Efficiency in Arabian Banking

A Thesis

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By

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List of Acronyms

- 3-FCR : Three Firm Concentration Ratio
- AE : Allocative Efficiency
- AMF : Amman Financial Market
- ASE : Amman Stock Exchange
- Avg. : Average
- B : Bahrain
- BD : Bahrain Dinar
- BIS : Bank for International Settlements
- BMA : Bahrain Monetary Agency
- BSE : Bahrain Stock Exchange
- C : Commercial
- CAPMAS : Central Agency for Public Mobilization and Statistics, Egypt
- CBE : Central Bank of Egypt
- CBJ : Central Bank of Jordan
- CD : Certificate of Deposit
- CE : Cost Efficiency
- CR : Concentration Ratio
- CRS : Constant Return to Scale
- DEA : Data Envelopment Analysis
- DF : Degree of freedom
- DFA : Distribution Free Approach
- E : Egypt
- EC : European Community
- EMU : Economic and Monetary Union
- FCDs : Foreign Currency Deposits
- FDH : Free Disposal Hull
- FF : The Fourier-flexible
- GDP : Gross Domestic Product
- GNP : Gross National Product
- GST : General Sales Tax

- IMF : International Monetary Fund
- Inv. : Investment
- Isl. : Islamic
- J : Jordan
- JD : Jordanian Dinar
- K : Capital adequacy ratio
- L : Liquidity ratio
- LE : Egyptian Pound
- Libor : London Interbank Offer Rate
- LR : Log Likelihood Ratio
- M1 : Money Supply 1
- M2 : Money Supply 2
- Max. : Maximum value
- Min. : Minimum value
- MLE : Maximum Likelihood Estimates
- MS : Market Share
- N/A : Not available
- NIRS : Non-increasing Return to Scale
- No. : Number
- OIC : Organization of Islamic Conferences
- OLS : Ordinary Least Squares
- p1 : Price of loans
- p2 : Price of other earning assets
- p3 : Price of off-balance sheet items
- PPS : Production Possibility Set
- RAC : Ray Average Cost
- RJ : Royal Jordanian
- ROA : Return on Assets
- ROAA : Return on Average Assets
- ROAE : Return on Average Equity
- ROE : Return on Equity
- S : Saudi Arabia

- *S* : Asset quality ratio
- SAMA : Saudi Arabian Monetary Agency
- SE : Scale Efficiency
- SESRTCIC: Statistical Economic and Social Research and Training Centre for Islamic Countries
- SEZ : Special Economic Zone
- SF : Stochastic frontier
- SFA : Stochastic Frontier Approach
- SR : Saudi Riyal
- St. Dev : Standard Deviation
- *t* : Time trend
- T. : Total
- TA : Total assets
- TB : Treasury Bill
- TC : Total Cost
- TE : Technical Efficiency
- TFA : Thick Frontier Approach
- UNDP : United Nations Development Programme
- VAT : Value Added Tax (ad valorem tax)
- VRS : Variable Return to Scale
- w1 : The price of purchased funds
- w2 : Price of labour
- w3 : Price of physical capital
- WTO : World Trade Organization
- Y1 : $ value of loans
- Y2 : $ value of other earning assets
- Y3 : $ value of off-balance sheet items

Abstract

This thesis investigates the efficiency levels of the Jordanian, Egyptian, Saudi Arabian and Bahraini banking systems. The empirical evidence on bank efficiency in these markets aims to highlight the features associated with the role of economic and financial reforms that have taken place in these countries over the past decade.

Our sample comprises information on 82 banks operating in Jordan, Egypt, Saudi Arabia and Bahrain over the 1992-2000 period. We use the stochastic frontier and Fourier-flexible form to estimate cost and profit efficiency levels in these banking systems. In addition, we also estimate the scale elasticity and scale efficiency levels in the banking sectors under study. The sample size represents 78% of the banking sector of Jordan, just under 90% of the Egyptian banking sector, 63% of that of Saudi Arabia and over 50% of the banking sector of Bahrain.

To derive efficiency levels, we employ three distinct economic efficiency concepts (cost, standard profit and alternative profit efficiencies), using a number of different measurement methods (including the stochastic frontier approach, specification of the Fourier-flexible functional form versus the translog form, and inclusion of a banks' asset quality and financial capital in a number of different ways) to a single data set. In choosing the 'preferred' cost and profit models to estimate efficiency levels, we follow various contemporary methodologies that use a variety of hypotheses tests to arrive at preferred model specifications. Given cost efficiency, the preferred model is the Fourier-truncated form that excludes the control variables (capital adequacy, asset quality and the time trend) but includes all the environmental variables. Given the standard and alternative profit function, the preferred model is the Fourier-flexible that includes the control as well as the environmental variables.

The technical cost efficiency averaged around 95%, based on our preferred model, over the 1992-2000 period. Standard and alternative profit functions estimates reveal technical efficiency on average around 66% and 58% respectively. Islamic banks are found to be the most cost and profit efficient while investment banks are the least (cost and profit efficient). This result perhaps reveals the fact that the cost of funds for Islamic banks is relatively cheaper than the cost of funds for other financial institutions. Large banks, in assets terms, appear to be relatively more cost and profit efficient. This possibly signals the ability of large banks to utilise more efficient technology with less cost, the ability of these banks to introduce more specialised staff for the most profitable activities and the ability of these banks to provide (presumably) better quality outputs for which they can charge higher prices. Geographically, Bahrain is the most cost and profit efficient while Jordan is the least (cost and profit efficient).

The scale efficiency results reveal that, on average, banks in the countries under study are around 65% scale efficient in terms of cost. In terms of profit efficiency, estimates are around 60% for both standard and alternative profit function but with rather dissimilar movements overtime for scale efficiency scores using both sets of measures. Both cost and profit functions report Islamic and commercial banks as the most scale efficient types of banks. Based on asset size, the results of the alternative profit function estimates, in particular, indicate that large banks are more scale efficient than small banks. Geographically, Saudi Arabian and Egyptian banks appear to be the most cost and profit scale efficient.

The derived efficiency levels for the banks operating in the countries under study, however, provide little evidence to suggest that the economic and financial reforms undertaken in Jordan, Egypt, Saudi Arabia and Bahrain over the last decade have had a noticeable impact on improvement in banking sector efficiency. The main policy recommendation from this study, therefore, is that these countries need to continue the reform process in order to enhance financial sector performance.

Chapter 1: Introduction

1.1 Background of the thesis

Financial sectors in developing countries, including the Arabian systems, have traditionally been characterised by relatively high levels of government controls where regulatory authorities maintained a protected banking environment that inhibited competition. However, market conditions in banking have undergone extensive changes over the last two decades or so. On the demand side, customer preferences have changed substantially, becoming more sophisticated and price conscious. On the supply side, the globalisation of financial markets has been accompanied by governmental deregulation, financial innovation and automation. Both factors imply an increase in the number of competitors, followed by reductions in costs and narrowing of profit margins. In addition, progress in communications technology, especially phone-based and Internet banking has enabled the larger financial institutions to extend their activities beyond narrow national boundaries and to increase their market share both within national and overseas markets by providing competitive products at a lower price. New suppliers of retail banking products, such as retailers, automobile manufactures and so on, have entered the market. As such, banks are now faced with strong competition from both banks and non-bank institutions, and this also accentuates competition within the banking and financial services sector overall.

To assist banks in confronting the new challenge, financial authorities throughout the world have become more aware of the importance of financial deregulation to promote competition in the market, the aim being to concurrently increase both the efficiency and soundness of banking systems. In this respect, Arabian countries, including those under study – namely Jordan, Egypt, Saudi Arabia and Bahrain, have passed a substantial body of legislation (over the last few years) aimed at liberalising their financial systems. The liberalisation process has been accompanied by financial deregulation through the reduction of direct government control, at the same time, it is associated with upgrades of prudential regulations. The main objective of these reforms concurs with the views of McKinnon (1973) and Shaw (1973); namely that liberalised financial systems direct scarce economic resources to the most efficient use and this impacts favourably on the growth of the national economy.

