An Empirical Investigation of Efficiency, Competitiveness, Performance and Market structure in the G.C.C. Countries' Banking Industry

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ABSTRACT

This thesis analyses the market structure, competitiveness, efficiency, and performance of the GCC countries' banking sector over the period 1993-2002. The study first examines the banking industry concentration using the concentration ratio of three largest banks (CR_3) and Herfindahl-Hirschman Index (HHI) of concentration. Then, it assesses the competitive conditions using the Panzar-Rosse model. Third, it investigates the technical, pure technical and scale efficiency of commercial and Islamic banks using the Data Envelopment Analysis (DEA). In addition, change in banks' productivity growth was measured at this part by Malmquist Index. Finally, it investigates four different hypotheses explaining the relationship between market structure and performance using the Structure-Conduct-Performance (SCP) model.

In relation to measurement of market concentration, it was found that the GCC banking industries are highly concentrated. Thus both indices indicated that these banking industries were ranging from "some what" to "very" concentrated markets.

In terms of assessing competitive conditions, the results show that banks in Kuwait, Saudi Arabia and the UAE are earning their revenue under perfect competition. Bahraini and Qatari banks make their revenue in monopolistic competition. Oman's banks were making their total revenue under an "undetermined" environment.

Concerning technical efficiency and productivity growth, the results reveal that smaller banks exhibited superior performance in terms of overall technical efficiency than larger ones, mainly associated with diseconomies of scale. A decomposition of technical efficiency into pure technical and scale efficiency showed that large banks proved to be more successful in adopting best available technology (pure technical efficiency) while medium banks proved to be more successful in choosing optimal levels of output (scale efficiency). Islamic banks proved to be more successful in both the adoption of the best available technology and choosing optimal levels of output than commercial banks. Malmquist analysis showed downward shift in the average efficiency of banks.

In last part, the thesis assesses the relevance of the Structure-Conduct-Performance (SCP) and the Relative-Market-Power (RMP) hypothesis and the Efficient-Structure (ES) hypotheses in the form of Technical efficiency or Scale efficiency to explain the performance of the banking industry in GCC countries; and, finally, to test the existence of "Quiet Life Hypothesis" in these markets. Results observed supported the Market Structure hypotheses and the quiet life effect was also observed. Thus, GCC banks were working in concentrated markets and were enjoying "Quiet Life", therefore, gaining their profits in a more relaxed environment.

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ASSET	Bank total assets
ATM	Automated Teller Machine
BCC	Banker, Charnes and Cooper model of measuring efficiency
BD	Bahraini Dinar
BIS	Banks for International Settlements
BMA	Bahrain Monetary Currency
BRT	Number of branches of each bank to the total number of branches of the whole banking system
CAPAST	Capital and reserves as a percentage of total assets
CBO	Central Bank of Oman
CCR	Charnes, Cooper and Rhodes model of measuring efficiency
CI	Capital Intelligence of Bankscope database
CMT	Contestable Markets Theory
CONC	Concentration
CR2	The highest two-bank deposit concentration ratio
CR3	The highest three-bank deposit concentration ratio
CR_k	*k* largest banks concentration ratio
CRS	Constant returns to scale
DDTDEP	The ratio of demand deposits to total deposits
DEA	Data Envelopment Analysis
DEPGRW	Deposit growth
DFA	Distribution Free Approach
DMU	Decision-making unit
DRS	Decreasing returns to scale
ED	UAE Dirham currency
ESH	Efficient-Structure hypotheses
ESH	Efficient Structure Hypothesis
FDH	Free Disposal Hull
fixdasst	Fixed assets
GATS	General Agreement on Trade in Services
GATT	General Agreement on Tariffs and Trade
GCC	Gulf Cooperation Council
GCC-SC	GCC's Secretariat General
GDP	Gross Domestic Products
GDPPC	GDP divided by the number of population
HHI	Herfindahl-Hirschman Index
H-statistic value	Sum of the factor price elasticity: PL, PK and PF
IBs	Investment Banking licences
IMF	International Monetary Fund
IRS	Increasing returns to scale
KD	Kuwaiti Dinar
Ln	Natural logarithm
LOANAST	Loans to assets ratio of each commercial bank
LT	Long term

M & A	Merger and Acquisition
MI	Malmquist index
MKGRW	Market Growth
MS	Market share
NIRS	Non-increasing returns to scale
numstaff	Number of staff
OBS	Off balance sheet activities
OBSTA	Ratio of off-balance sheet activities to total assets
OBU	Offshore Banking Unit
OEA	Other earning assets
OLS	Ordinary Least Squares
ORS	Optimal returns to scale
Orthrincm	Other operating income
OTE	Overall technical efficiency
PF	Ratio of annual interest expenses to own funds (unit price of funds)
PK	Capital expenses to fixed assets (unit price of capital)
PL	Personnel expenses to employees (unit price of labour)
POPBRANCH	The ratio of population per branch
P-R	Panzar and Rosse model
PTE	Pure technical efficiency
QCB	Qatar Central Bank
QLH	Quiet Life Hypothesis
QMA	Qatar Monetary Agency
QR	Qatari Riyal
Repos	Repurchase Agreements
RISKAST	Provisions to total assets
RMP	Relative-Market-Power
RO	Riyal Omani
ROA	Return on Assets
ROA	Net profits to total assets
ROE	Return on Equity
S & L	Savings and Loans
SAMA	Saudi Arabia Monetary Agency
SC-EFF	Scale efficiency score in input orientation
SCP	Structure-Conduct-Performance
SDRs	Special Drawing Rights
SE	Scale efficiency
SFA	Stochastic Frontier Approach
SPECIALZ	Specialisation dummy variable given the value of 1 for Islamic banks, 0 for commercial banks
SR	Saudi Riyal
ST	Short term
TA	Total assets
TC	Technological change
tdeposit	Total deposits
TE	Technical efficiency
TEC	Technical Efficiency Change
Te-EFF	Technical efficiency score in input orientation
TEXPTA	Total Expenditure as a percentage of total assets
TFA	Thick Frontier Approach

TFP	Total factor productivity
tloans	Total loans
TREV	Total revenue to total assets
UAE	United Arab Emirates
US	United States (of America)
USD	United States Dollar currency
VRS	Variable returns to scale
WTO	World Trade Organisation

CHAPTER 1

STUDY BACKGROUND, AIMS AND STRUCTURE PLAN

1.1 Introduction

Due to the global trend toward deregulating financial services, the increasing use of advanced technology, and a revolution in the dissemination of financial information, banking firms are under competitive pressure domestically and internationally. In response to this competitive pressure, banking firms are actively looking for alternative ways to reduce their production costs by enhancing production efficiency, and to exploit scale and scope economies. Banks' managers and policy regulators are also trying to find ways to improve financial performance.

As well accepted, commercial banks performance is determined by the market structure in which they operate such as perfect competition, monopoly, in which they operate. Perfect competition is known to be an idealistic market structure that secures socially just and efficient outcomes. On the other hand, pure monopoly causes inefficiency of resources, inequality of income distribution, and net social welfare loss. Monopoly is therefore viewed by societies as an evil situation that requires government intervention for correction through different schemes of regulation. In reality, there is a spectrum of market structures that contains a variety of structures ranging from perfect competition to pure monopoly and in many cases, decision makers face a grey area of market structures where it is difficult to determine the deviation from the competitive norm, and to what extent the situation may justify regulatory action.

According to Bikker and Haaf (2000), the literature on the measurement of competition can be divided into two major streams. The structural approach to model competition embraces the Structure-Conduct-Performance (SCP) paradigm and the efficiency hypothesis, as well as a number of formal approaches with roots in Industrial Organisation theory. The SCP paradigm investigates whether a highly concentrated market causes collusive behaviour among larger banks resulting in superior market performance (Bain, 1951), whereas the efficiency hypothesis tests whether it is the efficiency of larger banks that enhances their performance (Demsetz, 1973).

In response to the theoretical and empirical deficiencies of the structural models, non-structural models of competitive behaviour have been developed, namely, the Iwata model (Iwata, 1974), the Bresnahan model (Bresnahan, 1982), and the Panzar and Rosse (P-R) model (Panzar and Rosse, 1987). These New Empirical Industrial Organisation approaches test competition and stress the analysis of the competitive conduct of banks without using explicit information about the structure of the market.

There are different hypotheses in banking explaining the relationship between performance and market structure and offering different explanations for merging decisions. Consequently, in the last few years, a large number of research studies have examined financial performance efficiency, market structure, and competition in the banking industry. While most of these studies have examined the market structure, performance, competitive conditions, and concentration of the banking industry in the US and other developed countries, no attention has been paid to banks located in GCC countries and other emerging markets.

The implications of results obtained from studies conducted in the US and other developed economies, however, cannot directly be extended to banking firms of the GCC economies. This is because the banking industry is highly regulated, and the regulatory environment that affects the market structure and performance of banks is not uniform across nations. Thus, the evaluation of bank performance is a complex process involving interactions between the environment, internal operations, and external activities which make each country unique in its evaluation.

This thesis consists of four stages. First, chapter 4 estimates the GCC banking industry's concentration. An attempt is made to ascertain whether GCC countries' banking markets are concentrated or not. Chapter 5 investigates the competitive conditions of these markets using the Panzar-Rosse model. The result of this test identifies the competitive environment of each market, whether it is monopoly, monopolistic or perfect competition. Chapter 6 explores the technical, pure technical, and scale efficiency of commercial and Islamic banks using the two basic models of Data Envelopment Analysis (DEA). In addition, change in banks' productivity growth is measured. Finally, Chapter 7 focuses on four different hypotheses that are explaining the relationship between market structure and performance using the Structure-Conduct-Performance (SCP) model. At this chapter, the emphasis of the study is: first, to analyse the relationship between market structure and banks' profitability and then it seeks to assess the relevance of the *Structure-Conduct-Performance (SCP)*, the *Relative-Market-Power (RMP), and* the *Efficient-Structure (ES) hypotheses* in the form of *Technical-efficiency* or *Scale efficiency* in explaining the performance of the banking industry in GCC countries. Third, it tries to test the existence of the "*Quiet Life Hypothesis*" in these markets.

The aim of this chapter is to present the context of the thesis. After this section, section two provides a background details on the study area. The importance of the financial system is highlighted in section three. Section four explains the motivation for the study. The importance and rationale of this study are presented in sections five and six respectively. The study's aims and objectives are shown in section seven. Sections eight and nine reveal the research's questions and testable hypotheses, respectively. The last section outlines the structure and plan of the study.

1.2 Background to the study

Traditionally, banks have been heavily regulated by the monetary authorities. On the one hand, such regulation led financial markets in most developing countries, especially in the 1970s and early 1980s, to be characterised by financial repression. The financial system was highly repressed, characterised by heavy regulation through credit and interest rate controls until the late 1980s. This negated the vital role the banking sector played in economic development and growth. Governments' interventions in the financial system were the basis of the McKinnon–Shaw hypothesis of financial repression in developing countries (McKinnon, 1973; Shaw, 1973). It is argued that for sustainable growth, the banking sector has to be effective and efficient to respond favourably to the needs of the productive sectors of the economy.

On the other hand, government intervention and regulation in the financial sector also created highly concentrated market structures in the banking industry, leading to monopolistic or oligopolistic market structures. Economic theory predicts different welfare outcomes for different market structures through firms' price and non-price behaviours. The market structure–conduct–performance (SCP) hypothesis has been a basis for analysing firm behaviour or performance given the structure of the market. According to the SCP hypothesis, market structure influences the conduct (behaviour) of firms through, for instance, pricing and investment policies, and this, in turn, translates into performance. The definitive theoretical implication of the SCP hypothesis is that in concentrated markets, prices will be less favourable to consumers because of the non-competitive behaviour that arises in such markets. This hypothesis is a tool of analysis in industrial business behaviour, and is also applied in the banking sector, especially in developed countries. See surveys by Clark (1986), Evanoff and Fortier (1988), and Gilbert (1984). The following section highlights the importance of the financial system.

1.3 The importance of the financial system

The banking and financial system also plays a major role in economies of all countries, especially those countries that pursue liberal economic and monetary policies. Therefore, the degree of development of the institutions and activities of the system helps to form the indicators by which the general economic progress of the country is judged. In particular, the quantitative and qualitative development of the banking and financial system of a country is normally used to illustrate the degree of success attained in the area of mobilising and allocating national financial resources to satisfy various domestic needs.

Moreover, the progress of the system depends, by and large, on a variety of political and economic factors which, in fact, have a visible impact on the pattern and direction of this progress. In the context of developing countries, the development of the banking and financial system may also reflect the extent of the importance given by the country to this vital sector which can be largely relied upon to achieve the desired growth in the national economy.

A sound and efficient financial system is the most important prerequisite for savings and investment decisions and thus economic growth. It is the system by which a country's most profitable and efficient projects are systematically and continuously funded. Economists have long recognised that financial markets in general, and banks in particular, play a vital role in the efficient functioning and development of any economy. Some of the recent studies examining the relationship between banks, financial markets, and the macro-economy, have their origins in early work by Cameron (1967), Goldsmith (1969), McKinnon (1973), and Shaw (1973). These authors highlight the fact that financial markets affect, and in turn are affected by, economic growth. They argue that well-developed financial markets are necessary for the overall economic advancement of less developed countries.

A prominent line of research stresses the role of financial institutions in economic growth. Among others, Goldsmith (1969), and McKinnon (1973) provide conceptual descriptions of how, and empirical examples of when, the financial system affects economic growth. Building on these seminal contributions, Bhattacharya (1993); King and Levine (1993); Choudhuri et al. (1995); De Gregorio & Guidotti (1995); and Hassan and Islam (1995) show that measures of banking development are strongly correlated with economic growth in broad cross-section of countries. According to this research view, a well-functioning financial system is critical for sustained economic growth. On the basis of data from 35 countries between 1860 and 1963, Goldsmith (1969) concludes that "a rough parallelism can be observed between economics and financial development if periods of several decades are considered". King and Levine (1993) investigate the causality problem following a post hoc, ergo proper hoc approach. They showed that the predetermined component of financial development is a good predictor of growth over the next 10 to 30 years. Thus, banks are the most dominant financial institutions in any country. The role of government is to ensure that financial institutions serve the vital functions efficiently. This role of the government is being performed by regulatory and supervisory bodies in order to enhance the solvency and stability of the banking sector.

As financial markets become increasingly complex, the need to have a sound understanding of the institutions that comprise the players and forces that act upon them becomes greater. This is increasingly important in emerging markets as they evolve.

1.4 Motivation of the study

Many studies on bank performances, market power, competitive conditions and efficiencies have been conducted but, to-date; a wide gap exists and few have referred to banks in Gulf Cooperation Council (GCC) countries. This study is motivated by the researcher's aim to fill the gap in literature and also the fact that commercial banks play a vital role in the economy. Evaluating their overall performance and monitoring their financial condition is important to depositors, owners, potential investors, managers and, of course, regulators. In addition, to examining the theoretical aspects of market power, competitive conditions, technical efficiency and determinants of profitability, this study makes two contributions. First, in terms of empirical investigation, this is the first cross-country study investigate market power, competitive conditions and technical efficiency in the banking sector in GCC countries by analysing data pooled from six countries for ten years 1993-2002. Second, its findings may assist and guide policy makers and regulatory authorities in ways to minimise inefficiency in the banking sector in order to realise a number of benefits. As banks become more profitable, investors expect higher dividends because of increased profitability; investor confidence is boosted, thereby attracting more capital in addition to increased internally generated retained reserves, thus boosting capital accumulation. This increases the safety and soundness of banks and, hence, the stability of the financial system which means a reduction in the risk of bank failures and the pertinent costs.

Motivation for the study is also derived from the resolution passed at the 18th summit meeting attended by the leaders of GCC countries, held in Kuwait in December 1997, which allowed national banks in these countries to open branches in other members' countries. This represented a major turning point supporting the efforts towards financial integration among GCC states, in preparation for a higher degree of integration at the monetary level and a preparatory step toward the implementation of World Trade Organisation (WTO) Agreement on the liberalization of the financial services under the General Agreement on Trade in Services (GATS).

According to Murinde and Ryan (2003, p.7), main provisions of the GATS envisage that liberalisation of financial trade by signatory states will:

- Remove capital account restrictions to permit cross-border supply and consumption abroad;
- Grant 'market assess' to all, that is, give everyone the right to establish in or to freely provide services to the national market;
- Ensure 'national treatment', that is, the authorities should seek to treat all banks on an equal basis, regardless of country of origin, and make all banks subject to the same regulatory and tax regimes;
- Take steps to ensure that the regulatory and supervisory regime conforms to best international practice, though these requirements need not be specified in the agreement.

The GATS Agreement includes a number of principles that prevent states signatory to the agreement from discriminating between national and foreign institutions operating in their territories, and obliges member states to treat foreign institutions equally with national institutions. The agreement also removes restrictions on the entry of foreign institutions to local markets, unless such restrictions are clearly provided for in the schedule of commitments of the member state, as specified upon signing the agreement. Such restrictions include, for instance, those limiting the number of banks which would be permitted to enter the local market, or those determining the quantity or type of financial services allowed, such as the number of ATM machines for each bank, or those restrictions associated with specific laws or legislations, such as the laws prohibiting the presence of foreign investments except through joint projects with national capitals, or those related to the determination of the percentage of foreign capital participation in the local projects.

Undoubtly, when a country joins the agreement on the liberalisation of trade in services, this implicitly entails financial liberalisation of the banking sector, in both its partial and entire forms. Hence, the adoption by the GCC countries of the principle of partial liberalisation of the markets has, together with the summit resolution referred to above, major implications for the local banking sector of each GCC country, particularly those countries whose current systems do not allow foreign banks to operate in their local markets.

The final motivation is derived from the recent wave of mergers and acquisitions in banking industry which raises important questions concerning public policy tradeoffs between possible gains in operating efficiency versus possible social efficiency losses from a greater exercise of market power. This consolidation has generated renewed fears of market concentration and monopoly power in the banking industry. Policy makers are suspicious of concentration and seek to limit it because they believe it enables banks to exercise monopoly power, thereby harming depositors and borrowers. It was in light of the above circumstances along with increasing competition and innovation which are forcing banks to adopt attitudes that are more professional that the idea for this study came out, as a means to assess market structure, competitive conditions, banks' performance and efficiency.

1.5 The contribution of the study

GCC commercial banks, faced with the increasing competition both from the local and foreign banks, will be forced to improve efficiency, productivity and profitability in order to gain a competitive edge on rivals and enhance or even maintain their market share and profits. Risk exposures will have to be made transparent and adequately provided for in the balance sheets; such banks will be compelled to deliver the services to customers at the lowest possible costs. The public will want to avail themselves of financial services at the minimum price. GCC countries will want to keep intervention, control and regulation of the banking industry to a minimum at the same time maintaining optional operations and consumers' protection. Hence, all parties concerned will be interested in estimating the cost consequences of their decisions.

Therefore, an examination of the market structure, performance, efficiency and competition of banks operating in emerging economies is as important as that of developed countries for the following reasons. First, bond and other debt markets in a number of emerging economies are not well developed and efficient; hence, the role of the banking system in the intermediation of funds process is essential. Second, commercial banks are exposed to global competition as a result of the recent waves of deregulatory and anti-protectionism policies imposed on the banking industry as well as internationalisation of financial markets. In order to make appropriate adjustments in managerial policies such that banking firms become well equipped to face challenges brought about by this new competitive environment, an examination of the performance of these banks and the markets' structure is worthwhile. Third, no similar comparison studies between commercial and Islamic banks in GCC countries have been conducted. Fourth, the study focuses on bank earnings' performance over a ten-year period and previous statistical studies in this area have generally examined bank profitability over shorter periods. Fifth, bank regulators and others have become increasingly concerned in recent years with the capital adequacy of banks. Since large banks typically have lower capital ratios (higher leverage) than their smaller counterparts, and since capital accumulation is primarily dependent on earnings' performance, any information regarding factors that differentiate relatively profitable institutions should be of interest. Sixth, the recent waves of mergers and acquisitions in the banking industry have renewed fears of market concentration and monopoly power. Policy makers are suspicious of concentration and seek to limit it because they believe it enables banks to exercise monopoly power, thereby harming depositors and borrowers. Finally, the study results may provide managers and policy makers with valuable information that can be utilised to establish optimal managerial strategies and public policies.

1.6 Rationale for the study

Commercial banks in GCC are the most active sector in the respective economies and they play both an active and dynamic role in the economic development. Therefore, attention paid to commercial banks' activities is extremely important because they undoubtly contribute the success of the national economy.

Financial sector reforms in GCC countries have started recently as part of their overall programme of economic stabilisation and growth. As economic activity has picked up and banking habits developed, this ratio has increased substantially in all GCC countries over the last decade. Moreover, there is an increasing move towards privatisation in this region. GCC countries' banks have a great opportunity in this area. Banks could play an important role in their economic development by promoting private sector activities. In most GCC countries, bank shares are considered to be the most attractive investment opportunities and bank shares account for a large portion of stock markets' capitalisation. There is a growing need for a well developed Gulf financial market to attract domestic funds being currently invested outside, and to divert them to regional private sector investments. For the banking sector, this presents real challenges.

This study notes the absence of empirical inquiry into the effects of market structure on the performance of the banking industry in GCC countries, and attempts to provide such missing empirical evidence. Within this context, the current study addresses and aims to measure the concentration, performance, efficiency and the market power of banking sector in GCC countries. If there is evidence of a positive relationship between market structure and profitability in such countries' banking market, this suggests regulatory policies should aim at changing market structure to increase competition or quality of bank services.

1.7 The aims and objectives of the study

The aims of this study are to measure the relationship between performance, efficiency and market structure, and to investigate the role of the market structure in determining bank performance of the banking industry in the six GCC countries by attempting to achieve the following objectives:

1. Describe the main characteristics within each banking industry;
2. Assess the market concentration in each country;
3. Identify whether these markets are contestable or not;
4. Evaluate competitive conditions under different types of market structure;
5. Assess banking efficiency of these six countries;
6. Evaluate the change in banks' productivity since 1993-2002;
7. Examine the concentration performance relationship;
8. Determine and empirically analyse the factors that affect performance; and
9. Make recommendations based on the study, focusing on areas of reform in the banking industry that the GCC authorities have to target in the future.

1.8 The Research's Questions

After identifying the aim and the objectives, this thesis tries to answer the questions below to help the author identify the market structure-profitability relationship and the determinants of successful commercial and Islamic banks in GCC countries in order to formulate policies for the improved financial performance and efficiency of these institutions:

1. What are the main characteristics of GCC countries' banking markets? And, what is the market concentration in each GCC country?

2. What are the competitive conditions under the different types of market structure?
3. Do higher profits in concentrated industries reflect only monopoly?
4. What are the characteristics of efficient banks?
5. What are the effects of size, specialisation and number of branches on efficiency?
6. Was the change in productivity over a decade an increase or decrease?
7. Which theory better explains the relationship between market structure and bank profitability?
8. Does the market concentration doctrine, unaided by "efficient structure" explanation, adequately explain the pattern of profit rates and market concentration?
9. Does the "Quiet Life Hypothesis" exist in GCC countries' markets?
10. Are the determinants of performance similar in GCC countries' banks?
11. To what extent, are discrepancies in a bank's profitability due to variations in endogenous factors under the control of the bank's management?
12. Is there a relationship between monopoly power and commercial bank profitability? Or, is the relationship between efficiency and profitability is much stronger?
13. Do the study findings lead to policy suggestions in the direction of more restrictive (or lenient) banking regulation?

1.9 Testable hypotheses

Proponents of financial liberalisation such as (Aryeetey et al., 1997) argue that financial sector reforms that eliminate direct government intervention in the financial system are expected to lead to financial deepening (therefore increased savings' mobilisation); improved efficiency of the financial system resulting in lower intermediation margins; and increases in the flow of funds between various segments of the financial system. Reforms are also expected to yield greater access to finance for hitherto marginalised borrowers, and a diminishing role of the informal financial sector. Thus, with liberalisation several policy variables are expected to change, such as the interest rate structure, the structure of assets and liabilities, investment decisions by banks, and the cost structure. However, some of these policy variables can be influenced by the degree of competition in the financial sector.

Proponents of competition policy have used the SCP framework to test whether structural and behavioural characteristics of banks have some influence on bank profitability. The SCP hypothesis predicts that market concentration lowers the cost of collusion between firms and results in higher than normal profits for all market participants (Evanoff and Fortier, 1988; Smirlock, 1985; and Gilbert, 1984). However, following Demsetz (1973) and Peltzman (1977), there is a competing efficient market hypothesis that argues that an industry's structure may exist as a result of superior efficiency in production by particular firms, therefore obtaining larger market shares. Smirlock (1985) argued that firms possessing a comparative advantage in production become large and obtain a high market share and, as a result, the market becomes more concentrated. The efficient market hypothesis involves testing the relationship that exists between market share and firm's profitability.

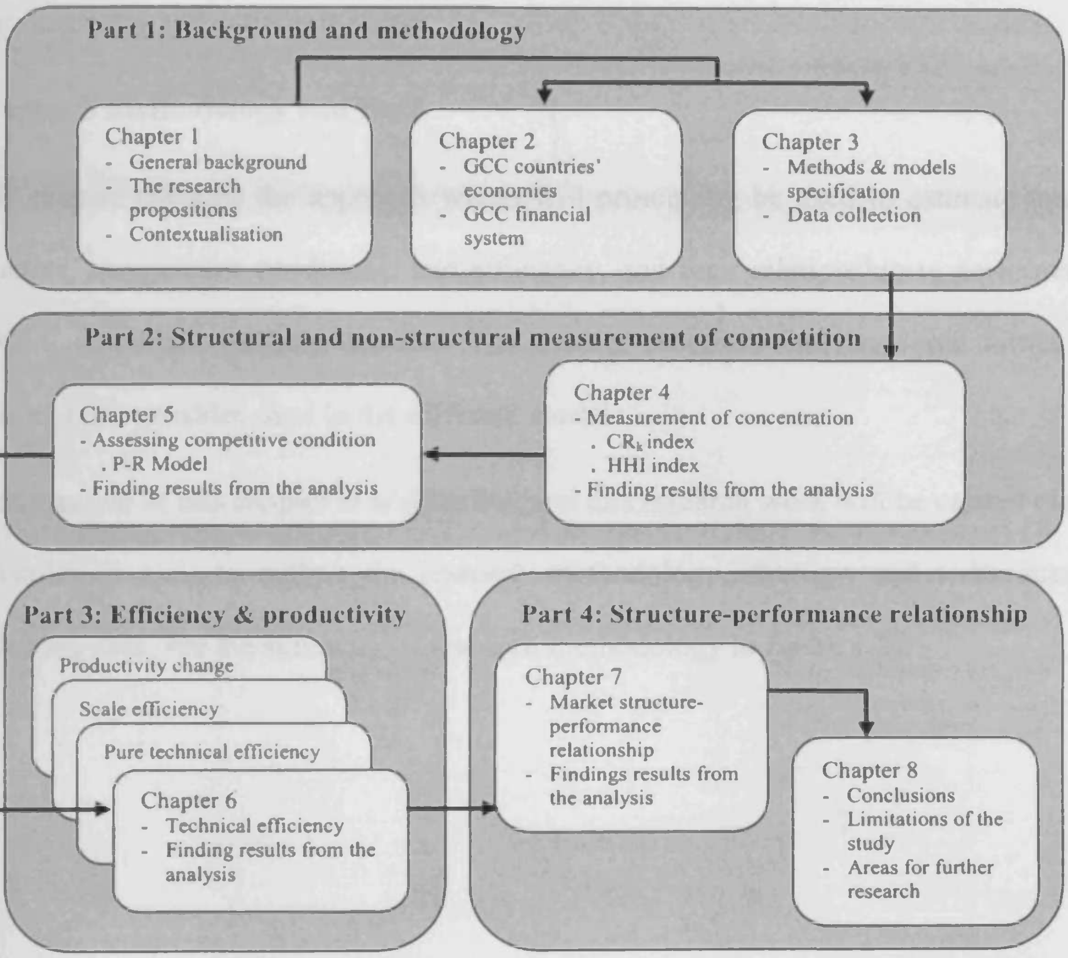
In light of the above, the study intends to test the following hypotheses:

1. GCC countries' financial markets were not "very concentrated" and the concentration indices were within average range.
2. The competitive conditions of financial markets were monopolistic.
3. There was an inverse relationship between size of a bank and number of branches in efficiency.
4. Islamic banks were more efficient than commercial banks.
5. Banks' productivity decreased over the sample period.
6. Concentration had led to higher profitability of dominant firms in the banking sector.
7. Market power hypotheses (SCP and RMP) better explained the market structure relationship than the efficient hypotheses (technical and scale efficiency).
8. The "Quiet Life Hypothesis" existed in some GCC countries' markets.
9. A bank's characteristics (management control or internal determinants) were the main determinants of profitability, followed by market structure and finally, by macroeconomic factors (external determinants).

1.10 The thesis' structure plan

A framework for the study has been constructed to assist in navigating the various chapters. This is displayed in Figure 1.1.

Figure 1.1: Framework for the thesis



The thesis is divided into eight chapters as follows:

Chapter 1 Introduction

Chapter 2 GCC Countries' Economies and Banking Systems' Development

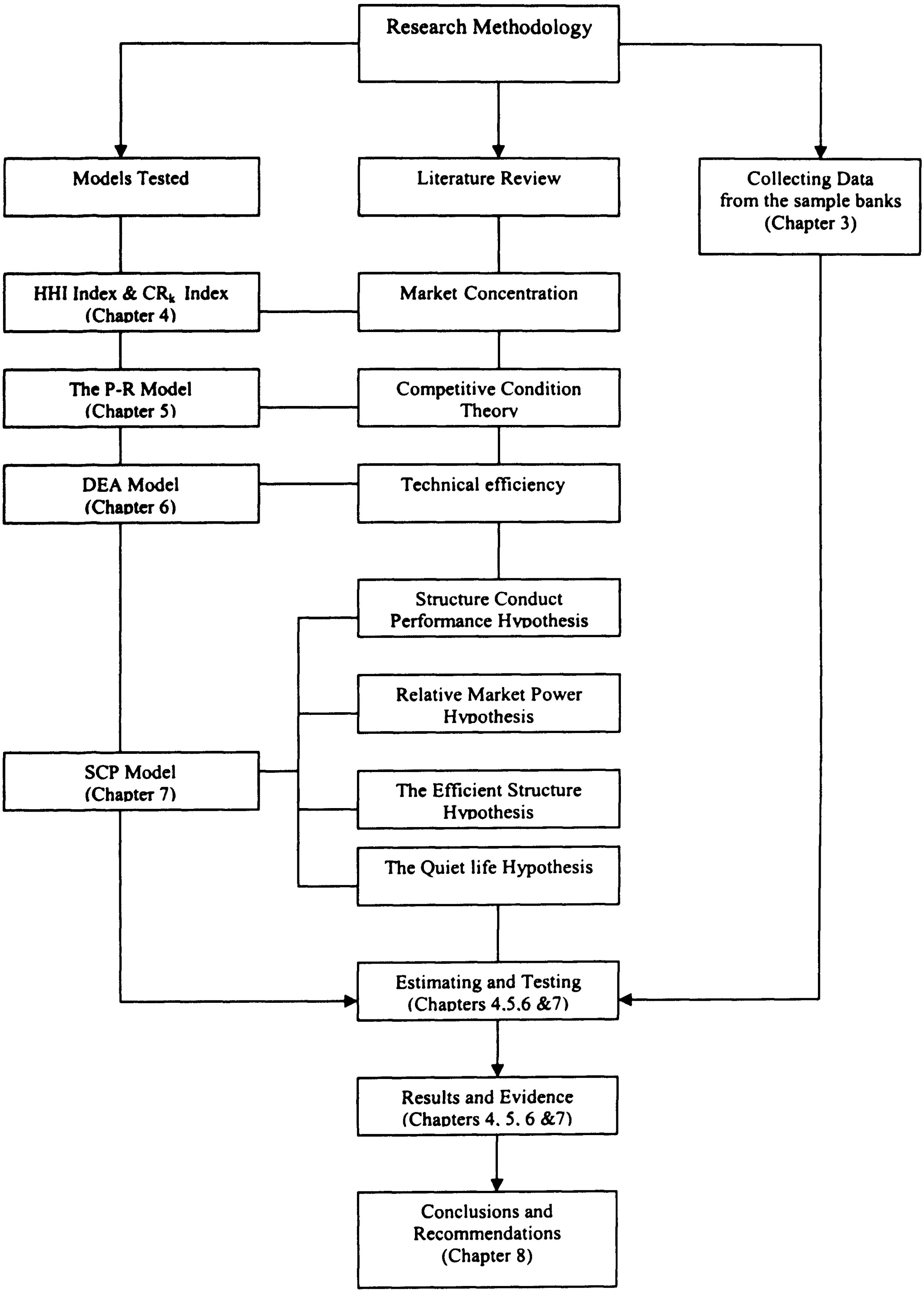
This chapter describes the main characteristics of the GCC countries' economies, presenting main economic characteristics, developments, and challenges. The chapter also focuses on such countries' financial sectors' structure and development. It then provides a review of recent changes in banking sector structure and regulations in each country. The chapter also provides an overview of GCC countries' banking systems' soundness and performance and highlights the progress undertaken by GCC countries to form monetary and economic union.

Chapter 3 Methodology and Data

This chapter explains the approach which will principally be used to estimate market structure, competitive conditions, and efficiency, and their relationship to performance in GCC countries' banking markets. The chapter describes the functional forms, the data, and the variables used in the different models.

The objective of this chapter is to describe how this research work will be carried out. In particular, it aims to outline the research methodology, strategy, and techniques of collecting data (see the summary of research methodology in figure 1.2).

Figure 1.2: Research methodology outline



Chapter 4: Measurement of GCC banking concentration.

This chapter attempts to ascertain the extent to which the GCC countries' markets are concentrated by using the following methodology:

1. CR_2, CR_3 measuring the percentage of the highest two and three banks in terms of total loans and total deposits.
2. HHI index measuring each bank's market share of deposits in the banking industry.

This chapter thus contributes to the literature on bank concentration by examining cross-country data of GCC countries' banking industry. The researcher uses measures of the ratio of deposits and loans of each bank relative to the entire banking industry in each country.

Chapter 5: Assessing competitive conditions and monopoly power

This chapter endeavours to analyse the conditions under which banks earn their revenues and profits by using the bank revenue equation (i.e., the Panzar-Rosse model) in which revenue is explained by factor prices and other bank-specific variables affecting long-run equilibrium bank revenues for GCC countries' banks during the years 1993-2002.

$$LnTREV = \alpha_0 + (\alpha_1 lnPL + \alpha_2 lnPK + \alpha_3 lnPF) + \alpha_4 lnRISKASS + \alpha_5 lnASSET + \alpha_6 lnBR \quad (1)$$ [2]

The value of H-statistics of the input coefficients ($\alpha_1+\alpha_2+\alpha_3$) will indicate under what conditions banks make their revenue and profit. If the H-statistics of the input coefficients equals or less than zero, this indicates that banks make their revenue under monopoly condition, if the H-statistics ranges between 0 and 1, this indicates that banks

[2] Section 5.5 in Chapter 5 explains the definitions of the variables that are used in equation 1.

make their revenue under monopolistic competitions, and if the H-statistics equals to 1, this indicates that banks make their revenue under perfect competition.

Chapter 6 Technical efficiency and productivity growth

This chapter's aim is to investigate the efficiency of commercial banks in the GCC countries. To achieve this objective, first, the study measures and analyses the efficiency of commercial and Islamic banks using the Data Envelopment Analysis model. The scope of efficiency is, however, limited to the technical aspect only. Second, it then compares the efficiency scores across Islamic and commercial banks based on their specialisation. The idea is to determine whether the specialisation is related to efficiency. Third, the study then seeks to identify the main characteristics of the so-called efficient or inefficient banks. Amongst others, the characteristics cover the rates of return, market power, and bank size and number of branches. Finally, it analyses change in productivity, which is measured by the Malmquist Index. This study applies a nonparametric frontier approach using Data Envelopment Analysis (DEA) to calculate the overall technical, pure technical, and scale efficiencies for a sample of 52 banks. Since this study uses the intermediation approach, interest costs are included in total costs. Bank deposit is used also as an output (production approach) to test its influence over efficiency measures.

Chapter 7: Utilisation of DEA efficiency measures to explain the market structure-performance relationship

Four hypotheses are proposed to explain the positive relationship between market structure and corporate profitability. These are the *Structure-Conduct-Performance (SCP)*, the *Relative-Market-Power (RMP)*, and the *Efficient-Structure (ES) hypotheses* in the form of *X-efficiency or Scale efficiency.*

The chapter investigates the profit-structure relationship in the banking industry in GCC countries over the period 1993-2002. Differing from previous literature, this study uses Data Envelopment Analysis (DEA) to estimate efficiency measures. This method appears to be more appropriate than the parametric estimate in consideration of the small number of observations available. In addition, DEA allows us to consider two efficiency terms (i.e. *Technical* and *Scale efficiency*), rather than the two traditionally employed (i.e. *X-efficiency* and *Scale efficiency*) in the literature.

The emphasis of the chapter is: first, to analyse the relationship between market structure and banks' profitability. Then it seeks to assess the relevance of the *Structure-Conduct-Performance (SCP),* the *Relative-Market-Power (RMP)* and the *Efficient-Structure (ES) hypotheses* in the form of *X-efficiency* or *Scale efficiency* in explaining the performance of the banking industry in GCC countries. Third, it tries to test the existence of the "*Quiet Life Hypothesis*" in these markets.

Chapter 8: Summary and Conclusions

This chapter provides a summary of the main findings, policy implications, and recommendations. It also presents the limitations of this research and proposes areas for future research.

CHAPTER 2

DEVELOPMENT OF GCC COUNTRIES' ECONOMIES AND BANKING SYSTEMS

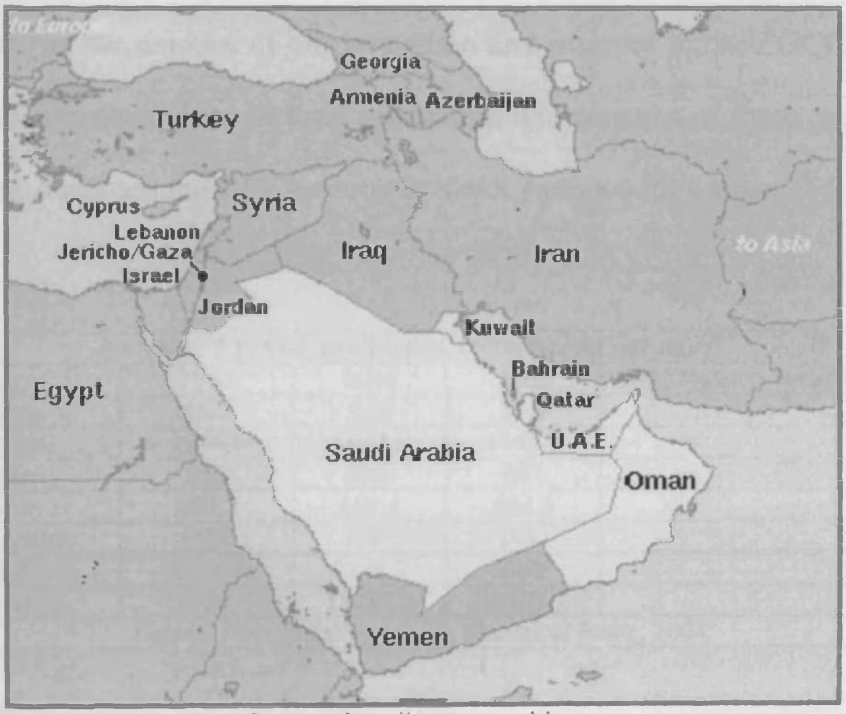
2.1 Introduction

In chapter one, the objectives of this study were specified, however, before embarking on accomplishing the objectives, it is important to provide background details about the economies and banking structures and development in GCC countries. The first part of this chapter outlines the main characteristics of GCC countries' economies, while the second part provides an overview of their financial systems. Section 2.2 presents background information about the GCC countries' economies including their history, the size of their economies (in terms of GDP), their demography, and various indicators relating to recent economic performance. Section 2.3 provides an overview of GCC countries' financial systems covering the development of individual countries' banking systems, an evaluation of the performance of their banks, and recent moves to create an economic and financial union among GCC member countries. Section 2.4 presents our conclusions.

2.2 Background to GCC countries' economies

The Gulf Cooperation Council (GCC) was founded in 1981 with the aim of coordinating political, economic, and social policies across the Gulf region.[1] GCC countries consist of six Arab Gulf states: the Kingdom of Bahrain, the State of Kuwait, the Sultanate of Oman, the State of Qatar, the Kingdom of Saudi Arabia, and the United Arab Emirates (UAE) (see Figure 2.1).

Figure 2.1 Map indicating the location of GCC countries



Source: http://www.geocities.com

GCC countries are located in one of the most important economic regions of the world. In particular, the capability of the region to meet the world demand for hydrocarbon consumption has contributed to the region's strategic economic significance in the global economy (Crystal, 1990). GCC countries were responsible for about 18 per cent of total world oil production in 1999, and they account for around 45 per cent of the world's proven crude oil reserves, and 15 per cent of the

[1] GCC Secretariat General (http://www.gcc-sg.org/Foundations.html).

world's total proven natural gas reserves (GCC Secretariat General's Economic Bulletin, 2001, p. 12-13).

The importance of the Gulf region to the global oil market and economy lies in the fact that any interruption in Gulf oil production can destabilise the world economy, especially through deliberate limitation of the supply of oil. GCC countries can also make up any shortages in the world oil supply when oil production is interrupted elsewhere.

Table 2.1 shows the amount of oil production and reserves in each GCC country as well as each country's share in total production and reserves of these products. The largest oil producer among GCC country is Saudi Arabia with a share of 57.8 per cent in 2002.

Table 2.1: OIL production (1000 barrel per day)

Country	2000	2001	2002	2002 Relative weight %
Bahrain	38.0	37.0	38.0	0.03%
Kuwait	1984.5	1947.6	1745.9	13.5%
Oman	955	956	897	6.9%
Qatar	688.5	682.1	563.8	4.4%
Saudi Arabia	8100	7997	7483	57.8%
U.A.E.	2174.7	2114.2	2208	17.1%
Total	**13940.7**	**13733.9**	**12935.7**	**100%**

Source: Secretariat General's Statistical Book, 2004.

2.2.1 Recent economic growth in the region

GDP is widely used as an indicator to measure economic development in a country. Using this reference, it is clear that GCC countries achieved significant economic development throughout the 1990s. According to the GCC's Secretariat General's report (2001, p. 15-16), the GDP of GCC countries grew by 78 per cent from $180 billion in 1990 to $321 billion in 2000. IMF Report in table 2.2 shows that the size of GDP of GCC countries from 1993-2002. In 2002, Saudi Arabia accounted for 55.2% of the total GDP of GCC countries followed by the UAE (21%) then Kuwait (10.3%).

Oman, Qatar and Bahrain came fourth, fifth and sixth with 5.9%, 5.1% and 2.5% respectively.

Table 2.2: GDP of GCC Countries (Billions US dollars)										
Country	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Bahrain	5.200	5.566	5.848	6.100	6.350	6.183	6.617	7.966	7.927	8.415
Kuwait	23.996	24.797	27.189	31.492	30.350	25.945	30.123	37.017	34.232	35.333
Oman	12.494	12.919	13.803	15.277	15.839	14.085	15.711	19.868	19.944	20.085
Qatar	7.157	7.374	8.138	9.059	11.298	10.255	12.388	17.760	17.127	17.466
Saudi Arabia	118.516	120.167	127.811	157.743	167.866	151.704	162.758	188.772	183.257	188.471
UAE	35.745	38.268	42.807	47.993	51.209	48.500	55.193	70.249	69.546	71.711
Source: www.imf.org/external/pubs/ft/2004/01/data										

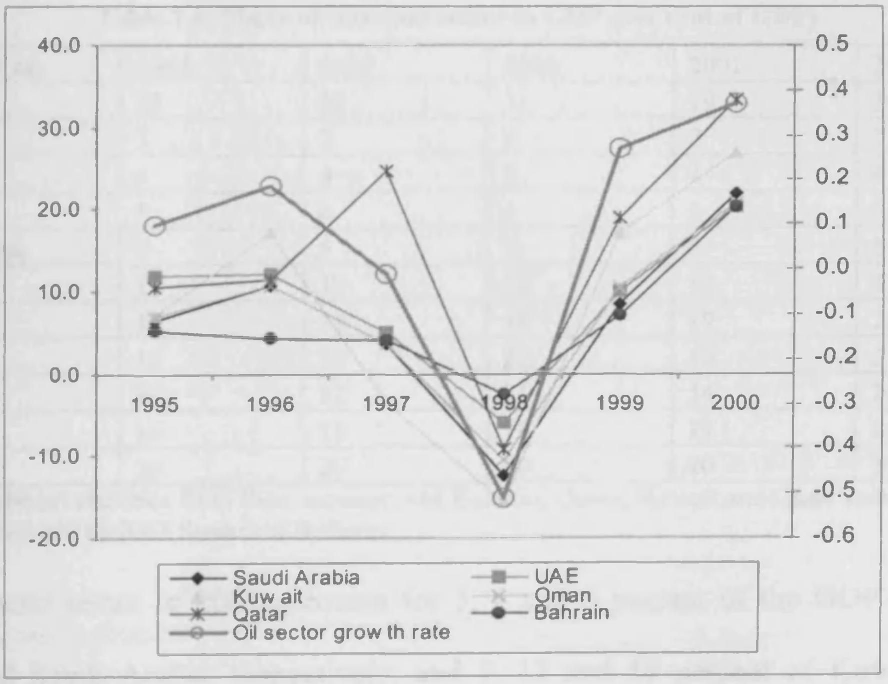
The significant income generated from the wealth of the hydrocarbon resources, accompanied by relative small population (see the section 2.2.3 on demography) has led to high records of per capita incomes.

Table 2.3: The distribution of GCC countries' GDP and GDP per capita at current price (US B$)						
Country	2000		2001		2002	
	GDP*	Per capita	GDP*	Per capita	GDP*	Per capita
Bahrain	7.969	11549.03	7.933	11162.43	8.554	11684.90
Kuwait	35.824	16136.72	32.803	14200.29	33.099	13677.44
Oman	19.868	7822.030	19.944	7670.716	20.295	7578.559
Qatar	17.760	30850.80	17.127	28884.39	17.466	28599.58
Saudi Arabia	188.772	9167.535	183.257	8598.756	188.471	8544.373
U.A.E.	70.522	21698.98	69.861	20017.44	71.243	19628.28
Source: Compiled by the researcher from the IMF: www.imf.org						

For instance, the average per capita income in GCC countries stood at around $14,952 in 2002, up from $8,144 in 1993 and $8,653 in 1995. Individually, Qatar had the highest per capita income in the GCC region in 2002, standing at around $28,599, followed by the UAE with a per capita income of around $19,628. Table 2.3 illustrates the growth in GDP and per capita income in the GCC countries from 2000-2002.

Generally, GCC countries' economies are vulnerable to international price conditions influencing their primary export product, oil. For instance, during 1995-2000, GCC countries' GDP performance fluctuated, mainly on account of the vulnerability of the oil sector. Thus, as Figure 2.2 shows, both GDP and oil sector growth rates exhibit similar patterns. The figure also indicates that all GCC countries experienced negative GDP growth in 1998 because of the crash in oil prices. The average oil price stood at $12.60 a barrel for Brent in this year compared with $19.12 in 1997.

Figure 2.2 GDP and oil growth rates of GCC countries between 1995-2000



Source: GCC's Secretariat General's Economic Bulletin, 2001.

According to Qatar Central Bank (1998 and 1999) the decrease in oil price came after a huge excess supply in the oil market, mainly due to reduction in oil demand by countries affected by the Asian financial crisis. The recovery in oil demand and the success of the OPEC cartel to limit oil supply resulted in an increase in economic growth after 1998. The figure shows also that the least affected country among GCC countries' during 1998 was Bahrain, mainly because of the more diversified nature of its economy and the country's low dependence on oil income. As mentioned earlier, the strong growth of the Qatari economy shown in the figure was mainly due to the large capital expenditures on gas projects undertaken over the period.

2.2.2 The relative size of the financial sector

The relative size of the financial sector, as reflected by its share in GDP, varies considerably among GCC countries (Table 2.4).

Table 2.4: Share of financial sector in GDP (per cent of GDP)

Country/ Year	1998	1999	2000	2001	2002
Bahrain	23	22	21	19	19
Kuwait	7	7	5	7	7
Oman	5	4	3	4	4
Qatar	5	4	3	3	3
Saudi Arabia	5	5	5	5	5
UAE	13	12	12	12	12
Japan	18	19	19	19	20
Korea	19	20	19	19	21
Singapore	32	32	31	34	24
UK	16	18	19	19	20
USA	20	20	20	20	20

Sources: National statistics from Euro monitor; and Bahrain, Oman, Kuwait and Qatar's share of GDP from GCC-SG 2001&2002 Statistical Bulletin.

The financial sector in 2002 accounts for 3, 4 and 5 percent of the GDP of Qatar, Oman and Saudi Arabia, respectively, and 7, 12 and 19 percent of Kuwait's, the UAE's and Bahrain's respectively. Moreover, the size of the financial sector in these countries is relatively small when compared to those of other upper-middle income countries or developed countries. Therefore, it is obvious that GCC countries, especially Qatar, Oman, Saudi Arabia and Kuwait, need to strengthen their financial sectors for better participation in GDP.

2.2.3 Demography

The Gulf region has experienced rapid growth in population. Between 1993 and 2002, the population of GCC countries increased by 34.5 per cent. In 2002, the population reached 32,367.35 million, distributed between 68.9 per cent in Saudi Arabia, 11.6 per cent in the UAE, 8.4 per cent in Oman, 7.1 per cent in Kuwait, 2.2 per cent in Bahrain and 1.8 per cent in Qatar (see Table 2.5). According to GCC's Secretariat General's Economic Bulletin (2001, pp. 39-40) data for 2000 also reveal GCC populations are very young, since about 45 per cent are under 20 years old.

Table 2.5: The growth of GCC population

	Bahrain	Kuwait	Oman	Qatar	Saudi	UAE	Total
1993	536.48	1,742.14	2,037.78	497.48	17,017.20	2,234.94	24,066.02
1994	556.33	1,638.27	2,118.86	507.25	17,595.79	2,325.98	24,742.48
1995	575.99	1,575.57	2,198.67	517.09	18,194.04	2,411.09	25,472.45
1996	595.38	1,670.12	2,275.78	527.72	18,776.25	2,552.05	26,397.30
1997	614.14	1,894.64	2,350.16	539.24	19,339.53	2,693.04	27,430.75
1998	632.57	2,129.18	2,423.01	551.32	19,842.37	2,833.99	28,412.44
1999	650.32	2,273.72	2,495.87	563.35	20,338.42	3,032.99	29,354.67
2000	667.68	2,228.36	2,570.43	574.85	20,846.89	3,247.01	30,135.22
2001	684.29	2,243.08	2,647.50	585.53	21,555.68	3,488.00	31,204.08
2002	700.41	2,301.80	2,727.14	595.43	22,288.57	3,754.00	32,367.35

Source: International Monetary Fund: International Financial Statistics (2003)

2.2.4 Inflation

Another characteristic of the GCC countries is that they all experienced relatively low levels of inflation (generally less than 5 per cent) between the 1993-2002 period (GCC-SG, 2001). For example, in 2001, the inflation rate ranged from 1.2 per cent in Bahrain to 2.2 per cent in the UAE (see Table 2.6). Most of the inflation rates were similar to those experienced in the developed countries, which range between 1 and 4 per cent for the same year (The World Fact book, 2002). Increased competition and substitutes for imported goods probably helped moderate the inflation level as more than 90 per cent of GCC countries' imports are supplied by non-GCC countries (GCC-SG, 2001). Moreover, since most of the imports of GCC economies are Dollar denominated, GCC countries' economies can face price inflation due to unstable exchange rates against the US Dollar. However, on average, the Dollar was relatively stable for the period 1993-2002 against major international currencies and this helped dampen potential inflationary pressures (GCC countries' Central Banks' various reports).

In addition, the use of appropriate monetary and fiscal policies to control liquidity and finance budget deficits helped, to some extent, in keeping pace with changes in oil prices and achieving stability in average general prices. The low interest rate/inflation climate in the global economy throughout 1993-2002 must also have been an important factor in limiting inflationary forces. The broad effect of this low-inflation environment has clearly been seen in the maintenance of a stable macroeconomic climate.

Table 2.6 Inflation rates in GCC countries (annual % change)

Country	2000	2001	2002
Bahrain	-0.7	-1.2	-1.0
Kuwait	1.8	1.7	1.4
Oman	-1.2	-1.0	-0.7
Qatar	1.7	1.4	1.0
Saudi Arabia	-0.6	-0.8	-0.6
United Arab Emirates	1.4	2.2	1.4

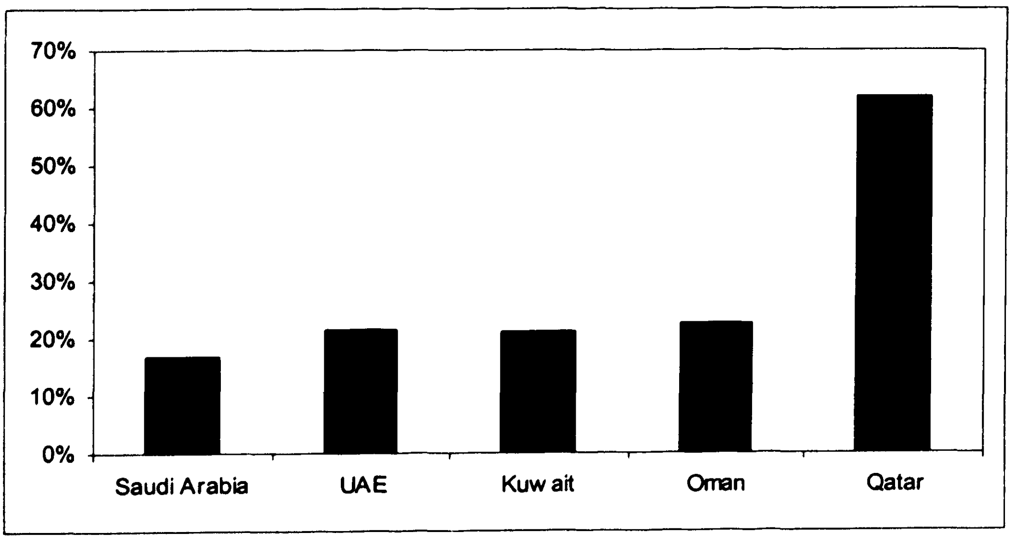
Source: International Monetary Fund, 2003.

2.2.5 External Indebtedness

The current external indebtedness of GCC countries' economies reflects, more or less, the extent to which they have financed their development projects as well as public deficits. For example, governments like Qatar and Oman have tapped international markets and sold bonds to finance government projects in gas and petrochemical areas. Various budget deficits have also been run up to bolster domestic government policy (*Gulf Business*, 2000).

Saudi Arabia has the highest external debt, amounting to $28.8 billion in 2000, followed by the UAE ($14.1 billion), Qatar ($10.1 billion), Kuwait ($7.9 billion), and Oman ($4.4 billion). Relative to GDP, most Gulf countries' external debts are modest, except those of Qatar, whose external debts in 2000 amounted to 60 per cent of GDP (see Figure 2.3), having declined from about 80 per cent of GDP in 1998. The large Qatari external debt is mainly due to the country's determined plan to complete the construction of its huge gas field project. Repayments of these debts are expected to be arranged from sales of gas (*Gulf Business*, 2002).

Figure 2.3 External debts as a share of GDP, 2000



Source: Bank for International Settlements (2002)

2.2.6 Financial integration of GCC countries

The GCC was formed by Arab Gulf countries with the aim of establishing a foundation for cooperation between them that will lead to greater economic convergence and a more unified and integrated market. From the date the GCC agreement was signed (1981), negotiations have commenced aimed at increasing the free flow of products and factors of production within GCC countries. The council's negotiations yielded an agreement, signed in 1999, aimed at unifying trade customs charges. This agreement took effect from January 2003, and under it all products entering the GCC zone will face a unified customs rate. This is expected to increase non-price competition within the GCC zone by encouraging each country to improve its ports and alter trade facilities (by attracting higher volumes and provides cheaper warehousing services, and so on) so that the cost of imports may foster re-exporting business.

A major part of the GCC's economic integration programme focuses on the creation of an economic and monetary union. In achieving this goal, the GCC has agreed to introduce a unified currency by 2010. Certain steps have clearly been accomplished that will gradually help pave the way to establishing a unified currency. For example, GCC countries have completed a project linking all ATM networks throughout the region. In essence, residents within GCC countries are able to obtain money from their bank accounts at the same cost they pay in their own countries and at the same official currency exchange rate. Moreover, GCC countries agreed at their last Omani summit (in 2000) to establish a timetable to adopt the Dollar as a currency to which all current GCC currencies' would be pegged. (This was in place at start of 2003 as

Kuwait, the only GCC country adopted a basket of currency, pegged its Dinar currency to the US Dollar commencing January 2003).

The committee of GCC central bank governors is also currently studying ways in which to develop GCC countries' capital markets and especially bond markets, because of their expected positive effect on attracting investment and enhancing monetary policy tools. Moreover, with the aim of encouraging GCC countries' banks to expand regionally, the GCC summit of 2000 issued a resolution urging central banks to allow banks from GCC countries to open branches throughout the region. This calls for GCC countries to change their local laws in order to permit greater bank entry. The impact of this resolution is already bearing fruit. For example, branches of a bank from the UAE have been opened in Saudi Arabia and Bahrain and Qatar. Bahrain has also permitted the establishment of branches from Oman and the UAE. In fact, the phased opening up of GCC banking markets should foster greater competitiveness and possibly encourage increased mergers and alliances between banks within the region.

Overall, GCC countries' economies have been growing mostly due to oil production. However, these economies still remain exposed to fluctuations in international oil prices. This suggests an increased need for reforms and greater economic diversification.

The above provides a broad insight into the main economic features of GCC countries' economies. The following sections present the main features of financial and banking system developments in each country.

2.3 Overview of GCC countries' financial systems

This section of the chapter outlines the development of individual GCC countries' financial systems, focusing mainly on the banking sector. We then examine the overall banking sector performance. Finally, the section concludes by noting recent efforts aimed at shaping a more integrated financial system.

2.3.1 Background to GCC countries' financial systems

In GCC countries, the banking industry is relatively young, since the oldest banks date back to no earlier than the1950s. Although the majority are privately owned, the role of the public sector remains substantial. Whether through equity participation in several banks or through a number of governments owned specialised credit institutions that provide financing to public and private sector enterprises at subsidised rates, the public sector continues to have a prominent role in the banking industry of GCC countries. Private sector ownership of financial institutions also tends to be concentrated in a few shareholders; a matter that reduces the threats (and benefits) of the market for corporate control. In addition, all GCC countries have moratoria on the establishment of new and foreign banks. The latter are permitted only minority ownership of local banks[2].

2.3.1.1 Scale and Scope

While enormous potential exists within the GCC states' financial institutions for the region's further development, more progress could be made. Considering the region's massive oil wealth, the combined Tier One capital of the GCC's Top 50 banks at $31.5 billion is relatively small-amounting to 1.7% of the capital of the Top 1000 world banks. When comparing banks, the total capital of GCC countries' 50 banks is considerably less than that of HSBC Holdings at $35 billion. Although banks of GCC countries, such as National Bank of Kuwait, have been able to receive the highest rating of any bank in the Arab world or emerging markets, the GCC has not been able to produce large powerhouse institutions that could be a force in the Arab or international banking arena. For various reasons, many of them political, the global trend towards consolidation has passed by the Gulf. With World Trade Organisation (WTO) liberalisation planned, GCC banks need to rethink their competitive strategies for the future. Bahrain-based Gulf Banking stressed in a recent report: "GCC banks need to strengthen their position through consolidation in order to compete effectively with international banks. The current fragmented banking sector will be unable to put up a good fight when markets do eventually open up" (*The Banker*, 2002).Therefore, the size of the banking sector in GCC countries, in absolute terms, is relatively small when compared to that in other developed countries.

The aggregate assets of Saudi Arabian commercial banks (the largest in the region) are valued at about 2 per cent those of the United States[3]. GCC financial markets are sometimes characterised as being "over-banked". It has been further argued that the existence of such a banking structure is overcrowding the market and reducing lending margins. At first glance, however, the data do not seem to support this claim for all GCC countries (Table 2.7).

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[2] Systems and Labour Markets in the Gulf Cooperation Council Countries, International Monetary Fund, November 1997.

[3] Valuation figures for bank assets in the region should be viewed with caution. Among the issues to be considered is the value of real estate that is carried on the balance sheets of commercial banks. In many instances, these numbers tend to be inflated and do not reflect the true value of the underlying assets. "A Question of Assets," Middle East, July 1998.

Table 2.7: Ratio of GDP (in Billion US dollars) to number of local commercial banks

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Bahrain	0.87	0.93	0.97	1.02	1.06	1.03	1.10	1.33	1.32	1.40
Kuwait	3.43	3.54	3.88	4.50	4.34	3.71	4.30	5.29	4.89	5.05
Oman	2.50	2.58	2.76	3.06	3.17	2.82	3.14	3.97	3.99	4.02
Qatar	1.19	1.23	1.36	1.51	1.88	1.71	2.06	2.96	2.85	2.91
Saudi Arabia	11.85	12.02	12.78	15.77	16.79	15.17	16.28	18.88	18.33	18.85
UAE	1.99	2.13	2.25	2.53	2.70	2.55	2.90	3.70	3.66	3.77

Source: Compiled by the researcher from the IMF and central banks in GCC countries

In 2002, Bahrain and Qatar had the lowest ratio of GDP to number of local commercial banks among GCC countries. However, this ratio was much higher than that of many developed countries at the time, thus reflecting a certain degree of under-banking. The same holds true for other GCC countries. Such reasoning, however, does not take into consideration the increasing importance of economies of scale in the banking industry. Due to the limited size of the market they service, GCC commercial banks are faced with a strong need for consolidation. In order to evolve into major players in international financial markets, it is imperative that these banks succeed in expanding their asset base. Such a strategy will allow them to improve the quality of their assets, through proper diversification, and to invest in expensive new technology that has increasingly become, and will continue to be in the foreseeable future, critical to success in the global banking industry.

Another feature of the banking industry in GCC countries is the high degree of market concentration. In their analysis of this issue, Jbili et al. (1997, p.4) found that:

> In Saudi Arabia (1996) and Oman (1994) the three largest banks accounted for approximately one-half of total bank assets, equity and loans, with one bank accounting for approximately one-fifth of assets and equity. These ratios are even higher in Kuwait, where the three largest banks accounted for nearly 80 per cent of the banking sector's total assets and equity in 1995, while the largest single bank accounted for one-third.

The benefits (and costs) of such a market structure largely depend on the dynamics of the banking industry in GCC countries. On a positive note, high industry concentration could lead to larger banks with a more diversified asset base and a greater capacity to keep up with the changing nature of the banking industry worldwide. Moreover, it has often been argued that it is not the degree of market concentration that is necessarily problematic especially in an industry where entry costs are high rather; it is the existence of barriers to new competition. The presence of "dynamic" competition and the constant threat of new market entrants keep industry players competitive and efficient. Only in such an environment will high market concentration not result in a monopolistic environment. As mentioned earlier, however, all GCC countries have moratoria on the establishment of new banks, shielding existing banks from the threat of new competition. The negative effects of this strategy are especially pertinent to the case of foreign banks, since by closing the door to these banks, such countries' governments have not only reduced the level of competition, but have also halted the "dynamic gains" that accompany foreign investments. These gains are generated through the transfer of technological innovations, managerial know-how, and foreign expertise in product diversification and customer service all necessary if GCC countries' banks are to someday become major players in world markets. Moreover, the lowering of barriers to foreign entry is of special importance to those GCC countries that have entered the World Trade Organisation (WTO) and now need to reconcile their national laws with the requirements of the General agreement on Trade in Services (GATS)[4].

