0.0305	0.0321
100 - 300	0.0290	0.4627	0.0828	0.6359	0.6408	0.6137	-0.0295	-0.0282
300 - 600	0.0745	0.4116	0.0328	0.7732	0.7143	0.6850	0.0641	0.2238
600 - 1000	0.2013	0.5361	0.1892	0.8557	0.7748	0.7295	0.1373	0.3547
1000 - 3000	0.4369	0.6574	0.3998	0.9266	0.8014	0.7535	0.1753	0.4604
3000 - 5000	0.8092	0.7213	1.0492	0.9569	0.8499	0.7835	0.1505	0.5443
5000 <	8.5531	0.5333	4.1264	0.9963	0.8367	0.7691	0.0300	0.6029
All	0.0062	0.0215	0.0064	0.0438	0.3326	0.3303	0.0036	0.0010

## 8.6 Elasticities of Substitution

If a bank knows the value of its elasticities of substitution and the own price elasticities of inputs, the banking institution may be able to substitute a less expensive input for a more expensive one and therefore reduce total costs. Tables 8.11a to 8.11d report the Allen partial elasticities of substitution, which have been computed at the branch and firm level for French, German, Italian and Spanish banks, and the corresponding approximate standard errors.

Several comments should be made concerning the estimated results for elasticities of substitution. The model indicates that in most cases there is substitutability between all pairs of variable inputs, although the extent of substitutability is much greater between the physical inputs (i.e. labour and capital). Noulas et al. (1990) reported similar results for his study on large *US* banks. The main exceptions to this are in Italy where various inputs appear to be complementary at the branch level and in Spain and Germany where labour and deposit inputs are complementary in certain cases at the firm level.

Table 8.11a Elasticities of substitution between pairs of inputs for French banks<sup>a</sup>

Total Assets Sizes (\$ mil)	Labour-Deposits		Labour-Capital		Deposits-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	0.1037* (0.0510)	0.9311 (0.1038)	1.6734* (0.0227)	1.9657* (0.0228)	1.3162* (0.0222)	0.8239* (0.0070)
100 - 300	0.6653* (0.0994)	0.9340 (0.0996)	1.6398* (0.0194)	1.9176* (0.0195)	1.3326* (0.0710)	0.8148* (0.0224)
300 - 600	0.6221* (0.1122)	0.9254 (0.1124)	3.0788* (0.0310)	3.9812* (0.0311)	1.4315* (0.0208)	0.7596* (0.0066)
600 - 1000	0.6152* (0.1143)	0.9241 (0.1145)	3.3011* (0.0098)	4.2999* (0.0099)	1.4510* (0.0790)	0.7488* (0.0250)
1000 - 3000	0.6082* (0.1164)	0.9227 (0.1166)	3.3976* (0.0192)	4.4383* (0.0193)	1.4540* (0.0879)	0.7471* (0.0278)
3000 - 5000	0.6054* (0.1172)	0.9221 (0.1174)	3.2026* (0.0003)	4.1587* (0.0003)	1.4265* (0.0058)	0.7624* (0.0018)
5000 <	0.4884* (0.1520)	0.8990 (0.1522)	3.9029* (0.0256)	5.1630* (0.0256)	1.3912* (0.0156)	0.7821* (0.0049)
All	0.6293* (0.1101)	0.9269 (0.1103)	2.5674* (0.0241)	3.2478* (0.0241)	1.3754* (0.0835)	0.7909* (0.0264)

<sup>a</sup> Approximate standard error in parentheses.

\* Significantly different from one at 0.01 level.

\*\* Significantly different from one at 0.05 level.

\*\*\* Significantly different from one at 0.10 level.

Table 8.11b Elasticities of substitution between pairs of inputs for German banks<sup>a</sup>

Total Assets Sizes (\$ mil)	Labour-Deposits		Labour-Capital		Deposits-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	2.1869* (0.0362)	0.2781* (0.0405)	1.2921* (0.0382)	1.3348* (0.0440)	3.0507* (0.0490)	0.0674* (0.0510)
100 - 300	2.1642* (0.0355)	0.2919* (0.0398)	1.6439* (0.0055)	1.7380* (0.0063)	2.7317* (0.0114)	0.2125* (0.0118)
300 - 600	2.1632* (0.0354)	0.2925* (0.0397)	1.7806* (0.0234)	1.8947* (0.0269)	2.8426* (0.0432)	0.1620* (0.0450)
600 - 1000	2.2112* (0.0369)	0.2633* (0.0414)	1.7245* (0.0160)	1.8304* (0.0185)	2.7114* (0.0056)	0.2217* (0.0058)
1000 - 3000	2.1841* (0.0361)	0.2798* (0.0404)	1.8703* (0.0351)	1.9975* (0.0405)	2.8853* (0.0015)	0.1426* (0.0016)
3000 - 5000	2.1394* (0.0347)	0.3069* (0.0389)	2.1666* (0.0345)	0.3372* (0.0398)	3.2968* (0.0117)	-0.0446* (0.0122)
5000 <	2.6516* (0.0503)	0.2048* (0.0564)	4.9336* (0.0027)	5.5086* (0.0031)	4.5609* (0.0507)	-0.6194* (0.0528)
All	2.2165* (0.0371)	0.2601* (0.0416)	2.0702* (0.0219)	2.2266* (0.0252)	3.0181* (0.0396)	0.0822* (0.0412)

- <sup>a</sup> Approximate standard error in parentheses.
- \* Significantly different from one at 0.01 level.
- \*\* Significantly different from one at 0.05 level.
- \*\*\* Significantly different from one at 0.10 level.

Table 8.11c Elasticities of substitution between pairs of inputs for Italian banks\*

Total Assets Sizes (\$ mil)	Labour-Deposits		Labour-Capital		Deposits-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	-0.1067* (0.0395)	0.5587* (0.1030)	2.8965* (0.1568)	4.1913* (0.1768)	-0.1176* (0.2021)	2.3970* (0.2121)
100 - 300	-0.1089* (0.0396)	0.5578* (0.1032)	2.4081* (0.1164)	3.3695* (0.1364)	-0.4810* (0.2678)	2.8512* (0.2668)
300 - 600	-0.1038* (0.0395)	0.5598* (0.1027)	2.4307* (0.1183)	3.4075* (0.1483)	-0.4625* (0.2645)	2.8281* (0.2641)
600 - 1000	-0.1710* (0.0418)	0.5330* (0.1089)	2.1901* (0.0984)	3.0026* (0.1084)	-0.5175* (0.2744)	2.8969* (0.2745)
1000 - 3000	-0.2094* (0.0432)	0.5177* (0.1126)	2.0184* (0.0842)	2.7137* (0.1142)	-0.2597* (0.2278)	2.5746* (0.2277)
3000 - 5000	-0.3053* (0.0467)	0.4795* (0.1215)	1.8860* (0.0733)	2.4910* (0.1233)	-0.3640* (0.2466)	2.7050* (0.2336)
5000 <	-0.8151* (0.0649)	0.2762* (0.1689)	1.4815* (0.0397)	1.8102* (0.1395)	-0.1014* (0.1625)	2.1233* (0.1732)
All	-0.1491* (0.0411)	0.5418* (0.1069)	2.1859* (0.0981)	2.9956* (0.1218)	-0.2465* (0.2254)	2.5582* (0.2189)

\* Approximate standard error in parentheses.

\*\* Significantly different from one at 0.01 level.

\*\*\* Significantly different from one at 0.05 level.

\*\*\*\* Significantly different from one at 0.10 level.

Table 8.11d Elasticities of substitution between pairs of inputs for Spanish banks\*

Total Assets Sizes (\$ mil)	Labour-Deposits		Labour-Capital		Deposits-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	0.3991 (0.8042)	-2.9208 (1.4921)	2.5871* (0.0861)	2.7887* (0.1060)	1.2206 (0.3124)	1.4964 (0.5234)
100 - 300	-0.3457 (1.8011)	-7.7804** (3.3416)	2.8283* (0.0992)	3.0605* (0.1221)	1.3349 (0.4742)	1.7534 (0.7944)
300 - 600	-1.4855 (3.3264)	-15.2167** (6.1716)	2.8746* (0.1018)	3.1127* (0.1252)	1.5545 (0.7852)	2.2476 (1.3155)
600 - 1000	-0.1422 (1.5287)	-6.4527*** (2.8363)	2.6875* (0.0916)	2.9018* (0.1127)	1.3271 (0.4632)	1.7360 (0.7761)
1000 - 3000	-0.9770 (2.6459)	-11.8991** (4.9090)	2.4826* (0.0805)	2.6708* (0.0990)	1.6432 (0.9108)	2.4472 (1.5260)
3000 - 5000	-1.5253 (3.3798)	-15.4768** (6.2706)	2.4671* (0.0796)	2.6534* (0.0980)	1.8183 (1.1588)	2.8412 (1.9415)
5000 <	-0.8048 (2.4155)	-10.7759** (4.4816)	2.4103* (0.0765)	2.5894* (0.0942)	1.6464 (0.9154)	2.4544 (1.5336)
All	-0.4530 (1.9446)	-8.4803** (3.6079)	2.6216* (0.0880)	2.8279* (0.1083)	1.4248 (0.6015)	1.9557 (1.0077)

\* Approximate standard error in parentheses.  
 \* Significantly different from one at 0.01 level.  
 \*\* Significantly different from one at 0.05 level.  
 \*\*\* Significantly different from one at 0.10 level.

Tables 8.12a to 8.12d present the own and cross-partial price elasticities of input demands for the French, German, Italian and Spanish banking industries, respectively. It can be seen that the own price elasticities have the correct negative signs across all banks' output ranges for both plant level and firm level estimates as well as the ordinary and hybrid forms. The own price elasticities of labour for the Spanish and French banks at the firm level are greater than one in absolute terms. This suggests that labour input demands in these countries banking systems are elastic. In contrast, our findings for Italy and Germany for both functional forms suggest that labour inputs price are inelastic. Moreover, the own-price elasticity of deposits seems to be inelastic in every case. Capital input demands appear to be elastic for Italian and French banks at both the branch and firm level. In Germany capital input demands are only elastic at the branch level, while in Spain they are inelastic at both the branch and firm level.

Table 8.12a Own and cross-partial elasticities of input demands for  
French banks

Total Assets Sizes (\$ mil)	Labour- Labour		Labour-Deposit		Labour-Capital		Deposit- Deposit		Deposit-Capital		Capital-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	-0.74	-0.94	0.32	0.46	0.42	0.49	-0.50	-0.45	0.33	0.21	-1.08	-0.92
100 - 300	-0.72	-0.91	0.32	0.44	0.40	0.47	-0.51	-0.46	0.33	0.20	-1.09	-0.93
300 - 600	-0.83	-1.16	0.44	0.65	0.40	0.50	-0.29	-0.25	0.18	0.10	-1.53	-1.20
600 - 1000	-0.84	-1.18	0.44	0.67	0.39	0.51	-0.29	-0.24	0.17	0.09	-1.57	-1.23
1000 - 3000	-0.84	-1.19	0.44	0.67	0.40	0.52	-0.27	-0.23	0.17	0.09	-1.59	-1.24
3000 - 5000	-0.84	-1.19	0.43	0.66	0.41	0.53	-0.27	-0.24	0.18	0.10	-1.53	-1.20
5000 <	-0.88	-1.35	0.38	0.68	0.51	0.68	-0.24	-0.21	0.18	0.10	-1.50	-1.19
All	-0.82	-1.12	0.42	0.62	0.40	0.50	-0.33	-0.29	0.21	0.12	-1.39	-1.11

Table 8.12b Own and cross-partial elasticities of input demands for  
German banks

Total Assets Sizes (\$ mil)	Labour- Labour		Labour-Deposit		Labour-Capital		Deposit- Deposit		Deposit-Capital		Capital-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	-0.28	-0.45	0.77	0.10	0.34	0.35	-0.74	-0.13	0.81	0.02	-1.56	-0.54
100 - 300	-0.22	-0.50	1.22	0.16	0.32	0.33	-0.86	-0.11	0.53	0.04	-1.94	-0.54
300 - 600	-0.20	-0.50	1.30	0.18	0.30	0.32	-0.44	-0.09	0.48	0.03	-2.12	-0.53
600 - 1000	-0.20	-0.50	1.30	0.16	0.32	0.34	-0.46	-0.10	0.50	0.04	-1.98	-0.59
1000 - 3000	-0.18	-0.49	1.36	0.28	0.30	0.32	-0.42	-0.08	0.46	0.02	-2.20	-0.52
3000 - 5000	-0.17	-0.49	1.43	0.20	0.27	0.29	-0.36	-0.06	0.40	0.01	-2.65	-0.46
5000 <	-0.21	-0.35	2.17	0.00	0.32	0.36	-0.22	-0.04	0.29	0.04	-4.31	-0.14
All	-0.15	-0.49	1.46	0.17	0.29	0.31	-0.38	-0.06	0.43	0.01	-2.40	-0.50



Table 8.12c Own and cross-partial elasticities of input demands for  
Italian banks

Total Assets Sizes (\$ mil)	Labour- Labour		Labour-Deposit		Labour-Capital		Deposit- Deposit		Deposit-Capital		Capital-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	-0.17	-0.62	-0.07	0.29	0.22	0.32	0.05	-0.41	-0.01	0.19	-1.08	-2.92
100 - 300	-0.15	-0.48	-0.04	0.22	0.19	0.26	0.10	-0.52	-0.04	0.22	-1.08	-2.90
300 - 600	-0.15	-0.49	-0.10	0.56	0.19	0.27	0.09	-0.51	-0.04	0.22	-1.08	-2.91
600 - 1000	-0.13	-0.45	-0.06	0.19	0.19	0.28	0.14	-0.55	-0.04	0.25	-1.06	-2.71
1000 - 3000	-0.14	-0.85	-0.07	0.18	0.21	0.28	0.14	-0.55	-0.03	0.27	-1.02	-2.38
3000 - 5000	-0.12	-0.42	-0.09	0.14	0.21	0.40	0.22	-0.58	-0.04	0.30	-1.00	-2.28
5000 <	-0.14	-0.46	-0.19	0.06	0.32	0.28	0.43	-0.62	-0.02	0.47	-0.83	-1.49
All	-0.15	-0.49	-0.06	0.21	0.21	0.31	0.10	-0.52	-0.02	0.24	-1.03	-2.54

Table 8.12d Own and cross-partial elasticities of input demands for Spanish banks

Total Assets Sizes (\$ mil)	Labour- Labour		Labour-Deposit		Labour-Capital		Deposit- Deposit		Deposit-Capital		Capital-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	-1.81	-1.65	-0.04	-0.29	1.77	1.91	-0.92	-0.37	0.84	1.02	-0.69	-0.76
100 - 300	-2.17	-1.96	-0.02	-0.41	2.19	2.37	-0.97	-0.01	1.03	1.36	-0.56	-0.62
300 - 600	-2.28	-2.05	-0.05	-0.46	2.32	2.51	-1.02	-0.64	1.26	1.82	-0.51	-0.57
600 - 1000	-2.01	-1.82	-0.01	-0.36	2.02	2.18	-0.97	-0.05	1.00	1.30	-0.59	-0.66
1000 - 3000	-1.84	-1.67	-0.03	-0.33	1.87	2.01	-1.02	-0.77	1.24	1.84	-0.59	-0.66
3000 - 5000	-1.84	-1.67	-0.03	-0.34	1.87	2.01	-1.04	-1.25	1.38	2.15	-0.58	-0.65
5000 <	-1.75	-1.60	-0.02	-0.31	1.77	1.90	-1.02	-0.74	1.21	1.80	-0.62	-0.68
All	-1.97	-1.79	-0.02	-0.36	1.99	2.15	-0.99	-0.20	1.08	1.48	-0.58	-0.65

## 8.7 Conclusions

This chapter examines the cost structure of four EU banking markets using the ordinary and hybrid translog cost functions. The results suggest that there are significant noticeable differences in cost structure across the French, German, Italian and Spanish banking markets. However, scope and scale economies seem to be evident in each country over a wide range of bank output levels and especially for the largest banks. Our findings can be summarised as follows:

- (1) Using the ordinary translog cost function, branch level economies of scale tend to be evident for all output ranges across the French, German, Italian and Spanish banking markets. At the firm-level there appear to be constant returns to scale for the French, Italian and Spanish banking industries. Diseconomies of scale, however, seem to exist at the firm-level for German banks across all outputs.
- (2) For the hybrid translog cost function, at the firm level scale economies are only found for all sizes of banks in Spain. French and Italian banks exhibit constant returns to scale and the German banks experience diseconomies of scale for all output ranges. In contrast to these firm-level findings economies of scale are more evident at the branch level. Branch-level scale economies appear in all output ranges for French banks apart from those with more than \$ 5 billion assets. They occur for Italian banks with asset of more than \$ 1 billion and for German banks with assets between \$ 100 million to \$ 300 million and greater than \$ 5 billion. Product specific economies of scale also appear to be evident in each case.
- (3) Firm level economies of scope are evident in French banking at all output ranges, but for the other countries our findings are mixed. In Germany banks with assets greater than \$ 3 billion appear to have firm level scope economies but these are not statistically significant; nor are they for Italian banks. In Spain we find evidence of significant diseconomies of scope for banks with assets greater than \$ 600 million. At the branch level economies of scope are more

prevalent and we find strong economies of scope for large French and German banks as well as for all Italian banks. Branch-level diseconomies of scope are found for the smaller French, German and Spanish banks. From the above we conclude that scope economies are more prevalent at the branch level than at the overall firm level.

- (4) Expansion path subadditivity estimates suggest that the break-up of large banks into smaller banks will bring about higher costs, except for small Spanish banks with assets of less than \$ 300 millions. These results are in line with the findings of Hunter et al. (1990) who shows that costs are subadditive for the largest US banks and Noulas et al. (1993) who finds that the break up of medium-sized US banks, with assets between \$3 and \$6 billion, results in higher costs, suggesting a tendency for banks to become larger.

Overall, these results suggest noticeable differences in cost characteristics across European banking markets and 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 increasing the average size of established banks' branches rather than through adding new branches. It also appears that scale and scope economies will be important in generating economic gains to EU banking markets under the Single Market programme. The cost advantages to be had through larger bank size (mainly by increasing the average size of established branches) could also further promote the consolidation trend leading to increased concentration in European banking markets.

## **CHAPTER 9**

### **THE COST IMPLICATIONS OF HYPOTHETICAL BANK MERGERS WITHIN AND ACROSS COUNTRIES**

#### **9.1 Introduction**

This chapter examines the potential for efficiency gains and cost savings resulting from hypothetical bank mergers both within the French, German, Italian and Spanish banking markets and across their national boundaries. The approach adopted is similar to that of Shaffer (1993) where bank mergers are simulated and then hypothetical inputs and outputs for the merged institutions are put back into the estimated cost functions and predicted total costs are calculated for the hypothetically merged bank. These costs are then compared with the sum of the original predicted total costs for the individual banks which have been hypothetically merged. If the total costs for the hypothetically merged bank are less than those for the sum of the unmerged original banks then there is a hypothetical cost saving brought about by merger. The within country merger simulations are based on use the hybrid translog cost functions already estimated in this thesis (See Chapter 8), whereas for the hypothetical European cross border bank mergers we have to estimate a new cost function.

This chapter is organised as follows. Section 9.2 briefly describes the recent merger movement in banking markets. Section 9.3 summarises the motives for merger in banking markets. Previous literature on bank mergers will be surveyed in section 9.4. Section 9.5 outlines our methodology and discusses the merger simulation. The empirical results are reported in section 9.6. Section 9.7 discusses possible shortcomings of the analysis and Section 9.8 reports the conclusions.

#### **9.2 Brief Overview of the Recent Merger Movement in Banking Markets**

Over the last three decades, business has become increasingly global. In the manufacturing industry, development costs for products such as microchips, new drugs,

automobiles, and planes are so high that companies must serve worldwide markets to cover fixed costs, whilst economies of scale in production speed up the need for worldwide operations. Thus, as manufacturing and trade become global, service industry firms have been forced to become bigger, thus stimulating mergers within and across national boundaries.

During the 1980s, European banking and financial services markets have experienced major structural changes, including a significant reduction in the number of independent banking institutions. This change has partly been the result of the increased pace of bank mergers and acquisitions (See Bank of England, 1993; Lafferty Business Research, 1993; Molyneux, 1991; Revell, 1987 and 1991; Rhoades, 1986; Srinivasan, 1992). For instance, between 1984 and 1987 the annual averages were 99 deals in the banking sector and 42 in insurance (Lafferty Business Research, 1993). However, in 1988 these figures almost doubled. Roughly half of the European banking deals were between institutions in their own domestic markets, and a quarter each were attributable to intra-Community and other international deals. Within the European Union, Table 9.1 shows that there was a considerable increase in both the number of domestic bank mergers and acquisitions of minority holdings during the late 1980s (Lafferty Business Research, 1993). As a result of the slow progress made by the EU Commission in securing a single market for insurance, however, there had been relatively fewer significant domestic insurance mergers by the late 1980s.

Substantial increases in cross-border activity within the EU was one of the most important characteristics of the restructuring process undergone by financial institutions during the late 1980s (Lafferty Business Research, 1993). Table 9.2 shows that the number of cross-border acquisitions in banking and insurance increased in the years between 1986 and 1990. Banking merger and acquisition activity revealed a gradual increase, whereas in the insurance sector the trend was less consistent<sup>1</sup>.

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<sup>1</sup>During the two decades from 1960 to 1979, US bank mergers averaged 170 per year, with an average of \$4.9 billion in total bank assets being acquired each year. In the period between 1980 and 1989 there was a yearly average of 498 mergers and \$64.4 billion in total bank assets acquired (Rhoades, 1985; LaWare, 1991). In addition, the total number of U.S. banking organisations decreased gradually throughout the 1980s. In 1980, there were 14737 banking organizations; by 1984, 14500; and in 1990, about

Table 9.1 Domestic banking mergers in the EU 1986-1990  
(including acquisitions of majority holdings)

Year	No. of Mergers
1986-87	22
1987-88	53
1988-89	51
1989-90	65

Source: Lafferty Business Research (1993), *Financial Revolution in Europe II: The Revolution Deepens and Widens*, (Lafferty Publications Ltd: Dublin).

Many of these mergers have been driven by new kinds of economic pressures and by the lifting of restrictive regulations that had previously isolated banks from competition. By far the most important structural change has been the introduction of the EU's Single Market Programme, which has generated both defensive and offensive strategies. Firstly, financial institutions are strengthening defensively their home position in order to meet the competitive challenges arising from other domestic and foreign contenders. Secondly, many institutions have taken advantage of the more liberal environment by expanding offensively into foreign markets. With the advent of the single market in financial services, there has been a tendency for financial institutions to increase their size to match the larger "European Single Market". The onset of financial liberalisation and deregulation throughout the world and the Single Market Programme in Europe have led to an increase in the number of institutions merging either within domestic markets or across potential borders. Perhaps, the most significant structural change affecting European banking has been the trend towards abolition of exchange control regulations. Other important changes have included the removal of legal barriers and administrative regulations, allowing mergers, acquisitions and other alliances to take place, both within domestic markets and across national frontiers. Continuing economic and deregulatory forces will perhaps prompt further mergers during the 1990s.

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12300, a 15 percent decline in numbers of banks from 1980 (LaWare, 1991; Boyd and Graham, 1991).

Table 9.2 Cross-border banking mergers and acquisitions  
in the EU 1986-1990

Year	No. of Mergers	
	Within EU Institutions	EU and Non-EU Institutions
1986-87	3	10
1987-88	12	13
1988-89	16	16
1989-90	23	25
Total	54	64

Source: Lafferty Business Research (1993), *Financial Revolution in Europe II: The Revolution Deepens and Widens*, (Lafferty Publications Ltd: Dublin).

Changes in legislation, regulation, and competition in banking as well as general economic conditions have affected the profitability of European banks in recent years, and therefore this viability, leading them to fail or be forced to combine with financially stronger and better-managed institutions. Hempel and Simonson (1991) suggest that there are three main forces at work in developed bank markets;

1. Banks face new competition from both financial and non-financial firms. Thrift institutions can offer services and compete with banks' transaction accounts and traditional bank lending markets. Moreover, a number of types of nondeposit firms compete with banks in the production of financial services, such as mutual funds.
2. Banks and thrift institutions have lost their monopoly on offering consumer savings accounts. In Europe, interest rates on consumer time and savings accounts have been deregulated. Banks have had to offer interest-bearing accounts to compete with unregulated and booming money market funds and other investment media. As a result, the growing consumer demand for nonbank investment media, (brought about by low nominal interest rates) has increasingly affected banks profitability.



3. The position of banks as credit-granting intermediaries has been corroded by alternative lower-cost forms of credit extension. Financial markets, especially the commercial paper market and the bond market, increasingly supply credit to borrowers. This direct competition (through the usual forms of disintermediation and securitisation) applies further pressure on banks' profit margins.