The process of deregulation has some important implications for banks. First, deregulation removes or reduces collusive and/or restrictive practices, promoting competition between banks thereby increasing the banks' risk. Second, changes arise from the ability of banks to seek new business in much wider fields of activity such as loan purchases and off-balance sheet transactions. Moves into new business areas and an increased competitive environment change the nature of the banks' risks and perhaps substantially increase the cost of funds to the established players, thus reducing their competitive advantage. This induces banks to pay greater attention to the areas of pricing and upgrading the quality of their products. Therefore, banks become more concerned about analysing and controlling their costs and revenues, as well as dealing with risks taken to produce acceptable returns. In this context, maximising shareholders wealth and promoting improvements in productive efficiency have become much more important strategic targets for banks. A number of studies have shown that efficient banks have substantial competitive advantages over those with average or below average efficiency (Sinkey, 1992; Berger et al., 1993; Gardner, 1995 and Molyneux et al., 1996).

Given the inextricable link between financial liberalisation and efficiencies, it is therefore interesting to highlight the impact of economic and financial reforms in various Arabian markets on the efficiency levels of the financial institutions operating in these countries (as suggested by Berger and Humphrey, 1997). It should be noted, however, that the limited literature on the impact of financial deregulation on banking sector efficiency is mixed, as pointed out by Berger and Humphrey (1997). Some studies find that financial sector deregulation has brought about higher levels of efficiency (Berg et al., 1992; Zaim, 1995; Bhattacharya et al., 1997; Leightner and Lovell, 1998). Others, however, argue that there was no noticeable impact from banking sector deregulation (Bauer et al., 1993; Elyasiani and Mehdian, 1997; Griffell-Tatjé and Lovell, 1997; Humphrey and Pulley, 1997).

Despite the extensive literature that has examined productive efficiency, especially in the US banking system and other European markets (see Berg et al., 1993; Berg et al., 1995; Bergendahl, 1995; Pastor et al, 1995; Allen and Rai, 1996; European Commission, 1997a), empirical research on financial sectors in developing countries, including Arabian countries, is limited.

1.2 Aims of the thesis

The aim of this thesis is to explore efficiency levels in various Arabian banking industries and to examine the impact of economic and financial reforms which have taken place in these countries over the past two decades. There are various reasons for examining efficiency levels in Arabian banking systems. First, little empirical work has been undertaken to investigate efficiency levels in Arabian banking and as such an empirical investigation may yield interesting insights that could be of use to policy makers operating in these countries and to the financial institutions themselves. Second, such a study should help assessing the impact of the economic and financial reforms that have taken place in the countries under study. In addition, assessing the impact of financial reforms on banking sector efficiency levels should provide useful policy information. Furthermore, this thesis aims to provide empirical evidence about efficiency differences across various Arabian banking industries (and across various types of financial institutions operating in these countries such as commercial, investment and Islamic banks). The study further seeks to assess, for instance, whether there is a link between bank's size, and cost and profit efficiency levels. If we find a positive size and efficiency relationship, there will be a tendency for continued consolidation and concentration in the industry. Furthermore, this study attempts to reveal the determinants of Arabian banks' efficiency by examining various factors that help explaining Arabian banking sector efficiency and reveal characteristics of efficient banks. In particular, the thesis evaluates whether such factors as asset quality, capital levels and other environmental variables (such as bank size, market characteristics, geographic position and liquidity ratios) influence bank's efficiency levels (see Mester, 1996; Berger and Mester, 1997; Berger and DeYoung, 1997; and Altunbas et al., 1997). This thesis also presents some methodological suggestions as to how productive efficiency is best evaluated. Finally, in general, the study ultimately aims to extend the established literature on bank efficiency in developing countries.

1.3 Methodology of the thesis

This thesis utilises mainly the stochastic frontier and Fourier-flexible (FF) form to estimate the cost and profit efficiency levels in the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain over the 1992-2000 period. In addition to estimating technical efficiency levels based on the selected preferred models, we also estimate scale elasticity and scale efficiency levels in the banking industry under study.

The stochastic frontier methodology was proposed by Gallant (1981, 1982), discussed later by Elbadawi, Gallant and Souza (1983), Chalfant and Gallant (1985), Eastwood and Gallant (1991), Gallant and Souza (1991) and applied to the analysis of bank cost efficiency by Spong et al. (1995), Mitchell and Onvural (1996) and Berger et al. (1997). It has been shown (Tolstov, 1962), that a linear combination of the sine and cosine function, namely the Fourier series, can fit exactly any well-behaved multivariate function. This is the main reason why the Fourier-flexible (FF) functional form is nowadays preferred over the translog for estimating bank efficiency. That is, it better approximates the underlying cost (or profit) function across a broad range of outputs as suggested by Spong et al. (1995) and Mitchell and Onvural (1996). When using the Fourier functional form, one avoids holding any maintained hypothesis by allowing the data to reveal the true cost function through a large value of fitted parameters. In addition, the FF has several appealing properties in terms of modelling bank cost structures, as pointed out by Williams and Gardener (2000). In addition to the aforementioned stochastic frontier methodology, we also estimate efficiency levels utilising the non-parametric Data Envelopment Approach (DEA) to check the robustness of the results derived from the former stochastic frontier methodology.

1.4 Data of the thesis

Our sample comprises a data set of 82 banks operating in Jordan, Egypt, Saudi Arabia and Bahrain over the 1992-2000 period. This sample represents around 78%, 88%, 63% and 52% respectively, of the asset size of the financial systems* in these countries (excluding the assets of the central banks and branches of foreign banks). The sample represents the major banks that have consistently published financial statements over the last ten years. Other reasons for the selection of these countries as a sample for study includes: the banking systems in these countries, apart from Jordan, are the largest in the Arabian region. In addition, the banking systems operating in some Arabian countries, such as Iraq, Libya and Syria, are excluded, as these are dominated by government (non-profit) institutions. Furthermore, the banking systems in Comoros, Djibouti and Somalia are significantly underdeveloped and data is difficult to obtain. Moreover, the banking systems in Kuwait and Lebanon have undergone extreme economic conditions as a result of wars during our sample period. Finally, the lack of relevant information about banking systems in other Arabian countries is the main reason for excluding them from our sample.

* The financial system includes all financial institutions that are licensed, by financial authorities, to borrow deposits and/or lend loans in the respective countries. These usually include commercial, investment and Islamic banks as well as all other sorts of licensed specialised financial institutions.

1.5 The thesis structure

Chapter 2 An overview of Arabian Economies with particular focus on Jordan, Egypt, Saudi Arabia and Bahrain

Chapter 2 outlines developments in the economies of Arabian countries over the last two decades with a particular focus on the countries under study; Jordan, Egypt, Saudi Arabia and Bahrain. It presents the economic and demographical characteristics of the Arabian countries; the living standards, poverty levels and other socio-economic characteristics of these countries. Furthermore, this chapter reviews various economic reforms that have been undertaken in these countries aimed at accelerating economic development and examines the impact of these reforms on various macroeconomic trends during the 1990s. The chapter aims to assess the impact of these reforms on the productive efficiency of the banks and other financial institutions operating in these countries.

Chapter 3 The Financial Systems of Jordan, Egypt, Saudi and Bahrain

Chapter 3 presents a brief historical overview and evaluates the characteristics of the financial sectors of Jordan, Egypt, Saudi Arabia and Bahrain. It highlights financial reforms that have taken place in these countries over the last decade and examines the impact of these reforms, using a variety of financial indicators, on financial deepness in these countries during 1990s. The chapter aims to provide a preliminary view of the soundness of the financial systems under study as well as to indicate the anticipated performance and efficiency trends for the banks operating in these countries.

Chapter 4 Efficiency in Banking: a theoretical outlook

Chapter 4 presents a theoretical background concerning efficiency measurement in banking. It shows the role of the seminal studies of Aigner and Chu (1968), Afriat (1972) and Richmond (1974) in turning the focus of researchers attention to the importance of efficiency measurement using frontier production functions. The chapter outlines mainly the features of economies of scale and productive efficiency concepts and describes how productive efficiency can be decomposed into technical and allocative efficiency. The chapter also discusses issues relating to technical efficiency and its decomposition into pure technical efficiency and scale efficiency. Furthermore, the chapter presents the three main types of economic functions from which efficiency and productivity estimates can be derived; cost, standard and alternative profit functions. These will be utilised later in the empirical analysis undertaken to derive efficiency levels for the banking sectors of the countries under study.