A related issue is that of inter-regional banking. Cross-border lending within the GCC has been approved by the organisation's council for a number of years. Moreover, during the eighteenth GCC summit in December 1997, government leaders agreed to

[4] Although barriers to the entrance of foreign banks are in force in most of GCC countries, many banks in the region have begun to espouse outward looking strategies. In their quest for a more global role in

allow banks headquartered in one GCC country to open branches in other member countries. Despite these efforts to bolster interregional banking, it has not yet shown any significant signs of growth, due to several factors. First, by shielding domestic banks from competition, GCC governments have indirectly granted them quasi-monopolistic powers in their local markets; this, in turn, has reduced their incentive to expand into other countries. Second, it can be safely argued that one of the main incentives for expansion of inter-regional banking is the growth of inter-GCC trade in goods and services. Yet the level of inter-GCC trade continues to claim only a minimal share of member countries' overall external trade. Third, the absence of a common regulatory framework in GCC countries creates substantial impediments to the free flow of financial services across boundaries. Finally, if one assumes that maximisation of returns and maintenance of diversified loan portfolios are at the heart of sound bank management, then inter-GCC expansion is difficult to validate. For one, the returns on investments outside the GCC area are often greater than on interregional alternatives and are unfettered by the bureaucratic and regulatory hassles that tend to accompany investments in the region. Furthermore, due to the vastly similar economic policies followed by the GCC governments, the dominant share of the oil sector in their economies and the pervasive role of the public sector, economic cycles of GCC countries have been and, in the absence of necessary reforms will continue to be, strongly correlated over time. Consequently, for a GCC bank seeking portfolio diversification, the appeal of inter-regional investments is diminished not only by the intrinsic risks of the investments themselves, but by the minimal degree of diversification that they would offer the institution's already regionally biased portfolio.

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financial markets, many of the region's more powerful financial institutions have been pursuing an outward-looking strategy through foreign branching and strategic alliances with foreign institutions.

2.3.1.2 Financial Development and Growth

According to Creane et al. (2004), the theoretical argument for linking financial development to growth is that a well-developed financial system performs several critical functions to enhance the efficiency of intermediation by reducing information, transaction, and monitoring costs. A modern financial system promotes investment by identifying and funding good business opportunities, mobilising savings, monitoring the performance of managers, enabling the trading, hedging, and diversification of risk, and facilitating the exchange of goods and services. These functions result in a more efficient allocation of resources, a more rapid accumulation of physical and human capital, and faster technological progress, which in turn feed economic growth.

To compute the comprehensive index, Creane et al. (2004) assigned a set of weights to each of the 36 indicators. They found that grouping countries into high, medium, and low financial development categories was robust to the different weighting schemes, although the relative ranking of countries within each grouping changed slightly (see Table 2.8). One can see that all GCC countries' banking systems are categorised under a high level of financial development in Middle East and North Africa region.

Table 2.8: Middle East and North Africa: Financial Development Ranking

Level of Financial Development		
High	**Medium**	Low
Bahrain	Algeria	Iran, I.R. of
Jordan	Djibouti	Libya
Kuwait	Egypt	Sudan
Lebanon	Mauritania	Syria
Oman	Morocco	Yemen
Qatar	Pakistan	
Saudi Arabia		
U.A.E.		

Note: Based on an index of qualitative and quantitative data; 2000–01 data; scoring 0–10, with 10 representing the highest level of development. Within each category, the countries are arranged in alphabetical order.

2.3.1.3 The development of banking business in Bahrain

Conventional commercial banking was established in Bahrain earlier than in most other Gulf countries. According to the Bahrain Monetary Agency (1994), banking business in Bahrain started when a branch of the Eastern Bank opened in 1921. This bank was the only one operating in Bahrain until the British Bank of the Middle East opened its branch two decades later in 1944. The Bank of Bahrain, the first bank to be owned by Bahrainis, and subsequently renamed the National Bank of Bahrain (NBB), was established in January 1957. The Bank of Bahrain enjoyed the status of being the country's only local commercial bank for nearly 15 years until the Bank of Bahrain and Kuwait commenced operations in March 1971. Currently, only 7 of the19 banks with full commercial bank status are locally incorporated.

2.3.1.3.1 Growth of Bahrain Banking Sector

Table 2.9 shows the growth of the total assets of local commercial banks in Bahrain. With an exception of 1996, the period 1994-2002 showed a yearly increase in total assets. The overall increase, in total assets from 1993-2002, was 85%.

Table 2.9: Growth in total assets of Bahraini banks (million BD)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Δ TA 1993-2002
Total Assets	1,926	2,220	2,268	2,263	2,497	2,529	3,134	3,337	3,480	3,569	1,643
% Growth	NA	15%	2%	0%	10%	1%	24%	6%	4%	3%	85%

Source: Compiled by the researcher from banks annual reports

Bahrain commercial banks had also expanded their branch networks considerably, from 55 branches at the end of 1993 to 77 at the end of 2002 as shown in table 2.10. The table shows the total number of branches had increased in each year with an exception for 1994 and 1999.

Table 2.10: Growth in number of branches of Bahraini Banks											
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ΔBranches 1993-2002
Total	55	55	61	63	67	71	71	73	76	77	22
Source: Compiled by the researcher from banks' annual reports											

2.3.1.3.2 Centre for financial services in the Gulf region

2.3.1.3.2.1 The financial centre for OBUs

Because the Government of Bahrain was conscious of the risks associated with depending solely on its oil reserve, it was among the first GCC countries to embark on initiatives aimed at diversifying the economy away from oil (BMA, 1994). Bahrain has focused on developing itself as a centre for financial services in the Gulf region, with the aim of attracting oil revenues from neighbouring countries. In fact, Bahrain has successfully attracted Offshore Banking Units (OBUs) and developed the main offshore financial centre in the Gulf region. Offshore banks located in Bahrain are not required to pay income taxes. Moreover, they are exempted from foreign exchange controls and cash reserve requirements. On the other hand, OBUs must not accept deposits from citizens and residents of Bahrain, and must refrain from transactions involving Bahraini Dinars. In return, Bahrain benefits from employment opportunities for its national labour force and collects annual license fees. The first OBUs to operate in Bahrain were Citibank and Algemene Bank Nederland. They were opened in 1975. One of the main factors that contributed to the fast growth of Bahrain's OBUs market was the shift of OBUs located in Lebanon to Bahrain. The Number of OBUs in Bahrain reached a maximum of seventy –six in 1984. However, owing to the dramatic decline in oil prices in the mid 1980s, many OBUs contracted their business, resulting in the non-renewal of various licenses. Moreover, trends towards consolidation within and between banking groups increased. As a result, the number of OBUs in Bahrain declined and, by 2002, around forty-seven were active in the country. According to the Bahrain Monetary Agency (2001), around 34% of the assets of OBUs are from Arab countries (mostly from GCC countries). Western European banks account for 32%, American banks 21.3%, and Asian banks 12.7% of total OBU banking sector assets.

2.3.1.3.2.2 The financial centre for Investment Banking

In 1977, Bahrain also introduced a third category of banking licences, called Investment Banking licences (IBs), for banks intending to carry out investment business (BMA, 1994). The first of these banks was the Bahrain Investment Bank (in 1977). The number of these types of banks had increased from a handful in the late 1970s to thirty-two by 2001. The aggregate assets/ liabilities of IBs had increased by 17.6%, from US$3.4 billion end-2000 to US$4.0 billion at end-2001(BMA 2001).

2.3.1.3.2.3 The financial centre for Islamic Banking

Bahrain aims to establish itself as a centre for Islamic banking and finance. Bahrain hosted a first Islamic bank in 1975 and the number of licensed Islamic banks (commercial banks, offshore banking units, and investment banks) at end-2001 totalled 20. The aggregate assets/ liabilities of Islamic banks had increased from US$1.9 billion at end-2000 to US$2.5 billion at end-2001, or by 31.6% (BMA, 2001). Early on Bahrain took the lead in introducing a comprehensive prudential set of regulations for Islamic banks, which follow guidelines from the Bahrain-based Accounting and Auditing Organisation for Islamic Financial institutions and the Basel Committee on banking supervision, as well as guidelines from the accounting firm Ernst & Young. These regulations aim mainly to cover regulatory issues concerning capital adequacy, asset quality, and liquidity management give Bahrain-based Islamic banks a competitive edge and may create interest among other countries to adopt Islamic banking regulations similar to those developed by Bahrain (*Standard and Poor's Credit week*, 2002).

At end-2001, total banking sector assets amounted to US $102.7 billion, a GDP multiple of about thirteen. Offshore banking units accounted for 86.1% of the total balance sheet, while commercial and investment banks accounted for 10% and 3.9%, respectively. By the end of 2001, Bahrain's banking sector comprised forty-seven OBUs and twenty-one commercial banks, of which two were Islamic and thirty-two were investment banks (Bahrain Monetary Agency, 2001).

Although the Bahraini commercial banking sector is the smallest in the GCC region, Bahrain commercial banks have achieved significant growth over the last decade or so. Commercial banking credit experienced a growth of 112 per cent from the year 1990 to 2000, increasing annually by an average of 9 per cent and totalling $3.7 billion by 2000.[5] Over the same period, deposits increased by 70 per cent, with an annual growth rate of 7 per cent. These deposits totalled $6.5 billion in 2000. In addition, capital and reserves of the banking sector amounted to $0.6 billion by 2000. The assets size of Bahrain commercial banks reached $7.9 billion by the year 2000.

Overall, the Bahraini banking sector development reflects its special position as a major financial centre in the Gulf region. The country constantly aims to provide an environment conducive to banking and financial activity, and has recently made various moves to establish itself as the major Islamic finance centre in the region. While there is increasing competitive pressure from Dubai, Bahrain still remains one of the world's premier financial centres. Given its role as an offshore centre, the

[5] Researcher's own calculation based on the GCC's Secretariat General's Economic Bulletin, 2001.

domestic banking sector remains relatively small, in fact the smallest in GCC countries; nevertheless, domestic banks continue to provide an important role in mobilising domestic savings and financing economic development within the country.

2.3.1.4 Banking sector development in Kuwait

The British Bank of the Middle East was permitted to set up a branch in Kuwait in 1941. Many banks tried later to enter the Kuwaiti banking market, but the authorities prohibited foreign banks from conducting banking business in the country. When the British Bank's concession ended in 1971, this bank changed its name to the Kuwait Bank for the Middle East and Kuwaitis purchased 60 per cent of the bank's capital (Al-Sharrah, 1999).

In 1952, a group of Kuwaiti families founded the First National Bank in Kuwait, known as the National Bank of Kuwait, which is currently the largest commercial bank in the country. In fact, after Kuwait gained its independence in 1961, the establishment of several other banks, all under Kuwaiti ownership, followed. By 2002, the number of commercial banks operating in Kuwait amounted to seven.

The huge revenues generated from oil production that coincided with the rise in oil prices after 1973 resulted in a substantial increase in the wealth of Kuwait and its inhabitants. Some of the increased prosperity was channelled into speculative activities on the Kuwaiti stock market and this resulted in a small stock market crash in 1977 (Economist Intelligence Unit, 1992). As a response to these difficulties, the government provided compensation for certain investors and also introduced reforms and stricter regulations. The introduction of tougher capital market regulations unintentionally contributed to the creation of an illegal stock market, known as the Suq al-Manakh. The Suq al-Manakh emerged as an unofficial stock market operating alongside the official one and its stocks were mainly traded by wealthy families trading in large amounts. Because deals were undertaken using post-dated cheques, this created a huge demand for credit, and when stock prices fell in 1982, the Suq al-Manakh crashed creating a severe shake-out of the Kuwaiti financial sector and the entire economy. Officials revealed total outstanding cheques amounted to $94 billion from about 6,000 investors. The debts from the crash left all but one bank in Kuwait technically insolvent. Only the National Bank of Kuwait, the largest commercial bank, survived the crisis. In response, the government devised a complicated set of policies, embodied in the Difficult Credit Facilities Resettlement Programme, to bail out banks and investors.

During the Iraqi invasion of Kuwait in 1990, the largest commercial bank in Kuwait (the National Bank of Kuwait) was the bank least affected by the Iraqi invasion thanks to its substantial international funds (Economist Intelligence Unit, 1992; and Central Bank of Kuwait, 2002). It controlled the exiled government's finances during the invasion. However, in the aftermath of the Iraqi invasion, between1990-1994 the annual decline in the Kuwaiti banks' assets reached 6.5 per cent, and the decline in these banks' foreign assets reached 13.4 per cent as the Kuwait government directed these banks to fulfil their international liabilities so as to maintain international confidence in them (Al-Sharrah, 1999).

Since April 1993, the domestic interest rate structure has been linked to the KD discount rate and banks have been permitted to set their interest charges with a margin (not to exceed a certain level) set with reference to the Central Bank of Kuwait's rate (Central Bank of Kuwait, 2000). Further, in January 1995, all ceiling rates on deposits were lifted and are now determined according to the market mechanism.

2.3.1.4.1 Growth of Kuwait's Banking Sector

Table 2.11 shows the growth of the total assets of local commercial banks in Kuwait. 1999 and 2000 witnessed -1% and 0% growth in total assets which could be attributed to the effect of the decline in oil prices. Overall, Kuwaiti banks grew 69.5% from 1993-2002.

Table 2.11: Growth in total assets of Kuwait banks (million KD)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Δ TA 1993-2002
Total Assets	9,532	10,471	11,008	11,140	12,021	11,932	11,939	12,633	14,167	16,155	6,623
% Growth	NA	1%	5%	1%	8%	-1%	0%	6%	12%	14%	69.5%

Source: Compiled by the researcher from banks' annual reports

Kuwaiti commercial banks had also expanded their branch networks considerably, from 111 branches at the end 1993 to 176 at the end of 2002 as shown in table 2.12. A yearly increase in number of branches accumulate an overall growth of 65 branches (58.6%) from 1993-2002.

Table 2.12: Growth in number of branches of Kuwaiti Banks

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ΔBranches 1993-2002
Total	111	115	123	132	139	147	154	160	171	176	65

Source: Compiled by the researcher from banks' annual reports

In sum, the Kuwaiti banking sector has been restoring its pre-invasion position. Kuwaiti banking credits were severely affected in the years immediately after the Iraqi invasion. However, banking credit recovered and reached $17.1 billion by 2000, showing more confidence. In addition, total deposits in the banking sector had reached $25.8 billion by the end of the millennium. Moreover, the level of financial capital and reserves of the banking system reached $5.7 billion, a 50 per cent increase over the decade, suggesting a strengthened banking environment (GCC-SG's Economic Bulletin, 2001).

2.3.1.5 The development of the banking sector in Oman

According to the Central Bank of Oman (CBO) (2000), commercial banking in Oman dates back to 1948 when a branch of the British Bank of the Middle East was established in Muscat and provided commercial banking services in the country. Since then, commercial banking activities have grown significantly in terms of branch networking, capital employed, assets and range of financial services provided. To trace the history of commercial banking up to 1975, there were only three commercial banks operating in Oman in early 1970 with seven offices, most of which were located in and around the capital area. The banks were operating under a banking agreement between themselves during this period. After the implementation of the Currency Act of 1970, whereby the Riyal Saidi became the sole legal currency in the country, the management of the Currency Authority was entrusted to the British Bank of the Middle East under the supervision of the Secretary for Financial Affairs.

Commercial banking in Oman has grown over the years in tandem with overall economic development. Total deposit mobilisation of the commercial banking system, which was around RO 1418 million or 27 per cent of GDP in 1995, progressively grew to RO 2350 million in 1999, which worked out to around 40 per cent of GDP. Total deposits as a percentage of gross domestic savings had increased from 33 per cent to 43 per cent in 1998 after reaching as high as over 100 per cent in 1996. The total assets of commercial banks almost doubled, from RO 2048 million in 1995 to RO 3842 million by the end of 1999 (CBO, 2000).

Five important mergers have taken place in the banking history of Oman, of which three were during 1991-95. Two mergers were effected in 1993; Bank Al-Ahli Al-Omani merged with Bank Muscat to form Bank Muscat and the Commercial Bank of Oman took over Oman Banking Corporation. The year 1994 saw the acquisition of the Oman European Bank by Oman Arab Bank (CBO, 2000).

According to the Central Bank of Oman (1996), its establishment law also facilitated the entry of foreign-owned banks and permitted an increase in the number of local banks in the Sultanate. During the 1970s (the period that witnessed the oil price boom), the number of banks operating in Oman increased, reaching twenty by the end of the decade. In addition, three specialised development banks were established: the Oman Development Bank (1977), the Oman Housing Bank (1977), and the Oman Bank for Agriculture and Fisheries (1981). Although the increase in the number of banks facilitated an inflow of foreign capital and increased funds to the development process, during the early 1980s the CBO froze new bank licensing, fearing that the available number of banks might lead to excess capacity in the Omani banking system. Moreover, the steep fall in oil prices in the mid 1980s exposed the Omani banking system to pressures that led to a rationalisation of various lending schemes and forced the authorities to encourage banks to strengthen their capital and to make adequate provisions and reserves.

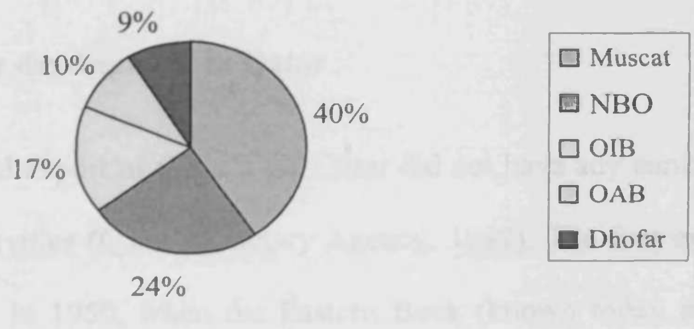
Bank licensing was, however, relaxed from the mid 1980s onwards, and the number of banks had increased to twenty-two by the end of 1980s, with nine national and thirteen foreign banks. In 1991, the CBO was given increased powers allowing the central bank to suspend or withdraw the licenses of banks violating regulatory rules. In fact, the CBO exercised its new power on the Bank of Credit and Commerce International (BCCI) because of the institution's engagement in illegal practices such as weapon finances (CBO, 1996). During the 1990s, certain banking regulations were put in force in order to advance the soundness of the Omani banking system (CBO, 1996, 2000, and 2002). In 1991, the CBO amended the ceiling on the amount banks could lend to their directors, from a maximum of 20 per cent to 15 per cent of their capital. Moreover, although banks in Oman had been in full compliance with the Basel capital adequacy minimum requirement of 8 per cent since 1992, the CBO wanted to further enhance the capital cushion, and thus it asked banks in Oman to achieve a minimum ratio of 12 per cent by 1998 (Central Bank of Oman, 2000). This led all banks in Oman to achieve a ratio even higher than the 12 per cent target. Moreover, an expansion in personal lending in 1997 and 1998 induced the CBO to put a ceiling of 30 per cent on the proportion of personal loans in total private sector lending. However, this limit was relaxed in 2000 as the ceiling increased to 35 per cent (owing to the improved macroeconomic climate). The loan to deposit or lending ratio is currently set at 87.5 per cent. The minimum reserve requirement for banks is set at 5 per cent of total deposits. Until 1993, the authorities set ceilings on the interest rates commercial banks could charge on both deposits and loans. In a move towards deregulation, the authorities decided to gradually prepare the banking market for market-determined interest rates. Oman freed up the ceiling imposed on deposits of Riyal Omani in the last quarter of 1993. In mid 1994, the authorities also deregulated interest rates on consumer loans of RO 9,000 or less. By January 1999, consumer loans were fully deregulated (CBO, 2000).

Over the period 1990-2000, Omani banking credit grew by 198 per cent, increasing annually by an average of 13 per cent over the period, and totalling $7.7 billion by 2000.[6] Total deposits in the banking sector stood at $6.8 billion. In addition, capital and reserves of the banking sector reached $1.1 billion in 2000, reflecting an average annual growth of 15 per cent. Total commercial bank assets reached $15.2 billion in 2000.

2.3.1.5.1 Characteristics of the Omani Banking Sector

Many local banks formed or grew when foreign banks sold their operations to Omani interests. However, there are only five local commercial banks, and unlike the rest of GCC countries, Oman has no Islamic banks. Bank Muscat is the biggest bank in Oman and it is dominating the market. Figure 2.4 shows the relative asset size of these five commercial banks.

Figure 2.4: Relative asset size of Omani banks in 2002



Source: Compiled by the researcher from banks' annual reports

Omani commercial banks continued to expand their branch networks considerably, from 135 branches at the end 1993 to 296 at the end of 2002 as shown in table 2.13. However, the pace of expansion has slowed in recent times. Most networks are

[6] Researcher's own calculation based on the GCC's Secretariat General's Economic Bulletin, 2001.

concentrated in the capital area, though the CBO encourages local banks to open branches in regions outside the capital area.

Table 2.13: Growth in number of branches of Omani banks

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ΔBranches 1993-2002
Total	153	162	181	194	213	224	223	275	293	296	143

Source: Compiled by the researcher from banks' annual reports

Overall, these indicators show that, as in other GCC markets, the Omani financial sector has expanded substantially over the last decade. Following a series of mergers during the 1990s, the numbers of commercial banks at the end of 2000 stood at fifteen, of which six are locally incorporated and nine are branches of foreign banks (Central Bank of Oman, 2000). With the recent merger between the Bank Dhofar Al-Omani Al-Fransi and the Majan International Bank, there are five Omani commercial banks.

2.3.1.6 Banking sector development in Qatar

Prior to the commercial export of Qatar's oil, Qatar did not have any banking entities practising banking activities (Qatar Monetary Agency, 1992). The first ever bank in Qatar was established in 1950, when the Eastern Bank (known today as the ANZ Standard Chartered Bank) established its Qatar branch after Qatar's oil exports commenced in December 1949. In 1954 and 1956, the British Bank of the Middle East (known today as the HSBC bank) and the Ottoman Bank (currently known as the Grindlays Bank), respectively, opened their Qatar branches. Two Arab banks were also established later: the Arab Bank Limited in 1957 and the Intra Bank (known later as the Almashreq Bank) in 1960. Until the mid 1960s, foreign bank branches dominated banking activities, until Qatar established its first national bank (know as the Qatar National Bank) in 1965 with joint venture capital shared equally between the Government of Qatar and the public. The economic expansion in Qatar attracted more foreign banks; thus, in the second half of the 1960s, the government authorised four new foreign banks.

Qatar established in 1973 the country's central bank known as the Qatar Monetary Agency (QMA, later called the Qatar Central Bank, QCB). The QMA regulates banking credit and finances, issues currency, and manages the foreign reserves necessary to support the Qatari Riyal. One of the first steps taken by the QMA was to restrict the licensing of new bank establishments or branch openings of foreign banks. The oil boom started in 1973, promoting economic growth, and this resulted in an expansion of the banking sector as three national banks were established during the latter part of the 1970s. Another two national banks were added to the banking structure during the 1980s. However, one foreign bank, the Qatar branch of Al-Mashrek Bank headquartered in Beirut was closed and put into liquidation in 1989 (Qatar Monetary Agency, 1992).

As a result of the Iraqi invasion of Kuwait, banks in Qatar lost an estimated 15 to 30 per cent of deposits in late 1990, while QMA (with its ready reserves) left banks free to accept or reject the withdrawal of deposits before their maturity but in accordance with their liquidity status (QMA, 1992). Moreover, the QMA directed money exchangers to sell the Dollar at the official rate, with penalties to be set for any reported violation. These measures adopted during the Gulf crisis maintained confidence and soundness in the financial system that continued throughout the 1990s.

According to *Gulf Business* (August, 2002), one important banking problem occurred in 2000 when one of Qatar's national banks (the Al-Ahli Bank of Qatar) was hit by a severe loan problem caused by one of its major corporate clients' defaulting. Al-Ahli Bank's credit risk exposure to this corporate was discovered to approach 40 per cent of the total bank loan portfolio. The QCB rescued the bank on an agreement providing a 10-year guarantee with an amount close to the amount of the bank's non-performing loan ($28 million). The QCB also changed the bank's management and imposed significant bank restructuring. It has been argued that confidence in Qatar's banking sector would have been harmed if the QCB had let this bank fail. Moreover, one of the major weaknesses that appeared to have led to this problem was that the bank's management generally remained hostage to the key shareholders and political influence. This necessitated moves to enhance the management and monitoring systems in order to reduce the likelihood of conflicts of interest in the future.

The current regulations require that banks' credits are limited to 95 per cent of their total deposits. In addition, banks must maintain a ratio of no less than 6 per cent of their capital to total assets at all times. Moreover, capital adequacy must be maintained at a minimum of 8 per cent, in line with the Basel 1988 recommendations. Nevertheless, it should be noted that, starting from the mid 1990s, the QCB has gradually lifted the restriction on deposit rates and, currently, all deposit rates are set according to market forces.[7] Banks are also permitted to offer interest on demand deposit accounts with balances exceeding QR 2 million. The QCB amended the reserve requirements from 19 per cent on demand deposits to 2.75 per cent effective on the total of all deposit accounts.

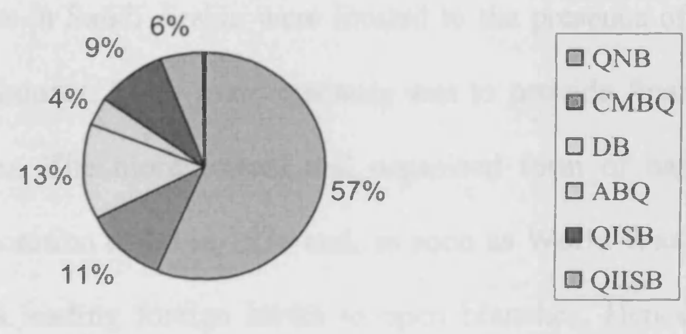
[7] Qatar Central Bank Guidelines to banking institutions (http://www.qcb.gov.qa/pages/English_Site/intro.html).

Within the period 1990-2000, the level of credit in the economy increased by 188 per cent, progressing by an average annual rate of 13 per cent and reaching $7.6 billion by 2000. Deposits increased by 136 per cent with an annual growth of 11 per cent, totalling $9.9 billion by the end of the millennium. Bank capital and reserves grew by 61 per cent, achieving an average annual growth of 6 per cent and reaching some $1.7 billion by 2000 (GCC- SG's Economic Bulletin, 2001). Moreover, the level of assets stood at $14.8 billion (Qatar Central Bank, 2000).

2.3.1.6.1 Characteristics of the Qatari Banking Sector

Figure 2.5 shows the relative asset size of Qatar local commercial and Islamic banks. Qatar National Bank is the main player in Qatar banking sector and its size accounted 57% for 2002. Since Qatar Government is one of the main share holders, this gives an indication of the support that had been given to this bank dominate the market.

Figure 2.5: Relative asset size of Qatari banks in 2002



Source: Compiled by the researcher from banks' annual reports

Qatar banks had also expanded their branch networks considerably, by 86.8%, from 38 branches at the end of 1993 to 71 at the end of 2002 as shown in table 2.14. This increase in branches was considered the highest relative percentage increase (87%) in the region for 1993-2002.

Table 2.14: Growth in number of Branches of Qatari banks

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ΔBranches 1993-2002
Total	38	38	41	44	49	54	61	71	73	71	33

Source: Compiled by the researcher from banks' annual reports

Overall, the Qatari banking sector substantially developed during the period 1993-2002. The authorities continue to strengthen supervision of the banking system in order to ensure improved soundness and to comply with various international standards. Moreover, the relaxation of various barriers, such as interest rate ceilings, should help facilitate greater competition in the banking system.

2.3.1.7 Banking sector development in Saudi Arabia

Early banking activities in Saudi Arabia were limited to the presence of a handful of foreign-based trading houses. Their main business was to provide financial services for locals and pilgrims. The more formal and organised form of banking system emerged after the exploration of oil in 1939 and, as soon as World War II ended, the Saudi market attracted leading foreign banks to open branches. Hence, the French Banque de l'Indochine and the Arab Bank Limited opened their branches in Jeddah in 1948, while, in 1950, three international banks opened their branches, namely, the British Bank of the Middle East, the National Bank of Pakistan, and the Bank of Egypt.

At that time, Saudi Arabia did not have a national currency. In 1952, the Saudi Arabia Monetary Agency (SAMA) was established. Over the years 1950 and 1956, the

SAMA introduced paper money in the form of pilgrim receipts, which were covered by foreign currencies and precious metals. The introduction of the Saudi national currency, called the Riyal, came in 1960.

The SAMA is responsible for issuing and preserving the value of the Saudi Riyal, and for supervising and setting regulations governing the banking sector. At the time of the SAMA's establishment, the Saudi government continued to use the Al-Kake and Bin Mahfouz Money Changer Company as its agent to undertake its payment services. In 1953, this company was permitted by the government to be transformed into a bank known as the National Commercial Bank, the first ever Saudi bank. By the end of the 1950s, the Saudi banking system had witnessed the opening of an additional three foreign banks and two domestic banks. However, the two newly established Saudi banks, namely, the Riyad Bank and Al-Watani Bank that started in 1957 and 1959 respectively, faced financial difficulties due to various liquidity problems. These were mainly caused by poor governance as board members of the two banks borrowed heavily, exposing the banks to various default problems. Being unable to meet depositors' claims, the Al-Watani Bank became insolvent and was liquidated, ending up being merging with the Riyad Bank (Al-Suhaimi, 2001). As a result, in 1966, a banking law provided the SAMA with broader supervisory powers that made banks subject to various liquidity, capital adequacy, lending, and reserve requirements.

By the early 1970s, other banks had entered the Saudi banking system, attracted by the opportunities brought about by the boom in the economy resulting from the increased oil revenues, especially from 1973 onwards. The strong presence of foreign banks, of which there were ten by the mid 1970s, encouraged the Saudi authorities to introduce a policy encouraging foreign banks to be converted into publicly traded companies with the participation of Saudi nationals. The legislation introduced in 1975 aimed to preserve the rights and interests of foreign banks' positions as partners in the newly incorporated banks. In order to maintain the performance and stability of the banking sector, foreign banks were allowed to hold up to 50 per cent ownership and include the name of their origins in the bank title.[8] They could also maintain management responsibilities and were allowed to enjoy treatment equal to that of national banks (SAMA, 1998).

In the 1980s, the Saudi economy experienced two major incidents. One was the sharp rise in oil prices during 1979-1981 due to the Iran-Iraq war, and the second was the severe decline in oil prices in 1986 (Al-Suhaimi, 2001). These incidents affected the Saudi banking system in that Saudi banks substantially extended their lending in the early 1980s, backed by the increase in their balance sheets after the oil price hike. Many of these loans were made without adequate assessment and monitoring procedures. Consequently, when oil prices fell in 1986, many banks faced difficulties recovering their loans owing to the severe contraction in the domestic economy, mainly because of declining government revenues. (For instance, government revenues fell from SR333 billion in 1981 to SR74 billion in 1987). As a result, non-performing loans in the banking system increased sharply, amounting to 20 per cent of total loans by 1986. This, understandably, depressed bank profits on account of the substantial rise in loan loss provisions. However, these incidents helped discipline banks' lending activities and, by 1988, most banks had adequate provisions for doubtful loans, with average loan provisions increasing to more than 12 per cent of total lending (Banks for International Settlements, 2001).

[8] For example, the Saudi British Bank and the Saudi American Bank.

Another noteworthy event during the 1980s was the near failure of the Saudi Cairo Bank resulting from unauthorised bullion trading during 1979 and 1981. Accumulated losses exceeded the bank's capital, forcing the authorities to intervene (Al-Suhaimi, 2001). In response, the SAMA directed the bank to issue new shares and double its capital by 1986, and the increase in capital was undertaken by the Saudi Public Investment Fund.

During the 1980s, various other national banks were established, including the Al-Rajhi Banking and Investment Corporation (the largest money exchanger licensed as a full commercial bank), the Saudi Investment Bank (authorised as a full commercial bank with foreign ownership reduced to 25 per cent and the remaining shares sold to the public), and the United Saudi Bank (formed after the take over of three foreign banks). These banks contributed to the restructuring of the Saudi banking sector. Meanwhile, the SAMA encouraged banks to strengthen their capital positions so as to improve the soundness of the system (Al-Sahlawi, 1997; Al-Jarrah, 2002).

Another major development during the 1980s was the introduction of government bonds that helped strengthen banks' investment portfolios. In addition, automated teller machines were introduced in order to advance the quality of banks' services to the public, and debit and credit card services became more widely available.

The decade of the 1990s commenced with a serious test to the Saudi banking system after the Iraqi invasion of Kuwait (Al-Sahlawi, 1997; Al-Jarrah, 2002). Banks faced substantial deposit withdrawals in August 1990, accounting for 11 per cent of total banking sector deposits, and these were exchanged into foreign currencies. By the end of 1990, the withdrawals had eased (declining to 1.1 per cent of total deposits) owing to intervention by the SAMA.

From 1991 to 1995, domestic loans and advances increased by 90 per cent, and banking profitability indicators continued to show sustained improvement (Al-Sahlawi, 1997; Al-Jarrah, 2002). The second half of the 1990s witnessed a merger between the United Saudi Commercial Bank and the Saudi Cairo Bank, to form the United Saudi Bank. The United Bank also merged with the Saudi American Bank in 1998. Moreover, Saudi banks continued to embrace operational development by investing in new technologies, such as electronic fund transfer systems and by setting up widespread point-of-sale terminals.

The Saudi banking sector expanded during the 1990s. Banking credit grew by 147 per cent, with an annual average growth rate of 11 per cent, amounting to $46.2 billion by 2000. Also, deposits rose by 73 per cent, reaching some $71.2 billion.[9] Moreover, the level of financial capital and reserves of the banking system reached $11.6 billion, mirroring an annual growth of 10 per cent over the 1990-2000 period. By 2000, total banking assets amounted to some $121.1 billion, when there were eleven commercial banks operating in Saudi Arabia, of which four were joint ventures with foreign banks. From mid 1975, no new foreign bank entities have been allowed to enter the Saudi banking system. However, in the move towards GCC financial sector integration, the International Gulf Bank of Bahrain and the Abu Dhabi National Bank of the UAE have been lately granted licenses to open branches on Saudi soil.

2.3.1.7.1 Growth of the Saudi Arabian Banking Sector

Table 2.15 shows the growth of the total assets of local commercial banks in Saudi Arabia. The table shows a continuous yearly growth for nine years and an overall growth for the period 1993-2002 was 65%.

[9] Author's own calculation based on the GCC's Secretariat General's Economic Bulletin, 2001.

Table 2.15: Growth in total assets in Saudi Arabia's banks (million SR)											
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Δ TA 1993-2002
Total Assets	301,607	308,697	316,283	330,021	356,091	379,069	413,394	449,625	461,271	497,162	195,555
Growth	NA	2%	2%	4%	8%	6%	9%	9%	3%	8%	65%
Source: Compiled by the researcher from banks' annual reports											

Saudi Arabia's commercial banks had also expanded their branch networks, from 1106 branches at the end of 1993 to 1181 at the end of 2002 as shown in table 2.24.

Table 2.24: Growth in number of branches of Banks in Saudi Arabia										
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ΔBranches 1993-2002
Total	1106	1120	1116	1118	1125	1135	1168	1177	1176	1181	75
Source: Compiled by the researcher from banks' annual reports											

Overall, the Saudi financial system, the largest in the Gulf region, had witnessed a remarkable expansion in banking accompanied by ongoing updating and revision of its regulatory framework to ensure increased soundness and prudence.

2.3.1.8 The development of banking business in the UAE

According to the UAE Central Bank (2001), the British Bank of the Middle East started as the first bank in the UAE in 1946, taking a location in Dubai. This bank opened its second branch in Abu Dhabi following the discovery of oil. Later, the Eastern Bank and the Ottoman Bank opened their branches in Abu Dhabi in 1961 and 1962, respectively. The year 1963 witnessed the establishment of the first national bank, the National Bank of Dubai, followed in 1968 by the opening of the Abu Dhabi National Bank in 1968. Obviously, the attractiveness of these two cities in the UAE derives mainly from the acceleration of trade activities (primarily in Dubai) and oil exports (largely in Abu Dhabi).

The UAE Central Bank (2001) notes that after the formation of the federation, which resulted in the establishment of the state of UAE in 1972 (consisting of seven emirates), the rush to open national and foreign branches accelerated. In 1972, the Currency Board was established to issue the UAE national currency, the Dirham, and to supervise and regulate the banking system. In the same year, the number of commercial banks increased to six domestic and fifteen foreign banks, most concentrated in Abu-Dhabi and Dubai and a few in the third largest emirate, Sharjah. Following the dramatic increase in international oil prices, the number of banks had reached thirteen national and twenty-eight foreign banks by 1975. After 1975, the Currency Board realised that the economy needed more banking institutions to help with financing associated with the economic boom, thus, more bank licenses were issued and by 1977 there were twenty national and thirty-four foreign banks operating throughout the Emirates.

In 1980, the UAE issued a Federal Law establishing the Central Bank of the UAE, with extensive powers to operate as the country's central bank. The central bank was formally in charge of issuing and controlling the supply of the Dirham and maintaining gold and foreign currencies to support its value. In 1981, the UAE Central Bank lifted the freeze on new bank establishments; however, it imposed it again specifically on the licensing of new foreign banks. It also instructed existing foreign banks that from 1984 they would not be allowed to have more than eight branches throughout the UAE.

In the early 1980s, the UAE Central Bank adopted several measures to strengthen the banking system (UAE Central Bank, 2001). It set minimum capital requirements, enhanced audit and reporting requirements, increased inspection, established a department dedicated to oversee bank loan risks, and set regulations that limited the amount of loans that could be given to the board of directors. In 1983, one bank failure resulted from the violation of the loan limit to the board of directors. This caused the UAE Central Bank to appoint administrators to this bank and, in essence, the central bank and the government of Dubai bailed out the bank with an amount of $380 million.

As the UAE Central Bank (2001) notes, the oil price fell below $10 per barrel in 1986 and this led to a sharp decline in federal revenues. Consequently, contractions in government expenditure slowed down economic activities and, as a result, the banking sector experienced loan problems arising from accelerated loan losses. This led to a restructuring of the banking sector when three banks in Dubai merged, as did another three in Abu Dhabi. This resulted in banking sector numbers falling to nineteen national and twenty-nine foreign banks. Another threat emerged in the wake of Iraq's 1990 invasion of Kuwait, when between 15 and 30 per cent of customer bank deposits were transferred out of the UAE. At this time, the UAE Central Bank injected funds into at least two banks in order to strengthen their liquidity and restore confidence in the banking system as a whole (Economist Intelligence Unit, 1991).

During the 1990s, the UAE Central Bank introduced various regulations aimed at improving banking sector soundness (UAE Central Bank, Annual Report, 2001). By 1993, banks were subjected to a capital to assets ratio of 10 per cent. Moreover, banks were required to accumulate reserves by shifting 10 per cent of their annual net profits to the reserve accounts until the latter equalled 50 per cent of their paid-up capital. In 1994, banks were urged to move towards adopting International Accounting Standards. These directions enhanced, to some extent, the capitalisation of the UAE banking system. For example, in 1997, the average ratio of capital to risk-weighted assets for all banks was 21 per cent, which was well above the Basel 1988 recommendations. Recently, the UAE Central Bank has raised the capital reserve ratio to 14 per cent. This move came after one banker fled the UAE with an estimated quarter billion Dollars of customers' funds (*The Banker*, Sept., 2000).

Commercial banks in the UAE made significant developments during the 1990s. Commercial credit to different economic sectors grew by 169 per cent over the period 1990-1999, with an average annual growth of 12 per cent.[10] Such credit amounted to $37.6 billion in 2000. Deposits in commercial banks grew by 72 per cent, with an annual growth of 8 per cent, and total deposits reaching $36.8 billion in 2000. Moreover, bank capital and reserves amounted to some $9.3 billion by 2000, having experienced an annual average growth of 9 per cent throughout the 1990s. Total banking sector assets amounted to $75.5 billion in 2000. Over the decade of the 1990s, only small changes in the number of banks had occurred and by the end of 2000, the number of national banks had reached twenty while foreign banks stood at twenty-six.

2.3.1.8.1 Growth of the UAE's Banking Sector

UAE commercial banks have expanded their branch networks considerably, from 255 branches at the end of 1995 to 333 at the end of 2002 as shown in table 2.17.

[10] Author's own calculation based on the GCC's Secretariat General's Economic Bulletin, 2001.

Table 2.17: Growth in number of banks' branches in the UAE									
Year	1995	1996	1997	1998	1999	2000	2001	2002	ΔBranches 1995-2002
Total	255	263	272	284	295	300	312	333	78
Source: compiled by the researcher from banks' annual reports									

Overall, UAE banks operate in a relatively healthy financial system. The banking system's development over the last twenty years or so reflects the system's ability to cope with minor crises as well as the changing demands of clients and the economy.

2.4 Conclusion

In the late 1950s and in the following decade, most GCC countries were under British protection agreements, and the region witnessed the establishment of foreign banks, of which many were of British origin. By the early 1960s, the structure of the GCC financial system started to grow through the establishment of national banks. The financial systems also set up currency boards responsible for the control of money supply, aiming to replace the British Pound Sterling and Gulf Rupees that had been circulating in the region. In general, the 1960s and 1970s were characterised by the establishment of central banks as well as the issuance of national currencies. During the 1980s and 1990s, the number of banks operating in the region increased, improving the sophistication of financial activity. In addition, regulatory authorities started to place greater emphasis on banking sector soundness and prudential regulation. As the competitive environment heightened, this was accompanied by consolidation and gradual deregulation of various banking systems, a process which continues.

Capital Intelligence's (CI's) Bankscope database (2003) ratings summarised the positions of banks in GCC countries an in Appendix 2. From the appendix, one can conclude that most of banks in GCC show an overall excellent performance.

This chapter has provided an overview of GCC countries' economies and their banking systems. The first part of the chapter has outlined the history of GCC economies and banking systems, their characteristics and various recent developments. The chapter has also analysed the performance and soundness of banks in different GCC countries. Finally, the chapter has outlined various important developments that are aimed at achieving GCC economic and monetary union. The following chapter addresses the data and the research methodology.

CHAPTER 3

METHODOLOGY AND DATA COLLECTION

3.1 Introduction

As mentioned in chapter 1, this thesis examines four areas: (1) market structure, (2) competitive conditions, (3) technical efficiency and (4) the performance of GCC countries' local banks. The aim is to use four different models, namely, the CR_k and HHI indices to measure the market concentration, the Panzar-Rosse model to test the level of competition, the DEA Model to assess the efficiency, and finally, the SCP Model to assess the structure-performance relationship.

This chapter, therefore, describes the methodologies used to measure market concentration, monopoly power and competitive conditions, technical efficiency as well as structure-performance relationship analysis. Based on the implementation of the methodology outlined in the present chapter, Chapters 4, 5, 6 and 7 present a further elaboration in this methodology and outlines the results.

As mentioned above, the objective of this study is to investigate, explore and understand the market structure, the competitive conditions, technical efficiency and structure-performance relationship in GCC countries' banking industries and it is considered useful for bank managers in knowing the determinants of profitable and efficient banks and as well as for policy makers when deciding about the banks mergers. Therefore, it is the intention of the researcher to analyse the secondary data for the ten years from 1993-2002.

The remainder of this chapter is structured into nine sections. Section 2 describes the methods and models' specification used in chapters 4, 5, 6 and 7. It presents the different approaches and models utilised to obtain the study's results. Types of data used in the analysis are described in section 3. Section 4 provides a brief background about Islamic banking practices while section 5 explains the data sources. The modelling process is outlined in section 6 and panel data is described in sections 7. Section 8 details the statistical analysis software used to analyse different models and approaches. Finally, section nine concludes the chapter.

3.2 Methods and models' specification

This section illustrates the four models used to estimate and test different hypotheses and to obtain results and evidences in order to derive conclusions and recommendations.

3.2.1 Measurement of market concentration

Bikker and Haaf (2002) observed that the Panzar-Rosse (P–R) approach provides a link between number of banks and competition. However, as a description of the market structure, the number of banks is a rather limited concept. For instance, it fully ignores the size distribution of banks (or inequality) in a given market. As concentration indices, weighted averages of banks' market shares, take both the size distribution and the number of banks into account, they are often used as a simple proxy of the market structure. Apart from the number of banks itself, two-frequently applied-types of such indices are used as a proxy. The first is the so-called k-bank concentration ratio (CR_k) which takes the market shares of the k largest banks in the market and ignores the remaining banks in that market. This index is based on the idea that the behaviour of a market is dominated by a small number of large banks. Summing only the market shares of the *k* largest banks in the market, it takes the form:

$$CR_k = \sum_{i=1}^{k} S_i \qquad (1)$$

giving equal emphasis to the *k* leading banks, but neglecting the many small banks in the market. There is no rule for the determination of the value of *k*, so that the number of banks included in the concentration index is a somewhat arbitrary decision. The concentration ratio may be considered as one point on the concentration curve, and it is a one-dimensional measure ranging between zero and unity. The index approaches zero for an infinite number of equally sized banks (given that the *k* chosen for the calculation of the concentration ratio is comparatively small when compared to the total number of banks) and it equals unity if the banks included in the calculation of the concentration ratio make up the entire industry.

The second index is the Herfindahl-Hirschman Index (HHI), which takes market shares as weights. It includes each bank separately and differently, and thereby avoids an arbitrary cut-off and insensitivity to the share distribution. The HHI is a static measure and, therefore, gauges market concentration at a single point in time. Algebraically, it can be depicted as:

$$\text{HHI} = \sum_{i=1}^{n} (\text{MS}_i)^2 \qquad (2)$$

where MS is the market share of the i^{th} firm and n is number of firms in the market. The Herfindahl-Hirschman index stresses the importance of larger banks by assigning them a greater weight than smaller banks, and it incorporates each bank individually, so that arbitrary cut-offs and insensitivity to the share distribution are avoided.

The value of the k-bank concentration ratios (for various values of k) always exceeds the value of the HHI, since the latter gives less prominence to the markets shares (the weights again being market shares) than the former (unit weights).

3.2.2 Assessing competitive conditions and monopoly power

In the banking literature, there are two major empirical approaches for assessing competition: the Structural Approach and the Non-Structural Approach (Bikker and Haaf 2000). The *structural approach* includes the Structure-Conduct-Performance (SCP) paradigm and the Efficient Structure Hypothesis (ESH). Basically, the SCP paradigm implies that concentration in the banking industry can generate market power, allowing banks to earn monopolistic profits by offering lower deposit rates and charging higher loan rates. This view assumes that banks in a concentrated market can ignore potential competitors due to technological and regulatory barriers to entry (Bain, 1951).

The SCP paradigm is challenged by other theoretical approaches. The first challenge comes from the "efficient structure hypothesis" (ESH). The ESH suggests that the positive relationship is not a consequence of market power but of the greater efficiency of firms with larger market share (Demsetz, 1973). In other words, the superior performance of the market leaders (due to firm specific factors such as technological or managerial skills, etc.) endogenously determines the market structure, implying that higher efficiency produces both higher concentration and greater profitability.

"*Non-structural models*" suggest an alternative approach to competitive behaviour. These models do not infer the competitive conduct of banks through the analysis of market structure, but rather recognise that banks behave differently depending on the market structure in which they operate. The basic principle of these models concerning competitive conditions is that there is no clear evidence that the use of market power will be greater in more concentrated industries. Under this framework, the Contestable Markets Theory (CMT) stresses that a concentrated industry can behave competitively if the barriers for new entrants to the market are low. CMT assumes that firms can enter or leave rapidly any market without losing their capital, and potential competitors have the same cost function as incumbent firms (Baumol, 1982).

These features of contestable markets imply that a concentrated banking market can be effectively competitive even if it is dominated by a handful of large banks. Therefore, policymakers should be relatively less concerned about the market dominance of some type of financial intermediaries in a country's financial system, if the financial markets are contestable. Based on these arguments, deregulation and liberalisation will make the banking industry more contestable or open to competition.

A lack of strong theoretical foundations and mixed empirical evidence motivates the search for alternative methodologies to investigate firms' competitive behaviour. And non-structural models of competitive behaviour by the New Empirical Industrial Organisation approach, namely, the Panzar and Rosse (P-R) model, have been developed.

The method developed by Panzar and Rosse (1987) determines the competitive behaviour of banks on the basis of the comparative static properties of reduced-form revenue equations based on cross-section data. Panzar and Rosse (P-R) show that if their method is to yield plausible results, banks need to have operated in a long-term equilibrium (*i.e.* the number of banks needs to be endogenous to the model) while the performance of banks needs to be influenced by the actions of other market participants. Furthermore, the model assumes a price elasticity of demand, *e*, greater than unity, and a homogeneous cost structure.

Following Shaffer and Shaffer, Nathan and Neave (1989), and Molyneux et al. (1994), the model in the present study for obtaining measures of the competitive banking environment is the Panzar-Rosse model employing the following logarithmic form:

$$LnTREV = \alpha_0 + (\alpha_1 lnPL + \alpha_2 lnPK + \alpha_3 lnPF) + \alpha_4 lnRISKAST + \alpha_5 lnASSET + \alpha_6 lnBRT \quad (3)$$

And for estimating equilibrium conditions, the model is:

$$LnROA = \beta_0 + (\beta_1 lnPL + \beta_2 lnPK + \beta_3 lnPF) + \beta_4 lnRISKAST + \beta_5 lnASSET + \beta_6 lnBRT \quad (4)$$

Variables are defined in Table 3.1 below.

Table 3.1 Variables' definition

Descript ion	Variable
Ln	natural logarithm
TREV	total revenue to total assets
ROA	net profits to total assets
PL	personnel expenses to employees (unit price of labour)
PK	capital expenses to fixed assets (unit price of capital)
PF	ratio of annual interest expenses to own funds (unit price of funds)
RISKAST	provisions to total assets
ASSET	bank total assets
BRT	number of branches of each bank to the total number of branches of the whole banking system

The dependent variable TREV is used since it reflects the banking market forces. According to Coccorese (1998), the nature of the estimation of the H-statistic means that we are especially interested in understanding how the total revenue reacts to variations in the cost figures and, for this reason, the dependent variable is given by the sum of all the revenues, including the interest revenues.

The independent variables include firm specific and market specific variables similar to those used in other studies (Nathan and Neave, 1989; Molyneux et al., 1994). To account for firm specific risk the author uses the provisions to assets ratio (RISKAST). The author expects the RISKAST to be positively correlated to the dependent variables, since higher provisions should lead to higher bank revenue. The ASSET variable is included in the analysis to account for possible scale economies, given the wide range of bank asset sizes in the GCC banking system. Finally, the BR variable is used as a proxy for bank size. All variables are expressed in logarithmic form.

Table 3.2 Discriminatory power of H

Values of *H*	**Competitive environment test**
$H \leq 0$	Monopoly equilibrium: each bank operates independently as under monopoly profit maximisation conditions (H is a decreasing function of the perceived demand elasticity) or perfect cartel.
$0 < H < 1$	Monopolistic competitions free entry equilibrium (H is an increasing function of the perceived demand elasticity).
$H = 1$	Perfect competition. Free entry equilibrium with full efficient capacity utilisation.
Values of *H*	**Equilibrium test**
$H = 0$	Equilibrium
$H < 0$	Disequilibrium

Source: Rosse and Panzar 1997; Panzar and Rosse 1982, 1987; Shaffer 1982, 1993; Nathan and Neave 1989.

PL, PK and PF are the unit prices of the inputs of the banks: labour, capital and funds or proxies of these prices. In the notation of equation (5), the *H* statistic reads as (α_1 + α_2 +

α_3) and in equation (6), the *H* statistic reads as ($\beta_1 + \beta_2 + \beta_3$). Table 3.2 describes the discriminatory power of H.

3.2.3 Technical efficiency and productivity growth

Efficiency can be classified into four categories: overall technical efficiency, pure technical efficiency, scale efficiency, and allocative efficiency. In this study, overall technical efficiency is broken down into pure technical efficiency and scale efficiency. Simply put, technical inefficiency refers to the extent to which a bank fails to produce maximum output from its chosen combination of factor inputs, and scale inefficiency refers to sub-optimal size. Technically, inefficient banks use a relatively excessive quantity of inputs when compared with peer group banks operating with the same size and outputs. In empirical studies, however, the measurement of these efficiencies has been controversial in multiple-input, multiple-output cases. The DEA model provides an easy method to deal with this problem.

The DEA approach was pioneered by Charnes et al. (1978), and later extended by Banker et al. (1984). DEA decomposes cost (input saving) efficiency into technical and allocative efficiencies. It also allows the decomposition of technical efficiency into pure technical efficiency and scale efficiency. Charnes, Cooper and Rhodes (1978), assuming constant returns to scale (CRS) and strong disposability of inputs (and outputs), developed the generic DEA model, called CCR, in 1978. The CCR model drew upon Farrell's work (1957) using the mathematical programming knowledge of Charnes and Cooper (1962). In 1984, this model was extended to account for variable returns to scale (VRS) by Banker, Charnes and Cooper (1984), originating the model known as BCC. The BCC model represents the VRS by adding a convexity constraint to ensure that an inefficient bank is only compared against a bank of similar size. The scope of efficiency is, however, limited to the technical aspect only. If we compute a CRS and a VRS DEA, we may obtain a scale efficiency (SE) measure for each bank. Hence, CRS technical efficiency measure can be decomposed into pure technical efficiency (PTE) and scale efficiency (SE). The Malmquist index is commonly used to assess bank's productivity changes. In order to identify possible causes behind productivity changes, the latter is usually decomposed into technical and technological changes.

In the DEA model, the production frontier, which is the set of banks that are producing a given number of outputs with the fewest number of inputs, is identified and the maximum score of 1 is assigned to banks on the frontier. Then efficiency scores for those banks which are not on the frontier are calculated by the ratio of inputs used by an efficient bank that produces comparable outputs to inputs used by a non-frontier bank. Thus, the score of a non-frontier bank is less than 1 (above 0).

This study's aim is to investigate the efficiency of commercial and Islamic banks in GCC countries. To achieve this objective, firstly, the study measures and breaks down the efficiency of commercial and Islamic banks using the two basic models of Data Envelopment Analysis (BCC) (Banker, Charnes and Cooper, 1984) and (CCR) (Charnes, Cooper and Rhodes, 1978) input oriented models. The study then seeks to identify the main characteristics of the so-called efficient or inefficient banks. Amongst others, the characteristics cover the bank size, specialisation, number of branches and market structure of each country. Finally, the chapter analyses the change in productivity, which is measured by the Malmquist Total Factor Productivity (TFP)

Index. This index contains two parts (technical and technological changes) that are commonly used to explain possible factors behind productivity changes in banks.

3.2.4 Utilisation of DEA efficiency measures to explain the market structure-performance relationship

Several studies (see for example, Molyneux, 1992; Molyneux and Forbes, 1995; Goldberg and Rai, 1996; De Young and Hasan, 1998; Pilloff and Rhoades, 2002; and Chirwa, 2003) have investigated the relationship between market structure and bank profitability. Four hypotheses have been proposed to explain the positive relationship between market structure and corporate profitability. These are the *Structure-Conduct-Performance (SCP)*, the *Relative-Market-Power (RMP)* and the *Efficient-Structure (ES) hypotheses* in the form of *X-efficiency or Scale efficiency.*

The Traditional *SCP* hypothesis identifies a setting of prices less favourable to customers in more concentrated markets as the cause of the positive relationship between profitability and market structure. According to this theory, banks have higher profits in more concentrated markets because they can charge higher prices (than those set in competitive markets) having a stronger market power (Bain, 1951). Similarly, the *RMP* hypothesis states that banks with high market shares and well differentiated products can exploit their market power by setting prices to earn supernormal profits. A different explanation of the positive relation between profits and firm profitability is supplied by the ES hypothesis. This hypothesis asserts that more efficient companies have lower costs which directly increase profits: in this way, these firms can increase their market share determining a higher market concentration. The *ES hypothesis* has been usually proposed in two different forms, depending on the type of efficiency considered. In the *X-efficiency* form, more efficient firms have lower costs, higher profits and larger market share, because they have a superior ability in minimising costs to produce any given outputs. In the *Scale Efficiency* form, the same relationship described above is due to the fact that more scale efficient firms produce closer to the minimum average-cost point.

Some researchers have argued for a *Quiet Life hypothesis* in the banking industry (Nyong, 1990). The Quiet Life hypothesis states that uncertainty avoidance by large firms varies directly with the degree of market power that these firms possess. In such cases, banks with substantial market power may choose to trade some of their potential monopoly profits for a reduction in risk by choosing safer portfolios.

The researcher tests the collusion and efficient market hypotheses on commercial banks using banking industry data from 1993 to 2002. The market structure–profitability model specified in this study tests the traditional *SCP,* the *Relative Market Power,* the *Quiet Life,* and the *efficient market hypotheses.*

The emphasis of the study is: first, to assess the relevance of the *Structure-Conduct-Performance (SCP),* the *Relative-Market-Power (RMP),* and the *Efficient-Structure (ES) hypotheses* in the form of *X-efficiency* or *Scale efficiency* in explaining the performance of the banking industry in GCC countries. Then it seeks to analyse the relationship between market structure and banks profitability. Third, it tries to test the existence of "*Quiet Life Hypothesis*" in these markets.

The starting point is the analysis undertaken by Berger and Hannan (1997), which tested all four hypotheses previously mentioned. Regression analyses undertaken are presented in table 3.3, the only substantial difference is the substitution of the X-efficiency terms with the technical efficiency terms. Whilst the first focuses on the cost function referring to "the closeness of costs to the minimum that could be achieved on the efficiency frontier" (Berger and Hannan 1997), technical efficiency focuses only on physical quantities and technical relationship, expressing the ability of a firm to obtain maximal outputs from a given set of inputs or of minimising inputs for a given target of outputs. In other words, both technical and X-efficiency refers to the best-practice firm on the efficiencies frontier: the difference is that X-efficient firms are "the best" in terms of costs (i.e. quantities and price) while technically efficient firms are the best in terms of "quantities". As will be discussed in chapter 7, the substitution of X-efficiency with Technical efficiency should not affect the significance of the approaches undertaken, but it allows us to test more precisely the market structure-performance relationship.

Table 3.3: Regression analyses carried out to test the relationship between market structure and profitability

Regression No.	Approach	Response Variable	Predicator variables
1	1st	ROA	CONC, MS, Z vectors[*]
2		ROE	CONC, MS, Z vectors[*]
3	2nd	ROA	CONC, MS, Te-EFF, S-EFF, Z vectors[*]
4		ROE	CONC, MS, Te-EFF, S-EFF, Z vectors[*]
5	4th	CONC	Te-EFF, S-EFF, Z vectors[*]
6		MS	Te-EFF, S-EFF, Z vectors[*]
7	QLH	Te-EFF	MS, CONC, Z vectors[*]

[*]Z vectors include: GDPPC, DEPGRW, ASSET, CAPAST, LOANAST, DDTTDEP, TEXPTA, POPBRANCH, OBS and SPECIALIZ

In detail, regressions 1 and 2 embody the first approach to test the positive relationship between market structure and profitability: ROA and ROE are in fact regressed on market shares and market concentration, whilst efficiency measures are not directly considered. Regressions 3 to 7 directly consider efficiency measures as response variables. Regressions 3 and 4 refer to the second approach and regressions 5 and 6 reflect the fourth approach. In addition, regression 7 embodies the version of Hicks' (1935) "Quiet life" hypothesis proposed by Berger and Hannan (1997). Table 3.4 summarises the independent variables that are used in the aforementioned approaches.

Table 3.4 Summary of Independent Variables used in the SCP model

Determinant	Variable	Descript ion
Local economic condition factors		
Per Capita Income	GDP divided by the number of population	GDPPC
Market Concentration	The highest three-bank deposit concentration ratio	CR3
Market Growth	Annual growth rate of market deposits for the banking industry	MKGRW
Bank Size	The assets of each bank to the ratio of the total assets of the banking industry	ASSET
Firm specific factors		
Determinant	Variable	Description
Risk management	Capital and reserves of each commercial bank as a percentage of total assets	CAPAST
	Loans to assets ratio of each commercial bank	LOANAST
Cost of funds	The ratio of demand deposits to total deposits	DDTDEP
Market share	Total deposits at each bank as a percentage of all banks' total deposits	MS
Expenses' Management	Total Expenditure as a percentage of total assets	TEXPTA
Geographic diversification	The ratio of population to number of branches	POPBRNCH
Investment diversification	Ratio of off-balance sheet activities to total assets	OBSTA
Specialisation	A dummy variable given the value of 1 for Islamic banks, 0 for commercial banks	SPECIALZ

The above section has described the methodology used to measure market concentration, monopoly power and competitive conditions, technical efficiency as well as structure-performance analysis. The following section describes types of data which are used in the analysis.

3.3 Data

GCC banks function as universal banks, and are able to offer a full range of banking, saving, foreign exchange, and investment services to their depositors and clients. They hold funds or other assets, broker securities, underwrite equity issues, give advice on asset placement, manage accounts, and so on. The majority of GCC banks are commercial. Most of the remainder are investment banks, mainly owned locally or regionally and operating under public statutes or cooperatives that perform such specialised services as agricultural, industrial or mortgage lending.

In a performance analysis, production units are expected to be relatively homogenous, providing similar services and using similar resources. Commercial banks operating in G.C.C countries are depository institutions that cannot take part in the leasing and trading in commodities for commercial purposes. In contrast, development and investment banks can engage in such activities, but they cannot accept deposits. These non-depository institutions also do not extend small commercial and individual loans, which require a substantial amount of investment. In fact, they are mostly single branch banks that finance large long term projects, which provide substantial savings on overhead, monitoring and control costs. Because of their small market share in the sector as well as quite different technology, structure and goal, this study excludes development and investment banks and instead concentrates on commercial banks.

Further, a number of banks have also been excluded from the final dataset according to the following criteria:

1. Banks for which full data are not available.
2. Mortgage and Housing banks.
3. Banks whose accounting periods are different from 12 months.
4. Industrial banks.
5. Development banks.
5. Banks in liquidation.

6. Banks generating a net loss with negative equity.

7. New banks whose age is less than the sample period (ten years).

8. Central banks

9. Foreign banks[1]

The number of banks and observations in each country included in the final analysis is set out in Table 3.5, while the names of the banks are listed in appendix 1. This study covered 52 banks privately held and domestically owned, fully licensed commercial banks, distributed as follows: 6 banks in Bahrain, 7 banks in Kuwait, 5 banks in Oman, 6 banks in Qatar, 10 banks in Saudi Arabia, and 18 banks in the UAE. The period investigated covered 1993-2002. Due to the difficulty in obtaining data, the period investigated for UAE banks covered 1995-2002. The final sample consisted of 484 bank-year observations, 60 in Bahrain, 70 in Kuwait, 50 in Oman, 60 in Qatar, 100 in Saudi Arabia, and 144 in the UAE.

Table 3.5: Number of banks and observations in each country

Year/ Country	Bahrain			Kuwait			Oman			Qatar			Saudi Arabia			UAE		
Bank type	C	I	T	C	I	T	C	I	T	C	I	T	C	I	T	C	I	T
1993	4	2	6	6	1	7	5	0	5	4	2	6	9	1	10	-	-	-
1994	4	2	6	6	1	7	5	0	5	4	2	6	9	1	10	-	-	-
1995	4	2	6	6	1	7	5	0	5	4	2	6	9	1	10	17	1	18
1996	4	2	6	6	1	7	5	0	5	4	2	6	9	1	10	17	1	18
1997	4	2	6	6	1	7	5	0	5	4	2	6	9	1	10	17	1	18
1998	4	2	6	6	1	7	5	0	5	4	2	6	9	1	10	17	1	18
1999	4	2	6	6	1	7	5	0	5	4	2	6	9	1	10	17	1	18
2000	4	2	6	6	1	7	5	0	5	4	2	6	9	1	10	17	1	18
2001	4	2	6	6	1	7	5	0	5	4	2	6	9	1	10	17	1	18
2002	4	2	6	6	1	7	5	0	5	4	2	6	9	1	10	17	1	18
Total observations			60			70			50			60			100			144

Notes: C = Local Commercial bank; I = Local Islamic Bank and T = Total number of local banks

[1] Foreign banks are excluded from the study sample because they are placed under restrictions which differ from those on local banks.