### **9.3 Motives for Merging**

There are many reasons why a corporation may wish to merge. This section will only discuss which are the most relevant to banks, because a full discussion of this topic lies outside the scope of this thesis. Gitman (1991) and Brigham (1991) have stated that the primary goal of a merger is to maximise the owners' wealth as reflected in the acquirer's share price. Moreover, specific motives, which include benefits such as growth or diversification, synergy, economies from increased managerial skill or technology, tax considerations, increased ownership liquidity, and maintaining control, should only be pursued when these are said to be consistent with owner wealth maximisation. Revell (1987, p.26) lists the following motives for merger:

- a)* to secure unrealised scale and scope economies
- b)* to carry out the rationalisation of branch networks
- c)* to enable the demands of large customers to be met
- d)* to match the size of other banks in international banking
- e)* to meet foreign bank competition in the domestic market
- f)* to achieve economies in investment for automation

Banks that wish to expand may find that a merger can be used to achieve these objectives. Bank expansion may also be less costly through merger than through internal growth or diversification. In addition, a merger may reduce the number of competitors and also help reduce the risk associated with new products. Synergy is said to exist when a whole is greater than the sum of parts ("2 plus 2 equals 5"). The synergistic benefits from bank merger are generally expected to result from four main sources: (a) operating scale economies, generally from cost reductions when two banks are combined; (b) financial economies, that could include a higher price/earning ratio, a

lower cost of debt, or a greater debt capacity; (c) differential management efficiency, which indicates that the management of one firm is relatively inefficient, so the profitability of the acquired assets could be improved by merger; and (d) increased market power resulting from greater market share of merged institutions.

Humphrey (1985) pointed out that although scale and scope economies do not seem to exist for larger US banks, these institutions may merge for the following reasons:

1. Larger banks, in particular the money centre institutions, appear to be able to operate (without strong regulatory interference) using greater leverage *i.e.* cheaper deposits and debt per dollar of (expensive) equity capital.
2. Larger regional and money-centre banks face somewhat lower costs of purchased funds such as Certificate Deposits, federal funds, Eurodollars. They also find it easier to raise large amounts of purchased funds.
3. Larger banks are seemingly better able to diversify their assets and reduce risk. They can offer a broader range of services to customers and play a role in both domestic and international markets.
4. Larger banks have higher levels of executive compensation than their smaller counterparts.

The first three motives (greater leverage, lower cost of purchased funds, and risk and product diversification) should all result in higher profits, and hence represent a logical reason for merging and becoming larger. Of course, this does not apply in the fourth case.

Mergers may bring about improvement in net interest margins, because merged banks may be able to realise economies of scale in holdings of cash (e.g. cash and deposits at other banks) and in securities held as liquid assets. For example, if a smaller organisation is combined with a larger bank, the proportion of short-term securities and other liquid assets might fall since large banks tend to hold lower liquidity ratios than smaller banks. It also may result in external funds being raised at a lower cost. By decreasing holdings of cash and/or securities, management could move funds from non-

or low-interest earning to higher-return assets i.e. from cash to loans and securities.

A larger or dominant bank may have a more aggressive or sophisticated products and services pricing structure for products and services, which might improve both interest and non-interest income. Furthermore, it is also possible that a merger may give rise to a repricing of some types of loans, deposit accounts, and bank services at the acquired bank in an attempt to improve profitability. *Ceteris paribus*, changes in loan and deposit pricing may result in higher net income/assets ratios; and increases in fees (i.e. deposit service charges) may also increase the bank's ratio of noninterest income to assets.

Additionally, mergers may allow the dominant bank to enjoy economies of scope by distributing a range of products through the newly combined network system. This can also improve the ratio of both net interest and non-interest income to assets. On the other hand, a bank merger could potentially reduce non-interest expense/assets by consolidating back office operations and information systems. These economies may result from a reduction in staff numbers, sharing computer hardware and software or/and improving back office productivity. Merging banks could achieve economies of scale in marketing activities e.g. product development and advertising. Merger might also create opportunities to eliminate redundant management positions or to close overlapping branch networks.

## **9.4 Previous Studies**

Studies of bank mergers can be classified into two broad groups of literature. The first group examines the financial implications of actual mergers by analysing financial ratios and stock prices. For exposition purposes we term these the event-day bank merger studies. The second group use cost function analysis to analyse the cost implications of simulated bank mergers. These we call the cost function studies.

### **9.4.1 Event-day Bank Merger Studies**

The majority of studies which investigate bank mergers tend to be of an event-day

nature, where actual mergers are investigated. The studies investigate pre-merger and post-merger financial ratios and stock prices to identify changes in corporate behaviour.

Rhoades (1986) used an extensive US sample of 413 acquired banks and 3600 non-acquired banks, over the years 1968-1984, to examine pre- and post merger performance. The findings provide no indication that the performance of the average acquired firm improved after the merger. His later study (1990) compared a sample of 68 acquired firms and 322 non-acquired large banking organizations (banks with assets exceeding \$1 billion) between 1981-1987 to determine whether acquired firms tend to be poor performers. The results showed that acquired firms were not necessarily poor performers before acquisition and that their post-acquisition performance did not necessarily differ from that of other firms.

Boyd and Graham (1988) analysed the effects of Bank Holding Company (BHC) expansion into prohibited business areas by simulating mergers between actual BHCs and nonbank firms, using data for 249 publicly traded bank and nonbank financial firms during 1971-84. Their merger simulations indicated that when BHCs combine with securities firms or real estate developers, the volatility of returns increased as did the risk of failure, whereas combinations of BHCs and life insurance companies seemed to reduce both the volatility of returns and the risk of failure.

Spindt and Tarhan (1991) analysed the broader issue of the profitability of bank mergers. The authors focused on US bank mergers which occurred in 1986, comparing bank performance two years before and two years after each merger to a matched pair of banks that did not merge over the five-year period, 1984-1988. The results indicate that independent target banks typically under performed the comparison group in the pre-merger period. Spindt and Tarhan also found that the combined institutions generally increased their ROE (return on equity) after merger.

Cornett and Tehranian (1992) examined the post-acquisition performance of large bank mergers between 1982 and 1987. They found that the merged banks experienced greater improvements in their corporate performance than the US banking industry as a whole. This seemed to be due, at least partly, to the merged banks greater ability to attract

loans and deposits per dollar of equity, as well as to the resultant improved employee productivity and assets growth. This study also found significant correlations between the abnormal announcement-period stock returns and various performance measures, indicating that the market anticipates improved performance of the merged bank when acquisitions are announced.

Linder and Crane (1992) examined changes in non-interest expenses for New England bank mergers during the period 1982-87. They found that there was a significant reduction in non-interest expenses as a proportion of total expenses after merger. Their findings also suggested that cost savings did not result in significant increases in operating profits.

Srinivasan and Wall (1992) analysed the impact on operating efficiency of merging bank holding companies. The authors examined the ratio of operating expenses to assets of bank holding companies involved in mergers for the period 1982-86. They found that the operating expense ratios of holding companies involved in any kind of merger started out significantly "more efficient" than a national composite of banking organisations that did not merge during this period. The median operating cost ratios for the "merging" holding companies then rose significantly after the merger and ended up closer to the median of the national composite.

Srinivasan (1992) used the same sample as Srinivasan and Wall (1992) to examine merger-related changes in non-interest expenses for US BHCs. The study focused on the ratio of non-interest expenses to the sum of net interest income and non-interest revenue. The study found that the non-interest expense ratio for the acquirer declined significantly after the merger.

Recently, Rhoades (1993) conducted tests to determine whether there was an increase in efficiency, as measured by various expense-to-assets ratios, of merged banks relative to other banks. This study examined the efficiency effects of a sample of 898 horizontal bank mergers and acquisitions in the US between 1981-1986. Rhoades found that horizontal bank mergers did not have a significant effect on efficiency relative to other banks. Moreover, a greater degree of deposit overlap between merging banks had no

impact on bank efficiency. The results also suggested that, in general, acquiring banks were more efficient than target banks.

Most of the studies cited above conclude that no major benefits occur from merger on the cost side, although Cornett and Tehranian (1992) and Spindt and Tarhan (1991) find various benefits on the revenue or output side.

#### **9.4.2 Cost Function Bank Merger Studies**

Shaffer (1992) estimated a hedonic translog cost function and used the parameters to calculate the cost savings associated with simulated bank mergers. Cost function parameters were estimated for the period 1984-1989 for US banks with assets in excess of \$1 billion. The data in the analysis represented 57 percent of all US banking assets as of 1988. Quarterly Call Reports from March 1984 to June 1989 comprised the source of data, drawing a total of 4426 observations in the pooled cross section-time series dataset. The effect on bank costs of the hypothetical merger is measured by comparing predicted costs of the two banks as unmerged banks with the predicted costs of the merged entity. Shaffer (1992) found that forty-five percent (9198 out of 20503 pairs) of the simulated mergers showed a reduction in costs, with 19 percent (1029 pairs) revealing savings greater than 10 percent. However, the majority of the mergers (11305) were predicted to increase cost, with 1139 of the increases over 10 percent. For the largest bank mergers (with assets size over \$10 billion), 593 pairs showed an increase in cost, of which in 308 pairings the increase in cost exceeded 10 percent. The study also found that an excessive amount of the cost-efficient mergers were estimated to occur for banks which operated interstate. Of 19731 interstate pairs, 8930 (or 45 percent) revealed a reduction in cost. Moreover, 19 percent of these hypothetical mergers (1697 pairs) reduced costs by more than 10 percent. Conversely, 268 of 772 intrastate pairs (35 percent) resulted in a reduction in cost; of these, only 22 pairs (8 percent) showed a reduction. Shaffer pointed out that although there was the potential for cost-effective large mergers, the average intrastate hypothetical merger caused a 1.97 percent increase in the predicted total cost. Overall, the results indicate that there may be a substantial public benefit in allowing interstate branching in the US banking market. His results also indicate that any mergers between large banks should be chosen

carefully on the basis of economic fundamentals, not randomly.

Savage (1991) focused on branch overlaps to help measure the potential cost savings associated with hypothetical mergers leading to branch closures by using US data from 41 large banking organisation. The results of his merger simulations between banks with at least 200 branches suggested that, if the two largest banks in the same state closed one-half of their branches in overlapping markets, then the total number of branches in the United States would be reduced by only 2.7 percent. Savage (1991) concluded that the cost savings that may be achieved by mergers and branch consolidation are relatively small.

Murphy (1992) conducted two merger simulation exercises using a translog cost function with data from the Federal Reserve's Functional Cost Analysis Program in 1987, 1988 and 1989, to examine the magnitude of savings brought about by acquiring a failed-bank deposit franchise and subsequently closing some of the failed banks branches. By simulating mergers between operating and failed banks he showed that the closure of branches, after acquisition, led to a reduction in cost.

Shaffer (1993) extended his earlier study using the stochastic thick frontier approach to simulate the potential effects of scale and product mix, branch closure, and X-efficiency changes arising from hypothetical mergers on bank costs. Shaffer found that the majority of cost-reducing mergers appear to be between high-cost and low-cost banks rather than between banks of equal X-inefficiency.

As far as we are aware there are no European studies on the cost implications of simulated bank mergers. Revell (1987) has reviewed historical merger and acquisitions among core banks in various European countries from 1958 to 1981. His study concluded that beyond a certain point, in the formation of core banks, size was sought for reasons of competitive power. The study also concluded that mergers were far from being a quick, sure way of increasing efficiency. Other studies such as Molyneux (1991) and Bank of England (1993) have examined cross-border activity in European banking markets but have not examined the cost implications of bank mergers. Using our cost function estimates from the previous chapters, we use a similar approach to

Shaffer (1992, 1993), to estimate the cost implications of hypothetical bank mergers in European banking markets.

### **9.5 Methodology and Mergers Simulation**

The following analysis examines hypothetical mergers between banks in four countries: France, Germany, Italy and Spain. We also examine hypothetical mergers across national boundaries.

The present study is based on various simplifying assumptions that also have been adopted by Boyd and Graham (1988) and Shaffer (1992, 1993). It is assumed that the merged bank is simply the sum of two individual banks. Except for input prices, the total assets, loans, securities and branches are consolidated and input prices are taken as the means of those for two individual banks. This approach also assumes that there are no further cost synergies resulting from a restructuring of the product mix and the merged portfolio, and that the hypothetical merger in the model does not shift either bank closer to the production frontier in cases where *ex ante* allocative or technical inefficiency existed. Furthermore, the model also assumes that there are no branch closure by the merged, bank even if both banks are operating in the same market. Obviously, this assumption may cause us to understate the potential reduction in cost. The assumption of no branch closures is probably reasonable for mergers between banks from different countries; however mergers between the largest banks within a domestic market would usually be expected to involve substantial consolidation of overlapping branch networks (See Savage, 1991). Mergers within domestic markets might therefore be expected to reduce cost by a greater proportion than cross-border mergers, because of the potential for rationalisation of overlapping branch networks.

The criteria we use for simulating hypothetical mergers is straightforward. For the domestic market mergers, all banks with assets exceeding \$1 billion in 1988 are hypothetically merged. For instance, in our sample, the number of banks with assets size over \$1 billion are 88, 128, 71 and 84 and the possible number of hypothetical merger cases are 3828, 8128, 2485 and 3486 for France, Germany, Italy and Spain, respectively.



We use the hybrid translog cost functions estimated for France, Germany, Italy and Spain in 1988 (and reported in Appendix 2) to evaluate whether there are cost savings from large bank mergers within those countries. For each hypothetical merger, the sum of predicted costs for the separate unmerged banks (which are calculated by inserting values of regressors from each individual bank into the relevant estimated cost functions) are compared with the predicted costs for the hypothetical merged banks. If the figure for the sum of predicted total costs for the separate banks exceeds the hypothetical post-merger predicted total cost, the model implies that the merger of that given pair, if carried out, would enable a reduction of total costs.

For the hypothetical European cross-border mergers we focus only on European megabanks. We estimate a European hybrid translog cost function (with exactly the same specifications as those for the individual country estimates) using 1988 data on French, German, Italian and Spanish banks combined. The sample is the 371 banks from these countries which have total assets of more than \$1 billion. The descriptive statistics and estimated parameters are shown in Appendix 5. The hypothetical merger simulations are carried out for banks with assets over \$5 billion. The total number of banks amounts to 124, generating 7626 possible hypothetical merged pairings of banks. We identify cost savings resulting from hypothetical mergers in the same way as the country mergers described above.

## **9.6 Results**

### **9.6.1 Results for Individual Countries**

Table 9.3 shows that the average merger yielded a 0.912 percent decrease in the predicted total cost for Spanish banks whereas for France, Germany and Italy, the average merger generated a 2.098, 0.082, 4.585 percent increase in the predicted total cost respectively. These findings are consistent with the economies of scale results reported in the previous chapter.

Table 9.3 Summary statistics for hypothetical mergers

	France	Germany	Italy	Spain
N. of pairs	3828	8128	2485	3486
Mean	2.098	0.082	4.585	-0.912
Minimum	-16.749	-56.695	-3.835	-30.968
Maximum	22.067	72.957	16.054	32.826

Not: A negative value shows cost reduction while positive value indicates cost increasing in percentage.

Table 9.4 shows that in Italy, 93.96 percent of possible pairs (2335 out of 2485 pairs), and in France 67.14 percent of possible pairs (2570 out of 3828 pairs) cause an increase in total costs. However, 56 percent of the possible bank pairings (4552 out of 8128 pairs) in Germany and 52.37 percent of possible bank pairings (1825 out of 3486 pairs) in Spain cause a reduction in total cost. These results illustrate the lack of opportunity for cost savings between larger banks in Italy compared with the other three banking systems.

Table 9.4 Distribution of cost-saving and cost-increasing hypothetical mergers

	France		Germany		Italy		Spain	
	N	%	N	%	N	%	N	%
Cost Saving	1258	32.86	4552	56.0	150	6.04	1825	52.37
Cost Increase	2570	67.14	3576	44.0	2335	93.96	1661	47.63
Total	3828	100	8128	100	2485	100	3486	100

Table 9.5 provides descriptive statistics for all hypothetical bank mergers which yielded cost reductions. The largest cost savings occurred in Germany, followed by Spain,

France and Italy. Substantial cost savings appear to be achievable through hypothetical mergers between megabanks in Germany. Although not shown in the table, the twenty eight German banks in 1988 with assets of more than \$10 billion allow 378 possible pairings, all of which would show a decrease in costs ranging from 0.373 to 42.654 percent. Table 9.6 shows down the number of pairs which have hypothetical cost savings exceeding 5, 10 and 25 percent. In Germany, 57 percent of cost saving pairings (2595 out of 4552 pairs) cause an improvement of more than 10 percent, compared with 44.2 and 8.66 percent (807 and 109 pairs) in Spain and France respectively. No substantial cost savings over 5 or 10 percent appear to occur through hypothetical big-bank mergers in the Italian banking markets. This indicates that cost savings resulting from hypothetical merger appear to be relatively larger in the German and Spanish banking market than in other countries.

Table 9.5 Descriptive statistics on cost saving hypothetical mergers

	France	Germany	Italy	Spain
N. of pairs	1258	4552	150	1825
Mean	4.227	12.688	1.048	9.300
Minimum	0.005	0.004	0.002	0.007
Maximum	16.749	56.695	3.835	30.968

Table 9.6 Distribution of cost saving hypothetical mergers

Reduction in Costs	France		Germany		Italy		Spain	
	N	%	N	%	N	%	N	%
> 25 %	-	-	387	8.50	-	-	12	0.66
> 10 %	109	8.66	2595	57.00	-	-	807	44.22
> 5 %	430	34.18	3622	79.57	-	-	1302	71.35

Tables 9.7a, 9.7b, 9.7c and 9.7d show the hypothetical mergers between large banks in the French, German, Italian and Spanish banking markets respectively which create the largest savings.

For France, the largest cost savings are generated by the merger of the central organisation of two very large mutual and cooperative sectors: Credit Mutual and Groupe des Banques Populaires. Around 3000 local associations operate within the Credit Mutual group. These are organised on a mutual basis, but do not generally specialise by sector. The Banques Populaires also have mutual status although nowadays the activities of these banks are similar to those of commercial banks. The majority of large cost savings are created by hypothetical mergers between these institutions (Credit Mutual and Groupe des Banques Populaires) and smaller specialised private or investment banks. These combinations however, seem unrealistic, given the different ownership characteristics and business mixes of the types of institutions. They do indicate, however, that there are opportunities for substantial cost savings through banks merging, albeit through unusual combinations.

For Germany, there appear to be substantial cost savings resulting from hypothetical bank mergers. These again appear to be generated by markedly different institutions merging. For example, the largest cost saving, 56.695 percent, is created by the hypothetical merger between Sudwestdeutsche Genossenschafts-Zentralbank and SchmidtBank. Sudwestdeutsche Genossenschafts-Zentralbank is a regional credit co-operative institution which operates as a clearing house to co-operative banks, enabling them to provide a universal banking service. SchmidtBank is a private commercial bank which provides banking services to wealthy customers. Both institutions have small branch networks and their businesses are primarily specialist. It is unlikely that a merger between the two institutions would result in the cost savings predicted because their production functions are so different. Other large cost savings result from hypothetical mergers between commercial banks and regional co-operative banks, and between savings and mortgage banks. For example, the hypothetical merger between the sixth largest commercial bank, DG Bank, and Sudwestdeutsche Genossenschafts-Zentralbank generates a 42.654 percent reduction in predicted total cost. Moreover, hypothetical mergers between savings banks (e.g. Stadtsparkasse Munchen, Nassauische

Sparkasse, Sparkasse Krefeld, etc.) and co-operative banks generate substantial cost savings. Savings banks are very important in Germany (rivaling commercial banks) and are mainly municipal or district banks operating in specific geographical areas. Various laws govern the operations of savings banks, which aim to encourage savings and giro transactions, to provide credit for low- and middle-income households and to serve the financial requirements of local communities. Savings banks are also owned primarily by local or regional governments (See Revell, 1987). Other large cost savings results appear for hypothetical mergers between mortgage banks (such as Rheinische Hypothekenbanken) and co-operative banks. In general, the largest cost savings are generated by hypothetical pairings which seem unrealistic in practice although we will show later that hypothetical mergers between the largest German commercial banks also generate substantial cost savings.

Table 9.7a The largest cost savings for French banks mergers

HYPOTHETICAL BANK MERGER PAIRS	CHANGE (%)
CREDIT MUTUEL/GROUPE DES BANQUES POPULARES	16.749
BANQUE STERN <sup>2</sup> /GROUPE DES BANQUES POPULARES	15.985
BANQUE STERN/CREDIT MUTUEL	15.931
CETELEM/GROUPE DES BANQUES POPULARES	15.168
CETELEM/CREDIT MUTUEL	15.159
BANQUE OBC-ODIER BUNGENER/GROUPE DES BANQUES POPULARES	15.112
BANQUE OBC-ODIER BUNGENER/CREDIT MUTUEL	15.103
BANQUE DUMENIL-LEBLE/CREDIT MUTUEL	14.538
BANQUE DUMENIL-LEBLE/GROUPE DES BANQUES POPULARES	14.533
BANQUE FRANCAISE DU COMMERCE EXTERIEUR/CREDIT MUTUEL	14.109
BANQUE FRANCAISE DU COMMERCE EXTERIEUR/GROUPE DES BANQUES POPULARES	14.100
UNION INDUSTRIELLE DE CREDIT/CREDIT MUTUEL	14.060
UNION INDUSTRIELLE DE CREDIT/GROUPE DES BANQUES POPULARES	14.046
BANQUE STERN/CETELEM	13.260
BANQUE STERN/BANQUE OBC-ODIER BUNGENER	12.671
BANQUE OBC-ODIER BUNGENER/CETELEM	12.319
BANQUE FRANCAISE DU COMMERCE EXTERIEUR/BANQUE STERN	12.112
BANQUE FRANCAISE DU COMMERCE EXTERIEUR/CETELEM	11.961
BANQUE FRANCAISE DU COMMERCE EXTERIEUR/BANQUE OBC-ODIER BUNGENER	11.393
CREDISUEZ/CETELEM	11.255

<sup>2</sup>On June 19, 1992 merged with Banque Pallas Farance and name changed to Banque Pallas Stern.

Table 9.7b The largest hypothetical cost savings for German bank mergers

HYPOTHETICAL BANK MERGER PAIRS	CHANGE (%)
SUDWESTDEUTSCHE GENOSSENSCHAFTS-ZENTRALBANK/SCHMIDTBANK	56.695
GENOSSENSCHAFTLICHE ZENTRALBANK-STUTTGART/SCHMIDTBANK	52.697
GENOSSENSCHAFTLICHE ZE.-STUTTGART/SUDWESTDEUTSCHE GENOSSENSCHAFTS-ZETR.	51.324
DG BANK/SUDWESTDEUTSCHE GENOSSENSCHAFTS-ZENTRALBANK	42.654
DG BANK/SCHMIDTBANK	42.096
BODEN-WURTTMDERGISCHEBANK/SUDWESTDEUTSCHE GENOSSENSCHAFTS-ZENTRALBANK	41.928
BADEN-WURTTMDERGISCHEBANK/SCHMIDTBANK	40.737
SUDWESTDEUTSCHE GENOSSENSCHAFTS-ZENTRALBANK/RHEINISCHE HYPOTHEKENBANK	39.626
BADEN-WURTTMDERGISCHEBANK/GENOSSENSCHAFTLICHE ZENTRALBANK-STUTTGART	39.215
STADTSPARKASSE MUNCHEN/SUDWESTDEUTSCHE GENOSSENSCHAFTS-ZENTRALBANK	38.803
NASSAUISCHE SPARKASSE/SUDWESTDEUTSCHE GENOSSENSCHAFTS-ZENTRALBANK	38.548
SPARKASSE KREFELD/SUDWESTDEUTSCHE GENOSSENSCHAFTS-ZENTRALBANK	38.316
SPARKASSE PFORZHEIM/SUDWESTDEUTSCHE GENOSSENSCHAFTS-ZENTRALBANK	38.171
RHEINISCHE HYPOTHEKENBANK/GENOSSENSCHAFTLICHE ZENTRALBANK-STUTTGART	37.759
STADTSPARKASSE MUNCHEN/GENOSSENSCHAFTLICHE ZENTRALBANK-STUTTGART	36.818
NASSAUISCHE SPARKASSE/GENOSSENSCHAFTLICHE ZENTRALBANK-STUTTGART	36.517
STADTSPARKASSE DUSSELDORF/SUDWESTDEUTSCHE GENOSSENSCHAFTS-ZENTRALBANK	36.422
SPARKASSE KREFELD/GENOSSENSCHAFTLICHE ZENTRALBANK-STUTTGART	36.301
SPARKASSE PFORZHEIM/GENOSSENSCHAFTLICHE ZENTRALBANK-STUTTGART	35.992
HAMBURGER SPARKASSE/GENOSSENSCHAFTLICHE ZENTRALBANK-STUTTGART	35.889
SUDWESTDEUTSCHE GENOSSENSCHAFTS-ZENTRALBANK/DRESDNER BANK	35.763

In Italy, the predicted cost savings are relatively small. The largest saving results from a merger between two savings banks: Cassa di Risparmio di Ravenna and Cassa di Risparmio di Verona Vicenza Belluno. Thereafter the cost savings come from hypothetical mergers between commercial banks and savings banks such as Cassa di Risparmio di Ravenna and Banco di Santo Spirito<sup>3</sup>, whose hypothetical merger generates a 3.642 percent reduction in predicted total cost. It is noteworthy that the following banks appear in most cost-saving pairings: Cassa di Risparmio di Ravenna, Cassa di Risparmio di Verona Vicenza-Belluno, Credito Italiano, perhaps implying that these institutions are 'good' merger partners. In most cases it also appears that cost savings are generated by large banks merging with the smaller banks.