Chapter 5 Parametric and non-parametric approaches to measuring efficiency in banking

Chapter 5 presents the theoretical framework underpinning the utilisation of the stochastic frontier approach to derive banking efficiency levels, and reviews some previous studies that investigate efficiency characteristics in banking and financial systems in various countries. The chapter presents the advantages of frontier methodology in evaluating the performance of financial institutions, and outlines the differences between parametric and non-parametric approaches. This chapter also reviews the features of the linear programming Data Envelopment Analysis (DEA) method, the main non-parametric approach. Furthermore, this chapter discusses the bank production process and notes that the banking literature is still divided concerning how one defines bank inputs and outputs.

Chapter 6 Methodology and empirical results

Chapter 6 presents the empirical part of this thesis which investigates efficiency levels in the banking sectors of various Arabian countries; Jordan, Egypt, Saudi Arabia and Bahrain over the period 1992-2000. The empirical evidence on bank efficiency aims to highlight the features associated with the role of economic development and financial reforms that have taken place in these countries over 1992-2000.

We employ three distinct economic efficiency concepts (cost, standard profit, and alternative profit efficiencies) using a number of different measurement methods (including stochastic frontier approach, specification of the Fourier-flexible functional form versus the translog form, and inclusion of bank's asset quality and financial capital in a number of different ways) to a single data set. Given cost efficiency, the preferred model is the Fourier-truncated form that excludes the control variables (capital adequacy, asset quality and time trend) but includes all the environmental variables. Given the standard and alternative profit function, the preferred model is the Fourier-flexible including the control as well as environmental variables.

Technical cost efficiency averaged around 95%, based on our preferred model, over the 1992-2000 period. Standard and alternative profit functions estimates reveal technical efficiency on average around 66% and 58% respectively. Islamic banks are found to be the most cost and profit efficient, while investment banks are the least (cost and profit efficient). This result perhaps reveals the fact that the cost of funds for Islamic banks is relatively cheaper than those for other financial institutions. Large banks, in assets terms, appear to be relatively more cost and profit efficient. This signals the ability of large banks to utilise more efficient technology with less cost, the ability of these banks to set up more specialised staff for the most profitable activities and the ability of these banks to provide (presumably) better quality outputs for which they can charge higher prices. Geographically, Bahrain is the most cost and profit efficient while Jordan is the least cost and profit efficient.

The scale efficiency results reveal that, on average, banks in the countries under study are around 65% scale efficient in terms of cost. Scale efficiency, given the standard and alternative profit functions, were 56% and 61% respectively but with rather dissimilar movements for efficiency scores over time for both sets of measures. Despite the inconsistency between cost and profit functions results, we find that the Islamic and commercial banks are the most scale efficient types of banks. Based on asset size, the results of the profit functions estimates, in particular, indicate that large banks are more scale efficient than small banks. Geographically, Saudi Arabian, in particular, and Egyptian banks appear to be the most cost and profit scale efficient.

Overall, the estimated efficiency scores for the banks in the countries under study, differ according to the three various efficiency concepts that are used (cost, profit and alternative profit) and each method adds some independent informational value. A somewhat interesting result is that the choices made concerning the efficiency measurement method leads to somewhat similar model specifications.

We also present, in this chapter, the results of efficiency measures obtained utilising the DEA procedure to compare our results with those obtained utilising the stochastic frontier approach in order to verify the consistency of the efficiency estimates derived from both approaches. Utilising both Pearson and Spearman rank correlations, both of these two measures report a correlation of around 40% between the scores from both methodologies, despite the major differences in assumptions underlying each approach. These findings suggest that the cost efficiency estimates are robust to differences in methodology.

Chapter 7 Conclusion and limitations

This chapter summarises the main findings of this thesis, draws attention toward the study limitations and presents some general policy considerations. The chapter outlines that the derived efficiency scores, for the banks operating in the countries under study, provide little evidence to suggest that the major economic and financial reforms undertaken in Jordan, Egypt, Saudi Arabia and Bahrain over the last decade have had a noticeable impact on the banking sector efficiency. The main policy recommendation from this study, therefore, is that these countries need to continue the reform process in order to enhance financial sector performance.

One shortcoming of the present study may relate to sample size, which is confined to only four Arabian countries. It might be interesting to carry out the same research over a larger number of Arabian countries to compare banking sector efficiency across different Arabian regions. However, the lack of publicly available data on many Arabic banking markets made this impractical. Furthermore, one should always bear in mind that while frontier efficiency models have advantages over traditional measures of efficiency, they must also be regarded as imperfect measures. For instance, it is not possible to include every item or dimension of a bank's output in model specifications, and banks that are producing a wide range of outputs or providing specialised services could, therefore, be judged less efficient than they really are (as these models do not take into account factors such as service or product quality).

Chapter 2: An overview of Arabian economies with particular focus on Jordan, Egypt, Saudi Arabia and Bahrain

2.1 Introduction

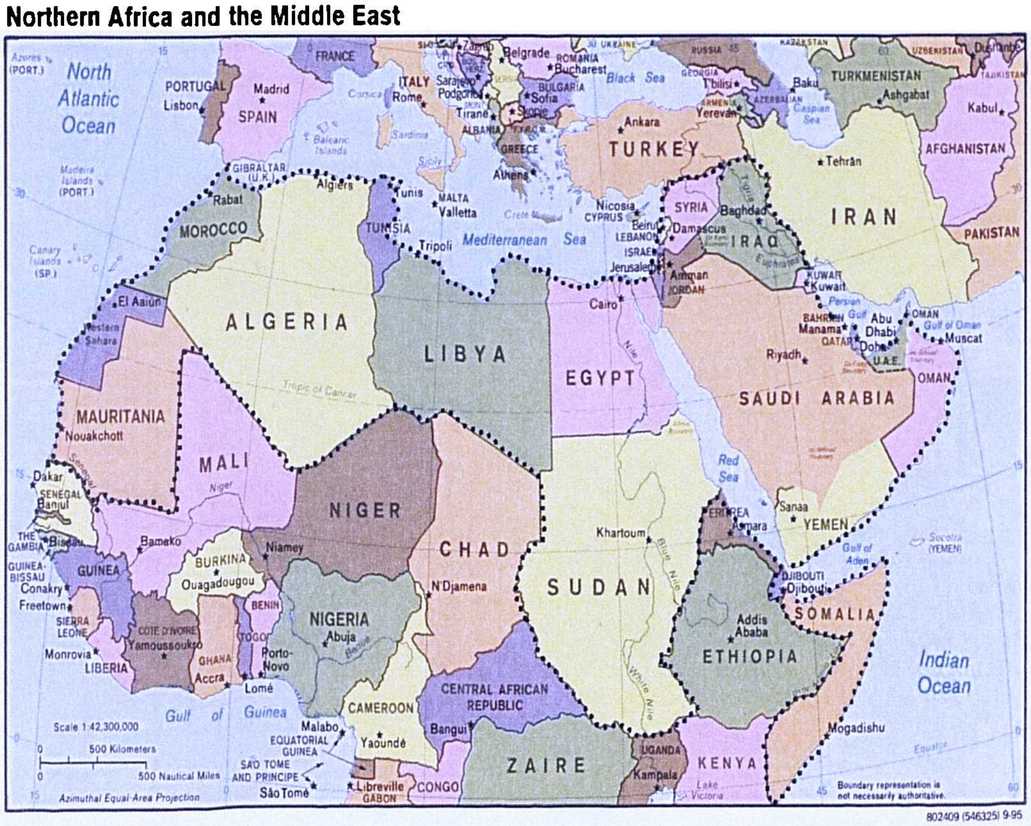
This chapter outlines the socio-economic trends in Arabian countries over the last twenty years focusing on Jordan, Egypt, Saudi Arabia and Bahrain. The aim is to evaluate the nature of the economic and financial reforms undertaken in these countries and to highlight their influence on the financial sector. Section 2.2 reviews the demographic and other socio-economic features that illustrate differences in living standards, poverty levels and the general economic situation in these countries. Section 2.3 examines the main economic trends characteristics in Arabia over the past two decades. This part of the chapter also notes the main structural constraints that have been suggested as reasons for constraining economic growth in Arabia during the 1980s. The section also reviews various economic reforms initiated aimed at accelerating economic development. Various economic growth indicators of Arabic countries during 1990s are presented in section 2.4. Section 2.5 outlines the objectives and achievements of the Gulf Cooperation Council (GCC). The broad features of the countries under study in this thesis (Jordan, Egypt, Saudi Arabia and Bahrain) are presented in section 2.6 and section 2.7 is the conclusion.