Due to similarities between commercial banks and Islamic banks, which are depository institutions and take part in different types of investments, Islamic banks are included in this study. Since Islamic banks comprise 13.5% of the study's sample, it is felt important to provide a brief background details about Islamic banks and their investment mechanism.

3.4 Background details about Islamic banking practices

One of the main features of Islamic banking is the absence of an explicit interest rate mechanism, due to the religious dictates of Sharia Law. In terms of operations, Islamic banking is a relatively recent phenomenon, with effective operations starting in 1970 as a result of the oil boom and the resulting accumulation of financial surpluses in a number of Islamic countries. It received a new impetus in the early 1980s when Iran and Pakistan converted their financial sectors to exclusively Islamic banking procedures.

The most important distinguishing features of these banks compared to conventional banks are their credit instruments, famous among which are Mudarabah, Murabaha, Musharaka and Ijara. Under Mudarabah (interpreted as trust-financing) an Islamic bank, as a limited partner, provides cash (capital requirements) to a borrower or an entrepreneur who is free to use the funds in pursuit of the partnership's goal. While the share of each party in the profits and losses must be in percentages, and all expenses related to the partnership are deductible before profit distribution, the duration of such a scheme is not to be predetermined. The funds must be in cash, and can be invested in trade or industry for an unlimited time – although either party may rescind the contract upon notice to the other (Uppal, 1999).

Under the Murabaha mode of financing (interpreted as cost-plus trade financing) an Islamic bank, as a partner, finances the purchase of commodities in return for a share in the profits realised when the goods are sold. However, if losses are incurred, the contracting banks may (or may not) share the loss depending on the terms and conditions of the agreement. Repayment of such financing can be deferred or made in settlements (Iqbal and Mirakhor, 1987).

Under Musharaka (interpreted as participation in financing) an Islamic bank provides part of the equity plus working capital of a project and shares in profits and/or losses (Iqbal and Mirakhor, 1987). Ijara (interpreted as rental financing or leasing) has provided the bulk of the operating income of Islamic banks, and covers both long-term leasing/lease financing and short-term hire-purchase. In financing, the Islamic bank or its leasing company, purchases a piece of equipment selected by the entrepreneur and then lease it back to him. In a hire-purchase arrangement, the entrepreneur may partially purchase and partially rent the equipment (Iqbal and Mirakhor, 1999).

In current practices of Islamic banks are able to provide nearly all the services that are available in conventional banks. All Islamic banks have three kinds of deposit account: current, savings, and investment. Current or demand deposit accounts are virtually the same as in all conventional banks. Deposit is guaranteed. Savings deposit accounts operate in different ways (Abdul Gafoor, 1995). In some banks, the depositors allow the banks to use their money but they obtain a guarantee of getting the full amount back from the bank. Banks adopt several methods of inducing their clients to deposit with them, but no profit is promised. In others, savings accounts are treated as investment accounts, but with less strict conditions as to withdrawals and minimum balance. Capital is not guaranteed but the banks take care to invest money from such accounts in relatively risk-free short-term projects. As such, lower profit rates are expected and only on a portion of the average minimum balance, on the grounds that a high level of reserves need to be kept at all times to meet withdrawal demands. Investment deposits are accepted for a fixed or unlimited period of time and investors agree in advance to share the profit (or loss) in a given proportion with the bank. Capital is not guaranteed.

Main forms of lending are: a) *Loans with a service charge* where the bank lends money without interest but they covers its expenses by levying a service charge. This charge may be subject to a maximum set by the authorities; b) *No-cost loans*, where each bank is expected to set aside a part of its funds to grant no-cost loans to needy persons such as small farmers, entrepreneurs, producers, etc. and to needy consumers; and c) *Overdrafts* also are to be provided, subject to a certain maximum, free of charge. Other banking services, such as money transfers, bill collections, trade in foreign currencies at spot rate, etc. where the bank's own money is not involved, are provided on a commission or charges basis (see Abdul Gafoor, 1995; Bahrain Islamic Bank, 2003; and Qatar Islamic Bank, 2003).

3.4.1 Islamic banks and international accounting standards

In recent years there has been an emphasis in the accounting world to develop international accounting standards in response to the increasing globalisation of markets and economies. Some argue that international standards will increase comparability and understandability of financial statements, save time and money, ease interpretation and improve the credibility of the financial reporting process and profession (Choi & Mueller, 1992). But the domain of international standard-setting is dominated by Anglo-American accounting thought, with most of the standards following the United States' practice. Since few aspects of accounting data of the Islamic banking may differ from conventional banking such as obtaining the valuation of risk, inventories, and account receivables. Anglo-American accounting techniques would give wrong comparability and understandability to Islamic banking and thus, international accounting standards based on such techniques would create difficulties for Islamic banks around the world. For this reason, it is important for regulators to ensure that these are considered by international accounting standard-setting bodies.

Bahrain Monetary Agency, for example, had introduced in early 2000 a comprehensive prudential set of regulations for Islamic banks (BMA, 2002). This is referred to as the Prudential Information and Regulatory Framework. The framework covers areas such as capital adequacy, asset quality, the management of investment accounts corporate, governance and liquidity management. According to BMA, the Accounting and Auditing Organisation for Islamic Financial Institutions (AAOIFI) was established on 1990 and established the following year in Bahrain as an international, autonomous, non-profit-making body. It is the leading international standard setter for Islamic financial institutions, in the field of accounting, auditing, governance and transparency. It works closely with bodies such as the International Accounting Standards Board; its standards are based on international accounting standards. All Islamic financial institutions licensed in Bahrain have to comply with AAOIFI standards.

3.5 Sources of data

The author travelled in the summer 2003 to the six GCC countries under study and visited their central banks and monetary agencies. He was able to collect the original annual reports of most of the sample banks for a decade. Data for commercial and Islamic banks were obtained from their original annual reports, web pages on the

Internet, annual central banks' reports, and specialised databases. Finally, data from the above sources were supplemented with information collected from Bank scope database. This study investigated 52 privately held and domestically owned fully licensed commercial and Islamic banks. The period examined covered 1993-2002.

3.6 Modelling process

3.6.1 Analysing quantitative secondary data

The study adopts quantitative secondary data analysis. To analyse quantitative secondary data, it was essential to pick the right variable to assess competitive conditions as well as the market structure and concentration.

3.6.1.1 Secondary data and technical efficiency

Reliable efficiency prediction requires appropriate definitions and certain assumptions regarding the measurement of input, output and input price variables. The exclusion of certain important bank inputs and/or outputs might bias the final measures. To determine what constitutes the inputs and outputs of banks, one should first decide on the nature of banking technology. In the literature on the theory of banking, there are two main approaches competing with each other in this regard: the production and the intermediation approaches (Sealey and Lindley, 1977). Like many studies on banking efficiency (e.g., Aly; Zaim; DeYoung; Berger; Resti and DeYoung), the author adopted the intermediation approach in this study. Accordingly, the author modelled commercial banks as multi-product firms, producing 4 outputs and employing 3 inputs. All variables, except for the input factor labour, were measured in millions of US dollars.

3.6.1.2 Secondary data and testing the SCP hypothesis

SCP studies in banking may simply not be directly comparable to those in the industrial sector. Looking at the independent variables in recent research, it is evident there has been a fairly substantial increase in the number of independent variables examined[2]. Unfortunately, to a large extent, this is due to the basic nature of the models being used in recent years rather than reflects innovations and refinements in the models being used to test the SCP hypothesis. Specifically, the use of the individual bank as the unit of observation requires that the model contains variables (in addition to basic market structure variables) to control for various differences (size, portfolio, liability structure, etc.) among banks. While such controls are necessary, it is important that care is taken to avoid the inclusion of variables that do not have a sound foundation in theory, simply because the data are easily obtainable. Otherwise we will wind up with very cumbersome models that add nothing to our knowledge. A few studies appear to suffer from this problem.

3.7 Panel Data

Panel data, also called longitudinal data or cross-sectional time series data, are data where multiple cases (banks, countries, etc.) are observed at two or more time periods. There are two kinds of information in cross-sectional time-series data: the cross-sectional information reflected in the differences between subjects, and the time-series or within-subject information reflected in the changes within subjects over time. Panel data regression techniques allow the researcher to take advantage of these different types of information.

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[2] In some cases, the independent variables are substitutes for one another.

Panel data refers to 'the pooling of observations on a cross-section of households, countries, firms, etc. over several time periods' (Baltagi, 2001, p. 1). Thus, this study's panel data combines both time series (10 years) and cross-sections (52 banks) together. Generally, the analysis of panel data simply tends to have more of the cross-section than time-series characteristics since $N > T$; that is, the number of the observed firms in panel data is greater than the number of the observed times (see Greene, 2000).

Panel data sets for economic research possess several major advantages over conventional cross-sectional or time-series data sets. Panel data usually give the researcher a large number of data points, increasing the degree of freedom and reducing the collinearity among explanatory variables hence improving the efficiency of econometric estimates. More importantly, longitudinal data allow a researcher to analyse a number of important economic questions that cannot be addressed using cross-sectional or time-series data sets (Hsiao, 2003, p.3).

In estimating the models, the study uses panel data approaches. The main benefits of using such approaches are (see Baltagi, 2001; Hsiao, 1985; Solon, 1989):

- Panel data approaches can help control for heterogeneity across the data sample. Differences in size, ownership type, and so on can be more accurately controlled using the panel data approach.

- Because panel data have more N relative to fewer T, the domination of the cross-section over the time series gives much variability and more informative data. This helps overcome the multicollinearity problem, which usually plagues time-series data. In this case, panel data estimators are more statistically efficient.

- Panel data techniques are better able to treat dynamic changes, adjustments, and inter-temporal changes that occur from one point to another within the period studied.

- The use of panel data may also provide a means for analysing more fully the nature of the latent, or unobserved, disturbance terms in the econometric relationship. These disturbances are supposed to measure the effects of all sorts of left-out factors and, as such, may frequently be subject to the objection that some of them are correlated with the included explanatory variables.

According to the panel data literature, firm specific characteristics are modelled by either fixed or random effects approaches (see Greene, 2000, Chapter 14; Gujarati, 2003, Chapter 16). In the fixed effects approach, the regression model is allowed to differ among banks in order to capture some special characteristics of each bank. Thus, the differences across banks can be captured by differences in the constant term. In the random effects approach, the firm specific characteristics are captured to reflect an intercept which is assumed to be a random disturbance drawn from a much larger population with a constant mean value. The deviation from this constant mean is the individual intercept.

In this study framework, as is shown in chapter 5, the fixed effects approach is more appropriate than the random effects approach. Even though the fixed effects approach may induce a large loss in the degrees of freedom when the number of units is large, however, the rejection of the pooled specification raises the possibility that the country specific differences, for example, may disguise country-bank specific differences and structure differences within the GCC. These potential differences are explored by estimating competitive conditions and profitability for each country's banking industry.

(However, in chapters 5 and 7, the study also tests if the banks' individual effects and random effects are present so as to compare fixed and random effects approaches).

3.7.1 Random and fixed effects models for panel data

In many cases, the independent variables explain much of what is different about an observation, a unit, or a year, but there is probably some unmodelled heterogeneity. Since it has not been modelled, it goes into $e_{i,t}$. The real problem comes when some units (or, less commonly, time periods) share some unmodelled heterogeneity. We would like to be able to explain everything that contributes to difference, but usually we can not, so we need to violate the prohibition on using proper names as independent variables and do something to remove this shared and thus systematic heterogeneity from the error term. The recent literature, particularly in the area of panel data analysis, has produced a number of new techniques.

3.7.1.1 Fixed Effects model

One way to do this is to estimate a "fixed effects" model that gives every unit its own intercept. The most intuitive way to do this is by including a dummy variable for N-1 units. Fixed effects regression is the model to use when the researcher wants to control for omitted variables that differ between cases but are constant over time. It lets the researcher use the changes in the variables over time to estimate the effects of the independent variables on the dependent variable, and is the main technique used for analysis of panel data. This technique works best when there are relatively fewer cases and more time periods, as each dummy variable removes one degree of freedom from the model.

3.7.1.2 Test for Fixed Effects

The null hypothesis is that the simple, restrictive model is appropriate, that all of the units share the same intercept. The alternative is that they vary across units, so the way to test this is by running both models and then comparing their sum of squares in a joint F-test.

3.7.1.3 Random Effects Model

If the researcher has reason to believe that some omitted variables may be constant over time but vary between cases, and others may be fixed between cases but vary over time, then s(he) can include both types by using random effects.

Instead of thinking of each unit as having its own systematic baseline, we think of each intercept as the result of a random deviation from some mean intercept. The intercept is a draw from some distribution for each unit, and it is independent of the error for a particular observation. Instead of trying to estimate N parameters as in fixed effects, we just need to estimate parameters describing the distribution from which each unit's intercept is drawn.

3.8 Statistical analysis software

Three different programs will be used to analyse the data:

1. Using E-views to analyse translog formation of multiple regression to get the competition level,
2. Using E-views to analyse the OLS of multiple regression to test the structure-profitability relationship of the SCP model,

3. Using DEA Excel Solver software (Zhu, 2003) to measure technical efficiency and its two components, namely: pure technical efficiency and scale efficiency, and
4. Using EXCEL software to analyse the market concentration.

3.8.1 EViews software

According to EViews 4 User's Guide (1994), EViews provides sophisticated data analysis, regression, and forecasting tools on windows-based computers. With EViews you can quickly develop a statistical relationship from your data and then use the relationship to forecast future values of the data. Areas where EViews can be useful include: scientific data analysis and evaluation, financial analysis, macroeconomic forecasting, simulation, sales, and cost analysis.

EViews is a new version of a set of tools for manipulating time series data originally developed in the Time Series Processor software for large computers. The immediate predecessor of EViews was MicroTSP, first released in 1981. Though EViews was developed by economists and most of its uses are in economics, there is nothing in its design that limits its usefulness to economic time series. Even quite large cross-section projects can be handled in EViews.

EViews provides convenient visual ways to enter data series from the keyboard or from disk files, to create new series from existing ones, to display and print series, and to carry out statistical analysis of the relationships among series.

EViews provides sophisticated data analysis, regression, and forecasting tools on Windows-based computers. Even though EViews is used primarily for time-series data analysis, it provides good breadth of functionality. Some of the capabilities of EViews include: Single and Multiple Equation Estimation, Pooled Time Series-Cross Section Data Analysis: Fixed and random effects models, balanced and unbalanced data sets User-Defined Maximum Likelihood Estimation, Model Evaluation and Diagnostic Tests, Forecasting and Simulation, Data Management and Graph Generation. Based on the functionality of EViews, this study uses it to generate the result.

3.8.2 DEA Excel Solver software

DEA uses mathematical programming techniques and models to evaluate the performance of peer units (e.g., bank branches, hospital and schools) in terms of multiple inputs used and multiple outputs produced. DEA examines the resources available to each unit and monitors the "conversion" of these resources (inputs) into the desired outputs. Since DEA was first introduced in 1978, over 2000 DEA-related articles have been published (Zhu, 2003). Researchers in a number of fields have quickly recognised that DEA is an excellent methodology for modelling operational processes. DEA's empirical orientation and absence of *a priori* assumptions have resulted in its use in a number of studies involving efficient frontier estimation in the non-profit regulated sector and in the private sectors. DEA applications involve a wide range of contexts, such as education, health care, banking, armed forces, auditing, market research, retail outlets, organisational effectiveness, transportation, public housing, and manufacturing.

The DEA Excel Solver provides the user with the ability to perform a variety of DEA models and approaches. DEA Excel Solver uses Excel Solver; it provides a custom Excel menu which calculates more than 150 different DEA models. The DEA Excel Solver requires 97 or later versions and does not set any limit on the number of DMUs, inputs or outputs. With the capacity of Excel Solver engines, this allows the user to deal with large sized performance evaluation problems (Zhu, 2003).

3.9 Conclusion

This chapter has provided an overview of the methodologies that are used to carry out measuring market concentration, monopoly power and competitive conditions, technical efficiency as well as structure-performance relationship. Based on the implementation of the methodology outlined in this chapter, chapters 4, 5, 6 and 7 present a further elaboration of the methodology as well as the results. The following chapter addresses the measurement of concentration in GCC countries' banking industries.

CHAPTER 4

MEASUREMENT OF GCC MARKET CONCENTRATION

4.1 Introduction

The literature on the measurement of competition can be divided into two major streams: structural and non-structural approaches. The *structural approach* to the measurement of competition embraces the Structure-Conduct-Performance paradigm (*SCP*) and the efficiency hypothesis, as well as a number of formal approaches with roots in Industrial Organisation theory. The two former models investigate, respectively, whether a highly concentrated market causes collusive behaviour among the larger banks resulting in superior market performance, and whether it is the efficiency of larger banks that enhances their performance. These structural models, which link competition to concentration, are presented in chapter 7. Non-structural models for the measurement of competition, namely, the Iwata model (Iwata, 1974), the Bresnahan model (Bresnahan, 1982), and the Panzar-Rosse model (Panzar and Rosse, 1987), were developed in reaction to the theoretical and empirical deficiencies of the structural models. These New Empirical Industrial Organisation approaches test competition and the use of market power, and stress the analysis of banks' competitive conduct in the absence of structural measures. These non-structural approaches, which ignore the impact of concentration, will be discussed in chapter 5 in assessing the competitive conditions of the banking industry in GCC countries.

Over the last 30 years, GCC financial markets have experienced significant structural change as a result of the implementation of financial liberalisation and financial restructuring with the goal of enhancing competitiveness in the banking sector. Thus, questions may arise such as: What does the market structure look like? Are these banking markets concentrated? If yes, has their concentration increased or decreased over time? Does concentration cause concern? And, have the fears of concentration been realised? This chapter seeks a partial answer to these questions by examining changes in concentration that have occurred during 1993-2002 within GCC countries' banking industry. It presents the Herfindahl-Hirschman index and the *k* bank concentration ratio to measure concentration changes over ten years.

The chapter is structured into six sections. Section 2 provides definitions of market structure and the different types of measurement. Practical problems associated with concentration measures are discussed in section 3. Section 4 focuses on the methodology that is used to measure the market concentration. Empirical results are covered in section 5, and section 6 concludes the chapter.

4.2 Market structure

Shepherd (1985) defined a market as a group of buyers and sellers exchanging goods that are highly substitutable. This substitutability may be measured in terms of cross-elasticity of demand, which shows how sharply a price change for one product will cause the quantity sold of another product to change. Cross-elasticity of demand is expected to be high between products within a market and low between products outside the market under study. Another definition provided by Houck (1984, p. 356) states that a market is:

> A collection of actual or potential sellers and buyers of a specific good or service, this collection has two characteristics (1) none of the buyers has the option of purchasing the item from sellers outside the collection and (2) none of the sellers has the option of selling the item to the buyers outside this collection. The interaction of these buyers and sellers generates a set of interrelated prices and conditions of sale or use. The principles or facts determining which buyers and sellers are in this collection identify the market spatially, temporally, and politically.

In the context of banking, however, it is difficult to delineate the boundaries of banking markets. Problems relating to the definition of the banking market arise especially if there are a large number of firms providing close substitutes. Some researchers have argued that consumer substitutability is the main criterion for defining the market but, in practice, a great deal of judgment must be used in classifying firms, and the researcher must always be alert to the possibility that the empirical results may be sensitive to the particular industry grouping that has been used. Moreover, defining the scope of banking markets becomes more complex when considering banking as a multi-product industry. The same bank may compete in local, national and international markets, and across a wide array of product segments.

According to Rose (1977), banking markets may be viewed in terms of transaction costs that include the time and expense incurred in searching for information concerning the availability of product and prices, and the costs of communication and delivery and commissions or fees needed to enlist the services of a broker or dealer. Rose (1977) also emphasises the size of the customer and the bank in the structure of banking markets. Where the customer is bigger in size (according to income and assets) then the demand for loans and for other financial services is usually higher, which leads to a larger banking market. In other words, where customer demands are relatively large, then markets will tend to become more national or international.

Market structure, therefore, describes the characteristics of composition of markets and industries in an economy. Structure can refer to the number and size distribution of firms in the economy as a whole, and also relates to the importance and characteristics of individual markets within the economy. The characteristics of market structure can be described by examining (either separately or jointly): the number of firms, the extent of product differentiation, entry conditions or the extent of entry barriers, the level of integration within the market, and market concentration, which represents that part of total market goods or services supplied or managed or produced by a few large firms in the relevant market. In the context of banking, Rose (1977) defines market structure as the number of banks and competing non bank financial service firms serving in a given place, the particular services they offer in that market, the size distribution of banks' customers, the barriers to market entry, and the geographic dispersion of both banks and their customers. Structure may also be described by the type of ownership, the number of bank offices, and other properties.

There are several types of markets which describe the structure of firms, from markets with many firms, which are equal in size with competitive rivalry, to markets where there is only one supplier of financial services The various categories of market, as presented in table 4.1, have been defined to reflect the degree of competition. At the extremes are pure monopoly with just one firm and pure competition in which there are many competitors, none having any significant influence on the market.

Table 4.1: Types of market structure

Market type	Main condition	Familiar instances
Pure monopoly	One firm has 100% of the market	Electric, telephone, water, buses
Dominant firm	One has 50-100% of the market and no close rival	Soap (Campbell), razorblades (Gillette)
Tight oligopoly	The leading four firms combined have 60-100% of the market: collusion among them to fix prices is relatively easy	Copper, aluminium, TV broadcasting, and banking industry
Loose oligopoly	The leading four firms combined have 40% or less of the market; collusion among them to fix prices is virtually impossible	Lumber, furniture, hardware, small machinery, and magazines
Monopolistic competition	Many effective competitors, none with more than 10% of the market	Retailing and clothing
Pure competition	Over 50% competitors, all with negligible shares	Wheat, corn, cattle, hogs

Sources: Adopted from Shepherd (1985, page 4)

Table 4.1 shows that the main elements of market structure relating to the market share of individual companies and the sum of market share of the largest firms in the industry. The industrial organisation literature refers to the relative size of the top firms as market concentration. Market concentration can range from 100 per cent (if one firm controls the whole market) down to nearly zero (if there are an infinite number of firms in the market). Market type can range from pure monopoly to perfect competition.

Another aspect of market structure is the existence of barriers to entry. Entry barriers play a crucial role in defining industry structure (Goddard et al., 2001). If established firms are able to prevent entry, the extent to which competitive pressure imposes restraints on their pricing decisions and other aspects of conduct may be severely curtailed. This is likely to have far-reaching consequences for performance indicators as well. For instance, in a particular market there may exist a potential competitor ready to enter the market and likely to increase rivalry in the market. Anything decreasing the likelihood (or slows down the process) of the potential competitor coming into the market is a barrier to entry (Molyneux, 1996). In contrast, the entry of firms into the market may be considered a catalyst to competition and theory suggests that, if the number of firms in the market increases, it will become more competitive and therefore less concentrated. Bain (1956) defines entry as the establishment of a new firm that introduces new capacity that did not previously exist, or the conversion of existing plant and machinery already used by an established firm in another industry for use in the new venture. Bain's broad definition of barriers to entry includes any factors that allow established firms to earn abnormal profits without attracting entry. Stigler (1968, p.67) defines entry barriers as "the cost of producing (at some or every rate of output) which must be borne by a firm which seeks to enter an industry but is not borne by firms already in the industry".

Entry barriers can be created by incumbents' favoured access to high quality inputs that are in short supply, or cheaper to finance in the long-term, or from learning economies of scale. According to Caves and Porter (1977), such barriers may not only separate incumbents from potential entrants, but also separate groups of existing firms. Such groups may emerge due to product differentiation, vertical integration, or differences in ownership. Shepherd (1997) distinguishes between exogenous and endogenous entry barriers. Exogenous barriers derive from structural characteristics of the industry, such as product characteristics and production technology. Endogenous barriers derive from conscious decisions taken by incumbent firms to seek to impede entry, through their own price or non-price decisions. Thus, a market's structure is comprised mainly of the market shares of incumbent firms and the barriers to entry. In general, each market's structure lies somewhere between pure monopoly (a high market share and high entry barriers) to pure competition (a low market share and low barriers). Table 4.2 summarises sources of entry barriers.

Table 4.2: Sources of entry barriers	
I	<u>**Exogenous causes: external sources of barriers:**</u> 1. **Capital requirement:** related to minimum efficient scale of plants and firms, capital intensity, and capital market imperfections. 2. **Economies of scale:** both technical and pecuniary, which require large-scale entry, with greater costs, risks and intensity of retaliation. 3. **Absolute cost advantages:** many possible causes, including lower wage rates and lower cost technology. 4. **Product differentiation:** may be extensive. 5. **Sunk costs:** any cost incurred by an entrant that cannot be recovered upon exit. 6. **Research and development intensity:** requires entrants to spend heavily on new technology and products. 7. **High durability of firm-specific capital (asset specificity):** imposes costs for creating narrow-use assets for entry, and losses if entry fails. 8. **Vertical integration:** may require entry at two or more stages of production for survival; raises costs and risks. 9. **Diversification by incumbents:** mass resources deployed among diverse branches may defeat entrants. 10. **Switching costs:** complex systems may entail costs of commitment and training, which impede switching to other systems. 11. **Special risks and uncertainties:** entrants' higher risks may raise their costs of capital. 12. **Gaps and asymmetries of information:** incumbents' superior information helps them bar entrants and may raise entrants' cost of capital. 13. **Formal, official barriers set by government agencies or industry-wide groups:** examples are utility franchises, bank entry limits, and foreign trade duties and barriers.
II	<u>**Endogenous causes: voluntary and strategic sources of barriers:**</u> 1. **Pre-emptive and retaliatory actions by incumbents:** including selective price discounts to deter or punish entry. 2. **Excess capacity:** the incumbent's excess capacity lets it retaliate sharply and threaten retaliation credibly. 3. **Selling expenses, including advertising:** increases the degree of product differentiation. 4. **Segmenting the market:** segregates customer groups by demand elasticities, and makes broad entry more difficult. 5. **Patents:** may provide exclusive control over critical or lower-cost technology and products. 6. **Exclusive controls over other strategic resources:** such as superior ores, favourable locations, and unique talents of personnel. 7. **Raising rivals' costs:** actions that require entrants to incur extra costs. 8. **Packing the product space:** may occur in industries with high product differentiation.
Source: Goddard et al. (2001, p. 42).	

4.2.1 Measurement of market structure

> Among the most important characteristics that define the four main theoretical market structures are the number of firms, the degree of product differentiation, and the height of barriers to entry. The number and size distribution of firms are usually the most easily quantified aspects of market structure (Goddard et al., 2000, p. 68).

Market structure can be described by examining (either jointly or separately) the number of firms, the extent of product differentiation, entry conditions, and the level of integration within the market. The most commonly used measure is market concentration. A concentration measure shows the level to which the production of a good service is restricted to a few large firms. If a market has a small number of firms, or a great disparity in size between firms, the more concentrated and so less competitive the market will be. Ferguson (1988, p.23) indicates why concentration measures are the most widely used measure of market structure:

> The attraction of this measure is easily understood. Differences in the number and size distribution of firms are key factors distinguishing the theoretical models of perfect competition, oligopoly, monopoly and monopolistic competition. Market concentration is easily estimated since published data on the number and size distribution of firms are generally available. For other structural variables, published information is rare.

However, a major problem associated with SCP studies in banking relates to a seemingly simple but controversial question; namely, how should we measure bank structure and the market in which banks operate? Defining what constitutes the 'market' is, of course, problematic in banking, in view of the multi-product nature of the modern-day financial services firm, although the most commonly used measures are the three-firm or five-firm deposits or assets concentration ratio.

In general, banking structure refers to the number, size and location of banks in a market. Molyneux et al. (1996a) notes that to characterise banking structure by size and concentration involves setting criteria for size, choosing a method of determining significant market areas, defining products, and taking into account the influence of all competitors in these markets.

In addition, while all market structure measures, in general, are subject to their own idiosyncrasies and limitations, they do usually tend to correlate highly with one another (Scherer and Ross, 1990; Goddard et al., 2001). The following section focuses on the desirable properties of market structure measures, although not all of the measures of concentration satisfy all of these criteria, and there is no perfect measure.

4.2.1.1 Desirable Properties of Measures of Market Structure

There are a wide range of statistical measures of concentration and it is important to analyse these because if they provide us with contradictory rankings of industry concentration then this has implications for how we interpret the SCP relationship. However, before we consider the various concentration measures, we should first discuss what constitutes a desirable property of a concentration measure. Hall and Tideman (1967) identified desirable properties for measure of concentration as follows:

1- The measure used must yield an unambiguous ranking of industries.
2- The measure should be independent of the size of industry but be a function of the combined market share of firms.
3- Concentration increases if the market share of any firm is increased at the expense of a smaller firm, that is, the 'principle of transfer' should hold.
4- If all firms are divided into a given number of equal parts, the concentration measure should fall in the same proportion. For instance, if all firms are divided into two equal parts, the concentration measure should halve.
5- The concentration measure should be a decreasing function of a number of firms.
6- The limits of a concentration ratio measure should be zero and one (some proposed measures do not exhibit this property per se but can be normalised to do so by expressing the limits as a proportion of their maximum value).

4.2.2 Concentration indices

The importance of concentration ratios arises from their ability to capture structural features of a market. Concentration ratios are therefore often used in structural models to explain competitive performance in the banking industry as the result of market structure[1].

The concept of industrial concentration has been extensively treated and lively debated in the economics literature. Despite the many different approaches to its measurement, general agreement prevails about the constituting elements of concentration measures, *i.e.* the number of banks (fewness) and the distribution of bank sizes (inequality) in a given market. However, the classification of concentration measures in the literature is not systematic.

There are ten concentration indices, namely: the k bank Concentration Ratio (CR_k); the Herfindahl-Hirschman Index (*HHI*); the Hall-Tideman Index (*HTI*); the Rosenbluth Index (*RI*); the Comprehensive Industrial Concentration Index (*CCI*); the Hannah and Kay Index (*HKI*); the U Index (*U*); the multiplicative Hause Index (*Hm*); the additive Hause Index (*Ha*); and the Entropy measure (*E*). However, this study considers only two of them namely: concentration ratios – the k bank Concentration Ratio (CR_k) and the Herfindahl-Hirschman Index (*HHI*).

4.3 Practical problems associated with concentration measures

Three major problems may arise when measuring the structure of a banking market. These are:

1- Difficulties in defining the scope of the banking industry, for example, whether or not to include all financial institutions, and ascertaining whether the market is

[1] It should be noted, however, that a measure of concentration does not warrant conclusions about the competitive performance in a particular market. Even in a highly concentrated market, competitive behaviour between the leading banks is still possible.

exclusively national or it extends to international banking. There are problems of defining product areas given that a bank is a multi-product services firm.

2- Difficulties in choosing a method to measure the size of institutions.

3- Different concentration indices may yield conflicting measures of market structure.

4.3.1 Difficulties in defining the scope of the banking industry

In the context of the first problem, the size of the market is difficult to define, especially if there are a large number of firms providing close substitutes. Measurement problems are compounded given the multi-product nature of the banking business. Asch (1983) states that consumer substitutability is the main criterion for defining the market, but 'in practice' a great deal of judgement must be used in classifying firms, and the researcher must always be alert to the possibility that empirical results may be sensitive to the particular industry grouping that has been used. However, in defining the scope of the banking industry, the majority of US empirical structure studies have only included the number of commercial banks in their studies, for example, Edwards (1964); Frazer and Rose (1971); Smirlock (1985); and Evanoff and Fortier (1988).

On the other hand, Goldberg and Rai (1996) included commercial and saving banks in their study covering eleven European countries, and Lloyd-Williams et al. (1994), and Molyneux and Forbes (1995) included all relevant financial institutions in their research design. The majority of US studies focus on local domestic banking markets, usually defined as Standard Metropolitan Statistical Areas (SMSAS) (but sometimes as rural counties). Studies such as those undertaken by Short (1979); Bourke (1989); and Goldberg and Rai (1996) provide international comparisons and therefore focus on national banking markets, thus treating each single country as a market and eliminating the kind of problems that arise in defining local areas for each country.

4.3.2 Difficulties in choosing a method to measure the size of institutions

In relation to the second problem, there are also difficulties in choosing a method to measure bank size. The market share of individual firms can be measured by using a whole range of variables, for example, total assets, output, value added, employment, etc. Different variables are quite likely to yield different concentration rankings and therefore it is up to researchers to provide both empirical and theoretical justifications for the choice of the market share measure used in structure type studies. However, the use of total assets is far from ideal, either for measuring concentration or for acting as a denominator of various other ratios (Goddard, 2001). Another measure of size is total deposits, but its shortcomings are that it includes both domestic and international deposits. The term total deposits can be defined in a number of ways, including or excluding inter-bank, foreign currency and non-resident deposits. Size can be also measured using the shares of demand deposits in differing size categories, for example, segregating customers according to size of accounts. Yet another measure for size is in terms of the total credits of the banking firm. However, this measure is seldom used empirically.

4.3.3 Different indices may yield conflicting measures

In relation to the different concentration indices, Jaquemin and de Jong (1977) in a study of European manufacturing industries estimated rank correlation coefficients for different concentration measures. They found a high correlation between rankings using the four and eight-firm concentration ratios. Correlation between the H-index and the entropy coefficient were much lower. George and Ward (1975) also showed that changes in the measure of concentration can affect empirical results. In a study of the change in concentration among the top European Community companies between 1962 and 1972, they found the Herfindahl and entropy measures showed that concentration had declined, whereas the variance of logs method recoded an increase in concentration. Other studies by Bailey and Boyle et al. (1971); Aaronovich and Sawyer (1975); and Vanlommel (1977) have found various concentration measures to be highly correlated with one another.

However, in this context, mention should also be made of the Honohan and Kinsella (1982) study which provided a critique of cross-country comparisons of traditional measures of concentration. This study noted that when one compares concentration across countries, one must take into account the effects of market size on the "minimum practicable degree of concentration having regard to the desirability of an efficient scale of production" (p.262). They developed, with the help of a theoretical model, a measure which takes account of market size - essentially Herfindahl indices scaled-up by an amount proportionate to the level, or the square root of GDP. Their study, using data obtained from Short (1979) for 1973, showed that if their measures were used, Japan, which had the least concentrated market as measured by the Herfindahl index, would have almost the highest degree of concentration of any country if either measure were chosen. Belgium and Sweden, which appeared among the most concentrated according to the Herfindahl index, would appear to have the 'minimum feasible level' of concentration across countries if the Herfindahl multiplied by GDP measure was used.

All in all, from the above literature, it appears that four and eight-firm concentration ratios, the H-index, and entropy measure are highly correlated, and thus provide similar concentration ratings. Inequality measures of concentration, such as the Gini coefficient, and variance of logs method, appear to be less closely and also are more likely to provide conflicting rankings of the aforementioned concentration measures (Molyneux et al., 2001).

4.4 Methodology

In a review of 73 US SCP studies from 1961 to 1991, Molyneux et al. (1996a) summarised the market structure measures used in the banking literature. These are shown in table 4.3.

Table 4.3 Market structure measures used in the US SCP literature

Measures of Market Structure (Concentration ratios)	**Number of times the respective market structure measures have been used in the SCP literature**
5-firm deposits	2
3-firm deposits	**37**
2-firm deposits	3
1-firm deposits	9
Herfindahl Index (H)	**18**
Deposits	2
Numbers equivalent (1/H)	16
Number of firms in the market	2
Gini coefficients	2
Entropy	1
Hall-Tideman index	1
Dummy variables for markets with relatively low H	1
Change in H	1

Source: Molyneux et al. (1996, p.101)

It can be seen from the table above that most frequently used measure of market structure is the 3-firm deposits concentration ratio, since it is employed in 37 studies out of the 73 studies reviewed. The second most frequently used is the Herfindahl index, followed by the number of firms in the market. This chapter therefore considers these two indices in measuring market concentration.

4.4.1 The k bank concentration ratio

Simplicity and limited data requirements make the *k* bank concentration ratio one of the most frequently used measures of concentration in the empirical literature. Summing only the market shares of the *k* largest banks in the market, it takes the form:

$$CR_k = \sum_{i=1}^{k} S_i$$

The index gives equal emphasis to the *k* leading banks, but neglects the many small banks in the market. There is no rule for the determination of the value of *k*, so that the number of banks included in the concentration index is a somewhat arbitrary decision. The concentration ratio may be considered as one point on the concentration curve, and it is a one-dimensional measure ranging between zero and unity. The index approaches zero for an infinite number of equally sized banks (given that the *k* chosen for the calculation of the concentration ratio is comparatively small when compared to the total number of banks) and it equals unity if the banks included in the calculation of the concentration ratio make up the entire industry.

Overall, the formula states that the concentration ratio is the sum of the deposits, loans, or assets shares of the K largest banks. Note that this measure places total importance on the largest banks by implying that they are the only relevant firms to consider when gauging the degree of monopoly power that exists in a market. The concentration ratio does not distinguish between alternative distributions or mixes of market shares between even these largest banks. The same result would be derived from markets A or B if the three largest banks in each controlled 55, 10, 10 and 25, 25, 25 per cent, respectively. Each market would have a three-bank concentration ratio of 75, yet the implications for monopoly power would be quite different in the two markets. Note also that the concentration ratio takes no account of the number of firms in a market or the distribution of the remaining shares among small firms.

4.4.2 The Herfindahl-Hirschman Index

Policy makers in the U.S. Department of Justice have for many years published formal guidelines that identify structural changes resulting from mergers that are likely to cause the Department to challenge a merger. Since 1982, the Department has based its merger guidelines on the Herfindahl-Hirschman Index of concentration (HHI). This measure, which is also used by bank regulatory agencies, is calculated by squaring the market share of each firm competing in a defined geographic banking market and then summing the squares. The HHI can range from zero in a market having an infinite number of firms to 10,000 in a market having just one firm (with a 100 per cent market share).

The HHI index was developed independently by the economists A.O. Hirschman (in 1945) and O.C. Herfindahl (in 1950) (Rhoades, 1993). The HHI is a static measure and, therefore, gauges market concentration at a single point in time. Algebraically, it can be depicted as:

$$\text{HHI} = \sum_{i=1}^{n} (\text{MS}_i)^2$$

where MS is the market share of the i^{th} firm and n is number of firms in the market. The Herfindahl-Hirschman index stresses the importance of larger banks by assigning them a greater weight than smaller banks, and it incorporates each bank individually, so that arbitrary cut-offs and insensitivity to the share distribution are avoided. The HHI can be used to measure concentration in a variety of contexts. For example, it can be used to measure the concentration of income (or wealth) and also market concentration, that is, the degree of concentration of output of firms in banking. It is useful in analysing horizontal mergers because such mergers affect market concentration, and economic theory and considerable empirical evidence suggest that, other things equal, the concentration of firms in a market is an important element of market structure and a determinant of competition. However, despite its visibility, the HHI is sometimes not appreciated in terms of its use, measurement, or interpretation in merger analysis.

The HHI is a particularly useful tool for bank merger analysis because it accounts for the presence of every competitor in a market and provides a measure of the structural effect of a merger of any firms in a market. In addition, the squaring of market shares gives greater weight to firms that have large market shares. This weighting of the largest competitors in a market is consistent with economic theories that predict weak competition in markets in which a few competitors hold a large combined market share.

A merger of two banking competitors will increase the HHI in their shared market (mathematically, the increase is equal to the product of the two firms' market shares times two). The amount of the increase and the level to which the HHI will rise after the merger are key elements in the structural analysis of bank mergers. The following example of calculating the HHI before and after a merger illustrates the use of the formula.

Assume there are four banks in a market. Bank A holds 40 per cent of bank deposits in the market, Bank B holds 30 per cent, bank C holds 20 per cent, and Bank d holds 10 per cent. Substituting these values in the formula gives the HHI for bank deposits in this market: $(40)^2 + (30)^2 + (20)^2 + (10)^2 = 1{,}600 + 900 + 400 + 100 = 3{,}000$.

Next assume that Bank B, with 30 per cent of the market, acquires Bank C, which has 20 per cent of the market. The HHI after merger would be = $(40)^2 + (30+20)^2 + (10)^2$. Completing this calculation gives the post-merger HHI: 1,600 +2,500 +100 = 4,200.The merger therefore increases the HHI by 1,200 from 3,000 to 4,200.

The HHI reaches a maximum value of 10,000 when a monopoly exists in which one firm has 100 per cent of the market, that is, the HHI = $(100)^2 = 10{,}000$. In contrast, the HHI takes on a very small value, theoretically approaching zero, in a purely competitive market in which there are many firms with small market shares (For more details about the HHI see Rhoades, 1993). For example, in a market with 100 firms that each has a 1 per cent share of the market, the

HHI = $(1_1)^2 + (1_2)^2 + \ldots\ldots\ldots + (1_{100})^2 = 100$.

According to the current screening guidelines in USA, the banking industry is regarded to be a competitive market if the HHI is less than 1000, a somewhat concentrated market if the HHI lies between 1000 and 1800, and a very concentrated market if HHI is more than 1800. If the post merger market HHI is lower than 1,800 points, and the increase in the index from the pre-merger situation is less than 200 points, the merger is presumed to have no anticompetitive effects and is approved by the regulators. Should these threshold values be exceeded, the regulators will check for the existence of potential mitigating factors. If the mitigating factors are not enough to justify the merger, the regulators may require the divestiture of some branches and offices, in order to bring the concentration ratio to or below the threshold level. If divestiture would not accomplish this goal, the merger application is denied.

In conclusion, the Herfindahl-Hirschman Index *(HHI)* is the most widely utilised summary measure of concentration in the theoretical literature and often serves as a benchmark for the evaluation of other concentration indices. In the United States, the *HHI* plays a significant role in the enforcement process of antitrust laws in banking. An application for the merger of two banks will be approved without further investigation if the basic guidelines for the evaluation of the concentration in deposit markets are satisfied. These guidelines imply that the post-merger market *HHI* does not exceed 0.18 and that the increase of the index from the pre-merger situation is less than 0.02 (Cetorelli, 1999). The *HHI* is often called the full-information index because it captures features of the entire distribution of bank sizes.

Table 4.4 summarises the advantages and disadvantages of the Herfindahl-Hirschman Index and the k bank concentration ratio.

Table 4.4: Advantages and disadvantages the HHI and CR_k models

Model	**Descriptive**	**Advantages and disadvantages**
HHI	A measure of concentration based on the sum of squares of market shares of firms, expressed as proportions of total market sales.	Disadvantage: This concentration index is very demanding in terms of data.
CR_k	A commonly used measure of concentration in an industry, CR_k is the share of the total market held by an absolute number of the largest firms in the industry or market, e.g. the largest 4, 8 or 20.	Advantages: it is easy to construct and understand. Disadvantages: covers only portions of the total market and small size firms are not covered

4.4.3 Market structure hypothesis

Based on the number of national banks in each of the six countries, the author expects that the 2-bank deposits, 3-bank deposits and HHI value when testing the market structure in GCC markets will indicate that Kuwait, Saudi Arabia and UAE markets can be described as 'unconcentrated markets', while the markets of Bahrain, Oman and Qatar can be described as 'concentrated markets'.

4.5 HHI and CR*k* Concentration empirical results

Following the steps of the two most popular measuring indices and due to the limited number of banks in GCC countries, this study adopted the highest 2 &3 firm deposits and loans concentration ratio as well as the Herfindahl-Hirschman Index (HHI) for deposits only.

The following empirical results show the HHI and CR*k* trends for the GCC countries over the ten years 1993-2002.

4.5.1 Bahrain

Estimating both measures shows that Bahrain's banking industry has become a heavily concentrated market. Table 4.5 presents the HHI and CR*k* trends for the period 1993-2002 where total deposits has been taken as the measure of bank size.

Table 4.5: Concentration Trends in the Deposit Market

Bank/ Year	AUB	BBK	NBB	BSB	BISB	SHB	**CR2**	**CR3**	**HHI**
2002	0.13	0.34	0.32	0.06	0.06	0.09	**0.66**	**0.79**	**2502**
2001	0.13	0.31	0.33	0.06	0.05	0.12	**0.64**	**0.77**	**2424**
2000	0.11	0.31	0.33	0.06	0.06	0.14	**0.64**	**0.75**	**2439**
1999	0.10	0.33	0.33	0.05	0.05	0.14	**0.66**	**0.76**	**2524**
1998	0.12	0.37	0.36	0.05	0.07	0.02	**0.73**	**0.85**	**2887**
1997	0.10	0.34	0.42	0.05	0.06	0.02	**0.76**	**0.86**	**3085**
1996	0.11	0.34	0.41	0.06	0.07	0.01	**0.75**	**0.86**	**3044**
1995	0.11	0.39	0.33	0.06	0.08	0.04	**0.72**	**0.83**	**2847**
1994	0.11	0.37	0.34	0.06	0.08	0.04	**0.71**	**0.82**	**2762**
1993	0.09	0.40	0.32	0.06	0.08	0.04	**0.72**	**0.81**	**2821**

Source: Calculated by the researcher from the banks' annual reports

In general, the concentration ratio shows a decreasing trend. The concentration ratio in the deposit market suggests a concentration market with CR2, CR3 recording 72% and 81%, respectively, and the HHI value standing at 2821 points in the 1993. However, by 2002 the concentration ratio had gone down, with CR2 and CR3 recording 66% and 79% and the HHI value standing at 2502 points due to the increase share of Al-Ahli United Bank (AUB) and the Shamil Bank of Bahrain (SHB) (Islamic Bank) and the decreased share of the Bank of Bahrain and Kuwait. According to current screening guidelines in U.S.A and since the HHI value exceeds 1800 points, Bahrain market could be described as a "very concentrated market"[2]. Thus, any further mergers between banks will have a negative impact on the market. However, the HHI index in table 4.5 suggests that market on the whole is moving towards a lower concentrated market, since the index decreased by 395 points in a decade.

Table 4.6 Concentration Trends in Bahrain's Loan Market

Bank/ Year	AUB	BBK	NBB	BSB	BISB	SHB	CR2	CR3
2002	0.16	0.33	0.29	0.07	0.10	0.05	**0.62**	**0.78**
2001	0.15	0.30	0.28	0.08	0.10	0.09	**0.58**	**0.73**
2000	0.14	0.32	0.27	0.08	0.10	0.10	**0.59**	**0.73**
1999	0.13	0.34	0.27	0.07	0.09	0.10	**0.61**	**0.74**
1998	0.14	0.37	0.28	0.07	0.10	0.03	**0.65**	**0.79**
1997	0.13	0.39	0.25	0.08	0.12	0.03	**0.64**	**0.77**
1996	0.14	0.41	0.22	0.09	0.13	0.02	**0.63**	**0.77**
1995	0.13	0.41	0.21	0.08	0.14	0.03	**0.62**	**0.76**
1994	0.15	0.36	0.23	0.09	0.15	0.02	**0.59**	**0.74**
1993	0.15	0.36	0.24	0.08	0.15	0.02	**0.60**	**0.75**

Source: Calculated by the researcher from the banks' annual reports

The concentration ratio in the loan market in table 4.6 shows an opposite trend with that in the deposit market since CR_2 increased from 60% to 62% and CR_3 increased from 75% to 78%. This is attributed to the increased share of the National Bank of Bahrain

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2 According to current screening guidelines in the USA, the banking industry is regarded as a competitive market if the HHI is less than 1000, somewhat concentrated if the HHI lies between 1000 and 1800, and very concentrated if the HHI is more than 1800.

(NBB) from 24% to 29%, the increased share of the Shamil Bank (SHB) from 2% to 5%, and that of the Ahli United Bank (AUB) from 15% to 16%.

However, the two tables show that the two banks with the highest deposit and loan market share control more than half of the market share in both loans and deposits. In addition, the three banks with the highest deposit and loan market share control more than three quarters of the market in terms of both loans and deposits. Therefore, Bahrain's banking industry is controlled by the Bank of Bahrain and Kuwait (BBK) and the National Bank of Bahrain (NBB). These two banks determine the overall shape of the industry. However, Bahrain is a hub of financial institutions in the region; therefore, an existence of big banks is healthy and logical to compete with these well established foreign banks.

4.5.2 Kuwait

Both HHI and CR*k* measures show that Kuwait's banking industry has become a less concentrated market. Table 4.7 presents the HHI and CR*k* trends for the period 1993-2002 where total deposits has been taken as the measure of bank size. In general, the deposit concentration ratio shows a slight trend towards more concentration, even though CR2, CR3 recording of 48% and 61%, respectively, in 1993 had increased to 49% and 62% respectively, in 2002. However, the HHI value of 1950 points in 1993 had decreased by 53 points to 1897 points in 2002. According to current screening guidelines in U.S.A using HHI value and looking at the steadily decrease of the index, Kuwait's market could be described as moving toward "un-concentrated market". However, if we consider CR2 and CR3 recording 49% and 62% for the year 2002, then we come to a conclusion that this market is concentrated and the monopoly power is obvious.

Table 4.7: Concentration Trends in Kuwait's Deposit Market										
Bank/ Year	NBK	GULF	CMBK	Burgan	Ahli	KME	KFH	**CR2**	**CR3**	**HHI**
2002	0.34	0.13	0.09	0.11	0.08	0.09	0.15	**0.49**	**0.62**	**1897**
2001	0.33	0.14	0.11	0.10	0.09	0.08	0.16	**0.49**	**0.63**	**1907**
2000	0.34	0.14	0.11	0.09	0.09	0.08	0.15	**0.49**	**0.63**	**1924**
1999	0.33	0.16	0.11	0.10	0.10	0.07	0.14	**0.49**	**0.63**	**1911**
1998	0.33	0.16	0.11	0.09	0.10	0.08	0.13	**0.49**	**0.62**	**1880**
1997	0.35	0.15	0.11	0.10	0.11	0.08	0.12	**0.5**	**0.62**	**2000**
1996	0.36	0.15	0.10	0.08	0.11	0.08	0.12	**0.51**	**0.63**	**2014**
1995	0.36	0.13	0.10	0.08	0.11	0.09	0.12	**0.49**	**0.61**	**1975**
1994	0.38	0.13	0.10	0.08	0.11	0.08	0.12	**0.51**	**0.63**	**2106**
1993	0.35	0.13	0.11	0.09	0.11	0.08	0.13	**0.48**	**0.61**	**1950**
Source: Calculated by the researcher from the banks' annual reports										

The concentration ratio in the loan market as illustrated in table 4.8 shows an opposite trend to that for the deposit market. The decrease in loan indices is due to the decreased share of the National Bank of Kuwait (NBK), from 41% to 29%, and to the decreased share of the Kuwait Finance House (KFH) from 31% to 19%. These shares were taken by the other five smaller banks.

Table 4.8: Concentration Trends in Kuwait's Loan Market									
Bank/ Year	NBK %	GULF %	CMBK %	Burgan %	Ahli %	KME %	KFH %	**CR2 %**	**CR3 %**
2002	0.29	0.14	0.13	0.10	0.08	0.08	0.19	**0.48**	**0.62**
2001	0.25	0.16	0.14	0.09	0.09	0.07	0.20	**0.45**	**0.61**
2000	0.25	0.17	0.13	0.09	0.09	0.07	0.21	**0.46**	**0.63**
1999	0.26	0.14	0.12	0.09	0.10	0.07	0.22	**0.48**	**0.62**
1998	0.28	0.14	0.11	0.10	0.10	0.07	0.21	**0.49**	**0.63**
1997	0.33	0.13	0.10	0.07	0.09	0.07	0.21	**0.54**	**0.67**
1996	0.38	0.12	0.07	0.06	0.08	0.07	0.22	**0.60**	**0.72**
1995	0.38	0.13	0.05	0.06	0.07	0.06	0.25	**0.63**	**0.76**
1994	0.41	0.10	0.04	0.05	0.05	0.07	0.28	**0.69**	**0.79**
1993	0.41	0.09	0.04	0.06	0.04	0.04	0.31	**0.72**	**0.81**
Source: Calculated by the researcher from the banks' annual reports									

Since there are only seven banks in Kuwait, then the HHI index is very positive and one can safely rank Kuwait as an un-concentrated market. Even though the National Bank of Kuwait (NBK) controlled more than one-third of the deposit and almost a third of the loan market, however, this bank is among the biggest banks in the Middle East, thus, it is expected to compete locally, first by having the lion's share in the home country as well as competing in the international arena. Consequently, Kuwait's banking industry is not in a concentrated stage.

4.5.3 Oman

Estimating both HHI and CR*k* measures shows that Oman's banking industry has become a heavily concentrated market. Tables 4.9 & 4.10 present the HHI and CR*k* trends in deposits and loans for the period 1993-2002. In general, the concentration ratio shows an increasing trend. Moreover, the concentration ratio in the deposit market implies a concentrated market with CR2 and CR3 recording 54% and 79%, respectively, and HHI standing at 2308 points in the 1993. In 2002, the concentration ratio had increased, to CR2 and CR3 recording 66% and 81% respectively, and HHI standing at 2712 points due to the exit of foreign banks and takeovers. Since the HHI for any year between1993-2002 was more than 1800 points, then according to current screening guidelines in the U.S.A, Oman's market could be described as a "very concentrated market".

Table 4.9: Concentration Trends in Oman's Deposit Market

Bank/ Year	Muscat	NBO	OIB	OAB	Dhofar	**CR2**	**CR3**	**HHI**
2002	0.41	0.25	0.15	0.10	0.09	**0.66**	**0.81**	**2712**
2001	0.30	0.30	0.19	0.10	0.11	**0.60**	**0.79**	**2382**
2000	0.33	0.26	0.23	0.09	0.09	**0.59**	**0.82**	**2456**
1999	0.21	0.28	0.32	0.10	0.09	**0.50**	**0.81**	**2430**
1998	0.23	0.27	0.29	0.11	0.10	**0.56**	**0.79**	**2320**
1997	0.24	0.26	0.27	0.13	0.10	**0.53**	**0.77**	**2250**
1996	0.24	0.28	0.26	0.13	0.09	**0.54**	**0.78**	**2286**
1995	0.24	0.27	0.26	0.14	0.09	**0.53**	**0.77**	**2258**
1994	0.26	0.24	0.28	0.13	0.09	**0.54**	**0.78**	**2286**
1993	0.27	0.25	0.27	0.12	0.09	**0.54**	**0.79**	**2308**

Source: Calculated by the researcher from the banks' annual reports

Table 4.10 Concentration Trends in Oman's Loan Market							
Bank/ Year	Muscat	NBO	OIB	OAB	Dhofar	**CR2**	**CR3**
2002	0.42	0.27	0.14	0.08	0.09	**0.69**	**0.83**
2001	0.40	0.26	0.16	0.08	0.09	**0.66**	**0.82**
2000	0.39	0.25	0.20	0.09	0.08	**0.64**	**0.84**
1999	0.27	0.28	0.26	0.10	0.09	**0.55**	**0.81**
1998	0.27	0.28	0.26	0.10	0.09	**0.55**	**0.81**
1997	0.29	0.26	0.25	0.11	0.10	**0.55**	**0.80**
1996	0.26	0.27	0.26	0.12	0.10	**0.53**	**0.79**
1995	0.27	0.25	0.25	0.13	0.11	**0.52**	**0.77**
1994	0.28	0.24	0.24	0.14	0.10	**0.52**	**0.76**
1993	0.28	0.24	0.27	0.12	0.09	**0.55**	**0.79**
Source: Calculated by the researcher from the banks' annual reports							

The concentration ratio in the loan market shows a similar trend to that in the deposit market. The Bank Muscat is the dominant player in the Omani market and the similar trend in both deposits and loans is attributed to the increase a share of this bank. The Bank Muscat almost doubled its market share within a decade and took over the share of two banks, namely, Oman International Bank (OIB) and Oman Arab Bank (OAB). These significant changes in Oman's banking industry raise important policy concerns in that banks in the highly concentrated market will gain market power and be able to charge higher than competitive prices for their products, thus inflicting welfare costs that could more than offset any presumed benefit associated with mergers.

4.5.4 Qatar

Both measures show that Qatar's banking industry has become a heavily concentrated market. Tables 4.11 & 4.12 present the HHI and CR*k* trends for the period 1993-2002. In general, the concentration ratio shows an increasing trend. The concentration ratio in the deposit market implies a concentrated market, with CR2 and CR3 recording 65% and 80%, respectively, and the HHI value standing at 3028 in 1993. By 2002, the concentration ratio had increased, to CR2 and CR3 recording 70% and 80%, respectively, and the HHI value standing at 3565 due to Qatar National Bank's increased market share from 49% in 1993 to 56% in 2002. Since HHI of Qatar's banking industry is almost double the benchmark points, and according to current screening guidelines in the U.S.A, this market could be described as a "very concentrated market".

Table 4.11: Concentration Trends in Qatar's Deposit Market

Bank/ Year	QNB	CMBQ	DB	ABQ	QISB	QIISB	**CR2**	**CR3**	**HHI**
2002	0.56	0.10	0.14	0.04	0.09	0.06	**0.70**	**0.80**	**3565**
2001	0.57	0.10	0.14	0.05	0.09	0.06	**0.71**	**0.81**	**3687**
2000	0.55	0.11	0.13	0.07	0.09	0.05	**0.68**	**0.79**	**3470**
1999	0.54	0.11	0.13	0.07	0.10	0.05	**0.67**	**0.78**	**3380**
1998	0.52	0.12	0.14	0.07	0.11	0.05	**0.66**	**0.78**	**3239**
1997	0.54	0.11	0.14	0.07	0.10	0.04	**0.68**	**0.79**	**3398**
1996	0.53	0.12	0.14	0.07	0.10	0.04	**0.67**	**0.79**	**3314**
1995	0.60	0.09	0.13	0.06	0.10	0.03	**0.73**	**0.83**	**3995**
1994	0.47	0.11	0.15	0.07	0.15	0.04	**0.62**	**0.77**	**2845**
1993	0.49	0.09	0.15	0.07	0.16	0.04	**0.65**	**0.80**	**3028**

Source: Calculated by the researcher from the banks' annual reports

The concentration ratio in the loan market shows a stable to a decreasing trend. CR2 decreased from 73% to 70% while CR3 remained the same, with 80%. Similar to Oman's banking industry, Qatar's banking industry is dominated by the Qatar National Bank (QNB) which controls more than half of the deposits and loans market.

Table 4.12 Concentration Trends in Qatar's Loan Market

Bank/ Year	QNB	CMBQ	DB	ABQ	QISB	QIISB	**CR2**	**CR3**
2002	0.58	0.10	0.09	0.02	0.12	0.08	**0.70**	**0.80**
2001	0.59	0.09	0.10	0.03	0.11	0.07	**0.70**	**0.80**
2000	0.54	0.10	0.11	0.05	0.13	0.07	**0.67**	**0.78**
1999	0.57	0.09	0.11	0.05	0.12	0.06	**0.69**	**0.80**
1998	0.60	0.10	0.09	0.05	0.11	0.05	**0.71**	**0.81**
1997	0.60	0.08	0.12	0.05	0.11	0.05	**0.72**	**0.83**
1996	0.58	0.09	0.12	0.06	0.11	0.05	**0.70**	**0.81**
1995	0.61	0.08	0.11	0.06	0.11	0.04	**0.72**	**0.83**
1994	0.59	0.08	0.10	0.05	0.13	0.04	**0.72**	**0.82**
1993	0.59	0.07	0.11	0.05	0.14	0.04	**0.73**	**0.84**

Source: Calculated by the researcher from the banks' annual reports

4.5.5 Saudi Arabia

Estimating both measures shows that Saudi Arabia's banking industry has become a less concentrated market. Tables 4.13 & 4.14 present the HHI and CR*k* trends for the period 1993-2002. In general, the concentration ratio shows a decreasing trend with CR2, CR3 recording 42% and 56%, respectively, and HHI standing at 1455 points in the 1993, and in 2002 CR2 and CR3 recording 37% and 50%, respectively, and HHI standing at 1295 points, due to the decrease of the market share of National Commercial Bank and the increase of the market share of the smaller banks. According to current screening guidelines in the U.S.A, Saudi Arabia's banking industry's market could be described as a 'somewhat concentrated market' moving towards "competitive market".

As can be seen in table 4.14, the concentration ratio in the loan market shows a trend similar to that in the deposit market.

Table 4.13: Concentration Trends in Saudi Arabia's Deposit Market

Bank	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
NCMB	0.25	0.25	0.25	0.25	0.25	0.25	0.23	0.23	0.23	0.22
SAMBA	0.14	0.14	0.13	0.12	0.13	0.13	0.18	0.18	0.17	0.15
RIYAD	0.17	0.17	0.17	0.16	0.16	0.15	0.15	0.14	0.14	0.13
SABR	0.07	0.09	0.08	0.09	0.10	0.10	0.09	0.10	0.09	0.09
ARAB	0.11	0.10	0.11	0.11	0.10	0.09	0.09	0.08	0.09	0.09
SAFR	0.08	0.08	0.09	0.09	0.09	0.08	0.08	0.09	0.09	0.09
SAHO	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06
INVEST	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04
JAZERA	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
RAJHI	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.11
CR2	**0.42**	**0.42**	**0.42**	**0.41**	**0.41**	**0.40**	**0.41**	**0.41**	**0.40**	**0.37**
CR3	**0.56**	**0.56**	**0.55**	**0.53**	**0.54**	**0.53**	**0.56**	**0.55**	**0.54**	**0.50**
HH1	**1455**	**1466**	**1468**	**1424**	**1447**	**1380**	**1420**	**1429**	**1403**	**1295**

Source: compiled by the researcher from banks' annual reports

Table 4.14: Concentration Trends in Saudi Arabia's Loan Market										
Bank	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
NCMB	0.29	0.28	0.28	0.29	0.31	0.33	0.2	0.21	0.21	0.19
SAMBA	0.10	0.12	0.12	0.10	0.10	0.12	0.19	0.18	0.18	0.16
RIYAD	0.13	0.14	0.12	0.12	0.11	0.13	0.11	0.12	0.12	0.11
SABR	0.06	0.07	0.07	0.08	0.07	0.09	0.10	0.09	0.09	0.09
ARAB	0.09	0.08	0.08	0.07	0.06	0.06	0.08	0.08	0.08	0.07
SAFR	0.08	0.07	0.07	0.06	0.07	0.08	0.09	0.09	0.09	0.10
SAHO	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06
Invest	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04
Jazera	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Rajhi	0.18	0.17	0.17	0.2	0.2	0.1	0.12	0.11	0.12	0.17
CR2	**0.47**	**0.45**	**0.45**	**0.49**	**0.51**	**0.46**	**0.39**	**0.39**	**0.39**	**0.36**
CR3	**0.60**	**0.59**	**0.57**	**0.61**	**0.62**	**0.58**	**0.51**	**0.51**	**0.51**	**0.52**
Source: Compiled by the researcher from banks' annual reports										

4.5.6 UAE

Tables 4.15 & 4.16 present the trends of the HHI and CR*k* trends for the period 1995-2002. The concentration ratio shows a decreasing trend. The concentration ratio in the deposit market implies a concentrated market, with CR2 and CR3 recording 39% and 53%, respectively, and the HHI standing at 1300 in the 1995. However in 2002, the concentration ratio went down, with CR2 and CR3 recording 34% and 44% respectively, and the HHI value decreasing to 1064 points, due to the decreased market share of the two largest banks, the National Bank of Abu Dhabi (NBAD) and National Bank of Dubai (NBD), and the increased market share of the two Islamic banks, the Dubai Islamic Bank and Abu Dhabi Islamic Bank as well as other small commercial banks. According to current screening guidelines in the USA, this market could be described as an "unconcentrated market" moving toward "competitive market". The concentration ratio in the loan market shows a trend similar to that in the deposit market.