Finally, in Spain, it appears that substantial cost savings result from hypothetical mergers between investment banks and savings banks and between pairs of savings banks. The hypothetical merger between the investment banks, Banco de Progreso and the savings banks, Caja de Ahorros y Monte de Del C.C.O de Burgos, results in the largest saving of 30.968 percent, but is perhaps unlikely in reality. Mergers between savings banks such as Caja de Ahorros y Monte de Del C.C.O de Burgos and Caja de Ahorros Provincial de Gerono (26.993 percent cost saving) are perhaps more likely given their similar ownership, business strategy and production characteristics. Hypothetical mergers between commercial banks and savings banks (e.g. Banco de Granada and Caja de Ahorros y Monte de Del C.C.O de Burgos) also brought about noticeable cost savings (29.865 percent).

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<sup>3</sup>On August 1, 1992 merged with Banco di Roma, and the name changed to Banca di Roma.

Table 9.7c The largest hypothetical cost savings for Italian bank mergers

HYPOTHETICAL BANK MERGER PAIRS	CHANGE (%)
CASSA DI RISP DI RAVENNA/CASSA DI RISP DI VERONA VICENZA BELLUNO	3.835
CASSA DI RISP DI RAVENNA/BANCO DI SANTO SPIRITO	3.642
CASSA DI RISP DI RAVENNA/CREDITO ITALIANO	3.608
CASSA DI RISP DI VERONA VICENZA BELLUNO/CREDITO ITALIANO	3.278
BANCO DI SANTO SPIRITO/CASSA DI RISP DI VERONA VICENZA BELLUNO	3.266
BANCO DI SANTO SPIRITO/CREDITO ITALIANO	3.132
CASSA DI RISP DI RAVENNA/BANCA TOSCANA	2.616
CASSA DI RISP DI RAVENNA/BANCA DI CREDITO PIEMONTESE	2.542
BANCA TOSCANA/CASSA DI RISP DI VERONA VICENZA BELLUNO	2.301
BANCA TOSCANA/CREDITO ITALIANO	2.286
BANCA DI CREDITO PIEMONTESE/CASSA DI RISP DI VERONA VICENZA BELLUNO	2.238
BANCA DI CREDITO PIEMONTESE/CREDITO ITALIANO	2.232
CASSA DI RISP DI RAVENNA/CREDITO FONDIARIO E SEZ OPERE PUBBLICHE	2.227
CASSA DI RISP DI RAVENNA/BANCO DI CHIAVARI E DELLA RIVIERA LIGURE	2.187
BANCO DI SANTO SPIRITO/BANCA TOSCANA	2.125
BANCA DI CREDITO PIEMONTESE/BANCO DI SANTO SPIRITO	2.063
CASSA DI RISP DI RAVENNA/CASSA DI RISP DI REGGIO EMILIA	2.017
CREDITO FONDIARIO E SEZ OPERE PUBBLICHE/CREDITO ITALIANO	2.007
CREDITO FONDIARIO E SEZ OPERE PUBBLICHE/CASSA DI- VERONA VICENZA BELLUNO	1.980
BANCO DI CHIAVARI E DELLA RIVIERA LIGURE/CREDITO ITALIANO	1.957

Tables 9.8 and 9.9 present analogous results for cost increasing mergers. Descriptive statistics for hypothetical mergers which generated cost increases are shown for France, Germany, Italy and Spain in table 9.8. For those hypothetical mergers which increased costs, the average increase was much higher in market than elsewhere. Furthermore, as table 9.9 shows, for Germany, 59.84 percent (2140 out of 3576 pairs) of possible pairings exhibit an increase of more than 10 percent, compared with 34.14, 9.92 and 6.90 percent (567, 255 and 161 pairs) in Spain, France and Italy, respectively. Various information, not shown in the tables, is of specific interest. For example, the hypothetical mergers among the nine largest Spanish banks (with assets size over \$10 billion) allow 36 possible pairings, which create cost increases ranging from 4.476 to 23.980 percent. In Germany, over 50 percent of cost increases result from mergers between banks with assets of less than \$10 billion. the size of the hypothetically merged bank increases, the percentage of mergers which increase costs becomes smaller. It seems that in Germany, large bank mergers reduce costs whereas small bank mergers are increase costs.



Table 9.7d The largest hypothetical cost savings for Spanish bank mergers

HYPOTHETICAL BANK MERGER PAIRS	CHANGE (%)
BANCO DE PROGRESO/CAJA DE A. Y M. DE DEL C.C.O. DE BURGOS	30.968
BANCO DE PROGRESO/ BANCO DE GRANADA	29.920
BANCO DE GRANADA/CAJA DE A. Y M. DE DEL C.C.O. DE BURGOS	29.865
BANCO DE PROGRESO/CAJA DE A. PROVINCIAL DE GERONO	27.234
CAJA DE A. Y M. DE DEL C.C.O. DE BURGOS/CAJA DE A. PROVINCIAL DE GERONO	26.993
BANCO DE PROGRESO/CAJA GENERAL DE A. DE CANARIAS	26.864
CAJA DE A. Y M. DE DEL C.C.O. DE BURGOS/CAJA GENERAL DE A. DE CANARIAS	26.603
BANCO DE GRANADA/CAJA DE A. PROVINCIAL DE GERONO	25.816
BANCO DEL COMERCIO/BANCO DE PROGRESO	25.559
BANCO DE GRANADA/CAJA GENERAL DE A. DE CANARIAS	25.438
BANCO DE PROGRESO/BANCO NATWEST ESPANA	25.364
BANCO DEL COMERCIO/CAJA DE A. Y M. DE DEL C.C.O. DE BURGOS	25.217
CAJA DE A. Y M. DE DEL C.C.O. DE BURGOS/BANCO NATWEST ESPANA	24.965
BANCO DE PROGRESO/CAJA DE A. Y MONTE DE PIEDAD DE EXTREMADURA	24.729
BANCO DE PROGRESO/CAJA DE A. DE JEREZ	24.501
CAJA-Y MONTE DE PIEDAD DE EXTREMADURA/CAJA-YM. DE DEL C.C.O. DE BURGOS	24.314
CAJA DE A. DE JEREZ/CAJA DE A. Y M. DE DEL C.C.O. DE BURGOS	24.082
BANCO DEL COMERCIO/BANCO DE GRANADA	24.028
BANCA DE CASTILLA/BANCO DE PROGRESO	23.846
CAJA DE A. DE MURCIA/BANCO DE PROGRESO	23.734

Table 9.8 Descriptive statistics on cost increasing hypothetical mergers

	France	Germany	Italy	Spain
N. of pairs	2570	3576	2335	1661
Mean	5.195	16.335	4.947	8.327
Minimum	0.004	0.001	0.010	0.002
Maximum	22.087	72.957	16.054	32.826

Table 9.9 Distribution of cost increasing hypothetical mergers

Increase in Costs	France		Germany		Italy		Spain	
	N	%	N	%	N	%	N	%
> 50 %	-	-	106	2.96	-	-	-	-
> 25 %	-	-	776	21.70	-	-	18	1.08
> 10 %	255	9.92	2140	59.84	161	6.90	567	34.14
> 5 %	1163	45.25	2791	78.05	1006	43.08	1066	64.18

Tables 9.10a, 9.10b, 9.10c and 9.10d show the hypothetical mergers between large banks in the French, German, Italian and Spanish banking markets respectively which create the largest increasing.

Table 9.10a The largest hypothetical cost increases for French bank mergers

HYPOTHETICAL BANK MERGER PAIRS	CHANGE (%)
UNION FRANCAISE DE BANQUES LOCABAIL/ELECTRO BANQUE	22.067
BANQUE DE BRETAGNE/ELECTRO BANQUE	21.507
BANQUE SOFIREC/ELECTRO BANQUE	21.445
BANQUE REGIONALE DE L'QUEST/ELECTRO BANQUE	20.970
BANQUE INTERNATIONALE DE GESTION ET DE TRESORERIE/ELECTRO BANQUE	20.938
CREDIT INDUSTRIELLE DE NORMANDIE/ELECTRO BANQUE	20.304
BANQUE DU CREDIT MUTUEL LORRAINE/ELECTRO BANQUE	20.300
SOCIETE DE BANQUE OCCIDENTALE/ELECTRO BANQUE	20.214
SOCIETE BORDELAISE DE CREDIT IND. ET COMM./ELECTRO BANQUE	20.004
UNION DE BANQUES A PARIS/ELECTRO BANQUE	19.506
BANQUE SOFIREC/SOVAC	16.142
BANQUE DE BRETAGNE/SOVAC	16.062
BANQUE SUDAMERIS/UNION INDUSTRIELLE CREDIT	16.019
BANQUE DU B.T.P./BANQUE HARVET	16.001
BANQUE REGIONALE DE L'QUEST/BANQUE HARVET	15.356
BANQUE SUDAMERIS/BANQUE HARVET	15.205
BANQUE DU B.T.P./BANQUE SOFIREC	14.675
BANQUE SOFIREC/BANQUE DE BRETAGNE	14.641
BANQUE DE BRETAGNE/BANQUE DU B.T.P.	14.539
BANQUE HARVET/BANQUE INTERNATIONALE DE GESTION ET DE TRESORERIE	14.443

In France, the ten largest increases resulted from mergers between Electro Banque and other relatively small commercial, investment, or co-operative banks. Electro Banque SA, with one branch, is a commercial bank owned by Alcatel Alsthom, (98.32 percent) and is the telecommunications firm's banking company. It is clearly a specialist operation and is unlikely to merge with any of the suitors cited in Table 9.10a. Below the Electro Banque mergers, the results are more varied and large cost increases appear to result from mergers between commercial banks (e.g. Banque de Bretagne, Banque Harvet etc.) and other types of financial firms such as finance houses (i.e. SOVAC), investment banks (i.e. Banque Sofirec, Banque Internationale de Gestion et de Tresorerie, Credit Industriel de Normandie), public credit institutions (e.g. Union Industrielle Credit). Overall, the results suggest that cost increasing mergers resulted mainly from hypothetical link-ups between very specialist institutions and banks.

Table 9.10b The largest hypothetical cost increases for German bank mergers

HYPOTHETICAL BANK MERGER PAIRS	CHANGE (%)
BERENBERG BANK/DEUTSCHE BANK SAAR	72.957
SUDDEUTSCHE BODENCREDBANK/DEUTSCHE BANK SAAR	68.088
BERENBERG BANK/SUDDEUTSCHE BODENCREDBANK	67.651
DEUTSCHE BANK SAAR/RHEINBODEN HYPOTHEKENBANK	64.669
BERENBERG BANK/RHEINBODEN HYPOTHEKENBANK	64.223
BHW BANK/DEUTSCHE BANK SAAR	63.982
SAL OPPENHEIM/DEUTSCHE BANK SAAR	63.560
DEUTSCHE HYPOTHEKENBANK/DEUTSCHE BANK SAAR	59.771
DEUTSCHE HYPOTHEKENBANK/BERENBERG BANK	59.359
DEUTSCHE HYPOTHEKENBANK/SUDDEUTSCHE BODENCREDBANK	57.817
RHEINBODEN HYPOTHEKENBANK/DEUTSCHE HYPOTHEKENBANK	54.657
HYPOTHEKENBANK IN HAMBURG/SUDDEUTSCHE BADENCREDBANK	52.764
DEUTSCHE HYPOTHEKENBANK/SAL OPPENHEIM	52.717
DEUTSCHE SCHIFFSBANK/DEUTSCHE BANK SAAR	52.403
BERENBERG BANK/DEUTSCHE SCHIFFSBANK	51.980
DEUTSCHE BANK SAAR/ULMER VOLKSBANK	51.946
DEUTSCHE SCHIFFSBANK/SUDDEUTSCHE BADENCREDBANK	51.748
BERENBERG BANK/ULMER VOLKSBANK	51.487
SUDDEUTSCHE BADENCREDBANK/ULMER VOLKSBANK	51.339
SUDDEUTSCHE BODENCREDBANK/WURTTMENDERGISCHEBANK HYPOTHEKENBANK	50.764

For Germany, it is noticeable that the cost increases are very large. The largest

increase, 72.957 percent, resulted from the merger between Berenberg Bank (an investment bank with two branches) and Deutsche Bank Saar (a commercial bank subsidiary of Deutsche Bank). The top cost increasing mergers appear to be generated by mergers between specialist banks (private commercial banks, investment banks, mortgage banks) such as Berenberg Bank, Deutsche Bank Saar, Sal Oppenheim, Suddesche Badencreditbank, Deutsche Hypothekenbank. In general, mergers that include mortgage banks (such as Suddesche Bodencreditbank, Rheinboden Hypothekenbank, Deutsche Hypothekenbank) create large cost increases, such as the merger between Suddesche Bodencreditbank and Deutsche Bank Saar which generated a 68.088 percent increase in predicted total cost. Overall, these results indicate that cost increasing mergers resulted from hypothetical link-ups involving specialist institutions.

Table 9.10c The largest hypothetical cost increases for Italian banks mergers

HYPOTHETICAL BANK MERGER PAIRS	CHANGE (%)
BANCA POPOLARE DI CREMONA/ISTITUTO BANCARIO SAN PAOLO DI TORINO	16.054
CASSA DI RISP DELLA PR. DI TERAMO/ISTITUTO BANCARIO SAN PAOLO DI TORINO	15.788
CASSA DI RISP DI SAN MINIATO/ISTITUTO BANCARIO SAN PAOLO DI TORINO	15.533
CASSA DI RISP DI FERMO/ISTITUTO BANCARIO SAN PAOLO DI TORINO	15.459
CREDITO LOMBARDO/ISTITUTO BANCARIO SAN PAOLO DI TORINO	15.320
BANCO SAN PAOLO DI BRESCIA/ISTITUTO BANCARIO SAN PAOLO DI TORINO	14.849
BANCA POPOLARE DI ANCONA/ISTITUTO BANCARIO SAN PAOLO DI TORINO	14.678
CASSA DI RISP DELLA PROVINCIA DI TERAMO/BANCA EMILIANA	14.677
ISTITUTO BANCARIO SAN PAOLO DI TORINO/BANCA AGRIC. POP DI RAGUSA	14.489
ISTITUTO BANCARIO SAN PAOLO DI TORINO/BANCA POPOLARE UDINESE	14.443
ISTITUTO BANCARIO SAN PAOLO DI TORINO/CASSA DI RISP DI RIMINI	14.410
CASSA DI RISP DI SAN MINIATO/BANCA EMILIANA	14.355
CASSA DI RISP DI FERMO/BANCA EMILIANA	14.179
BANCA DI PIACENZA/ISTITUTO BANCARIO SAN PAOLO DI TORINO	14.172
CREDITO LOMBARDO/BANCA EMILIANA	14.041
CASSA DI RISP DELLA PROVINCIA DI TERAMO/CASSA DI RISP DI SAN MINIATO	14.002
BANCA DEL MONTE DI PARMA/ISTITUTO BANCARIO SAN PAOLO DI TORINO	13.864
CASSA DI RISP DELLA PROVINCIA DI TERAMO/CASSA DI RISP DI FERMO	13.809
CASSA DI RISP DELLA PROVINCIA DI TERAMO/CREDITO LOMBARDO	13.688
BANCA EMILIANA/BANCA POPOLARE DI VERONA	13.257

For Italy, the largest cost increase is generated by the hypothetical merger between Istituto Bancario San Paolo di Torino (a public commercial bank and the largest Italian

bank in our sample in 1988) and Banca Popolare di Cremona (a co-operative bank). Moreover, Istituto Bancario San Paolo di Torino is a partner in 10 out of the 11 hypothetical mergers which of the top create the largest increases in cost. There are cost increasing hypothetical mergers between co-operative banks (e.g. Banca Popolare di Cremona, Banca Popolare di Ancona, Banca popolare Udinese, Banca Popolare di Verona) and commercial banks (i.e. Istituto Bancario San Paolo di Torino, Credito Lombardo, Banca Emiliana) as well as between savings banks (for example, Cassa di Risparmio della Provincia di Teramo, Cassa di Risparmio di San Miniato, Cassa di Risparmio di Fermo) and commercial banks. Overall, the results for Italy suggest that mergers are much more likely to result in cost increases than cost savings.

For Spain, the biggest cost increases are found for mergers between commercial banks and specialist investment banks: *e.g.* between Banca Catalana and Banco Industriel de Bilbao, the hypothetical merger generated a 32.826 percent increase in predicted total cost. Other significant pairings are between commercial banks (combinations between Banco de Santander, Bankinter, Banco Pastor Banca Catalana) or savings banks (combinations between Caja de Ahorros y Monte de Piedad de Madrid). The results suggest that cost increasing mergers are generated by link-ups between commercial banks which have a strong regional focus. In these cases there are no branch overlaps after merger, perhaps suggesting that the cost estimates are not generally overstated. Recent big bank mergers that have occurred in the Spanish market, between Banco de Bilbao and Banco de Vicaya in 1988 and Banco Central and Banco Hispano Americano in 1992 (Morgan Stanley, 1990, 1993) have led to increases in cost, despite the merged banks being able to shed substantial branch numbers. However, but cost savings may still arise from the long term restructuring of these organisations. In Spain, mergers between large banks have been supported and encouraged by the Government which sees the need for Spanish banks to become larger if they are to compete in Europe and take-up the advantage of the opportunities offered by the EU Single Market Programme (See Lloyd-Williams, Molyneux and Thornton, 1994).

Table 9.10d The largest hypothetical cost increases for Spanish bank mergers

HYPOTHETICAL BANK MERGER PAIRS	CHANGE (%)
BANCO CATALANA/BANCO INDUSTRIEL DE BILBAO	32.826
BANCO DE SANTANDER/BANCO INDUSTRIEL DE BILBAO	32.240
BANKINTER/BANCO INDUSTRIEL DE BILBAO	32.211
BANCO PASTOR/BANCO INDUSTRIEL DE BILBAO	31.120
BANKINTER/BANCO CATALANA	26.261
BANCO DE SANTANDER/BANCO CATALANA	26.240
BANCO PASTOR/BANCO CATALANA	25.600
BANCO PASTOR/BANCO DE SANTANDER	25.219
BANCO CATALANA/CAJA DE A. Y MONTE DE PIEDAD DE MADRID	24.951
BANCO DE PASTOR/BANKINTER	24.580
BANCO DE SANTANDER/BANKINTER	24.545
BANKINTER/CAJA DE A. Y MONTE DE PIEDAD DE MADRID	24.018
BANCO DE SANTANDER/CAJA DE A. Y MONTE DE PIEDAD DE MADRID	23.984
BANCA CATALANA/BANCO ARABE ESPANOL	23.652
BANCA CATALANA/BANCO CENTRAL	23.532
BANCO PASTOR/CAJA DE A. Y MONTE DE PIEDAD DE MADRID	23.491
BANCA CATALANA/BANCO DEL COMERCIO	23.330
BANCA CATALANA/BANCO ATLANTICO	23.251
BANKINTER/BANCO CENTRAL	22.496
BANCO CENTRAL/BANCO HISPANOAMERICANO <sup>4</sup>	22.453

Overall, the results from Tables 9.5 to 9.10 suggest that mergers between large banks within domestic banking markets can generate substantial cost savings or increases depending on the merger partners. In general, opportunities for cost saving mergers appear greater in Germany and Spain than in France and Italy. In fact the prospects for cost saving merger in Italy, based on our analysis, look relatively thin. In addition, the biggest cost savings and cost increases are generated by hypothetical mergers (in most cases) between quite different banking organisations. Such mergers would be unlikely in practice. Given these findings, the following sections aims to evaluate the cost implications of more selective bank mergers.

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<sup>4</sup>On January 1, 1992 merged with Banco Central and established Banco Central Hispano.

### 9.6.1.1 Predicted Cost of Selected Bank Mergers

The following examines the effects of hypothetical mergers among the 20 largest banks (generally with assets greater than \$10 billion) on total cost in France, Germany, Italy and Spain. The results are reported in tables 11a, 11b, 11c and 11d respectively. In general, the results suggest that as in the previous analysis, the cost implications of merger depend very much upon the partner chosen.

In France, mergers involving large banks such as Banque Paribas, Cie Financiere Cic et de L'union Europeenne, Groupe Des banques Populaires, Credit Mutuel, Banque Francaise du Commerce Extérieur, and Credisuez generally cause a reduction in predicted total cost when the merger partner is either a similar- sized or a larger bank. For example, the greatest cost saving for French banks results from the hypothetical merger between Groupe Des banques Populaires and Credit Mutuel, which generates a 16.75 percent fall in total cost. The second largest cost saving results from the hypothetical merger between Credit Mutuel and Banque Francaise du Commerce Extérieur. On the other hand, a hypothetical merger between the largest two banks Credit Agricole and Banque Nationale de Paris results in a 4.36 percent increase in predicted total cost. It appears that Credit Agricole, Banque Nationale de Paris, Credit Lyonnais, Societe Generale, Compagnie Bancaire, Credit Local de France are not good merger partners. This might relate to the state ownership characteristics of Banque Nationale de Paris, Credit Lyonnais and Societe Generale, which may have pursued non profit maximising objectives in 1988, when they were still fully nationalised.

de Boissieu (1990) has argued that French banks have been operating in a relatively protected environment, which has relieved them from some pressures to minimise costs, has created certain patterns of expense preference behaviour, and has caused X- efficiency to emerge and become extensive. As a result, in addition to possible risk avoidance, imperfect competition has led to overstaffing, large branch networks, slack in organisational structures and, consequently, inefficient use of resources. All this suggests that there are substantial opportunities to reduce costs through consolidation in the French market. However, for French banks, cost reduction through big bank merger may be relatively problematic because, as Morgan Stanley (1993) has pointed

out, the prospects for rationalisation of the domestic retail network are severely limited in practice because of legal and other commitments to the powerful French trade unions. French bank expense ratios, which have remained generally in the 70-75 percent range in recent years for major retail banks, require a significant change in the legal environment or in labour unions laws to fall significantly in the foreseeable future.

Table 9.11a The effect of hypothetical mergers on predicted cost for specific pairs among the largest top 20 French banks

NAME OF BANK PAIRS	CHANGE <sup>1</sup> (%)
CREDIT AGRICOLE / BNP	4.36
BNP / CREDIT LYONNAIS	3.84
CREDIT LYONNAIS / SOCIETE GENERALE	4.22
SOCIETE GENERALE / BANQUE PARIBAS	1.83
BANQUE PARIBAS / CIE FINANCIERE	4.02
CIE FINANCIERE / BANQUE WORMS	8.40
GRUPE DES BANQUES POPULAIRE / CREDIT MUTUEL	-16.75
CREDIT MUTUEL /BANQUE FRANCAISE DU COMMERCE	-14.11
CREDIT FONCIER FRANCE / CREDISUEZ	-4.41
BANQUE INDOSUEZ / CIE FINANCIERE	5.93
BANQUE FRANCAISE DU COMMERCE / CREDISUEZ	-10.75
CREDIT COMMERCIAL DE FRANCE/CREDIT DU NORD	3.62
COMPAGNIE BANCAIRE / CREDIT MUTUEL	-10.41
CREDIT LOCAL DE FRANCE / SOGENAL	-1.89
CREDIT INDUSTRIEL ET / CREDIT AGRICOLE	5.58
CREDIT DU NORD / BNP	3.55
CAISSE CENTRALE DES BANQUES /CREDISUEZ	-3.31
SOGENAL / GROUPE DES BANQUES POPULAIRES	-10.60
BANQUE WORMS / BANQUE FRANCAISE DU COMMERCE	-4.18
CREDISUEZ / SOGENAL	-6.89

<sup>1</sup> Percentage change in predicted cost due to merger. Negative values indicate cost reductions while positive values indicate an increases in cost.