2.2 Economic, social and demographical characteristics of the Arabian countries

Arabia comprises 21 countries whose people speak the Arabic language. Geographically, Arabia covers the largest part of the Middle East and North Africa; its borders extend from Iran in the East to the North Atlantic Ocean in the West, and from Turkey in the North to the Arabian Sea in the South (see figure 2.1 below).

Figure 2-1: Geographical map of Arabian countries

Northern Africa and the Middle East



Source: UT Library (http://www.lib.utexas.edu/maps/middle_east_and_asia/n_africa_mid_east_pol_95.jpg); the dotted lines separate the Arabian area.

Regionally, four major Arabian blocs have emerged over the last fifty years (see table 2.1). The first is the Council of Arab Economic Unity which was established in Cairo in 1957. This bloc aimed to achieve closer economic integration among its members through the free movements of goods, persons and capital. The second bloc is the Arab Maghreb Union, established in 1989, with the aim of strengthening economic and cultural ties, ensuring regional stability and promoting trade among its members. The third bloc is the Gulf Cooperation Council which was established in 1981. This bloc includes all the Arabian Gulf states except Iraq and has as its main objective to secure stability in the Gulf region through economic and political cooperation, and the coordination of commercial, monetary, financial, and economic policies among member states (further details about this bloc are considered later in this chapter). The fourth bloc is known as the Arab Mashreq (Mashreq translates as "the Arab East") that also aims to promote economic and political integration between its members (see Bayomi, K. 1995, SESRTCIC, 2000b).

Table 2-1: Members of Arabian countries

Council of Arab Economic Unity	Arab Maghreb Union	The states of Gulf	Arab Mashreq	Other Arabian Countries
Egypt	Algeria	Bahrain	Egypt	Comoros
Iraq	Libya	Iraq	Jordan	Djibouti
Jordan	Mauritania	Kuwait	Lebanon	Somalia
Lebanon	Morocco	Oman	Palestine	Sudan
Palestine	Tunisia	Qatar	The Syria	
Syria		Saudi Arabia		
		The UAE		

Source: Adapted from (El-Erian et al. 1996, p2 and Bayomi, K., 1995)

In addition to the above classification based on regional and trading blocs, table 2.2 shows that Arabian countries can also be classified into oil and non-oil producing countries.

Table 2-2: Oil and non-oil Arabian countries

Oil Producing Countries	Non-oil producing countries*
Algeria	Comoros
Bahrain	Djibouti
Iraq	Egypt
Kuwait	Jordan
Libya	Lebanon
Oman	Mauritania
Qatar	Morocco
Saudi Arabia	Palestine
The UAE	Somalia
	Sudan
	Tunisia
	The Syria

Source: Adapted from (El-Erian et al., 1996, p2).

The area of individual Arabian countries varies considerably (table 2.3). The area of the largest three (Sudan, Algeria and Saudi Arabia) is more than 7 million square kilometres comprising about 64 percent of the total Arabia area. On the other hand, the area of each of the smallest six countries (Kuwait, Qatar, Bahrain, Djibouti, Lebanon and Comoros) does not exceed 25 thousand square kilometres.

* Although other countries such as Egypt, Syria, Tunisia and the Republic of Yemen export oil, the role of oil in their economies is relatively limited.

Table 2-3: Area of Arabian countries (sq. km, thousands)

Arab States	Area
Oil-Exporter (Total)	**7,055**
Algeria	2,382
Saudi Arabia	2,150
Libya	1,760
Iraq	438
Oman	212
UAE	84
Kuwait	18
Qatar	11
Bahrain	1
Non-oil Exporter (Total)	**6,619**
Sudan	2,506
Mauritania	1,026
Egypt, Arab Rep.	1,001
Somalia	638
Yemen, Rep.	528
Morocco	447
Syria	185
Tunisia	164
Jordan	89
Djibouti	23
Lebanon	10
Comoros	2
Middle East & North Africa	**11,024**

Source: The World Bank (1999/2000), p. 230-231.

The population of Arabia was around 275 million in 1999; nearly the same size as the USA. The smallest countries, in terms of population, are Bahrain, Djibouti and Qatar where each has less than one million persons, while the largest are Egypt, Algeria, Morocco and Iraq, each with a population of over 20 millions person (table 2.4). Population density in Arabia also varies considerably. While Bahrain, Lebanon and Comoros are the most populated; Mauritania, Libya, Saudi Arabia and United Arab Emirates are the least populated.

Table 2-4: Population & population density of Arabian countries over 1970-1999
(In millions, figures round to nearest digit)

	1970	1980	1990	1999	Population Density/1999
Arab Oil-exporter (Total)*	**29**	**39**	**70**	**87**	**130**
Algeria	15	20	25	**30**	3
Iraq	10	13	17	**22**	10
Saudi Arabia	...	...	16	**21**	10
Libya	2	3	4	**5**	13
UAE	0	1	2	**3**	35
Oman	1	1	2	**2**	45
Kuwait	1	1	2	**2**	50
Qatar	...	...	1	**1**	100
Bahrain	...	...	1	1	900
Arab Non-Oil-exporter (Total)*	**82**	**105**	**151**	**188**	**100**
Egypt	35	40	50	**62**	2
Sudan	15	20	25	**30**	12
Morocco	15	20	25	**30**	15
Yemen, Republic of	...	...	13	**15**	30
Syria	6	9	12	**18**	30
Tunisia	5	6	8	**10**	50
Somalia	3	5	9	**9**	60
Jordan	2	3	4	**5**	60
Lebanon	...	...	3	**4**	60
Mauritania	1	2	2	**3**	83
Djibouti	...	...	...	**1**	300
Comoros	...	...	...	**1**	400
Arabian countries (Total)*	**111**	**144**	**221**	**275**	...
Middle East & North Africa	...	...	...	**290**	...

Source: World Bank (1991), various pages; & Arab Monetary Fund, 2002 (www.amf.org.ae) for 1990 and 1999 data. *for countries that have available data; (... = Not Available)

Arabian countries possess abundant natural resources; nevertheless, the living standards in the individual countries exhibit a broad diversity of characteristics. While some Arabian countries are classified among high-income countries with per capita income of more than $7,000 (United Arab Emirates, Kuwait, Bahrain, and Libya), others have per capita income less than $1,000 and are classified among the poorest in the world (Morocco, Comoros and Mauritania) (the details are discussed later). The wide dispersion in prosperity across the region is reflected by various indicators such as those shown in Table 2-5. For instance, around 10% of the population of Bahrain, Lebanon and Jordan live in poverty compared to about half the population of Yemen, Djibouti and Mauritania.

Table 2-5: Poverty in Arabian Countries (Mid/1997)

	Population suffering from poverty (million)*	Poverty (%) of population**
Oil-Exporter	**10.4**	**19**
Algeria	8.4	29
Saudi Arabia	...	...
Libya	1.0	16
Iraq	...	...
Oman	0.6	24
UAE	0.5	18
Kuwait	...	...
Qatar	...	...
Bahrain	0.1	10
Non-oil Exporter	**57.2**	**31**
Sudan	10.3	37
Mauritania	1.1	48
Egypt, Arab Rep.	20.5	33
Somalia	...	...
Yemen, Rep.	8.1	49
Morocco	10.7	39
Syria	3.0	20
Tunisia	2.1	23
Jordan	0.6	10
Djibouti	0.3	41
Lebanon	0.4	11
Comoros	0.2	34
Arabian countries	**67.6**	**28**

Source: * = UNDP, Human Development Report 1999, p. 146-150. **= Concluded.