Table 4.15: Concentration Trends in the UAE's Deposit Market

Bank/ year	1995	1996	1997	1998	1999	2000	2001	2002
NBAD	0.21	0.24	0.23	0.23	0.21	0.21	0.17	0.18
NBD	0.18	0.17	0.16	0.15	0.15	0.15	0.16	0.16
Emirates	0.14	0.12	0.12	0.12	0.12	0.10	0.10	0.10
ADCom	0.10	0.10	0.12	0.13	0.14	0.13	0.12	0.11
Mashreq	0.12	0.12	0.12	0.11	0.12	0.12	0.11	0.10
Union	0.05	0.05	0.05	0.05	0.06	0.07	0.07	0.07
ComBD	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.03
First	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
Arab	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03
Sharjah	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NBRasK	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
ComInt.	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Fujairah	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01
NBSharjah	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
UNArab	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
MEB	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Qawain	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
DIslm	0.06	0.06	0.06	0.05	0.03	0.07	0.08	0.09
CR2	**0.39**	**0.41**	**0.39**	**0.38**	**0.36**	**0.36**	**0.33**	**0.34**
CR3	**0.53**	**0.53**	**0.51**	**0.50**	**0.48**	**0.48**	**0.44**	**0.44**
HHI	**1300**	**1351**	**1308**	**1272**	**1229**	**1211**	**1063**	**1064**

Source: Calculated by the researcher from the banks' annual reports

Table 4.16: Concentration Trends in the UAE's Loan Market

Bank/ year	1995	1996	1997	1998	1999	2000	2001	2002
NBAD	0.25	0.2	0.2	0.19	0.17	0.18	0.18	0.18
NBD	0.05	0.06	0.07	0.07	0.08	0.08	0.08	0.07
Emirates	0.16	0.16	0.15	0.15	0.15	0.11	0.13	0.14
ADCom	0.13	0.13	0.15	0.16	0.15	0.16	0.14	0.13
Mashreq	0.13	0.14	0.13	0.12	0.12	0.11	0.11	0.11
Union	0.05	0.05	0.06	0.07	0.07	0.07	0.07	0.07
ComBD	0.03	0.04	0.04	0.05	0.05	0.05	0.05	0.05
First	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
Arab	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01
Sharjah	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NBRasK	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
ComInt.	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
Fujairah	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01
NBSharjah	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
UNArab	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
MEB	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01
Qawain	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
DIslm	0.08	0.08	0.08	0.08	0.08	0.10	0.12	0.12
CR2	**0.41**	**0.36**	**0.35**	**0.35**	**0.32**	**0.34**	**0.32**	**0.32**
CR3	**0.54**	**0.50**	**0.50**	**0.50**	**0.47**	**0.45**	**0.45**	**0.45**

Source: Calculated by the researcher from the banks' annual reports

4.6 Conclusion

Table 4.17 summarises the concentration trend in the deposit market in GCC countries according to CR3 and HHI values for the period 1995-2002. The three largest banks in each country show a very high market share in terms of deposits and loans especially those in Oman, Qatar, Bahrain and Kuwait. In addition, none of the six countries had an HHI score of less than 1000. Thus both indices results' indicate that the banking industries in these countries operate in markets ranging from "somewhat" to "very" concentrated markets.

The significant changes in GCC countries' banking industry identified by the research raise important policy concerns in that banks in highly concentrated market can gain market power due to being able to charge higher than competitive prices for their products, thus inflicting welfare costs that could more than offset any presumed benefit associated with mergers. Other concerns related to the higher concentration ratio include such problems as the limited effectiveness of monetary and credit policy, increased probability of systemic risk, and reduction in lending to small and medium corporations.

Table 4.17: Concentration trend in the deposit market in GCC countries according to CR3 and HHI values for 1995-2002

Country	Bahrain		Kuwait		Oman		Qatar		Saudi Arabia		UAE	
Measure/ Year	CR3	HHI	CR3	HHI	CR3	HHI	CR3	HHI	CR3	HHI	CR3	HHI
2002	0.79	2502	0.62	1897	0.81	2712	0.80	3565	0.50	1295	0.44	1064
2001	0.77	2424	0.63	1907	0.79	2382	0.81	3687	0.54	1403	0.44	1063
2000	0.75	2439	0.63	1924	0.82	2456	0.79	3470	0.55	1429	0.48	1211
1999	0.76	2524	0.63	1911	0.81	2430	0.78	3380	0.56	1420	0.48	1229
1998	0.85	2887	0.62	1880	0.79	2320	0.78	3239	0.53	1380	0.50	1272
1997	0.86	3085	0.62	2000	0.77	2250	0.79	3398	0.54	1447	0.51	1308
1996	0.86	3044	0.63	2014	0.78	2286	0.79	3314	0.53	1424	0.53	1351
1995	0.83	2847	0.61	1975	0.77	2258	0.83	3995	0.55	1468	0.53	1300

However, can we explicitly conclude that these markets are highly concentrated; bearing in mind they are newly emerging markets with a limited number of local banks? In addition, there are many foreign banks in these countries (with the exception of Saudi Arabia).

Based on Gelos and Rolos (2002), table 4.18 shows the number of banks and market concentration in selected emerging market banking systems. In 2000, Brazil, Mexico, the Czech Republic and Hungary had HHI values of 1278.6, 1360.5, 1757.8 and 1241.2, respectively, which are close to the HHI indices of GCC countries.

Table 4.18: Number of Banks and Market Concentration in Selected Emerging Market

Country	1994			2000		
	Share in total deposits (%)			Share in total deposits (%)		
	No. of banks	Largest 3 banks	HHI	No. of banks	Largest 3 banks	HHI
Asia						
Rep. of Korea	30	52.8	1263.6	13	43.5	899.7
Malaysia	25	44.7	918.9	10	43.4	1005.1
Philippines	41	39.0	819.7	27	39.6	789.9
Thailand	15	47.5	1031.7	13	41.7	854.4
Latin America						
Argentina	206	39.1	756.9	113	39.8	865.7
Brazil	245	49.9	1220.9	193	55.2	1278.6
Chile	37	39.5	830.4	29	39.5	857.9
Mexico	36	48.3	1005.4	23	56.3	1360.5
Venezuela	43	43.9	979.2	42	46.7	923.1
Central Europe						
Czech Rep.	55	72.0	2101.5	42	69.7	1757.8
Hungary	40	57.9	1578.8	39	51.5	1241.2
Poland	82	52.8	1263.6	77	43.5	899.7
Turkey	72	40.7	957.2	79	35.9	710.2

Source: Gelos and Rolos (2002)

Comparing results in table 4.17 and 4.18, GCC countries are better off than many of those in table 4.18 for the following reasons. First, GCC countries are less populated than most of the cited countries. Second, GCC countries' banking industries have fewer banks, therefore, are expected to have higher concentration ratios. For example, Oman has five banks. If these five banks have an equal share of 20%, then the HHI will be $(20)^2 + (20)^2 + (20)^2 + (20)^2 + (20)^2 = 2000$. The CR2 and CR3 will be 40% and 60%, respectively. Thus, based on the example, this market is a highly concentrated market. Therefore, the concentration ratios in Oman and the remaining GCC countries are reasonable, bearing in mind the relatively low number of local banks in these markets. Third, this study's sample covered local commercial and Islamic banks, and other types of local banks were left out of the study's scope. For example, according to the Directory of Financial Institutions of BMA (2003), Bahrain has a total of 23 commercial banks, 50 offshore banking units, 36 investment banks, 2 specialised banks, and 29 representative offices. Finally, concentration ratio results do not appear to accurately reflect the actual situation in these countries for the following reasons. Their banking industries are considered the best banking industries in the whole Middle East and North Africa. Moreover, GCC countries are moving well ahead of other countries in the region towards financial liberalisation and the openness of the financial markets.

The banking industries in GCC are therefore at a transitional stage. Local banks, which are generally small, have managed to withstand competition from large foreign banks which dominated the market in the 1950s, 1960s and early 1970s. They have been protected indirectly by their governments, however, the doors are now open for foreign banks to enter the market and compete with them due to most GCC countries' recent entry to the WTO. As a consequence, their markets will become more open and local banks will no longer receive government protection.

Evidence of decreasing concentration in the majority of markets does not necessarily mean lower prices or an improvement in services to bank customers. Similarly, though the HHI and CR3 values may indicate changes in monopoly power in Oman and Qatar, higher prices and deterioration in customer service are not necessarily implied.

Moreover, it does not appear that concentration has increased in GCC countries' banking industry. In fact, with the exception of Oman's banking industry, concentration measures reported here indicate that 5 of the 6 countries examined actually experienced declines in concentration over the 1993-2002 period. On the basis of these findings, it is safe to conclude that GCC banking industries are not highly concentrated and, with the exception of Oman's banking industry, concentration in GCC countries' banking industry should not cause a big concern since the concentration indices indicate decline in the concentration over the years.

This chapter has presented formal approaches to the measurement of market structure, and given evidence of the appropriateness of the *CRk* and the *HHI* in the empirical application of market concentration, helping policy makers to select a measure of concentration appropriate to their needs. The next chapter discusses the competitive conditions and monopoly power in GCC countries' banking industry. The results in this chapter and the next chapter will help draw overall conclusions about market concentration and monopoly power in these six GCC countries.

CHAPTER 5

ASSESSING MARKET STRUCTURE AND COMPETITIVE CONDITIONS

5.1 INTRODUCTION

It was mentioned in Chapter 1 that competition in the banking industry matters for a number of reasons. As in other industries, the degree of competition in the financial sector can matter for the efficiency of the production of financial services, the quality of financial products, and the degree of innovation in the sector. Moreover, specific to the banking industry is the link between competition and stability which has been long recognised in theoretical and empirical research (Vives 2001). In addition, the degree of competition in the financial sector can matter for the access of firms and households to financial services and external financing, in turn affecting overall economic growth, although not all relationships are clear.

Therefore, testing degree of effective competition requires a structural, contestability approach, along the lines pursued in much of the industrial organisation literature. As in other sectors, the degree of competition in the banking system should be measured with respect to the actual behaviour of (marginal) bank conduct. The actual behaviour should be related not only to banking market structure, but also to entry barriers, including foreign ownership, and the severity of activity restrictions since these can limit the degree of intra-industry competition. Furthermore, the degree of competition from other forms of financial intermediation (capital markets, non-bank financial institutions, insurance companies) will play a role in determining banking system competitiveness. To date, however, few cross-country tests have taken this approach.

Previous studies have documented the monopoly power and competition level of banking industries in various countries. To the researcher's knowledge, no one has examined the competitiveness of the banking industry in the six GCC countries. This pioneering study seeks to investigate the market structure of GCC countries' banking industry between the period 1993 to 2002, and to evaluate the monopoly power of banks over this ten year period. The aim is to test competitive conditions of the banks in these six markets using the *H*-statistic value of the P-R model to measure monopoly power. Since these markets were found to be some what concentrated to concentrated in Chapter 4 from CR*k* and HHI indicators, the H value derived for testing the competitive conditions in GCC countries is expected to be greater than zero and less than one. It is, therefore, hypothesised that banks in GCC countries are concentrated and gain their total revenue under monopolistic conditions. Therefore, the expectation is to see whether a direct relationship exists between concentration and non-competitive behaviour.

The structure of this chapter is as the follows. Section two provides background details about the growth of banking sector in the GCC countries. A review of the banking literature is undertaken in section three while the Panzar-Rosse Approach is discussed in section four. The study methodology is detailed in section five and section six presents the empirical results pertaining to competitive conditions in the markets under study. Section seven provides background details about equilibrium test and presents the empirical results derived from such test. Section eight concludes the chapter.

5.2 Growth of banking sector

Figure 5.1 shows the relative size of the total assets of banks in each of the six GCC countries for the years 1995 and 2002. In 2002, assets of 52 banks under study totalled US$ Billion 283.2 of which 47% , 22%, 19%, 5%, 3% and 3% belonged to Saudi Arabian, UAE, Kuwaiti, Qatari, Bahraini and Omani banks, respectively.

Figure 5.1: Relative size of the total assets of GCC banks

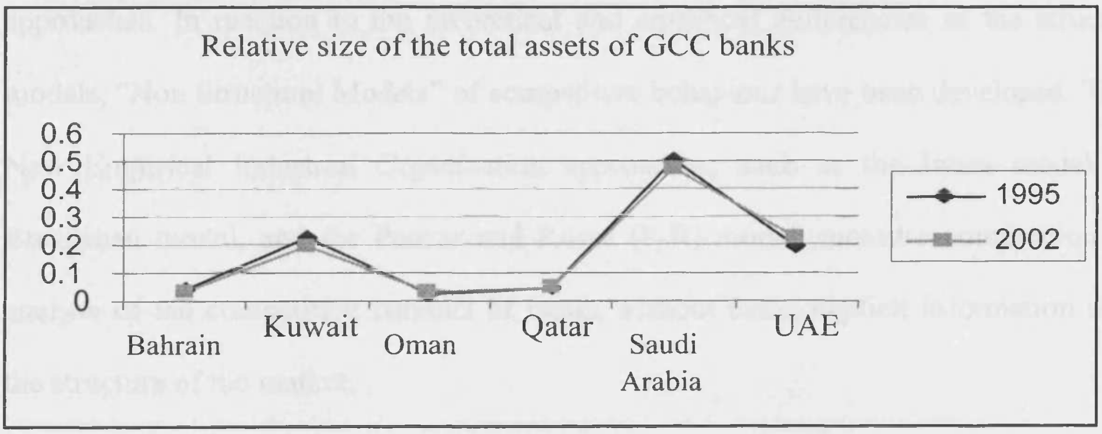


Table 5.1 shows the growth in the number of branches for the period from 1995 to 2002. Even though Saudi Arabia comes in first place, followed by the UAE, Oman, Kuwait, Bahrain and Qatar, respectively, however, in terms of the percentage growth of branches over this period, Qatar had the highest growth rate of 73% followed by Oman (64%), Kuwait with (43%), UAE (31%), Bahrain (26%) and Saudi Arabia (6%).

Table 5.1: Growth of banks' branches in GCC markets												
Year	Bahrain	%	Kuwait	%	Oman	%	Qatar	%	Saudi	%	UAE	%
1995	61	26%	123	43%	181	64%	41	73%	1116	6%	255	31%
2002	77		176		296		71		1181		333	

5.3 The relationship between competition and market structure

The view on the relationship between competition and market structure is based on the traditional monopoly power hypothesis, which suggests that more concentrated markets tend to be more collusive, generating market power which allows banks to earn monopolistic profits by offering lower deposit rates and charging higher loan rates.

These arguments are called 'Structural Models' and are challenged by other theoretical approaches. In reaction to the theoretical and empirical deficiencies of the structural models, "Non Structural Models" of competitive behaviour have been developed. These New Empirical Industrial Organization approaches, such as the Iwata model, the Bresnahan model, and the Panzar and Rosse (P-R) model, measure competition and analyse of the competitive conduct of banks without using explicit information about the structure of the market.

This study employs one of the "Non-Structural Model" approaches suggested by Rosse and Panzar (1977) and Panzar and Rosse (1982, 1987), the so-called "*H statistic*", which has been widely employed in the examination of the competitive structure of the banking industry in various countries.

5.3.1 The Literature Survey

In the banking literature, there are two major empirical approaches for assessing competition: the Structural Approach and the Non-Structural Approach (Bikker and

Haaf, 2000). The structural approach includes the Structure-Conduct-Performance (SCP) paradigm and the Efficient Structure Hypothesis (ESH). The SCP paradigm was originally developed by Mason (1939) and Bain (1951), and attempts to infer the degree of competition in an industry from its structural features establishing a direct link from industry structure to firm conduct, and from firm conduct to industry performance. Basically, the SCP implies that concentration in the banking industry can generate market power, allowing banks to earn monopolistic profits by offering lower deposit rates and charging higher loan rates. This view assumes that banks in a concentrated market can ignore potential competitors due to technological and regulatory barriers to entry.

The SCP paradigm is challenged by other theoretical approaches. The first challenge comes from the "efficient structure hypothesis" (ESH) advocated by Demsetz (1973) and Peltzman (1977). The ESH suggests that the positive relationship is not a consequence of market power but of the greater efficiency of firms with larger market share (Demsetz, 1973). In other words, the superior performance of the market leaders (due to firm specific factors, such as technological or managerial skills, etc.) endogenously determines the market structure, implying that higher efficiency produces both higher concentration and greater profitability.

"Non-structural models" suggest an alternative approach to competitive behaviour. These models do not infer the competitive conduct of banks through the analysis of market structure; rather they imply banks behave differently due to the market structure in which they operate. The basic tenet of these models concerning competitive conditions is that there is no clear evidence that the use of market power is greater in more concentrated industries. Under this framework, the Contestable Markets Theory (CMT) developed by Baumol (1982) stresses that a concentrated industry can behave competitively if the barriers for new entrants to the market are low. CMT assumes that firms can rapidly enter or leave any market without losing their capital, and potential competitors have the same cost function as incumbent firms.

These features of contestable markets imply that a concentrated banking market can be effectively competitive even if it is dominated by a handful of large banks. Therefore, policymakers should be relatively less concerned about the market dominance of some types of financial intermediaries in a country's financial system, if the financial markets are contestable. Based on these arguments, deregulation and liberalisation will make the banking industry more contestable or open to competition.

The empirical evidence for the existence of the market concentration-market power relationship is mixed. Some influential papers have suggested a positive relationship between concentration and the degree of market power. For example, Berger and Hannan (1989) analysed a cross-section of banking markets over the period 1983-85. After controlling for various factors affecting price-setting behaviour, they reported that deposit rates were significantly lower in the most concentrated markets.

Other work compares the time-series behaviour of the deposit interest rate (and/or the loan rate) with the benchmark money market rate, which is not controlled by the banks. Hannan and Berger (1991) and Neumark and Sharpe (1992) found evidence of deposit rate rigidity and, thus, evidence of market power in the US banking industry. Importantly, they found a higher level of rigidity in markets with higher HHIS.

However, recent research casts doubt on the market concentration-market power relationship. Reviewing Berger and Hannan's (1989) results, Jackson (1992) suggests that the market concentration-market power relationship may not be monotonic. Such a relationship holds at low levels of concentration, but in markets with middle levels of concentration the relationship vanishes, and it actually changes significantly in highly concentrated markets.

A lack of strong theoretical foundations and mixed empirical evidence motivates the search for alternative methodologies to investigate firms' competitive behaviour. Non-structural models of competitive behaviour utilising the New Empirical Industrial Organization approach, namely the Iwata model, the Bresnahan model, and the Panzar and Rosse (P-R) have subsequently been developed. Now we turn to the method suggested by Panzar and Rosse (1987) in more detail.

5.4 The Panzar and Rosse Approach

The method developed by Panzar and Rosse (1987) determines the competitive behaviour of banks on the basis of the comparative static properties of reduced-form revenue equations based on cross-section data. Panzar and Rosse (P-R) state that if their method is to yield plausible results, banks need to have operated in a long-term equilibrium (*i.e.* the number of banks needs to be endogenous to the model) while the performance of banks needs to be influenced by the actions of other market participants. The model further assumes a price elasticity of demand, *e*, greater than unity, and a homogeneous cost structure. To obtain the equilibrium output and the equilibrium number of banks, profits are maximised at the bank as well as the industry level. This means, first, that bank i maximises its profits where marginal revenue equals marginal cost:

$$R_i\,(x_i\,,n,z_i)\text{-}\ C_i\,(x_i\,,w_i\,,t_i\,)=0 \qquad (1)$$

x_i being the output of bank i, n the number of banks, w_i a vector of m factor input prices of bank i, z_i a vector of exogenous variables that shift the bank's revenue function, and t_i a vector of exogenous variables that shift the bank's cost function. Secondly, it means that, in equilibrium, the zero profit constraint holds at the market level:

$$R^*\,(x^*,n^*,z)-C_i^*\,(x^*,w,t)=0 \qquad (2)$$

Variables marked with * represent equilibrium values. Market power is measured by the extent to which a change in factor input prices (∂w_{ki}) is reflected in the equilibrium revenues (∂R_i^*) earned by bank i. Panzar and Rosse define a measure of competition, the 'H statistic' as the sum of the elasticity of the reduced form revenues with respect to factor prices:

$$H=\sum\nolimits^{m}_{k=1}\ (\partial R_i^*\,/\,\partial w_{ki})\,(wki\,/\,R_i^*) \qquad (3)$$

The estimated value of the H statistic ranges between $-\infty < H \leq 1$. H is zero or smaller than zero if the underlying market is monopoly, it ranges between more than zero and unity for monopolistic competition and an H of unity indicates perfect competition. Shaffer (1983) demonstrated formal linkages between the Panzar-Rosse H statistic, the conjectural variation elasticity, and the Lerner index (For details of the formal derivation of the H statistic see Panzar and Rosse, 1987; and Vesala, 1995).

The first application of this test was made by Rosse and Panzar (1977), who employed a cross-section of data in order to estimate the H-statistic for newspaper firms in local media markets. In the banking industry there has been growing attention towards the application of the Panzar-Rosse methodology. Table 5.2 summarises the results of these investigations. Most have been conducted in European countries and indicate that banks earn revenues as if they are under conditions of monopolistic competition.

Table 5.2: P-R model results in other studies			
Authors	Period	Countries considered	Results
Shaffer (1982)	1979	New York	monopolistic competition
Nathan and Neave (1989)	1982-84	Canada	1982: perfect competition; 1983-84: monopolistic competition
Lloyd-Williams *et al.* (1991)	1986-88	Japan	monopoly
Molyneux *et al.* (1994)	1986-89	France, Germany, Italy, Spain and the UK	monopoly: Italy; monopolistic competition: France, Germany, Spain, UK
Vesala (1995)	1985-92	Finland	monopolistic competition for all but two years
Molyneux *et al.* (1996b)	1986-88	Japan	monopoly
Coccorese (1998)	1988-96	Italy	monopolistic competition
Rime (1999)	1987-94	Switzerland	monopolistic competition
Hondroyiannis *et al.* (1999)	1993-1995	Greece	monopolistic competition
Bikker and Groeneveld (2000)	1989-96	15 EU countries	monopolistic competition
De Bandt and Davis (2000)	1992-96	France, Germany and Italy	large banks: monopolistic competition in all countries; small banks: monopolistic competition in Italy, monopoly in France, Germany
Bikker and Haaf (2002)	1988-98	23 OECD countries	monopolistic competition
Hempell (2002)	1993-1998	Germany	Monopolistic competition
Coccorese (2004)	1997-1999	Italy	monopolistic competition

Shaffer (1982), in his pioneering study on New York banks, observed monopolistic competition. For Canadian banks, Nathan and Neave (1989) found perfect competition for 1982 and monopolistic competition for 1983-84. Lloyd-Williams *et al.* (1991) and Molyneux *et al.* (1996) revealed perfect collusion for Japan. Molyneux *et al.* (1994) tested the P-R statistic on a sample of French, German, Italian, Spanish and British banks for the period 1986-89 in order to assess the competitive conditions in major EC banking markets. They obtained values for H which did not significantly differ from zero and from unity for France, Germany (except for 1987), Spain and the UK, thus pointing to monopolistic competition. The H-statistic for Italy during 1987-89 was negative and significantly different from zero; hence it was not possible to reject the hypothesis of monopoly. Coccorese (1998), however, who evaluated the degree of competition in the Italian banking sector, obtained significantly non-negative values for *H*. *H*, was also significantly different from unity, except in 1992 and 1994. Vesala (1995) applied the model to the Finnish banking sector (1985-92) to test for competition and market power. His estimates of *H* were always positive, but significantly different from zero and from unity only in 1989 and 1990. For Switzerland, Rime (1999) observed monopolistic competition. Bikker and Groeneveld (2000) determined the competitive structure of the whole EU banking industry. The estimated values for the *H*-statistic lay between two-thirds and one in most countries. The hypothesis $H = 0$ was rejected for all countries, whereas $H = 1$ could not be rejected for Belgium and Greece at the 95% confidence level. De Brandt and Davis (2000) investigated banking markets in France, Germany and Italy within groups of large and small banks. Aiming to assess the effects of EMU on market conditions, they obtained estimates of *H*, which significantly differed from zero and from unity for large banks in all three countries. The *H* statistics estimated for the sample with small banks indicated monopolistic competition in Italy, and monopoly power in France and Germany. Bikker and Haaf (2000) considered banks in 23 OECD countries and investigate small, medium-sized and large banks separately. Their P-R analysis found monopolistic competition virtually everywhere, although perfect competition could not be rejected for some market segments.

5.4.1 Assumptions for using the Panzar and Rosse Model

According to Gelos et al, (2002, p. 13) various assumptions need to be made to apply this framework in our context. First, one needs to assume that banks can be treated as single product firms, acting exclusively as financial intermediaries (De Bandt and

Davis, 2000). Banks produce interest revenues using labour, capital and intermediated funds (mainly deposits) as inputs. This assumption, while widely used in the literature, is, of course, controversial. Second, one needs to assume that higher input prices are not associated with higher quality services that generate higher revenues, since such a correlation may bias the computed *H* statistic. This means, however, that if one rejects the hypothesis of a contestable/competitive market, this bias cannot be too large (Molyneux, Thornton and Lloyd-Williams, 1996). A third, and possibly less innocuous assumption, given the volatile economic environment in the economies we are studying, is that one needs to be observing banks in long-equilibrium. As discussed below, we try to overcome this problem by using a panel data specification. Moreover, the problem might be less severe if we are mainly interested in changes in the *H* measure over time. In other words, the hope is that, even if we cannot assess with certainty whether at any point in time the market structure in the countries studied falls into one of the three categories, we will still be able to infer the direction of change in market structure by testing for changes in the *H* values over time.

5.4.2 The Panzar-Rosse test for competition

The idea behind this test is to observe whether a bank's total revenue changes in the same or opposite direction as its input prices (such as wages, office rental rates, etc.). As the following example given by Shaffer (1994) illustrates, changes in the same direction indicate a competitive market, whereas changes in the opposite direction tend to reflect some degree of market power. The test was developed by Rosse and Panzar (1977) (see also Panzar and Rosse, 1987) and can be shown to be much more general than the simple example might suggest.

In a competitive market, as banks compete for customers, the selling price will eventually be driven down to the minimum average cost of production, and each bank will produce the asset quantity that minimises its average cost. The bank's total revenue is the competitive price times its quantity. In table 5.3, average cost is originally lowest for a bank that produces $20 million in assets, and total revenue is initially $4 million (= $20 million times an average cost of $0.20 per dollar of assets), as shown in the left-hand "original revenue" column. If the bank's input prices fall, the bank's average cost curve may shift down to resemble the right-hand average cost column; the efficient size remains at $20 million, but total revenue declines to $3.8 million (= $20 million times $0.19 per dollar of assets), since the price is driven down by competitive forces-perhaps involving the entry of additional banks into the market-to match the new lower average cost. Here, total revenue changes in the same direction as costs (the same effect could also be illustrated by considering an increase in costs).

Table 5.3: Bank's behaviour in a competitive market environment

Bank Assets ($Million)	Original Average Cost Per $ of Assets	Original Revenue ($ Million)	New Average Cost After Input Prices Fall	New Revenue ($ Million)
17	0.23	3.91	0.22	3.74
18	0.22	3.96	0.21	3.78
19	0.21	3.99	0.20	3.80
20	0.20	4.00	0.19	3.80
21	0.21	4.41	0.20	4.20

Source: Shaffer (1994)

If instead, a bank is facing these same original and new average cost figures has some market power-that is, if its market is not perfectly competitive-its selling price (the interest rate it charges on a loan) will vary with the amount it produces, and it may choose a smaller size to maximise its profits. Table 5.4 shows the price that such a bank can charge at different asset sizes, as well as the resulting profit levels (calculated by subtracting total costs, using the average cost figures shown in the table above, from total revenues).

Table 5.4: Bank's behaviour in a market power environment

Bank Assets ($M)	Orig. Avg. Cost ($)	Price per $ of Assets	Total Revenue (=Col.1x Col.3)	Total Cost (Col.1 x Col.2)	Original Profit (=Col.4 - col.5)	New Avg. Cost ($)	New Total Cost ($M)	New Profit (Col.4 – Col.8)
17	0.23	0.325	5.525M	3.91M	1.615M	0.22	3.74M	1.785M
18	0.22	0.310	5.580	3.96	1.620	0.21	3.78	1.80
19	0.21	0.295	5.605	3.99	1.615	0.20	3.80	1.805
20	0.20	0.280	5.600	4.00	1.600	0.19	3.80	1.80
21	0.21	0.265	5.565	4.41	1.155	0.20	4.20	1.365

Source: Shaffer (1994)

Given the original costs, the bank can earn maximum profits by operating at a level of $18 million in assets, yielding a total revenue of $5.58 million and net profits of $1.62 million; in this protected market, competition does not force the bank to expand to the cost-minimising size, and the bank can earn a positive profit. After the reduction in costs, the bank can earn maximum profits by operating at a level of $19 million in assets, yielding total revenue of $5.605 million and profits of $1.805 million; no entry occurs to challenge these profits or to force the bank to reach the cost-minimising size. Here, even though the asset quantity that minimises average costs has not changed (i.e., $20 million), the bank with market power responds to a downward cost shift by expanding its output. As a result, its total revenue increases even though its average costs have fallen. Again, the same effect (that revenue moves in the opposite direction as average costs) can also be shown by considering an increase in costs.

5.4.3 The advantages and disadvantages of the Panzar-Rosse Test

A major advantage of the P-R technique is that no geographic market need be defined a priori; even data from a single bank can suffice for the test. This avoids much potential bias from misspecified market boundaries. If the bank operates in more than one market, the measured conduct will reflect an average of the bank's conduct in each of its markets - which may tell us less than we would like to know to evaluate a particular merger involving one market, but it is at least useful in studying the validity of structural indices or the overall degree of competition in the banking industry. One drawback of the test is that it can give misleading results under a variety of circumstances, such as when the number of banks in the sample has not fully adjusted to market conditions; the direction of bias in this case is always towards a spurious appearance of market power (Shaffer, 1982, 1983)[1]. But, in general, when the test indicates a competitive outcome, we can be relatively sure that monopoly power is not being exercised[2].

5.5 Methodology

5.5.1 The empirical model

Following Shaffer (1982, 1985), Nathan and Neave (1989), Molyneux et al. (1994) and Hondroyiannis et al. (1999) the study estimates the following bank revenue equation in which revenue is explained by factor prices and other bank-specific variables that affect long-run equilibrium bank revenues for GCC banks during the years 1993-2002.

$$\mathbf{LnTREV} = \alpha_0 + (\alpha_1 \ln PL + \alpha_2 \ln PK + \alpha_3 \ln PF) + \alpha_4 \ln RISKAST + \alpha_5 \ln ASSET + \alpha_6 \ln BRT \quad (4)$$

And for estimating equilibrium conditions the model is:

$$\mathbf{LnROA} = \beta_0 + (\beta_1 \ln PL + \beta_2 \ln PK + \beta_3 \ln PF) + \beta_4 \ln RISKAST + \beta_5 \ln ASSET + \beta_6 \ln BRT \quad (5)$$

[1] This anticompetitive bias means that, in the absence of a reliable test for market disequilibrium, the Panzar-Rosse test cannot be used to rule out competitive pricing, as some studies have claimed.

[2] The test is also unable to distinguish between competitive pricing and simple "cost-plus" pricing, discussed above; but since cost-plus pricing is not specifically associated with a particular degree of market power, the implications of this limitation for interpreting the Panzar-Rosse test are not clear.

Table 5.5 Summary of variables used in testing competition conditions and equilibrium	
Descript ion	Variable
Ln	Natural logarithm
TREV	Total revenue to total assets
ROA	Return on assets
PL	Personnel expenses to employees (unit price of labour)
PK	Capital expenses to fixed assets (unit price of capital)
PF	Ratio of annual interest expenses to own funds (unit price of funds)
RISKAST	Provisions to total assets
ASSET	Bank total assets
BRT	Number of branches of each bank to the total number of branches of the whole banking system

The justification for using the log linear form is to improve the regression's goodness of fit (De Bandt & Davis, 2000). Molyneux et al. (1996b) found that a log linear revenue equation gave similar results as a more flexible translog equation. The revenue equation in the Panzar- Rosse model is interpreted as a reduced form rather than a structural equation. Table 5.5 summarises the variables which are used in equations (4) and (5).

The H-statistic value is the sum of the factor price elasticity: PL, PK, and PF. Table 5.6 presents in brief the *H*-statistic values for the different interpretations of the Rosse-Panzar '*H*-statistic'.

Table 5.6 Discriminatory power of H	
Values of H	**Competitive environment test**
$H \leq 0$	Monopoly equilibrium: each bank operates independently as under monopoly profit maximisation conditions (H is a decreasing function of the perceived demand elasticity) or perfect cartel.
$0 < H < 1$	Monopolistic competitions free entry equilibrium (H is an increasing function of the perceived demand elasticity).
$H = 1$	Perfect competition. Free entry equilibrium with full efficient capacity utilisation.
Values of H	**Equilibrium test**
$H = 0$	Equilibrium
$H < 0$	Disequilibrium
Source: Rosse and Panzar 1997; Panzar and Rosse 1982, 1987; Shaffer 1982, 1983; and Nathan and Neave 1989.	

5.5.2 Estimation strategy

The empirical implementation of equation (4) on a panel of banks with a time-series and cross sectional dimension requires some care. Various forms of estimation were employed in the main set of tests. In the empirical literature on banking competition, cross-sectional results are usually reported. The implicit assumption is that all banks have access to the same factor markets and only differ in terms of scale of operations, although it is reasonable to believe that, depending on their specialisation, banks rely on different factor markets. Here, the study argues that the time-series dimension is equally important. In addition, as is well known, running an OLS regression on equation (4), year by year (t=1,...T), may provide irregular results, and we therefore decide to concentrate on pooled sample regressions.

First, the study estimates equation (4) by OLS with a constant term on the pooled sample of banks and years, implicitly assuming that all observations are independent. Second, as it is important to test whether omitted bank-specific variables or time-varying factors (e.g. aggregate supply and demand shocks) affect inference, the study reports the "fixed effects" estimator. It introduces therefore different intercepts ($\alpha = \alpha i$, i = 1… I) as well as time dummies (Dt, t=1 …T-1) in equation (1). These constitute the study's core results.

Unlike previous studies, which rely on a simple cross-sectional estimation, the current study investigates competitive conditions in the GCC banking system using two types of regression: pooled estimation with fixed effects using GCC ten years pooled data and country by country estimation. As explained by Gelos and Roldos (2004), this approach has various advantages. First, by including bank fixed effects, we can control for unobserved heterogeneity this is important since the regressions are otherwise likely to suffer from omitted variable problems. All bank-specific, non time-varying determinants of revenues not explicitly addressed in the regression specification are captured by the fixed effects. Second, as noted above, panel estimation allows us to obtain more reliable estimates by observing the behaviour of banks over time and testing for changes in the coefficients.

Finally, in order to confirm that the Panzar-Rosse statistics provide useful results we need to determine that the banking systems that we are considering are in equilibrium. This is especially important for the cases of perfect competition and monopolistic competition (H>0), while H $\leq$0 is a long run condition for monopoly. As suggested by different authors (in particular, Shaffer, 1983; Hondroyiannis et al. 1994; Molyneux et al., 1994; and Coccorese, 2004), one should verify that input prices are not correlated with industry returns. To implement such a test, the study computes a "modified" version of the Panzar-Rosse statistics by running the same equation as (4) with the ratio "net income/total assets" as the endogenous variable. In this framework, the result of the H value from equation (5), where H=0, implies that the data are in equilibrium. It should be noted that equilibrium does not mean that competitive conditions are not allowed to change. It only implies that changes in banking are taken as gradual.

5.5.3 Data presentation

As mentioned in chapter 3, this study covers 52 privately held and domestically owned fully licensed commercial and Islamic banks. The sample of 60 observations in Bahrain, 70 in Kuwait, 50 in Oman, 60 in Qatar, 100 in Saudi Arabia and 144 in UAE is very similar to that in previous studies of banking. For example, Nathan and Neave (1989) used a sample of 39 observations on Canadian trust companies and 33 observations on mortgage companies; Shaffer (1993) used 25 observations on Canadian banks; and Shaffer and DiSalvo (1994) used a sample of 36 and 44 observations on duopoly banks in alternate specifications. The observations from each country are pooled together for all the years. A panel data regression model is used as the estimation technique. The use of panel data has a number of advantages such as increased number of data points, additional degree of freedom, and the pooling of cross-section and time series variables can considerably decrease the problem that arises from omitted variables. For further discussion on the advantages of the panel data regression models see (Gujarati, 2003).

The dependent variable total revenue to total assets (TREV) is used since it reflects banking market forces. According to Coccorese (1998), the nature of the estimation of the H-statistic means that we are especially interested in understanding how the total revenue reacts to variations in the cost figures and, for this reason, the dependent variable is given by the sum of all the revenues, including the interest revenues. So, in line with Nathan and Neave (1989); Molyneux et al. (1996b); Coccorese (1998, 2004);

Hondroyiannis et al. (1999); De Bandt and Davis (2000); and Bikker and Haff (2002), this study uses the ratio of total revenue to total assets as the dependent variable in measuring the competitive conditions.

The independent variables are chosen to account for firm specific and market specific variables similar to those used in other studies (Nathan and Neave, 1989; Molyneux et al., 1994; and Hondroyiannis et al., 1999). First, as in Hondroyiannis et al. (1999), and Coccorese (2004), to account for firm specific risk, this study uses the provisions to assets ratio (RISKAST). The author expects the RISKAST to be positively correlated to the dependent variables, since higher provisions should lead to higher bank revenue. Second, as in Nathan and Neave (1989); Molyneux et al. (1996b); Hondroyiannis et al. (1999); De Bandt and Davis (2000); Shaffer (2002); and Coccorese (2004), the total ASSET variable is included in the analysis to account for possible scale economies, given the range of bank asset sizes in the GCC banking system. The author expects a mixed correlation with the dependent variable. Third, in line with Nathan and Neave (1989); Hondroyiannis et al. (1999); and Coccorese (2004), each bank's number of branches to total branches of the whole market, the BRT variable, is used as a proxy for the bank's market share. The author expects the BRT variable will negatively correlate with the dependent variable.

Table 5.7 Definitions of variables used in testing competition conditions and equilibrium	
Variable	Definition
ASSET	Bank total assets. *Total assets* include cash in hand and deposits with GCC central banks or monetary authorities, Government and other securities acceptable for refinancing with the GCC central banks or monetary authorities, loans and advances to credit institutions and customers less provisions, bonds and other fixed income securities, shares and other variable-income securities, participation in affiliated and non-affiliated companies, intangible assets, tangible fixed assets and other assets, as well as prepaid expenses and accrued income.
TREV	Total revenue to total assets. Total revenue includes interest revenue received from loans and advances, as well as other interest income, including interest from long-term claims, claims on banking activity, government securities, special deposits with the Bank of Greece as well as non-interest revenue, such as commissions and other revenues.
ROA	Return on assets is defined as net profits to total assets. *A net profit is* defined as gross operating profit less total operating results. Gross operating profit is defined as the sum of net interest revenue (interest revenue minus interest expenses) and non-interest revenue (participation revenue, revenue from trading portfolio, commissions, foreign currency transactions revenue, net capital gains and other revenue). Total operating results include wages and personnel expenses, general expenses, depreciation expenses and provisions.
PL	Personnel expenses per employee (unit price of labour). *Personnel expenses* include wages and salaries, social security contributions, contributions to pension funds and other related expenses.
PK	Capital expenses to fixed assets (unit price of capital). *Capital expenses* refer to depreciation expenses on a historical cost-basis balance sheet. *Fixed assets* include tangible fixed assets (land, lots, buildings and installations, furniture, office equipment, etc., less depreciation), as well as intangible fixed assets (goodwill, software, restructuring expenses, research and development expenses, minority interests, formation expenses, underwriting expenses, etc.).
PF	Ratio of annual interest expenses to own funds (unit price of funds). *Interest expenses* include interest paid on deposits and commission expenses and payments. *Own funds* include share capital, reserves (regular, extraordinary and special), subordinated debt, reserves paid in excess of par value and balance carried forward.
BRT	Number of branches to total number of branches. The ratio of a bank's number of branches to the number of branches of the whole banking system.
RISKAST	Provisions to total assets. *Provisions* include provisions for contingent liabilities and other provisions, such as staff pensions, depreciation of fixed assets and of previous year's expenses, etc.
H- statistic	H- statistic value is the sum of the factor price elasticity of PL, PK and PF.

Finally, PL, PK and PF are variables of the unit prices of the inputs of banks: labour, capital and funds or proxies of these prices. Table 5.7 summarises the definitions of variables used in assessing the competition conditions and equilibrium tests.

5.5.4 The hypothesis of H-*statistic* for testing competitive conditions

The nature of estimation of the H-statistic means that we are especially interested in understanding how total revenues react to variations in the cost figures. PL, PK and PF are the unit prices of the inputs of banks: labour, capital and funds or proxies of these prices. In the notation of equation (4), the *H statistic* reads as $(\alpha_1 + \alpha_2 + \alpha_3)$. Based on the HHI and CR*k* results shown in chapter 4, the author expects the H values for testing the competitive conditions in GCC to be greater than zero and less than one. It is, therefore, hypothesised that the banks in GCC gain their total revenue under monopolistic conditions.

Study hypothesis: (H_1) GCC banks gain their total revenue under monopolistic competitions.

Null hypothesis: (H_0) GCC banks do not gain their total revenue under monopolistic competitions.

5.5.5 The pooled least squares and the LSDV (fixed effect) models

We have assumed in our model that there is a common intercept across GCC commercial banks. In another words, there are no cross sectional differences not accounted for by the variables included in equation (4). Further, the implicit assumption in our model is that the effect of the cross sectional differences are limited to the intercept term. Such assumption is necessary as, according to Pindyck and Rubinfeld (1991), each separate cross-sectional regression would require a distinct model and the pooling would be wrong if the slopes were to vary over time and cross sectional units. In addition, in order to test the validity of the above assumption, our restricted model, equation (4) is tested for cross-sectional differences by adding 5 dummy variables so that the LSDV (fixed effect) model is as follows:

$$\mathbf{LnTREV} = \alpha_0 + \alpha_1 C_{2i} + \alpha_2 C_{3i} + \alpha_3 C_{4i} + \alpha_4 C_{5i} + \alpha_5 C_{6i} + (\alpha_6 \ln PL + \alpha_7 \ln PK + \alpha_8 \ln PF) + \alpha_9 \ln RISKAST + \alpha_{10} \ln ASSET + \alpha_{11} \ln BRT \qquad (6)$$

and for estimating equilibrium conditions, the LSDV (fixed effect) model is:

$$\mathbf{LnROA} = \beta_0 + \beta_1 C_{2i} + \beta_2 C_{3i} + \beta_3 C_{4i} + \beta_4 C_{5i} + \beta_5 C_{6i} + (\beta_6 \ln PL + \beta_7 \ln PK + \beta_8 \ln PF) + \beta_9 \ln RISKAST + \beta_{10} \ln ASSET + \beta_{11} \ln BRT \qquad (7)$$

where, C_{2i} = 1 if the observation belongs to Kuwait, 0 otherwise; C_{3i} =1 if the observation belongs to Oman, 0 otherwise; C_{4i} = 1 if the observation belongs to Qatar, 0 otherwise; C_{5i} = 1 if the observation belongs to Saudi Arabia, 0 otherwise; and C_{6i} = 1 if the observation belongs to UAE, 0 otherwise. We did not include a six dummy variable for Bahrain in order to avoid falling into the "dummy-variable trap". Equations 6 & 7 represent the unrestricted model in our test and are called the least-square dummy variable (LSDV) model as they use dummy variables in order to estimate the cross-sectional differences. Equations 6 & 7 are also known as the fixed effect model (FEM) due to the fact that "although the intercepts may differ across individuals (here the six countries), each individuals country's intercept does not vary over time; that is, it is time invariant" (Gujarati, 2003).

Our decision as to which model is better, the restricted model (equations 4 and 5) or the unrestricted model (equations 6 and 7), was based on statistical testing which required comparison of the error sum of the squares of the restricted model and the unrestricted model by employing the formal restricted F test. The formal equation for the F value is:

$$F = \frac{(R_{UR}^2 - R_R^2)/m}{(1 - R_{UR}^2)/(n-k)} \qquad (8)$$

Where:

R_{UR}^2 = the sum squared value of the unrestricted model (equation 2),

R_R^2 = the sum squared value of the restricted model (equation 1),

m = the number of linear restrictions (five in our example)[3],

k = the number of parameters in the unrestricted regression,

n = the number of observations.

During the F-test, our hypothesis for the cross-sectional differences is as follows:

H_0: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ for competition, and

H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ for equilibrium

which means that all the α 's and β's are simultaneously zero[4] where as for H_1 : Not all the α 's and β's are simultaneously zero.

The F-test is conducted for both the competition and equilibrium measures of the study, LnTrev and LnROA1. Therefore, the F ratios for LnTrev and LnROA1 are:

LnTrev = [(0.391995-0.244678)/ 5] / [(1-0.391995)/ (484-11)] = 22.92

LnROA1 = [(0.141890-0.078820)/ 5] / [(1-0.141890)/ (484-11)] = 6.95

The values have the *F* distribution with 5 linear restrictions and 473 degrees of freedom. At 5%, clearly these *F* values are statistically significant [$F_{0.5}$ (5,473) = 2.21]. The results of the test are presented in table 5.8.

[3] The value of m in the present case is 5, since there are five restrictions involved: $\alpha_1 = 0$, $\alpha_2 = 0$, $\alpha_3 = 0$, $\alpha_4 = 0$, $\alpha_5 = 0$.

[4] In the case of competition, H_0 implies that Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates are simultaneously unrelated determinants of competition. In the case of equilibrium, H_0 implies that Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates are simultaneously unrelated determinants of long-term equilibrium.

Table 5.8: Results of statistical test for cross-sectional differences					
Dependant variable	R_{UR}^2	R_R^2	F- statistic	Critical F-value at 5% level*	Conclusion
Trev	0.391995	0.244678	22.92	≈ 2.21	Reject H_0
ROA1	0.141890	0.078820	6.95	≈ 2.21	Reject H_0

*We have 5 degrees of freedom (df) in the numerator and 467 df in the denominator, $F_{0.05}(5,466)$.

According to the statistical results in the above table, and since the observed F values (22.92 and 6.95) exceed the critical value (2.21), the F value is statistically significant at five per cent. Therefore, we should reject the null hypothesis, which implies that the appropriate performance model is the constrained (unrestricted) regression, equations (6) and (7). Accordingly, we have continued our study with the LSDV model (fixed effect model) instead of the pooled least squares model. However, even though the conclusions and recommendations will be based on fixed effect model results, the study also presents the pooled aggregate results of the GCC banking industry.

5.6 Competitive conditions' empirical results

5.6.1 All GCC banks

Although previous studies generally employ OLS estimation methodology on the cross section yearly data, this could produce unstable results. This study employs panel regression methodology combining cross section and time series data. One of the advantages of having panel data is that it allows controlling for heterogeneity bias, or the confounding effects of omitted variables that are stable over time. It uses the fixed effects estimators, correcting for the effect of any combination of time-invariant variables that have been omitted, knowingly or not, from the regression model.

The competitive position tests for the fixed effects and pooled models are reported in table 5.9.

Table 5.9: P-R model results for the pooled and fixed effects of all GCC banks

Lntrev	Pooled	Fixed effects
Intercept	-1.465235 (-13.51804)***	0.676643 (2.342935)**
PK	0.051997 (2.794040)***	0.039720 (2.323662)**
PF	0.200258 (9.902313)***	0.241675 (12.53611)***
PL	-0.006792 (-1.429570)	0.189869 (4.890874)***
ASSET	-0.061637 (-2.845832)***	-0.350656 (-8.403306)***
BRT	-0.003443 (-0.284683)	0.178065 (8.280013)***
RISKAST	0.041695 (4.599913)***	0.037788 (4.578583)***
H-Value	0.24	0.47
Competitive condition	Monopolistic competition	Monopolistic competition
Adj. R^2	25%	39%
F-statistic	26.32119	28.48864
Prob(F-stat)	0.000000	0.000000
Wald test for H=1	786.1865 (0.000000)	141.5207 (0.000000)
Wald test for H=0	83.20197 (0.000000)	112.4269 (0.000000)
No. of observations	484	484

The values in parentheses are the t-statistics, *** Significant at 1%, ** significant at 5% and * significant at 10%. The Wald test is used to test the H= 0 and H= 1 hypotheses. The values in parentheses for the Wald tests are the significance levels where the null hypothesis can be rejected.

There is no evidence of multicollinearity among the independent variables. All tests confirm the good fit of the models. The estimated regression equations explained from 39% of the fixed effects and 25% of the pooled models' variability in the TREV equation. The results of the two models support our choice of fixed effects as mentioned in section 5.5.5. Therefore, the following focuses on competition using fixed effects model.

The H-statistic value (the sum of price elasticity: PL, PK, PF) was 0.47. As the researcher had expected, the overall results show that GCC banks were earning their total revenue under monopolistic competition for the period of the study. The regression coefficients for the unit price of labour, capital and fund were positive. The regression coefficients for the unit price of fund and the unit price of labour were positive and statistically significant at the 1% level of significance. The regression coefficient for the unit price of capital was positive and statistically significant at the 5% level of significance, indicating the direct effect of unit price of fund, labour and capital on total revenue. The BRT coefficient was positive and statistically significant at the 1% level of significance. The direct effect of the number of branches on the total revenue would seem to indicate, first, that the higher the number of branches, the higher the bank's total revenue. This will encourage banks to expand their branch network. Second, this result indicates that the GCC banking market is not saturated.

The regression coefficient for the Provisions to total assets, RISKAST, variable was positive and statistically significant at the 1% level of significance. This indicates that banks with higher provisions to assets in their balance sheet generate higher revenues per currency of assets.

The regression coefficient for ASSET variable (bank total assets) was negative and statistically significant at 1% level of significance. This implies that larger banks are less efficient than small banks; therefore, the former cannot depend on their size only to compete. This result is very important to banks' managers and policy makers at the central banks at the six GCC countries since it seems to imply that growth in size via mergers/ acquisitions may not be the most efficient and effective strategy (see chapters 6 and 7 for further discussion).

5.6.2 Country by country or pooling the data

While there are a number of advantages of using panel methods for estimation of the GCC as a whole, the rejection of the pooled specification raises the possibility that country specific differences may disguise country-bank specific differences and competitive differences within the GCC. Potential differences are thus explored by estimating Rosse-Panzar H-statistic for each country's banking industry.

One of the major limitations of this study is the small number of banks: the number with all data available ranged from a minimum of 5 banks in Oman to a maximum of 18 banks in the UAE. It is therefore, inappropriate to investigate the change in competitive conditions in each country over ten years by conducting year to year estimation. To overcome this limitation and to ensure a sufficient number of observations for robust results and reasonable conclusions, the study used a pooled cross-sectional time-series regression approach for each individual country, to deal with heteroscedasticity, cross-sectional dependence, and auto regression. However, because this method is capable only of processing data with the same number of time series observations across different cross-sections, we could only include in the sample banks that had data available for all explanatory variables during all time periods.

The decision as to which model is better, the restricted model (equations 4 and 5) or the unrestricted model (equations 6 and 7) was repeated for each individual country. The only change in these equations is that the dummy variables representing countries are changed to represent banks in each of the countries under study.

With the exception of the UAE, the F value was statistically significant at five per cent. We could therefore reject the null hypothesis, which implies that the appropriate performance model is the constrained (unrestricted) regression model, equations 6 and 7. Accordingly, we continued our study with the LSDV model (fixed effects model) instead of the pooled least squares model. The F value for the UAE was statistically insignificant at five per cent. The UAE was thus assessed based on the pooled least squares model. Table 5.10 summarises the results of the statistical tests.

Table 5.10: Results of statistical tests evaluating country by country cross-sectional differences

Country	F-value	Critical F-value at 5% level	Conclusion
Bahrain	8.15	≈ 2.45	Since the F-value exceeds the critical value, H_0 is rejected.
Kuwait	6.37	≈ 2.25	Since the F-value exceeds the critical value, H_0 is rejected.
Oman	16.11	≈ 3.48	Since the F-value exceeds the critical value, H_0 is rejected.
Qatar	6.67	≈ 2.45	Since the F-value exceeds the critical value, H_0 is rejected.
Saudi Arabia	12.59	≈ 2.04	Since the F-value exceeds the critical value, H_0 is rejected.
UAE	1.02	≈ 1.75	Since the F-value does not exceed the critical value, H_0 is not rejected.

5.6.3 country by country competition results

The results for individual country's estimates of competition are reported in Table 5.11. As indicated in the previous section, the UAE's competitive condition is estimated using the pooled model, and the other five countries are estimated using the fixed effects model.

The signs of the regression coefficients for the unit price of labour, capital and fund are mixed: Regression coefficients for the unit price of fund are positive and statistically significant at the 1% level of significance for Bahrain, Kuwait, Qatar, Saudi Arabia, and the UAE, indicating the direct effect of unit price of fund on total revenue for these countries' banks. Regression coefficient for the unit price of fund is positive and statistically insignificant for Oman, implying the weak direct effect of unit price of fund on total revenue for its banks.

The regression coefficients for the unit price of labour are positive and statistically significant at the 1% level of significance for Bahrain, Kuwait, and Saudi Arabia. The regression coefficients for the unit price of labour are positive and statistically significant at the 10% level of significance for Qatar, indicating the direct effect of unit price of labour on banks' total revenue for Bahrain, Kuwait, Saudi Arabia and Qatar.

Table 5.11: Country by country P-R model competition results

Lntrev	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE(pooled)
Intercept	5.443559 (4.967253)***	1.977308 (2.236442)**	-3.570912 (-2.484833)**	-2.168788 (-2.731716)***	2.605569 (1.685548)*	0.566587 (1.523684)
PK	-0.005335 (-0.136120)	0.027225 (1.008267)	-0.216897 (-1.613818)	0.076337 (2.030069)**	0.061844 (1.721147)*	0.014492 (0.529147)
PF	0.234434 (5.365359)***	0.549254 (13.26743)***	0.050228 (0.602072)	0.406191 (10.97727)***	0.326109 (10.32427)***	0.271149 (6.581330)***
PL	0.472184 (3.974093)***	0.468678 (5.068583)***	-0.010953 (-0.083008)	0.146464 (1.928540)*	0.616260 (4.395118)***	0.747934 (1.042450)
ASSET	-0.621952 (-6.166567)***	-0.125447 (-1.655103)	0.027950 (0.399966)	0.117807 (1.798735)*	-0.243888 (-2.286223)**	-0.169832 (-5.127098)***
BRT	0.826674 (3.642395)***	-0.050934 (-0.335215)	-0.191520 (-1.465525)	-0.082615 (-0.988303)	0.135305 (0.722321)	0.201145 (4.313080)***
RISKAST	-0.010779 (-0.503567)	0.006528 (0.603535)	0.051457 (2.157334)**	0.030974 (1.922890)*	0.013433 (0.883978)	0.039275 (2.090794)**
H-Value	0.70	1.0	-0.18	0.63	1.0	1.0
Competitive condition	Monopolistic competition	Perfect competition	Undetermined	Monopolistic competition	Perfect competition	Perfect competition
Adj. R^2	84%	83%	74%	85%	71%	44%
F-statistic	28.03305	27.45107	14.74449	29.00449	16.41724	19.80558
Prob(F-stat)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Wald test for H=1	6.310788 (0.015572)	0.208204 (0.649975)	40.52605 (0.000000)	27.33563 (0.000004)	0.001040 (0.974356)	0.001318 (0.971096)
Wald test for H=0	34.78189 (0.000000)	111.5342 (0.000000)	0.921971 (0.342873)	78.56930 (0.000000)	59.09738 (0.000000)	2.033107 (0.156132)
No. of observations	60	70	50	60	100	144

The values in parentheses are the t-statistics, *** Significant at 1%, ** significant at 5% and * significant at 10%. The Wald test is used to test the H= 0 and H= 1 hypotheses. The values in parentheses for the Wald tests are the levels of significance where the null hypothesis can be rejected.

The regression coefficients for the unit price of labour are positive and statistically insignificant for the UAE and negative and statistically insignificant for Oman indicating a weak direct effect of unit price of labour on banks' total revenues in the UAE and a weak opposite effect of unit price of labour on banks' total revenue for Oman.

The regression coefficients for the unit price of capital are positive and statistically significant at the 5% and 10% level of significance for Qatar and Saudi Arabia indicating the direct effect of unit price of capital on banks' total revenues in Qatar and Saudi Arabia. The regression coefficients for the unit price of capital are positive and statistically insignificance for Kuwait and the UAE, indicating a weak direct effect of capital on these two countries' banks' total revenue, and negative and statistically insignificant for Bahrain and Oman indicating a weak indirect effect of unit price of labour on these two countries' banks' total revenue.

The sign of the RISKAST variable was positive and statistically significant for Oman, the UAE and Qatar at 5%, 5% and 10% level of significance, respectively, suggests banks in these three countries with higher provisions to assets in their balance sheet generate higher revenues per currency of assets. The regression coefficient for the RISKAST variable was positive and statistically insignificant for Kuwait and Saudi Arabia implying that banks in these two countries with higher provisions to assets in their balance sheet may have generated higher revenues per currency of assets. On the other hand, the sign of the RISKAST variable is negative and statistically insignificant for Bahrain. This suggests that banks in this country with higher provisions to assets in their balance sheet may have generated lower revenues per currency of assets.

The regression coefficient of the ASSET variable was negative and statistically significant for Bahrain, the UAE and Saudi Arabia at 1%, 1% and 5% levels respectively. This suggests that size, in terms of assets, in these countries led to lower total revenue per currency of asset implying that larger banks were less efficient than small banks. The regression coefficient of the ASSET variable was negative and statistically insignificant for Kuwait. This suggests that size, in terms of assets, may have led to lower total revenue per Dinar of asset. On the other hand, the regression coefficient of the ASSET variable was positive and statistically significant at 10% for Qatar. This implies that size of banks in Qatar led to an increase in total revenue per Riyal of asset inferring that larger banks seemed to be more efficient compared to smaller banks. The regression coefficient of the ASSET variable was positive and insignificant for Oman, suggesting that size may have led to an increase in total revenue per Riyal of asset.

The regression coefficient of the variable relating to bank market share effects in terms of branches, BR, was positive and significant for Bahrain and UAE, suggesting that a greater number of a bank's branches give higher total revenue in Bahrain and the UAE. The coefficient of BRT was positive and insignificant in Saudi Arabia, suggesting that a greater number of a bank's branches may give higher total revenue. These findings suggest that Bahrain and the UAE were not over branched and there was scope of branch expansion where in Saudi Arabia the limit to the number of branches viable in the market may have been reached, thus, further expansion in branch numbers might lead to lower total revenue.

On the other hand, the BRT regression coefficient was negative and insignificant for Kuwait, Oman and Qatar, suggesting that in these countries higher number of branches may have led to lower total revenue. This implies that Kuwait, Oman and Qatar were over branched and the local authorities should consider slowing down the growth of the number of branches, bearing in mind that these three countries had the highest growth in branches for the period 1995 to 2002 (table 5.1).

The H-statistic value (the sum of price elasticity: PL, PK, PF) was 1.0 for Kuwait, Saudi Arabia and UAE, indicating that banks in these three countries earned their revenue under perfect competition. These results support the measurement of concentration shown in table 4.17 in chapter 4. However, H-statistics values were 0.73 and 0.63 for Bahrain and Qatar, respectively, indicating that banks in these two countries earned their revenue under monopolistic competition. These results also supported with the measurement of concentration shown in table 4.17 in chapter 4. On the other hand, the H-statistic value was -0.18 for Oman, which did not support the concentration measurements of concentration shown in table 4.17 in chapter 4, since Qatar had higher CR*k* and HHI than Oman, yet was considered at a monopolistic competition. However, the estimated value of H for Oman did not significantly differ from zero or from some small positive number. In addition, because none of the regression coefficients for the unit price of capital, fund, and labour were significant, we can not reject the hypothesis of monopolistic competition for Oman. Thus, the competition in this country could be considered "Undetermined" competition rather than monopoly.

The Wald test results confirmed perfect competition in Kuwait, Saudi Arabia and the UAE. The test confirmed monopolistic competition in Bahrain and Qatar and undetermined competition in Oman.

5.7 Equilibrium Test

Since the P-R model is only valid if the market is in equilibrium, the study also estimated equation (5) for all GCC banks and for each country. This empirical test was justified on the grounds that competitive banking markets will equalise risk-adjusted rates of return across banks such that, in equilibrium, rates of return are not correlated statistically with input prices. Under long-run competitive equilibrium an increase in average costs, in the short term, reduces revenues, leading to the exit of incumbents. This exist will increase the demand for the remaining incumbents. Following established theory, in the long run, an unchanged equilibrium level of output is expected. A proportional increase in revenue for the remaining incumbents will give a value of unity for the H statistic (Ashton, 2000). It should be noted that equilibrium does not mean that competitive conditions are not allowed to change during the sample period. It only implies that changes in banking are taken as gradual.

The long-run equilibrium test measures the sum of elasticity of return on assets with respect to input prices. As suggested by different authors (see, for example, Molyneux et al., 1994), one should verify that input prices are not correlated with industry returns. To implement such a test, the author computed a "modified" version of the Panzar-Rosse statistics by running equations (6 and 7) with the ratio return on assets (ROA) as the dependent variable. Because ROA can take on small negative values, following Claessens and Laeven (2003 and 2004) and Utrero-Gonzalez (2004), the study computes the dependent variable as ROA1 = Ln (1+ROA) where ROA is the unadjusted return on assets. The author defined the equilibrium H-statistic as ($\beta_1 + \beta_2 + \beta_3$) and tested whether ($\beta_1 + \beta_2 + \beta_3$) = 0, using a Wald Test to obtain F-statistics. H = 0 implies that the data are in equilibrium. If rejected, the market is assumed not to be in equilibrium. However, if the sample is not in long-run equilibrium, since it is the case that $H < 0$ no longer proves monopoly, it remains true that $H > 0$ disproves monopoly or conjectural variation short-run oligopoly (Shaffer, 1985).

5.7.1 Equilibrium empirical results

5.7.1.1 All GCC banks

The equilibrium tests for the fixed effects and pooled models are reported in table 5.12. The test confirmed the good fit of the fixed effects model. The results derived from the two models supported the choice of the fixed effects model as mentioned in section 5.5.5. Therefore, the following explains the equilibrium using the fixed effects model. The H-statistic value (the sum of price elasticity: PL, PK, PF) was equal to zero. The overall result thus confirms that GCC banks were earning their total revenue under long term equilibrium of monopolistic competition for the period of the study.

Table 5.12: P-R model equilibrium aggregate results of the GCC banking industry

Ln(1+ROA)	Fixed effects	Pooled
Intercept	0.043028 (4.994025)***	0.004155 (1.382331)
PK	-0.001910 (-3.745159)***	-0.001671 (-3.238312)***
PF	-0.001172 (-2.037491)**	-0.001827 (-3.258272)***
PL	0.004304 (3.716191)***	0.000450 (3.414730)***
ASSET	-0.007402 (-5.945740)***	-0.002390 (-3.978606)***
BRT	0.003383 (5.272608)***	0.000281 (0.838638)
RISKAST	-0.000663 (-2.691099)***	-0.000611 (-2.430594)**
H-Value	0.00	0.00
Equilibrium test	Equilibrium	Equilibrium
Adj. R^2	14%	8%
F-statistic	8.050013	7.688253
Prob(F-stat)	0.000000	0.000000
Wald test for H=0	0.849660 (0.357134)	16.68881 (0.000052)
No. of observations	484	484

The values in parentheses are the t-statistics, *** Significant at 1%, ** significant at 5% and * significant at 10%. The Wald test is used to test the H= 0 hypothesis. The values in parentheses for the Wald tests are the levels of significance where the null hypothesis can be rejected.