From Table 9.11b it can be seen that hypothetical pairings among the largest German banks create substantial cost savings. The marriages between Deutsche Bank and Dresdner Bank, Dresdner Bank and Commerzbank, Commerzbank and Bayerische Vereinsbank and Hypo-bank and Dg Bank resulted in 25.26, 25.47, 22.96 and 25.04



percent decreases in predicted cost. However, the simulation between Berliner Bank and Deutsche Centralbodencredit-AG, Depfa-Bank and Deutsche Hypothekbank Frankfurt, and Landwirtschaftliche Rentenbank and Hamburger Sparkasse shows a hypothetical increase in cost of 27.46, 10.74 and 6.79 percentage respectively. It can be observed that Kreditanstalt für Wiederaufbau (which was founded in 1948 to provide long-term export credits and credit for the reconstruction of economy), Deutsche Hypothekbank Frankfurt, Berliner Bank, Landwirtschaftliche Rentenbank and Deutsche Centralbodencredit-AG are merger partners which cause large cost increases. On the other hand, substantial savings can be generated by hypothetical mergers between Germany's large commercial banks. Commercial banks such as Deutsche Bank, Dresdner Bank, Commerzbank have always played an important economic role not only as providers of funds to industry, but also as owners of companies and providers of liquidity to the government. These banks are usually regarded as being among the strongest in the world. Morgan Stanley (1988) stated that the German banking system is ready for rationalisation; however, the structure of private, state and regional banks makes restructuring very difficult. Our results, which indicate substantial cost savings through mega-mergers, suggest strong economic reasons for consolidation within this sector.

In Italy, hypothetical cost savings are often achievable when Monte Dei Paschi di Siena, Credito Italiano, Cariplo, Banco di Santo Spirito and Cassa di Risparmio di Verona Vicenza Belluno are merger partners. Specifically, the pairs Cassa di Risparmio di Verona Vicenza Belluno and Credito Italiano, Credito Italiano and Banco di Santo Spirito, Monte Dei Paschi di Siena and Credito Italiano result in small cost reductions. The vast majority of hypothetical mergers, however, show an increase in predicted costs. For example, the largest banks such as Istituto Bancario San Paolo di Torino, Banca Nazionale del Lavoro, Banca Commerciale Italiana, Banca di Napoli, Banca di Roma and Banca di Sicilia are not cost efficient, and pairings among this group raise costs *e.g.* Istituto Bancario San Paolo di Torino and Banca Nazionale del Lavoro (10.19%), Banca Nazionale del Lavoro and Monte Dei Paschi di Siena (2.13%), Banca di Napoli and Istituto Bancario San Paolo di Torino (10.40%), Banca Commerciale Italiana and Banca di Sicilia (3.25%), Banca Popolare di Milano and Banca Nazionale del Lavoro (3.42%).

Table 9.11b The effect of hypothetical mergers on predicted cost for specific pairs among the largest top 20 German banks

NAME OF BANK PAIRS	CHANGE <sup>1</sup> (%)
DEUTSCHE BANK / DRESDNER BANK	-25.26
DRESDNER BANK / COMMERZBANK	-25.47
COMMERZBANK / BAYERISCHE VEREINSBANK	-22.96
BAYERISCHE VEREINSBANK / DRESDNER BANK	-23.00
HYPO-BANK / DG BANK	-25.04
DG BANK / DEUTSCHE BANK	-30.13
KREDITANSTALT FUR WIEDERAUFBAU/BERLINER BANK	5.33
DEPPFA-BANK / DEUTSCHE HYPOTHEKENBANK FRANKFURT	10.74
BFG BANK / KREDITANSTALT FUR WIEDERAUFBAU	-14.33
DEUTSCHE HYPOTHEKENBANK FRANKFURT/ BERLINER BANK	24.23
DSL BANK / DRESDNER BANK	-18.68
LANDES KREDITBANK BADEN WURTTENBERG/LANDWIR. REN	1.73
DEUTSCHE GIROZENTRALE-KOMMUNALBANK/DEUTSCHE BANK	-24.76
RHEINISCHE HYPOTHEKENBANK / DG BANK	-32.71
BERLINER BANK / DEUTSCHE CENTRALBODEN CREDIT	27.46
BHF BANK / DEUTSCHE HYPOTHEKENBANK FRANKFURT	8.13
LANDWIRTSCHAFTLICHE RENTENBANK/HAMBURGER SPARK.	6.79
FRANKFURTER HYPOTHEKENBANK / BERLINER BANK	9.20
DEUTSCHE CENTRALBODEN CREDIT/FRANKFURTER HYPOTH.	11.00
HAMBURGER SPARKASSE/DEUTSCHE CENTRALBODEN CREDIT	25.15

<sup>1</sup> Percentage change in predicted cost due to merger. Negative values indicate cost reductions while positive values indicate an increases in cost.

The reason why we find few cost reductions relating to hypothetical mergers is perhaps related to the way in which the Italian market has been regulated. In 1988, Italy was probably the most regulated of the major banking markets in the EU. Banks were restricted to certain types of lending (either short-term or medium-term) and there was strict control on branch openings. Nearly all the Italian banks in our sample are under state ownership (of one form or another) and strict liquidity and capital controls were in place at this time. Since the late 1980s, many of these restrictions have changed as a result of moves towards deregulation under the EU Single Market Programme. There was (and still is) a general perception that the Italian banking industry was over-banked but under-branched, with one thousand banks and only 13000 branches.

Moreover, Italian banking is still split between short- and long-term institutions.

Commercial banks usually lend short-term, offering loans of up to 18 months duration. They offer some medium- and long-term products, but only through clearly defined divisions or sections. There have, however, been moves for commercial banks to link-up with long-term institutions; for example in 1992, Istituto Bancario San Paolo di Torino, the largest commercial bank in Italy, acquired 90 percent of Creditop, a long-term lending institution.

Table 9.11c The effect of hypothetical mergers on predicted cost for specific pairs among the largest top 20 Italian banks

NAME OF BANK PAIRS	CHANGE <sup>1</sup> (%)
ISTITUTO BANCARIO SAN PAOLO DI TORINO / BNL	10.19
BNL / MONTE DEI PASCHI DI SIENA	2.13
MONTE DEI PASCHI DI SIENA / CREDITO ITALIANO	-1.45
BANCA COMMERCIALE ITALI/CASSA DI RIS. DI VERONA	-1.01
BANCO DI NAPOLI / ISTITUTO BANCARIO SAN PAOLO	10.40
CREDITO ITALIANO / BANCO DI SANTO SPIRITO	-3.13
BANCO DI ROMA / MONTE DEI PASCHI DI SIENA	2.13
CARIPLO / BANCA DI NAPOLI	3.30
BANCO DI SICILIA / BANCA COMMERCIALE ITALIANA	3.25
BANCA POPOLARE DI NOVARA/BANCO DI SANTO SPIRITO	-0.67
ISTITUTO MOBIL. ITALI/CASSA DI RIS. DI VERONA	-1.52
BANCA NAZIONALE DELL'AGRICO./CREDITO ITALIANO	-1.51
CREDIOP/ISTITUTO BANCARIO SAN PAOLO DI TORINO	10.14
BANCO AMBROSIANO VENETO/BANCO DI SANTO SPIRITO	-0.57
BANCO DI SANTO SPIRITO/CASSA DI RIS. DI VERONA	-3.27
BANCA POPOLARE DI MILANO / BNL	3.42
CASSA DI RISPARMIO DI VERONA/CREDITO ITALIANO	-3.28
BANCA TOSCANA / BANCA DI ROMA	3.91
CREDITO ROMAGNOLO / BANCO DI SICILIA	6.56
MEDIOBANCA / CREDITO ITALIANO	-1.37

<sup>1</sup> Percentage change in predicted cost due to merger. Negative values indicate cost reductions while positive values indicate an increases in cost.

Bank merger in Italy is also fraught with some important structural obstacles in that ownership is by control. Capital in such cases is provided by endowment funds rather than shares. The Amato law passed in 1989 allows Italian banks to change their

ownership structure so that organisations can effectively become incorporated with share capital. In this way it is possible for similar, complementary or neighbouring institutions to merge. This is the first step towards rationalisation, which seems a likely prospect for the small to medium sized banks. Even large institutions are likely to be squeezed in an increasingly competitive market, especially in the context of 1992 the Single Market Programme, although the above analysis suggest that few big-bank mergers will result in opportunities for substantial cost savings.

It is also noteworthy that our hypothetical merger simulations are conducted at the firm level. Since Italian banking markets are over-banked and over-staffed, with constant returns to scale at the firm level, it is not surprising that the vast majority of hypothetical simulated merger pairings show increases in predicted total costs.

Recently Morgan Stanley (1993) has suggested that, over the last few years, rationalisation and restructuring has been disappointing in the Italian banking market. The 1989 Amato law facilitated mergers from a fiscal perspective; however, few banks have taken advantage of the opportunity. While the current political uncertainties continue and privatisation is still being pursued, Morgan Stanley (1993) argue that one is unlikely to see any significant large mergers taking place. This again appears to support our findings for 1988.

Finally, in Spain, Caja de Pensiones para la Vejez y de Ahorros de Cataluna y Baleares, Banco Hispano Americano (which merged with Banco Central in 1992), Banco Exterior de Espana (now part of Argentaria), Banco Popular Espanol, Caja de Ahorros de Galicia-la Coruna and Banco Urquijo appear to be good merger partners for mergers with smaller banks with the exception of the simulation between two savings banks, Caja de Barcelona and Caja de Pensiones para la Vejez y de Ahorros de Cataluna y Baleares, 3.15 per cent. Our results suggest that there are no cost savings from mergers between the top 20 largest Spanish banks. The large Spanish banks are generally over-staffed and have lower standards of technology than their European counterparts (Morgan Stanley, 1989). It seems that they are not as capable of controlling their operating costs as the smaller Spanish banks. For example, a 19.03 percent increase in cost results from the hypothetical merger between Banco Bilbao

Vizcaya and Banco Central, and a 26.24 percent increase from the merger between Bankinter and Banca Catalana. Two recent mergers between large Spanish banks also indicate the difficulties associated with reducing costs. The first in 1988 was between two large regional commercial banks, Banco de Bilbao and Banco de Vizcaya, which created the largest banking group in Spain with 14 percent of total banking assets. The merger brought about substantial reductions in overlapping branches and staff numbers and cost increased by 9 percent on a group level. Staff costs increased by 8 percent and other costs advanced by 11 percent. Operating costs as a percentage of operating income increased by 1.5 percent to 49.4 percent (Morgan Stanley, 1990). The second case was the 1992 merger between Banco Central and Banco Hispano Americano into Banco Central Hispano. The merged bank, Banco Central Hispano, had 3500 branches and employed 30000 people in its principal banking entity. The first stage of the rationalisation programme envisaged the closure of over 500 branches in its mainstream operations by the end of 1993. Around 200 branches had been closed or merged by the end of 1992 and over 300 disappeared by 1993. A further 100 branches are scheduled for closure in 1994. Staff numbers fell by nearly 3000. However, despite these costs, operating costs still increased by 4.5 percent in 1992 (Morgan Stanley, 1993). Given the lack of cost incentives for the top 20 banks to merge, perhaps strategic motives will play a more important role in encouraging consolidation in the Spanish banking industry, especially given the government's desire to encourage big-bank mergers. If we consider the findings from the previous section it seems that there are greater opportunities for cost saving mergers between medium and smaller sized banks rather than mergers between the top 20 institutions in Spain.

The results for the hypothetical mergers between the 20 largest banks in each country show that substantial cost savings can be generated from mergers between Germany's top commercial banks. In Italy, the analyses indicate that most of hypothetical mergers imply an increase in costs. Evidence from Spain and France is less clear-cut. Substantial costs saving in Spain appear to occur for hypothetical mergers between medium and smaller banks rather than mergers between top 20 organisations. Finally, in France cost saving seem to result from hypothetical mergers between either the largest specialist institutions or medium-sized banks.

Table 9.11d The effect of hypothetical mergers on predicted cost for specific pairs among the largest top 20 Spanish banks

NAME OF BANK PAIRS	CHANGE <sup>1</sup> (%)
BANCO BILBAO VIZCAYA / BANCO CENTRAL	19.03
LBANCO CENTRAL / BANCO ESPANOL DE CREDITO	15.61
BANCO ESPANOL DE CREDITO/CAJA DE CATALUNA-BALEARES	15.67
CAJA DE CATALUNA-BALEARES / BANCO CENTRAL	8.30
BANCO HISPANOAMERICANO/BANCO DE SANTANDER	18.48
BANCO DE SANTANDER / BANKINTER	25.22
BANCO EXTERIOR DE ESPANA / BANCA CATALANA	19.14
CAJA DE MONTE DE PIEDAD DE MADRID/CAJA DE VALENCIA	16.79
BANCO POPULAR ESPANOL / CAJA DE BARCELONA	4.35
CAJA DE BARCELONA / CAJA DE CATALUNA-BALEARES	-3.15
BANKINTER / BANCA CATALANA	26.26
BANCO DE SABADELL / CAJA DE CATALUNA-BALEARES	4.65
BANCA CATALANA / BANCO DE SANTANDER	26.24
CAJA DE AHORROS DE CATALUNA / BANCO URQUIJO	12.50
BANCO ATLANTICO / BANCO PASTOR	21.48
CAJA DE ZARAGOZA IBER CAJA/CAJA DE GALICIA-CORUNA	12.86
BANCO PASTOR / BANCO DE SABADELL	19.94
CAJA DE AHODE VALENCIA/BANCO HISPANOAMERICANO	11.67
CAJA DE GALICIA-CORUNA/CAJA DE CATALUNA-BALEARES	0.97
BANCO URQUIJO / BANCO ATLANTICO	14.89

<sup>1</sup> Percentage change in predicted cost due to merger. Negative values indicate cost reductions while positive values indicate an increases in cost.

### 9.6.2 The Results of Hypothetical Bank Mergers Across Border in Europe

The 1980s was a decade of cross-border mergers in the banking industry (Bollenbacher, 1992). The main objective for instituting cross-border mergers are to expand the institution's marketplace, to gain new customers, to increase the geographical coverage, and obviously to do more business. The EU's Cecchini Report (1988) emphasized the potential for substantial gains related to economies of scale in linking as result of the EU's Single Market Programme after 1992. Two important supply-side may follow to come from the Single Market process. Firstly, savings resulting from rationalization and economies of scale may lower production costs. Secondly, improvements in productivity may result from a reallocation of resources (human, financial and technological) or

industrial restructuring through rationalisation or mergers.

Cross-border mergers are distinctly different from domestic mergers. The primary purpose of a cross-border is to expand into new markets whereas, the main purpose of a domestic merger is to increase the market share and capacity. Cross-border mergers between sizeable commercial banks are likely to add branches to the bank's network, while the domestic merger is often aimed at closing overlapping branches in the same market. While cross-border mergers are designed to increase the customer base, domestic merger often seek to reduce the work force.

In the US, a number of studies (Shaffer, 1992; LaWare, 1991, Cornett and De, 1991; Holder, 1993; Dunham and Syron, 1984; Phillis and Pavel, 1986) have predicted that interstate bank mergers are less likely to generate cost synergies than intrastate mergers, on the grounds that no overlapping branch network exists across states. Srinivasan and Wall (1992) also find that opportunities for cost-reductions are greater when the merger partner operates in the same deposit market.

Table's 9.12 and 9.13 provide the summary results of simulation of the cost effects of hypothetical cross-border European bank mergers (The estimated scale and scope results are reported in Appendix 5). The average hypothetical merger yields a 7.06 percent increase in predicted total cost, compared with the sum of total costs of the unmerged banks. These results appear to be consistent with our economies of scale results for cross-border European bank mergers in which constant returns to scale were found for all sizes of large banks. Our results show that 28.31 percent of the possible pairings (2159 out of 7626 pairs) cause a reduction in cost, with 14.91 percent of these (322 pairs) showing an improvement of more than 10 percent. However, it can be seen that in a large majority of the mergers (5467 pairs or 71.69 percent) costs are predicted to increase, with 44.0 percent of these cases (2406 out of 5467 pairs) producing increases in costs exceeding 10 percent.

Table 9.12 Summary statistics for hypothetical cross-border mergers<sup>1</sup>

Descriptive Statistics	Overall	Cost Savings	Cost Increasing
N. of Pairs	7626	2159	5467
Mean	7.06	5.39	11.97
Minimum	-27.38	0.007	0.013
Maximum	74.91	27.38	74.91

<sup>1</sup> Percentage change in predicted cost due to merger. A negative value shows a cost reduction while a positive value indicates an increase in cost.

The results suggest that reductions in cost are often possible with hypothetical mergers between Italian and German banks. This could be related to the structure of both banking systems, which in general are both over-banked and in the Italian case under-branched. It also suggests that mergers between traditionally strongly capital based and lower cost northern universal banks and relatively labour intensive and higher cost southern banks generate the greatest cross-border cost savings. Table 9.14 shows the largest hypothetical cost savings among European banks with assets of more than \$5 billion. The highest cost saving (27.38 percent) would have occurred by hypothetically merging the Italian savings bank, Cassa di Risparmio di Verona Vicenza Belluno with a German mortgage bank, Allgemeine Hypothekenbank. In fact the top five cost-savings cross-border mergers all involved the Allgemeine Hypothekenbank suggesting that this is a good cross-border merger partner. In general, the majority of pairs with cost reductions of more than 10 percent resulted from hypothetical mergers between Italian and German banks.



Table 9.13 Distribution of hypothetical cross-border mergers

Change In Cost	Cost Saving		Cost Increasing	
	N	%	N	%
> 50 %	-	-	41	0.75
> 25 %	2	0.092	721	13.99
> 10 %	322	14.91	2406	44.00
> 5 %	932	43.17	3830	70.06

Table 9.14 The largest cost savings for hypothetical cross-border mergers

NAME OF BANK PAIRS	CHANGE (%)
CASSA DI RISPARMIO DI VERONA VICENZA BELLUNO/ALLGEMEINE HYPOTHEKENBANK	27.38
MEDIOBANCA/ALLGEMEINE HYPOTHEKENBANK	25.37
ALLGEMEINE HYPOTHEKENBANK/BANCO DI SANTO SPRITTO	24.53
BANCA TOSCANA/ALLGEMEINE HYPOTHEKENBANK	24.47
ALLGEMEINE HYPOTHEKENBANK/BANCA POPOLARE DI MILANO	23.25
BAYERISCHE LANDESANSTALT FUR AUFBAUFINAZIERUNG/BANCA TOSCANA	20.75
BANCA TOSCANA/HYPOTHEKENBANK IN ESSEN AG	20.21
UFB LOCABAIL/ALLGEMEINE HYPOTHEKENBANK	19.68
SOVAC/STADTSPARKASSE KOLN	19.64
BANCO ATLANTICO/HYPOTHEKENBANK IN HAMBURG	18.89
BANCO DE SABADELL/WESTFALISCHE HYPOTHEKENBANK	18.23
MEDIOBANCA/MUNCHENER HYPOTHEKENBANK	16.03
BAYERISCHE LANDESANSTALT FUR AUFBAUFINAZIERUNG/CREDITO ROMAGNOLO	15.55
MUNCHENER HYPOTHEKENBANK/BANCA TOSCANA	15.00
MUNCHENER HYPOTHEKENBANK/BANCA NAZIONALE DELL'AGRICOLTURA	14.75
CASSA DI RISPARMIO DI VERONA VICENZA BELLUNO/HYPOTHEKENBANK IN ESSEN	14.66
UFB LOCABAIL/CREDITO ROMAGNOLO	14.08
CRETITO ROMAGNOLA/ BANQUE SUDAMERIS	14.03
MEDIOBANCA/CTE FINANCIERE	11.11
CREDITO ROMAGNOLA/CAJA DE ZARAGOZA IBER CAJA	11.09

In contrast, table 9.15 shows that the hypothetical mergers which cause the largest increases in costs are generally between the largest French and German banks. Again these mergers tend to be between specialist banking institutions in considerably different areas of business.

Table 9.16 shows the effect of hypothetical mergers on predicted cost among a sample of cross-border mergers between the largest banks. The pairings are taken from among the top 10 banks (according to total assets) of each country. From table 9.16, it can be seen that the opportunities for cross-border mergers to increase costs appear to be greater than for such mergers save costs. For instance, if the largest French and German banks hypothetically merged, total cost would increase by 9.854%. Moreover, if the largest French bank (i.e. Credit Agricole) and Italian bank (i.e. Istituto bancario San Paolo di Torino) hypothetically merged, the predicted total cost would only increase by 1.79 percent, whereas the merger between the largest German bank, Deutsche Bank, and Istituto bancario San Paolo di Torino would result in a 7.02 percent increase in total cost. The merger between the largest Spanish bank, Banco Bilbao Vizcaya and Istituto bancario San Paolo di Torino would generate a 6.63 percent increase in cost. Cost savings were no greater than 7 percent in any hypothetical cross-border merger involving the largest banks. In addition, the potential for substantial cost savings resulting from cross-border mergers between Europe's biggest banks appears to be somewhat limited. These results clearly conflict with the views of the EU's Cecchini Study, which placed substantial emphasis on the cost advantages associated with cross-border mergers in the EU.

Table 9.15 The largest hypothetical cost increases for cross-border  
European bank mergers

NAME OF BANK PAIRS	CHANGE (%)
DEUTSCHE HYPOTHEKENBANK FRANKFURT/GROUPE DES BANQUES POPULAIRE	66.39
DEUTSCHE HYPOTHEKENBANK FRANKFURT/CREDIT MUTUEL	65.71
FRANKFURTER HYPOTHEKENBANK/GROUPE DES BANQUES POPULAIRE	60.21
FRANKFURTER HYPOTHEKENBANK/CREDIT MUTUEL	59.64
COMPAGNIE PARISIENE DE REESCOMPTE/DEUTSCHE HYPOTHEKENBANK FRANKFURT	58.79
DEUTSCHE HYPOTHEKENBANK FRANKFURT/BANQUE FRANCAISE DU COMMERCE	57.63
CETELEM/INDUSTRIEKREDITBANK AG	57.51
CETELEM/FRANKFURTER HYPOTHEKENBANK	57.00
CETELEM/SUDWESTDEUTSCHE GENOSSENSCHAFTS ZENTRALBANK	52.14
RHEINISCHE HYPOTHEKENBANK /CREDIT MUTUEL	49.62
KREDITANSTALT FUR WIEDERAUFBAU/GROUPE DES BANQUES POPULAIRE	45.28
CREDISUEZ/SUDWESTDEUTSCHE GENOSSENSCHAFTS ZENTRALBANK	44.72
COMPAGNIE PARISIENE DE REESCOMPTE/BADEN-WURTTENBERGISCHEBANK	41.48
SUDWESTDEUTSCHE GENOSSENSCHAFTS ZENTRALBANK/UFB LOCABAIL	40.14
BANQUE COMM. POUR L'EUROPE DU NORD/KREDITANSTALT FUR WIEDERAUFBAU	39.69
CREDISUEZ/BERLINER BANK	38.46
BANQUE COMM. POUR L'EUROPE DU NORD/BADEN-WURTTENBERGISCHEBANK	38.17
COMPAGNIE PARISIENE DE REESCOMPTE/RHEINISCHE HYPOTHEKENBANK	37.68
CAJA DE BARCELONA/DEUTSCHE HYPOTHEKENBANK FRANKFURT	35.16
BANCO DE SANTANDER/CREDIT MUTUEL	35.12

Table 9.16 The effect of hypothetical mergers between specific pairs of large European banks on predicted costs

NAME OF BANK PAIRS	CHANGE <sup>1</sup> (%)
CREDIT AGRICOLE/DEUTSCHE BANK	9.85
BANQUE NATIONALE DE PARIS/BANCA NAZIONALE DEL LAVORO	1.44
CREDIT LYONNAIS/COMMERZBANK	8.17
SOCIETE GENERALE / BANCA DI SICILIA	0.34
BANQUE PARIBAS/KREDITANSTALT FUR WIEDERAUFBAU	22.50
CIE FINANCIERE CIC/ BANCO BILBAO VIZCAYA	6.78
GROUPE DES BANQUES POPULAIRES/DRESDNER BANK	32.05
CREDIT MUTUEL/KREDITANSTALT FUR WIEDERAUFBAU	45.17
CREDIT FONCIER FRANCE/CARIPLO	3.41
BANQUE INDOSUEZ/CREDITO ITALIANO	-0.30
DEUTSCHE BANK/ISTITUTO SAN PAOLO DI TORINO	7.02
DRESDNER BANK/BANCO CENTRAL	10.56
COMMERZBANK/BANCA POPOLARE DI NOVARA	-0.93
BAYERISCHE VEREINSBANK/GROUPE DES BANQUES POPULAIRES	30.57
HYPO-BANK/BANCA POPOLARE DI NOVARA	-2.88
DG BANK/CREDITO ITALIANO	-7.03
KREDITANSTALT FUR WIEDERAUFBAU/BANCO DE SANTANDER	18.24
DEPFA-BANK/BANCO DI NAPOLI	-4.30
BFG BANK/ BANCO CENTRAL HISPANOAMERICANO	10.20
DEUTSCHE HYPOTHEKENBANK FRANKFURT/BANCA COMMERC. ITALIANA	-2.03
ISTITUTO SAN PAOLO DI TORINO/CREDIT AGRICOLE	1.79
BANCA NAZIONALE DEL LAVORO/BANCO DE SANTANDER	-2.12
MONTE DEI PASCHI DI SIENA/ DG BANK	-6.03
BANCA COMMERCIALE ITALIANA/CIE FINANCIERE CIC	-6.53
BANCO DI NAPOLI / DG BANK	-4.86
CREDITO ITALIANO /DEUTSCHE HYPOTHEKENBANK FRANKFURT	-2.81
BANCO DI ROMA / DEPFA-BANK	-2.64
CARIPLO / HYPO-BANK	-0.49
BANCO DI SICILIA / DEUTSCHE HYPOTHEKENBANK FRANKFURT	-0.57
BANCA POPOLARE DI NOVARA /DEPFA-BANK	-6.25
BANCO BILBAO VIZCAYA / DEUTSCHE BANK	13.98
BANCO CENTRAL /BANCA NAZIONALE DEL LAVORO	3.62
BANCO ESPANOL DE CREDITO /BFG BANK	10.90
CAJA DE CATALUNA-BALEARES/CARIPLO	3.12
BANCO CENTRAL HISPANOAMERICANO/BANCO DI NAPOLI	1.95
BANCO DE SANTANDER/BANCA COMMERCIALE ITALIANA	-3.83
BANCO EXTERIOR DE ESPANA / DRESDNER BANK	8.59
CAJA DE PIEDAD DE MADRID/ COMMERZBANK	6.76
BANCO POPULAR ESPANOL/SOCIETE GENERALE	5.12
CAJA DE BARCELONA/MONTE DEI PASCHI DI SIENA	-1.31

<sup>1</sup> Percentage change in predicted cost due to merger. Negative values indicate cost reductions while positive values indicate an increases in cost.