Furthermore, other human development indicators (i.e., adult literacy, educational attainment and life expectancy) have shown that only four Arabian countries, out of the 21, rank as highly developed countries (table 2.6). These include the countries of Bahrain, Qatar, Kuwait, and the Untied Arab Emirates while at the other extreme are

Djibouti, Mauritania, Sudan and Yemen. Adult illiteracy is high in Arabia especially in the non-oil exporting countries; for instance, in the least developed countries, it is slightly less than 50 percent (for instance in Djibouti, Morocco and Yemen).

Table 2-6: Trends in Human Development of Arabian countries for 1997

Arab States	Life expectancy at birth	Adult literacy	HD rank*
Oil-Exporter (Average)	**71**	**73**	
Bahrain	73	86	high
Kuwait	76	80	high
Qatar	72	80	high
Libya	70	77	Medium
UAE	75	75	high
Saudi Arabia	71	73	Medium
Oman	71	67	Medium
Algeria	69	60	Medium
Iraq	62	58	Medium
Oil-Exporter (Average)	**62**	**59**	
Jordan	70	87	Medium
Lebanon	70	84	Medium
Syria	69	72	Medium
Tunisia	70	67	Medium
Comoros	59	55	Medium
Sudan	55	53	Low
Egypt	66	53	Medium
Djibouti	50	48	Low
Morocco	67	46	Medium
Yemen	58	43	Low
Mauritania	54	38	Low
Somalia	N/A	N/A	

Source: UNDP (1999), p. 135-140.

The general indicators reviewed earlier show that individual Arabian countries vary considerably in demographical and economic characteristics. Differences in the human

* The HD rank, according to World Bank, is based on longevity as measured by life expectancy at birth; educational attainment as measured by a combination of adult literacy (two-thirds weight) and the combined gross primary, secondary and tertiary enrolment ratio (one-third weight); and standard of living, as measured by real GDP per capita.

development characteristics in these countries are, perhaps, attributed mainly to the variations in the distribution of natural resource in these countries.

2.3 Economies of Arabian Countries

This section reviews the economic features of Arabian countries' and discusses various features of economic growth over the last two decades or so. It examines how the role of the public sector has changed over the last twenty years and how the authorities in these countries have started to develop the private sector in the process of economic development. Finally, we review the economic reforms that have been initiated in these countries aimed at promoting economic growth.

2.3.1 An historical overview of Arabian Economies

Individual Arabian countries vary considerably in their demographic and economic characteristics. About two thirds of the world's crude-oil reserves lie in these countries, with one quarter located in Saudi Arabia. Arabia also possesses various non-fuel mineral and non-mineral resources. Algeria, Morocco, Tunisia, Jordan and Syria account for about one third of the world's phosphate production. Arabia is also endowed with other natural resources like Potash (Jordan), Iron (Mauritania), ammonia and urea (Qatar), copper and gypsum (Mauritania), cotton (Egypt and Sudan), tobacco (Syria) and coffee (Yemen) (El-Erian et al., 1996).

During the 1960s and 1970s, several Arabian economies experienced favourable economic performance (Bisat et al., 1997). The discovery of natural resources, especially oil, contributed effectively to their economic growth during this period. Increases in the price of oil, especially between 1973 and 1979 enhanced economic performance especially in the oil exporting countries. The other Arabian countries experienced a positive secondary effect, primarily because of remittance flows, receipts of financial assistance and the availability of greater financial assistance from the rich oil countries.

During the 1980s, the economic performance of Arabia lagged especially in comparison with the higher rates of economic growth achieved in other developing regions of the world (Alonso-Gamo et al., 1997a &b). The economic growth of the Arabic countries (as measured by real GDP growth) averaged about 1.6 percent over 1982-1991. This growth rate was much lower than that of other developing countries and Asian industrialised countries that achieved more than 4 percent annualised growth over the same period (details are shown later). The slowness in economic growth has been attributed mainly to the vulnerability of sources of income in Arabia which rely heavily on exports of their natural resources.

Moreover, during the 1980s, the investment performance of Arabian countries weakened markedly (Bisat et al., 1997). The investment levels stayed at about 20 percent of GDP from the mid 1980s until the mid 1990s; a level lower than the average for developing countries as a whole that reached nearly 26 percent by 1996. In addition to low levels of domestic investment, Arabia attracted only modest amounts of foreign direct investment, a significant share of which was concentrated in the energy sector. From the mid -1980s until 1995, the ratio of foreign direct investment to GDP amounted to 0.5 percent annually. In comparison, the Asian region attracted foreign direct investment flows equivalent to more than 1 percent of GDP per year over the same period (investment details are discussed later in this chapter).

2.3.2 The role of the public sector in Arabian countries

Before 1980s, various Arabian countries relied on the public sector as a mechanism for their economic growth (Zeinelabdin, 1997). Governments invested in areas considered important to development, especially in projects where the private sector was either unwilling or unable to invest because of the perceived risk or excessive capital requirements. Fulfilling major social objectives was often behind decisions to establish various government enterprises in 'strategic' sectors of the economy.

The macroeconomic policy in Arabia, especially in non-oil countries, started to change during the 1980s as a result of increases in foreign indebtedness and the rise in fiscal deficits (El-Erian and Fennell, 1997). Arabic governments were forced to re-examine their policy stance. As a consequence, various Arabian countries initiated widespread macroeconomic reforms, especially since the early 1990s, involving substantial privatisation programmes. The largest moves in this respect occurred in Morocco, Tunisia, Egypt and Jordan.

Privatisation in Arabia has been viewed as a means of reducing public indebtedness as well as a way to attract foreign technology and management; the latter is supposed to improve economic efficiency. The objectives of privatisation enumerated by the governments of the respective countries varied although they had identical objectives. These were to develop a stronger private sector, improve the performance and profitability of public enterprises, strengthen performance of financial market institutions and improve the climate for increased private investment.

2.3.3 Constraints delaying economic growth in Arabian countries during the 1980s

In addition to the decline in oil price that heavily affected the economic performance of Arabian countries during the 1980s and early 1990s, other important structural constraints have been suggested as contributory factors to the sluggish economic growth.

The dominance of the public sector in most countries has, some suggest, undermined the productivity of the private sector (Alonso-Gamo et al., 1997 a&b and Bisat et al., 1997). The existence of large public sectors have crowded-out private sector initiatives resulting in a lack of investment opportunities for foreign and domestic private capital.

On the other hand, while the large revenues derived from oil and other natural resources have allowed many Arabian countries to finance their external account deficits, this however has contributed to the postponent of needed internal reforms including trade liberalisation. Moreover, the excessive reliance on volatile oil export receipts in various Arabian countries increases the vulnerability of revenues to external shocks.

The financial systems of many Arabic countries are also underdeveloped. Only a few Arabic countries have stock markets (namely Morocco, Tunisia, Egypt, Jordan, Oman, Kuwait, Lebanon and Bahrain) making it difficult for domestic firms in many activities to raise equity and non-bank finance (Alonso-Gamo et al., 1997b). Furthermore, the existence of restrictions on the establishment of foreign banks has also limited competition and hindered the transfer of knowledge and technology for local institutions (Alonso-Gamo et al., 1997b). While in Jordan there are no restrictions on private or foreign ownership of banks, in countries such as Egypt and Saudi Arabia, no more than 49 percent of a domestic bank can be held by foreigners. In Lebanon, a foreign bank can open only one branch; and in Morocco, offshore branches are allowed but can only deal with non-residents.

Finally, the lack of adequate institutional and legal frameworks for investment in many Arabian countries has resulted in a lack of transparency in the regulatory environment. However, since the mid 1990s, many Arabian countries have become members of the World Trade Organisation (WTO) and this has enhanced the transparency and increased credibility of these countries in terms of their trading performance.

2.3.4 Economic reforms in Arabian countries

During the 1980s and early 1990s, many Arabian governments faced unfavourable economic conditions, represented by rising rates of unemployment and increasing social demands associated with the sluggish economic growth. In response, governments initiated structural reforms aimed at facilitating a more efficient allocation of resources and achieving higher rates of economic growth.