5.7.1.2 country by country long-term equilibrium results

The results for estimation of individual countries' long-term equilibrium are reported in Table 5.13. As it was indicated in section 5.5.5, the UAE's long-term equilibrium was estimated using the pooled model. That of the other five countries was estimated by using fixed effects model. The test results for Bahrain, Oman, Qatar and Saudi Arabia, Kuwait and the UAE show that we can not reject the null hypothesis, confirming long term equilibrium in these four countries.

Table 5.13: Country by country equilibrium results for GCC banking markets

Ln(1+ROA)	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE(pooled)
Intercept	0.072821 (2.167342)**	0.020224 (0.675546)	0.003240 (0.110243)	-0.090256 (-2.025056)**	0.003142 (0.046171)	0.068804 (5.454787)***
PK	-0.000648 (-0.539413)	0.000576 (0.629485)	-0.001868 (-0.679602)	0.000386 (0.182822)	0.000965 (0.610054)	-0.005634 (-6.064227)***
PF	0.001326 (0.990045)	0.001921 (1.370745)	-0.001801 (-1.055626)	-0.000778 (-0.374317)	-0.000464 (-0.333946)	0.001043 (0.746052)
PL	0.000658 (0.180684)	0.007272 (2.322465)**	0.001529 (0.566720)	-0.002330 (-0.546472)	0.007637 (1.237209)	0.064622 (2.655250)***
ASSET	-0.006083 (-1.967310)*	0.001808 (0.704345)	-0.000738 (-0.516571)	0.007606 (2.068801)**	6.62E-05 (0.014087)	-0.006374 (-5.672631)***
BRT	0.0131462 (1.934680)*	-0.005171 (-1.004998)	0.004627 (1.731395)*	-0.005204 (-1.109039)	0.002758 (0.334463)	0.006964 (4.402306)***
RISKAST	-0.000735 (-1.120418)	-0.000220 (-0.601052)	-0.002208 (-4.526493)***	-0.001897 (-2.098205)**	-0.002960 (-4.424502)***	-0.000484 (-0.759817)
H-Value	0.00	0.00	0.00	0.00	0.00	0.00
Equilibrium test	Equilibrium	Equilibrium	Equilibrium	Equilibrium	Equilibrium	Equilibrium
Adj. R^2	32%	45%	41%	4%	52%	26%
F-statistic	3.444883	5.538031	4.458451	1.232378	7.669653	9.632614
Prob(F-stat)	0.001499	0.000004	0.000328	0.294467	0.000000	0.000000
Wald test for H=0	0.134367 (0.715627)	8.498168 (0.513400)	0.319887 (0.574915)	0.466721 (0.498002)	2.002358 (0.160985)	5.960653 (0.158760)
No. of observations	60	70	50	60	100	144

The values in parentheses are the t-statistics, *** Significant at 1%, ** significant at 5% and * significant at 10%. The Wald test is used to test the H= 0 hypothesis. The values in parentheses for the Wald tests are the levels of significance where the null hypothesis can be rejected.

5.8 The conclusion

This chapter assessed the concentration and competitive conditions of the GCC banking industry during the period 1993-2002, and evaluated the monopoly power of banks. Table 5.14 summarises concentration and competitive condition findings in GCC countries.

Table 5.14: Summary of the findings

Test\Country	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE
CR_2 deposit*	0.66	0.49	0.66	0.70	0.38	0.34
CR_3 deposit*	0.79	0.62	0.81	0.81	0.51	0.44
HHI deposit*	2351	1897	2712	3565	1298	1064
H-statistic value	0.7	1.0	-0.18	0.63	1.0	1.0
Competitive condition	Monopolistic competition	Perfect competition	undetermined	Monopolistic competition	Perfect competition	Perfect competition

* CR and HHI results are for the year 2002 (from chapter 4).

The results show that Kuwait, Saudi Arabia and UAE had un-concentrated markets and were moving to less concentrated positions as shown in chapter 4. The P-R results, perfect competition in these three countries, supported the results of measures of concentration, CR*k* and HHI.

On the other hand, CR*k* and HHI values showed that Qatar, Bahrain and Oman were very concentrated markets. However, the H-statistic value (the sum of price elasticity: PL, PK, PF) indicated Bahrain and Qatar banks made their revenue in monopolistic competition, even though Oman has a lower concentration ratio compare to Qatar as indicated by CR_2, CR_3 and HHI ratios. None of the coefficients of the variables PL, PK and PF are significant in Oman; therefore, the H-value was less than zero. The result was not robust, perhaps explaining Oman's bank result, and the consequent conclusion that banks in Oman were making their total revenue under "undetermined" competition environment.

Even though the author expected low competitive behaviour in all six countries, the H-statistic value (the sum of price elasticity: PL, PK, PF) was 1.0 for Kuwait, Saudi Arabia and UAE, indicating that the banks in these three countries earned their revenue under perfect competition. This could be explained by either the presence of foreign banks in these countries or the prepared ness of these three countries for entering the WTO and the future existence of more foreign banks in their land. The H-statistics was 0.70 and 0.63 for Bahrain and Qatar, respectively, indicating that banks in these two countries earned their revenue under monopolistic competition.

The F-statistic for testing the hypothesis H_0 (GCC banks do not gain their total revenue under monopolistic competitions) indicates that the research can reject the null hypothesis at 0.01% level of significance for banks in the GCC region as a whole. However, the F-statistic for testing hypothesis H_0 country by country shows individual differences. The research findings reject the null hypothesis for Bahrain and Qatar since banks in these two countries gain their total revenue under monopolistic competition. The research accepts the null hypothesis for Kuwait, Saudi Arabia, and the UAE since banks in these three countries earn their total revenue under perfect competition. In addition, the research accepts the null hypothesis for Oman since its banks were gaining their total revenue under an "undetermined" competition environment.

However, we should be cautious with the result of Panzar-Rosse model. As Perrakias (1991) stated, unfortunately the size of H tells us very little about the competitiveness of the sector, except in the extreme cases of monopoly (or perfect collusion) and perfectly competitive long-run equilibrium. Another drawback of the Panzar-Rosse test is that it can give misleading results under a variety of circumstances, such as when the number of banks in the sample has not fully adjusted to market conditions; the direction of bias in this case is always towards a spurious appearance of market power (Shaffer, 1982, 1983). Third, studying all banks may lead to a distorted measure of all overall competitiveness of a banking system, because small banks may operate in local markets that are less competitive (Claessens and Laeven, 2004). The next chapter focuses on technical efficiency and change in productivity.

CHAPTER 6

TECHNICAL EFFICIENCY AND CHANGE IN PRODUCTIVITY

6.1 Introduction

It was mentioned in the earlier chapters that a sound and efficient financial system is the most important prerequisite for savings and investment decisions and thus economic growth. Economists have long recognised that financial markets in general, and banks in particular, play a vital role in the efficient functioning and development of any economy. In developing countries, the development of the banking and financial system may reflect the extent of importance given by the country to this vital sector, which can be largely relied upon to achieve the desired growth in the national economy. The performance of financial institutions is crucial for the well-being of the whole economy and has attracted the attention of many researchers. Berger and Humphrey (1997) surveyed 130 studies that had applied frontier-efficiency analyses to financial institutions in more than 20 different countries. The majority of studies were limited to the U.S. banking industry, and they therefore emphasized for the need to examine the efficiency of banks outside the United States. This makes study more interesting since the GCC countries have ever been left untouched.

The banking industry in GCC countries has developed at a rapid pace during the transitional period, shifting from the domination of foreign banks, which in some countries had been acting as central banks, to a free market system with many national banks. The changes have resulted in more even distribution of the industry's output and higher competition in the sector. Thus, the GCC banking industry faces an increasingly complex operating environment and has to exhibit superior performance and efficiency in order to remain profitable. However, even more challenging developments are yet to come. New regulations are expected to be fully enforced by 2010 to implement a single currency.

Accession to the WTO will both open up new markets and further increase competition, which will impact on both the banking industry as a whole and banks on an individual basis. Minimising costs, pursuing potential scale efficiencies and achieving given output levels more efficiently, i.e. with lower levels of imputes, are all likely to become issues of highest concern for the GCC banking industry. The study therefore devised the following research questions:

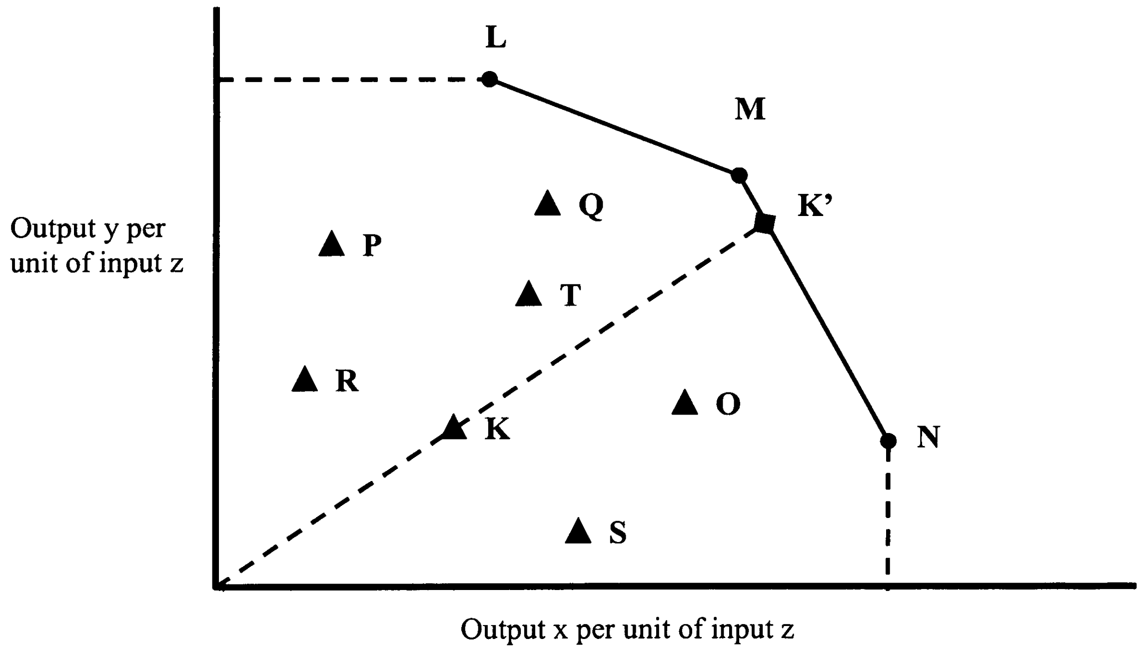
1. How is the efficiency of GCC banks related to bank size and specialisation?
2. Does efficiency differ across GCC countries?
3. How did efficiency develop during the period 1993-2002?
4. Is there a potential for unutilised economies of scale; is consolidation desirable in the banking sector?
5. What are the factors affecting efficiency?
6. How did productivity develop during the period 1993-2002?

The chapter is organised into nine sections. Section 2 illustrates Data Envelopment Analysis approach. Types of returns to scale are explained in section 3 while the methodology approach in calculating technical, pure technical and scale efficiency is detailed in section 4. Section 5 shows how productivity changes are measured during the sample period, while data is presented in section 6. Section 7 presents derived from the methodology is the efficiency empirical results. Productivity empirical results are described in section 8, and section 9 concludes the chapter.

6.2 Data Envelopment Analysis

The DEA problem can be illustrated using a simple example. Consider the case where we have a group of ten banks producing two outputs. Assume for simplicity, that each bank has identical input vectors. These ten banks are depicted in Figure 6.1.

Figure 6.1: A two-output, one-input DEA Model showing the efficient frontier



The solid line going through efficient banks L, M and N depicts the efficient frontier that represents achieved efficiency. Clearly, the efficient frontier envelops all other points, thus giving the name *data envelopment analysis (DEA)*. For example, bank k is classified as inefficient in this sample of ten banks, and it needs to travel to K' on the frontier before it can also be deemed efficient. Bank k would be directly compared to banks M and N on the efficient frontier (i.e. its reference set or peer group) in calculating its efficiency score. In this case, bank M makes a greater contribution to bank K's score.

Bank K is an inefficient bank. For bank K the technical efficiency score is equal to

$$TE_K = 0K/0\,K' \qquad (1)$$

and its peers are banks M and N. In the DEA output listing, this bank would have a technical efficiency score of approximately 45 per cent. For bank Q, the technical efficiency score is equal to

$$TE_Q = 0Q/0Q' \qquad (2)$$

and its peers are banks L and M. In the DEA output listing, this bank would have a technical efficiency score of approximately 90 per cent. Note that the DEA output listing for banks L, M and N would provide technical efficiency scores equal to one and each bank would be its own peer.

6.2.1 DEA Models

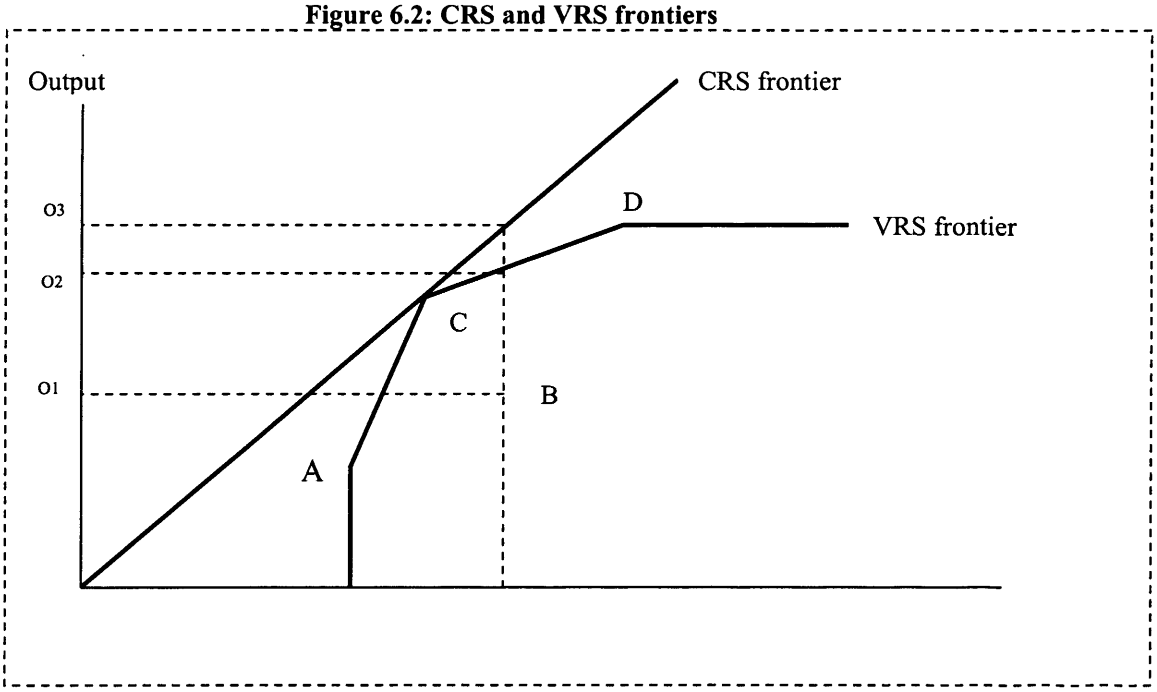
DEA is a non-parametric linear programming technique that computes a comparative ratio of outputs to inputs for each unit, which is reported as the relative efficiency score. The efficiency score is usually expressed as either a number between zero and one or 0 and 100 per cent. A decision-making unit with a score less than one is deemed inefficient relative to other units. Traditional DEA measures the technical efficiency of decision-making units (DMUs) as opposed to their allocative efficiency. In the context of DEA, allocative efficiency is defined as the effective choice of inputs vis-à-vis prices with the objective of minimising production costs (i.e. selection of an effective production plan), whereas technical efficiency investigates how well the production process converts inputs into outputs (i.e. effective implementation of the production plan) (Avkiran, 1999). Charnes, Cooper and Rhodes (1978), assuming constant returns to scale (CRS) and strong disposability of inputs (and outputs), developed the generic DEA model, called CCR, in 1978. The CCR model drew upon Farrell's work (1957) using the mathematical programming knowledge of Charnes and Cooper (1962). In 1984, this model was extended to account for variable returns to scale (VRS) by Banker, Charnes and Cooper (1984), originating the model known as BCC. The BCC model represents the VRS by adding a convexity constraint to ensure that an inefficient bank is only compared against a bank of similar size. If we compute a CRS and a VRS DEA, we may obtain a scale efficiency (SE) measure for each bank. Hence, CRS technical efficiency measure can be decomposed into pure technical efficiency (PTE) and scale efficiency (SE).

6.2.2 CRS and VRS frontiers

The envelopment surface will differ depending on the scale assumptions that underpin the model. Two scale assumptions are generally employed: constant returns to scale (CRS), and variable returns to scale (VRS) (Coelli et al. 1998; and Avkiran, 1999). The latter encompasses both increasing and decreasing returns to scale. CRS reflects the fact that output will change by the same proportion as inputs are changed (e.g. a doubling of all inputs will double output); VRS reflects the fact that production technology may exhibit increasing, constant and decreasing returns to scale. Input and output-based capacity measures are only equivalent under the assumption of constant returns to scale. Cooper, Seiford and Tone (2000) discussed methods for determining returns to scale. In essence, the researcher examines the technical efficiency given different returns to scale, and determines whether the observed levels are along the frontier corresponding to a particular return to scale.

The effect of the scale assumption on the measure of capacity utilisation is demonstrated in Figure 6.2. Four data points (A, B, C, and D) are used to estimate the efficient frontier and the level of capacity utilisation under both scale assumptions. Note that only fixed inputs are considered in Figure 6.2. The frontier defines the full capacity output given the level of fixed inputs. With constant returns to scale, the frontier is defined by point C for all points along the frontier, with all other points falling below the frontier (hence indicating capacity underutilisation). With variable returns to scale, points A, C and D, define the frontier and only point B lies below the frontier i.e. exhibits capacity underutilisation. The capacity output corresponding to variable returns to scale is lower than the capacity output corresponding to constant return to scale.

Figure 6.2: CRS and VRS frontiers



6.2.3 Mathematical specification of the DEA approach

Technically speaking, DEA is an approach rather then a model. Unlike the Stochastic frontier approach (SFA), where the parameter estimates represent the production elasticises, the resultant weights associated with the input variables have no economic interpretation. They simply define the relative contribution of reference points on the frontier to the estimation of efficient or capacity output for the point under examination. As a result, it is a method for estimating efficiency and capacity utilisation. Models can be developed, however, to assess allocative and scale efficiencies, congestion, and overall economic efficiency (Färe, Grosskopf and Kirkley, 2000). Linear programming (LP) models are developed to undertake DEA, and for purposes of simplicity, these can be referred to as DEA LP models.

6.2.4 CRS model

The following CRS model measures overall technical efficiency for each of the sample banks. The objective function is to maximise the efficiency score E for bank k, subject to the constraints that no bank will be more than 100% efficient and the coefficient values are positive and non-zero when the same set of u and v coefficients (weights) are applied to all other banks being compared.

An output-oriented approach is generally more appropriate for the estimation of capacity and capacity utilisation. Following Färe, Grosskopf and Kokkelenberg (1989), and Färe, Grosskopf and Lovell (1994), the output-oriented DEA LP model of capacity output given current use of inputs is given as:

$$\text{Max. } E_k = \Sigma\, u_r Y_{rk} \qquad\qquad r = 1,\ldots,s$$

Subject to

$$\Sigma\, v_i X_{ik} = 1, \qquad i = 1,\ldots,m$$

$$\Sigma u_r Y_{rj} - \Sigma\, v_i X_{ij} \leq 0 \qquad j = 1,\ldots,n$$

$$v_{1,\ldots,} v_s > 0$$

$$u_{1,\ldots,} u_m > 0$$

where E_k is the efficiency score for bank k.

Input and output variables are as follows:

Y_{rk}: the actual amount of output r produced by bank k.

X_{ik}: the actual amount of input I used by bank k.

u_r: the weight to output r, computed in the solution by the DEA model.

v_i: the weight to input i, computed in the solution by the DEA model.

6.2.5 VRS model

According to Coelli, Rao and Battese (1998), the constant returns to scale (CRS) DEA model is only appropriate when the bank is operating at an optimal scale. Some factors such as imperfect competition, constraints on finance, etc. may cause the bank not to be operating at an optimal level in practice. To allow for this possibility, Banker, Charnes and Cooper (1984) introduced the variable returns to scale (VRS) DEA model.

The following VRS model, though similar to the CRS model, measures pure technical efficiency and returns to scale for each of the sample banks. Scale efficiency can be measured by dividing the CRS efficiency score by the VRS efficiency score. From the VRS model, it is possible to analyse whether a bank's production indicates increasing, constant, or decreasing return to scale by the sign of the variable w. Increasing returns to scale exist if the w_k is greater than zero ($w_k > 0$), constant returns to scale if the value of w_k is equal to zero (w_k=0), and decreasing returns to scale if the value of w_k is less than zero (w_k<0).

Following Fare, Grosskopf and Lovell (1985), Coelli, Rao and Battese (1998) and Sharma, Leung and Zaleski (1999), the VRS model is presented below:

$$\text{Max. } E_k=\sum u_r Y_{rk} + w_k \qquad r = 1,\ldots,s$$

Subject to

$$\sum v_i X_{ik} = 1, \qquad i = 1,\ldots,m$$

$$\sum u_r Y_{rj} - \sum v_i X_{ij} + w_k \leq 0, \qquad j = 1, \ldots,n$$

$$v_1,\ldots, v_s>0$$

$$u_1,\ldots, u_m>0$$

6.2.6 DEA Strengths and Weaknesses

An advantage of DEA is that there is no preconceived structure imposed on the data in determining the efficient units (Banker, 1984; Al-Faraj et al., 1993; Burley, 1995; Mester, 1996; Avkiran, 1999), that is, DEA does not assume a particular production technology or correspondence. The importance of this feature of DEA is that a bank's efficiency can be assessed based on other observed performance. As an efficient frontier technique, DEA identifies the inefficiency in a particular DMU by comparing it to similar DMUs regarded as efficient, rather than trying to associate a DMU's performance with statistical averages that may not be applicable to that DMU.

DEA main features are related to the fact that DEA does not prescribe an underlying functional form for the efficient frontier and it does not give specific values to the weights. The DEA technique is said to be empirically based, in contrast to parametric and statistical approaches to measuring efficiency. DEA has both strengths and limitations. Coelli (1995), among many others, indicated that the DEA approach has two main advantages in estimating efficiency scores. First, it does not require the assumption of a functional form to specify the relationship between inputs and outputs. This implies that one can avoid unnecessary restrictions relating to functional form that can affect the analysis and distort efficiency measures, as mentioned by Frasier and Cordina (1999). Second, the approach does not require the distributional assumption of the inefficiency term.

On the other hand, DEA has several shortcomings in that it is very sensitive to outliers, is very demanding concerning the required information and does not allow the associated error measurement either to test statistically the results or the specified models. The principal disadvantage of DEA is that it assumes data are free of measurement error (Mester, 1996). When the integrity of data has been violated, DEA results cannot be interpreted with confidence. While the need for reliable data is the same for all statistical analyses, DEA is particularly sensitive to unreliable data because the units deemed efficient determine the efficient frontier and, thus, the efficiency scores of those units under this frontier.

6.3 Types of returns to scale

Decomposing technical efficiency (TE) into pure technical efficiency (PTE) and scale efficiency (SE) allows an insight into the source of inefficiencies. It also helps determine whether banks have been operating at optimal returns to scale (ORS), increasing returns to scale (IRS), or decreasing returns to scale (DRS). The CRS efficiency score represents technical efficiency which measures inefficiencies due to the input/output configuration as well as the size of operations. On the other hand, the VRS efficiency score represents pure technical efficiency, that is, a measure of efficiency without scale efficiency. It is thus possible to decompose TE into PTE and SE. Scale efficiency can be calculated by dividing PTE into TE (Coelli et al., 1998; Avkiran, 1999).

6.3.1 Constant returns to scale

It would be expected to observe constant returns where the typical firm (or industry) consists of a large number of units doing pretty much the same thing, so that output can be expanded or contracted by increasing or decreasing the number of units. In the days before computer controls, machinery was a good example. Essentially, one machinist used one machine tool to perform a series of operations to produce one item of a specific kind—and to double the output the number of machinists and machine tools had to be doubled. Constant Returns to Scale is also known as "constant costs". Both phrases mean exactly the same.

6.3.2 Increasing returns to scale

Economists usually explain "increasing returns to scale" by indivisibility. That is, some methods of production can only work on a large scale—either because they require large scale machinery, or because they require a great deal of division of labour. Since these large-scale methods cannot be divided up to produce small amounts of output, it is necessary to use less productive methods to produce smaller amounts. Thus, costs increase less than in proportion to output—and average costs decline as output increases. Increasing Returns to Scale is also known as "economies of scale" and as "decreasing costs". All three phrases mean the same.

6.3.3 Decreasing returns to scale

A unit is said to operate at decreasing returns to scale (DRS) if a proportionate increase in all of its inputs results in a less than proportionate increase in its outputs. If for a given DMU, the sum of the dual weights in the dual model is greater than 1 (i.e. Sum (Lambda)>1), then that unit can be said to operate at DRS, assuming it is technically efficient (see Banker and Morey (1986) or Banker and Thrall (1992) for an in depth analysis).

Decreasing returns to scale are associated with problems of management of large, multi-unit firms. In a firm in which production takes place by a large number of units doing pretty much the same thing, the different units need to be coordinated by a central management. The management faces a trade-off. If too little is spent on management, coordination will be poor, leading to waste of resources, and higher cost. If a lot is spent on management, this will raise costs in itself. The idea is that the bigger the output is, the more units there are, and the worse this trade-off becomes—so, costs rise either way. Decreasing Returns to Scale is also known as "diseconomies of scale" and as "increasing costs".

6.4 Methodologies

6.4.1 Methodology Used

A bank is said to be technically efficient (TE) if it operates on the efficient frontier and allocatively efficient (AE) if it is properly choosing the correct mix of inputs given the input prices. Technical efficiency (TE) can be decomposed into pure-technical efficiency (PTE) and scale efficiency (SE). Pure-technical inefficiency results from using more inputs than necessary (input waste), while scale-inefficiency occurs if the bank does not operate at a constant return to scale.

Several alternative models have been introduced in the DEA literature (see Charnes *et al.*, 1994, for details). Each of these models seeks to determine which Decision Making Units (DMUs) establish the best efficiency frontier. The DEA model employed defines the shape of the efficiency frontier.

6.4.2 The DEA Methodology

This study uses the CCR (Charnes, Cooper and Rhodes, 1978) as well as the BCC (Banker, Charnes and Cooper, 1984) input oriented models, where the first model assumes constant returns to scale, and the second assumes variable-returns-to scale.

The analysis presented in this chapter uses standard DEA techniques to estimate technical, pure technical, and scale efficiency, using an input-orientation. An innovative feature of the analysis is the estimation of *cross-frontier efficiencies,* where Islamic banks are compared to a reference set consisting of all commercial banks and commercial banks are compared to a reference set consisting of all Islamic banks.

6.4.3 The hypotheses for testing overall, pure technical, and scale efficiency

The study is interested in understanding the relationships between technical efficiency and its two components (pure technical efficiency and scale efficiency) and bank size, number of branches, specialisation and country. Since there are big similarities in the economies and the banking environment's conditions of GCC countries, the author expects that technical efficiency and its two components to be at the similar levels with bank size, number of branches, specialisation and country. It is, therefore, hypothesised that:

First study hypothesis: (H_{1_1}) There was an inverse relationship between size and technical efficiency. (H_{0_1}) rejects the first hypothesis.

Second study hypothesis: (H_{1_2}) There was an inverse relationship between number of branches and technical efficiency. (H_{0_2}) rejects the second hypothesis.

Third study hypothesis: (H_{1_3}) GCC banks (in each country) had different technical, pure technical, and scale efficiency scores. (H_{0_3}) rejects the third hypothesis.

Fourth study hypothesis: (H_{1_4}) GCC Islamic banks were more efficient than commercial banks. (H_{0_4}) rejects the fourth hypothesis.

6.4.4 Estimation Strategy

Since the data is a pooled cross section and time series, several possibilities arise within the computation of efficiency, using DEA. According to Estache, Rossi and Ruzzier (2004), three alternative approaches are possible. The first alternative would be to compute a frontier for each ten periods and to compare each of these cross-section results. This way, a frontier is constructed in each year and the efficiency of each bank is calculated relative to the frontier in each period. The second possibility is to treat the panel as a single cross-section (each bank in each period considered as an independent observation), pooling all the 484 observations together. With this approach, a single frontier is computed, and the relative efficiency of each bank in each period is calculated in reference to this single frontier. The last approach would be the window analysis approach proposed by Charnes et al. (1985). The problem with this approach, however, is that the choice of width for the windows poses an additional complication given that it is entirely ad hoc, and "currently determined by trial and error" (Charnes et al., 1994).

Section 6.4.3 stated the study's hypotheses that this chapter endeavours to investigate. Thus, is it more appropriate to test efficiency scores based on pooled efficiency scores with all bank efficiencies estimated relative to a common frontier or own-frontier efficiency scores with efficiencies estimated separately for size, specialisation, and country?

Since our sample consists of 7 Islamic banks only out of the total sample of 52 banks, it is not possible to construct own-frontier for Islamic banks because the research uses 3 inputs and 4 outputs to test the technical, pure technical, and scale efficiency and this requires many observations. Therefore, it is statistically sounder to analyse Islamic banks together with commercial banks as one frontier. Also, the study aims to test changes in efficiency during the ten year period and running one pooled frontier will not satisfy this aim. In addition, Oman has only 5 banks, while Bahrain and Qatar have 6 banks each. Kuwait, Saudi Arabia and UAE have 7, 10 and 18 banks respectively. Therefore, it is not possible to run country own-frontier on a yearly basis. Running the whole panel of 484 observations as a single cross-section is inappropriate as well and, as a result, the research cannot test efficiency and productivity changes over time.

This study follows the first approach by conducting "yearly cross-frontier efficiency analysis", where commercial and Islamic banks in all the GCC countries are pooled together on a yearly basis for ten periods. Commercial banks' scores are compared to Islamic banks' scores in each year. This approach allows us to see not only the difference in scope between specialisation of bank, but also the difference in size, bank branches, and among the six countries.

This strategy enables robust results and identifies ten years' efficiency and productivity changes for each bank, each country and each bank specialisation and, of course, analysis of each year. This strategy guarantees a 52 bank observation for the last eight years (1995-2002) and 34 banks in the first two years (1993 and 1994)[1]. In addition, this strategy gives the freedom of choosing a reasonable number of inputs and outputs.

A comparative study of overall technical, pure technical, and scale efficiency among the six GCC countries is undertaken. In addition, the shift of efficiency over the ten years is analysed. Moreover, the relationships between technical efficiency and its two components (pure technical efficiency and scale efficiency) and bank size, number of branches, specialisation and country are examined. A regression test is conducted to see the factors that effect efficiency. Finally, the Malmquist productivity index, which shows the efficiency, technology and TFP changes for GCC countries, is also investigated.

6.4.5 The Sample size

In order to discriminate effectively between efficient and inefficient banks, there is a need for a sample size larger than the product of number of inputs and outputs (Dyson et al., 1998). However, DEA can be used with small sample sizes (Evanoff and Israilevich, 1991) and many such examples can be found in the literature (e.g. Sherman and Gold, 1985; Parkan, 1987; Oral and Yolalan, 1990; and Haag and Jaska (1995). Examples of DEA studies that also use small samples include Oral and Yolalan (1990) with 20 observations; Vaissiloglou and Giokas (1990) with 20 observations; Giokas (1991) with 17 observations; Haag and Jaska (1995) with 14 observations; and Avkiran

[1] This difference stems from the unavailability of data for 18 UAE banks for the years 1993 and 1994.

(1999) with 16 observations. Curiously, Oral and Yolalan (1990) employ an input/output product that is equal to their sample size (20 for each).

Another rule of thumb for selecting an appropriate sample size is to ensure that the sample size is at least three times larger than the sum of number of inputs and outputs (Stern et al., 1994). The product of inputs times outputs in a DEA application should optimally be less than the sample size in order to effectively discriminate among banks. Therefore, this study's sample size satisfies the requirements to run a robust analysis.

6.4.6 Input and output variables

Defining inputs and outputs is a critical step in executing efficiency assessment using the Data Envelopment Analysis technique. Analysis of several previous studies, however, reveals no one correct way of doing this. Various researchers argue in favour of choosing slightly different inputs and different outputs for banks, making this step of analysis more complicated.

The choice of bank inputs and outputs remains an issue for debate. This is due to different perceptions of the ideal function of the bank, the differences in the focus of study, and the types of data available. Siems and Barr (1998) outlined key considerations in choosing appropriate inputs and outputs of the bank. Both must reflect their importance and contribution in attracting deposits and making loans and advances.

Two main approaches can be used to determine what constitutes bank input and output. In *the intermediation approach*, the selection is based on the bank's assets and liabilities. Bank assets represent inputs and liabilities for outputs. For Berger and Mester

(1997), bank inputs are purchased funds, core deposits and labour. Outputs are consumer loans, business loans and securities. Rezvanian and Mehdian (2002) applied the same method. Inputs are borrowed funds (time deposits and other borrowed funds) and other inputs (labour and capital). Outputs are total loans, securities and other earning assets. Cavallo and Rossi (2002) also viewed labour, capital and deposits as bank inputs. In contrast, the *production approach* considers the bank as a producer just like producers in the product market. Inputs, therefore, are physical entities such as labour and capital. In relation to *deposits*, proponents of this approach argue that all deposits should be treated as outputs since they are associated with liquidity, safekeeping and are involved in generating value added.

In this study, the selection of inputs and outputs is based on the intermediation approach. Inputs are the number of employees, fixed assets, and total deposits. Total deposits are made up of demand deposit, saving deposit and fixed deposit. This study uses bank deposit as either an input or output to test its influence over the efficiency measure.

Table 6.1 DEA Models 1 to 5

	DEA Model **1 I**	DEA Model **2 P**	DEA Model **3 I**	DEA Model **4 P**	DEA Model **5 I**
Inputs	Fixed assets Staff number Total deposits	Fixed assets Staff number	Fixed assets Staff number Total deposits Provision for bad debt	Fixed assets Staff number Provision for bad debt	Staff expenses Capital expenses Fund expenses
Outputs	Total loans Other operating income Other earning assets Off balance sheet	Total deposits Total loans Other operating income Other earning assets Off balance sheet	Total loans Other operating income Other earning assets Off balance sheet	Total deposits Total loans Other operating income Other earning assets Off balance sheet	Total loans Other operating income Other earning assets Off balance sheet

Note: I = Intermediation approach and P= production approach.

In this study, the selection of inputs and outputs was based on the intermediation approach. Assuming constant returns to scale and modelling input minimisation, Table 6.1 shows the first DEA analysis was run with fixed assets, staff number, total deposits as input variables, and total loans, other operating income, other earning assets and off balance sheet as output variables (hereafter referred to as DEA Model 1 intermediation). To test the sensitivity of results to total deposits, a second DEA analysis was run with fixed assets and staff numbers as inputs, and total loans, other operating income, other earning assets and off balance sheet as well as total deposits as outputs (hereafter referred to as DEA Model 2 production). By including provisions for bad debts as an input, a third DEA analysis was run employing four input variables: total loans, other operating income, other earning assets, and off-balance sheet (hereafter referred to as DEA Model 3 intermediation). Again, to test the sensitivity of results to total deposits, a fourth DEA analysis was run with fixed assets, staff numbers and provisions for bad debs as inputs, and total loans, other operating income, other earning assets, and off-balance sheet as well as total deposits as outputs (hereafter referred to as DEA Model 4 production). A fifth DEA analysis was run employing three inputs (labour expenses, capital expenses, and fund expenses), and four outputs variables: total loans, other operating income, other earning assets, and off-balance sheet (hereafter referred to as DEA Model 5 intermediation).

The researcher measured labour by the number of employees, capital by the book value of fixed assets and premises, and funds by the sum of demand and saving deposits. Labour expenses comprised the total cost of all bank's employees (i.e. salaries, employee benefits, etc.). Capital expenses were assessed by the total expenditure on fixed assets and premises. Fund expenses were derived from the total interest on deposits. As to the outputs, net loans included all types, such as real estate loans, commercial and industrial loans, and consumer loans. Net deposits reflected the value of all deposits derived from the sum of demand and savings deposits. The five DEA models are summarised in table 6.1.

6.4.7 DEA software

Estimating individual efficiency measures was carried out using Joe Zhu's DEA Excel Solver (Zhu, 2003). Overall, technical efficiency (OTE) and pure technical efficiency (PTE) are calculated directly by the CCR (CRS) and BCC (VRS) models respectively. Scale efficiency (SE) on the other hand, is given by dividing overall technical efficiency by pure technical efficiency (OTE/PTE).

6.5 Measuring productivity changes

Equally important to the regulator is information about the rate at which efficiency gains are made. Accordingly, this chapter also examines historic rates of productivity change in banks in GCC countries. Total factor productivity (TFP) changes were calculated for the period 1993 to 2002 using the Malmquist DEA. Malmquist TFP calculations are based upon DEA-like linear programs. The input and output variables used in these calculations are the same as those used in the DEA technical efficiency calculations.

Another useful metric within the DEA framework is the Malmquist index (MI) which is the product of two elements: the change in technical efficiency change (TE), or how close a bank can get to the efficient frontier (catching up) and technological change

(TC), or how much the benchmark production frontier shifts at each bank's observed input mix (innovations or shocks).

The purpose of this section is to analyse the change in the productivity of GCC banks during the period 1993 to 2002. Productivity is measured by the Malmquist index, using the Data Envelopment Analysis (DEA) technique. This section aims to answer the question whether financial sector reforms have resulted in productivity growth in the GCC banking industry. To measure productivity change and to decompose this productivity change into technical change and technical efficiency change, Malmquist indices were worked out using the linear programming technique of Data Envelopment Analysis (DEA). By comparing annual changes in the productivity of individual banks, it is possible both to identify general trends in the productivity of the banking industry as a whole, and to identify individual banks exhibiting patterns of change in productivity that differ from the rest of the industry.

6.5.1 Productivity change: A review of the literature

The analysis of productivity change and its sources in financial intermediaries has drawn the increasing attention of scholars, resulting in a wide and diverse literature on the subject over the last two decades. This line of research approaches the efficiency and productivity of banking firms from the perspective of considering how productivity changes are motivated and driven by changes in regulation, differences across countries, and the effects of innovation and technological processes.

The diversity and disperse evidence of these studies precludes a direct comparison of productivity changes in different geographical areas over the same time interval due to differences in the methodology chosen to estimate efficiency and productivity, not only because of the traditional distinction between parametric and non-parametric methods but also due to differences in the choice of productivity decomposition. Also, the existence of alternative time intervals and other differences, such as size of the banks included in the sample, preclude an international comparison of the evolution of productivity in areas with different legal and institutional frameworks. Elyasiani and Mehdian (1995) working with US data selected 1979 and 1986 as rough proxies for the pre and post-deregulation periods. Using DEA they calculated efficiency scores for samples of US banks from these two years. They found, for large banks, that technical efficiency declined by 3% and, using time dependent ratio analysis, that technology regressed by 2% over this eight year period.

Recent studies of productivity changes focusing on US banks in the post-deregulation period, have concentrated on either total factor productivity growth or technological progress in the US commercial banking industry during the 1980s. Mukherjee et al. (2001) explored productivity growth for a group of large commercial banks over the period 1984 to 1990. They found an overall productivity growth rate of 4.5% per year on average[2]. They also reported that larger banks and a higher specialisation of product mix are associated with higher productivity. Alam (2001) studied bank productivity over the period 1980 to 1989 and found productivity movements mainly attributable to technological change rather than scale changes or convergence to the frontier.

2 They claimed that bank productivity, after an initial period of adjustment to deregulation, would increase. However, the majority of previous commercial bank total factor productivity studies reported either little, zero, or even negative productivity growth. See Humphrey (1991, 1993), Hunter and Timme (1991), and Bauer et al. (1993) for parametric methods used to estimate productivity growth, and Wheelock and Wilson (1999) for a nonparametric approach.

Wheelock and Wilson (1999) studied productivity change in US banks from 1984 to 1993. They found banks of all sizes experienced decline in technical efficiency and productivity also declined on average. They attributed this decline in productivity to a minority of banks in each size category pushing the frontier forward, while the rest remained behind during the time interval that was considered. However, they did find technological progress over the sample period. Grifell-Tatjé and Lovell (1997) found commercial banks had lower productivity growth than saving banks over the period 1986-1993. In a subsequent paper, Grifell-Tatjé and Lovell (1999) analysed the sources of profit growth in Spanish commercial banks over the period 1987-1994, and observed a large increase in bank productivity. This was offset by a large negative price effect due to increasing competition. The increase in productivity was entirely attributed to technological progress, and partially offset by negative catching up. The same result - technological progress, negative catching up, and an overall increase in productivity - was also reported by Kumbhakar et al. (2001) and Maudos (1996).

Productivity growth in Asian banking has received little attention in the literature. In the case of Japanese banks, Fukuyama (1995) reported large indexes of technological progress and moderate negative indexes of catching up in a sample of 155 banks during 1989-1991. Leightner and Lovell (1998) also reported increases in production and total factor productivity in a sample of Thai banks during 1989-94. Thus, increases in productivity and technological progress during the late 1980s and early 1990s are a consistent finding across the world, with the exception of Portuguese banks (Mendes and Rebelo, 1999).

Instead of analysing variations in productivity over time, some studies have carried out analyses across countries. For example, Dietsch et al. (2001) used Malmquist decomposition to explain productivity gaps in banking industries across four major European countries, and was able to separate productivity differences into purely technological differences and differences due to environmental or external factors. Berg et al. (1994) made cross-country comparisons using cross-section data on banks from three Nordic countries, and reported important differences between them.

All the studies cited above refer to productivity growth during the 1980s and early 1990s, and few make inter-country productivity comparisons. This study aims to extend the literature by analysing the evolution of bank productivity over the 1993-2002 across GCC countries. To accomplish this task, a complete panel of 52 banks from six GCC countries covering the period 1993-2002 is used. Decomposition of the Malmquist index allows identification of the components of productivity growth or regress.

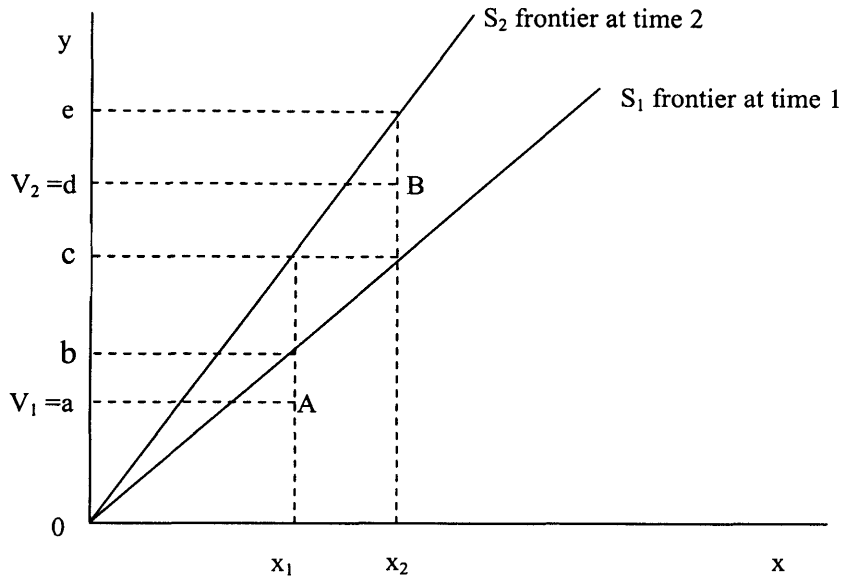
6.5.2 Productivity Methodology

The Malmquist productivity index was introduced by Caves et al. (1982) as the ratio of two distance functions pertaining to distinct time periods. The productivity level of a firm may be measured by the relationship between the inputs employed and the outputs attained.

This section briefly explains the background to the computation of Malmquist productivity indexes and their decomposition with non-parametric estimators. In order to estimate efficiency and productivity growth in the banks that make up the sample, the study will follow a non-parametric approach to the computation and decomposition of the Malmquist productivity index. Several different decompositions of the Malmquist index have been proposed. The most commonly used are Färe et al (1994), which assumes a constant returns to scale technology, and Ray and Desli (1997) which does not require that assumption. Previous literature on the analysis of bank productivity has used both of these approaches. For instance, Alam (2001) used the Malmquist productivity decomposition suggested by Färe et al. (1994), while Mukherjee et al. (2001) followed the decomposition proposed by Ray and Desli (1997). A third decomposition, which extends that of Ray and Desli (1997), has recently been suggested by Simar and Wilson (1998) and Zofio and Lovell (1998).

This study follows the method of Caves et al. (1982) and Zhu (2003) in calculating the Malmquist productivity index. Both studies employ the technology in period 2 as the reference technology. Alternatively, the technology in period 1 (base period) can also be used as the reference technology. This is the approach taken by Casu et al. (2004), Canhoto and Dermine (2003), Wheelock and Wilson (1999) and Färe et al (1994). The difference in the reference technology used affects the magnitude in interpreting the index. When the reference technology is based on period 2, then MI>1 implies a deterioration in productivity over the period under study. Alternatively, when the reference technology is based on period 1, then MI>1 implies an improvement in productivity. An illustration using one input and one output is shown in Figure 6.3 below.

Figure 6.3: change of productivity between two periods



Points A and B represent observations in periods 1 and 2, respectively. The rays from origin S_1 and S_2 represent frontiers of production for periods 1 and 2, respectively. Relative efficiency is measured in one of two ways. The relative efficiency of production as A compared to the frontier S_1 is $d_1(y_1,x_1) = 0a/0b$. But compared with the period 2 frontier S_2, it is $d_2(y_1,x_1) = 0a/0c$. The relative efficiency of production at B compared to the period 2 frontier S_2 is $d_2(y_2,x_2) = 0d/0e$. Compared with the period 1 frontier S_1, the relative efficiency is $d_1(y_2,x_2) = 0d/0c$. The Malmquist index (MI) of total factor productivity change is the geometric mean of the two indices based on the technology for periods 1 and 2, respectively. In other words:

$$\mathrm{MI} = \left[\frac{d_1(y_1,x_1)}{d_1(y_2,x_2)} \frac{d_2(y_1,x_1)}{d_1(y_1,x_1)} \right]^{\frac{1}{2}} \qquad (3)$$

An equivalent way of writing (3) is:

$$\text{MI} = \frac{d_1(y_1,x_1)}{d_2(y_2,x_2)}\left[\frac{d_2(y_2,x_2)}{d_1(y_2,x_2)}\frac{d_2(y_1,x_1)}{d_1(y_1,x_1)}\right]^{\frac{1}{2}} \tag{4}$$

or $\quad$ MI = ET

where

MI = the Malmquist productivity index

E = a change in efficiency over the period (t) and (t+1) (the term outside the square bracket

T = a measure of technical progress measured by shifts in the frontier from periods 1 and 2 (the two ratios in the square brackets).

When the reference technology is based on period 2 as in equation (4), then M<1 means there has been a positive total factor productivity change between periods 1 and 2.

6.6 Data presentation

Data used in this study are compiled from balance sheet and income statements of banks, their web pages on the Internet, annual central bank reports, and from the Fitch-IBCA Ltd Bankscope CD Rom. This study covers 52 privately held and domestically owned fully licensed commercial and Islamic banks. The distribution of these banks is as follows: 6 banks in Bahrain, 7 banks in Kuwait, 5 banks in Oman, 6 banks in Qatar, 10 banks in Saudi Arabia and 18 banks in the UAE. The period sampled covered from 1993-2002. The final sample consisted of 484 bank-year observations: 60 in Bahrain, 70 in Kuwait, 50 in Oman, 60 in Qatar, 100 in Saudi Arabia, and 144 in the UAE. Table 6.2 provides a snapshot of data. Except for the number of staff, other variables are measured in million US $.

Table 6.2 Descriptive statistics of bank inputs and outputs 1993-2002

Variable	fixdasst	numstaff	tdeposit	Tloans	Othrincm	OEA	OBS
Mean	65.0	905.4	3485.1	1913.4	37.2	4092.4	1751.8
Std. Error	5.8	47.0	196.3	100.9	2.2	221.9	163.5
Median	25.7	546.0	1668.5	974.3	21.0	2074.9	531.9
Mode	14.8	500.0	2283.5	45.5	1.3	407.8	1508.0
Std Deviation	126.5	1034.7	4319.3	2219.9	47.4	4882.6	3596.4
Kurtosis	24.2	6.8	5.4	5.8	11.5	4.2	21.4
Skewness	4.6	2.5	2.2	2.1	2.9	2.0	4.3
Range	918.7	5743.0	25181.1	15026.5	343.5	27572.0	26724.5
Minimum	0.3	80.0	70.2	36.2	1.1	194.1	9.0
Maximum	919.0	5823.0	25251.3	15062.6	344.6	27766.1	26733.5
Count	484	484	484	484	484	484	484

Note: fixdasst = fixed assets; numstaff = number of staff; tdeposit = total deposits; tloans = total loans; orthrincm = other operating income; OEA = other earning assets; and OBS = off balance sheet activities. Figures are in million US $ except for the number of staff.

6.7 Efficiency empirical results

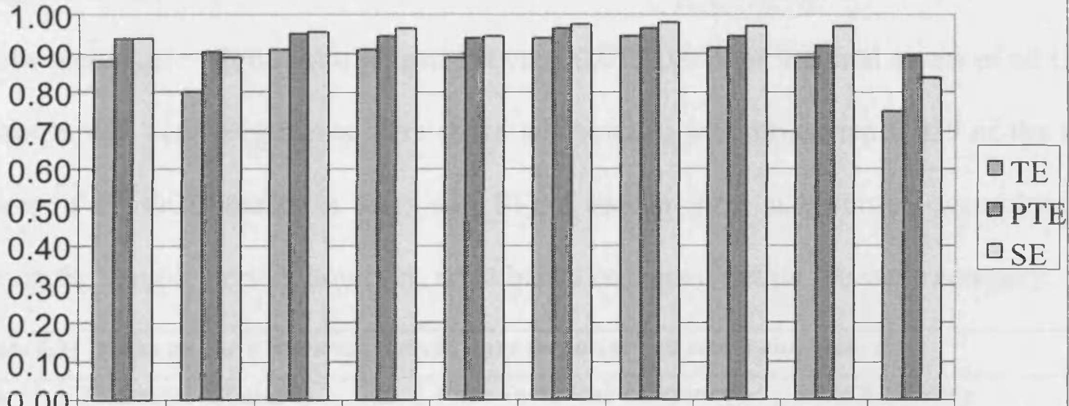
Table 6.1 shows this study ran five different models: 3 intermediation approaches and 2 production approaches. To test the sensitivity of results to total deposits this study placed the total deposit variable as an input (intermediation) and as an output (production). The results show the total deposit variable is very sensitive to its location as an input or as an input. Appendix 3 presents a summary of the results of the five models.

However, because among others, Berger, Leusner and Mingo (1997) suggest that the intermediation approach is superior because it is more inclusive, and captures the essence of a financial institution, this study adopted the intermediation approach and the following sections presents the analysis of the findings derived from DEA Model 1 (intermediation).

6.7.1 Average efficiencies

The precise results obtained from yearly pooled cross-section of efficiency analysis (technical, pure technical and scale efficiency) for GCC banks are presented in figure 6.4. The ten year period witnessed vicissitudes in efficiency score. One can also see that in 2002 banks had a lower average efficiency score, which would suggest an increase in average efficiency over time. Yet, this also might have occurred due to a positive change in technology (i.e. an outward shift of the efficiency frontier) and it is therefore wise to refrain from drawing firm conclusions for the time being. A more thorough analysis on this point will be developed, which will be based on the calculation and analysis of the Malmquist index.

Figure 6.4: change in efficiency in the GCC banking industry



	93	94	95	96	97	98	99	00	01	02
TE	0.88	0.80	0.91	0.91	0.89	0.94	0.94	0.91	0.89	0.75
PTE	0.94	0.90	0.95	0.94	0.94	0.96	0.96	0.94	0.92	0.89
SE	0.94	0.89	0.96	0.96	0.94	0.97	0.98	0.97	0.97	0.84

However, the analysis starts first by drawing conclusions regarding the relationships between overall technical, pure technical efficiency and scale efficiency and the effects of bank's size, specialisation, geographical diversification, and country. Before doing so, the analysis starts by identifying statistics relating to the types of banks constructing the yearly cross-section frontiers.

6.7.2 Banks on the Frontiers

The study attempts to explore types of banks constructing yearly-pooled cross-section frontiers. It tests the relationship between frontier banks and bank size and bank's branches. The following sub-sections show that relationship.

6.7.2.1 Banks on the Frontiers and Size

For explanatory purposes, the study divided all the sample banks into three groups. The formation of groups was based on the ratio of their asset size to the asset size of the whole sample. The cut-off points were as follows: Small banks were those whose their ranged between 0.000-0.009 of the total assets to all GCC banks in one year. Medium banks were those whose ratio ranged between 0.010-0.039 of the total assets of all GCC banks in one year. Big banks were those whose ratio was more than 0.039 of the total assets of all GCC banks in one year. Slight switch from size subsets was observed during the sample period; however, most banks remained within the same category.

Table 6.3: Banks on the Frontiers (overall, pure technical and scale) and bank size

Year	**Technical Efficiency**			**Pure Technical Efficiency**			**Scale Efficiency**		
	Small	Medium	Big	Small	Medium	Big	Small	Medium	Big
1993	**7**	1	1	10	2	**9**	**7**	1	1
1994	**3**	2	**3**	5	3	**9**	**3**	2	**3**
1995	3	**6**	1	7	**12**	6	3	**6**	1
1996	3	**10**	0	5	**14**	3	3	**10**	0
1997	5	**8**	0	5	**10**	5	5	**8**	0
1998	**9**	4	3	**16**	5	5	**9**	4	3
1999	**15**	5	3	**18**	7	3	**15**	5	3
2000	**12**	2	3	**16**	3	5	**12**	2	3
2001	**8**	4	4	**18**	4	5	**8**	4	4
2002	**9**	1	2	**13**	6	8	**9**	1	2
Total	74	43	20	113	66	58	74	43	20

Table 6.3 shows the distribution of banks on the frontiers over the ten years. Even though big and medium banks dominated overall technical efficiency yearly frontiers for the first half of the sample (with the exception of 1993), small banks dominated the yearly frontiers for the second half. This is true for the two components of technical efficiency (pure technical and scale efficiency) where small banks had gained the highest number, being on the yearly frontiers from the period 1998-2002.

The number of small banks on the frontiers of technical efficiency (74 banks) outnumbered the combined total of big and medium banks (20+43 banks). Slightly fewer small banks were on the frontiers of pure technical efficiency (113 banks) than the combined total of big and medium banks (58+66 banks). Finally, small banks exceeded the combination of the total of big and medium banks (20+43 banks) on the scale efficiency.

Does this result explicitly suggest that smaller banks in general are more efficient than bigger banks? Or is it merely telling us that most banks on the yearly frontiers are small banks. To be able to draw firmer conclusions, the study will carry out more detailed analysis of the size-efficiency relationship, and in the regression analysis sections, the focus will be on the technical and scale efficiencies exhibited by GCC banks.

6.7.2.2 Frontier banks and bank branches

Number of branches reflecting bank size, barriers for new entrants, investment diversification and geographical diversification, is also tested (table 6.4). The formation of bank groups for analysis purposes was based on the number of bank branches. Small banks were those whose number of branches ranged between 1-19 branches in one year;

medium banks were those whose branches ranged between 20-59 in one year; and big banks were those whose branched numbered more than 59 in one year.

Table 6.4: Banks on the Frontiers (overall, pure technical and scale) and bank branches

Year	**Technical Efficiency**			**Pure Technical Efficiency**			**Scale Efficiency**		
	Small	Medium	Big	Small	Medium	Big	Small	Medium	Big
1993	**9**	0	0	**12**	6	3	**9**	0	0
1994	**7**	1	0	**9**	2	6	**7**	1	0
1995	**9**	2	0	**14**	6	4	**9**	2	0
1996	**11**	1	1	**15**	4	3	**11**	1	1
1997	**7**	6	0	8	**9**	3	**7**	6	0
1998	**11**	5	0	**18**	6	1	**11**	5	0
1999	**13**	10	0	**20**	10	0	**13**	10	0
2000	**9**	7	1	**12**	9	2	**9**	7	1
2001	**10**	5	1	**15**	9	2	**10**	5	1
2002	7	5	0	**12**	9	5	7	5	0
Total	93	42	3	135	70	29	93	42	3

Ninety three small banks whose branches ranged 1-19 were on the frontiers of overall and scale efficiency compared to only 3 big and 42 medium size banks. The total number of big and medium banks (29 + 70 = 99) on the frontier of pure technical efficiency was lower than the total number of small banks (135). Overall, Small banks dominated technical efficiency yearly-frontiers, suggesting smaller banks with fewer branches were more efficient.

6.7.3 Efficiency by country

Table 6.5 illustrates banks' average overall, technical, pure technical and scale efficiency for 1993-2002. In analysing overall technical efficiency, Bahraini banks came first in 1993, 1997 and 2002 and second in 1998 and 1999, making them the most efficient banks in GCC countries. This result is not surprising. Because Bahrain is considered the financial hub in the region and attracts much foreign investment and banks, Bahraini banks have to be very efficient in order to able to compete with foreign banks to retain and maintain their share in Bahrain's market.

On the other hand, Saudi Arabia's banks were in last place, as the least efficient banks in the region in the years 1996, 1999, 2000, 2001 and 2002. They came in fifth place in 1997 and fourth in 1993, 1994, 1995 and 1998. Since there are no foreign banks in Saudi Arabia, this may explain the reason for the country's banks being on average the least efficient banks technically.

Kuwaiti banks had considerably improved in efficiency. They had been in last place in the years 1993, 1994, 1995 and 1997 but had improved to come in second place in 1999, 2000 and 2002 and first place in 2001.

Oman's banks scored the highest overall technical efficiency in the region and came in the first place in 1995 (95%) and 1996 (97%) and in second place in 1994 (84%). However, in 1999, 2000 and 2001 they were fifth, fourth and fifth, respectively. In 2001, their average efficiency was 85%, which could be attributed to bad loans, a problem which faced more than the half of Omani banks at that time.

Table 6.5: Yearly average technical, pure technical and scale efficiency sorted by countries

1993	TE	PTE	SE
Bahrain	**0.94**	0.95	**0.98**
Kuwait	0.77	0.85	0.92
Oman	0.90	0.93	0.97
Qatar	0.92	0.96	0.96
Saudi Arabia	0.88	**0.99**	0.89

1994	TE	PTE	SE
Bahrain	0.80	0.90	0.88
Kuwait	0.72	0.76	**0.95**
Oman	0.84	0.91	0.93
Qatar	**0.85**	0.91	0.93
Saudi Arabia	0.80	**1.00**	0.80

1995	TE	PTE	SE
Bahrain	0.85	0.89	0.95
Kuwait	0.84	0.88	0.97
Oman	**0.95**	0.96	**0.98**
Qatar	0.92	0.96	0.96
Saudi Arabia	0.90	**1.00**	0.90
UAE	0.94	0.97	0.97

1996	TE	PTE	SE
Bahrain	0.85	0.88	0.96
Kuwait	0.85	0.88	0.98
Oman	**0.97**	**0.98**	0.99
Qatar	0.93	0.95	0.97
Saudi Arabia	0.83	0.94	0.88
UAE	**0.97**	0.97	**1.0**

1997	TE	PTE	SE
Bahrain	**0.96**	0.96	**1.00**
Kuwait	0.78	0.89	0.88
Oman	0.92	0.94	0.99
Qatar	0.90	0.92	0.98
Saudi Arabia	0.80	**0.98**	0.82
UAE	0.93	0.94	0.99

1998	TE	PTE	SE
Bahrain	0.94	**1.00**	0.94
Kuwait	0.93	0.95	0.98
Oman	0.93	0.94	**0.99**
Qatar	**0.96**	0.97	0.98
Saudi Arabia	0.93	0.98	0.96
UAE	0.94	0.96	0.98

1999	TE	PTE	SE
Bahrain	0.96	0.98	0.98
Kuwait	0.96	0.97	**0.99**
Oman	0.95	0.96	**0.99**
Qatar	**0.99**	**0.99**	**0.99**
Saudi Arabia	0.86	0.91	0.94
UAE	0.96	0.98	**0.99**

2000	TE	PTE	SE
Bahrain	0.90	0.96	0.94
Kuwait	0.94	0.95	**0.99**
Oman	0.92	0.95	0.97
Qatar	0.94	0.95	**0.99**
Saudi Arabia	0.83	0.87	0.96
UAE	**0.95**	**0.97**	0.97

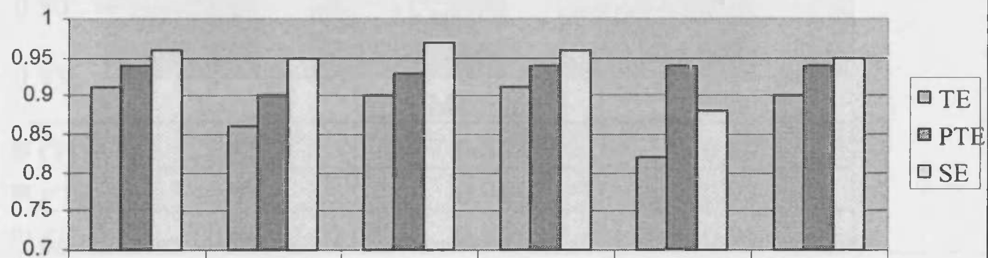
2001	TE	PTE	SE
Bahrain	0.94	0.97	0.97
Kuwait	**0.95**	0.97	0.98
Oman	0.85	0.9	0.95
Qatar	0.92	0.92	**1.00**
Saudi Arabia	0.71	0.71	0.99
UAE	**0.95**	**1.00**	0.95

2002	TE	PTE	SE
Bahrain	**0.92**	0.95	**0.97**
Kuwait	0.83	0.93	0.90
Oman	0.8	0.86	0.92
Qatar	0.75	0.85	0.88
Saudi Arabia	0.63	**1.00**	0.63
UAE	0.71	0.82	0.84

Qatar's banks were at the top of the technical efficiency ranking in 1994 (85%), 1998 (96%) and in 1999 (99%). Even though they were placed fourth in 2001 (92%) and 2002 (75%), they maintained overall second position after Bahrain for overall technical efficiency for the period, with a score of 91%.

The UAE's banks achieved the highest technical efficiency in 1996 (97%), 2000 (95%) and 2001 (95%) and were second in 1995 (94%), 1997 (93%), 1998 (94%) and 1999 (96%). 2002 was the worst year since they were in fifth place, with 71% technical efficiency.