## 9.7 Limitations of the Hypothetical Merger Analysis

In our model the hypothetical merger simulations are based on simple assumptions. Following Shaffer (1993), Boyd and Graham (1988), for each possible hypothetical pair, the pre-merger bank costs were estimated at the observed input prices for individual banks, whilst post-merger costs were calculated at the mean input prices for the given pairs. We also assume that the procedure does not change demand-side factors. Furthermore, it is assumed that the merged banks are simply the sum of the two individual unmerged banks. Banks are merged according to their accounting values. Consolidated total assets, loans, and securities for the hypothetically merged bank are generated by summing the assets, loans and securities of the two individual banks. In addition, it is assumed that the merged banks do not benefit from further cost synergies that might result from the combination or restructuring of output mix as well as out-of-pocket merger costs, or merger premiums. Noticeably, some of these assumptions could lead to bias in the results. These factors can be grouped as follows:

*i. Random merger partners.* The merger simulations have been carried out hypothetically ignoring any prior information about pairs. In reality, senior management would select the better merger partners. Bank managers would not pick up partners exhibiting disagreeable financial arithmetic unless improvements were expected.

*ii. Big bank mergers.* The study uses data predominantly for large size banks. The analysis neglects hypothetical merger with small banks or other financial institutions.

*iii. Merger premiums or cost.* In the analysis, it assumed that there are no premiums or out of pocket merger costs. Boyd and Graham (1988) have pointed out that it is difficult to incorporate these within the simulation. Merger premiums may be substantial (*e.g.* exchanges of shares or cash buy-outs). Although these factors could be detrimental to the attractiveness of potential mergers, their inclusion in the analysis was beyond the scope of this study.

*iv. Other limitations.* The analysis uses data for one year only, 1988. The results might not necessarily be the same if data for different years were employed. In addition,

standard methodological problems associated with the use of the hybrid translog cost function (see Chapter 4 of this thesis) could affect the results. Furthermore, mergers between large banks could in reality be impractical because of national and European competition law, incompatible ownership characteristics and other factors not taken into consideration in the present analysis.

## 9.8 Conclusions

This chapter examines the potential for improvements in efficiency and cost savings resulting from hypothetical bank mergers both within the French, German, Italian and Spanish banking markets and also across their national boundaries. Our findings can be summarised as follows:

- (1) The evidence for the individual domestic banking markets suggest that mergers between large banks can generate substantial cost savings or increases depending on the merger partners. The results generally indicate that opportunities for cost saving mergers seem to be greater in Germany and Spain than in France and Italy. In fact the prospects for cost saving big-bank mergers in Italy, appear to be very limited. In addition, the biggest cost savings and cost increases result from hypothetical mergers (in most cases) between quite different banking organisations. Such mergers would probably be unlikely in practice.
- (2) Our selective results for the hypothetical mergers between the 20 largest banks within domestic banking markets imply that substantial cost savings can be generated from mergers between top commercial banks in Germany. For Italy, the analysis shows that the vast majority of hypothetical mergers shows an increase in predicted total costs. The findings from Spain and France are less clear-cut. In Spain, cost savings appear to occur for hypothetical mergers between the largest and smallest banks within the top 20, (*i.e.* the 1st, 2nd, or 3rd largest banks merging with, say the 18th, 19th or 20th largest). Finally, cost savings in France seem to result from hypothetical mergers between either the largest specialist institutions or second-tier medium-sized banks.

- (3) The evidence from our analysis of hypothetical bank mergers across borders in Europe suggest that costs saving for this type of merger seem to be somewhat limited. In general, cost savings appear to be generated by mergers between Italian and German banks, whereas the biggest cost increasing mergers are brought about by hypothetical mergers between French and German institutions. The cost advantages brought about through hypothetical cross-border mergers do not appear to generate the substantial benefits suggested by the EU in their study of the Single Market Programme.

Overall, these results indicate that mergers between large banks either within domestic banking markets or across national border can create substantial cost savings or cost increases depending on the merger partners chosen. The empirical evidence in this chapter strongly supports the view that merger partners should be carefully selected given the substantial variation of cost outcomes.

## CHAPTER 10

### CONCLUSION AND LIMITATIONS

#### 10.1 Conclusion

The purpose of this thesis has been to investigate evidence of economies of scale and scope in various European banking markets. The thesis has also examined the cost implications from hypothetical bank mergers both within the French, German, Italian and Spanish banking markets and cross-border in the EU. The analysis has been prompted by claims that substantial cost savings could be expected as the result of the EU's single market programme in the banking area. Economies of scale and scope, a substantial part of industrial organisations literature, have been widely examined in the US banking system, although little empirical work to date has been undertaken on European banking markets. This thesis aimed to rectify this imbalance in the literature by providing a detailed, in-depth and original analysis of scale and scope economies as well as investigating the cost implications of hypothetical bank mergers.

The specific findings of this thesis are as follows. Firstly, in the examination of the related questions of economies of scale and scope, the ordinary translog results find strong evidence of economies of scale at the branch level for all output ranges across each of the four systems under study. In contrast, at the firm-level the results reveal constant returns to scale for the French, Italian and Spanish banking markets. This result appears to confirm earlier findings of cost studies undertaken on large and small European banking markets which have shown stronger evidence of cost economies compared with the US studies.

The hybrid translog cost function findings also indicate similar results. Branch-level scale economies appear across all output ranges and especially for large banks with assets size over \$1 billion. For example, scale economies seem to strongly exist for Italian and German banks with more than \$1 billion and \$5 billion in assets respectively. At the firm level scale economies are found for all sizes of banks in Spain but the French and Italian banking markets exhibit constant returns to scale.



Diseconomies of scale, however, appear to exist at the firm-level for German banks across all outputs using both the ordinary and hybrid translog cost functions methodologies. Product specific economies of scale also appear to be evident in each banking market.

Country-specific studies undertaken on the cost characteristics of European banking markets have in general, suggested that economies of scale exist for small and medium sized banks. Our results, in contrast, suggest that economies of scale are also present for large banks over \$1 billion in asset size. Cross-country cost studies, such as Venet (1993) however, have also found that the optimal scale is situated in \$3 billion to \$10 billion assets size range. In addition, previous European cost studies have failed to conclude as to whether these economies occur at the branch or firm level. The results in this thesis find strong evidence of economies of scale and scope at the branch level in all but the Spanish market. As a consequence, cost savings appear to occur mainly through the increased average size of banks' branches rather than by increasing branch size by adding new branches.

The results on economies of scale appear to be in general agreement with current industry trends. Although there are a large number of banks in Europe, the industry is continuing to be dominated and concentrated by a smaller number of core banks. But, structure is changing rapidly. In recent years, the number of banking organisations and other financial institutions has decreased, as acquisitions and mergers have led to consolidation in the industry.

The empirical evidence of cost economies resulting from the multiproduct nature of banks' business appear less clear-cut than the scale economy findings. Firm-level economies of scope appear to be evident in French banking at all output ranges, whereas, for the other countries our findings are mixed. In Germany, banks with assets size greater than \$3 billion appear to have significant firm-level scope economies. In the case of Italian banks scope economies are evident but not statistically significant. In Spain we find evidence of significant diseconomies of scope for banks with assets size greater than \$600 million. At the branch-level economies of scope are more prevalent and we find strong economies of scope for large French and German banks

as well as for all Italian banks. Branch-level diseconomies of scope are found for the smaller French, German and Spanish banks. From the above it is concluded that scope economies are more prevalent at the branch-level than at the overall firm-level. As with the results on scale economies, scope economies appear much more prevalent at the branch rather than at the firm-level. Again, this suggests that banks should increase business through established branch networks to obtain cost savings rather than by adding extra branches.

In general, the above results suggest that scale and scope economies could be important in generating economic gains to EU banking markets under the Single Market programme. The cost advantages to be had through larger bank size (mainly by increasing the average size of established branches) could also further promote the consolidation trend leading to increased concentration across European markets.

Following on from the scale and scope estimates the thesis further extended the established literature by examining the cost implications from hypothetical domestic and cross-border bank mergers. For the French banking market, the evidence suggests that mergers between large banks can generate substantial cost savings depending on the merger partners chosen. In addition, the biggest cost savings and cost increases result from hypothetical mergers (in most cases) between quite different banking organisations and such mergers would be unlikely in practice. Our selective results for the hypothetical mergers between the 20 largest banks imply that the findings are less straightforward. Mergers between large banks such as Banque Paribas, Cie Financiere Cic et de L'Union Europeenne, Groupe Des Banques Populaires, Credit Mutuel, Banque Financiere du Commerce Exterieur and Credisuez generally show a reduction in predicted total cost when they merge with similar sized banks. The hypothetical merger between France's two largest banks, Credit Agricole and Banque Nationale de Paris, would result in a 4.36 per cent increase in predicted total cost. It appears that Credit Agricole, Banque Nationale de Paris, Credit Lyonnais, Societe Generale, Compagnie Bancaire, Credit Local de France are not good merger partners. Our findings suggest that there are reasonable opportunities for cost reduction through mergers in the French banking market depending on the partner chosen although in practice cost reductions may not be as large as we predict because labour union laws in France restrict

substantial labour cost shedding opportunities post merger.

In Germany, the results show that substantial cost savings could be generated from mergers between the top commercial banks. In particular, hypothetical mergers between Deutsche Bank and Dresdner Bank, Dresdner Bank and Commerzbank, Commerzbank and Bayerische Vereinsbank and Hypo-bank and Dg Bank resulted in 25.3, 25.5, 22.9 and 25.0 percent decreases in predicted cost, respectively. Mergers between banks with asset size greater than \$10 billion in 1988 in most cases generated substantial cost savings compared with mergers between smaller banks which tended to be cost increasing. Our scale and scope estimates at the firm-level point to diseconomies of scale at all output ranges but strong economies of scope for those banks with asset size of \$3 billion. This finding appears to support Steinherr's (1992) observation that scope economies are more important to the universal banking firm compared with scale economies. Finally, our results indicate a strong cost incentive for big-bank mergers in the German market.

The finding for the merger simulations in the Italian market indicated limited opportunities for cost savings resulting from big-bank mergers. A possible reason as to why there are only a few cost reductions relating to hypothetical mergers is perhaps related to the way in which the Italian market has been regulated. In 1988, Italy was probably the most regulated of the major banking markets in the EU. Banks were restricted to certain types of lending either short-term or medium-term, and there was strict control on branch openings. A large proportion of the banks in the data sample used in the estimation were under state ownership and strict liquidity and capital controls were in place at this time. Since the late 1980s, many of these restrictions have changed in the moves towards deregulation under the EU Single Market Programme. The Amato law passed in 1989 now allows Italian banks to change their ownership structure so that organisations can effectively become incorporated with share capital. In this way it is possible for similar, complementary or neighbouring institutions to merge. Despite the deregulation of the system, however, rationalisation and restructuring has been disappointing in the Italian banking market (see Berlanda and Masera, 1993). The 1989 Amato law facilitated mergers from a fiscal perspective, however, few banks have taken advantage of the opportunity. This again appears to

corroborate the findings of limited opportunities for cost-saving big-bank mergers in the Italian system.

Finally, in the Spanish banking market, substantial potential cost savings appear to be available for hypothetical mergers between medium-sized banks, but not for mergers between the largest organisations. Out of all the simulations of mergers between pairings drawn from the top 20 banks we find only one case involving two savings banks; Caja de Barcelona and Caja de Pensiones para la Vejez y de Ahorros de Cataluna y Baleares, which creates a cost saving.

The evidence from our analysis of hypothetical cross-border mergers in the EU indicates only limited opportunities for costs saving from big bank mergers and that such mergers are more likely to result in an increase in total costs. Whilst there is a large variation in the simulated cost outcomes, the greatest opportunities for cost savings would appear to be generated by mergers between German and Italian banks. In contrast, mergers between French and German banks appear likely to result in substantial cost increases. The substantial variation of cost outcomes generated suggests that large banks seeking economies through cross-border mergers select potential partners with great care. It is also far from clear that substantial cost savings could be expected as a result of cross-border bank mergers under the EU's single market programme.

## **10.2 Limitations of the Study**

Overall, the above analysis provides an informative and new insight, employing a hitherto infrequently used and substantial dataset to investigate evidence of scale and scope economies and the cost implications of hypothetical bank mergers across European markets. This analysis, however, is not without its limitations as identified in Sections 4.7.7, 8.3 and 9.7 of this thesis. In a study of this nature a major problem relates to accounting for country-specific differences. Cross-country comparisons of the type implicit in this study should be conducted with caution. The models estimated for different countries use different variable definitions, and the regulatory structures governing the performance of different banks are not the same, although the EU's

single market programme aims to harmonise and impose a similar regulatory environment across the systems under study.

The analysis is also limited because it is a cross-sectional study based only on one-years data. To see if the results are stable over time one would need to examine a panel of sample banks over several years, since market environments and structures change rapidly.

The methodological approach adopted also has its limitations because it assumes that the banks included in the sample are operating on the frontier of the production opportunities set. In other words, the cost efficiencies reported in this study are related to the assumption that the sample firms are efficient. It is recognised that this assumption is doubtful and that the use of data from banks operating off the frontier confounds the scale and scope efficiencies with differences in X-efficiency. Further research should focus on examining X-efficiency of the sample and subgroups, within individual banking systems, and cross-border. X-efficiency comparisons could also be undertaken, using the stochastic frontier or DEA approaches. An area of further research could be to examine the relationship between ownership characteristics and bank efficiency across European markets.

Other limitations relate to the fact that the analysis does not take account of banks' off-balance sheet business as an output. It could be useful to understand the impact of these items on traditional calculations of scale and scope economies.

Finally, as the methodology relies heavily on the traditional cost-minimising and profit-maximising behaviour of a firm, advocates of the 'new' industrial economics could argue that it would be more appropriate to focus on the non-profit-maximising objectives and/or game-theoretic oligopoly models to analyse the strategic behaviour of banks. This could well be a fruitful avenue for future research. However, no doctoral thesis can hope to cover all of the related ground on even a fairly specialised area of research. This thesis started with specific aims, which have been broadly achieved, but with an awareness of their inherent limitations and constraints.

## APPENDICES

### Appendix 1 The ordinary translog cost function estimates at the branch and firm level

Table A1.1 Maximum Likelihood Parameter Estimates For French Banks at the Branch Level (Translog)

Variables	Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
Intercept	$\alpha_0$	-3.37810	0.23310	-14.491	0.00000
$\ln Q_1$	$\alpha_1$	0.74254	0.06844	10.850	0.00000
$\ln Q_2$	$\alpha_2$	0.30395	0.05407	5.622	0.00000
$\ln P_1$	$\beta_1$	-0.46390	0.05769	-8.043	0.00000
$\ln P_2$	$\beta_2$	0.44930	0.06148	7.309	0.00000
$\ln P_3$	$\beta_3$	1.01460	0.06902	14.700	0.00000
$\ln Q_1 \ln Q_1$	$\delta_{11}$	-0.04230	0.01208	-3.503	0.00046
$\ln Q_1 \ln Q_2$	$\delta_{12}$	-0.04087	0.00833	-4.905	0.00000
$\ln Q_2 \ln Q_2$	$\delta_{22}$	0.02681	0.00870	-3.080	0.00207
$\ln P_1 \ln P_1$	$\gamma_{11}$	-0.00510	0.00558	-0.914	0.36500
$\ln P_1 \ln P_2$	$\gamma_{12}$	-0.03810	0.00832	-4.579	0.00005
$\ln P_2 \ln P_2$	$\gamma_{22}$	0.00380	0.00724	0.522	0.60201
$\ln P_1 \ln P_3$	$\gamma_{13}$	0.04320	0.00361	11.937	0.00000
$\ln P_2 \ln P_3$	$\gamma_{23}$	0.03430	0.00554	6.190	0.00000
$\ln P_3 \ln P_3$	$\gamma_{33}$	-0.07750	0.00769	-10.064	0.00000
$\ln P_1 \ln Q_1$	$\rho_{11}$	0.10080	0.01436	7.020	0.00000
$\ln P_1 \ln Q_2$	$\rho_{12}$	0.02610	0.01102	2.365	0.01804
$\ln P_3 \ln Q_1$	$\rho_{31}$	-0.10770	0.01123	-8.756	0.00000
$\ln P_2 \ln Q_1$	$\rho_{21}$	0.00690	0.00965	0.716	0.47400
$\ln P_2 \ln Q_2$	$\rho_{22}$	0.04460	0.01093	4.083	0.00004
$\ln P_3 \ln Q_2$	$\rho_{32}$	-0.07090	0.00940	-7.542	0.00000
$\ln B$	$\lambda_b$	-0.16029	0.01523	-10.523	0.00000
$\ln B \ln B$	$\lambda_{bb}$	-0.04641	0.01603	-2.894	0.00380
$\ln B \ln Q_1$	$\lambda_{b1}$	0.084569	0.01600	5.286	0.00000
$\ln B \ln Q_2$	$\lambda_{b2}$	0.054981	0.01228	4.477	0.00001
$\ln B \ln P_1$	$\tau_{b1}$	-0.17760	0.01807	-9.829	0.00000
$\ln B \ln P_2$	$\tau_{b2}$	-0.00110	0.01990	-0.057	0.95432
$\ln B \ln P_3$	$\tau_{b3}$	0.17870	0.01513	11.811	0.00000

Table A1.2 Maximum Likelihood Parameter Estimates For  
French Banks at the Firm Level (Translog)

Variables	Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
Intercept	$\alpha_0$	-1.25400	0.31150	-4.026	0.00006
$\ln Q_1$	$\alpha_1$	0.46207	0.08802	5.249	0.00000
$\ln Q_2$	$\alpha_2$	0.27244	0.07630	3.570	0.00036
$\ln P_1$	$\beta_1$	-0.13500	0.08391	-1.609	0.10769
$\ln P_2$	$\beta_2$	0.40200	0.08281	4.854	0.00000
$\ln P_3$	$\beta_3$	0.73300	0.08664	8.460	0.00000
$\ln Q_1 \ln Q_1$	$\delta_{11}$	0.06661	0.01708	3.899	0.00010
$\ln Q_1 \ln Q_2$	$\delta_{12}$	-0.05176	0.01036	-4.998	0.00000
$\ln Q_2 \ln Q_2$	$\delta_{22}$	0.08678	0.01476	5.878	0.00000
$\ln P_1 \ln P_1$	$\gamma_{11}$	-0.0540	0.01004	-5.378	0.00000
$\ln P_1 \ln P_2$	$\gamma_{12}$	-0.0092	0.01325	-0.694	0.49100
$\ln P_2 \ln P_2$	$\gamma_{22}$	0.03050	0.00718	4.249	0.00002
$\ln P_1 \ln P_3$	$\gamma_{13}$	0.06320	0.00427	14.776	0.00000
$\ln P_2 \ln P_3$	$\gamma_{23}$	-0.0213	0.01153	-5.482	0.00000
$\ln P_3 \ln P_3$	$\gamma_{33}$	-0.04190	0.01446	-2.901	0.00373
$\ln P_1 \ln Q_1$	$\rho_{11}$	0.00820	0.01674	0.491	0.62350
$\ln P_1 \ln Q_2$	$\rho_{12}$	0.03910	0.01588	2.461	0.01387
$\ln P_3 \ln Q_1$	$\rho_{31}$	-0.01410	0.01456	-0.968	0.33600
$\ln P_2 \ln Q_1$	$\rho_{21}$	0.00590	0.01300	0.457	0.64753
$\ln P_2 \ln Q_2$	$\rho_{22}$	-0.02420	0.01331	-1.815	0.06946
$\ln P_3 \ln Q_2$	$\rho_{32}$	-0.01490	0.01377	-1.082	0.28000

Table A1.3 Maximum Likelihood Parameter Estimates For  
German Banks at the Branch Level (Translog)

Variables	Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
Intercept	$\alpha_0$	-4.42910	0.33980	-13.036	0.00000
$\ln Q_1$	$\alpha_1$	0.87000	0.08496	10.240	0.00000
$\ln Q_2$	$\alpha_2$	0.37420	0.08518	4.393	0.00001
$\ln P_1$	$\beta_1$	-0.36450	0.06319	-5.768	0.00000
$\ln P_2$	$\beta_2$	0.63560	0.07497	8.478	0.00000
$\ln P_3$	$\beta_3$	0.72890	0.08192	8.897	0.00000
$\ln Q_1 \ln Q_1$	$\delta_{11}$	-0.08110	0.01404	-5.779	0.00000
$\ln Q_1 \ln Q_2$	$\delta_{12}$	-0.03070	0.00968	-3.176	0.00149
$\ln Q_2 \ln Q_2$	$\delta_{22}$	0.01040	0.01475	-7.083	0.00000
$\ln P_1 \ln P_1$	$\gamma_{11}$	0.16630	0.00972	17.109	0.00000
$\ln P_1 \ln P_2$	$\gamma_{12}$	-0.11420	0.01125	-10.151	0.00000
$\ln P_2 \ln P_2$	$\gamma_{22}$	-0.03330	0.00463	-7.190	0.00000
$\ln P_1 \ln P_3$	$\gamma_{13}$	0.01450	0.00258	5.614	0.00000
$\ln P_2 \ln P_3$	$\gamma_{23}$	0.14750	0.01154	12.781	0.00000
$\ln P_3 \ln P_3$	$\gamma_{33}$	-0.16200	0.01270	-12.756	0.00000
$\ln P_1 \ln Q_1$	$\rho_{11}$	0.10080	0.01080	9.333	0.00000
$\ln P_1 \ln Q_2$	$\rho_{12}$	0.00370	0.01199	0.305	0.76025
$\ln P_3 \ln Q_1$	$\rho_{31}$	-0.07430	0.01282	-5.795	0.00000
$\ln P_2 \ln Q_1$	$\rho_{21}$	-0.02650	0.00768	-3.449	0.00056
$\ln P_2 \ln Q_2$	$\rho_{22}$	0.07590	0.01268	5.991	0.00000
$\ln P_3 \ln Q_2$	$\rho_{32}$	-0.07960	0.01388	-5.734	0.00000
$\ln B$	$\lambda_b$	-0.12364	0.01289	-9.589	0.00000
$\ln B \ln B$	$\lambda_{bb}$	0.00421	0.01534	0.274	0.78398
$\ln B \ln Q_1$	$\lambda_{b1}$	0.03804	0.01015	3.746	0.00018
$\ln B \ln Q_2$	$\lambda_{b2}$	0.09918	0.01587	6.251	0.00000
$\ln B \ln P_1$	$\tau_{b1}$	-0.19110	0.01596	-11.977	0.00000
$\ln B \ln P_2$	$\tau_{b2}$	0.05690	0.01622	3.508	0.00045
$\ln B \ln P_3$	$\tau_{b3}$	0.13420	0.01518	8.840	0.00000



Table A1.4 Maximum Likelihood Parameter Estimates For  
German Banks at the Firm Level (Translog)