Various Arabian countries have undertaken steps to expand the role of their private sectors through deregulation, opening their economies to greater foreign participation, adopting transparent commercial procedures and harmonising tax provisions. The countries that have initiated substantial privatisation programmes since the 1990s or earlier include Egypt, Algeria, Kuwait, Yemen and Jordan (El-Erian et al. 1996). Other countries have initiated major reform programmes including Morocco, Tunisia and

Mauritania (see for example Alonso-Gamo et al., 1997b, El-Erian and Fennell, 1997, Bisat et al., 1997). On the other hand, oil-exporting economies have intensified adjustment efforts by focusing on expenditure reduction in the face of lower oil revenues and a reduced flow of investment.

Several Arabian countries have also introduced new legislation in the second half of the 1990s, aimed at simplifying investment procedures (particularly Mauritania, Lebanon, Egypt, Morocco and Jordan). Further steps have also undertaken by several Arabian countries including Egypt, Morocco, Sudan, Yemen, Algeria and Syria to remove price distortions (such as administered prices, interest rate ceilings and restrictions on foreign exchange) (El-Erian and Fennell, 1997, El-Erian et al. 1996).

The aforementioned policies enhanced foreign investment and increased non-oil exports. El-Erian and Fennell (1997), for instance, note that various Arabic countries have renewed their access capabilities to international capital markets including Egypt, Jordan, Lebanon, Morocco and Tunisia. Furthermore, many Arabian countries have joined the World Trade Organization (WTO): Bahrain, Djibouti, Egypt, Jordan, Kuwait, Mauritania, Morocco, Qatar, Saudi Arabia, Tunisia and United Arab Emirates. Other countries have requested WTO membership: Algeria and Sudan (Alonso-Gamo et al 1997b).

In addition, various Arabian countries have undertaken substantial financial sectoral reforms to enhance the role of financial institutions and to improve the investment climate (Alonso-Gamo et al., 1997b and El-Erian and Fennell, 1997). Such reforms, for instance, prepared a number of Arabian countries for relatively high credit ratings in 1997 (Table 2-7 shows the details).

Table 2-7: Credit Ratings of Arabian countries for 1997*

Country	Moody's	Standard & Poor's
Bahrain	Ba1	
Egypt	Ba2	BBB-
Jordan	B1	BB-
Kuwait	Baa1	
Lebanon	Ba1	BB-
Oman	Baa2	BBB-
Qatar	Baa2	BBB
Saudi Arabia	Baa3	
Tunisia	Baa3	
The UAE	Baa1	

Source: Adapted from (Alonso-Gamo et al., 1997, p. 32).

A large number of Arabian countries have also embarked on comprehensive reforms of their financial and banking sectors to promote savings and to obtain better allocation of funds. Others also have or are considering taking steps to open their banking sectors and stock markets to greater foreign participation. According to El-Erian and Fennell (1997), the Arabian countries that have initiated comprehensive financial sector reforms during the 1990s include Jordan, Lebanon, Morocco, Tunisia and Egypt.

To sum up, Arabia possesses valuable natural resources that have helped to enhance living standards in these countries. However, many Arabian countries have suffered from sluggish economic growth (a long with higher levels of population growth) during the 1980s; this has forced the authorities to initiate economic reforms aimed at promoting the adoption of a more market-oriented environment. The impact of these reforms on various macroeconomic indicators is outlined in the next section.

* Moody's ratings rank long-term foreign currency bonds and notes (from D, C, Ca, and Caa: default rate; B and Ba: non-investment grade; and Baa, A, Aa, and Aaa: investment grade.) Intermediate rankings range from 1 (highest) to 3 (lowest). S&P's ratings rank long-term foreign currency credit (from C to CCC+: default rate; B- to BB+: non-investment grade; and BBB- to AAA: investment grade).

2.4 The economic performance of Arabian countries during the 1990s

This section outlines various economic indicators that illustrate the performance of Arabian countries during 1990s.

2.4.1 Economic growth in Arabian countries during the 1990s

The growth in economic performance of Arabian countries, as measured by real GDP, has shown substantial improvement over the period 1992-99. During this period, growth rate exceeded 4 percent per annum compared to around 2 percent during 1982-91. However, while annual real GDP growth hit a high of around 8 percent in 1992, it has slowed since then, nevertheless the growth gap compared to developing countries has been narrowed (see table 2.8).

The economic growth of Arab oil countries has improved from about 1 percent over the period 1982-91 to around 6 percent during 1992-99. The fastest growing economies include those of Kuwait, Qatar and Emirates while the slowest include those of Iraq, Saudi Arabia and Algeria. The real GDP of non-oil Arab countries has grown from around 2 percent annually during the period 1982-91 to more than 5 percent over the period 1992-99. The fastest growing non-oil countries include Lebanon, Egypt and Jordan while those experiencing the slowest growth include Djibouti, Libya and Mauritania. The enhanced real GDP growth of these countries is perhaps attributed to the economic reforms undertaken and the adoption of more market-oriented policies in these countries.

Table 2-8: **Real GDP growth, annual percent change of Arabia over 1982-99** (US $, millions)

Real GDP (Annual Percent Change)	1982-91 (Average)*	1992	1993	1994	1995	1996	1997	1998	1999	1992-99 Average*
Oil-exporter (Average)*	**1**	**16.9**	**3.3**	**1.4**	**5.8**	**9.9**	**5.1**	**-7.1**	**9.5**	**5.6**
Kuwait	-6	83.5	20.8	3.3	7.1	17.0	-3.4	-15.7	17.2	16.2
Qatar	-2	11.1	-6.4	3.0	10.4	11.3	24.7	-9.2	18.9	8.0
Emirates	0	4.4	0.9	7.1	11.9	12.1	5.0	-6.0	10.1	5.7
Bahrain	2	2.9	9.5	7.0	5.1	4.3	4.1	-2.6	7.1	4.7
Oman	8	9.8	0.3	3.4	6.8	10.7	3.7	-10.6	10.4	4.3
Iraq	...	14.2	1.5	1.5	0.3	0.0	1.0	0.9	3.0	2.8
Saudi Arabia	1	4.4	-3.8	1.4	6.4	10.6	3.7	-12.4	8.4	2.3
Algeria	2	4.7	4.0	-15.7	-1.7	13.5	2.2	-1.1	1.1	0.9
Libya	1	-3.0	-20.3	-14.0	11.8	13.8	7.2	-7.6	-0.5	-1.6
Non-oil Exporter (Average)*	**2**	**4.4**	**1.3**	**4.6**	**12.0**	**5.9**	**7.1**	**3.4**	**2.3**	**5.1**
Lebanon	-3	24.6	35.9	21.5	21.4	16.9	14.4	8.8	2.0	18.2
Egypt	6	22.0	12.3	10.2	17.0	11.3	12.3	9.4	7.6	12.8
Jordan	2	22.5	8.4	9.1	7.1	2.1	5.0	4.7	2.2	7.6
Tunisia		19.1	-5.7	7.0	15.3	8.7	-3.5	5.9	3.8	6.3
Sudan	3	-52.0	-3.0	7.7	58.0	-13.2	28.4	18.2	-8.0	4.5
Syria	2	5.2	4.7	11.4	8.4	5.9	-5.6	-3.4	4.8	3.9
Morocco	5	2.2	-5.8	13.2	8.7	11.1	-8.8	6.4	-1.2	3.2
Yemen	...	-1.4	-10.8	-8.1	-7.7	12.1	21.0	-9.6	13.0	1.1
Comoros	1	9	3	-5	-4	0	...	...	1	1
Djibouti	0	0	-4	-3	-4	-4	1	1	1	-1
Mauritania	4	1.3	-18.6	7.4	5.0	3.5	-1.7	-8.6	-4.4	-2.0
Somalia	-47.9	...	...	...	...	...	...	...	...	...
Arabian countries	**2**	**7.8**	**0.0**	**1.7**	**7.9**	**9.3**	**3.9**	**-3.1**	**5.8**	**4.2**
Industrial countries	**2**	**1**	**1**	**2**	**2**	**2**	**3**	**2**	**2**	**2**
Developing Countries	**4**	**6**	**6**	**7**	**6**	**7**	**6**	**3**	**4**	**6**
Middle East and North Africa	**3**	**5**	**2**	**2**	**2**	**5**	**3**	**3**	**3**	**3**

Source: Arab Monetary Fund, 2002 (www.amf.org.ae) for 1992-99 values of Arabian countries; IMF, World Economic Outlook, May 2000 for other data (p. 203-212).