Figure 6.5: Average efficiency by country for 1993-2002



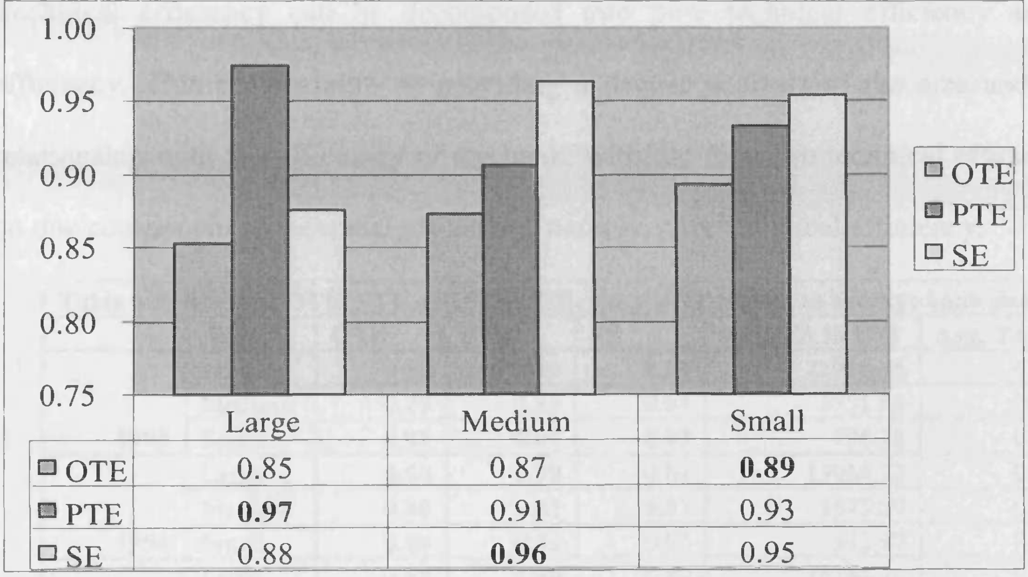
	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE
TE	0.91	0.86	0.9	0.91	0.82	0.9
PTE	0.94	0.9	0.93	0.94	0.94	0.94
SE	0.96	0.95	0.97	0.96	0.88	0.95

Figure 6.5 illustrates the average overall technical, pure technical and scale efficiency. Analysing overall technical efficiency, Bahrain and Qatar come first and second, respectively, since their banks are the most efficient with 91%. Oman's and the UAE's banks come third and fourth, respectively with 90%. Kuwait's banks with 86% come in fifth place while Saudi Arabia's banks in the last place with 82%.

6.7.4 Technical Efficiency

Figure 6.6 summarises the ten years' average OTE, PTE and SE. Even though large banks scored the highest pure technical efficiency with 97%, and medium banks scored the highest scale efficiency with 96%; small banks came first in overall technical efficiency by scoring 89%. Small banks maintained good progress with an excellent pure technical efficiency of 93% and scale efficiency of 95%.

Figure 6.6: Summary of Average OTE, PTE and Scale Efficiency with respect to average bank size



As previously indicated, a certain amount of the technical efficiency score can be attributed to existing scale inefficiencies, signifying that the true efficiency of a particular bank may be even higher. The technical efficiency of such banks thus could primarily be attributable to high pure technical efficiency scores (97%), much of which is lost due to sufficiently high scale inefficiency. Figure 6.6 illustrates this issue. Big banks are the best in terms of pure technical efficiency; however, due to scale inefficiencies of 12%, they come last in overall technical efficiency.

The opposite is true for small size banks; being not far away from a CRS efficient frontier, they are keen on adopting the best available technology (average pure technical efficiency scores are 93%) and also keen on choosing the best available technology (average scale efficiency scores are 95%).

6.7.4.1 Technical Efficiency and size

Technical efficiency can be decomposed into pure technical efficiency and scale efficiency. This section aims at providing a deeper analysis of the size and activity relationship with the efficiency of the bank, with the focus on technical efficiency and on one component of technical efficiency, namely, pure technical efficiency.

Table 6.6: Average OTE, PTE and Scale Efficiency with respect to average bank size

	Size	OTE	PTE	SE	Avg. TA in US$	Avg. TA%
	Large	0.88	**0.99**	0.89	21916.46	0.072
	Medium	0.79	0.85	0.94	3751.89	0.012
1993	Small	**0.91**	0.94	**0.97**	796.22	0.003
	Large	**0.80**	**0.99**	0.81	15068.72	0.067
	Medium	**0.80**	0.82	**0.97**	3573.89	0.016
1994	Small	**0.80**	0.89	0.90	573.97	0.003
	Large	0.89	**1.00**	0.89	16144.26	0.042
	Medium	**0.93**	0.96	**0.97**	7635.16	0.020
1995	Small	0.88	0.92	**0.97**	1509.45	0.004
	Large	0.81	**0.96**	0.85	10367.64	0.038
	Medium	**0.93**	0.94	**0.98**	5390.97	0.020
1996	Small	0.91	0.93	**0.98**	1238.41	0.005
	Large	0.79	**0.98**	0.80	10135.66	0.045
	Medium	0.89	0.93	0.96	3977.29	0.018
1997	Small	**0.92**	0.93	**0.99**	1328.58	0.006
	Large	0.94	**0.98**	0.96	8983.40	0.051
	Medium	**0.95**	0.96	**0.99**	3242.82	0.018
1998	Small	0.93	0.96	0.97	797.05	0.005
	Large	0.90	0.94	0.95	6658.23	0.051
	Medium	0.93	0.95	0.98	3248.05	0.025
1999	Small	**0.97**	**0.98**	**0.99**	520.49	0.004
	Large	**0.94**	**0.98**	0.96	6666.90	0.058
	Medium	0.87	0.89	**0.98**	2575.30	0.022
2000	Small	0.93	0.96	0.97	528.32	0.005
	Large	0.92	0.93	**0.99**	5921.85	0.058
	Medium	0.83	0.83	**0.99**	1588.98	0.015
2001	Small	**0.93**	**0.98**	0.95	483.39	0.005
	Large	0.66	**1.00**	0.66	11989.81	0.052
	Medium	**0.81**	0.93	**0.88**	5590.89	0.024
2002	Small	0.75	0.84	0.87	1069.69	0.005
	Size	**OTE**	**PTE**	**SE**	**Avg. TA in US$**	**Avg. TA%**
	Large	0.85	**0.97**	0.88	11385.29	0.053
Overall	Medium	0.87	0.91	**0.96**	4057.52	0.019
	Small	**0.89**	0.93	0.95	884.56	0.004

Table 6.6 reveals a clear and persistent trend of large banks having higher pure technical efficiency scores than smaller ones, and also shows that most banks defining the

efficient frontier tend to be representatives of the "large" group. One possible explanation could lie in the observation that large banks frequently have better opportunities for risk pooling and therefore may diversify away the risk more efficiently. A large asset base also makes these banks more resilient to industry shocks (Kohn, 1994). Overall averages of pure technical efficiency for medium and small banks are 91% and 93% respectively. Since big banks preformed the best pure technical efficiency average scores, the results suggest that growth of banks or consolidation should increase overall pure technical efficiency of the sector.

6.7.4.2 Technical Efficiency and specialisation

Banks were divided into two groups, namely, commercial and Islamic banks. Yearly-pooled cross-frontier efficiencies, reflecting the efficiency of commercial banks and Islamic banks' frontiers, are now the focus of analysis. Table 6.7 clearly shows that Islamic banks were on average more technically efficient than commercial banks in 1997, 2000, 2001 and 2002. Banks constituting an efficiency frontier (i.e. those with 100% technical efficiency) were mainly commercial banks. This does not contradict the result because there were only 7 Islamic banks among the total sample of 52, representing only 14% of the whole sample (see the appendix 4 for more details of efficiency results).

Islamic banks' scores were significantly higher than those of commercial banks, implying the former were more efficient relative to the latter, suggesting that the Islamic banks dominated the yearly-pooled cross-frontiers on average. This provides evidence that Islamic banks on average had developed efficiencies and technologies superior to those of commercial banks.

Table 6.7: Average efficiency sorted by banks' specialisation				
Specialization	**Year**	**TE**	**PTE**	**SE**
Commercial	**1993**	**0.88**	**0.94**	**0.94**
Islamic		**0.88**	**0.93**	**0.94**
Commercial	**1994**	**0.81**	**0.91**	**0.89**
Islamic		**0.76**	**0.89**	**0.87**
Commercial	**1995**	**0.91**	**0.95**	**0.95**
Islamic		**0.90**	**0.93**	**0.97**
Commercial	**1996**	**0.91**	**0.94**	**0.96**
Islamic		**0.92**	**0.93**	**0.98**
Commercial	**1997**	**0.88**	**0.93**	**0.94**
Islamic		**0.93**	**0.98**	**0.95**
Commercial	**1998**	**0.94**	**0.96**	**0.97**
Islamic		**0.94**	**0.98**	**0.96**
Commercial	**1999**	**0.95**	**0.96**	**0.98**
Islamic		**0.93**	**0.96**	**0.97**
Commercial	**2000**	**0.91**	**0.94**	**0.97**
Islamic		**0.92**	**0.95**	**0.96**
Commercial	**2001**	**0.88**	**0.91**	**0.97**
Islamic		**0.92**	**0.93**	**0.99**
Commercial	**2002**	**0.74**	**0.89**	**0.84**
Islamic		**0.78**	**0.93**	**0.84**
Avg. Commercial		**0.88**	**0.93**	**0.946**
Avg. Islamic		**0.89**	**0.94**	**0.947**

The reason for different efficiencies scores may be due to wide range of options and contracts that Islamic banks offer to their customers, therefore, utilising their inputs of capital and funds more than commercial banks. Additionally, it may presumably be and positive incentive for specialising. Iqbal and Llewellyn (2002, p. 13) indicate that several potential benefits can arise from the emergence of Islamic banks, besides their desirability from an Islamic point of view. These include:

1. The range of contracts available to customers is widened. This is an example of the *efficiency-enhancing* characteristics of spectrum filling (Llewellyn, 1992).
2. It creates a financial system populated by financial institutions with a different *modus operandi*, which has the effect of widening choice for consumers.
3. The widening of the range of financial contracts available, and difference in the *modus operandi* of conventional and Islamic banks, has the effect of enhancing

competition between alternative banking models, which is expected, in turn, to increase *efficiency* of the financial system.

4. It enables Islamic religious beliefs to be reflected in financial arrangements and transactions, thereby, fulfilling the financial needs of Muslims in accordance with their faith.
5. Allocation of financial resources based on profit/loss-sharing (PLS) gives maximum weight to the profitability of investment, whereas an interest-based allocation gives it to creditworthiness. We may expect the allocation made based on profitability to be more *efficient* than that made based on interest.
6. Because of the nature of the contracts on the liabilities side of the balance sheet, Islamic banks are often less vulnerable to external shocks and are less susceptible to insolvency. This is because a wider range of liability holders share in the risks of the bank compared with the conventional banks.
7. Because holders of investment deposits share in the risks of an Islamic bank (for example, through PLS contracts) and are not offered guarantees, incentives are created for a wider range of stakeholders in the bank to monitor its behaviour and risk-taking.
8. By creating more systemic diversity, the stability of the financial system may be enhanced because the behavioural characteristics of different types of bank are likely to vary.
9. In the case of both the PLS and Murabaha contracts, since bank assets are created in response to investment opportunities in the real sector of the economy, the real factors related to the production of goods and services (in contrast with the financial factors) become the prime movers of the rates of return to the financial sector.

6.7.5 Scale Efficiencies

As indicated previously, a certain amount of the technical efficiency score may be attributable to existing scale inefficiencies, meaning that the true efficiency of a particular bank may be even higher. It was noted earlier that technical efficiency could be decomposed into pure technical efficiency and scale efficiency. This section therefore aims at providing a deeper analysis of the size and activity relationship with the efficiency of the bank, with the focus on one component of technical efficiency, namely, scale efficiency.

6.7.5.1 Scale Efficiencies and specialisation

As can be observed from Table 6.7, Islamic banks in GCC countries clearly outperformed commercial banks in 1995, 1996, 1997 and 2001 in terms of scale efficiency. In 2001 with 99% scale efficiency, Islamic banks were very close to producing an optimal level of output (or, in other words, very close to a CRS efficient frontier), whereas commercial banks were lagging behind, except in 1994, 1998 and 2000. The results therefore support the assumption that the largest part of (technical) efficiency enjoyed by small banks can be attributable to their size and realised diseconomies of scale and scope.

Commercial banks try to compensate for scale inefficiencies by pushing as much as possible towards the frontier of pure technical efficiency (adopting the best available technology). The overall (technical) efficiency of such banks is still worse than that of Islamic banks, since the losses created by scale inefficiencies outweigh the gains of pure technical efficiency. Consolidation of such banks (commercial bank with commercial bank) therefore could create inefficiency yields.

6.7.5.2 Scale Efficiencies and Size

The estimated pure technical efficiency (or efficiency under VRS) and scale efficiency scores for the generalised size- and activity- based subsets can be observed in Table 6.6 above.

Table 6.6 shows superior technical efficiency scores by small GCC banks may be attributable to both sufficiently high pure technical and scale efficiencies. Scale efficiency scores of 97% (1993), 90% (1994), 97% (1995), 98% (1996), 99% (1997), 97% (1998), 99% (1999), 97% (2000), 95% (2001) and 87% (2002) were rather unexpected, since small banks should presumably have been subject to increasing returns to scale, meaning they would realise economies of scale. A more detailed discussion on returns to scale dominating the industry will be presented later in this chapter; however, for now we may conclude that small GCC banks were *scale efficient*. Medium-size banks also tended to be very efficient in scale terms (they were close to the optimal in 1994 (97%), 1995 (97%), 1996 (98%), 1998 (99%), 1999 (98%), 2000 (98%), 2001 (99%)). Overall, medium banks scored the best average scale efficiency of 96%. From a theoretical viewpoint, this was an expected result. Medium sized banks are less likely to suffer from realised diseconomies of scale (such as excess layers of management, etc.) than large banks. This reason could also serve as an explanation for the low scale efficiency scores of large size banks. An overall average scale efficiency score of 88% suggests that many large banks in the GCC banking sector were operating under decreasing returns to scale. Obviously, this produced an incentive for small banks to become more efficient on a pure technical efficiency basis, which is what we also observe from the table.

The efficiency analysis with introduced scale efficiencies therefore supports our initial proposition that further consolidation and growth of banks is undesirable in the GCC banking industry. Large banks in the GCC did not attain high technical efficiency scores. More importantly, they suffered from big scale inefficiencies caused by DRS. As a result, efficiency gains could be achieved by fostering growth of small banks together with expansion of the market or encouraging the diversification of activities. Medium size banks, in turn, being scale efficient, would benefit from a more careful adaptation of the best available technology, thereby increasing their pure technical efficiency and, as a result, technical efficiency indices.

Particular returns to scale dominating the GCC banking sector are defined in the next section of this chapter, which will enable more clear-cut conclusions and implications to be drawn.

6.7.6 Estimating Returns to Scale

Small banks either operate under CRS, or are very close to a CRS frontier. A medium-sized bank is even closer to it and, despite the analysis suggesting that most such banks experience IRS; the costs due to unrealised scale economies in this case are particularly low. Large banks, as expected and presupposed in earlier stages of the study, suffer much more from unrealised scale economies (better risk pooling opportunities, etc.). The same is true for commercial banks; as expected, most operate under DRS.

The scale efficiency analysis that allows "super efficiency" scores to be obtained provides very similar results. It is evident that large GCC banks tend to operate under DRS. However, small banks are both very efficient at choosing optimal output levels (scale efficiency) and employing the best available technology (pure technological efficiency). Thus, efficiency gains could be achieved by encouraging growth of the market and looking for new markets outside the region.

As for Islamic and small commercial banks, their situations are quite similar. Most Islamic banks are small yet, which means they operate under IRS, or very close to a CRS frontier and do not suffer from scale inefficiencies. Thus, the regulations should encourage small banks to specialise. However, if we take into account the fact that the GCC banking industry is rather immature, with only a few banks operating in the market, the regulations should welcome new banks, especially small and specialised banks targeting the local and regional markets as well as large banks diversifying their activities and targeting international markets. From these findings, the study rejects the four null hypotheses and accepts the four study hypotheses; therefore:

- (H_{1_1}) There was an inverse relationship between size and efficiency.
- (H_{1_2}) There was an inverse relationship between number of branches and efficiency.
- (H_{1_3}) GCC banks (in each country) had different technical, pure technical, and scale efficiency scores.
- (H_{1_4}) GCC Islamic banks were more efficient than commercial banks.

6.7.7 Regression analyses

To provide evidence on whether the results pertaining to technical efficiency were maintained when we controlled for bank characteristics, the study conducts a multiple regression analysis using the yearly cross-frontier efficiency scores as dependent variables and bank characteristics as independent variables. In the regressions analysis, control variables for bank size included the ratio of an individual bank's total assets to GCC banks' total assets (TAMSGCC) and for market share the ratio of individual banks' deposits to GCC banks' total deposits (DPMSGCC). Profitability was included by calculating the ratio of return on assets (ROA). The study also included a control variable for geographical distribution by including the total number of a bank's branches (BRANCHES), and for each individual country's market concentration by including the (CR3) the share of the three highest banks in deposits market. Finally, the study also includes control variable for specialisation (SPECIALZ) by including dummy variables: 1 if the bank is Islamic and 0 if the bank is commercial.

The regression discussion focuses on the pure technical and scale frontier results because minimisation of costs and maximisation of revenues are required for profit maximisation.

6.7.7.1 Tobit Regression results

The research uses the Tobit regression method to find the effects of environmental variables on efficiency scores. Since a significant proportion of the efficiency scores obtained by DEA are equal to one, they are the truncated data for which the ordinary least squares (OLS) method will be inappropriate. Thus, the study instead uses the Tobit (censored) regression method to estimate the effects of environmental variables on efficiency scores (Greene, 2000).

Table 6.8: Pooled regression of 484 observations for OTE, PTE and SE			
Variable	**OTE**	**PTE**	**SE**
C	1.064788 (0.0000)***	1.496849 (0.0000)***	0.538284 (0.0000)***
TAMSGCC	11.20084 (0.0005)***	12.51018 (0.0000)***	-0.441617 (0.8544)
ROA	0.180898 (0.5381)	0.167496 (0.4696)	0.043116 (0.8442)
CR3	-0.230993 (0.2282)	-0.72938 (0.0000)***	0.528549 (0.0002)***
SPECIALZ	0.03325 (0.0204)**	0.024435 (0.0306)**	0.009394 (0.3792)
DPMSGCC	-9.167017 (0.0041)***	-9.77882 (0.0001)***	-0.148851 (0.9501)
BRANCHES	-0.000604 (0.0000)***	-0.000212 (0.0037)***	-0.000409 (0.0000)***
R-squared	0.42	0.32	0.42
Adjusted R-squared	0.39	0.29	0.39
F-statistic	16.43616	10.72343	16.39756
Prob(F-statistic)	0.000000	0.000000	0.000000

Note: *** significant at 1%, ** significant at 5% and * significant at 10%.

As can be seen in table 6.8, even though, the regression results are divided into overall technical efficiency and it components pure technical and scale efficiency, the discussion will focus on the pure technical and scale frontier results only.

6.7.7.1.1 Causes of pure technical efficiency

The result shows that for bank size, which is represented by the ratio of bank's total assets to GCC banks' assets, does matter and affect pure technical efficiency at 1% significance level. This confirms the size-pure technical efficiency relationship discussed earlier (see section 6.10.4). Deposit market share concentration of the highest three banks in deposits in each country is negatively significant at 1%. Even though, Bahrain, Oman and Qatar are highly concentrated banking market, their banks are the most efficient banks in the region. This could be attributed to a high number of foreign banks in these three countries which necessitates efficiency on the part of local banks in order to compete. Although Saudi Arabia is less concentrated than these three countries, its banks are less efficient. The absence of foreign banks in Saudi Arabia may be the main reason for their inefficiency.

The specialisation dummy also shows that, on average Islamic banks were more pure technical efficient than commercial banks at the 5% significance level. As has been suggested in earlier sections, the variety of options and contracts of Islamic banks could be the main reason for their superior efficiency.

Deposit market share is negatively significant at the1% level. This suggests GCC banks are not utilising deposits effectively possibly to limited investment opportunities of or the bad management.

Geographical diversification, represented by the total number of banks' branches, is negatively significant at 1%. Regulations in many developing countries and GCC countries among them require banks to become involved in development of the economic and social activities in rural areas. Therefore, they are required to open one or two branches for each new branch opened in an urban area. Therefore, banks open branches which are not economical to run. This could explain the negative relationship between pure technical efficiency and number of branches. However, efficiency is not related to a measure of profitability.

6.7.7.1.2 Causes of scale efficiency

Table 6.8 shows that both market concentration and geographical diversification are negatively significant at 1%. Profitability and specialisation show a positive insignificant relationship with scale efficiency, whereas bank size and deposit market share show a negative insignificant relationship with scale efficiency.

6.8 Productivity empirical results

The Malmquist (input-oriented) Total Factor Productivity (TFP) change index was calculated. A value of the index greater than one indicates negative TFP growth while a value less than one indicates TFP increase over the period. Productivity change is then decomposed into *Technological Change* (TC), and *Technical Efficiency Change* (TEC), where TFP = TC x TEC. An improvement in TC is considered a shift in the best practice frontier, whereas an improvement in TEC is the "catch up" term. According to Zhu (2003, p.279):

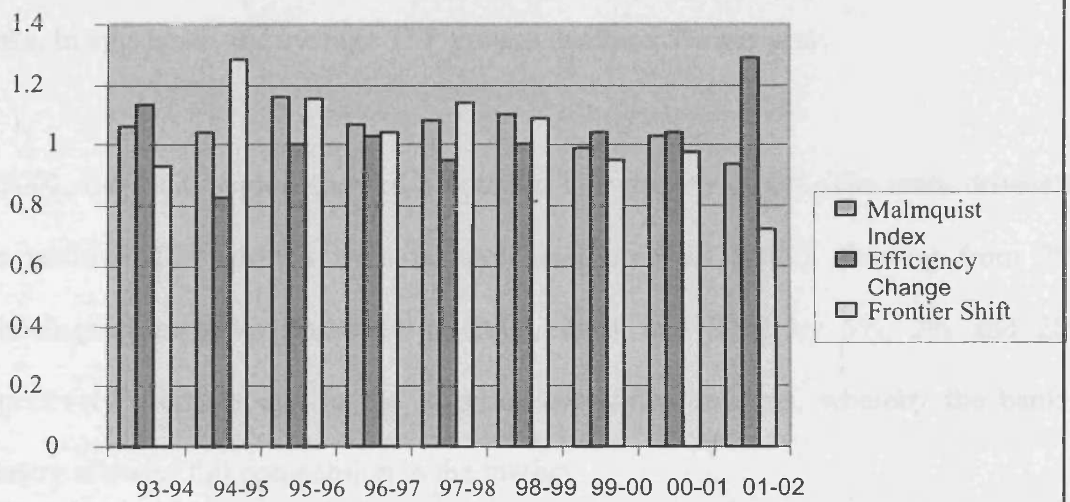
> The Malmquist productivity index (M_0) measures the productivity changes between periods (t) and (t+1). Productivity declines if $M_0 > 1$, remains unchanged if $M_0 = 1$ and improves if $M_0 < 1$.

The Malmquist productivity index results in table 6.9 and figure 6.7 show efficiency, technological, and TFP changes for GCC countries. Seven-year intervals out nine (1993-1994, 1994-1995, 1995-1996, 1996-1997,1997-1998, 1998-1999, and 2000-2001) showed a decline in TFP of an overall 5% due to negative efficiency and technological regress. For the six GCC countries, technical changes jointly led to a decline in productivity of 3% per year. Technological regress worsened due to the negative average efficiency decline of 3% per year.

Table 6.9 Malmquist productivity index results			
Avg. change	***Malmquist Index***	***Efficiency Change***	***Frontier Shift***
1993-1994	1.06	1.13	0.93
1994-1995	1.04	0.83	1.28
1995-1996	1.16	1.00	1.15
1996-1997	1.07	1.03	1.04
1997-1998	1.08	0.95	1.14
1998-1999	1.10	1.00	1.09
1099-2000	0.99	1.04	0.95
2000-2001	1.03	1.04	0.98
2001-2002	0.94	1.29	0.72
Overall	**1.05**	**1.03**	**1.03**

Note: A value <1 indicates growth; a value =1 remains unchanged, and a value >1 indicates decline.

Figure 6.7: Malmquist index, efficiency and technological changes



Decline in technical efficiency reduced the TFP growth in 1994, 1997, 2000, 2001 and 2002. Declines in technological progress reduced the TFP growth in 1995, 1996, 1997, 1998 and 1999. Low catching-up effect and technological regress both contributed to the decrease in productivity growth from between 4 to 16 per cent per year for the period 1993-1999.

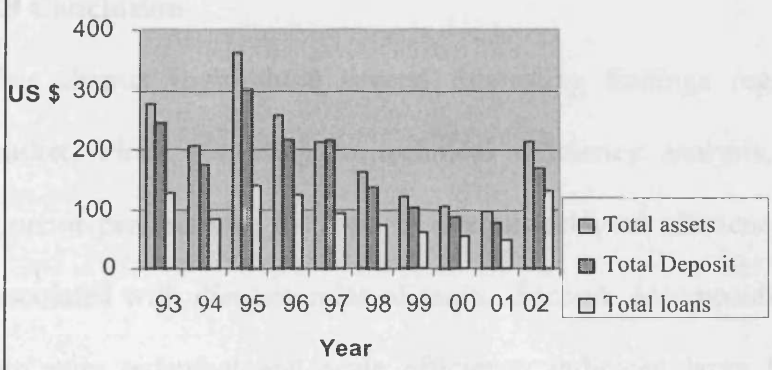
Even though year 2001 witnessed a 3% negative TFP growth, the years 2000 and 2002 saw the highest productivity growth of 1% and 6%, respectively. This positive TFP growth may be attributed to increased technological progress over time rather than catching-up effect. Positive catching-up effect was seen in 1995 and 1998 of 7% and 5%, respectively. This suggests efficient performance over time. However, this positive catching-up effect was inadequate to pull TFP growth upward because of very low technological progress.

GCC countries had an overall TFP growth of 95% and needed a 5% improvement to achieve international best practice. This is not surprising because, for example, Saudi Arabia's banking industry, the biggest market in the region remained closed to foreign banks. In aggregate, the average TFP growth declined 5% per year.

In 2002, the GCC region showed a positive TFP growth of 6%. The main drivers for this positive TFP growth were technological progress (28%). Starting from 2000 technological progress improved in 2000, 2001 and 2002 by 5%, 2% and 28%, respectively, perhaps due to the injection of market reforms, whereby the banking industry allowed full competition in the market.

The researcher looked at the causes of technological change and checked the behaviour of total assets, deposits and loans for the period 1993-2002. As revealed in figure 6.8, there was a downward trend in total of assets, deposits and loans. This decrease could be attributed to the unstable political situation in the region, starting with Iran-Iraq war followed by Iraqi invasion to Kuwait, and then the liberation of Kuwait. These situations led many local and international investors to withdraw their money to safer regions. However, 2002 witnessed an increase in total assets, deposits and bank loans. This phenomenon could be the result of September 11th, 2001, after which many Arab investors brought back their money from Europe and America to GCC countries for political and security reasons. Such movement of capital out and into GCC countries could be the main reason for the decline in technological change which contributed to the productivity decline.

Figure 6.8: Changes in total assets, deposits and loans in US Billion $



In addition, the resolution at the 18th summit meeting in 1997 of leaders of GCC countries, allowed national banks in these countries to open branches in member states. This resolution represented a major turning point in the course of supporting efforts towards financial integration among GCC countries, in preparation for higher degrees of integration at the monetary level. The resolution also represented a preparatory step towards implementation of the World Trade Organisation (WTO) Agreement on the liberalisation of financial services.

The Malmquist index provides a useful insight into development of efficiency over time. During the sampled period, the average Malmquist index amounted to 1.05, indicating a negative change in efficiency from 1993 to 2002 (Table 6.9). Further decomposition into technical efficiency change and technology change revealed the sector's decreased efficiency was the result of the "catching up" effect – banks decreased their technical efficiency by 3%. However, this may have been a temporary effect, evident during the sampled period only. To draw firmer conclusions a longer sample period is needed. GCC countries' efficiency growth and technological progress required 3% improvement to achieve 100 per cent efficiency. This improved innovation is expected since most GCC countries are all diversified growing economies, with well-developed and advanced banking infrastructure.

6.9 Conclusion

This chapter highlighted several interesting findings regarding the GCC banking market. First, according to technical efficiency analysis, smaller banks exhibited superior performance in terms of overall technical efficiency than larger ones, mainly associated with diseconomies of scale. Second, decomposition of technical efficiency into pure technical and scale efficiency indicated large banks proved to be more successful in adopting best available technology (pure technical efficiency) while medium banks proved to be more successful in choosing optimal levels of output (scale efficiency). Since small banks usually operate under increasing returns to scale, growth of small banks or consolidation in the market to a medium size is desirable and should enhance the efficiency of the whole banking sector. Third, decomposition of technical efficiency into pure technical and scale efficiency revealed Islamic banks were more successful in both the adoption of the best available technology (pure technical efficiency) and choosing optimal levels of output (scale efficiency). This suggests that as commercial banks expand in their constant options offered to customers, realising potential scale economies, their overall technical efficiency may grow considerably. Fourth, according to the overall technical efficiency of banks in Bahrain, Qatar, Oman, UAE, Kuwait and Saudi Arabia ranked first to sixth, respectively, markets open to foreign banks seemed to perform better. Therefore, Saudi Arabia's banking industry would apparently be in a better position if it opened its market to foreign banks.

Fifth, pooling regression of 484 observations for OTE revealed that bank size and specialisation were positively significant at 1% and 5%, respectively, while deposit market share and number of branches were negatively significant at 1%. The regression analysis for PTE showed the same result with the addition that market concentration was negatively significant at 1%. Regression analysis for SE showed market concentrations positively significant at 1%, while number of branches was negatively significant at 1%.

The Malmquist analysis showed a slight downward shift in average efficiency of the banks in the sector during 1993 to 2002, stemming from change in the technical efficiency of banks (catching up effect), and technology equally decreasing during the period. The research also provided several suggestions for further studies in the banking market. Since Data Envelopment Analysis is an important tool, further elaborations in terms of period or sample size could produce even more accurate and useful results. Additionally, DEA may be well supplemented by other approaches, such as econometric or profitability analysis, and thereby provide a view from diverse perspectives. Since banking markets in GCC countries are currently undergoing notable changes, DEA analysis could serve as a valuable device for determining further direction of market consolidation and providing guidelines for policy makers in transition economies.

Further evidence on efficiency gains can be found by examining profit performance as measured by return on assets. Return on assets is a key ratio used by managers, investors and business analysts to evaluate overall performance of a firm. "The best measures of a firm's (bank's) overall performance are the profitability ratios ROE (return on equity) and ROA (return on assets)" (Sinkey, 1983, p. 201). ROA is defined as operating profit after tax but before abnormal and extraordinary items divided by total assets.

This chapter has provided an overview of technical, pure technical and scale efficiency and change in productivity over 1993-2002. The following chapter utilises the DEA efficiency score to explain the market structure-performance relationship.

CHAPTER 7

UTILISATION OF DEA EFFICIENCY MEASURES TO EXPLAIN THE MARKET STRUCTURE-PERFORMANCE RELATIONSHIP

7.1 Introduction

Numerous studies have investigated the relationship between market structure and firm profitability and a positive relationship is usually found. Although this result is generally accepted in the literature, there is no agreement on the hypotheses which generate it. Four hypotheses have been proposed to explain the positive relationship between market structure and corporate profitability. These are the *Structure-Conduct-Performance (SCP)*, the *Relative-Market-Power (RMP)* and the *Efficient-Structure (ES) hypotheses* in the form of *X-efficiency or Scale efficiency.*

The Traditional *SCP* hypothesis identifies a setting of prices less favourable to customers in more concentrated markets as the cause of the positive relationship between profitability and market structure. According to this theory, companies have higher profits in more concentrated markets because they can charge higher prices (than those set in competitive markets) due to having a stronger market power. Similarly, the *RMP* hypothesis states that companies with high market shares and well differentiated products can exploit their market power by setting prices to earn supernormal profits.

A different explanation of the positive relation between market structure and firm profitability is presented by the ES hypothesis. This hypothesis asserts that more efficient companies have lower costs which directly increase profits: in this way, these firms can increase their market share so achieving a higher market concentration. The *ES hypothesis* has been usually proposed in two different forms, depending on the type of efficiency considered. In the *X-efficiency* form, more efficient firms have lower costs; higher profits and larger market share because they have a superior ability in minimising costs to produce any given outputs. In the *Scale Efficiency* form, the same relationship described above is due to the fact that more scale efficient firms produce closer to the minimum average-cost point.

This chapter examines the profit-structure relationship in the GCC banking industry over the period 1993-2002. Differing from the previous literature, this study uses Data Envelopment Analysis (DEA) to estimate efficiency measures. This method appears to be more appropriate than parametric estimation in view of the small number of observations available. In addition, DEA allows consideration of technical and scale efficiency), rather than x-efficiency and scale efficiency traditionally employed in the literature.

The aims of the study are, first, to analyse the relationship between market structure and banks, profitability, and then to assess the relevance of the *Structure-Conduct-Performance (SCP),* the *Relative-Market-Power (RMP)* and the *Efficient-Structure (ES) hypotheses* in the form of *X-efficiency* or *Scale efficiency* to explain the performance of the banking industry in the GCC. Third, it endeavours to test the existence of "*Quiet Life Hypothesis*" in these markets. Fourth, it aims to fill the gap in the literature since there is an absence of published studies using DEA efficiency measures to explain the market structure-performance relationship of GCC markets. Finally, it seeks to add to the wide range of empirical studies on banking throughout the world.

This chapter is structured into eight sections. Section 2 focuses on market structure and banks' profitability in the GCC region. Section 3 provides a brief review of the literature on the performance-market structure relationship. Performance measures approach is presented in section 4 while model methods are discussed in section 5. Section 6 details the study methodology. Section 7 presents the empirical findings and section 8 concludes the chapter.

7.2 Market structure and banks' profitability in the GCC region

GCC banking industries are characterised by high market concentration. In 2002, the three largest banks in Kuwait accounted for about 62 per cent of total commercial banking sector deposits, whereas in the least concentrated market, the UAE, the top three held 44 per cent share of banking sector deposits. The Qatari banking sector was also highly concentrated, with a three-firm concentration ratio of 81 per cent. Saudi Arabia's three largest banks accounted for 51 per cent of the domestic banking sector. The three largest banks in Oman and Bahrain accounted for about 81 per cent and 79 per cent, respectively. Overall, the high degree of concentration in GCC banking markets suggests that the strict licensing rules and restrictions on foreign bank entry have helped create these market structures. It can be seen that the UAE has the lowest level of concentration and this is almost certainly a consequence of laxity in restrictions on the licensing of domestic and foreign banks that have increased in number, especially in the late 1970s and 1980s.

In order to test the relationship between market structure and profitability, the author first calculated the return on assets (ROA) and return on equity (ROE) (see table 7.1) and then calculated the market structure (see Table 7.2) of the GCC banking industry during period of 1995 to 2002, using the most frequently applied measures of concentration, namely, k-bank concentration ratio (CR*k*) and Herfindahl-Hirschman Index (HHI).

The two tables show that market concentration may be one of the main reasons for the positive ROA and ROE. On the other hand, market concentration is not the sole determinant of profitability in GCC countries' banks. The possibility of concentration having an impact on other variables has to be investigated. The next step is therefore to use regression analysis to identify the underlying determinants of GCC banks performance. Specifically, the study will use a linear regression model to analyse pooled cross-section time series data in order to examine the profitability determinants of the sampled banks.

Table 7.1: Average ROA & ROE for 1995-2002

	Bahrain		**Kuwait**		**Oman**		**Qatar**		**Saudi Arabia**		**UAE**	
Year	ROA	ROE	ROA	ROE	ROA	ROE	ROA	ROE	ROA	ROE	ROA	ROE
2002	0.010	0.078	0.014	0.154	0.016	0.146	0.023	0.218	0.018	0.202	0.024	0.134
2001	0.015	0.130	0.014	0.157	0.008	0.060	0.015	0.142	0.020	0.203	0.023	0.132
2000	0.015	0.108	0.016	0.149	0.014	0.132	0.005	0.027	0.020	0.199	0.025	0.134
1999	0.015	0.117	0.013	0.119	0.016	0.148	0.018	0.185	0.011	0.075	0.021	0.115
1998	0.013	0.107	0.011	0.109	0.022	0.180	0.022	0.198	0.018	0.158	0.017	0.083
1997	0.030	0.168	0.013	0.123	0.024	0.228	0.015	0.158	0.016	0.153	0.023	0.226
1996	0.023	0.130	0.013	0.119	0.024	0.252	0.017	0.167	0.014	0.140	0.024	0.144
1995	0.018	0.122	0.013	0.139	0.020	0.214	0.012	0.130	0.015	0.146	0.017	0.106

Source: Calculated by the researcher from the banks' annual reports.

Table 7.2 Trends in Concentration in the Deposits Market

Country	Bahrain			Kuwait			Oman			Qatar			Saudi Arabia			UAE		
Measure/ Year	CR2	CR3	HHI	CR2	CR3	HHI	CR2	CR3	HHI	CR2	CR3	HHI	CR2	CR3	HHI	CR2	CR3	HHI
2002	0.66	0.79	2351	0.49	0.62	1897	0.66	0.81	2712	0.70	0.81	3565	0.38	0.51	1298	0.34	0.44	1064
2001	0.63	0.76	2277	0.48	0.62	1907	0.60	0.79	2382	0.71	0.81	3687	0.39	0.53	1403	0.33	0.43	1035
2000	0.64	0.75	2290	0.49	0.62	1924	0.59	0.82	2456	0.69	0.79	3470	0.41	0.55	1429	0.36	0.45	1182
1999	0.66	0.76	2398	0.46	0.62	1911	0.49	0.81	2430	0.67	0.78	3380	0.41	0.56	1420	0.36	0.48	1224
1998	0.73	0.86	2747	0.45	0.61	1880	0.50	0.79	2320	0.66	0.78	3239	0.38	0.53	1383	0.38	0.50	1141
1997	0.76	0.86	2939	0.47	0.62	1971	0.50	0.77	2250	0.68	0.79	3398	0.38	0.53	1447	0.39	0.50	1306
1996	0.75	0.86	2879	0.48	0.62	2014	0.52	0.78	2286	0.67	0.79	3314	0.37	0.53	1424	0.41	0.53	1349
1995	0.72	0.83	2738	0.48	0.61	1983	0.51	0.77	2258	0.73	0.81	3995	0.38	0.54	1468	0.39	0.53	1299

Source: Calculated by the researcher from the banks' annual reports.

7.3 Literature review on performance and market structure relationship

The relationship between market structure and performance is viewed from two competing hypothesis: The *Market Power Hypotheses* in the form of *Structure-Conduct-Performance (SCP)* and *Relative-Market-Power (RMP) hypotheses*, and the *Efficient-Structure (ES) hypotheses* in the form *of X-efficiency or Scale efficiency*. The following subsections provide more information about these competing hypotheses.

7.3.1 Structure-Conduct-Performance (SCP) Hypothesis

The classic early work in this area was that by Bain (1951), who developed what has come to be called the Structure-Conduct-Performance (SCP) hypothesis. Bain postulated that, in a market with relatively few firms and barriers to entry, firms will, through collusion or price leadership, achieve above normal profits. The structure-conduct-performance hypothesis may be summed up by stating markets characterised by a structure with relatively few firms and high barriers to entry will facilitate pricing conduct that is aimed at achieving joint profit maximisation through collusion, price leadership, or other tacit pricing arrangements. This type of price conduct should in turn yield profits and prices that are greater than the competitive norm. According to

Rhoades (1977), structure-conduct-performance studies on the commercial banking industry are of more recent origin than those on the industrial sector. The initial impetus for such studies may be traced to American Federal legislation in 1960 (the Bank Merger Act) which was subsequently reinforced by additional legislation and Supreme Court decisions.

The traditional *structure-conduct performance hypothesis (SCP)* asserts that the setting of prices that are less favourable to consumers (lower deposit rates, higher loan rates) in more concentrated markets as a result of competitive imperfections in these markets. A related theory is the *relative-market-power hypothesis (RMP)*, which asserts that only firms with large market shares and well-differentiated products are able to exercise market power in pricing these products and earn supernormal profits (see Shepherd 1982).

The structure-conduct-performance hypothesis states that the way a market is structured will influence the conduct of firms in the market and ultimately the profit and price performance of firms in the market. The elements of market structure that are theorised to have the greatest influence on firms' conduct are:

1. The number and size distribution of firms in the market;

2. Barriers to the entry of new firms (usually attributable to scale economies, capital requirements, or legal restrictions on entry); and

3. The growth of the market – rapid growth can facilitate new entry and may lead to such uncertainty among rivals as to cause competitive conduct.

Gilbert (1984) reviewed 45 studies (published during 1964-1983) on the relationship between performance and market structure in the banking industry. He concluded that about half of the studies uncovered a statistically significant relationship between performance and market structure. Of studies uncovering statistically significant coefficients on market concentration, estimates of the effect of changes in the concentration ratio on the performance measures were economically very small.

7.3.1.1 The Importance of (SCP)

Considerable importance is given by the commercial banking industry to empirical evidence supporting the (SCP) hypothesis for several reasons as follows:

1. Because of the large and continuous changes in the international financial system and environment, it provides empirical justification for the argument that an unrestrained financial system automatically solves all its economic problems, that is, contributes to deregulation of the banking system (See Goodfriend and King, 1988).

2. It can be used for evaluating the impact of commercial banks on economic growth. Since commercial banks are the primary and major suppliers of money to the different industries and organisations, the availability of bank credit at affordable rates is very important for the level of investments of firms and ultimately for the healthy growth of the economy. For further discussion of the link between bank credit and economic growth, see Dennis (1981, pp. 21-22).

3. It builds a strong base for banking regulatory and supervisory authorities to provide, modify and monitor public policy measures designed to enhance social welfare.

4. According to the (SCP) hypothesis, the structure characteristics of the bank market have a clear impact on the costs of bank credit, so an increase in cost of lending has a detrimental effect on the level of business investments.
5. Empirical evidence pertaining to the SCP relationship can assist government regulatory policies and in modifying the environment in which banks operate. Increased bank concentration, by increasing the cost of credit, has the effect of reducing firms' demand for credit and, consequently, affects the level of intermediation and retards the growth of the economy.

7.3.2 Quiet life hypothesis

Hicks (1935) introduced the *Quiet Life Hypothesis* which posits that firms with greater market power may take part of the gains from non-competitive pricing in a more relaxed environment in which less effort is put into the rigours of maximising cost efficiency.
The "*Quiet Life Hypothesis*" is not a necessary part of the market power paradigm, but is sometimes included in it (see Shepherd 1979; Caves and Barton 1990). Berger and Hannan (1995) found quiet life effects in banking appeared to be several times larger than social losses associated with the mispricing of products from market power. According to Berger and Hannan (1997), failure to account for the possibility of quiet life effects may lead to biased coefficients in testing the efficient-structure condition that efficiency increases concentration and market share. Interestingly, the quiet life hypothesis, if it holds, tends to offset the positive profit-structure relationship, since gains from pricing are partially offset by cost increases from poorer efficiency ratio. This perhaps explains why the profit-structure relationship is so weak in many banking papers [see the survey by Gilbert, 1984]. It could also help explain why prices tend to be much more strongly related to concentration than profits.

7.3.3 The Efficiency Hypothesis

The second hypothesis is the *efficient-structure (ES)* hypothesis that emerges from criticism of the SCP hypothesis (Demsetz, 1973 and Peltzman, 1977). The efficiency hypothesis postulates that the relationship between market structure and performance of any firm is defined by the efficiency of that firm. In cases where a firm is highly efficient relative to competitors, the firm can maximise profit by maintaining its current size and pricing strategy or by reducing prices and expanding its operations. If the firm chooses to expand its operations, it will eventually gain market share and thus, concentration will be a consequence of efficiency. The efficiency hypothesis is defined by a number of sub-branches such as the relative market power hypothesis and the efficient structure hypothesis.

The efficient structure hypothesis states that only the efficiency of firms can explain the positive relationship between profits and concentration or profits and market share. The *efficient-structure (ES)* hypothesis states that those firms with superior management or production technologies have lower costs and therefore higher profits. By extension, those more efficient firms will gain greater market shares, which may result in a more concentrated market. In this context, efficiency influences the level of profit and market structure.

The *ES hypothesis* has been usually proposed in two different forms, depending on the type of efficiency considered. In the *X-efficiency* form, more efficient firms have lower costs, higher profits and larger market share, because they have a superior ability in minimising costs to produce any given outputs. In the *Scale Efficiency* form, the same relationship described above is due to the fact that more scale efficient firms produce closer to the minimum average-cost point.

The *structure-conduct performance hypothesis (SCP)* has radically contrasting implications from the *efficient-structure (ES)* hypotheses for merger and antitrust policy. To the extent that the SCP hypothesis is correct, mergers may be motivated by desires to set prices that are less favourable to consumers, which will decrease total consumer plus producer surplus. To the extent that the ES hypothesis is correct, these mergers may be motivated by efficiency considerations that will increase total surplus. Thus, advocates of the SCP hypothesis tend to see antitrust enforcement as socially beneficial, while ES advocates tend to see policies that inhibit mergers as socially costly.

7.3.3.1 The relationship between efficiency and profitability

From a theoretical point of view, there are at least two different scenarios for the relationship between efficiency and profitability. The first one suggests that efficiency is the driving force in shaping the structure of a market, in particular, the higher the efficiency of a given firm, the higher the profits this firm can earn. Market dynamics imply then that more profitable firms gain higher market shares, and this in turn will lead to market concentration. In this case, there is a positive relationship between efficiency and profitability. Conversely, a second scenario suggests that in a concentrated industry where firms hold market power, banks will earn monopoly rents. This clearly reduces consumers' welfare, since banks increase prices and reduce the quantity of financial services supplied. However, Berger and Hannan (1998) show that another type of welfare loss could be more important in this case. Their study suggests that in more concentrated markets, efficiency of banks worsen, because the absence of competitive pressures results in lessened effort by managers to minimise cost. Managers can simply have a "quiet life", translating higher inefficiencies in higher prices. In this scenario, the relationship between profitability and efficiency is much less clear.

7.4 Performance measures

SCP studies generally can be divided into two groups according to the measure of performance they use. The first group uses some measure of the price of certain banking products and services in order to capture the performance of the firm, while the second group uses some kind of profitability measure, such as return on assets or return on equity.

> Most SCP studies also experience difficulties in measuring structure and performance variables adequately. Using the price of a single banking product as a measure of performance may be misleading because large banks are multi-product firms. Profit measures may be more informative in this respect, but may also be more difficult to interpret because of the complexity of the accounting procedures involved (Goddard et al., 2001, p. 73).

Evanoff and Fortier (1988) suggest a number of reasons why the ROA measure is preferable to other profit measures. Firstly, although some studies have used bank product prices as the dependent variable, banking is a multi-product business and individual prices may be misleading. Prices can only be used if costs directly associated with these prices are explicitly accounted for as explanatory variables, 'even then, given the regulatory constraints on the industry, the expected structure-price relationship may not be realised for a particular service because of differing pricing strategies among banks' (Evanoff and Fortier, 1988, p.281). Secondly, the potential for significant cross subsidisation between products obviously exists and pricing strategy will differ across markets. As a result, the use of profit measures should eliminate many of these potential problems. Recent studies, for example, by Molyneux and Thornton (1992), Molyneux and Forbes (1995), Berger (1995), Goldberg and Rai (1996), provide support for the use of these profitability measures as opposed to other product price measures:

> Profitability measures, where all product profit and losses are consolidated into one figure, are generally viewed as more suitable because they by-pass the problem of cross subsidisation (Molyneux and Forbes, 1995, p. 156).

ROA is generally regarded as a more satisfactory measure because of the significant discretion that individual banks in different countries have in dividing capital between debt and equity. Equity values may not be comparable across countries between banks, therefore bank assets is a more common denominator. However, difficulty in identifying the objectives of bank owners and managers may also tend to make SCP relationships tenuous (Molyneux et al., 2001). For example, if banks are sacrificing potential profits in order to reduce risk by investing in more secure activities, then researchers should be more interested in variability in profit and not in profit per se (Neuberger, 1998). Alternatively, if managers are maximising utility through expense preference behaviour, then large banks in concentrated markets will not necessarily make abnormal profit (Berger and Hannan, 1998). Indeed Berger (1995) argues that many of the regression models used to test the SCP relationship may be misspecified due to omitted variables. Berger et al. (1997, p. 23) note that:

> The dependent variable in the profit functions is essentially the return on equity, or ROE, achieved by the bank (normalised by prices and with a constant added), or a measure of how well the bank is using its scarce financial capital. This measure may be closer to the goal of the bank than maximising the level of profits, particularly in banking, which is one of the most highly financially levered industries. Shareholders are interested in their rate of return on equity, which is approximated by ROE, and most debt holders do not put much pressure on banks to earn profits because their returns are guaranteed by deposit insurance.

Of course, neither of the above measures is ideal (Goddard et al., 2001). For example, if banks with monopoly power have higher capital-to-asset ratios, because they are more conservative or they have generated larger absolute profits over time and have retained these funds, their ratios of profits to capital may be low, even though their net returns on assets may be high.

7.5 Review of model methods

As mentioned previously, four hypotheses have been proposed to explain the positive relationship between market structure and corporate profitability. These are the *Structure-Conduct-Performance (SCP)* and the *Relative-Market-Power (RMP) hypothesis* and the *Efficient-Structure (ES) hypotheses* in the form of *X-efficiency* or *Scale efficiency.* According to Berger and Hannan (1997), at least four approaches have been taken in the literature to distinguish among these four hypotheses and each has its benefits and limitations.

The first approach is to regress profits on the market structure variables, concentration and market share. The usual finding is a positive statistically significant coefficient of market share, and a statistically insignificant coefficient of concentration. Some argue that this finding supports the efficient-structure hypothesis, since both market share and profits are correlated with efficiency, which is excluded from this empirical specification (e.g. Smirlock, Gilligan, and Marshall, 1984, 1986); and (Smirlock, 1985). Others argue that this finding supports the relative-market-power hypothesis, since firms with larger shares can exercise greater market power and earn higher profits (e.g. Shepherd, 1986). The observational equivalence problem of these theories represents a severe limitation of this approach.

A second approach attempts to solve the observational equivalence problem by adding direct measures of efficiency to the profitability equation. If efficiency is properly controlled for, then the market share coefficient should reflect only market power effects. Some studies have included proxies for scale efficiency to control for the influence of the scale version of the efficient-structure hypothesis (e.g. Shepherd 1982; and Allen and Hagin, 1989). Two recent studies have also added explicit X-efficiency measures to the profitability regressions to control for the X-efficiency version of the hypothesis (Timme and Yang, 1991; and Berger 1995).

An important problem with both the first and second approaches is that the dependent variable, profitability, contains a significant amount of noise that is not related to the variables of interest. Some of this noise is created by difficulties in using accounting data (Fisher and McGowan, 1983). Profits are also influenced by a number of other factors, such as loan loss provisions, that are largely unrelated to either market power or cost efficiency.

A third approach used in banking research has been to avoid the problems associated with profit data by using instead some relatively precise survey information on the prices of individual bank deposit and loan products (e.g. Berger and Hannan, 1989; and Hannan 1991). These prices are regressed against the market structure variables to test the market-power hypotheses. A finding of less favourable prices for consumers (lower deposit rates or higher loan rates) when concentration or market share is high is taken as support for the market-power hypotheses. An advantage of this approach is that the exact prices paid or received are more accurate indicators of market power than are profits. However, this approach may also be problematic because efficiency measures have not been included in the analyses, and efficiency may be correlated with both the dependent and independent variables. Under the efficient-structure hypothesis, efficiency may be associated with more favourable prices for consumers as well as high concentration or market share. In this case, the omission of efficiency variables will bias the coefficients of the market structure variables against the predictions of the market-power hypotheses. A bias in the opposite direction occurs if efficiency is negatively correlated with the market structure variables. This may be true in banking because the highest concentration and market shares often occur in small, rural markets where firms may be less efficient. In such cases, the coefficients are biased towards finding unfavourable prices associated with high concentration or market share, a bias favouring the market-power hypotheses.

A fourth approach directly relates market structure to efficiency. Concentration and market share are regressed on the efficiency measures to test the efficient-structure condition that efficiency creates greater concentration or market share (see Berger, 1995). For the efficient-structure hypothesis to determine the positive relationship between performance and structure spuriously, efficiency must be positively related to both performance and structure. A potential problem in this approach is that causation may also flow in the opposite direction, with market structure affecting efficiency. Under the market-power hypotheses, market structure is associated with market power, and firms may take some of the benefits of this power as a more relaxed environment in which there is less pressure to maximise efficiency. Under this `quiet life' addendum to the market-power hypotheses, higher concentration and market share may be negatively related to efficiency, giving a downward bias to the coefficients when the market structure variables are regressed on the efficiency variables.

Thus, each of the approaches in the literature models one or more of the relationships among profits, prices, market structure, and efficiency; each provides some useful information for determining the empirical validity of the various hypotheses; and each has some important limitations. The purpose of this chapter is to investigate the profit-structure relationship in the GCC banking industry over the period 1993-2002. Differing from previous literature, this study uses Data Envelopment Analysis (DEA) to estimate efficiency measures. Although this innovation may imply a greater amount of noise in the regression analyses undertaken, this method appears to be more appropriate than the parametric estimate in consideration of the small number of observations available. In addition, DEA allows us to consider two efficiency terms (i.e. Technical and Scale efficiency), rather than the two traditionally employed (i.e. X-efficiency and Scale efficiency) in the literature. Finally, it examines the direct effects of market structure on explicitly calculated measures of X-efficiency and scale efficiency. This allows us to test for reverse causality in the fourth approach and to test for 'quiet life' effects, i.e., whether market-power benefits are enjoyed at least in part by less rigorous adherence to cost minimisation.

Table 7.3: Different approaches to test the relationship between market structure and profitability

Approaches	Regression Models	Expected sign of the regression coefficients according to:	
		Market Power Hypothesis	Efficient-Structure Hypothesis
1st approach	$\pi = f(MS, CONC, Z) + \varepsilon$	CONC≥0 MS≥0	CONC ≥ 0 MS≥0
2nd approach	$\pi = f(MS, CONC, X\text{-}EFF, Sc\text{-}EFF, Z) + \varepsilon$	CONC ≥ 0 MS≥0 X-EFF≥0 SC-EFF ≥0	CONC = 0 MS=0 X-EFF>0 SC-EFF>0
3rd approach	$P = f(MS, CONC) + \varepsilon$	CONC≥0, MS≥0	CONC=0 MS=0
3rd approach Version in B&H (1997)*	$P = f(MS, CONC, X\text{-}EFF, Sc\text{-}EFF, Z) + \varepsilon$ (*)	CONC≥0, MS≥0, 0≥X-EFF , 0≥SC-EFF	CONC = 0, MS=0 0≥ X-EFF, 0≥SCEFF
4th approach	$CONC = f(X\text{-}EFF, Sc\text{-}EFF, Z) + \varepsilon$ $MS = f(X\text{-}EFF, Sc\text{-}EFF, Z) + \varepsilon$		X-EFF≥ 0, Sc-EFF≥ 0
Quiet life effect	$X\text{-}EFF = f(CONC, MS, Z) + \varepsilon$ $SC\text{-}EFF = f(CONC, MS, Z) + \varepsilon$	0≥ CONC, 0≥ MS	

* This is the evolution of the third approach proposed by Berger and Hannan (1997).

π = profits; MS = Market share; CONC = concentration; X-EFF = E-efficiency; Sc-EFF = Scale efficiency; P = price; Z = Control variables, ε = random errors.

The aforementioned hypotheses have been traditionally tested in the literature by applying four different approaches. Table 7.3 summarises the approaches, regression models, and the expected sign of the regression coefficients.

The first approach consists in regressing profits on the market structure variables, such as concentration (CONC) and market share (MS): both CONC and MS coefficients are usually found positive, but only MS is also found statistically significant. The main limitation of this approach is the observation equivalence of these theories: in some literature (e.g. Smirlock et al. 1984 and 1986; and Smirlock, 1985), these findings are interpreted as a support to the ES hypotheses while, in other instances (e.g. Shepard, 1986), these results are seen as supporting the RMP hypothesis. The second approach attempts to solve the observational equivalence problem by considering efficiency measures in the analysis. In this case, X-efficiency and scale efficiency estimates are employed jointly to market share and concentration (e.g. Berger, 1995; and Timme and Yang 1991, added explicitly X-efficiency measures) as the predictor variables and profit measures (e.g. ROA and ROE) are the response variables. The significant amount of noise contained in profit measures, mainly generated by the difficulties in using accounting data, represents the most important limitation of this approach. The third approach attempts to solve this limitation by employing prices as the response variable, rather than profit indices. These prices (i.e. usually concerning bank deposits and loan products in banking) are regressed against the market structure variables: prices (paid or charged) are certainly more accurate indicators of the market power than profits' indices (see Berger and Hannan 1989; and Hannan 1991). However, the limitation of this approach is that it does not directly consider efficiency measures, which may be correlated with both dependent and independent variables. This drawback was solved by

Berger and Hannan (1997), who regressed price information on market structure variables and efficiency measures. The fourth approach directly assesses the relationship between market structure and efficiency by regressing market share and concentration on efficiency measures (Berger, 1995). The main problem in this approach is that the causation may also exist in the opposite direction: as originally noted by Hicks (1935), the lower competitive pressure in a concentrated market may result in a less rigorous effort by managers in the cost minimisation. Berger and Hannan (1997 and 1998) tested this reverse causality, labelled in the literature as the "quiet life effect", regressing the X-efficiency firm scores versus market structure variables.

A critical examination of the existing research and views on the SCP relationship enables the researcher to state the following:

a) The majority of existing studies employ a simple-equation model of bank profitability where a measure of profit rate is regressed on a measure of market concentration, along with some control variables.

b) Substantial disagreement still remains among researchers concerning the role of market concentration on bank profitability. Since the issue is essentially empirical it can only be settled on empirical grounds.

c) Existing studies provide valuable procedural and methodological guidelines for future studies on the concentration-profitability issue, however, since no prior published study on the SCP relationship exists in the GCC banking literature, this point is particularly important for the present investigation.

7.6 The study methodology

7.6.1 Profitability measures

The profitability measures include the rate of return on equity (ROE), rate of return on capital (ROC), and rate of return on assets (ROA). Smirlock (1985) notes that the use of (ROA) has provided the strongest evidence on the market concentration to profitability relationship. Keeton and Matsunaga (1985) assert that ROA is especially useful in measuring changes in bank performance over time, since banks' income and expense components are more closely related to assets. Several studies of the structure–performance hypothesis in the banking system have used both ROA and ROE (Civelek and Al-Alami, 1991; and Smirlock, 1985) used all three measures. However, Civelek and Al-Alami (1991) found results based on ROA to be statistically very inferior and justified the relative performance of ROE on the basis that it reflects the efforts of managers interested in maximising shareholders' wealth. Nonetheless, other studies have used ROA as a measure of profitability in testing the SCP hypothesis in banking (see Molyneux and Forbes, 1995; and Evanoff and Fortier, 1988).

As we read in section 7.4 about performance measures that there are many technical problems associated with using the interest (price) as performance measure. Therefore, this study will use profitability measure as performance indicator and employ the first, second and fourth approaches as well as test the quiet life effect. It excludes the third approach because this approach adopts the use of price as a performance measure. Basically, this study adopts all the approaches shown in table 7.3 with the exception of the third approach.

Two measures of profitability are used in this study, namely, ROA and ROE. ROA reflects management's ability to utilise the bank's financial and real investment resources to generate profits, specifically, it measures the profit earned per currency of assets. This ratio depends mainly on the bank's policy as well as some external factors related to the economy and government regulations. ROE reflects the effectiveness of management in utilising shareholders' funds. The choice between before and after tax net income is not expected to make a significant impact on the analysis since all GCC banks are subjected to a minimum corporation tax. Therefore, the net income after tax will be considered in the study.

7.6.2 Specification of models and tests

The starting point is the analysis undertaken by Berger and Hannan (1997), which tested all the four hypotheses previously summarised in Table 7.3. Regression analyses undertaken in this stage (summarised in table 7.4) embody the approaches presented in table 7.3, where the only substantial difference is represented by the substitution of X-efficiency terms with the technical efficiency terms. Whilst the first focuses on the cost function referring to "the closeness of costs to the minimum that could be achieved on the efficiency frontier" (Berger and Hannan 1997), technical efficiency focuses only on physical quantities and technical relationship, expressing the ability of a firm to obtain maximal outputs from a given set of inputs or of minimising inputs for a given target of outputs. In other words, both technical and X-efficiency refers to the best-practice firm on the efficient frontier: the difference is that X-efficient firms are "the best" in terms of costs (i.e. quantities and price) while technically efficient firms are the best in terms of "quantities". As will be discussed next, the substitution of X-efficiency with Technical efficiency should not affect the significance of the approaches undertaken, but it allows us to test more precisely the market structure-performance relationship.

Table 7.4: Regression analyses carried out to test the relationship between market structure and profitability

Regression No.	Approach	Response Variable	Predictor variables
1	1st	ROA	CONC, MS, Z vectors*
2		ROE	CONC, MS, Z vectors*
3	2nd	ROA	CONC, MS, Te-EFF, S-EFF, Z vectors*
4		ROE	CONC, MS, Te-EFF, S-EFF, Z vectors*
5	4th	CONC	Te-EFF, S-EFF, Z vectors*
6		MS	Te-EFF, S-EFF, Z vectors*
7	QLH	Te-EFF	MS, CONC, Z vectors*

*Z vectors include: GDPPC, DEPGRW, ASSET, CAPAST, LOANAST, DDTTDEP, TEXPTA, POPBRANCH, OBSTA and SPECIALIZ

VARIABLE DESCRIPTION

ROA	Net after tax return on assets
ROE	Net after tax return on equity.
CR3	Highest three banks in the deposit market.
MS	Market share (in terms of deposit)
Te-EFF	Technical efficiency score in input orientation
SC-EFF	Scale efficiency score in input orientation
GDPPC	Per capita income as a proxy for local market conditions.
DEPGRW	Deposit growth as a proxy for market growth.
ASSET	Bank total assets as a measure of bank size and economies of scale.
CAPAST	The ratio of capital to asset as a proxy for risk management.
LOANAST	The ratio of loan to assets as another proxy for risk management.
DDTTDEP	Demand deposits to total deposits as a proxy for cost of funds.
TEXPTA	Ratio of total expenses to total assets as a proxy for operating costs management.
POPBRANCH	The ratio of population per branch as a proxy for geographic diversification.
OBSTA	Off-balance sheet activities to total assets as a proxy for business diversification.
SPECIALIZ	Dummy variable for bank specialisation

In detail, regressions 1 and 2 embody the first approach to test the positive relationship between market structure and profitability: ROA and ROE are in fact regressed on market shares and market concentration, whilst efficiency measures are not directly considered. Regressions 3 to 7 directly consider efficiency measures as response variables. Regressions 3 and 4 refer to the second approach and regressions 5 and 6 reflect the fourth approach. In addition, regression 7 embodies the version of Hicks' (1935) "Quiet life" hypothesis proposed by Berger and Hannan (1997).

In this thesis, this chapter considers two efficiency terms (Technical Efficiency and Scale Efficiency) in the regression models. Concerning the Efficiency Structure Hypothesis, in the X-efficiency version, firms have higher profits (and therefore higher market share) because these firms have "superior skills in minimising the costs of producing any given output bundle" (Berger and Hannan 1997). However, because the X-efficiency incorporates both technical and allocative inefficiency (see, for example, Berger and Hannan, 1998), it is impossible to assess if these superior skills in minimising costs are generated by a technical efficiency (which focuses on quantities) or scale efficiency (which focuses on mass production). When technical and scale efficiency are considered (rather than X-efficiency), ES hypotheses can be stated in two different versions: technical and scale efficiency. In the technical efficiency version, higher profits and larger market shares are determined by superior skills in transforming input-quantities in output-quantities. In the scale efficiency version, profits and market share come from lower costs determined by an optimal operational scale. In conclusion, the four approaches proposed to test the relationship market structure-performance can be stated as shown in table 7.3. Regression analyses undertaken to embody these four approaches are shown in table 7.4.