Variables	Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
Intercept	$\alpha_0$	-4.01100	0.56890	-7.050	0.00000
$\ln Q_1$	$\alpha_1$	0.62248	0.11570	5.380	0.00000
$\ln Q_2$	$\alpha_2$	0.42525	0.18510	2.297	0.02162
$\ln P_1$	$\beta_1$	-0.69250	0.10680	-6.477	0.00000
$\ln P_2$	$\beta_2$	0.84560	0.15920	5.311	0.00000
$\ln P_3$	$\beta_3$	0.84690	0.15505	5.462	0.00000
$\ln Q_1 \ln Q_1$	$\delta_{11}$	0.01442	0.00711	2.028	0.04259
$\ln Q_1 \ln Q_2$	$\delta_{12}$	-0.02044	0.004672	-4.373	0.00001
$\ln Q_2 \ln Q_2$	$\delta_{22}$	0.12929	0.02694	4.800	0.00000
$\ln P_1 \ln P_1$	$\gamma_{11}$	0.02550	0.00270	9.444	0.00000
$\ln P_1 \ln P_2$	$\gamma_{12}$	-0.03780	0.00486	-7.777	0.00000
$\ln P_2 \ln P_2$	$\gamma_{22}$	0.15170	0.02302	6.588	0.00000
$\ln P_1 \ln P_3$	$\gamma_{13}$	0.01230	0.00235	5.246	0.00000
$\ln P_2 \ln P_3$	$\gamma_{23}$	-0.11390	0.00539	-21.250	0.00000
$\ln P_3 \ln P_3$	$\gamma_{33}$	0.10160	0.01343	7.525	0.00000
$\ln P_1 \ln Q_1$	$\rho_{11}$	0.01990	0.02870	0.693	0.48858
$\ln P_1 \ln Q_2$	$\rho_{12}$	0.12790	0.03233	3.956	0.00008
$\ln P_3 \ln Q_1$	$\rho_{31}$	0.01300	0.02191	0.593	0.54500
$\ln P_2 \ln Q_1$	$\rho_{21}$	-0.03290	0.01896	-1.737	0.08231
$\ln P_2 \ln Q_2$	$\rho_{22}$	-0.07050	0.02445	-2.881	0.00396
$\ln P_3 \ln Q_2$	$\rho_{32}$	-0.05740	0.02564	-2.238	0.02000

Table A1.5 Maximum Likelihood Parameter Estimates For  
Italian Banks at the Branch Level (Translog)

Variables	Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
Intercept	$\alpha_0$	3.27080	0.38640	8.464	0.00000
$\ln Q_1$	$\alpha_1$	0.82500	0.14650	5.630	0.00000
$\ln Q_2$	$\alpha_2$	0.36368	0.11550	3.149	0.00164
$\ln P_1$	$\beta_1$	1.36960	0.08999	15.22	0.00000
$\ln P_2$	$\beta_2$	-0.60573	0.03614	-16.762	0.00000
$\ln P_3$	$\beta_3$	0.23613	0.07820	3.019	0.00500
$\ln Q_1 \ln Q_1$	$\delta_{11}$	-0.11811	0.04686	-2.521	0.01172
$\ln Q_1 \ln Q_2$	$\delta_{12}$	-0.12425	0.03245	-3.829	0.00013
$\ln Q_2 \ln Q_2$	$\delta_{22}$	0.10323	0.02458	4.201	0.00003
$\ln P_1 \ln P_1$	$\gamma_{11}$	0.17040	0.01160	14.689	0.00000
$\ln P_1 \ln P_2$	$\gamma_{12}$	-0.22835	0.00843	-27.087	0.00000
$\ln P_2 \ln P_2$	$\gamma_{22}$	0.27370	0.00935	29.239	0.00000
$\ln P_1 \ln P_3$	$\gamma_{13}$	0.05803	0.00562	10.330	0.00000
$\ln P_2 \ln P_3$	$\gamma_{23}$	-0.04535	0.00678	-6.688	0.00000
$\ln P_3 \ln P_3$	$\gamma_{33}$	-0.01268	0.00318	-3.991	0.00007
$\ln P_1 \ln Q_1$	$\rho_{11}$	-0.15520	0.03119	-4.976	0.00000
$\ln P_1 \ln Q_2$	$\rho_{12}$	0.01460	0.02966	0.491	0.62319
$\ln P_3 \ln Q_1$	$\rho_{31}$	0.12750	0.02411	5.288	0.00000
$\ln P_2 \ln Q_1$	$\rho_{21}$	0.02770	0.01198	2.314	0.02066
$\ln P_2 \ln Q_2$	$\rho_{22}$	-0.00215	0.01044	-0.206	0.83657
$\ln P_3 \ln Q_2$	$\rho_{32}$	-0.01245	0.02168	-0.574	0.56000
$\ln B$	$\lambda_b$	-0.00043	0.00676	-0.064	0.94916
$\ln B \ln B$	$\lambda_{bb}$	-0.09223	0.03077	-2.997	0.00272
$\ln B \ln Q_1$	$\lambda_{b1}$	0.22381	0.03365	6.652	0.00000
$\ln B \ln Q_2$	$\lambda_{b2}$	-0.00041	0.02954	-0.014	0.98883
$\ln B \ln P_1$	$\tau_{b1}$	0.11100	0.03103	3.577	0.00035
$\ln B \ln P_2$	$\tau_{b2}$	0.10897	0.02470	4.411	0.00001
$\ln B \ln P_3$	$\tau_{b3}$	-0.21997	0.02568	-8.565	0.00000

Table A1.6 Maximum Likelihood Parameter Estimates For  
Italian Banks at the Firm Level (Translog)

Variables	Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
Intercept	$\alpha_0$	-2.9896	0.30360	-9.848	0.00000
$\ln Q_1$	$\alpha_1$	0.63572	0.12470	5.097	0.00000
$\ln Q_2$	$\alpha_2$	0.23612	0.10750	2.196	0.02810
$\ln P_1$	$\beta_1$	-1.09310	0.09442	-11.578	0.00000
$\ln P_2$	$\beta_2$	0.21723	0.05302	4.097	0.00004
$\ln P_3$	$\beta_3$	1.87587	0.07562	24.806	0.00000
$\ln Q_1 \ln Q_1$	$\delta_{11}$	0.12485	0.04481	2.786	0.00534
$\ln Q_1 \ln Q_2$	$\delta_{12}$	-0.10736	0.03430	-3.130	0.00175
$\ln Q_2 \ln Q_2$	$\delta_{22}$	0.10964	0.02891	3.792	0.00015
$\ln P_1 \ln P_1$	$\gamma_{11}$	-0.00640	0.01049	-0.610	0.54000
$\ln P_1 \ln P_2$	$\gamma_{12}$	-0.09120	0.00677	-13.471	0.00000
$\ln P_2 \ln P_2$	$\gamma_{22}$	0.03390	0.00895	3.786	0.00015
$\ln P_1 \ln P_3$	$\gamma_{13}$	0.09760	0.00484	20.151	0.00000
$\ln P_2 \ln P_3$	$\gamma_{23}$	0.05730	0.00827	6.928	0.00000
$\ln P_3 \ln P_3$	$\gamma_{33}$	-0.15490	0.00545	-28.402	0.00000
$\ln P_1 \ln Q_1$	$\rho_{11}$	0.00089	0.01686	0.053	0.95769
$\ln P_1 \ln Q_2$	$\rho_{12}$	-0.00004	0.01530	-0.003	0.99784
$\ln P_3 \ln Q_1$	$\rho_{31}$	0.02971	0.01717	1.730	0.08500
$\ln P_2 \ln Q_1$	$\rho_{21}$	-0.03060	0.01694	-1.808	0.07064
$\ln P_2 \ln Q_2$	$\rho_{22}$	-0.00182	0.01582	-0.115	0.90844
$\ln P_3 \ln Q_2$	$\rho_{32}$	0.00186	0.01544	0.120	0.89500

Table A1.7 Maximum Likelihood Parameter Estimates For Spanish Banks at the Branch Level (Translog)

Variables	Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
Intercept	$\alpha_0$	-1.21800	0.37250	-3.270	0.00108
$\ln Q_1$	$\alpha_1$	0.46588	0.14260	3.267	0.00109
$\ln Q_2$	$\alpha_2$	0.27474	0.10190	2.697	0.00700
$\ln P_1$	$\beta_1$	-0.86540	0.10170	-8.511	0.00000
$\ln P_2$	$\beta_2$	1.31310	0.12400	10.589	0.00000
$\ln P_3$	$\beta_3$	0.55230	0.09480	5.825	0.00000
$\ln Q_1 \ln Q_1$	$\delta_{11}$	0.01697	0.03722	4.559	0.00001
$\ln Q_1 \ln Q_2$	$\delta_{12}$	-0.06899	0.02349	-2.937	0.00331
$\ln Q_2 \ln Q_2$	$\delta_{22}$	0.11636	0.04047	2.875	0.00404
$\ln P_1 \ln P_1$	$\gamma_{11}$	-0.17200	0.04379	-3.927	0.00009
$\ln P_1 \ln P_2$	$\gamma_{12}$	0.05910	0.04502	1.310	0.19100
$\ln P_2 \ln P_2$	$\gamma_{22}$	-0.01790	0.00965	-1.859	0.06298
$\ln P_1 \ln P_3$	$\gamma_{13}$	0.11290	0.01440	7.840	0.00000
$\ln P_2 \ln P_3$	$\gamma_{23}$	-0.04120	0.04428	-0.930	0.35500
$\ln P_3 \ln P_3$	$\gamma_{33}$	-0.07170	0.04877	-1.470	0.14143
$\ln P_1 \ln Q_1$	$\rho_{11}$	-0.05330	0.03794	-1.405	0.16002
$\ln P_1 \ln Q_2$	$\rho_{12}$	-0.00087	0.02266	-0.039	0.96918
$\ln P_3 \ln Q_1$	$\rho_{31}$	-0.00610	0.02283	-0.267	0.78000
$\ln P_2 \ln Q_1$	$\rho_{21}$	0.05940	0.03970	1.495	0.13486
$\ln P_2 \ln Q_2$	$\rho_{22}$	-0.02620	0.03089	-0.848	0.39637
$\ln P_3 \ln Q_2$	$\rho_{32}$	0.02707	0.02906	0.931	0.35000
$\ln B$	$\lambda_b$	0.12692	0.03424	3.707	0.00021
$\ln B \ln B$	$\lambda_{bb}$	0.01513	0.03671	0.412	0.68030
$\ln B \ln Q_1$	$\lambda_{b1}$	0.01455	0.04053	0.359	0.71966
$\ln B \ln Q_2$	$\lambda_{b2}$	-0.04894	0.03734	-1.311	0.18995
$\ln B \ln P_1$	$\tau_{b1}$	0.05610	0.05497	1.021	0.30739
$\ln B \ln P_2$	$\tau_{b2}$	0.07610	0.05440	1.398	0.16198
$\ln B \ln P_3$	$\tau_{b3}$	-0.13220	0.03761	-3.515	0.00050

Table A1.8 Maximum Likelihood Parameter Estimates For Spanish Banks at the Firm Level (Translog)

Variables	Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
Intercept	$\alpha_0$	-1.13700	0.33560	-3.388	0.00070
$\ln Q_1$	$\alpha_1$	0.48686	0.13640	3.569	0.00036
$\ln Q_2$	$\alpha_2$	0.27722	0.09465	2.929	0.00340
$\ln P_1$	$\beta_1$	-0.96150	0.09838	-9.773	0.00000
$\ln P_2$	$\beta_2$	1.35800	0.10940	12.415	0.00000
$\ln P_3$	$\beta_3$	0.60350	0.08154	7.401	0.00000
$\ln Q_1 \ln Q_1$	$\delta_{11}$	0.14369	0.03228	4.451	0.00001
$\ln Q_1 \ln Q_2$	$\delta_{12}$	-0.05200	0.02198	-2.366	0.01798
$\ln Q_2 \ln Q_2$	$\delta_{22}$	0.08051	0.02881	2.794	0.00520
$\ln P_1 \ln P_1$	$\gamma_{11}$	-0.23430	0.02314	-10.125	0.00000
$\ln P_1 \ln P_2$	$\gamma_{12}$	0.10770	0.01632	6.599	0.00000
$\ln P_2 \ln P_2$	$\gamma_{22}$	-0.02670	0.00874	-3.050	0.00229
$\ln P_1 \ln P_3$	$\gamma_{13}$	0.12660	0.01329	9.519	0.00000
$\ln P_2 \ln P_3$	$\gamma_{23}$	-0.08100	0.01925	-4.207	0.00002
$\ln P_3 \ln P_3$	$\gamma_{33}$	-0.04560	0.01886	-2.419	0.01556
$\ln P_1 \ln Q_1$	$\rho_{11}$	-0.03830	0.02926	-1.307	0.19107
$\ln P_1 \ln Q_2$	$\rho_{12}$	0.02660	0.02219	1.199	0.23050
$\ln P_3 \ln Q_1$	$\rho_{31}$	-0.03410	0.02105	-1.619	0.11000
$\ln P_2 \ln Q_1$	$\rho_{21}$	0.07240	0.02718	2.663	0.00773
$\ln P_2 \ln Q_2$	$\rho_{22}$	-0.01560	0.02430	-0.628	0.52997
$\ln P_3 \ln Q_2$	$\rho_{32}$	-0.01100	0.02189	-0.502	0.61100

Appendix 2 The hybrid translog cost function estimates at the branch and firm level

Table A2.1 Maximum Likelihood Parameter Estimates For French Banks for Branch Level

Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
$\alpha_0$	-3.37160	0.23570	-14.303	0.00000
$\alpha_1$	0.73030	0.06681	10.930	0.00000
$\alpha_2$	0.30700	0.05325	5.766	0.00000
$\beta_1$	-0.46620	0.05742	-8.119	0.00000
$\beta_2$	0.41000	0.06320	6.489	0.00000
$\beta_3$	1.05620	0.07016	15.054	0.00000
$\delta_{11}$	-0.03650	0.01154	-3.165	0.00155
$\delta_{12}$	-0.03860	0.00806	-4.787	0.00000
$\delta_{22}$	0.02410	0.00846	-2.848	0.0044
$\gamma_{11}$	0.00060	0.00576	0.104	0.90000
$\gamma_{12}$	-0.04460	0.00859	-5.192	0.00000
$\gamma_{22}$	0.00600	0.00742	0.807	0.41939
$\gamma_{13}$	0.04400	0.00371	11.852	0.00000
$\gamma_{23}$	0.03860	0.00579	6.667	0.00000
$\gamma_{33}$	-0.08260	0.00801	-10.306	0.00000
$\rho_{11}$	0.10379	0.01383	7.505	0.00000
$\rho_{12}$	0.03036	0.01068	2.842	0.00448
$\rho_{31}$	-0.11010	0.01123	-9.804	0.00000
$\rho_{21}$	0.00630	0.00954	0.664	0.50691
$\rho_{22}$	0.04260	0.01086	3.918	0.00009
$\rho_{32}$	-0.07300	0.00940	-7.766	0.00000
$\lambda_b$	-0.17698	0.01546	-11.449	0.00000
$\lambda_{bb}$	-0.03946	0.01723	-2.29	0.02199
$\lambda_{b1}$	0.07364	0.01604	4.591	0.00000
$\lambda_{b2}$	0.05355	0.01245	4.303	0.00002
$\tau_{b1}$	-0.19640	0.01863	-10.544	0.00000
$\tau_{b2}$	0.00590	0.02103	0.280	0.77917
$\tau_{b3}$	0.19050	0.01597	11.928	0.00000

Table A2.2 Maximum Likelihood Parameter Estimates For  
French Banks at the Firm Level

Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
$\alpha_0$	-1.2626	0.30230	-4.177	0.00003
$\alpha_1$	0.47663	0.08226	5.794	0.00000
$\alpha_2$	0.26735	0.07188	3.719	0.00020
$\beta_1$	-0.13030	0.08219	-1.585	0.11287
$\beta_2$	0.40110	0.08154	4.919	0.00000
$\beta_3$	0.72920	0.08477	8.602	0.00000
$\delta_{11}$	0.05371	0.01542	3.484	0.00049
$\delta_{12}$	-0.04667	0.00943	-4.948	0.00000
$\delta_{22}$	0.07719	0.01348	5.726	0.00000
$\gamma_{11}$	-0.05430	0.01005	-5.403	0.00000
$\gamma_{12}$	-0.00880	0.01327	-0.664	0.50691
$\gamma_{22}$	0.03030	0.00719	4.217	0.00002
$\gamma_{13}$	0.06310	0.00428	14.732	0.00000
$\gamma_{23}$	-0.02150	0.01155	-1.861	0.06000
$\gamma_{33}$	-0.04160	0.01448	-2.874	0.00405
$\rho_{11}$	0.00780	0.01593	0.488	0.62587
$\rho_{12}$	0.03710	0.01521	2.438	0.01478
$\rho_{31}$	-0.01390	0.01384	-1.004	0.32500
$\rho_{21}$	0.00610	0.01240	0.494	0.62130
$\rho_{22}$	-0.02340	0.01276	-1.835	0.06658
$\rho_{32}$	-0.01370	0.01320	-1.037	0.32100

Table A2.3 Maximum Likelihood Parameter Estimates For  
German Banks at the Branch Level

Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
$\alpha_0$	-3.92900	0.34550	-11.374	0.00000
$\alpha_1$	0.76843	0.08467	9.076	0.00000
$\alpha_2$	0.38071	0.08622	4.415	0.00001
$\beta_1$	-0.41170	0.06766	-6.084	0.00000
$\beta_2$	0.52580	0.07663	6.861	0.00000
$\beta_3$	0.88590	0.08622	10.275	0.00000
$\delta_{11}$	-0.04968	0.01147	-4.329	0.00001
$\delta_{12}$	-0.02982	0.00905	-3.294	0.00099
$\delta_{22}$	0.00741	0.01437	-5.155	0.00000
$\gamma_{11}$	0.12970	0.01013	12.803	0.00000
$\gamma_{12}$	0.15980	0.01180	13.542	0.00000
$\gamma_{22}$	-0.02820	0.00514	-5.476	0.00000
$\gamma_{13}$	0.03010	0.00284	10.609	0.00000
$\gamma_{23}$	0.18800	0.01199	15.679	0.00000
$\gamma_{33}$	-0.21810	0.01323	-16.487	0.00000
$\rho_{11}$	0.11094	0.01122	9.889	0.00000
$\rho_{12}$	0.01750	0.01253	1.392	0.16380
$\rho_{31}$	-0.09390	0.01282	-7.324	0.00000
$\rho_{21}$	-0.01730	0.00603	-2.873	0.00407
$\rho_{22}$	0.04990	0.01263	3.950	0.00008
$\rho_{32}$	-0.06740	0.01409	-4.783	0.00000
$\lambda_b$	-0.15088	0.01402	-10.765	0.00000
$\lambda_{bb}$	0.01599	0.00738	2.166	0.03030
$\lambda_{b1}$	0.01179	0.00421	2.798	0.00514
$\lambda_{b2}$	0.10461	0.00946	11.056	0.00000
$\tau_{b1}$	-0.21037	0.01471	-14.301	0.00000
$\tau_{b2}$	0.05258	0.01224	4.294	0.00002
$\tau_{b3}$	0.15780	0.01647	9.581	0.00000



Table A2.4 Maximum Likelihood Parameter Estimates For  
German Banks at the Firm Level

Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
$\alpha_0$	-2.81800	0.53820	-5.236	0.00000
$\alpha_1$	0.63278	0.10090	6.271	0.00000
$\alpha_2$	0.43918	0.16730	2.625	0.00867
$\beta_1$	-0.29120	0.11410	-2.551	0.01073
$\beta_2$	0.57580	0.14030	4.105	0.00004
$\beta_3$	0.71540	0.12995	5.505	0.00000
$\delta_{11}$	0.06357	0.00695	0.915	0.36020
$\delta_{12}$	-0.01398	0.004634	-3.018	0.00255
$\delta_{22}$	0.08142	0.02180	3.735	0.00019
$\gamma_{11}$	0.06270	0.00276	22.717	0.00000
$\gamma_{12}$	-0.09720	0.00546	-17.802	0.00000
$\gamma_{22}$	0.18270	0.02122	8.611	0.00000
$\gamma_{13}$	0.03450	0.002917	11.829	0.00000
$\gamma_{23}$	-0.08550	0.00561	-15.240	0.00000
$\gamma_{33}$	0.05100	0.01343	3.797	0.00015
$\rho_{11}$	0.02440	0.02588	0.941	0.34663
$\rho_{12}$	0.09200	0.03069	2.998	0.00272
$\rho_{31}$	0.01270	0.02191	0.579	0.53200
$\rho_{21}$	-0.03706	0.01239	-2.991	0.00278
$\rho_{22}$	-0.05570	0.01971	-2.826	0.00472
$\rho_{32}$	-0.03630	0.02194	-1.654	0.10500

Table A2.5 Maximum Likelihood Parameter Estimates For Italian Banks at the Branch Level

Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
$\alpha_0$	3.39980	0.37610	9.04	0.00000
$\alpha_1$	0.78734	0.13770	5.719	0.00000
$\alpha_2$	0.34874	0.11080	3.148	0.00164
$\beta_1$	1.36720	0.08831	15.482	0.00000
$\beta_2$	-0.60160	0.03519	-17.096	0.00000
$\beta_3$	0.23440	0.07702	3.043	0.01500
$\delta_{11}$	-0.10806	0.04283	-2.523	0.01163
$\delta_{12}$	-0.11639	0.03010	-3.866	0.00011
$\delta_{22}$	0.09880	0.02327	4.245	0.00002
$\gamma_{11}$	0.17270	0.01165	14.824	0.00000
$\gamma_{12}$	-0.23070	0.00844	-27.334	0.00000
$\gamma_{22}$	0.27630	0.00932	29.634	0.00000
$\gamma_{13}$	0.05800	0.00562	10.32	0.00000
$\gamma_{23}$	-0.04560	0.00678	-6.725	0.00000
$\gamma_{33}$	-0.01240	0.00318	-3.913	0.00009
$\rho_{11}$	-0.14655	0.02995	-4.893	0.00000
$\rho_{12}$	0.01370	0.02879	0.477	0.63334
$\rho_{31}$	0.12055	0.02411	5.000	0.00000
$\rho_{21}$	0.02600	0.01144	2.277	0.02277
$\rho_{22}$	-0.00172	0.01010	-0.170	0.86498
$\rho_{32}$	-0.01200	0.02108	-0.569	0.54300
$\lambda_b$	-0.00092	0.00677	-0.136	0.89182
$\lambda_{bb}$	-0.08962	0.03115	-2.877	0.00402
$\lambda_{b1}$	0.21260	0.03287	6.468	0.00000
$\lambda_{b2}$	-0.00245	0.02862	-0.085	0.9319
$\tau_{b1}$	0.10007	0.03083	3.245	0.00117
$\tau_{b2}$	0.11348	0.02467	4.600	0.00000
$\tau_{b3}$	-0.21355	0.02544	-8.394	0.00000

Table A2.6 Maximum Likelihood Parameter Estimates For Italian Banks at the Firm Level

Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
$\alpha_0$	-2.97000	0.29950	-9.915	0.00000
$\alpha_1$	0.64872	0.11670	5.558	0.0000
$\alpha_2$	0.22576	0.10200	2.214	0.02684
$\beta_1$	-1.08280	0.09374	-11.551	0.00000
$\beta_2$	0.20990	0.05188	4.045	0.00005
$\beta_3$	1.87290	0.07487	25.015	0.00000
$\delta_{11}$	0.10839	0.04114	2.635	0.00842
$\delta_{12}$	-0.10120	0.03197	-3.165	0.00155
$\delta_{22}$	0.10422	0.02745	3.797	0.00015
$\gamma_{11}$	-0.00590	0.01049	-0.562	0.54500
$\gamma_{12}$	-0.09200	0.00678	-13.569	0.00000
$\gamma_{22}$	0.03470	0.00898	3.865	0.00011
$\gamma_{13}$	0.09760	0.00484	20.154	0.00000
$\gamma_{23}$	0.05700	0.00827	6.892	0.00000
$\gamma_{33}$	-0.15460	0.00546	-28.299	0.00000
$\rho_{11}$	-0.00044	0.01619	-0.027	0.97825
$\rho_{12}$	0.00051	0.01485	0.035	0.97244
$\rho_{31}$	0.02884	0.01717	1.679	0.09000
$\rho_{21}$	-0.02840	0.01623	-1.751	0.08001
$\rho_{22}$	-0.00208	0.01532	-0.136	0.89206
$\rho_{32}$	0.00157	0.01544	0.101	0.91000

Table A2.7 Maximum Likelihood Parameter Estimates For Spanish Banks at the Branch Level

Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
$\alpha_0$	2.18710	0.19260	11.358	0.00000
$\alpha_1$	0.30415	0.04835	6.290	0.00000
$\alpha_2$	0.25167	0.06930	3.632	0.00028
$\beta_1$	-0.35800	0.08330	-4.297	0.00002
$\beta_2$	0.56740	0.09841	5.766	0.00000
$\beta_3$	0.79060	0.06597	11.984	0.00000
$\delta_{11}$	-0.00057	0.00167	-0.339	0.73481
$\delta_{12}$	-0.01244	0.00266	-4.679	0.00000
$\delta_{22}$	0.00796	0.00538	1.479	0.13907
$\gamma_{11}$	-0.23266	0.03309	-7.031	0.00000
$\gamma_{12}$	-0.01224	0.03071	-0.398	0.70520
$\gamma_{22}$	-0.00140	0.01308	-0.104	0.91727
$\gamma_{13}$	0.24486	0.01492	16.417	0.00000
$\gamma_{23}$	0.01360	0.03048	0.446	0.67520
$\gamma_{33}$	-0.25846	0.03278	-7.884	0.00000
$\rho_{11}$	0.03497	0.01936	1.807	0.07084
$\rho_{12}$	0.06411	0.02735	2.344	0.01906
$\rho_{31}$	0.01280	0.01005	1.274	0.20500
$\rho_{21}$	-0.04785	0.01729	-2.768	0.00565
$\rho_{22}$	-0.00498	0.02490	-0.200	0.84164
$\rho_{32}$	-0.06910	0.01782	-3.877	0.00050
$\lambda_b$	-0.04309	0.04367	-0.987	0.32382
$\lambda_{bb}$	-0.01580	0.02208	-0.715	0.47435
$\lambda_{b1}$	0.014199	0.00920	1.543	0.12288
$\lambda_{b2}$	0.009267	0.01416	0.654	0.51288
$\tau_{b1}$	-0.12732	0.03914	-3.253	0.00114
$\tau_{b2}$	0.11336	0.04171	2.718	0.00657
$\tau_{b3}$	0.01390	0.02746	0.506	0.61496

Table A2.8 Maximum Likelihood Parameter Estimates For Spanish Banks at the Firm Level

Parameters	Coefficient	Std. Error	T-ratio	Prob >  T
$\alpha_0$	2.7298	0.2033	13.424	0.00000
$\alpha_1$	0.3791	0.04521	8.386	0.00000
$\alpha_2$	0.20037	0.06621	3.026	0.00248
$\beta_1$	-0.37080	0.08444	-4.391	0.00001
$\beta_2$	0.53420	0.09147	5.840	0.00000
$\beta_3$	0.83660	0.08154	10.259	0.00000
$\delta_{11}$	-0.00189	0.00196	-0.962	0.33592
$\delta_{12}$	-0.00498	0.00225	-2.214	0.02681
$\delta_{22}$	0.00548	0.00640	0.856	0.39177
$\gamma_{11}$	-0.19640	0.03659	-5.367	0.00000
$\gamma_{12}$	-0.07960	0.03029	-2.627	0.00956
$\gamma_{22}$	0.04905	0.00844	5.814	0.00000
$\gamma_{13}$	0.27604	0.01636	16.875	0.00000
$\gamma_{23}$	0.03060	0.03226	0.948	0.35010
$\gamma_{33}$	-0.30663	0.03263	-9.398	0.00000
$\rho_{11}$	0.07800	0.01921	4.060	0.00005
$\rho_{12}$	0.05150	0.02488	2.070	0.03849
$\rho_{31}$	0.01400	0.01111	1.260	0.21600
$\rho_{21}$	-0.09200	0.01597	-5.761	0.00000
$\rho_{22}$	-0.00790	0.02137	-0.370	0.71110
$\rho_{32}$	-0.04360	0.01798	-0.242	0.80200

Table A2.9 Estimated Lambda and the test for Linearity and Log-linearity for Hybrid Translog Cost Function<sup>a</sup>

Country and Products	Estimated Lambda ( $\lambda$ )	Linearity ( $\lambda = 1$ )	Log-linear ( $\lambda = 0$ )	Decision <sup>b</sup>	
				$\lambda = 1$	$\lambda = 0$
<u>France</u>					
Total Loans	0.1557* (0.0323)	431.08	251.23	Reject	Reject
Total Securities	0.1217* (0.0389)	348.37	144.51	Reject	Reject
<u>Germany</u>					
Total Loans	0.1283* (0.0397)	488.83	64.894	Reject	Reject
Total Securities	0.1646* (0.0435)	321.48	14.650	Reject	Reject
<u>Italy</u>					
Total Loans	0.0951* (0.0347)	36.065	7.085	Reject	Reject
Total Securities	0.1558* (0.0309)	692.28	26.045	Reject	Reject
<u>Spain</u>					
Total Loans	0.2309* (0.0273)	175.50	77.944	Reject	Reject
Total Securities	0.2557* (0.0296)	889.85	74.237	Reject	Reject

<sup>a</sup> Approximate standard error in parentheses.

<sup>b</sup> The Critical value of  $\chi^2_{1,05} = 3.84$ .

\* Significant at 0.01 level.

Appendix 3 Estimates of scale and scope economies as well as other relevant test results  
for the Ordinary Translog Cost function

Table A3.1 Partial Economies of Scale For French Banks Using the  
Ordinary Translog Cost Function\*

Total Assets Sizes (\$ mil)	Branch		Firm	
	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>1</sub>	Q <sub>2</sub>
0 - 100	0.4815 <sup>*</sup> (0.0874)	0.0813 (0.0653)	0.6189 <sup>*</sup> (0.0731)	0.2977 <sup>*</sup> (0.0906)
100 - 300	0.4916 <sup>*</sup> (0.0946)	0.0971 (0.0699)	0.5899 <sup>*</sup> (0.1627)	0.4234 <sup>*</sup> (0.0902)
300 - 600	0.4309 <sup>*</sup> (0.1002)	0.1163 (0.0788)	0.6111 <sup>*</sup> (0.0983)	0.4216 <sup>*</sup> (0.1108)
600 - 1000	0.4920 <sup>*</sup> (0.1079)	0.1203 (0.0840)	0.6415 <sup>*</sup> (0.1075)	0.4399 <sup>*</sup> (0.1197)
1000 - 3000	0.4855 <sup>*</sup> (0.1117)	0.2001 <sup>—</sup> (0.0953)	0.5976 <sup>*</sup> (0.1652)	0.5351 <sup>*</sup> (0.1344)
3000 - 5000	0.4775 <sup>*</sup> (0.1174)	0.2189 <sup>—</sup> (0.1040)	0.5999 <sup>*</sup> (0.1405)	0.5717 <sup>*</sup> (0.1460)
5000 <	0.4542 <sup>*</sup> (0.1381)	0.2355 <sup>—</sup> (0.1291)	0.6645 <sup>*</sup> (0.1809)	0.6011 <sup>*</sup> (0.1790)
All	0.4668 <sup>*</sup> (0.1079)	0.1523 <sup>—</sup> (0.0887)	0.6183 <sup>*</sup> (0.1149)	0.4775 <sup>*</sup> (0.1248)

\* Approximate standard error in parentheses.

<sup>\*</sup> Significant at 0.01 level.

<sup>—</sup> Significant at 0.05 level.

<sup>—</sup> Significant at 0.10 level.

Q<sub>1</sub> = Total Loans

Q<sub>2</sub> = Total Securities

Table A3.2 Partial Economies of Scale For German Banks Using the Ordinary Translog Cost Function\*

Total Assets Sizes (\$ mil)	Branch		Firm	
	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>1</sub>	Q <sub>2</sub>
0 - 100	0.6844* (0.1165)	0.0389 (0.0979)	0.7136* (0.1087)	0.9795* (0.1056)
100 - 300	0.5228* (0.1305)	-0.0219 (0.1087)	0.7379* (0.0814)	1.0078* (0.0918)
300 - 600	0.5661* (0.1362)	0.0124 (0.1157)	0.6961* (0.0714)	1.2293* (0.0793)
600 - 1000	0.5485* (0.1446)	0.0268 (0.1246)	0.6831* (0.0616)	1.3634* (0.0757)
1000 - 3000	0.4385* (0.1465)	0.1608 (0.1346)	0.6846* (0.0588)	1.3943* (0.0824)
3000 - 5000	0.3746 <sup>***</sup> (0.1568)	0.2787 <sup>***</sup> (0.1491)	0.6739* (0.0624)	1.4648* (0.0972)
5000 <	0.2777 (0.1718)	0.3082 <sup>***</sup> (0.1612)	0.7047* (0.0790)	1.4234* (0.0996)
All	0.4395* (0.1495)	0.1604 (0.1343)	0.6935* (0.0580)	1.3490* (0.0790)

\* Approximate standard error in parentheses.

\* Significant at 0.01 level.

<sup>\*\*</sup> Significant at 0.05 level.

<sup>\*\*\*</sup> Significant at 0.10 level.

Q<sub>1</sub> = Total Loans

Q<sub>2</sub> = Total Securities



Table A3.3 Partial Economies of Scale For Italian Banks Using the Ordinary Translog Cost Function\*

Total Assets Sizes (\$ mil)	Branch		Firm	
	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>1</sub>	Q <sub>2</sub>
0 - 100	0.8539* (0.2279)	0.1476 (0.2192)	0.8923* (0.1137)	0.1268 (0.2432)
100 - 300	0.6842* (0.2610)	0.1366 (0.2870)	0.8938* (0.2132)	0.1457 (0.3255)
300 - 600	0.6312* (0.2801)	0.1446 (0.3314)	0.8816* (0.2805)	0.1739 (0.3787)
600 - 1000	0.6008* (0.3018)	0.1139 (0.3626)	0.9059* (0.3264)	0.1547 (0.4151)
1000 - 3000	0.5349*** (0.3239)	0.0731 (0.3930)	0.8423*** (0.3713)	0.1306 (0.4505)
3000 - 5000	0.5068 (0.3571)	0.0286 (0.4422)	0.9768* (0.4440)	0.1075 (0.5075)
5000 <	0.4012 (0.4026)	-0.0014 (0.5232)	0.9901*** (0.5648)	0.1144 (0.6021)
All	0.6224*** (0.2916)	0.1105 (0.3409)	0.9086* (0.2936)	0.1434 (0.3893)

\* Approximate standard error in parentheses.

\* Significant at 0.01 level.

\*\* Significant at 0.05 level.

\*\*\* Significant at 0.10 level.

Q<sub>1</sub> = Total Loans

Q<sub>2</sub> = Total Securities

Table A3.4 Partial Economies of Scale For Spanish Banks Using the Ordinary Translog Cost Function\*

Total Assets Sizes (\$ mil)	Branch		Firm	
	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>1</sub>	Q <sub>2</sub>
0 - 100	0.5141* (0.1227)	0.2387*** (0.1276)	0.4330* (0.1076)	0.1977*** (0.1173)
100 - 300	0.5060* (0.1776)	0.1672 (0.2186)	0.7477* (0.1332)	0.1716 (0.1900)
300 - 600	0.4659** (0.2213)	0.1521 (0.2654)	0.8597* (0.1650)	0.1888 (0.2249)
600 - 1000	0.3989 (0.2725)	0.2067 (0.3250)	0.8666* (0.2053)	0.2433 (0.2666)
1000 - 3000	0.3486 (0.3209)	0.2225 (0.3786)	0.9033* (0.2391)	0.2927 (0.3013)
3000 - 5000	0.2635 (0.3777)	0.2603 (0.4442)	0.9730* (0.2855)	0.3607 (0.3485)
5000 <	0.2420 (0.4542)	0.2417 (0.5225)	1.0644* (0.3374)	0.3847 (0.3993)
All	0.4083 (0.2602)	0.2006 (0.3119)	0.8373* (0.1935)	0.2485 (0.2549)

\* Approximate standard error in parentheses.

\*\* Significant at 0.01 level.

\*\* Significant at 0.05 level.

\*\*\* Significant at 0.10 level.

Q<sub>1</sub> = Total Loans

Q<sub>2</sub> = Total Securities

Table A3.5 Product Specific Economies of Scale Using the Ordinary Translog Cost Function

Products	France		Germany		Italy		Spain	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
Total Loans	1.3406	1.5919	1.1405	1.4999	1.2620	1.2316	2.8272	1.3519
Total Securities	3.1892	2.8374	2.6517	2.1954	1.2631	0.3444	0.1203	1.7209

Table A3.6 Pairwise Cost Complementarities Using the Ordinary Translog Cost Function<sup>a</sup>

	Branch	Firm
France	0.1848* (0.03445)	0.0741* (0.03036)
Germany	0.2949* (0.06230)	0.2443* (0.10180)
Italy	0.1758* (0.05575)	0.0427 (0.02786)
Spain	0.0590 (0.11650)	0.0830 <sup>***</sup> (0.03847)

<sup>a</sup> Approximate Standard error in parentheses.

\* Significant at 0.01 level.

<sup>\*\*\*</sup> Significant at 0.05 level.

Table A3.7 Overall Economies of Scope Using the Ordinary Translog Cost Function<sup>a</sup>

Total Assets Sizes (\$ mil)	France		Germany		Italy		Spain	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	-0.5600 (0.4350)	0.2285 (0.5376)	-0.8410 (0.6113)	-0.8889 (0.9956)	1.5999* (0.2223)	0.6105 (0.6453)	0.5004 (0.5238)	0.0727 (0.4776)
100 - 300	-0.5935 (0.5034)	0.1109 (0.6442)	-0.8214 (0.7463)	-0.9017 (1.1014)	5.2600* (0.4727)	0.7611 (1.0242)	1.9807* (0.8685)	0.3663 (0.7869)
300 - 600	-0.5427 (0.5839)	0.2040 (0.7619)	-0.8318 (0.8264)	-0.9222 (1.1473)	12.0228* (0.7433)	0.9576 (1.4206)	2.9994* (1.0979)	0.6125 (0.9974)
600 - 1000	-0.4194 (0.6502)	0.5536 (0.8441)	-0.8201 (0.9279)	-0.9314 (1.1903)	25.0951* (0.9401)	1.1019 (1.7355)	3.3921* (1.4617)	0.6207 (1.3398)
1000 - 3000	-0.4658 (0.7358)	0.1752 (1.0150)	-0.8353 (1.0340)	-0.9517 (1.2231)	55.8766* (1.1488)	1.7873 (2.0832)	3.6959* (1.8365)	-0.6199 (1.6911)
3000 - 5000	-0.3982 (0.8127)	0.1879 (1.1993)	-0.8040 (1.1868)	-0.9576 (1.2515)	20.8459* (1.5318)	1.9634 (2.7373)	4.3368 <sup>**</sup> (2.4396)	-0.6579 (2.2546)
5000 <	0.2932 (1.0589)	1.0776 (1.6991)	-0.6921 (1.3443)	-0.9447 (1.2536)	19.8936* (2.3063)	2.6100 (4.0711)	6.6780* (3.1954)	-1.0326 (2.9633)
All	-0.4670 (0.6767)	0.3092 (0.9181)	-0.8107 (1.0405)	-0.9427 (1.2237)	16.8489* (0.7866)	1.3880 (1.4975)	2.8469* (1.3526)	-0.4840 (1.2382)

<sup>a</sup> Approximate standard error in parentheses.

\* Significant at 0.01 level.

<sup>\*\*</sup> Significant at 0.05 level.

<sup>\*\*\*</sup> Significant at 0.10 level.

Table A3.8 Expansion Path Subadditivity Using the Ordinary Translog Cost Function (%)

Total Assets Sizes (\$ mil)	France		Germany		Italy		Spain	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	0.0678	0.0778	0.0463	0.0208	0.5059	0.5424	-0.0337	-0.0479
100 - 300	0.2059	0.0718	0.1588	0.0571	0.6612	0.6491	0.1496	-0.0395
300 - 600	0.2952	0.0537	0.2826	0.0292	0.7453	0.7275	0.3036	0.1681
600 - 1000	0.3227	0.0022	0.3783	0.0283	0.8005	0.7690	0.2885	0.2328
1000 - 3000	0.3813	0.0529	0.4505	0.0494	0.8259	0.7921	0.2824	0.2806
3000 - 5000	0.4868	0.0263	0.5984	0.0289	0.8680	0.8229	0.2618	0.3189
5000 <	0.5565	6.4224	0.5663	0.3530	0.8598	0.8107	0.2631	0.3451
All	0.0001	0.0079	0.0273	0.0022	0.3557	0.3693	0.0057	0.0002

Table A3.9 Elasticities Of Substitution Between Pairs of Inputs For French Banks Using the Ordinary Translog Cost Function<sup>a</sup>

Total Assets Sizes (\$ mil)	Labour-Deposits		Labour-Capital		Deposits-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	0.7019 (0.5849)	0.9280* (0.0672)	1.6611* (0.0192)	1.9672* (0.0197)	1.2810* (0.0107)	0.8255* (0.0111)
100 - 300	0.7141 (0.5609)	0.9310* (0.0645)	1.6282* (0.0164)	1.9190* (0.0169)	1.2955* (0.0342)	0.8165* (0.0356)
300 - 600	0.6772 (0.6334)	0.9220* (0.0728)	3.0410* (0.0262)	3.9859* (0.0269)	1.3835* (0.0100)	0.7619* (0.0104)
600 - 1000	0.6713 (0.6450)	0.9206* (0.0741)	3.2592* (0.0083)	4.3051* (0.0085)	1.4008* (0.0380)	0.7511* (0.0396)
1000 - 3000	0.6653 (0.6567)	0.9192* (0.0755)	3.3540* (0.0163)	4.4438* (0.0167)	1.4035* (0.0423)	0.7495* (0.0441)
3000 - 5000	0.6629 (0.6614)	0.9189* (0.0760)	3.1625* (0.0002)	4.1637* (0.0002)	1.3790* (0.0028)	0.7646* (0.0029)
5000 <	0.5626 (0.8576)	0.8945* (0.0985)	3.8501* (0.0216)	5.1696* (0.0222)	1.3476* (0.0075)	0.7841* (0.0078)
All	0.6833 (0.6214)	0.9235* (0.0714)	2.5389* (0.0204)	3.2514* (0.0209)	1.3336* (0.0402)	0.7929* (0.0419)

<sup>a</sup> Approximate standard error in parentheses.

\* Significant at 0.01 level.

~ Significant at 0.05 level.

~ Significant at 0.10 level.

Table A3.10 Elasticities Of Substitution Between Pairs of Inputs For German Banks Using the Ordinary Translog Cost Function<sup>a</sup>

Total Assets Sizes (\$ mil)	Labour-Deposits		Labour-Capital		Deposits-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	0.7019 <sup>*</sup> (0.0836)	0.9280 <sup>*</sup> (0.0877)	1.6611 <sup>*</sup> (0.0249)	1.9672 <sup>*</sup> (0.0276)	1.2810 <sup>*</sup> (0.0331)	0.8255 <sup>*</sup> (0.0345)
100 - 300	0.7141 <sup>*</sup> (0.0820)	0.9310 <sup>*</sup> (0.0860)	1.6282 <sup>*</sup> (0.0036)	1.9190 <sup>*</sup> (0.0040)	1.2955 <sup>*</sup> (0.0077)	0.8165 <sup>*</sup> (0.0080)
300 - 600	0.6772 <sup>*</sup> (0.0819)	0.9220 <sup>*</sup> (0.0859)	3.0410 <sup>*</sup> (0.0152)	3.9859 <sup>*</sup> (0.0169)	1.3835 <sup>*</sup> (0.0292)	0.7619 <sup>*</sup> (0.0304)
600 - 1000	0.6713 <sup>*</sup> (0.0853)	0.9206 (0.0895)	3.2592 <sup>*</sup> (0.0105)	4.3051 <sup>*</sup> (0.0116)	1.4008 <sup>*</sup> (0.0038)	0.7511 <sup>*</sup> (0.0045)
1000 - 3000	0.6653 <sup>*</sup> (0.0834)	0.9192 <sup>*</sup> (0.0875)	3.3540 <sup>*</sup> (0.0229)	4.4438 <sup>*</sup> (0.0254)	1.4035 (0.0010)	0.7495 <sup>*</sup> (0.0011)
3000 - 5000	0.6629 <sup>*</sup> (0.0802)	0.9189 <sup>*</sup> (0.0842)	3.1625 <sup>*</sup> (0.0225)	4.1637 <sup>*</sup> (0.0249)	1.3790 <sup>*</sup> (0.0079)	0.7646 <sup>*</sup> (0.0082)
5000 <	0.5626 <sup>*</sup> (0.1163)	0.8945 <sup>**</sup> (0.1221)	3.8501 <sup>*</sup> (0.0018)	5.1696 <sup>*</sup> (0.0019)	1.3476 <sup>*</sup> (0.0343)	0.7841 <sup>*</sup> (0.0357)
All	0.6833 <sup>*</sup> (0.0857)	0.9235 <sup>**</sup> (0.0899)	2.5389 <sup>*</sup> (0.0143)	3.2514 <sup>*</sup> (0.0158)	1.3336 <sup>*</sup> (0.0268)	0.7929 <sup>*</sup> (0.0279)

<sup>a</sup> Approximate standard error in parentheses.

<sup>\*</sup> Significant at 0.01 level.

<sup>\*\*</sup> Significant at 0.05 level.

<sup>\*\*</sup> Significant at 0.10 level.

Table A3.11 Elasticities Of Substitution Between Pairs of Inputs For Italian Banks Using the Ordinary Translog Cost Function<sup>a</sup>

Total Assets Sizes (\$ mil)	Labour-Deposits		Labour-Capital		Deposits-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	-0.0957 <sup>***</sup> (0.0403)	0.5625 <sup>*</sup> (0.0339)	2.8965 <sup>*</sup> (0.1820)	4.1913 <sup>*</sup> (0.1462)	-0.1103 (0.1644)	2.4044 <sup>*</sup> (0.2021)
100 - 300	-0.0978 <sup>***</sup> (0.0405)	0.5616 <sup>*</sup> (0.0341)	2.4081 <sup>*</sup> (0.1352)	3.3695 <sup>*</sup> (0.1086)	-0.0368 (0.2179)	2.8610 <sup>*</sup> (0.2678)
300 - 600	-0.0928 <sup>***</sup> (0.0404)	0.5637 <sup>*</sup> (0.0338)	2.4307 <sup>*</sup> (0.1373)	3.4075 <sup>*</sup> (0.1103)	-0.4529 <sup>***</sup> (0.2152)	2.8377 <sup>*</sup> (0.2645)
600 - 1000	-0.1594 <sup>*</sup> (0.0427)	0.5371 <sup>*</sup> (0.0359)	2.1901 <sup>*</sup> (0.1142)	3.0026 <sup>*</sup> (0.0918)	-0.5075 <sup>***</sup> (0.2233)	2.9069 <sup>*</sup> (0.2750)
1000 - 3000	-0.1973 <sup>*</sup> (0.0444)	0.5219 <sup>*</sup> (0.0370)	2.0184 <sup>*</sup> (0.0978)	2.7137 <sup>*</sup> (0.0785)	-0.2514 (0.1853)	2.5829 <sup>*</sup> (0.2278)
3000 - 5000	-0.2922 <sup>*</sup> (0.0476)	0.4840 <sup>*</sup> (0.0400)	1.8860 <sup>*</sup> (0.0850)	2.4910 <sup>*</sup> (0.0683)	-0.3550 <sup>***</sup> (0.2006)	2.7139 <sup>*</sup> (0.2467)
5000 <	-0.7970 <sup>*</sup> (0.0663)	0.2825 <sup>*</sup> (0.0557)	1.4815 <sup>*</sup> (0.0463)	1.8102 <sup>*</sup> (0.0371)	0.1073 (0.1322)	2.1292 <sup>*</sup> (0.1621)
All	-0.1376 <sup>*</sup> (0.0419)	0.5457 <sup>*</sup> (0.0352)	2.1859 <sup>*</sup> (0.1138)	2.9956 <sup>*</sup> (0.0914)	-0.2383 (0.1834)	2.5664 <sup>*</sup> (0.2254)

<sup>a</sup> Approximate standard error in parentheses.

<sup>\*</sup> Significant at 0.01 level.

<sup>\*\*</sup> Significant at 0.05 level.

<sup>\*\*\*</sup> Significant at 0.10 level.

Table A3.12 Elasticities Of Substitution Between Pairs of Inputs For Spanish Banks Using the Ordinary Translog Cost Function<sup>a</sup>

Total Assets Sizes (\$ mil)	Labour-Deposits		Labour-Capital		Deposits-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	3.9110 <sup>***</sup> (2.2178)	6.3048* (1.5128)	1.7317* (0.0933)	1.8204* (0.0967)	0.3317 (0.7183)	-0.3139 (0.4944)
100 - 300	7.1680 (4.9666)	12.8801* (3.3879)	1.8429* (0.1075)	1.9452* (0.1114)	-0.0144 (1.0903)	-0.9943 (0.7505)
300 - 600	13.0403 (9.1729)	22.9414* (6.2571)	1.8642* (0.1102)	1.9691* (0.1142)	-0.6797 (1.8054)	-2.3024 <sup>***</sup> (1.2427)
600 - 1000	6.5333 (4.2156)	11.0836* (2.8756)	1.7779* (0.0992)	1.8723* (0.1028)	0.0090 (1.0651)	-0.9483 (0.7332)
1000 - 3000	10.5771 (7.2963)	1.7664 (4.9770)	1.6835* (0.0872)	1.7664* (0.0903)	-0.9485 (2.0942)	-2.8309 <sup>***</sup> (1.4416)
3000 - 5000	13.2334 (9.3200)	1.7584 (6.3575)	1.6763* (0.0863)	1.7584* (0.0894)	-1.4791 (2.6644)	-3.8739 <sup>***</sup> (1.8341)
5000 <	9.7431 (6.6610)	16.9329* (4.5436)	1.6502* (0.0829)	1.7290* (0.0859)	-0.9583 (2.1047)	-2.8500 <sup>***</sup> (1.4488)
All	8.0387 (5.3654)	13.8270* (3.6579)	1.7477* (0.0954)	1.8384* (0.0988)	-0.2868 (1.3830)	-1.5298 (0.9520)

<sup>a</sup> Approximate standard error in parentheses.