In terms of real GDP per capita, Arabian countries have not witnessed significant changes over the last two decades, as shown in table 2.9. The lack of growth in per capita GDP, especially in the oil exporting countries, is attributed mainly to the negative consequences of the Gulf War in 1991 where countries in the region were burdened with significant war expenses.

Table 2-9: Per capita GDP for Arabian countries (US $), (figures for 1975 to 1990 adjusted using 1987 prices)

	1975	1980	1985	1990	1995	1999
Oil-exporter (Average)*	**12,057**	**11,825**	**7,950**	**9,074**	**9,158**	**9,686**
UAE	29,200	29,900	20,000	18,250	17,755	17,745
Kuwait	24,400	18,400	11,400	8,610	13,553	13,160
Libya	10,500	13,200	6,900	7,758	5,772	5,859
Bahrain	...	10,000	7,300	9,004	10,103	9,956
Saudi Arabia	9,000	10,200	5,700	6,662	6,798	6,525
Oman	3,800	3,600	5,700	7,182	6,477	6,724
Iraq	5,200	6,600	3,600	4,145	3,834	3,674
Algeria	2,300	2,700	3,000	2,449	1,484	1,633
Qatar	...	...	...	17,609	16,642	21,898
Non-oil Exporter (Average)*	**843**	**1,000**	**1,013**	**815**	**1,226**	**1,371**
Jordan	1,200	2,100	2,200	1,159	1,517	1,524
Tunisia	1,000	1,200	1,300	1,520	2,013	2,201
Syria	1,000	1,200	1,100	1,147	1,171	1,044
Sudan	1,100	1,000	900	512	351	381
Morocco	600	800	800	1,055	1,216	1,197
Egypt	500	700	800	690	1,060	1,435
Mauritania	500	500	500	530	462	365
Comoros	...	500	500	500	500	500
Djibouti	...	...	...	...	...	...
Lebanon	...	...	...	1,124	3,656	4,676
Somalia	...	...	...	44	...	...
Yemen	...	...	...	682	318	383
All developing countries	**600**	**700**	**700**	**800**	**900**	**1030**
Arabian countries	**6,450**	**6,413**	**4,481**	**4,532**	**4,983**	**5,309**
Industrialized countries	**12,600**	**14,200**	**15,500**	**17,600**	**19,300**	**19,300**

Source: UNDP (1999), "Human Development Report" (for years 1975-85) and Arab Monetary Fund, 2002 (www.amf.org.ae) for other data. *For countries that have available data. (... = Not Available)

Concerning the composition of GDP, table 2.10 shows that the commodity sector dominates the other economic sectors in all countries; comprising about half of the total GDP of Arabian economies over 1990-99. The distributive sector accounted for about 27 percent of total GDP and the services sector around 21 percent.

Table 2-10: The composition of GDP in Arabian countries (Average 1990-99)*

	(In per cent)		
	Commodity	**Distributive**	**Services**
Arabian countries (Average)	**48.5**	**26.6**	**21.0**
Arab Oil-exporter (Average)	**51.3**	**23.7**	**24.5**
Saudi Arabia	59.0	17.7	21.5
UAE	57.6	21.5	21.3
Algeria	56.4	22.9	12.6
Kuwait	48.7	19.6	31.9
Oman	50.1	20.6	28.4
Qatar	54.6	20.8	24.1
Bahrain	37.6	24.8	34.1
Iraq	47.3	41.7	21.4
Libya	50.7	24.0	25.3
Arab Non-oil Exporter (Average)	**46.0**	**29.2**	**17.9**
Egypt	46.5	30.6	17.0
Morocco	48.4	26.0	25.6
Tunisia	42.7	25.7	18.9
Syria	53.1	27.7	11.1
Lebanon	27.7	38.7	33.6
Sudan	46.3	36.4	15.3
Jordan	27.7	38.1	19.5
Yemen, Republic of	53.5	24.2	18.9
Mauritania	50.2	25.2	14.0
Djibouti	...	...	...
Comoros	...	...	...
Somalia	63.9	19.1	5.6

Source: Arab Monetary Fund, 2002 (www.amf.org.ae); ... = Not available

2.4.2 External trade indicators of Arabian countries during the 1990s

Exports of Arabian countries have increased from about $135 billions in 1990 to more than $155 billions in 1999 and averaged about $140 billions over this period (table

* The Commodity sector includes mainly agriculture, fuel, manufacturing and construction activities; the Distribution sector includes mainly banking, insurance, finance, hotel and transport activities; and the Services sector includes mainly government, other services activities and housing.

2.12). The export of Arab oil countries comprised more than 85 percent of the total exports over this period. The exports of Saudi Arabia and the United Arab Emirates in particular comprised about 63 percent of the total oil-countries exports. In terms of annual export growth, those of Algeria, Yemen and Qatar have grown annually at more than 5 percent during 1990-99.

On the other hand, imports to Arabian countries increased from about $100 billion in 1990 to more than $140 billion in 1999 (table 2.12). Imports of Arab oil countries comprise about 70 percent of total Arabian imports. In particular, the imports to Saudi Arabia and the United Arab Emirates comprise around 60 percent of imports of Arab-oil countries while the imports of Egypt comprises around one third of those of the non-oil countries. In terms of annual growth, import to the United Arab Emirates has grown noticeably over the last decade.

Overall, the trade balance for Arabian countries decreased from around $ 36 billion in 1990 to around $ 14 billion in 1999. As to be expected, the trade balances of Arab oil countries are in surplus, while those of the non-oil countries have experienced deficits over the last decade (table 2.13).

Table 2-11: Exports of Arabian countries, 1990-99
(Millions of US dollars)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Average* 1990-99	Average Annual growth
Arabian countries (Total)*	136,290	119,620	130,710	121,380	127,590	145,290	168,530	169,060	132,320	156,420	140,720	2
Arab Oil-exporter *	120,380	103,420	115,570	106,910	111,150	125,850	147,620	147,820	110,430	132,710	122190	1
Saudi Arabia	37	46	44	40	38	40	41	41	35	37	40	0
UAE	18	22	21	22	25	23	23	23	28	27	23	6
Algeria	9	9	10	9	8	8	9	9	10	7	9	-2
Kuwait	6	1	6	10	10	10	10	10	9	9	8	6
Libya	11	10	9	7	8	7	7	6	6	6	8	-5
Bahrain	3	3	3	3	3	3	3	3	3	3	3	0
Oman	5	5	5	5	5	5	5	5	5	5	5	0
Qatar	3	3	3	3	3	3	3	3	5	5	3	7
Iraq	9	0	1	0	0	0	...	...	...	...	2	...
Arab Non-Oil-exporter*	15,910	16,200	15,140	14,470	16,440	19,440	20,910	21,240	21,890	23,710	18,540	5
Tunisia	22	23	26	26	28	28	26	26	26	25	26	2
Morocco	27	26	26	26	24	24	23	22	33	31	26	2
Syria	15	10	8	8	7	7	5	5	3	3	7	-9
Egypt	16	22	20	22	21	18	17	18	15	15	18	-1
Yemen, Republic of	4	2	1	1	1	4	9	12	7	10	6	17
Jordan	7	7	8	9	9	9	9	9	8	8	8	2
Lebanon	3	3	4	3	3	4	5	3	3	3	4	0
Mauritania	3	3	3	3	3	3	3	2	3	2	3	-4
Sudan	2	2	2	3	3	3	3	3	3	3	3	6
Somalia	1	1	1	...	...	...	...	...	...	...	1	...
Djibouti	...	...	...	...	...	...	...	...	...	...	...	...
Comoros	...	...	...	...	...	...	...	...	...	...	...	...