These regressions are flexible since all four hypotheses, the structural-conduct-performance hypothesis, the relative-market-power hypothesis, the *X*-efficiency version of the efficient-structure hypothesis, and the scale-efficiency version of the efficient structure hypothesis, can be represented by different variables. The positive profit concentration relationship occurs because concentration (*CR3*) affects price and price affects profit. On the other hand, under the relative-market-power hypothesis, market share (*MS*) becomes the key exogenous variable, since banks with large market shares have well-differentiated products and are able to exercise market power when pricing these products. In brief, under MP hypotheses, the appropriate market structure variables, concentration (*CR3*), and market share (*MS*) have a positive coefficient, while the other variables are simply irrelevant. For instance, if only the relative-market-power hypothesis holds, concentration (*CR3*) will have a zero coefficient because it is only spuriously related to profit through its correlation with *MS*.

By contrast, if ES hypotheses are accepted, the coefficients of the appropriate efficiency variables will be positive and the coefficients of all the other key variables will be either relatively small or zero. An important limitation of the reduced-form profit equation in regressions (3) and (4) of the second approach is that it tests only one of the three necessary conditions of the ES hypotheses. More precisely, in order to rigorously explain the profit-structure relationship, two more conditions (regressions (5) and (6) of the fourth approach, table7.4) should be met, since both profits and the market structure variables must be positively related to efficiency. For instance, one of the conditions is that in regression (6), more efficient firms must have greater market shares. This requirement can be explained since more efficient banks obtain greater market share through price competition or through the acquisition of less efficient banks.

The profit, the concentration, and the market share differences between banks probably depend on other characteristics in addition to technical and scale efficiency. To investigate, the researcher regressed ROA, ROE, CR3 and MS on a set of macro-economic factors, market factors, and bank specific factors. The following sub-sections elaborate on these factors.

7.6.3 Internal and external control variables

Several control variables that take into account firm-specific, market-specific, and local economic characteristics are theoretically justified and included in empirical studies of the banking industry. Therefore, the following control variables are categorised into the above three factors.

7.6.3.1 Local economic conditions factors

Bank performance has been heavily dependent upon local economic conditions. Samolyk (1994) observes that banking sector problems may be constrained by the poor economic activity in financially distressed regions, whereas no such relationship has been found in financially healthy regions. On the other hand, Goldberg & Rai (1996) hypothesised that the coefficient will be negative because countries with higher per capita income (GDPPC) are assumed to have a banking system that operates in a mature environment resulting in more competitive interest and profit margins. According to Demirguc-Kunt and Huizinga (1999), per capita GDP is a general index of economic development, and it thus reflects differences in banking technology, the mix of banking opportunities, and any aspects of banking regulations omitted from the regression. This study uses per capita income as a proxy for the local economic conditions. The author expects a positive insignificant relationship.

7.6.3.2 Market specific factors: Market specific factors include: market structure, market growth and economies of scale and bank size.

7.6.3.2.1 Market growth

Annual growth in the money supply or change in annual total deposits is used to represent market growth. This study uses the change in annual total deposits to measure market growth. Civelek and Al-Alami (1991) reported that market growth produced plausible results and appeared to be a relatively significant determinant in the bank profitability equation. As part of a bivariate analysis of the interactions between bank profitability and growth indicators, Goddard et al. (2004a) found evidence of significant persistence in bank profitability. Pilloff and Rhoades (2002) in bivariate and multivariate regression analyses reported deposit growth rate positively related and statistically significant to profitability and provide additional information on the level of competition in a market. It is therefore expected in this study that the profitability measure will be associated positively with market growth.

7.6.3.2.2 Economies of scale and bank size

Bank size is measured as a bank's total deposits or assets or as an average measure based on total assets (ASSET) (Civelek and Al-Alami, 1991; Molyneux and Forbes, 1995; Smirlock, 1985; and Evanoff and Fortier, 1988). The bank size variable takes into account differences brought about by size, such as economies of scale. This study uses the bank's total assets as a measure of bank size. The expectation is that larger banks compared with smaller banks can reap economies of scale and have greater diversification opportunities. However, according to Evanoff and Fortier (1988) and Smirlock (1985), any positive influence on profits from economies of scale may be partially offset by greater ability to diversify assets, resulting in a lower risk and a lower required return. Therefore, the impact of bank size is indeterminate. Empirical results on the performance of the bank size variable are mixed, with conclusions of no economies of scale (Kwast and Rose 1982; Civelek and Al-Alami 1991; Molyneux and Forbes, 1995; and Ben Naceur and Goaied 2001), and others reporting significant positive (Evanoff and Fortier, 1988; Lloyd-Williams and Molyneux 1994) and negative

(Smirlock, 1985; Goldenberg and Rai 1996; Chirwa 2003) relationships. According to Goddard et al. (2004b) a positive relationship between size and profit can be explained by several factors. Large banks may benefit from scale or scope economies. In addition, large banks may be able to exert market power through stronger brand image or implicit regulatory (too big to fail) protection. Abnormal profits obtained through the exercise of market power in wholesale or capital markets may also contribute to a positive size profitability relationship. Alternatively, if large banks encounter diseconomies of scale, the size-profit relationship could be negative.

In summary, theory in relation to returns to scale is still unclear, but research findings indicate that scale economies apply to a limited degree in banking, with little evidence that large banks enjoy anything better than constant returns to scale. However, according to Revell (1987, p68), the suggestion that the economies of scale that are one of the main justifications for so many mergers seem rather elusive and a somewhat ambiguous argument to use in this context. Discussing economies of scale and scope in banking he contends that economies of scale are relatively unimportant in determining the optimum size of bank; economies of scope may be more important because it takes a universal bank to derive the most benefit from them. It is expected that bank size will produce mixed signs for each country in this study.

7.6.3.3 Firm specific factors

In Haslam's (1968) two year study, balance sheet and income statement ratios were computed for all the member banks of the United States Federal Reserve System. The results indicated that: a) returns to scale did not operate over the entire size spectrum of banks; and b) most balance sheet and income statement ratios were significantly related to profitability, particularly capital ratios, interest paid and received and salaries and wages. In conclusion, Haslam stated that a guide for improved management should, first emphasise expense management, then funds, source management and, lastly, funds' use management. The empirical results of Ben Naceur and Goaied (2001) revealed the performance of Tunisian banks is mainly a function of endogenous factors under the control of the bank's management. Improvement of Labour and capital productivity and the definition of the bank's composition and capitalisation are two major considerations that are internally influenced by management policies. Firm specific factors include: risk management, cost of funds, efficiency, operating costs management, geographic diversification, investment diversification and specialisation.

7.6.3.3.1 Risk management

Banks are experiencing various sources of risk, including credit of default risk, investment risk, liquidity risk, cost of funds risk, financial risk, regulatory risk, and fraud and fiduciary risk. The stability of the net interest margin of a bank is highly dependent upon these sources of risk and use of risk management techniques.

As in Chirwa (2003), this study uses the capital–asset ratio (CAPAST) and loan-asset ratio (LOANAST) to account for differences in levels of risk between firms.

A bank having a high proportion of liquid assets is unlikely to earn high profits, but is also exposed less to risk; therefore shareholders should be willing to accept a lower return on equity. Lower CAPAST is associated with high risk. However, as a measure of risk, the capital asset ratio also produces a perverse sign, although it is statistically significant (Molyneux and Forbes, 1995). Evanoff and Fortier (1988) found a significant negative relationship between return on assets and capital–asset ratio. Bourke (1989) studied 90 banks for the period 1972 to 1981 in twelve countries and territories, and found capital ratios positively related to profitability. Lloyd-Williams and Molyneux (1994), who studied Spanish banks for the period 1986-1988, reported capital to assets ratio (CAPAST) to be positive and statistically significant. Goddard, et al. (2004b) found a positive relationship between the capital-assets ratio and profitability. This is somewhat surprising given that lower capital ratios are associated traditionally with greater risk taking.

The findings in relation to capital ratios are to be expected as, in accounting terms, capital represents a 'free' resource and Revell (1980) had noted an inverse relationship between capital ratios and costs of intermediation. It is also possible to speculate that well capitalised banks enjoy access to cheaper (because less risky) sources of funds prudence implied by high capital ratios is maintained in the loan portfolio with consequent improvement in profit rates. Berger (1995) reported a positive association between capital assets ratio and return on equity, and proposed several theoretical explanations. For example, expected bankruptcy costs may be relatively high for a bank maintaining CAPAST below its equilibrium value. An increase in CAPAST should lead to an increase in ROE by lowering insurance expenses on uninsured debt. Alternatively, according to a signalling hypothesis, bank managers may have both private information as to the bank's future profitability and a stake in the bank's value through personal share ownership or options. It may be less costly for managers of low risk banks to signal quality by maintaining a high CAPAST than for managers of high risk banks. This may create a signalling equilibrium involving a positive association between CAPAST and ROE.

Another measure of risk included is the loan–asset ratio (LOANAST). The loan–asset ratio is traditionally included in the model to capture bank-specific risk. Portfolio theory postulates that risky investments are usually associated with higher returns than primary assets. Chirwa (2003) found a positive relationship between profitability and the loan-asset ratio. The loan–asset ratio is expected to be positively correlated with bank profitability. However, empirically, this measure of bank risk has produced perverse results, suggesting there is risk reduction behaviour among bank managers (Evanoff and Fortier 1988; Civelek and Al-Alami 1991; Molyneux and Forbes, 1995). It is expected in this study that the profitability measure will associated positively with risk factors.

7.6.3.3.2 Cost of funds

The bank's relative cost of funds is captured by the ratio of demand deposits to total deposits (DDTDEP). Demand deposits are a relatively inexpensive source of funds. Empirical studies (Smirlock, 1985; Evanoff and Fortier, 1988) have found the demand deposit to total deposits ratio to be significant and positively related to profitability measures. These results confirm the argument that demand deposits are a cheaper source of funds for the banking industry. The author expects that the higher the ratio of demand deposits to total deposits, the higher the level of profitability.

7.6.3.3.3 Operating costs management

Does spending more bring more revenue and eventually more profits? The Federal Reserve Bank of Atlanta (1983) emphasised on the importance of internal bank management in the determination of bank profits. Its central finding was that profitable banks are those banks which have been able to reduce costs without sacrificing revenue. Hunter and Srinivasan (1990) indicated that three bank specific (internal) characteristics appear to be the primary determinants of newly chartered banks' likelihood of achieving financial success: credit policy, operating costs,[1] and the level of equity capitalisation. In this study, operating cost is indicated by the ratio of total expenses to total assets (TEXPTA). It is expected that the profitability measure will be associated negatively with operating cost.

7.6.3.3.4 Geographic diversification

Empirical evidence suggests that banking organisations tend to diversify geographically, and that diversification reduces the likelihood of bank failure. Hughes et al. (1999) reported that while growth through product and geographic diversification reduced bank risk, efficiency tended to improve as a result of geographic diversification. Country branching allows banks to take advantage of diversification. Geographic diversification reduces risk from the loan portfolio by spreading the product-inherited risk to different locations. It provides greater access to money markets and easier diversification into new markets and services. Generally, large banking firms are the most diversified geographically and more leveraged than small banking firms. Bauer and Cromwell (1989) found that the number of banks is not statistically significant, but the number of branches statistically significant. More branches could reflect more of a retail orientation of banks. Since this research is trying to identify the determinants of profitability for the six countries under study, number of branches is weighted by the number of population. It is expected that the profitability measure is associated positively with number of population per branch (in other words, the number of branches is negatively related to profitability).

[1] Operating cost is indicated by the ratio of wages and salaries to total assets.

7.6.3.3.5 Specialisation

One of the objectives of this study is to compare Islamic banks with commercial banks in the GCC region in order identify any meaningful differences either in terms of the significance of or the correlation signs between different factors and profitability. This study uses a dummy variable (DUMMY) to represent the difference between the two types of bank. Since the main feature of Islamic banking is the absence of an explicit interest rate mechanism, it is expected that Islamic banks will have a negative effect on profitability.

7.6.3.3.6 Investment diversification

Banking is moving away from traditional sources of revenue like loan making and towards activities that generate fee income, service charges, trading revenue, and other non-interest income. Banks are offering a wider range of products and services and conducting a significant proportion of their off balance sheet (OBS). These products and services include loan commitments, letters of credit, derivatives, and the creation of marketable securities.

Empirical results show neutral, negative or positive relationship between investment diversification and profitability. Klein and Saidenberg (1997) found diversified banks less profitable on average. Goddard (2004b) reported the relationship between the importance of off-balance-sheet business in a bank's portfolio and profitability to be positive for the UK, but either neutral or negative elsewhere. Vander Vennet (1998) found that financial conglomerates more efficient on average than their specialised competitors. This study uses the ratio of off balance sheet to total assets (OBSTA) activities and the author expects a positive relationship between profitability and investment diversification.

7.6.4 The Model

The bank profitability literature generally comes to the conclusion that the appropriate functional form for testing is a linear function, although there are different opinions. Short (1979) investigated the question of functional form and concluded that 'linear functions produce as good results as any other functional form'. Accordingly, and in line with earlier studies in the bank profitability literature, regression analysis will be used to identify the underlying determinants of commercial and Islamic banks' performance. Specifically, the study will use a linear regression model to analyse pooled cross-section time series data. The regression analysis will start by estimating the following linear equation:

$$\boldsymbol{P_{ijt} = \alpha_0 + \alpha_i B_{ijt} + \beta_j X_{jt} + \gamma_i D_i + \varepsilon_{ijt}} \qquad (1)$$

where, P_{ijt} represents the measure of performance for bank i in country j at time t; B_{ijt} are bank variables for bank i in country j at time t; X_{jt} are country variables for country j at time t; D_i is a dummy variable that = 1 for Islamic banks, 0 otherwise. Further, α_0 is a constant, and α_i, β_j and γ_i are coefficients, while ε_{ijt} is an error term.

7.6.5 The pooled least squares and the LSDV (fixed effect) models

The researcher assumes there is a common intercept across GCC commercial banks. In another words, there are no cross sectional differences, which are not accounted for by the variables included in equation 1. Further, the implicit assumption in our model is that the effects of the cross sectional differences are limited to the intercept term. Such assumption is necessary as, according to Pindyck and Rubinfeld (1991), each separate cross-sectional regression will require a distinct model and the pooling will be wrong if the slopes vary over time and cross sectional units. Further, in order to test the validity of the above assumption, our restricted model, equation 1, is tested for cross-sectional differences by adding 5 dummy variables as follows:

$$P_{ijt} = \alpha_0 + \alpha_1 C_{2i} + \alpha_2 C_{3i} + \alpha_3 C_{4i} + \alpha_4 C_{5i} + \alpha_5 C_{6i} + \alpha_i B_{ijt} + \beta_j X_{jt} + \gamma_i D_i + \varepsilon_{ijt} \qquad (2)$$

where, C_{2i} = 1 if the observation belongs to Kuwait, 0 otherwise; C_{3i} =1 if the observation belongs to Oman, 0 otherwise; C_{4i} = 1 if the observation belongs to Qatar, 0 otherwise; C_{5i} = 1 if the observation belongs to Saudi Arabia, 0 otherwise; C_{6i} = 1 if the observation belongs to UAE, 0 otherwise. The researcher did not include a six dummy variable for Bahrain in order to avoid falling into the "dummy-variable trap". Equation number two represents the unrestricted model in our test and is called the least-square dummy variable (LSDV) model as it uses dummy variables in order to estimate the cross-sectional differences. Equation number 2 is also known as the fixed effect model (FEM) due to the fact that "although the intercepts may differ across individuals (here the six countries), each individuals' intercept does not vary over time; that is, it is time invariant" (Gujarati, 2003).

The decision as to which model is better, the restricted model (equation 1) or the unrestricted model (equation 2), is based on statistical testing which requires comparison of the error sum of the squares of the restricted model and the unrestricted model employing the formal restricted F test. The formal equation of the F value is:

$$F = \frac{(R_{UR}^2 - R_R^2)/m}{(1 - R_{UR}^2)/(n-k)} \qquad (3)$$

Where:

R_{UR}^2 = the sum squared value of the unrestricted model (equation 2),

R_R^2 = the sum squared value of the restricted model (equation 1),

m = the number of linear restrictions (five in our example)[2],

k = the number of parameters in the unrestricted regression,

n = the number of observations.

During the F-test, our hypothesis for the cross-sectional differences is as follows:

H_0: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ which means that all the α 's are simultaneously zero[3]

H_1 : Not all the α 's are simultaneously zero.

The F-test is conducted for both the profitability measures of the study, ROE and ROA. Therefore, the F ratios for F_{ROA} and F_{ROE} are:

F_{ROA} = [(0.392803-0.381338)/ 5] / [(1-0.392803)/ (484-17)] = 1.75

F_{ROE} = [(0.167498-0.158527)/ 5] / [(1-0.167498)/ (484-17)] = 1.01

The F distribution has 5 linear restrictions and 467 degrees of freedom. At 5%, clearly these F values are statistically insignificant [$F_{0.5}$ (5,467) = 2.21]. The results of the tests are presented in table 7.5.

Table 7.5 Results of statistical tests for cross-sectional differences

Dependent variable	R_{UR}^2	R_R^2	F- statistic	Critical F-value at 5% level*	Conclusion
ROA	0.392803	0.381338	1.75	≈ 2.21	Accept H_0
ROE	0.167498	0.158527	1.01	≈ 2.21	Accept H_0

*We have 5 degrees of freedom (df) in the numerator and 467 df in the denominator, $F_{0.05}$ (5,467).

[2] The value of m in the present case is 5, since there are five restrictions involved: $\alpha_1 = 0$, $\alpha_2 = 0$, $\alpha_3 = 0$, $\alpha_4 = 0$, and $\alpha_5 = 0$.

[3] H_0 implies that Kuwait, Oman, Qatar, Saudi Arabia and UAE are simultaneously unrelated determinants of profitability.

According to the statistical results in the above table, and since the observed F values (1.75 and 1.01) do not exceed the critical value (2.21), the F value is statistically insignificant at five per cent. Therefore, there is no reason to reject the null hypothesis, which implies that the appropriate performance model is the constrained (restricted) regression, equation 1. Accordingly, the researcher continued the study with the pooled least squares model instead of the LSDV model (fixed effect model). However, the researcher has included all regression test results for both restricted and unrestricted models.

7.6.6 Country by country or pooling the data

One of the major limitations of this study is the small number of banks investigated: the number with all data available ranged from 5 banks in Oman (50 observations) to 18 banks in UAE (144 observations). To overcome this limitation and to ensure a sufficient number of observations for robust results and reasonable conclusions, the researcher used a pooled cross-sectional time-series regression approach for each individual country and all GCC countries' banks to deal with heteroscedasticity, cross-sectional dependence and auto regression. Further, because this method is capable only of processing data with the same number of time series observations across different cross-sections, the study could only include in the sample banks that had data available for all explanatory variables during all time periods.

7.6.7 Brief description of the efficiency measures

A fundamental aspect of the analysis undertaken is the nature of the efficiency estimates utilised in the regression analyses. Following the approaches proposed in the literature, firms' efficiency measures are directly considered in this study analysis. In particular, it calculates technical and scale efficiency measures using Data Envelopment Analysis. DEA is a linear programming algorithm, where the efficient frontier is approximated in a non parametric way by an envelope of hyper planes in the input/output space (Charnes et al., 1978, Banker et al., 1984). DMUs on the envelopment surface, named best-practice or technically efficient, form the efficient frontier. For each DMU outside the frontier, relatively technically inefficient, the efficiency score is determined by comparing its performance to the envelopment surface.

The main drawback of the DEA technique is that it does not allow for random error: DEA efficiency estimates may identify measurement errors and transitory differences in costs as inefficiency. The necessity to minimise the noise in the regression analysis usually induces researchers dealing with the profit-structure relationship to utilise econometric methodologies to estimate efficiency scores, which allows disentangling of error terms by efficiency terms. Despite this problem, the researcher believes that undertaking this analysis with the DEA efficiency estimates is worthwhile because:

- it would have been difficult to undertaking this analysis using a parametric technique to estimate cost efficiency. Although the sample collected is the largest available and the time period is the longest possible, the number of observations is still small: in such a situation, the application of a non deterministic method allows us to face the degrees of freedom problem, which we would have encountered if a parametric methodology had been selected to estimate the efficiency and productivity;
- Although an error term is not explicitly calculated, noise in the efficiency estimates should not be significant, because:

1) measurement errors "should" be avoided because data were collected from banks' annual reports and eventual inaccuracies in data measurement would be readily noted. Therefore, data can be reasonably assumed to be accurate;

2) a careful investigation to detect outliers and influential observations was carried out following the most relevant procedures. The detection process was undertaken as follows:

a) Identification of non conforming observations (outliers) by analysing input and output data and efficiency scores;

b) "Outliers" were prioritised on the basis of the underlying production process;

- A significant level of noise is already present in profit measures and the "potential" noise level involved in efficiency estimates should not substantially affect our results;
- DEA efficiency measures allow us to distinguish between technical and scale efficiency, rather than considering the X-efficiency term. As indicated earlier, by considering technical and scale efficiency, it is possible to restate the traditional SCP and the Relative-Market Power theories and to extend the Efficiency-Structure hypotheses.

7.7 Empirical results

Results are presented in three sub-sections. In the first section, tables 7.6, 7.7 and 7.8 present the tests undertaken without explicitly considering efficiency terms (i.e. the first approach shown in table 7.3). In the second section, tables 7.9 and 7.10 show regression analyses carried out when technical and scale efficiency are directly considered (i.e. second and fourth approaches shown in table 7.3). Table 7.11 shows the results for testing the "Quiet Life Hypothesis".

7.7.1 Profitability and Market Structure regressions without control for efficiency

The results for each individual country and the pooled GCC estimates are reported in table (7.6) for ROA and table (7.7) for ROE.

Table (7.6) Empirical results of the determinants of ROA as a measurement of profitability without control for efficiency direct variables (1st approach)

Variable	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE	GCC
Intercept	-0.157064 (-1.574007)	0.083144 (0.993039)	0.075579 (0.802743)	-0.108854 (-1.454925)	-0.050063 (-0.568747)	0.087141 (0.435871)	-0.009227 (-1.218822)
GDPPC	3.48E-06 (0.955823)	1.12E-06 (2.278507)**	-6.35E-06 (-1.707315)*	-1.91E-06 (-2.558640)**	4.00E-06 (1.663135)*	4.24E-06 (3.025695)***	2.87E-07 (1.845072)*
CR3	0.082614 (1.380540)	-0.134292 (-1.008101)	4.04E-05 (0.038524)	0.246185 (2.684119)***	0.128127 (1.243870)	-0.068994 (-0.374350)	3.45E-05 (0.941852)
MS	-0.037749 (-0.822743)	0.024199 (0.585126)	-0.005952 (-0.240465)	-0.026511 (-0.683142)	-0.176688 (-1.972929)**	0.013699 (0.150849)	0.017086 (2.420607)**
DEPGRW	0.042570 (1.517828)	-0.025048 (-1.202372)	0.032514 (2.109747)**	-0.030112 (-1.911296)*	-0.008007 (-0.165417)	-0.010823 (-0.298525)	0.008582 (0.981708)
ASSET	4.45E-06 (0.764285)	3.31E-07 (0.315507)	-2.22E-06 (-0.733199)	1.21E-06 (0.391546)	8.49E-07 (0.981943)	-3.80E-08 (-0.019352)	-2.39E-07 (-1.252311)
CAPAST	0.034751 0.653291	-0.011460 (-0.295486)	0.044110 (0.794230)	0.231259 (2.583853)**	0.234786 (4.165418)***	0.105421 (3.240782)***	0.128140 (10.35695)***
LOANAST	-0.013003 (-0.583197)	0.025956 (3.858017)***	0.000809 (0.033390)	-0.007506 (-0.429936)	0.024250 (1.997958)**	0.046895 (5.128897)***	0.018434 (4.479895)***
DDTTDP	-0.004241 (-0.220377)	-0.005158 (-1.693635)*	0.010140 (1.113854)	0.023361 (0.813471)	0.053558 (2.843688)***	-0.004301 (-0.346621)	0.004359 (1.236665)
TEXPTA	0.161201 (1.243286)	-0.073808 (-0.655761)	-0.105813 (-0.768539)	-0.117297 (-0.861927)	-0.734148 (-8.474573)***	-0.590362 (-7.338895)***	-0.418996 (-10.80120)***
POPBRNCH	6.67E-06 (1.333415)	-3.94E-07 (-0.498026)	-2.12E-06 (-1.011310)	-3.97E-06 (-1.709590)*	-2.48E-06 (-0.861449)	-1.21E-05 (-1.121204)	1.02E-06 (2.812810)***
SPECIALIZ	0.000190 (0.042415)	-0.008444 (-1.982962)*	NA[4]	0.006855 (1.000448)	-0.042099 (-2.828851)***	-0.037977 (-4.945933)***	-0.005919 (-2.520707)**
OBSTA	0.004917 (0.653130)	-.021708 (-0.950424	0.007386 (1.548030)	0.005579 (0.991787)	0.007844 (2.302736)**	-0.001544 (-0.349776)	0.005366 (2.892609)***
Adj. R^2	28%	40%	26%	21%	65%	51%	37%
F-statistic	2.894405	4.829059	2.586083	2.300124	16.10810	13.62142	24.03930
Prob (F-stat)	0.004542	0.000022	0.014679	0.021093	0.000000	0.000000	0.000000

The values in parentheses are the t-statistics, *** Significant at 1%, ** significant at 5% and * significant at 10%.

[4] Oman has no Islamic banks; therefore, the specialisation dummy variable is not included in the equation.

In the case of Oman, because of the non-existence of Islamic banks in this country, equations are estimated without the specialisation dummy variable. Tables (7.6) and (7.7) illustrate the marked instability in parameter estimates across countries and the substantial differences in explanatory variables.

Table (7.7) Empirical results of the determinants of ROE as a measurement of profitability without control for efficiency direct variables (1st approach)

Variable	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE	GCC
Intercept	-0.391874 (-0.721021)	1.042282 (1.406990)	0.315865 (0.395235)	-1.038581 (-1.192025)	-0.282401 (-0.117273)	1.690394 (0.818603)	0.089861 (0.705940)
GDPPC	-6.28E-06 (-0.316993)	8.61E-06 (1.977771)*	-5.81E-05 (-1.839443)*	-2.11E-05 (-2.430409)**	0.000115 (1.744077)*	2.23E-05 (1.542206)	4.04E-06 (1.545028)
CR3	0.205426 (0.630265)	-1.510217 (-1.281331)	0.007244 (0.813744)	2.513453 (2.353214)**	2.652982 (0.941450)	-1.171383 (-0.615345)	0.000642 (1.040903)
MS	-0.269908 (-1.080048)	0.396538 (1.083702)	0.211614 (1.007123)	-0.362065 (-0.801171)	-3.865687 (-1.577821)	-0.491866 (-0.524369)	0.221904 (1.869668)*
DEPGRW	0.067920 (0.444620)	-0.132909 (-0.721088)	0.387222 (2.960022)***	-0.287775 (-1.568500)	-0.822860 (-0.621419)	-0.002642 (-0.007055)	0.047740 (0.324786)
ASSET	5.14E-05 (1.619648)	-2.00E-06 (-0.215922)	-5.33E-05 (-2.075755)**	2.17E-05 (0.601603)	1.24E-05 (0.524025)	-2.57E-07 (-0.012695)	-4.44E-06 (-1.385462)
CAPAST	-0.343047 (-1.184033)	-0.850426 (-2.478377)**	-1.005906 (-2.133761)**	1.449221 (1.390447)	4.946313 (3.207714)***	-0.976726 (-2.907018)***	0.079340 (0.381378)
LOANAST	0.067398 (0.555011)	0.271039 (4.553276)**	0.079909 (0.388333)	-0.120131 (-0.590868)	0.288899 (0.870064)	0.129468 (1.370926)	0.165173 (2.387289)**
DDTTDP	0.051194 (0.488458)	-0.038823 (-1.440885)	0.036475 (0.472014)	0.344287 (1.029510)	1.158166 (2.247779)**	-0.172902 (-1.348988)	0.076913 (1.297612)
TEXPTA	1.108396 (1.569537)	-1.452703 (-1.458765)	-0.962277 (-0823394)	-0.662039 (-0.417753)	-22.29043 (-9.405464)***	-1.878870 (-2.261314)**	-5.452312 (-8.359039)***
POPBRNCH	3.48E-05 (1.279364)	-4.61E-06 (-0.657805)	-2.55E-05 (-1.438653)	-3.86E-05 (-1.429753)	-8.92E-05 (-1.130664)	-0.000110 (-0.986839)	7.95E-06 (1.308488)
SPECIALIZ	-0.014312 (-0.587880)	-0.029411 (-0.780636)	NA	0.112400 (1.408623)	-1.324771 (-3.253909)***	-0.091387 (-1.152309)	-0.016414 (-0.415718)
OBSTA	0.044050 (1.074294)	0.035468 (0.175512)	0.053906 (1.331060)	0.044556 (0.680173)	0.115786 (1.242475)	-0.026271 (-0.576206)	0.075187 (2.410346)**
Adj. R^2	12%	57%	31%	8%	58%	13%	14%
F-statistic	1.638170	8.371161	3.041011	1.470332	12.17480	2.734890	7.347302
Prob(F-stat)	0.113278	0.000000	0.005253	0.169529	0.000000	0.002452	0.000000

The values in parentheses are the t-statistics, *** Significant at 1%, ** significant at 5% and * significant at 10%.

Table (7.8) Restricted empirical results of the determinants of ROA and ROE for all GCC banks without control for efficiency direct variables (1st approach)				
Variable	ROA (Restricted)	ROA(Restricted)	ROE(Restricted)	ROE(Restricted)
Intercept	-0.009227 (-1.218822)	0.001643 (0.290887)	0.089861 (0.705940)	0.114317 (1.019562)
GDPPC	2.87E-07 (1.845072)*	------------------	4.04E-06 (1.545028)	4.27E-06 (1.679267) *
CR3	3.45E-05 (0.941852)	------------------	0.000642 (1.040903)	0.000759 (1.363134)
MS	0.017086 (2.420607)**	0.012674 (2.151854) **	0.221904 (1.869668)*	0.207823 (1.876936) *
DEPGRW	0.008582 (0.981708)	------------------	0.047740 (0.324786)	------------------
ASSET	-2.39E-07 (-1.252311)	------------------	-4.44E-06 (-1.385462)	-4.42E-06 (-1.386017)
CAPAST	0.128140 (10.35695)***	0.129458 (10.87071) ***	0.079340 (0.381378)	------------------
LOANAST	0.018434 (4.479895)***	0.019862 (5.470381) ***	0.165173 (2.387289)**	0.148520 (2.425149) **
DDTTDP	0.004359 (1.236665)	------------------	0.076913 (1.297612)	0.066950 (1.392021)
TEXPTA	-0.418996 (-10.80120)***	-0.405459 (-10.83689) ***	-5.452312 (-8.359039)***	-5.418338 (-8.444921) ***
POPBRNCH	1.02E-06 (2.812810)***	4.82E-07 (2.040371) **	7.95E-06 (1.308488)	7.37E-06 (1.293242)
SPECIALIZ	-0.005919 (-2.520707)**	-0.005381 (-2.908598) ***	-0.016414 (-0.415718)	------------------
OBSTA	0.005366 (2.892609)***	0.004884 (2.665747) ***	0.075187 (2.410346)**	0.081659 (2.766265) ***
Adj. R^2	0.37	0.36	0.137	0.142
F-statistic	24.03930	39.92992	7.347302	9.794021
Prob (F-stat)	0.000000	0.000000	0.000000	0.000000
The values in parentheses are the t-statistics, *** Significant at 1%, ** significant at 5% and * significant at 10%.				

Table 7.8 shows the results derived from the first approach previously presented in table 7.3 for all GCC countries' banks. Focusing on the profitability regressions (i.e. numbers 1 and 2 in table 7.4), both concentration (CR3) and market share (MS) are found to be positive, but only MS is statistically significant in the ROA & ROE regressions. Thus,

the positive relationship between market structure can be interpreted to support both the Market Power Hypotheses (SCP & RMP) and the Efficient Structure Hypotheses (i.e. observation equivalence problem).

In the individual country pooled regression, there is evidence that the SCP paradigm is in Qatar. This is in fact, supports the findings shown in table 7.2 that Qatar has the highest two and three banks deposit market share as well as the highest HHI in the region. On the other hand, market share effect is clear in Saudi Arabia, even though it is significant with negative sign. The *RMP* paradigm is in Kuwait and UAE, showing a positive insignificant relationship. This also supports the findings shown in table 7.2 that Kuwait, Saudi Arabia and the UAE have the lowest two and three banks deposit market share as well as the lowest HHIs in the region.

It can be seen also that the concentration ratio has a negative and significant impact on ROA and ROE for Kuwait and UAE. This suggests that concentration is less beneficial in terms of profitability to these two countries' commercial banks than competition.
The pooled six countries' estimates show (in table 7.8) that market share is positively significant at the 5% level for ROA and at the 10% level for ROE. Therefore, we can say there is a strong relationship between market structure (namely, bank market share) and banks profits

Overall, it is clear that significant country variations exist when the model specification is estimated. This is not surprising given the different regulatory regimes that existed in the various countries' banking systems over the study period. Whilst different regulatory regimes may lead to different relationships between structure and performance, it still remains likely that market structure will have an impact on performance on some of the countries. However, a bank's market share has much more impact on performance. In addition, looking at the other control variables, the most significant predictor variables in both regressions are the bank specific factors.

Overall, this section has tried to analyse how bank characteristics, market structure and macro economic conditions affect the profitability of commercial and Islamic banks in GCC countries. The six countries' pooled regressions show that bank specific factors are the primary determinants of profitability. Bank characteristics explain a substantial part of the within-country variation in bank net profitability. Risk factors, market share of the bank, overhead expenses management, geographic diversification, specialisation and investment diversification are elements of bank specific factors which contribute to the different levels of profitability. Whilst macro-economic factors may lead to different relationships with performance in the individual country pooled regressions, the six countries pooled regressions assert a positive relationship between per capita income and banks' profits. Concentration, market growth and bank size, the three elements of market factors, have no effect on profitability, with the exception of the positive relationship between market growth and profitability for Omani banks.

Everything considered, effective management remains the most important element in determining banks' profitability overshadowing either macro-economic or market factors. The evidence presented here clearly supports the view that market share, not concentration, is the principal structural determinant of profitability. All in all, banking systems in GCC countries differ widely in terms of size and operation. Across these six countries, commercial and Islamic banks have to deal with different environments, and different financial, legal and institutional conditions. Therefore, it is not surprising to find different determinants of profitability in these countries. Table 7.9 summarises the findings for determinants of profitability (ROA) without control for efficiency direct variables (1st approach) and shows the differences in what determines the profitability in each of the six countries separately and collectively.

Table (7.9) Summary of determinants of (ROA) without control for efficiency direct variables (1st approach)

Variable	Bahrain		Kuwait		Oman		Qatar		Saudi Arabia		UAE		GCC	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
GDPPC		x	**		*		**		*		***		*	
CR3		x		x		x	***			x		x		x
MS		x		x		x		x	**			x	**	
DEPGRW		x		x	**		*			x		x		x
ASSET		x		x		x		x		x		x		x
CAPAST		x		x		x	**		***		***		***	
LOANAST		x	***			x		x	**		***		***	
DDTTDP		x	*			x		x	***			x		x
TEXPTA		x		x		x		x	***		***		***	
POPBRNCH		x		x		x	*			x		x	***	
SPECIALIZ		x	*			na		x	***		***		***	
OBSTA		x		x		x		x	**			x	***	

Note: *** Significant at 1%, ** significant at 5% and * significant at 10%.

So far the study has analysed the determinants of ROA and ROE using the 1st approach (without control for efficiency direct variables). In the following sub-section direct technical and scale efficiencies are included in the assessment the market structure performance relationship and the determinants of profitability, as well as the determinants of market structure using the 2nd and 4th approaches, respectively.

7.7.2 Profitability and Market Structure regressions with control for efficiency: technical and scale efficiency

The second stage of this study's analysis is to introduce technical and scale efficiency variables (i.e. Te-EFF and Sc-EFF) in the profits regressions[5]: these regressions embody

[5] The addition of the efficiency variables substantially increased the R^2 of the regression analysis undertaken.

the second and fourth approaches stated in table 7.3. Since the efficiency variables are controlled, the MS variable can be interpreted as reflecting only market power effects. However, in the first approach, MS might reflect excluded efficiency effects. As shown in tables 7.10 and 7.11, regressions embodying the second approach (i.e. regressions no 3 and 4) seem to support the Market Power Hypotheses: Concentration (CR3) is found to be positive. In particular, the Market Power Hypotheses is strongly supported in the SCP Hypothesis: CR3 is in fact statistically significant at the 1% confidence level in ROA regression. The RMP hypothesis does not find any support: although profits are positively related to MS (confirming the previous results). Further, regarding the Efficient Market Hypotheses, both technical and scale efficiency do not exhibit a statistical influence on the profitability measures ROA and ROE. Technical efficiency is negatively insignificant with profitability measure, whereas scale efficiency is positive but insignificant.

In addition, because concentration (CR3) and market share (MS) coefficients changed in a meaningful way when efficiency terms were directly considered in regression analyses, one might conclude that the positive MS and CR3 coefficients estimated in regressions 1 and 2 (first approach) reflect the strong relationship between market structure and banks' profits argued by market structure advocates. Thus, market power hypotheses are supported by the profit rate equations with or without the efficiency measures included

The market power hypotheses' results support the conditions necessary for the SCP version of the market power hypotheses, that, in a more concentrated environment, banks have higher profits. Even though there is a positive relationship between market share and banks' profitability, this relationship is not significant. Therefore, MS results do not support the RMP hypothesis.

Table (7.10) Restricted and unrestricted empirical results of the determinants of ROA and ROE for all GCC countries' banks including technical and scale efficiency (2nd approach)

Variable	ROA Restricted Regression # 3	ROA Unrestricted Regression # 3	ROE Restricted Regression # 4	ROE Unrestricted Regression # 4
C	-0.03954 (0.0013)***	-0.04356 (0.1072)	-0.12497 (0.5471)	-0.46628 (0.3097)
CR3	0.019701 (0.0053)***	0.020322 (0.4771)	0.151075 (0.2060)	0.447709 (0.3568)
MS	0.007196 (0.3597)	0.00907 (0.2639)	0.160074 (0.2300)	0.170246 (0.2172)
TEFFIC	-0.00092 (0.8985)	-0.00399 (0.5845)	-0.07099 (0.5607)	-0.08146 (0.5113)
SCALEEFF	0.014191 (0.1511)	0.00427 (0.6801)	0.161302 (0.3359)	-0.05081 (0.7727)
GDPPC$	3.81E-07 (0.0085)***	1.10E-06 (0.0019)***	3.83E-06 (0.1180)	1.07E-05 (0.0742)
DEPSGROW	0.008317 (0.3238)	-0.00142 (0.8785)	0.067523 (0.6367)	-0.16611 (0.2945)
ASSET	1.43E-08 (0.9445)	-1.22E-07 (0.5962)	-2.76E-06 (0.4278)	-5.04E-06 (0.1967)
CAPAST	0.134784 (0.0000)***	0.136038 (0.0000)***	0.132752 (0.5363)	0.079216 (0.7194)
LOANASST	0.021692 (0.0000)***	0.02332 (0.0000)	0.210523 (0.0011)***	0.202948 (0.0071)***
DDTTDEP	0.006635 (0.0591)*	0.004885 (0.1709)	0.097356 (0.1025)	0.061307 (0.3117)
TEXPTA	-0.44812 (0.0000)***	-0.53686 (0.0000)***	-5.63183 (0.0000)***	-6.93743 (0.0000)***
POPBRNCH	1.28E-06 (0.0006)***	2.37E-06 (0.0015)***	9.19E-06 (0.1436)	3.67E-05 (0.0037)***
SPECIALZ	-0.00916 (0.0001)***	-0.00895 (0.0003)***	-0.04851 (0.2242)	-0.03167 (0.4511)
OBSTA	0.005526 (0.0028)***	0.005927 (0.0021)***	0.075923 (0.0154)**	0.096426 (0.0032)***
R-squared	0.39	0.44	0.16	0.23
Adjusted R-squared	0.38	0.41	0.14	0.18
F-statistic	21.68932	13.3754	6.404332	4.932251
Prob(F-statistic)	0.000000	0.000000	0.000000	0.000000

The values in parentheses are the t-statistics, *** Significant at 1%, ** significant at 5% and * significant at 10%.

Profitability regression (ROA) in table 7.10 shows that besides the concentration (CR3) variable, the macro-economic factor, proxied by per capita income, is positively significant at the 1% level of significance. The remaining bank factors such as CAPAST, LOANASST, POPBRNCH and OBSTA are positively significant at the 1% level of significance, while DDTTDEP is positively significant at 10%. On the other hand, TEXPTA and SPECIALZ are negatively significant at 1%. Regression for ROE shows almost similar results. Again, a bank's internal factors are the primary determinants of profitability.

Table 7.11 shows regressions no. 5 and no. 6 embody the fourth approach (in table 7.3). In these two regressions, market structure (concentration and market share) variables are regressed on the efficiency variables in order to test the ES hypotheses. Under these hypotheses, greater efficiency should be associated with a higher market share and concentration. The signs of regression coefficients observed support the prediction of the SCP theory. In the concentration (CR3) regressions, coefficients are negative and statistically significant at the 10% confidence level for technical efficiency and positive and statistically insignificant for scale efficiency, while for market share (MS) regressions, coefficients are positive, but not statically significant. These results are similar to the earlier results of Berger and Hannan (1997) for the US banking industry.

Table (7.11) Restricted and unrestricted empirical results of the determinants of market structure (concentration and market share) for all GCC countries' banks (4th approach)

Variable	**CR3** Restricted	**CR3** Unrestricted	**MS** Restricted	**MS** Unrestricted
	Regression # 5	Regression # 5	Regression # 6	Regression # 6
C	1.26E+00 (0.0000)***	0.832849 (0.0000)***	0.480005 (0.0000)***	0.211279 (0.0036)***
TEFFIC	-0.09556 (0.0711)*	-0.04489 (0.0001)***	0.057114 (0.2279)	0.103623 (0.0124)**
SCALEEFF	0.07338 (0.3160)	0.07782 (0.0000)***	0.01263 (0.8471)	0.004951 (0.9326)
GDPPC$	-1.26E-05 (0.0000)***	1.35E-06 (0.0200)**	-5.93E-06 (0.0000)***	-6.60E-07 0.7453
DEPSGROW	0.193974 (0.0018)***	0.03263 (0.0326)**	9.95E-02 (0.0730)*	-0.00789 (0.8831)
ASSET	-2.94E-06 (0.0189)**	9.31E-07 (0.0016)***	1.35E-05 (0.0000)***	1.74E-05 (0.0000)***
CAPAST	-0.74083 (0.0000)***	0.048629 (0.0199)**	-0.67245 (0.0000)***	-0.30103 (0.0000)***
LOANASST	-0.08345 (0.0028)***	0.012366 (0.0880)*	-0.03451 (0.1667)	-0.01178 (0.6439)
DDTTDEP	-0.05607 (0.0300)**	-0.00276 (0.6372)	0.018893 (0.4134)	0.026197 (0.2036)
TEXPTA	1.051495 (0.0003)***	0.140322 (0.0437)**	0.360709 (0.1680)	0.071633 (0.7695)
POPBRNCH	-2.91E-05 (0.0000)***	-1.11E-05 (0.0000)***	-2.56E-05 (0.0000)***	-6.97E-06 (0.0710)*
SPECIALZ	0.095444 (0.0000)***	0.00083 (0.8333)	-0.04315 (0.0030)***	-0.07281 (0.0000)***
OBSTA	-0.00676 (0.6206)	0.003149 (0.3166)	-0.00368 (0.7636)	-0.00176 (0.8734)
R-squared	0.52	0.98	0.44	0.61
Adjusted R-squared	0.51	0.98	0.42	0.59
F-statistic	42.97688	830.0343	30.42253	28.24608
Prob(F-statistic)	0.000000	0.000000	0.000000	0.000000

The values in parentheses are the t-statistics, *** Significant at 1%, ** significant at 5% and * significant at 10%.

As noted in table 7.11, one possible explanation for the negative relationship between technical efficiency and the market structure measure may be that banks with market power are less diligent in controlling costs. This is consistent with Hicks' (1935) "Quiet Life Hypothesis". Berger and Hannan (1995) provide evidence suggesting that quiet life effects in banking may be quite substantial. This suggests that the line of causation runs from structure to efficiency, rather than from efficiency to structure, as argued by proponents of the Efficient Structure Hypothesis. While the Quiet Life Hypothesis may also apply to scale efficiency, the focus is primarily on technical efficiency here because it fits more closely with the concepts of lax management and/or expense-preference behaviour that raises costs, and because the signs and significance of the technical efficiency coefficients are the ones most in need of explanation.

In the previous subsections, the study has analysed the determinants of ROA and ROE using the (1^{st} approach) without control for efficiency direct variables. Direct technical and scale efficiencies are included to assess the market structure performance relationship, the determinants of profitability and market structure using 2^{nd} and 4^{th} approaches. The following subsection tests for the "Quiet Life Hypothesis".

7.7.3 Testing For the "Quiet Life Hypothesis"

As suggested by Hicks (1935), the reduction in competitive pressure in concentrated markets may result in lessened effort by managers to maximise operating efficiency. Thus, in addition to the traditionally recognised higher prices and reduced output from market power, there may also be higher cost per unit of output in concentrated markets because of slack management.

In this section, the study examines whether banks in more concentrated markets exhibit lower operating efficiency. The basic hypothesis tested is that market power exercised by firms in concentrated markets allows them to avoid minimising costs without necessarily exiting the industry. Berger and Hannan (1998, p. 464) stated:

> The reduced pressures to minimise costs may result in lower costs efficiency for banks in concentrated markets through one or more of several mechanisms shirking by managers, the pursuit of objectives other than profit maximisation, political or other activities to defend or gain market power, or simple incompetence that is obscured by extra profits made available by the exercise of market power.

Table (7.12) Restricted and unrestricted empirical results of the "Quiet Life Test" for all GCC countries' banks		
Variable	TEFFIC Restricted	TEFFIC Unrestricted
	Regression no. 7	Regression no. 7
C	0.975400 (0.0000)***	1.142383 (0.0000)***
MS	0.202064 (0.0038)***	0.221608 (0.0011)***
CR3	-0.16865 (0.0070)***	-0.21542 (0.3592)
GDPPC$	-1.60E-06 (0.2139)	-4.59E-06 (0.1224)
DEPSGROW	-0.037932 (0.6143)	5.61E-02 (0.4748)
ASSET	-6.46E-06 (0.0003)***	-8.14E-06 (0.0000)***
CAPAST	0.251772 (0.0251)**	0.268642 (0.0132)**
LOANASST	0.025815 (0.4439)	0.025485 (0.4908)
DDTTDEP	-0.092002 (0.0032)***	-0.06638 (0.0264)**
TEXPTA	1.620269 (0.0000)***	0.238877 (0.5038)
POPBRNCH	-5.90E-06 (0.0735)*	-1.56E-05 (0.0114)**
SPECIALZ	0.047922 (0.0221)**	0.031845 (0.1252)
OBSTA	0.008342 (0.6106)	0.012471 (0.4388)
R-squared	0.21	0.36
Adjusted R-squared	0.19	0.32
F-statistic	10.40398	10.05406
Prob(F-statistic)	0.000000	0.000000
The values in parentheses are the t-statistics, *** Significant at 1%, ** significant at 5% and * significant at 10%.		

Lastly, the regression in table 7.12 enables us to test the positive causal relationship between efficiency and market structure variables predicted by the Efficient Market hypothesis which proposes a "reverse causation" model from market structure to efficiency. As seen earlier, this regression represents a version of the "quiet life effect". Market share (MS) is positive and statistically significant at the 1% confidence level and concentration (CR3) is negative and statistically significant at the 1% confidence level. The research found strong evidence that banks in more concentrated GCC markets exhibited lower technical efficiency for the period 1993-2002. This result is similar to earlier results reported by Berger and Hannan (1997, 1998), and suggests concentration (CR3) proxies market power and those banks with more market power are less diligent in controlling costs. The traditional SCP hypothesis supports the test results, thus, in general, GCC countries' banks are having a "Quiet Life", gaining their profits in a more relaxed environment in which less effort is put into the rigours of maximising cost efficiency.

In the banking industry in particular, the recent wave of horizontal mergers has often been justified by participants and consultants as being based on cost savings from consolidations of back-office operations and branching networks. The fact that banking mergers among banks in overlapping markets have not generally been found to improve cost efficiency (see Berger and Humphrey (1992)) could conceivably result from the efficiency costs of the higher concentration as measured here. That is, a reduction in market pressure to minimise costs in some cases may have offset the technological cost economies associated with the consolidations. Consideration of these efficiency costs in banking legislation and regulation may also be important, because so many regulatory issues involve changes in the degree of competition or market contestability. Examples are policies relating to geographic barriers to entry, limits on the issuing of bank charters, and the power of banks and other financial institutions to enter each other's traditional lines of business (Berger and Hannan, 1998).

According to Murinde and Ryan (2003, p.15):

> Although foreign commercial banks were allowed to operate in Saudi Arabia before 1976, they were forced into partial or full nationalisation after 1976. Hence, in terms of the GATS, the banking market is closed to foreign banks. For example, no new licences have been issued since 1988. Moreover, state development banks are supported by huge subsidies and therefore operate on a non-competitive basis. Saudi banks seem to be the most profitable in the GCC in terms of return on average equity. However, published performance ratios do not take into account the subsidy element.

The above comment gives an indication of the protection and support of some of these countries in region. Accordingly, the protection and fostering could cause many banks to enjoy the "Quiet Life". As a result, this type of uncompetitive environment in concentrated markets may result in lessened effort by banks to maximise operating efficiency. Thus, in addition to the traditionally recognised higher prices and reduced output from market power, there may also be the higher cost of the charged interest rate in concentrated markets because of slack management.

The author's empirical application implies that market concentration results in significantly lower technical efficiency. The author thus suggests this result may have general implications regarding mergers policy, and specific implications regarding regulation of the banking industry.

7.8 Conclusion

This chapter has analysed the relationship between market structure and bank performance in the GCC banking industry over the period 1993-2002. The empirical literature on this topic is extensive but concentrates on applying the first approach only (which excludes a direct measure of technical and scale efficiency). Very few studies have employed the four hypotheses to test the relationship between efficiency scores and market structure and profitability.

The author firstly applied the three approaches previously employed in the literature. However, differing from previous research, he employed DEA rather than a parametric estimation methodology. This allowed the study to consider two efficiency terms (i.e. technical and scale efficiency) rather than the two traditionally employed (i.e. X-efficiency and Scale efficiency). Although this innovation may be criticised, because it may imply a greater amount of noise in data utilised, the author believed it worthwhile to undertake this analysis because great care was taken to reduce the noise (by using high quality data and detecting possible outliers). In addition, by disentangling the X-efficiency term into technical and scale efficiency terms, two versions of the ES hypothesis terms were explicitly introduced in the RMP hypotheses. In addition, the quiet life effect was correctly tested considering the technical efficiency term, rather than the X-efficiency term.

Consistently with the banking literature, regressions 1 and 2 revealed a positive relationship between firms' profits and market structure variables (both CONC and MS). The "observation equivalence" problem was solved by running the other regressions: coefficients observed in regressions 3, 4, 5 and 6 showed this relationship should be interpreted as supporting the Market Structure hypotheses (especially the traditional SCP) rather than the RMP hypothesis. The quiet life effect was also observed in regression 7. Accordingly, GCC banks were having a "Quiet Life" and gaining their profits in more relaxed environment during the period under study.

The above findings, together with the fact that some of these relationships investigated had not been previously analysed, seem to require further research along these lines. The next chapter, the final chapter, summarises the main findings, discusses policy implications, and proposes recommendations. It also identifies the limitations of this study and suggests areas for future research.

CHAPTER 8

CONCLUSIONS

8.1 Introduction

This thesis was divided into four stages. First, it estimated the banking industry concentration. At this stage, the researcher checked whether GCC banking markets were concentrated or not. Second, it checked the competitive conditions of these markets using the Panzar-Rosse model. The results of tests identified the competitive environment of each market, whether the environment was monopoly, monopolistic or perfect competition. Third, it investigated the technical, pure technical and scale efficiency of commercial and Islamic banks using the two basic models of Data Envelopment Analysis (DEA). In addition, change in banks' productivity growth was measured at this stage. Finally, it investigated four different hypotheses explaining the relationship between market structure and performance using the Structure-Conduct-Performance (SCP) model. At this stage, the emphasis of the study was: first, to analyse the relationship between market structure and banks' profitability; then it assess the relevance of the *Structure-Conduct-Performance (SCP)* and the *Relative-Market-Power (RMP) hypothesis* and the *Efficient-Structure (ES) hypotheses* in the form of *X-efficiency* or *Scale efficiency* to explain the performance of the banking industry in GCC countries; and, finally, to test the existence of "*Quiet Life Hypothesis*" in these markets.

8.2 The study's findings

The contributions of the thesis to the area under study are detailed on the basis of the following empirical results:

8.2.1 Indication of banking size and capacity

While enormous potential exists within GCC countries for the region's financial development, more progress could be made. The GCC region has not been able to produce large powerhouse institutions that could be a force in the Arab or international banking arena. For various reasons, many of them political, the global trend towards consolidation has passed by the Gulf. With World Trade Organisation (WTO) liberalisation planned, banks need to rethink their competitive strategies for the future. The size of the banking sector in GCC countries, in absolute terms, is relatively small when compared to that of other developed countries.

While GCC banks are generally not performing badly, there is much room for improvement, and cross-broader mergers could help spur performance. Top banks such as Saudi American, Al Rajhi, and the National Bank of Kuwait, all show strong returns on capital of 26.8%, 23% and 25.8% respectively, but many other large banks are well down and need to improve. The GCC has the infrastructure but no single institution reaches effectively into all six states. Some of the bigger GCC banks need to become regional rather domestic players, if they do not, banking in the region will suffer.

In addition, the relative size of the financial sector, as reflected by its share in GDP, varies considerably among GCC countries (table 2.4). Whereas the financial sector in 2002 accounted for 3, 4 & 5 per cent of the GDP of Qatar, Oman and Saudi Arabia, respectively, it accounted for 7, 12 and 19 per cent of the GDP of Kuwait, the UAE, and Bahrain, respectively. Moreover, the size of the financial sector in these countries is relatively small when compared to those of other upper-middle income countries or developed countries. Therefore, it is obvious that GCC countries, especially Qatar, Oman, Saudi Arabia and Kuwait, need to strengthen their financial sectors for better participation in GDP.

Further, the aggregate assets of Saudi Arabian commercial banks (the largest in the region) are valued at about 2 per cent of those of the United States. GCC financial markets are sometimes characterised as being "over-banked". It has also been argued that the existence of such a banking structure is overcrowding the market and reducing lending margins. At first glance, however, the data do not seem to support this claim for all GCC countries (table 2.8). For the year 2002, the lowest GDP divided by the number of commercial banks was ($1.40 billion) and ($2.9 billion) in Bahrain and Qatar, respectively, is certainly higher than that of developed countries, thus revealing a certain degree of under-banking. The same holds true for the other GCC countries. Such reasoning, however, does not take into consideration the increasing importance of economies of scale in the banking industry. Due to the limited size of the market that they service, GCC commercial banks are faced with a strong need for consolidation. In order to evolve into major players in international financial markets, it is imperative that these banks succeed in expanding their asset base. Such a strategy will allow them to improve the quality of their assets, through proper diversification, and to invest in expensive new technology that has increasingly become, and will continue to be in the foreseeable future, critical to success in the global banking industry.

8.2.2 Indicators of concentration

Another feature of the banking industry in GCC countries is the high degree of market concentration. Table 4.17 summarizes the concentration trend in the deposit market for CR3 and HHI for the period 1995-2002. The concentration ratio of three largest banks in each country is very high especially Oman, Qatar, Bahrain and Kuwait. In addition, none of the six countries had a HHI score of less than 1000. Thus both indices indicate that these banking industries were ranging from "some what" to "very" concentrated markets.

Therefore, the significant changes in the GCC banking industry raise the important policy concerns that banks in highly concentrated markets will gain market power due to being able to charge higher than competitive prices for their products, thus inflicting welfare costs that could more than offset any presumed benefit associated with mergers. Other concerns regarding the higher concentration ratio include such problems as the limited effectiveness of monetary and credit policy, increased probability of systemic risk, and reduction in lending to small and medium corporations.

It does not appear, however, that concentration has increased in the GCC banking industry. In fact, with the exception of Oman's banking industry, concentration measures reported here indicate that 5 of the 6 countries examined actually experienced declines in concentration over the 1993-2002 period. On the basis of these findings, it is safe to conclude that GCC banking industries are not highly concentrated and the answer to our question is that with the exception of Oman's banking industry, concentration in general in the GCC banking industry should not cause a big concern since the concentration indices indicate a decline in concentration over the years.

The benefits (and costs) of such a market structure largely depend on the dynamics of the banking industry in GCC countries. On a positive note, high industry concentration could lead to larger banks with a more diversified asset base and a greater capacity to keep up with the changing nature of the banking industry worldwide. Moreover, it has often been argued that it is not the degree of market concentration that is necessarily problematic especially in an industry where entry costs are high rather; it is the existence of barriers to new competition. The presence of "dynamic" competition and the constant threat of new market entrants keep industry players competitive and efficient. Only in such an environment will high market concentration not result in a monopolistic environment. As mentioned earlier, however, all GCC countries have freeze on the establishment of new banks, shielding existing banks from the threat of new competition. The negative effects of this strategy are especially pertinent to the case of foreign banks, since by closing the door to these banks, GCC governments have not only reduced the level of competition, but have also halted the "dynamic gains" that accompany foreign investments. These gains are generated through the transfer of technological innovations, managerial know-how, and foreign expertise in product diversification and customer service all necessary if GCC banks are to someday become major players in world markets. Moreover, the lowering of barriers to foreign entry is of special importance to GCC countries that have entered the World Trade Organisation (WTO) and now need to reconcile their national laws with the requirements of the General Agreement on Trade in Services (GATS).

8.2.3 Assessing the competitive conditions

This stage of the study investigated the competitive conditions of the GCC banking industry during the period 1993-2002 and evaluated the monopoly power of banks.

Table 5.14 summarised the findings for the concentration and competitive conditions in GCC countries.

The results show that Kuwait, Saudi Arabia and the UAE having unconcentrated markets and moving to less concentrated positions (see chapter 4, section 4.6). The P-R results, perfect competition in these three countries, support the results of measures of concentration CR*k* and HHI.

On the other hand, CR*k* and HHI show that Qatar, Bahrain and Oman were very concentrated markets. However, the H-statistics value (the sum of price elasticity: PL, PK, PF) assessed Bahraini and Qatari banks make their revenue in monopolistic competition. Even though Oman had lower concentration ratio than Qatar as indicated by CR_2, CR_3 and HHI ratios, none of the coefficients of the variables PL, PK and PF were significant for Oman. Therefore, the H-value came to be less than zero. The result was not robust and this could explain the reason for Oman's banks' result. Oman's banks were therefore making their total revenue under an "undetermined" environment.

Even though the author expected less competitive behaviour in all of the six countries, the H-statistic value (the sum of price elasticity: PL, PK, PF) was 1.0 for Kuwait, Saudi Arabia and the UAE, indicating that banks in these three countries earned their revenue under perfect competition. This could be explained by the presence of foreign banks in these countries as well as the preparedness for entering the WTO and the future existence of more foreign banks in their lands. The H-statistic is 0.70 and 0.63 for Bahrain and Qatar, respectively, indicating that banks in these two countries earned their revenue under monopolistic competition.

The F-statistic for testing the null hypothesis H_0 (GCC banks do not gain their total revenue under monopolistic competitions) indicates that we could reject the null hypothesis at 0.01% level of significance for all GCC banks pooled sampled. Further, for individual country regressions, we could reject the null hypothesis for Kuwait, Saudi Arabia, and UAE and Oman.

8.2.4 Technical efficiency and productivity growth

This stage revealed several interesting findings about the GCC's banking market. First, according to the technical efficiency analysis, smaller banks exhibited superior performance in terms of overall technical efficiency than larger ones, mainly associated with diseconomies of scale. Second, decomposition of technical efficiency into pure technical and scale efficiency showed that large banks proved to be more successful in adopting best available technology (pure technical efficiency) while medium banks proved to be more successful in choosing optimal levels of output (scale efficiency). Since small banks usually operate under increasing returns to scale, growth of small banks or consolidation in the market to a medium size is desirable and would enhance the efficiency of the whole banking sector. Third, decomposition of technical efficiency into pure technical and scale efficiency showed that Islamic banks proved to be more successful in both the adoption of the best available technology (pure technical efficiency) and choosing optimal levels of output (scale efficiency) than commercial banks. This suggests commercial banks should expand their constant options offered to customers, and realise potential scale economies so that their overall technical efficiency may grow considerably. Fourth, according to overall technical efficiency, banks in Bahrain, Qatar, Oman, the UAE, Kuwait and Saudi Arabia came first to sixth place, respectively. This implies that markets which are open to foreign banks perform better. Therefore, Saudi Arabia would be in a better position if it were to open its market to foreign banks.

Fifth, pooling regression of 484 observations for OTE revealed that bank size and specialisation positively significant at 1% and 5% respectively, while deposit market share and number of branches were negatively significant at 1%. The regression for PTE showed the same result, with the addition of market concentration negatively significant at 1%. The regression for SE showed market concentration positively significant at 1%, while number of branches was negatively significant at 1%.

Finally, the Malmquist analysis showed a slight downward shift in the average efficiency of banks in the sector during 1993 to 2002. Major pull down for the shift stemmed from change in technical efficiency of banks (catching up effect), while technology equally decreased during the period. Several outliers that were analysed provided a useful insight into the underlying reasons for changes in efficiency and Malmquist scores.

8.2.5 Explaining the market structure performance relationship

This stage analysed the relationship between market structure and bank performance in the GCC banking industry over the period 1993-2002. The author first applied the three approaches previously employed in the literature. However, differing from previous research, he employed DEA rather than a parametric estimation methodology. This allowed the study to consider two efficiency terms (i.e. technical and scale efficiency) rather than the two traditionally employed (i.e. X-efficiency and Scale efficiency). The author believed it worthwhile to undertake this analysis because great care was taken to reduce the noise (by using high quality data and detecting possible outliers). In addition, by disentangling the X-efficiency term into technical and scale efficiency terms, two versions of the ES hypothesis were explicitly introduced in the RMP hypotheses. In addition, the quiet life effect was tested considering the technical efficiency term rather than the X-efficiency term. Consistent with the banking literature, regressions 1 and 2 found a positive relationship between firms' profits and market structure variables (both CONC and MS). The "observation equivalence" problem was solved by running the other regressions: coefficients observed in regressions 3, 4, 5 and 6 showed this relationship should be interpreted as supporting the Market Structure hypotheses (especially the traditional SCP) rather than the RMP hypothesis. The quiet life effect was also observed in regression 7. Thus GCC banks were enjoying a "Quiet Life" and gaining their profits in a more relaxed environment.

8.3 Policy implications

The first stage provided empirical evidence for a potential policy initiative on the part of GCC central banks and monetary authorities to establish a merger benchmark guideline similar to that of the HHI which is used in the United States. The benchmark would be able to examine every potential merger within financial institutions while comparing its effectiveness and impact on market concentration, competitive conditions, efficiency, and profitability of the whole banking industry.

The second stage suggests that caution is required as regards mergers, in particular among large 'core' banks. Oman and Qatar, for example, are dominated by the Bank Muscat and Qatar National Bank, respectively, and empirical results show that banking in these two countries is very concentrated and their banks are making their revenue and profit very close to a monopoly condition. The economies of scale and scope of big mergers appear to be thin, and may enhance concentration to the level that is problematic from the point of view of efficient allocation of resources. Moreover, they may bring about institutions which are 'too big to fail'.