\* Significant at 0.01 level.

\*\* Significant at 0.05 level.

\*\*\* Significant at 0.10 level.

Table A3.13 Own and Cross-Partial Elasticities of Input Demands for French Banks Using the Ordinary Translog Cost Function

Total Assets Sizes (\$ mil)	Labour- Labour		Labour-Deposit		Labour-Capital		Deposit- Deposit		Deposit-Capital		Capital-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	-0.76	-0.94	0.34	0.45	0.42	0.49	-0.50	-0.45	0.32	0.21	-1.06	-0.92
100 - 300	-0.74	-0.91	0.34	0.44	0.40	0.47	-0.52	-0.46	0.32	0.20	-1.07	-0.93
300 - 600	-0.86	-1.16	0.48	0.65	0.39	0.50	-0.29	-0.25	0.18	0.10	-1.48	-1.20
600 - 1000	-0.87	-1.17	0.48	0.66	0.39	0.51	-0.27	-0.24	0.17	0.09	-1.53	-1.23
1000 - 3000	-0.88	-1.19	0.48	0.67	0.39	0.52	-0.27	-0.23	0.16	0.09	-1.54	-1.24
3000 - 5000	-0.87	-1.18	0.47	0.66	0.40	0.53	-0.28	-0.24	0.17	0.10	-1.49	-1.20
5000 <	-0.93	-1.35	0.42	0.67	0.50	0.68	-0.24	-0.21	0.18	0.10	-1.46	-1.19
All	-0.85	-1.12	0.45	0.61	0.39	0.50	-0.33	-0.29	0.21	0.12	-1.35	-1.12

Table A3.14 Own and Cross-Partial Elasticities of Input Demands for German Banks Using the Ordinary Translog Cost Function

Total Assets Sizes (\$ mil)	Labour- Labour		Labour-Deposit		Labour-Capital		Deposit- Deposit		Deposit-Capital		Capital-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	-0.18	-0.55	0.05	0.25	0.30	0.29	-0.75	-0.22	0.69	-0.06	-1.35	-0.35
100 - 300	-0.07	-0.65	0.09	0.41	0.25	0.24	-0.49	-0.17	0.45	-0.01	-1.65	-0.28
300 - 600	-0.04	-0.66	0.10	0.44	0.23	0.22	-0.45	-0.15	0.41	-0.02	-1.79	-0.23
600 - 1000	-0.03	-0.66	0.08	0.42	0.25	0.24	-0.47	-0.15	0.44	-0.01	-1.69	-0.27
1000 - 3000	-0.02	-0.67	0.10	0.45	0.23	0.22	-0.43	-0.13	0.40	-0.02	-1.85	-0.20
3000 - 5000	-0.01	-0.67	0.12	0.49	0.19	0.18	-0.38	-0.11	0.34	-0.05	-2.20	-0.05
5000 <	-0.52	-0.67	0.14	0.50	0.19	0.17	-0.24	-0.00	0.25	-0.07	-3.44	-0.64
All	-0.03	-0.67	0.09	0.47	0.21	0.20	-0.39	-0.11	0.36	-0.03	-2.01	-0.14



Table A3.15 Own and Cross-Partial Elasticities of Input Demands for Italian Banks Using the Ordinary Translog Cost Function

Total Assets Sizes (\$ mil)	Labour- Labour		Labour-Deposit		Labour-Capital		Deposit- Deposit		Deposit-Capital		Capital-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	-0.17	-0.62	-0.05	0.30	0.22	0.32	-0.05	-0.41	0.01	0.19	-1.09	-2.92
100 - 300	-0.15	-0.22	-0.04	0.22	0.19	0.26	-0.09	-0.51	0.04	0.22	-1.08	-2.90
300 - 600	-0.15	-0.46	-0.04	0.23	0.19	0.27	-0.08	-0.51	0.04	0.22	-1.08	-2.91
600 - 1000	-0.15	-0.45	-0.06	0.19	0.19	0.26	-0.13	-0.55	0.04	0.25	-1.06	-2.71
1000 - 3000	-0.14	-0.46	-0.07	0.18	0.21	0.28	-0.13	-0.55	0.03	0.27	-1.02	-2.39
3000 - 5000	-0.12	-0.42	-0.09	0.15	0.21	0.28	-0.21	-0.57	0.04	0.30	-1.00	-2.28
5000 <	-0.14	-0.46	-0.18	0.07	0.32	0.40	-0.41	-0.62	0.02	0.47	-0.84	-1.49
All	-0.15	-0.49	-0.05	0.21	0.21	0.28	-0.09	-0.53	0.02	0.24	-1.04	-2.56

Table A3.16 Own and Cross-Partial Elasticities of Input Demands for Spanish Banks Using the Ordinary Translog Cost Function

Total Assets Sizes (\$ mil)	Labour- Labour		Labour-Deposit		Labour-Capital		Deposit- Deposit		Deposit-Capital		Capital-Capital	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
0 - 100	-1.54	-1.81	0.35	0.57	1.19	1.25	-1.11	-1.21	0.23	-0.21	-0.42	-0.38
100 - 300	-1.82	-2.18	0.39	0.68	1.43	1.51	-1.29	-1.46	0.01	-0.77	-0.32	-0.28
300 - 600	-1.90	-2.29	0.40	0.70	1.50	1.59	-1.56	-1.85	-0.55	-1.86	-0.28	-0.25
600 - 1000	-1.56	-2.02	0.36	0.61	1.33	1.41	-1.26	-1.43	0.01	-0.71	-0.34	-0.31
1000 - 3000	-1.56	-1.85	0.30	0.52	1.26	1.33	-1.60	-1.92	-0.71	-2.13	-0.34	-0.31
3000 - 5000	-1.56	-1.84	0.29	0.51	1.27	1.33	-1.79	-2.20	-1.12	-2.94	-0.34	-0.30
5000 <	-1.49	-1.76	0.28	0.48	1.21	1.27	-1.59	-1.90	-0.70	-2.10	-0.36	-0.33
All	-1.66	-1.99	0.34	0.58	1.33	1.40	-1.38	-1.59	-0.22	-1.16	-0.34	-0.30

**Appendix 4 The Number of hypothetical possible merger pairs, descriptive statistics of variables and the name of the largest 20 banks**

**Table A4.1 The Number of Banks and their Possible Hypothetical Pairs for Individual Countries**

Countries	Number of Banks <sup>1</sup>	Number of Banks <sup>2</sup>	Number of Possible pairs
France	88	37	3828
Germany	128	48	8128
Italy	71	21	2485
Spain	84	18	3486

<sup>1</sup> Total Asset sizes exceed \$1 billion.

<sup>2</sup> Total Asset sizes exceed \$5 billion.

**Table A4.2 A Comparison of Descriptive Statistics for Cross-Border**

Variable (\$ mil)	Mean	Std. Errors	Minimum	Maximum
$Q_1$	8308.2	962.09	101.0	144600
$Q_2$	3149.5	362.55	69.72	23620
$P_1$	0.4240	0.1550	0.007	1.4565
$P_2$	0.0727	0.0494	0.0112	0.4103
$P_3$	1.7536	0.7447	0.0038	12.570
$B$	28.078	470.41	1.000	5780.0
$TC$	789.97	501.41	5.520	21420
$S_1$	0.2438	0.0879	0.1007	0.3736
$S_2$	0.5837	0.1416	0.3892	0.8256
$S_3$	0.1725	0.0559	0.0737	0.3064
$TA$	3878.9	2909.0	1001.0	242000

Table A4.3 The Largest Top 20 French Banks

NAME OF BANKS	TOTAL ASSETS
1. CREDIT AGRICOLE	242002
2. BANQUE NATIONALE DE PARIS	196949
3. CREDIT LYONNAIS	178885
4. SOCIETE GENERALE	155484
5. BANQUE PARIBAS	72999
6. CIE FINANCIERE CIC ET DE L'UNION EUROPEENNE	63020
7. GROUPE DES BANQUES POPULAIRES	55932
8. CREDIT MUTUEL	55254
9. CREDIT FONCIER FRANCE	49747
10. BANQUE INDOSUEZ	48156
11. BANQUE FRANCAISE DU COMMERCE EXTERIEUR	41320
12. CREDIT COMMERCIAL DE FRANCE	38515
13. COMPAGNIE BANCAIRE	35721
14. CREDIT LOCAL DE FRANCE	30736
15. CREDIT INDUSTRIEL ET COMMERCIAL DE PARIS	29819
16. CREDIT DU NORD	22095
17. CAISSE CENTRALE DES BANQUES POPULAIRES	19964
18. SOGENAL	18070
19. BANQUE WORMS	11955
20. CREDISUEZ	10819

Table A4.4 The Largest Top 20 German Banks

NAME OF BANKS	TOTAL ASSETS
1. DEUTSCHE BANK	167125
2. DRESDNER BANK	127313
3. COMMERZBANK	99638
4. BAYERISCHE VEREINSBANK	90147
5. HYPO-BANK	74862
6. DG BANK	72323
7. KREDITANSTALT FUR WIEDERAUFBAU	53890
8. DEPFA-BANK	38774
9. BFG BANK	35782
10. DEUTSCHE HYPOTHEKENBANK FRANKFURT	25109
11. DSL BANK	25104
12. LANDES KREDITBANK BADEN WURTTENBERG	23897
13. DEUTSCHE GIROZENTRALE -DEUTSCHE KOMMUNALBANK	23031
14. RHEINISCHE HYPOTHEKENBANK	22237
15. BERLINER BANK	21059
16. BHF BANK	18474
17. LANDWIRTSCHAFTLICHE RENTENBANK	18359
18. FRANKFURTER HYPOTHEKENBANK	17804
19. DEUTSCHE CENTRALBODEN CREDIT-AG	16906
20. HAMBURGER SPARKASSE	16526

Table A4.5 The Largest Top 20 Italian Banks

NAME OF BANKS	TOTAL ASSETS
1. ISTITUTO BANCARIO SAN PAOLO DI TORINO	76336.0
2. BANCA NAZIONALE DEL LAVORO	67995.7
3. MONTE DEI PASCHI DI SIENA	58075.5
4. BANCA COMMERCIALE ITALIANA	51813.2
5. BANCO DI NAPOLI	50970.4
6. CREDITO ITALIANO	49751.7
7. BANCO DI ROMA	49553.1
8. CARIPLO	46574.1
9. BANCO DI SICILIA	24956.8
10. BANCA POPOLARE DI NOVARA	20116.6
11. ISTITUTO MOBILIARE ITALIANO	14956.5
12. BANCA NAZIONALE DELL'AGRICOLTURA	13728.1
13. CREDIOP	11759.3
14. BANCO AMBROSIANO VENETO	11383.3
15. BANCO DI SANTO SPIRITO	9773.2
16. BANCA POPOLARE DI MILANO	9650.8
17. CASSA DI RISPARMIO DI VERONA VICENZA BELLUNO	6437.5
18. BANCA TOSCANA	6392.0
19. CREDITO ROMAGNOLO	6348.0
20. MEDIOBANCA	5564.7

Table A4.6 The Largest Top 20 Spanish Banks

NAME OF BANKS	TOTAL ASSETS
1. BANCO BILBAO VIZCAYA	45949.6
2. BANCO CENTRAL	27828.1
3. BANCO ESPANOL DE CREDITO	26798.5
4. CAJA DE PENSIONES LA VEJEZ DE CATALUNA Y BALEARES	26624.8
5. BANCO CENTRAL HISPANOAMERICANO	22590.8
6. BANCO DE SANTANDER	19864.7
7. BANCO EXTERIOR DE ESPANA	17534.1
8. CAJA DE AHORROS Y MONTE DE PIEDAD DE MADRID	15367.3
9. BANCO POPULAR ESPANOL	11487.3
10. CAJA DE BARCELONA	9665.3
11. BANKINTER	6792.7
12. BANCO DE SABADELL	6515.2
13. BANCA CATALANA	6403.5
14. CAJA DE AHORROS DE CATALUNA	6008.3
15. BANCO ATLANTICO	5839.5
16. CAJA DE ZARAGOZA IBER CAJA	5526.4
17. BANCO PASTOR	5365.8
18. CAJA DE AHORROS DE VALENCIA	5312.9
19. CAJA DE AHORROS DE GALICIA- LA CORUNA	4933.5
20. BANCO URQUIJO	4914.3

Appendix 5 Estimates of the hybrid translog cost function for the cross-border sample of European banks

Table A5.1 Maximum Likelihood Parameter Estimates for Cross-border European Banks at Branch Level

Variables	Parameter	Coefficient	Std.Error	T-ratio	Prob >  T
Intercept	$\alpha_0$	2.02150	0.57150	3.537	0.00040
$\ln Q_1$	$\alpha_1$	0.29919	0.06228	4.804	0.00000
$\ln Q_2$	$\alpha_2$	0.20112	0.10820	1.858	0.06311
$\ln P_1$	$\beta_1$	0.25149	0.10510	2.394	0.01668
$\ln P_2$	$\beta_2$	0.54778	0.10470	5.234	0.00000
$\ln P_3$	$\beta_3$	0.20073	0.11574	1.734	0.04180
$\ln Q_1 \ln Q_1$	$\delta_{11}$	0.00172	0.00224	0.768	0.44241
$\ln Q_1 \ln Q_2$	$\delta_{12}$	-0.01420	0.00780	-1.819	0.06889
$\ln Q_2 \ln Q_2$	$\delta_{22}$	0.02438	0.00851	2.866	0.00415
$\ln P_1 \ln P_1$	$\gamma_{11}$	-0.04324	0.02274	-1.864	0.03110
$\ln P_1 \ln P_2$	$\gamma_{12}$	0.00541	0.02229	0.243	0.40300
$\ln P_2 \ln P_2$	$\gamma_{22}$	0.05660	0.00489	11.570	0.00000
$\ln P_1 \ln P_3$	$\gamma_{13}$	0.03783	0.01035	3.655	0.00026
$\ln P_2 \ln P_3$	$\gamma_{23}$	-0.06201	0.02194	-2.826	0.0060
$\ln P_3 \ln P_3$	$\gamma_{33}$	0.02418	0.02564	0.943	0.34571
$\ln P_1 \ln Q_1$	$\rho_{11}$	0.01184	0.01661	0.713	0.47604
$\ln P_1 \ln Q_2$	$\rho_{12}$	0.07160	0.02367	3.024	0.00249
$\ln P_2 \ln Q_1$	$\rho_{21}$	0.11273	0.00863	13.068	0.00000
$\ln P_2 \ln Q_2$	$\rho_{22}$	0.02393	0.01535	1.559	0.11897
$\ln P_3 \ln Q_1$	$\rho_{31}$	-0.12457	0.01650	-7.550	0.00000
$\ln P_3 \ln Q_2$	$\rho_{32}$	-0.09553	0.02379	4.016	0.00003
$\ln B$	$\lambda_b$	0.09357	0.11910	0.785	0.43226
$\ln B \ln B$	$\lambda_{bb}$	0.02207	0.01428	1.546	0.12221
$\ln B \ln Q_1$	$\lambda_{b1}$	-0.01725	0.00704	-2.449	0.01433
$\ln B \ln Q_2$	$\lambda_{b2}$	0.05463	0.01750	3.121	0.00180
$\ln B \ln P_1$	$\tau_{b1}$	0.02402	0.01744	1.378	0.16835
$\ln B \ln P_2$	$\tau_{b2}$	-0.12556	0.01334	-9.412	0.00000
$\ln B \ln P_3$	$\tau_{b3}$	0.10154	0.01804	5.629	0.00000

Table A5.2 Maximum Likelihood Parameter Estimates for Cross-border European Banks at Firm Level

Variables	Parameter	Coefficient	Std.Error	T-ratio	Prob >  T
Intercept	$\alpha_0$	2.07520	0.62880	3.300	0.00097
$\ln Q_1$	$\alpha_1$	0.27763	0.05962	4.656	0.00000
$\ln Q_2$	$\alpha_2$	0.23305	0.11260	2.069	0.03851
$\ln P_1$	$\beta_1$	0.44343	0.13120	3.380	0.00072
$\ln P_2$	$\beta_2$	0.12597	0.08879	1.419	0.15596
$\ln P_3$	$\beta_3$	0.43060	0.13039	3.302	0.00050
$\ln Q_1 \ln Q_1$	$\delta_{11}$	0.00910	0.00232	3.917	0.00009
$\ln Q_1 \ln Q_2$	$\delta_{12}$	-0.00364	0.00554	-0.658	0.51061
$\ln Q_2 \ln Q_2$	$\delta_{22}$	0.05026	0.00885	5.680	0.00000
$\ln P_1 \ln P_1$	$\gamma_{11}$	-0.18966	0.02902	-6.535	0.00000
$\ln P_1 \ln P_2$	$\gamma_{12}$	0.12806	0.01565	8.183	0.00000
$\ln P_2 \ln P_2$	$\gamma_{22}$	0.03643	0.00496	7.348	0.00000
$\ln P_1 \ln P_3$	$\gamma_{13}$	0.06160	0.01487	4.143	0.00003
$\ln P_2 \ln P_3$	$\gamma_{23}$	-0.16449	0.01654	-9.945	0.00000
$\ln P_3 \ln P_3$	$\gamma_{33}$	0.10289	0.01004	10.247	0.00000
$\ln P_1 \ln Q_1$	$\rho_{11}$	0.01380	0.01678	0.822	0.41087
$\ln P_1 \ln Q_2$	$\rho_{12}$	0.07256	0.02466	2.942	0.00326
$\ln P_2 \ln Q_1$	$\rho_{21}$	0.06806	0.00863	7.891	0.00000
$\ln P_2 \ln Q_2$	$\rho_{22}$	-0.00380	0.01232	-0.308	0.75812
$\ln P_3 \ln Q_1$	$\rho_{31}$	-0.08186	0.01698	-4.821	0.00000
$\ln P_3 \ln Q_2$	$\rho_{32}$	-0.06876	0.02359	-2.915	0.00180

Table A5.3 Structural Test Results for the Estimation of Cross-border European banks

Test Performed	Test Statistic		Degrees of Freedom		Crit. Val. $\chi^2$ at 0.05		Decision	
	Branch	Firm	Branch	Firm	Branch	Firm	Branch	Firm
Homotheticity	1149.6	667.65	8	6	15.5	12.6	rejected	rejected
Cobb-Douglas	1861.2	913.39	21	15	32.7	25.0	rejected	rejected
Non-jointness	2.0247	3.4180	1	1	3.84	3.84	not-rejected	not-rejected

Table A5.4 Estimated Lambda and the test for Linearity and Log-linearity for Hybrid Translog Cost Function for Cross-border European Banks<sup>a</sup>

Products	Estimated Lambda ( $\lambda$ )	Linearity ( $\lambda = 1$ )	Log-linear ( $\lambda = 0$ )	Decision <sup>b</sup>	
				$\lambda = 1$	$\lambda = 0$
Total Loans	0.1125* (0.0276)	747.06	17.62	Reject	Reject
Total Securities	0.1869* (0.0201)	1325.0	88.31	Reject	Reject

<sup>a</sup> Approximate standard error in parentheses.

<sup>b</sup> The Critical value of  $\chi^2_{1,0.05} = 3.84$ .

\* Significant at 0.01 level.

Figure A5.1 Output vectors  $[X, Y]$  for Banks  $i = 1, 2$  Before and After Simulated Merger

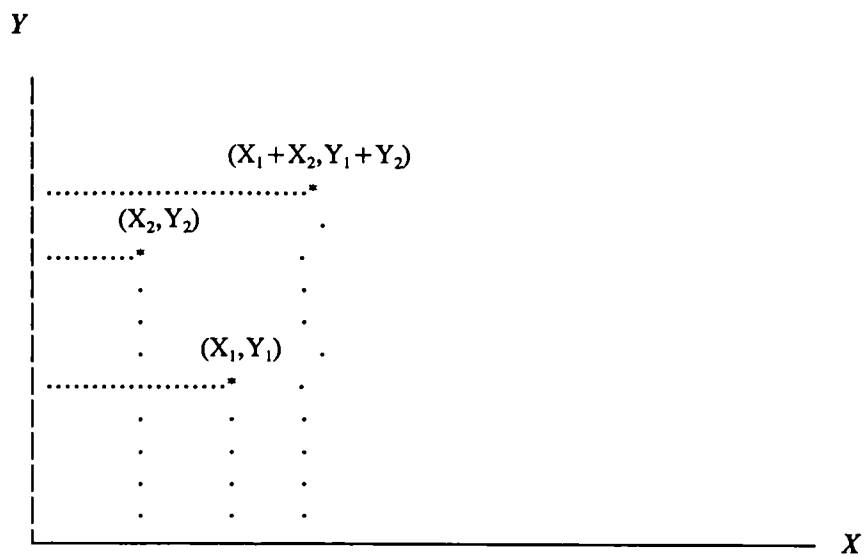




Table A5.5 Overall Economies of Scale For Cross-European Banks<sup>a</sup>

Total Assets Sizes (\$ mil)	Branch	Firm
1000 - 3000	0.4567* (0.1231)	0.8899 (0.1213)
3000 - 5000	0.4486* (0.1251)	0.9543 (0.1239)
5000 - 10000	0.4503* (0.1356)	1.0135 (0.1331)
10000 <	0.4073* (0.1280)	1.1762 (0.1256)
All	0.4307* (0.1270)	1.0323 (0.1205)

<sup>a</sup> Approximate standard error in parentheses.

\* Significantly different from one at 0.01 level.

~ Significantly different from one at 0.05 level.

— Significantly different from one at 0.10 level.

Table A5.6 Partial Economies of Scale For Cross-European Banks<sup>a</sup>

Total Assets Sizes (\$ mil)	Branch		Firm	
	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>1</sub>	Q <sub>2</sub>
1000 - 3000	0.2149 (0.2775)	0.2418 (0.2985)	0.3361* (0.0804)	0.5539* (0.1351)
3000 - 5000	0.2008 (0.3710)	0.2478 (0.3935)	0.3465* (0.0813)	0.6078* (0.1382)
5000 - 10000	0.1855 (0.3493)	0.2647 (0.3786)	0.3497* (0.0866)	0.6638* (0.1491)
10000 <	0.1554 (0.2863)	0.2519 (0.3104)	0.3917* (0.0832)	0.7844* (0.1405)
All	0.1842 (0.2896)	0.2465 (0.3048)	0.3652* (0.0854)	0.6731* (0.1363)

<sup>a</sup> Approximate standard error in parentheses.

\* Significant at 0.01 level.

~ Significant at 0.05 level.

— Significant at 0.10 level.

Q<sub>1</sub> = Total Loans

Q<sub>2</sub> = Total Securities

Table A5.7 Pairwise Cost Complementarities for Cross-border European Banks\*

	Branch	Firm
Cross-European	0.04597 (0.03231)	0.06106 <sup>***</sup> (0.03303)

- \* Approximate standard error in parentheses.
- ° Significantly different from one at 0.01 level.
- ™ Significantly different from one at 0.05 level.
- ™ Significantly different from one at 0.10 level.

Table A5.8 Overall Economies of Scope For Cross-border European Banks\*

Total Assets Sizes (\$ mil)	Branch	Firm
1000 - 3000	-0.0377 (0.5846)	-0.6956 <sup>™</sup> (0.5039)
3000 - 5000	0.1399 (0.6386)	-0.8276 <sup>™</sup> (0.5616)
5000 -10000	0.0920 (0.8876)	-0.9109 (0.8366)
10000 <	2.4702 <sup>°</sup> (0.7101)	-0.9814 <sup>™</sup> (0.6434)
All	0.7571 (0.6225)	-0.9186 <sup>™</sup> (0.5461)

- \* Approximate standard error in parentheses.
- ° Significant at 0.01 level.
- ™ Significant at 0.05 level.
- ™ Significant at 0.10 level.

Table A5.9 Expansion Path Subadditivity For Cross-border European Banks (%)

Total Assets Sizes (\$ mil)	Branch	Firm
1000 - 3000	0.0487	0.0100
3000 - 5000	0.1806	0.3674
5000 - 10000	0.1418	-0.4465
10000 <	-1.6552	-1.5862

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