The third empirical results' stage revealed that banks in an open banking industry are more efficient than those in a closed market. Oman and Qatar are the most concentrated and, accordingly, least competitive, yet the existence of 13 foreign banks in Oman and 10 foreign banks in Qatar, leads to a better efficiency score than those banks in Saudi Arabia whose market is closed to foreign banks. This leads also to confidence that the financial liberalisation policy will have fewer implications for Omani and Qatari than Saudi banks.

This stage of research revealed Islamic banks to be more efficient than commercial banks and to be viewed as strong potential competitors now and in the future. Islamic banks' efficiency could stem from the variety of investment options available to their customers. Commercial banks would be much more efficient if they adopted the same strategy.

At the fourth stage, the traditional SCP hypothesis supported the test of the market-structure performance relationship, indicating that, in general, GCC banks were having a "Quiet Life" and gaining their profits in more relaxed environment in which less effort was being put into the rigours of maximising cost efficiency. Since GCC banking industry will be facing global competition as a result of joining the GATS, their banks should be monitored and assisted by the central banks and monetary authorities, yet this assistance should not be at the fostering level.

8.4 The study's limitations

Overall, the four different stages provided informative and new insight analysis. The analysis, however, was not without any limitations. First, the sample set of data which is used excluded foreign banks. Thus, the exclusion of foreign banks in the analyses may have biased the study's result. In addition, the exclusion of new banks which had been in the market less than ten years may have also biased the results. Second, due to the small size of banks in most GCC, it was inappropriate to run different tests to assess the yearly change. For example, it was impossible to test the change in competitive conditions on a yearly basis for each country. Therefore, the competitiveness variable was not included in testing the market structure performance relationship. Third, a non-parametric measure, (DEA) was used to compute the technical, pure technical and scale efficiency scores among GCC banks. However, DEA could have been supplemented by other non-parametric approaches to support and confirm the results. Finally, the presented analyses pertain to the banks in the sample only and there is no international standard benchmark to compare the results.

8.5 Further studies

Overall, the thesis has provided empirical evidence to support that GCC banking industries are concentrated and their banks are working under monopolistic competition and they are enjoying "Quiet life". Understanding these facts is important to the successful implementation of monetary policy.

Moreover, the research also provided several implications for further studies in the banking market. Since Date Envelopment Analysis is an important tool, further elaborations in terms of period or sample size could produce even more accurate and useful results. Additionally, DEA may be well supplemented by other approaches such as econometric or profitability analysis and thereby provide a view from diverse perspectives. Since banking markets in the GCC countries are currently undergoing notable changes, DEA analysis could serve as a valuable device for determining further direction of market consolidation and providing guidelines for policy makers in transition economies. The inclusion of foreign banks in future studies would make the analysis more robust.

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Appendix 1: List of GCC Banks Included in the Sample (1993-2002)

Country	Name of banks	Acronyms
Bahrain Banks	1. Al-Ahli United Bank. 2. Bank of Bahrain and Kuwait. 3. National Bank of Bahrain 4. Bahraini Saudi Bank 5. Bahrain Islamic Bank (Islamic) 6. Shamil Bank of Bahrain (Islamic)	AUB BBK NBB BSB BIB SHB
Kuwait Banks	1. National Bank of Kuwait 2. Gulf Bank 3. Commercial Bank of Kuwait 4. Burgan Bank 5. Al-Ahli Bank of Kuwait 6. Bank of Kuwait & The Middle East 7. Kuwait Finance House (Islamic)	NBK GULF CMBK BURGAN AHLI KME KFH
Oman Banks	1. Bank Dhofar 2. Bank Muscat 3. National Bank of Oman 4. Oman Arab Bank 5. Oman International Bank	BD BM NBO OAB OIB
Qatar Banks	1. Qatar National Bank 2. Commercial Bank of Qatar 3. Doha Bank 4. Al-Ahli Bank of Qatar 5. Qatar Islamic Bank (Islamic) 6. Qatar International Islamic Bank (Islamic)	QNB CMBQ DOHA AHLIQ QISLM QIISLM
Saudi Arabia Banks	1. National Commercial Bank 2. Saudi American Bank (SAMBA) 3. Riyad Bank 4. Saudi British Bank 5. Arab National Bank 6. Al Bank Al Saudi Al Fransi 7. Saudi Hollandi Bank 8. Saudi Investment Bank 9. Bank Al-Jazera 10. Al-Rajhi Banking & investment (Islamic)	NCMB SAMBA RIYAD SABR ARAB SAFR SAHO INVST JAZRA RAJHI

UAE Banks	1. National Bank of Abu Dhabi	NBAD
	2. National Bank of Dubai	NBD
	3. Emirates Bank International	EMIRATE
	4. Abu Dhabi Commercial Bank	ADCOM
	5. Mashreq bank	MASHREQ
	6. Union National Bank	UNION
	7. Commercial Bank of Dubai	COMBD
	8. First Gulf Bank	FIRST
	9. Arab Bank for Investment & Foreign Trade	ARABTRD
	10. Bank of Sharjah	SHARJAH
	11. National Bank of Ras Al-Khaimah	NBRASK
	12. Commercial Bank International	COMINTER
	13. National Bank of Fujairah	FUJAIRAH
	14. National Bank of Sharjah	NBSHARJA
	15. United Arab Bank	UNARAB
	16. Middle East Bank	MEB
	17. National Bank of Umm Al-Qaiwain	QAWAIN
	18. Dubai Islamic Bank (Islamic)	DISLM

Appendix 2: GCC countries' banks overall performance

Capital Intelligence's (CI's) Bankscope database (2003) ratings show most commercial banks in GCC show excellent performance. The following tables show an individual bank's rating in each GCC country.

Summary of Ratings of local banks of Bahrain

Banks	Foreign Currency: LT	ST	Domestic Strength	Support	Short term outlook
Al-Ahli United Bank	BB+	A3	BBB+	2	Positive
Bahrain Islamic Bank	BB+	A3	BBB-	3	Stable
Bahrain Saudi Bank	BBB-	A3	BBB	3	Stable
Bank of Bahrain & Kuwait	BBB-	A3	BBB+	2	Stable
Faysal Islamic Bank of Bahrain	BB+	A3	BB+	2	Stable
National Bank of Bahrain	BBB-	A3	A	2	Stable

Source: Compiled by the author from the Capital Intelligence Bankscope database 2003.

Summary of Ratings of local banks of Kuwait

Banks	Foreign currency: LT	ST	Domestic Strength	Support	Short term outlook
Al-Ahli Bank of Kuwait	BBB-	A3	BB+	3	Stable
Bank of Kuwait & Middle East	BBB	A2	BBB	2	Stable
Burgan Bank	BBB	A2	BB+	3	Positive
Commercial Bank of Kuwait	BBB+	A2	BBB	3	Stable
Gulf Bank	BBB+	A2	A-	3	Stable
Kuwait Finance House	BBB+	A3	BBB+	2	Stable
National Bank of Kuwait	A	A2	AA-	2	Positive

Source: Compiled by the author from the CI Bankscope database 2003.

Summary of ratings of Local Banks of Oman

Banks	Foreign Currency LT	ST	Domestic Strength	Support	Short term outlook
National Bank of Oman	BBB-	A3	BBB-	2	Stable
Oman Arab Bank	BBB-	A3	BBB	2	Stable
Oman International Bank	BBB-	A3	BBB	3	Stable
Bank Muscat	BBB-	A3	BBB	2	Stable
Bank Dhofar	BBB-	A3	BBB	3	Stable

Source: Compiled by the author from the CI Bankscope database, 2003.

Summary of Ratings of local Banks of Qatar

Banks	Foreign Currency LT	Foreign Currency ST	Domestic Strength	Support	Short Term Outlook
AABQ	BBB-	B	BB	3	Stable
CMBQ	BBB	A3	BBB+	3	Stable
DB	BBB-	A3	BBB-	3	Stable
QIISB	BB+	B	BB+	3	Stable
QISB	BB+	A3	BB+	3	Stable
QNB	BBB	A3	A-	1	Stable

Source: Compiled by the author from the Capital Intelligence Bankscope database 2003.

Summary of ratings of local banks of Saudi Arabia

Bank	Foreign Currency: LT	Foreign Currency: ST	Domestic Strength	Support	Short Term Outlook
Al-Bank Al-Saudi Al-Fransi	A-	A2	A	2	Stable
Al-Rajhi Banking & Invest. Co.	BBB+	A3	A-	3	Stable
Arab National Bank	A-	A2	A-	2	Stable
Bank Al-Jazira	BBB-	A3	BBB-	3	Stable
National Commercial Bank	A-	A2	BBB+	1	Stable
Riyad Bank	A-	A2	A+	2	Stable
Saudi American Bank	A-	A2	A+	2	Stable
Saudi British Bank	A-	A2	A	2	Stable
Saudi Hollandi Bank	A-	A2	A	2	Stable

Source: Compiled by the author from the Capital Intelligence Bankscope database, 2003.

Summary of ratings of local banks of the UAE

Banks	Foreign Currency LT	Foreign Currency ST	Domestic Strength	Support	Short term outlook
Abu Dhabi Commercial Bank	A	A2	A+	1	Stable
Bank of Sharjah	BB+	A3	BBB-	3	Stable
Commercial Bank of Dubai	A-	A2	A	2	Stable
Commercial Bank International	BB	B	BB+	4	Stable
Dubai Islamic Bank	BB+	A3	BBB-	2	Stable
Emirates Bank International	A	A2	A+	1	Stable
First Gulf Bank	BB+	A3	BB+	3	Stable
Invest Bank	BB-	B	BB	4	Stable
Mashreq Bank	BBB	A3	BBB+	3	Stable
National Bank of Abu Dhabi	A	A2	A+	1	Stable
National Bank of Dubai	A	A2	A+	2	Stable
National Bank of Fujairah	BBB-	A3	BBB-	3	Stable
National Bank of Ras Al-Khaimah	BB+	A3	BBB-	3	Stable
National Bank of Sharjah	BB	B	BB+	3	Stable
National Bank of Umm AlQaiwain	BB+	A3	BB+	3	Stable
Union National Bank	A-	A2	A-	1	Stable
United Arab Bank	BB+	A3	BBB-	3	Stable

Source: Compiled by the author from the Capital Intelligence Bankscope database, 2003.

Review of scale and scope economies studies in US banking

Author	Year	Data	Methodology	Findings
Alhadeff	1954	Data on 210 California banks studied for the period 1938-1950. Data obtained from Federal reserve data of San Francisco	Simple cost function	Both small and large sized banks exhibited increasing returns to scale, while constant return to scale reported for medium sized banks.
Horvitz	1963	Data obtained form a sample of banks that are members in FDIC for the period 1940-1960	Simple cost function	Very large banks operate at more scale economies than small banks; however, magnitudes of scale economies were declining.
Schweiger and McGee	1961	Data on 6,233 banks member in Federal reserve member in the year 1959	Multiple regression approach	Small banks realise scale economies by increasing their size up to $50 million deposits. Branch banks have more cost savings than unit banks of the same size.
Gramely	1962	Data from Tenth Federal Reserve District of 270 small unit banks covered in the period 1956-1959	Multiple regression approach	Average cost decline sharply with size increases among small banks, but the cost curves become flatter afterwards as banks size increase. However, the results did not indicate if further increase in bank size further decrease cost. Generally, negative coefficient of the size in relation to cost indicated that banks in sample were enjoying scale economies.
Benston	1965a	Data are from the FCA programme of the Federal Reserve bank of Boston. The data cover the period 1959-1961 for 80 to 83 banks	Cobb-Douglas cost function	The coefficient of deposit and mortgage loans reported negative and significant, suggesting economies of scale; while time deposits and instalment were negative and significant, implying diseconomies of scale. Moreover, economies of scale were also found in branch banks.

Review of scale and scope economies studies in US banking

Author	Year	Data	Methodology	Findings
Benston	1965b	Same sample as in Benston 1965a	The Same as that in Benston 1965a	Economies of scale is found for branch banks
Greenbaum	1967	Data drawn from Fifth and Tenth Federal Reserve Districts for 413 and 745 banks	Weighted output index	Declining average cost for small banks, and increasing average cost for large banks. Branch banks operating cost were higher than unit banks.
Bell and Murphy	1968	Data are from the FCA programme of the Federal Reserve bank of Boston, New York and Philadelphia. The data cover the period 1963-1965 for 210 to 283 banks	Cobb-Douglas cost function	Authors found evidence of economies of scale for most bank services such as demand deposits and business and mortgage loans. They also found that branching operations have higher cost than unit banking operation
Schweitzer	1972	Data from the banks in the 9th Federal Reserve District for 1964	Cobb-Douglas cost function	Evidence found for U-shaped cost curve. Banks with assets less than $3.5 million exhibited scale economies. Banks with assets between $3.3 million and $25 million show constant returns to scale. Banks with assets over $25 million have diseconomies of scale.
Murphy	1972	Functional Cost Analysis (FCA) data for the years 1968 on 967 banks	Cobb-Douglas cost function	Generally, banks included in the sample found to exhibit constant returns to scale.
Kalish and Gilbert	1973	Functional Cost Analysis (FCA) data for the years 1968 on 989 banks	Cobb-Douglas cost function	Cost curve found to be shaped as a U-curve. Unit banks found to have the least cost, followed by affiliated banks and branch banks

Review of scale and scope economies studies in US banking

Author	Year	Data	Methodology	Findings
Mullineaux	1975	Functional Cost Analysis (FCA) data for the year 1970	Cobb-Douglas cost function	Economies of scale found to be larger for unit banks than branch banks
Longbrake and Haslem	1975	Functional Cost Analysis (FCA) data for the years 1968 on 989 banks	Cobb-Douglas cost function	Unit banks show having the lowest cost. However, as number of accounts and average deposit increase, unit banks show the highest cost.
Benston, Hanwek, and Humphrey	1983	Functional Cost Analysis (FCA) data from 1975 to 1978	Translog cost function	They found evidence of U-shaped cost curves. That is banks with deposit more than US$ 50 million experienced decreasing scale returns while bank in branching states enjoy small scale economies. The findings suggest that the optimal size of banks ranges between US$ 10 and 25 million in deposits.
Murray and White	1983	Canadian credit unions in 1977	Translog cost function	Most of credit union show existence of economies of scale, in which returns on scale increases as output increase. Evidence is also available on the strong existence of scope economies between mortgage and other lending activities. Credit union that are large and multiproduction are found more cost efficient than small and single product credit unions.
Gilligan and Smirlock	1984	US Federal Reserve Functional Cost Analysis (FCA) data for 714 banks observed in the year 1978. They also use data from Federal Reserve Bank of Kansas City on 2700 unit banks for the years 1973-1978.	Translog cost function	Scale economies exist for banks with less than $25 million in deposit, but scale diseconomies for banks beyond USD 100 million deposits. The results for the data from the Federal Reserve Bank of Kansas City indicate that banks with less that $10 million exhibit scale economies and those with $50 million show diseconomies of scale. Generally, banks output found to exhibit scope economies

Review of scale and scope economies studies in US banking

Author	Year	Data	Methodology	Findings
Lawrence and Shay	1986	FCA programme from 1979 to 1982	Translog cost function	Banks show constant returns to scale. When analysis is based on quartile, banks show significant scale economies. Branch banks exhibit scale economies at all sizes, and unit bank showed siginifican scale economies in general. Scale economies were found between products such as loans and deposits and deposits and investments. However, significant scope diseconomies were found between loans and investments
Kolari and Zardkoohi	1987	US Federal Reserve Functional Cost Analysis (FCA) data for the period 1979-1983	Translog cost function	Unit banks show flat cost curve (constant returns to scale), while branch bank exhibited U-shaped cost curve but tend to be upward in general. Generally, evidence of scope economies is present. However, cost benefit from joint production appeared greater for small banks than large banks. Moreover, unit banks exhibited greater scope economies than branch banks
Berger, Hanweck, and Humphrey	1987	Functional Cost Analysis (FCA) data	Translog cost function	Scale economies are evident for banks up to $50 million, and any size in assets above $50 million show diseconomies of scale. Moreover, scope economies are only evident for small banks.
Berger et. al.	1987	1983 Functional Cost Analysis (FCA) data for 413 branching state banks and 214 unit state banks.	Deterministic Translog cost function	Evidence is available for scale economies. In general, slight scale economies at branch level and slight scale diseconomies at the bank firm level. Scale diseconomies are shown at large unit state banks. Diseconomies of scope

Review of scale and scope economies studies in US banking

Author	Year	Data	Methodology	Findings
Humphrey	1987	Data include 13,959 US banks observed over 1980, 1982, and 1984	Translog cost function	By two to four times variation is found greater in average costs between banks that have the highest cost and those with the lowest cost compared to the observed differences in the average cost across bank size classes. Moreover, the result on cost economies did not show strong evidence of competitive advantage for large banks over small banks.
Cebenoyan	1988	Functional Cost Analysis (FCA) data on 413 branch state banks and for 214 unit state banks, all observed in the year 1983	Translog cost function	Branch banks show slight scale economies and slight scale diseconomies at the level of banking firm. Unit state banks showed large scale diseconomies for large banks. The study's finding indicated that there were scope diseconomies in banking, suggesting other consideration of joint production such as risk diversification, customer convenience and joint demand of products. Expansion path sub-additivity test indicates that production of a given bundle of output is more cost effective by two banks than one bank for banks with deposit amount of $10 million up to $1 billion
Hunter, Timme, and Yang	1990	Call and Income Report data on 311 largest US commercial banks	Translog cost function	Cost gains for large banks are more if they separate their production bundles into groups of specialist banks. Moreover, the finding shows no strong evidence on cost subadditivity.
Noulas, Ray, and Miller	1990	Call and Income Report data on 309 banks with assets over $1 billion	Translog cost function	Banks with assets between $1 billion and $3 billion exhibit scale economies. However, diseconomies of scale are found for banks beyond $3 billion in assets.

Review of scale and scope economies studies in US banking

Author	Year	Data and study period	Methodology	Findings
Mester	1993	Data form reports on Condition and Income on 328 branch banks with assets exceeding $1 billion	Translog cost function	Global scale economies exist in all banks sizes. Moreover, scope economies is also evident.
Mester	1996	Data come form the Third Federal Reserve District on 214 banks for the years 1991-1992	Translog cost function	Evidence on the flat frontier indicating constant returns to scale
Pulley, Berger, and Humphrey	1994	Data consist of panel of 683 US banks with assets over $100 for years 1987-1984 and located in state that allow state branching during 1980s. The sample also extended to include 626 banks covering the year 1990	A combination of a quadratic structure multiple outputs + log-quadratic Translog for input prices.	Revenue complementarities are not evident. Moreover, no significant evidence of scope economies among the set of revenue efficient banks. Weak evidence is found of significant revenue ray scale economies for small banks.
Mitchell and Onvural	1996	1986 and 1990 Call and Income Report data for 306 banks	Fourier Flexible cost function	Minimum cost or efficiency scale is found at $500 million. Diseconomies of scale beyond this level is quite small.

Review of scale and scope economies studies in US banking	Author	Year	Data and study period	Methodology	Findings
	Chem, Mason, and Higgins	2001	Data US banks in different categories by quarter from 1988 to 1997.	SFA and Regression model	Generally, economies of scale do exist in the banking industry. No economies of scale in the banks with agricultural loan specialization. Scale economies dominate the benefits of geographic diversification in community bank mergers.

Notes: SFA is the Stochastic Frontier Approach.

Sources: Berger and Humphrey (1997), Intarachote (2000), Casu (2000), Girardone (2000) and author's own updates.

Review of scale and scope economies studies in European banking

Author	Year	Data	Methodology	Findings
Levy-Garboua and Renard	1977	Data on French banks for 94 banks observed in 1974	Cobb-Douglas cost function	Finding show banks exhibiting Increasing returns to scale
Gouch	1979	Data on UK building societies for the period 1972-1976	Linear average cost function	No evidence of scale economies is found
Cooper	1980	Data on UK building societies covering the year 1977	Cobb-Douglas cost function	Scale economies are evident for societies with sizes under £100 million, and diseconomies of scale is found for larger societies.
Barnes and Dodds	1983	UK building societies in the years 1970-1978	Linear average cost function	No evidence of scale economies were found
Fanjul and Marvell	1985	Data on 83 Spain commercial banks and 54 savings banks for 1979	Cobb-Douglas cost function	Significant cost economies with respect to accounts per branch and deposits per account; and constant return to scale are found relating to the number of branches.
Fanjul and Maravall	1985	Sample of 83 commercial and 54 savings Spanish banks in the year 1979	Cobb-Douglas functional form	Significant cost economies and constant return to scale relating to the number of branches.
Dietsch	1988	243 French banks observed in the year 1986	Translog cost function	The results suggest that scale economies exist for the banks under study
Hardwick	1989	97 UK building societies in the year 1985	Translog form	Economies of scale exist for societies with assets under £280 million and diseconomies of scale for those with assets beyond £1500 million. No evidence found for scope economies

Review of scale and scope economies studies in European banking

Author	**Year**	**Data**	**Methodology**	**Findings**
Baldini and Landi	1990	Sample of 294 Italian banks studied in the year 1987	Translog cost function	Scale economies increase at plant level as bank size increase, however, scale economies become smaller and tend to decrease at the firm level as banks size increase
Hardwick	1990	97 UK building societies in the year 1985	Translog form	Economies of scale exist for societies with assets under £5500 million, where no evidence of scope economies found
Kolari and Zardkoohi	1990	Cooperative and saving banks in Finland during 1983 and 1984	Translog model	Cost curve of cooperative and saving banks tend to be L-shaped at plant level and U-shaped at firm level Diseconomies of scope in the joint production of Advances and bills. The author implied that merger among smaller banks are preferred than merger between larger banks
Martin and Sassenou	1992	Data on French banks covering the year 1987	CES-quadratic function	Scale economies exist in small banks, and large banks exhibit diseconomies of scale Scope economies exist in small banks production
Drake	1992	76 UK building societies in the year 1988	Translog form	Mild scale economies for societies in the £120-500 million asset size, but no evidence of scope economies
Glass and McKillop	1992	Data form the Bank of Ireland, on of the larges Irish banks, for the period 1972-1990	Hybrid translog model	Apart form the sub-period 1976-1978, banks were exhibiting diseconomies of scale, and decreasing product-specific scale economies for investment but increasing for loans Diseconomies of scope

Review of scale and scope economies studies in European banking	Author	Year	Data and study period	Methodology	Findings
	Dietsch	1993	Data on 343 French banks observed in the year 1987	Translog cost function	Economies of scale were found for banks of all output size ranges Scope economies were not evident
	Alevarez and Gromes	1993	64 Spanish banks in 1990	Hybrid translog form	Scale and scope economies for medium-sized saving banks and diseconomies of scale and scope for larger banks
	McKillop and Glass	1994	Data obtained from annual returns for a sample of 89 UK building societies in the year 1991	Hybrid translog form	Evidence existed for augmented scale economies of national and local societies, but constant returns to scale for societies with regional base No scope economies and cost complementarities are found between the provision of mortgage and non-mortgage products.
	Drake	1995	76 UK building societies in the year 1988	Translog form	No scale economies is found when expense-preference behaviour is take into considertion. No evidence of scope economies
	Lang and Welzel	1996	Sample of 700 German cooperative banks	Standard translog cost function	Scope economies are evident in the largest banks
	European Commission	1997	Sample on 10 EU countries covers the years 1987 (with 295 banks) to 1994 (with 1451 banks) obtained from the IBCA Bankscope database	SFA and DEA	Generally, in all countries the analysis show evidence of economies and diseconomies of scale. Small banks, in particular in Germany and France, show exhibiting increasing returns to scale. There is strong evidence indicating that largest banks realise large economies of scope.

Review of scale and scope economies studies in European banking

Author	Year	Data and study period	Methodology	Findings
Casu and Girardone	1998	Data cover 32 Italian banking groups and 78 bank parent companies and subsidiaries for the year 1995	Translog Cost Function	Moderate evidence on the existence of scale economies; but the analysis shows strong evidence of scope economies especially with banking groups
Cavello and Rossi	2001	Sample contains 442 European banks studies over 1002-1997 period	Translog function	Scale economies are evident but more pronounced for small banks.
Altunbas, Gardener, Molyneux, and Moore	2001	Data cover the period 1989-1997 obtained for banks from 15 European countries	Fourier Flexible functional form and stochastic cost frontier	Scale economies (inefficiency) ranges from 5% and 7%. Smallest banks and those banks with size ranging from ECU 1 billion to ECU 5 billion enjoy more scale economies

Notes: SFA is the Stochastic Frontier Aproach; DEA is the Data Envelopment Approach.

Sources: Berger and Humphrey (1997), Intarachote (2000), Casu (2000), Girardone (2000) and author's own updates.

Appendix 4: Results of average efficiency for the five models

Average efficiency model 1 Intermediation

Year	TE	PTE	SE
1993	0.88	0.94	0.94
1994	0.80	0.90	0.89
1995	0.91	0.95	0.96
1996	0.91	0.94	0.96
1997	0.89	0.94	0.94
1998	0.94	0.96	0.97
1999	0.94	0.96	0.98
2000	0.91	0.94	0.97
2001	0.89	0.92	0.97
2002	0.75	0.89	0.84
Overall	**0.88**	**0.94**	**0.94**

Average efficiency Model 4 production

Year	TE	PTE	SE
1993	0.80	0.88	0.92
1994	0.77	0.84	0.92
1995	0.74	0.84	0.89
1996	0.73	0.83	0.89
1997	0.66	0.77	0.86
1998	0.71	0.81	0.88
1999	0.73	0.80	0.91
2000	0.70	0.78	0.90
2001	0.66	0.71	0.91
2002	0.62	0.76	0.79
Overall	**0.71**	**0.80**	**0.89**

Average efficiency model 2 Production

Year	TE	PTE	SE
1993	0.70	0.81	0.88
1994	0.68	0.76	0.89
1995	0.55	0.75	0.77
1996	0.56	0.68	0.84
1997	0.61	0.73	0.85
1998	0.61	0.74	0.82
1999	0.65	0.76	0.85
2000	0.65	0.72	0.89
2001	0.61	0.66	0.90
2002	0.59	0.74	0.77
Overall	**0.62**	**0.74**	**0.85**

Average efficiency Model 5 Intermediation

Year	TE	PTE	SE
1993	0.86	0.91	0.94
1994	0.92	0.95	0.97
1995	0.82	0.90	0.90
1996	0.77	0.83	0.93
1997	0.89	0.91	0.97
1998	0.82	0.88	0.93
1999	0.87	0.92	0.95
2000	0.91	0.93	0.97
2001	0.85	0.90	0.95
2002	0.85	0.92	0.92
Overall	**0.85**	**0.91**	**0.94**

Average efficiency Model 3 intermediation

Year	TE	PTE	SE
1993	0.90	0.95	0.94
1994	0.85	0.93	0.92
1995	0.93	0.97	0.96
1996	0.92	0.96	0.96
1997	0.90	0.95	0.95
1998	0.96	0.98	0.98
1999	0.96	0.97	0.99
2000	0.94	0.96	0.98
2001	0.92	0.95	0.96
2002	0.80	0.91	0.87
Overall	**0.91**	**0.95**	**0.95**

Appendix 5: Model 1 Intermediation "pooled"

Outputs	**Inputs**	**Outputs**
	fixdasst	tloans
	numstaff	othrincm
	tdeposit	OEA
		OBS

DMU No.	DMU Name	Input-Oriented CRS Efficiency	*DMU No.*	*DMU Name*	*Input-Oriente VRS Efficiency*	SE	RTS
1	AUB	1.00000	1	1	1.00000	1	Constant
2	BBK	1.00000	2	2	1.00000	1	Constant
3	NBB	1.00000	3	3	1.00000	1	Constant
4	BSB	1.00000	4	4	1.00000	1	Constant
5	BIB	0.78484	5	5	0.80129	0.979466	Decreasing
6	SHB	0.83487	6	6	0.91622	0.911214	Increasing
7	NBK	0.87649	7	7	1.00000	0.876486	Decreasing
8	GULF	0.77096	8	8	0.77956	0.988969	Decreasing
9	CMBK	0.88152	9	9	1.00000	0.881515	Decreasing
10	BURGAN	0.68344	10	10	0.71115	0.961035	Increasing
11	AHLI	0.73310	11	11	0.73331	0.999719	Decreasing
12	KME	0.77873	12	12	0.80828	0.963435	Decreasing
13	KFH	0.69992	13	13	0.89366	0.783208	Decreasing
14	BD	0.96635	14	14	1.00000	0.966354	Increasing
15	BM	0.78213	15	15	0.80618	0.970166	Increasing
16	NBO	0.82870	16	16	0.82940	0.999163	Decreasing
17	OAB	1.00000	17	17	1.00000	1	Constant
18	OIB	0.92498	18	18	1.00000	0.924979	Decreasing
19	QNB	1.00000	19	19	1.00000	1	Constant
20	CMBQ	1.00000	20	20	1.00000	1	Constant
21	DOHA	0.95206	21	21	0.98518	0.96638	Decreasing
22	AHLIQ	0.83467	22	22	1.00000	0.834667	Increasing
23	QISLM	0.73609	23	23	0.75787	0.971263	Increasing
24	QIISLM	1.00000	24	24	1.00000	1	Constant
25	NCMB	0.76589	25	25	1.00000	0.765894	Decreasing
26	SAMBA	0.90656	26	26	1.00000	0.90656	Decreasing
27	RIYAD	0.65110	27	27	0.94541	0.688693	Decreasing
28	SABR	0.79349	28	28	0.93314	0.850338	Decreasing
29	ARAB	0.85488	29	29	1.00000	0.854877	Decreasing
30	SAFR	0.85196	30	30	1.00000	0.851956	Decreasing
31	SAHO	0.97031	31	31	1.00000	0.970311	Decreasing
32	INVST	1.00000	32	32	1.00000	1	Constant
33	JAZRA	0.99987	33	33	1.00000	0.999869	Decreasing
34	RAJHI	0.98963	34	34	1.00000	0.989626	Decreasing
		29.85253			31.90066	31.85614	
Avg. eff. 1993		**0.878015**			**0.938255**	**0.936945**	
1	AUB	0.64723	1	1	0.76094	0.85057	Increasing

2	BBK	0.61677	2	2	0.75583	0.816011	Increasing
3	NBB	0.59944	3	3	0.88613	0.67646	Increasing
4	BSB	1.00000	4	4	1.00000	1	Constant
5	BIB	0.92764	5	5	0.98359	0.943114	Decreasing
6	SHB	1.00000	6	6	1.00000	1	Constant
7	NBK	0.77963	7	7	0.92313	0.844552	Decreasing
8	GULF	0.80124	8	8	0.81473	0.983445	Decreasing
9	CMBK	0.57753	9	9	0.58873	0.980974	Increasing
10	BURGAN	0.66236	10	10	0.69438	0.953884	Increasing
11	AHLI	0.99315	11	11	1.00000	0.993151	Decreasing
12	KME	0.62306	12	12	0.65279	0.954456	Increasing
13	KFH	0.61046	13	13	0.66505	0.917927	Decreasing
14	BD	0.91806	14	14	1.00000	0.918057	Increasing
15	BM	0.71333	15	15	0.76540	0.931972	Increasing
16	NBO	0.76996	16	16	0.78705	0.978283	Increasing
17	OAB	1.00000	17	17	1.00000	1	Constant
18	OIB	0.81437	18	18	1.00000	0.814367	Decreasing
19	QNB	1.00000	19	19	1.00000	1	Constant
20	CMBQ	0.83200	20	20	0.85592	0.972056	Increasing
21	DOHA	0.78884	21	21	0.89471	0.881665	Decreasing
22	AHLIQ	0.74696	22	22	0.93617	0.797888	Increasing
23	QISLM	0.71214	23	23	0.75941	0.937749	Increasing
24	QIISLM	1.00000	24	24	1.00000	1	Constant
25	NCMB	0.72332	25	25	1.00000	0.723323	Decreasing
26	SAMBA	0.81653	26	26	1.00000	0.816532	Decreasing
27	RIYAD	0.62953	27	27	1.00000	0.629532	Decreasing
28	SABR	0.82758	28	28	1.00000	0.827582	Decreasing
29	ARAB	0.64821	29	29	1.00000	0.648214	Decreasing
30	SAFR	0.69938	30	30	0.95638	0.731283	Decreasing
31	SAHO	1.00000	31	31	1.00000	1	Constant
32	INVST	1.00000	32	32	1.00000	1	Constant
33	JAZRA	1.00000	33	33	1.00000	1	Constant
34	RAJHI	0.66441	34	34	1.00000	0.66441	Decreasing
		27.14313			30.68034	30.18746	
Avg. eff. 1994		**0.798327**			**0.902363**	**0.887866**	

1	AUB	0.86269	1	1	0.87351	0.987616	Increasing
2	BBK	0.83063	2	2	0.84093	0.987746	Increasing
3	NBB	0.86004	3	3	0.93541	0.919435	Increasing
4	BSB	0.88668	4	4	1.00000	0.886676	Increasing
5	BIB	0.85214	5	5	0.86900	0.980597	Increasing
6	SHB	0.79872	6	6	0.83272	0.959166	Increasing
7	NBK	0.79350	7	7	1.00000	0.793502	Decreasing
8	GULF	0.89811	8	8	0.89855	0.999509	Increasing
9	CMBK	0.93412	9	9	0.93977	0.993983	Increasing
10	BURGAN	0.81765	10	10	0.82590	0.990019	Increasing

11	AHLI	0.81754	11	11	0.82233	0.994174	Increasing
12	KME	0.78040	12	12	0.78346	0.996095	Increasing
13	KFH	0.85932	13	13	0.86301	0.995729	Increasing
14	BD	1.00000	14	14	1.00000	1	Constant
15	BM	0.90803	15	15	0.93821	0.967827	Increasing
16	NBO	0.83559	16	16	0.87849	0.951164	Increasing
17	OAB	1.00000	17	17	1.00000	1	Constant
18	OIB	1.00000	18	18	1.00000	1	Constant
19	QNB	1.00000	19	19	1.00000	1	Constant
20	CMBQ	0.95432	20	20	1.00000	0.95432	Increasing
21	DOHA	0.81548	21	21	0.84667	0.963161	Increasing
22	AHLIQ	0.86822	22	22	1.00000	0.868224	Increasing
23	QISLM	0.85837	23	23	0.88977	0.964707	Increasing
24	QIISLM	1.00000	24	24	1.00000	1	Constant
25	NCMB	0.82893	25	25	1.00000	0.828927	Decreasing
26	SAMBA	0.83549	26	26	1.00000	0.835487	Decreasing
27	RIYAD	0.90555	27	27	1.00000	0.90555	Decreasing
28	SABR	0.85615	28	28	1.00000	0.856146	Decreasing
29	ARAB	0.86326	29	29	0.99489	0.867692	Decreasing
30	SAFR	0.87348	30	30	0.98883	0.883346	Decreasing
31	SAHO	0.86431	31	31	0.98238	0.879807	Decreasing
32	INVST	0.99239	32	32	1.00000	0.992393	Decreasing
33	JAZRA	1.00000	33	33	1.00000	1	Constant
34	RAJHI	0.97640	34	34	1.00000	0.9764	Decreasing
35	NBAD	0.93887	35	35	1.00000	0.938869	Decreasing
36	NBD	1.00000	36	36	1.00000	1	Constant
37	EMIRATE	1.00000	37	37	1.00000	1	Constant
38	ADCOM	0.87916	38	38	0.96628	0.909835	Decreasing
39	MASHREQ	0.89382	39	39	1.00000	0.893825	Decreasing
40	UNION	0.93193	40	40	1.00000	0.931927	Decreasing
41	COMBD	0.89887	41	41	1.00000	0.898872	Decreasing
42	FIRST	1.00000	42	42	1.00000	1	Constant
43	ARABTRD	0.91873	43	43	0.93316	0.984538	Decreasing
44	SHARJAH	1.00000	44	44	1.00000	1	Constant
45	NBRASK	0.96233	45	45	0.96685	0.995327	Increasing
46	COMINTEF	0.88518	46	46	0.89158	0.99282	Increasing
47	FUJAIRAH	0.93170	47	47	0.94167	0.989418	Increasing
48	NBSHARJA	0.94972	48	48	0.97114	0.977946	Increasing
49	UNARAB	0.87118	49	49	0.88754	0.981562	Increasing
50	MEB	0.92284	50	50	0.92389	0.998867	Increasing
51	QAWAIN	1.00000	51	51	1.00000	1	Constant
52	DISLM	0.96017	52	52	0.96127	0.998858	Increasing
		47.17198			49.44719	49.67206	
Avg. eff.1995		**0.907154**			**0.950908**	**0.955232**	
1	AUB	0.83883	1	1	0.86110	0.974138	Increasing

2	BBK	0.78839	2	2	0.81300	0.969728	Increasing
3	NBB	0.89354	3	3	0.91691	0.974504	Increasing
4	BSB	0.89509	4	4	1.00000	0.89509	Increasing
5	BIB	0.82267	5	5	0.83189	0.988922	Increasing
6	SHB	0.85447	6	6	0.86953	0.982675	Increasing
7	NBK	0.85163	7	7	1.00000	0.851634	Decreasing
8	GULF	0.86902	8	8	0.87255	0.995955	Decreasing
9	CMBK	0.85740	9	9	0.85995	0.997035	Increasing
10	BURGAN	0.86770	10	10	0.87353	0.99333	Increasing
11	AHLI	0.82774	11	11	0.82971	0.997626	Increasing
12	KME	0.81243	12	12	0.81614	0.995448	Increasing
13	KFH	0.89681	13	13	0.89684	0.999957	Decreasing
14	BD	1.00000	14	14	1.00000	1	Constant
15	BM	0.98999	15	15	0.99124	0.99874	Decreasing
16	NBO	0.90193	16	16	0.90212	0.999784	Decreasing
17	OAB	0.94617	17	17	1.00000	0.946172	Increasing
18	OIB	1.00000	18	18	1.00000	1	Constant
19	QNB	1.00000	19	19	1.00000	1	Constant
20	CMBQ	0.81712	20	20	0.90320	0.904701	Increasing
21	DOHA	0.85994	21	21	0.86870	0.989909	Increasing
22	AHLIQ	0.92866	22	22	1.00000	0.928661	Increasing
23	QISLM	0.95224	23	23	0.95345	0.998728	Decreasing
24	QIISLM	1.00000	24	24	1.00000	1	Constant
25	NCMB	0.79944	25	25	1.00000	0.799444	Decreasing
26	SAMBA	0.82890	26	26	1.00000	0.828903	Decreasing
27	RIYAD	0.79142	27	27	1.00000	0.791425	Decreasing
28	SABR	0.82599	28	28	0.96110	0.859419	Decreasing
29	ARAB	0.81342	29	29	0.95315	0.853403	Decreasing
30	SAFR	0.81489	30	30	0.91973	0.88601	Decreasing
31	SAHO	0.82667	31	31	0.89060	0.928217	Decreasing
32	INVST	0.88636	32	32	0.90987	0.974157	Decreasing
33	JAZRA	0.87221	33	33	0.92436	0.943592	Decreasing
34	RAJHI	0.82349	34	34	0.87997	0.935821	Decreasing
35	NBAD	1.00000	35	35	1.00000	1	Constant
36	NBD	0.99851	36	36	1.00000	0.998514	Decreasing
37	EMIRATE	0.90551	37	37	0.92723	0.976577	Decreasing
38	ADCOM	0.89913	38	38	0.90266	0.996094	Decreasing
39	MASHREQ	0.88638	39	39	0.89496	0.990422	Decreasing
40	UNION	0.85323	40	40	0.85390	0.999219	Increasing
41	COMBD	0.99030	41	41	1.00000	0.990302	Decreasing
42	FIRST	1.00000	42	42	1.00000	1	Constant
43	ARABTRD	1.00000	43	43	1.00000	1	Constant
44	SHARJAH	1.00000	44	44	1.00000	1	Constant
45	NBRASK	1.00000	45	45	1.00000	1	Constant
46	COMINTER	0.97596	46	46	0.98169	0.994164	Decreasing

47	FUJAIRAH	1.00000	47	47	1.00000	1	Constant
48	NBSHARJA	1.00000	48	48	1.00000	1	Constant
49	UNARAB	1.00000	49	49	1.00000	1	Constant
50	MEB	0.96362	50	50	0.96483	0.998741	Decreasing
51	QAWAIN	0.93963	51	51	0.94713	0.992077	Decreasing
52	DISLM	1.00000	52	52	1.00000	1	Constant
		47.16687			48.97106	50.11924	
Avg. eff. 1996		**0.907055**			**0.941751**	**0.963832**	
1	AUB	0.77431	1	1	0.77734	0.996111	Increasing
2	BBK	1.00000	2	2	1.00000	1	Constant
3	NBB	1.00000	3	3	1.00000	1	Constant
4	BSB	1.00000	4	4	1.00000	1	Constant
5	BIB	1.00000	5	5	1.00000	1	Constant
6	SHB	1.00000	6	6	1.00000	1	Constant
7	NBK	0.77340	7	7	1.00000	0.773405	Decreasing
8	GULF	0.74174	8	8	0.91455	0.811044	Decreasing
9	CMBK	0.76241	9	9	0.86238	0.884084	Decreasing
10	BURGAN	0.73928	10	10	0.83478	0.885598	Decreasing
11	AHLI	0.74505	11	11	0.83392	0.893423	Decreasing
12	KME	0.75474	12	12	0.76529	0.986203	Decreasing
13	KFH	0.96000	13	13	1.00000	0.960004	Decreasing
14	BD	0.85930	14	14	0.91089	0.94336	Increasing
15	BM	1.00000	15	15	1.00000	1	Constant
16	NBO	0.90214	16	16	0.90777	0.993795	Increasing
17	OAB	1.00000	17	17	1.00000	1	Constant
18	OIB	0.86262	18	18	0.86936	0.992238	Increasing
19	QNB	1.00000	19	19	1.00000	1	Constant
20	CMBQ	0.82751	20	20	0.85611	0.966597	Increasing
21	DOHA	0.87215	21	21	0.88056	0.990455	Increasing
22	AHLIQ	0.77395	22	22	0.82511	0.937994	Increasing
23	QISLM	0.94692	23	23	0.95328	0.993331	Decreasing
24	QIISLM	1.00000	24	24	1.00000	1	Constant
25	NCMB	0.69718	25	25	1.00000	0.697177	Decreasing
26	SAMBA	0.71837	26	26	0.97062	0.740112	Decreasing
27	RIYAD	0.69640	27	27	0.96635	0.720652	Decreasing
28	SABR	0.97843	28	28	1.00000	0.978428	Decreasing
29	ARAB	0.68308	29	29	0.92901	0.735278	Decreasing
30	SAFR	0.66972	30	30	0.93393	0.717102	Decreasing
31	SAHO	0.88904	31	31	1.00000	0.889041	Decreasing
32	INVST	0.99350	32	32	1.00000	0.993504	Decreasing
33	JAZRA	1.00000	33	33	1.00000	1	Constant
34	RAJHI	0.71817	34	34	1.00000	0.718174	Decreasing
35	NBAD	1.00000	35	35	1.00000	1	Constant
36	NBD	0.97795	36	36	0.98499	0.99286	Decreasing
37	EMIRATE	0.92943	37	37	0.93736	0.991549	Decreasing

38 ADCOM	0.89332	38	38	0.90800	0.983831	Decreasing
39 MASHREQ	0.82379	39	39	0.86563	0.95166	Decreasing
40 UNION	0.84300	40	40	0.85517	0.985774	Decreasing
41 COMBD	0.88770	41	41	0.88802	0.999634	Increasing
42 FIRST	0.94955	42	42	0.96277	0.986269	Decreasing
43 ARABTRD	1.00000	43	43	1.00000	1	Constant
44 SHARJAH	1.00000	44	44	1.00000	1	Constant
45 NBRASK	0.88112	45	45	0.89298	0.986719	Increasing
46 COMINTEF	0.84193	46	46	0.85262	0.98746	Increasing
47 FUJAIRAH	0.96836	47	47	0.97143	0.996833	Increasing
48 NBSHARJA	0.96730	48	48	0.97663	0.990449	Increasing
49 UNARAB	0.93929	49	49	0.94231	0.996792	Increasing
50 MEB	0.98323	50	50	0.98412	0.99909	Increasing
51 QAWAIN	0.95980	51	51	0.96407	0.995577	Increasing
52 DISLM	0.90470	52	52	0.91774	0.985788	Increasing
	46.08990			48.89510	49.02740	
Avg. eff. 1997	**0.886344**			**0.94029**	**0.942835**	
1 AUB	0.90238	1	1	1.00000	0.90238	Increasing
2 BBK	0.92335	2	2	0.99882	0.924444	Increasing
3 NBB	0.96975	3	3	1.00000	0.969751	Increasing
4 BSB	0.97856	4	4	1.00000	0.978556	Increasing
5 BIB	0.91610	5	5	0.98996	0.92539	Increasing
6 SHB	0.94291	6	6	1.00000	0.942907	Increasing
7 NBK	0.97853	7	7	1.00000	0.978535	Decreasing
8 GULF	1.00000	8	8	1.00000	1	Constant
9 CMBK	0.90811	9	9	0.92632	0.980343	Decreasing
10 BURGAN	0.88792	10	10	0.91112	0.974531	Decreasing
11 AHLI	0.87746	11	11	0.89900	0.976038	Decreasing
12 KME	0.91180	12	12	0.91612	0.995289	Decreasing
13 KFH	0.97494	13	13	1.00000	0.974939	Decreasing
14 BD	0.85368	14	14	0.86557	0.986259	Increasing
15 BM	1.00000	15	15	1.00000	1	Constant
16 NBO	0.95680	16	16	0.96815	0.988274	Decreasing
17 OAB	1.00000	17	17	1.00000	1	Constant
18 OIB	0.83499	18	18	0.84877	0.98376	Decreasing
19 QNB	1.00000	19	19	1.00000	1	Constant
20 CMBQ	0.93671	20	20	0.93696	0.999736	Increasing
21 DOHA	0.95912	21	21	1.00000	0.959124	Decreasing
22 AHLIQ	1.00000	22	22	1.00000	1	Constant
23 QISLM	0.89194	23	23	0.89921	0.991918	Increasing
24 QIISLM	0.95666	24	24	1.00000	0.956658	Increasing
25 NCMB	0.87311	25	25	1.00000	0.873115	Decreasing
26 SAMBA	1.00000	26	26	1.00000	1	Constant
27 RIYAD	0.94424	27	27	0.97980	0.9637	Decreasing
28 SABR	0.94611	28	28	0.97156	0.973804	Decreasing

29	ARAB	0.90713	29	29	0.96565	0.939392	Decreasing
30	SAFR	0.88512	30	30	0.93968	0.94194	Decreasing
31	SAHO	0.97219	31	31	0.97654	0.995545	Decreasing
32	INVST	1.00000	32	32	1.00000	1	Constant
33	JAZRA	1.00000	33	33	1.00000	1	Constant
34	RAJHI	0.81084	34	34	0.93926	0.863278	Decreasing
35	NBAD	0.80851	35	35	0.87147	0.927756	Decreasing
36	NBD	0.83034	36	36	0.88571	0.937488	Decreasing
37	EMIRATE	0.76896	37	37	0.82813	0.928557	Decreasing
38	ADCOM	0.81942	38	38	0.85937	0.953507	Decreasing
39	MASHREQ	0.90231	39	39	0.93015	0.970069	Increasing
40	UNION	0.90087	40	40	0.92206	0.977016	Increasing
41	COMBD	1.00000	41	41	1.00000	1	Constant
42	FIRST	0.95018	42	42	0.99204	0.957797	Increasing
43	ARABTRD	0.96127	43	43	1.00000	0.96127	Increasing
44	SHARJAH	1.00000	44	44	1.00000	1	Constant
45	NBRASK	1.00000	45	45	1.00000	1	Constant
46	COMINTEF	0.95793	46	46	0.95810	0.999815	Increasing
47	FUJAIRAH	0.99003	47	47	0.99019	0.999837	Increasing
48	NBSHARJA	1.00000	48	48	1.00000	1	Constant
49	UNARAB	1.00000	49	49	1.00000	1	Constant
50	MEB	1.00000	50	50	1.00000	1	Constant
51	QAWAIN	1.00000	51	51	1.00000	1	Constant
52	DISLM	1.00000	52	52	1.00000	1	Constant
		48.79024			50.16971	50.55272	
Avg. eff. 1998		**0.938274**			**0.964802**	**0.972168**	

1	AUB	1.00000	1	1	1.00000	1	Constant
2	BBK	1.00000	2	2	1.00000	1	Constant
3	NBB	1.00000	3	3	1.00000	1	Constant
4	BSB	1.00000	4	4	1.00000	1	Constant
5	BIB	0.79979	5	5	0.88112	0.907703	Increasing
6	SHB	0.98417	6	6	0.99557	0.988548	Increasing
7	NBK	1.00000	7	7	1.00000	1	Constant
8	GULF	0.91797	8	8	0.92515	0.992234	Decreasing
9	CMBK	0.96749	9	9	1.00000	0.967494	Decreasing
10	BURGAN	0.91261	10	10	0.92288	0.988873	Decreasing
11	AHLI	0.91925	11	11	0.94754	0.97015	Decreasing
12	KME	0.97865	12	12	1.00000	0.978648	Decreasing
13	KFH	1.00000	13	13	1.00000	1	Constant
14	BD	0.92548	14	14	0.92894	0.996277	Increasing
15	BM	1.00000	15	15	1.00000	1	Constant
16	NBO	1.00000	16	16	1.00000	1	Constant
17	OAB	1.00000	17	17	1.00000	1	Constant
18	OIB	0.83081	18	18	0.87768	0.946588	Decreasing
19	QNB	1.00000	19	19	1.00000	1	Constant

20	CMBQ	1.00000	20	20	1.00000	1	Constant
21	DOHA	1.00000	21	21	1.00000	1	Constant
22	AHLIQ	1.00000	22	22	1.00000	1	Constant
23	QISLM	0.92220	23	23	0.96091	0.95972	Decreasing
24	QIISLM	1.00000	24	24	1.00000	1	Constant
25	NCMB	0.82417	25	25	0.94001	0.876768	Decreasing
26	SAMBA	0.86789	26	26	0.93060	0.932616	Decreasing
27	RIYAD	0.81068	27	27	0.91597	0.885051	Decreasing
28	SABR	0.83787	28	28	0.89185	0.939472	Decreasing
29	ARAB	0.84196	29	29	0.87326	0.964158	Decreasing
30	SAFR	0.84336	30	30	0.86127	0.979201	Decreasing
31	SAHO	0.87646	31	31	0.89369	0.980714	Decreasing
32	INVST	0.96504	32	32	0.96561	0.999412	Increasing
33	JAZRA	1.00000	33	33	1.00000	1	Constant
34	RAJHI	0.71204	34	34	0.82957	0.858328	Decreasing
35	NBAD	0.92796	35	35	0.92969	0.998131	Decreasing
36	NBD	1.00000	36	36	1.00000	1	Constant
37	EMIRATE	1.00000	37	37	1.00000	1	Constant
38	ADCOM	1.00000	38	38	1.00000	1	Constant
39	MASHREQ	0.92716	39	39	0.92938	0.997609	Increasing
40	UNION	0.94182	40	40	0.94251	0.999266	Increasing
41	COMBD	0.94150	41	41	0.95446	0.986419	Increasing
42	FIRST	1.00000	42	42	1.00000	1	Constant
43	ARABTRD	0.98182	43	43	1.00000	0.981822	Decreasing
44	SHARJAH	1.00000	44	44	1.00000	1	Constant
45	NBRASK	1.00000	45	45	1.00000	1	Constant
46	COMINTER	0.99911	46	46	1.00000	0.999109	Increasing
47	FUJAIRAH	1.00000	47	47	1.00000	1	Constant
48	NBSHARJA	0.93784	48	48	0.93895	0.998814	Decreasing
49	UNARAB	0.91215	49	49	1.00000	0.912148	Increasing
50	MEB	0.90752	50	50	0.94703	0.958288	Increasing
51	QAWAIN	1.00000	51	51	1.00000	1	Constant
52	DISLM	0.89259	52	52	0.91773	0.972607	Decreasing
		49.10735			50.10137	50.91617	
Avg. eff. 1999		**0.944372**			**0.963488**	**0.979157**	
1	AUB	0.84825	1	1	0.95402	0.88913	Increasing
2	BBK	0.79003	2	2	0.87807	0.899742	Increasing
3	NBB	0.84125	3	3	0.92537	0.909104	Increasing
4	BSB	1.00000	4	4	1.00000	1	Constant
5	BIB	1.00000	5	5	1.00000	1	Constant
6	SHB	0.94750	6	6	1.00000	0.947499	Increasing
7	NBK	1.00000	7	7	1.00000	1	Constant
8	GULF	0.93463	8	8	0.93877	0.995588	Decreasing
9	CMBK	1.00000	9	9	1.00000	1	Constant
10	BURGAN	0.87799	10	10	0.88001	0.997703	Increasing

11	AHLI	0.89368	11	11	0.89413	0.999502	Increasing
12	KME	0.91810	12	12	0.91890	0.999127	Decreasing
13	KFH	0.95457	13	13	1.00000	0.954575	Decreasing
14	BD	0.84655	14	14	0.89442	0.946486	Increasing
15	BM	1.00000	15	15	1.00000	1	Constant
16	NBO	0.94766	16	16	1.00000	0.947661	Decreasing
17	OAB	1.00000	17	17	1.00000	1	Constant
18	OIB	0.82432	18	18	0.86147	0.956869	Decreasing
19	QNB	1.00000	19	19	1.00000	1	Constant
20	CMBQ	0.90241	20	20	0.93009	0.970231	Decreasing
21	DOHA	0.87685	21	21	0.87741	0.999357	Decreasing
22	AHLIQ	0.83370	22	22	0.88618	0.940777	Increasing
23	QISLM	1.00000	23	23	1.00000	1	Constant
24	QIISLM	1.00000	24	24	1.00000	1	Constant
25	NCMB	0.85252	25	25	1.00000	0.852523	Decreasing
26	SAMBA	0.83838	26	26	0.92955	0.901926	Decreasing
27	RIYAD	0.84149	27	27	0.86955	0.967735	Decreasing
28	SABR	0.84824	28	28	0.89500	0.947755	Decreasing
29	ARAB	0.83758	29	29	0.86763	0.965372	Decreasing
30	SAFR	0.80310	30	30	0.81475	0.985704	Decreasing
31	SAHO	0.79741	31	31	0.80626	0.989019	Increasing
32	INVST	0.86248	32	32	0.88051	0.979514	Increasing
33	JAZRA	0.85040	33	33	0.86859	0.979068	Increasing
34	RAJHI	0.73435	34	34	0.74132	0.9906	Decreasing
35	NBAD	0.84077	35	35	0.87949	0.955975	Increasing
36	NBD	0.87073	36	36	0.92685	0.939455	Increasing
37	EMIRATE	0.81509	37	37	0.88361	0.922457	Increasing
38	ADCOM	1.00000	38	38	1.00000	1	Constant
39	MASHREQ	1.00000	39	39	1.00000	1	Constant
40	UNION	0.93220	40	40	1.00000	0.932203	Increasing
41	COMBD	1.00000	41	41	1.00000	1	Constant
42	FIRST	1.00000	42	42	1.00000	1	Constant
43	ARABTRD	0.94441	43	43	0.94736	0.996884	Increasing
44	SHARJAH	1.00000	44	44	1.00000	1	Constant
45	NBRASK	0.90692	45	45	0.93010	0.975073	Increasing
46	COMINTER	0.93059	46	46	0.93545	0.994802	Increasing
47	FUJAIRAH	0.96880	47	47	0.97868	0.989899	Increasing
48	NBSHARJA	1.00000	48	48	1.00000	1	Constant
49	UNARAB	1.00000	49	49	1.00000	1	Constant
50	MEB	1.00000	50	50	1.00000	1	Constant
51	QAWAIN	0.87698	51	51	1.00000	0.876982	Increasing
52	DISLM	0.94635	52	52	1.00000	0.946352	Increasing
		47.53628			48.99352	50.44265	
Avg. eff. 2000		**0.914159**			**0.942183**	**0.970051**	
1	AUB	0.92973	1	1	1.00000	0.929732	Increasing

2 BBK	0.88233	2	2	0.97692	0.90318	Increasing
3 NBB	1.00000	3	3	1.00000	1	Constant
4 BSB	1.00000	4	4	1.00000	1	Constant
5 BIB	0.83885	5	5	0.84293	0.995165	Decreasing
6 SHB	0.97369	6	6	0.98199	0.991548	Increasing
7 NBK	1.00000	7	7	1.00000	1	Constant
8 GULF	1.00000	8	8	1.00000	1	Constant
9 CMBK	1.00000	9	9	1.00000	1	Constant
10 BURGAN	0.93959	10	10	0.96435	0.974324	Decreasing
11 AHLI	0.89129	11	11	0.90058	0.989686	Decreasing
12 KME	0.90192	12	12	0.92552	0.974503	Decreasing
13 KFH	0.92994	13	13	1.00000	0.929942	Decreasing
14 BD	0.75703	14	14	0.79103	0.957016	Increasing
15 BM	1.00000	15	15	1.00000	1	Constant
16 NBO	0.82167	16	16	0.83976	0.978454	Decreasing
17 OAB	0.83089	17	17	1.00000	0.830891	Decreasing
18 OIB	0.86064	18	18	0.86077	0.999848	Decreasing
19 QNB	1.00000	19	19	1.00000	1	Constant
20 CMBQ	1.00000	20	20	1.00000	1	Constant
21 DOHA	0.81114	21	21	0.81418	0.996262	Decreasing
22 AHLIQ	0.81227	22	22	0.81934	0.991375	Increasing
23 QISLM	0.90606	23	23	0.91184	0.993655	Increasing
24 QIISLM	1.00000	24	24	1.00000	1	Constant
25 NCMB	0.74853	25	25	0.75562	0.990626	Decreasing
26 SAMBA	0.77805	26	26	0.78599	0.989899	Decreasing
27 RIYAD	0.72175	27	27	0.72718	0.99253	Decreasing
28 SABR	0.70690	28	28	0.71233	0.992377	Decreasing
29 ARAB	0.67164	29	29	0.67656	0.992738	Decreasing
30 SAFR	0.67484	30	30	0.67913	0.993685	Decreasing
31 SAHO	0.67471	31	31	0.67926	0.993297	Decreasing
32 INVST	0.74065	32	32	0.74265	0.99731	Decreasing
33 JAZRA	0.75869	33	33	0.75983	0.998491	Decreasing
34 RAJHI	0.62810	34	34	0.63135	0.994844	Decreasing
35 NBAD	0.93873	35	35	1.00000	0.938732	Increasing
36 NBD	0.83499	36	36	1.00000	0.834986	Increasing
37 EMIRATE	0.78764	37	37	0.96291	0.817978	Increasing
38 ADCOM	0.81019	38	38	1.00000	0.810189	Increasing
39 MASHREQ	0.97548	39	39	1.00000	0.975477	Decreasing
40 UNION	1.00000	40	40	1.00000	1	Constant
41 COMBD	0.99827	41	41	1.00000	0.998266	Decreasing
42 FIRST	1.00000	42	42	1.00000	1	Constant
43 ARABTRD	1.00000	43	43	1.00000	1	Constant
44 SHARJAH	1.00000	44	44	1.00000	1	Constant
45 NBRASK	0.95705	45	45	1.00000	0.957053	Increasing
46 COMINTER	0.91356	46	46	1.00000	0.913563	Increasing

47 FUJAIRAH	1.00000	47	47	1.00000	1	Constant
48 NBSHARJA	1.00000	48	48	1.00000	1	Constant
49 UNARAB	0.93390	49	49	0.97684	0.956044	Increasing
50 MEB	0.96671	50	50	1.00000	0.96671	Increasing
51 QAWAIN	0.94692	51	51	0.97338	0.972808	Increasing
52 DISLM	1.00000	52	52	1.00000	1	Constant
	46.25433			47.69224	50.51318	
Avg. eff. 2001	**0.889506**			**0.917158**	**0.971407**	
1 AUB	0.75965	1	1	0.90088	0.843234	Increasing
2 BBK	0.75772	2	2	0.78014	0.971262	Increasing
3 NBB	1.00000	3	3	1.00000	1	Constant
4 BSB	1.00000	4	4	1.00000	1	Constant
5 BIB	1.00000	5	5	1.00000	1	Constant
6 SHB	1.00000	6	6	1.00000	1	Constant
7 NBK	1.00000	7	7	1.00000	1	Constant
8 GULF	0.88971	8	8	1.00000	0.889708	Decreasing
9 CMBK	0.83588	9	9	1.00000	0.835875	Decreasing
10 BURGAN	0.86694	10	10	0.93192	0.930271	Decreasing
11 AHLI	0.71228	11	11	0.76294	0.933608	Decreasing
12 KME	0.79338	12	12	0.85083	0.932478	Decreasing
13 KFH	0.72804	13	13	0.96753	0.752475	Decreasing
14 BD	0.64374	14	14	0.77156	0.834337	Increasing
15 BM	0.89527	15	15	1.00000	0.895271	Decreasing
16 NBO	0.80816	16	16	0.88110	0.917218	Decreasing
17 OAB	1.00000	17	17	1.00000	1	Constant
18 OIB	0.63449	18	18	0.65849	0.96355	Decreasing
19 QNB	1.00000	19	19	1.00000	1	Constant
20 CMBQ	0.64171	20	20	0.69899	0.918053	Decreasing
21 DOHA	0.68387	21	21	0.69917	0.978113	Decreasing
22 AHLIQ	0.74339	22	22	1.00000	0.743386	Increasing
23 QISLM	0.78994	23	23	0.82887	0.953032	Increasing
24 QIISLM	0.61570	24	24	0.85939	0.716441	Increasing
25 NCMB	0.53324	25	25	1.00000	0.533244	Decreasing
26 SAMBA	0.56603	26	26	1.00000	0.56603	Decreasing
27 RIYAD	0.53947	27	27	1.00000	0.539475	Decreasing
28 SABR	0.53588	28	28	0.99550	0.538302	Decreasing
29 ARAB	0.52153	29	29	1.00000	0.521526	Decreasing
30 SAFR	0.59163	30	30	1.00000	0.591633	Decreasing
31 SAHO	0.66828	31	31	1.00000	0.668278	Decreasing
32 INVST	0.94822	32	32	1.00000	0.948225	Decreasing
33 JAZRA	1.00000	33	33	1.00000	1	Constant
34 RAJHI	0.41767	34	34	0.97065	0.430302	Decreasing
35 NBAD	0.98995	35	35	1.00000	0.989949	Decreasing
36 NBD	1.00000	36	36	1.00000	1	Constant
37 EMIRATE	0.43128	37	37	0.59082	0.729958	Increasing

38	ADCOM	0.42345	38	38	0.57321	0.73874	Increasing
39	MASHREQ	0.42106	39	39	0.56565	0.744391	Increasing
40	UNION	0.41144	40	40	0.54516	0.754713	Increasing
41	COMBD	0.40517	41	41	0.53012	0.764301	Increasing
42	FIRST	0.42664	42	42	0.63263	0.674388	Increasing
43	ARABTRD	0.46304	43	43	0.84805	0.546014	Increasing
44	SHARJAH	0.48574	44	44	1.00000	0.485742	Increasing
45	NBRASK	0.96470	45	45	1.00000	0.964705	Decreasing
46	COMINTEF	1.00000	46	46	1.00000	1	Constant
47	FUJAIRAH	1.00000	47	47	1.00000	1	Constant
48	NBSHARJA	1.00000	48	48	1.00000	1	Constant
49	UNARAB	0.67078	49	49	0.69573	0.964133	Increasing
50	MEB	0.79001	50	50	0.94779	0.833529	Increasing
51	QAWAIN	0.97104	51	51	1.00000	0.971044	Increasing
52	DISLM	0.88220	52	52	0.88431	0.997614	Decreasing
		38.85834			46.37143	43.50455	
Avg. eff. 2002		**0.747276**			**0.891758**	**0.836626**	
Overall avg. efficiency		**0.881048**			**0.935296**	**0.941612**	