Source: Arab Monetary Fund, 2002 (www.amf.org.ae). *For countries that have available data; ... = Not Available

Table 2-12: Imports of Arabian countries, 1990-99
(Millions of US dollars)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Average* 1990-99	Average Annual growth
Arabian countries (Total)*	**100,600**	**101,910**	**115,470**	**110,080**	**110,070**	**127,220**	**134,110**	**136,220**	**149,130**	**142,450**	**122,730**	**5**
Arab Oil-exporter *	**69,720**	**71,980**	**81,910**	**79,320**	**76,490**	**86,310**	**88,070**	**90,380**	**97,480**	**92,450**	**83,410**	**4**
Saudi Arabia	35	40	41	36	31	33	32	32	31	30	34	-2
UAE	17	19	21	25	30	27	29	29	31	35	26	12
Algeria	14	9	10	11	13	12	10	10	10	10	11	-3
Kuwait	6	7	9	9	9	9	10	9	9	8	8	4
Libya	11	11	6	7	5	6	6	6	6	5	7	-6
Bahrain	5	6	5	5	5	4	5	4	4	4	5	-2
Oman	4	4	5	5	5	5	5	6	6	5	5	3
Qatar	2	2	2	2	3	4	3	4	3	3	3	6
Iraq	7	1	1	1	1	1	...	...	...	...	2	...
Arab Non-Oil-exporter*	**30,880**	**29,930**	**33,560**	**30,760**	**33,580**	**40,910**	**46,040**	**45,840**	**51,650**	**50,000**	**39,315**	**7**
Tunisia	18	17	19	20	20	19	17	17	16	17	18	-1
Morocco	22	23	22	22	21	21	18	17	20	22	21	0
Syria	5	4	4	5	6	4	3	2	2	2	4	-7
Egypt	30	26	25	27	29	29	28	29	32	32	29	1
Yemen, Republic of	4	4	3	3	1	2	3	4	4	4	3	0
Jordan	8	8	10	12	10	9	9	9	7	7	9	-1
Lebanon	8	13	12	7	8	12	16	16	14	12	12	6
Mauritania	1	2	2	2	2	2	1	1	1	1	1	0
Sudan	2	3	2	3	3	3	3	3	4	3	3	6
Somalia	1	1	1	...	...	...	...	...	...	...	1	...
Djibouti	...	...	...	...	...	...	...	...	...	...	...	...
Comoros	...	...	...	...	...	...	...	...	...	...	...	...

Source: Arab Monetary Fund, 2002 (www.amf.org.ae). *For countries that have available data. (... = Not Available)

Table 2-13: Balance of trade of Arabian countries, 1990-99
(in millions of US dollars)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Average* 1990-99
Arabian countries (Total)*	**35,680**	**17,690**	**15,230**	**11,290**	**17,520**	**18,080**	**34,430**	**32,840**	**-16,820**	**13,960**	**17,990**
Arab Oil-exporter *	**50,640**	**31,440**	**33,640**	**27,580**	**34,650**	**39,550**	**59,550**	**57,440**	**12,960**	**40,260**	**38,770**
Saudi Arabia	20,350	18,610	17,010	14,190	19,250	21,950	32,960	31,990	8,810	20,450	20,560
UAE	10,080	8,830	6,840	4,030	4,700	5,850	7,760	7,400	550	3,380	5,940
Algeria	1,160	2,590	2,580	1,340	-980	360	3,490	5,070	1,020	-240	1,640
Kuwait	2,990	-3,620	-710	3,230	4,580	5,050	6,570	6,040	1,000	4,660	2,980
Libya	5,650	2,400	5,100	2,380	4,510	4,220	4,610	3,450	380	4,220	3,690
Bahrain	50	-600	-800	-130	-130	400	430	360	-300	500	-20
Oman	2,830	1,680	1,790	1,250	1,630	1,820	2,760	2,600	-170	2,560	1,870
Qatar	1,950	1,490	1,830	1,350	1,220	80	960	530	1,670	4,710	1,580
Iraq	5,590	60	10	-60	-110	-190	...	...	...	...	880
Arab Non-Oil-exporter*	**-14,960**	**-13,740**	**-18,420**	**-16,300**	**-17,140**	**-21,470**	**-25,120**	**-24,600**	**-29,780**	**-26,300**	**-20780**
Tunisia	-1,980	-1,400	-2,420	-2,400	-1,930	-2,420	-2,190	-2,390	-2,600	-2,580	-2230
Morocco	-2,690	-2,580	-3,380	-2,960	-3,200	-3,820	-3,510	-3,200	-3,130	-3,430	-3190
Syria	1,050	300	-160	-370	-650	-240	-390	-30	-230	-80	-80
Egypt	-6,600	-4,140	-5,250	-5,100	-6,110	-8,310	-9,500	-9,330	-13,330	-12,460	-8010
Yemen, Republic of	-760	-720	-890	-670	-250	150	470	490	-670	380	-250
Jordan	-1,540	-1,380	-2,040	-2,290	-1,960	-1,930	-2,480	-2,270	-2,030	-1,880	-1980
Lebanon	-2,030	-3,200	-3,530	-1,820	-2,280	-4,180	-6,560	-6,820	-6,410	-5,530	-4240
Mauritania	80	40	-150	-150	-120	-70	-80	-80	-60	-70	-70
Sudan	-240	-590	-500	-530	-640	-630	-880	-990	-1,330	-630	-700
Somalia	-250	-90	-100	...	...	...	...	...	...	...	-150
Djibouti	...	...	...	...	...	...	...	...	...	...	...
Comoros	...	...	...	...	...	...	...	...	...	...	...

Source: Arab Monetary Fund, 2002 (www.amf.org.ae). *For countries that have available data. ... = Not Available

2.4.3 Inflation in Arabian countries during the 1990s

Inflation rates in the Arabia, as measured by changes in the consumer price index, witnessed favourable improvement during the 1990s, especially in comparison with the high levels experienced during the 1980s (table 2.14). Inflation averaged about 8 percent during 1992-98 compared to 12 percent during 1982-91. The lower levels of inflation are similar to those experienced in other developing countries over the same period. Despite the decline in general inflation rates, some Arabian economies still suffer from relatively high rates of inflation (i.e., Algeria, Yemen, Sudan and Lebanon). The ability of various Arabian countries to reduce their inflation rates over the last decade is perhaps indicative of their adoption of more appropriate macro economic policies and the gradual structural reforms that have taken place.

Table 2-14: The rates of inflation in Arabian countries over 1987-99 (percent)

Consumer Prices	**1982-91**	**1989**	**1992**	**1995**	**1998**	**1992-98**
(Annual Percent Change)	(Average)					Average*
Arab Oil-exporter (Average)*	**5**	**4**	**5**	**4**	**2**	**4**
Oman	2	3	1	-1	-1	0
Saudi Arabia	...	1	0	5	0	2
Bahrain	1	2	...	3	0	2
Kuwait	4	3	-1	3	1	1
Qatar	3	4	3	3	3	3
UAE	4	7	6	5	2	4
Libya	8	...	18	11	7	12
Algeria	11	10	...	...	6	6
Iraq	...	...	...	...	...	...
Arab Non-Oil (Average)*	**19**	**23**	**11**	**6**	**4**	**12**
Djibouti	5	...	3	5	2	4
Jordan	7	6	4	2	5	4
Morocco	7	4	6	6	3	4
Comoros	3	...	1	7	1	6
Syria	22	60	3	1	0	6
Mauritania	8	4	10	7	8	7
Egypt	18	13	21	9	5	10
Lebanon	80	50	40	11	5	24
Yemen, Republic of	...	...	...	...	11	44
Sudan	...	...	...	...	...	...
Somalia	...	...	...	...	...	...
Arabian countries (Average)*	**12**	**13**	**8**	**5**	**3**	**8**
Developing Countries	**10**	**62**	**10**	**10**	**6**	**8**
Middle East and North Africa	**14.6**	**21.9**	**18**	**24.5**	**9.3**	**15.7**

Source: Arab Monetary fund (2002) (www.amf.org.ae) for Arabian countries over 1992-98; Zeinelabdin (1990) for data prior to 1992. *For countries that have available data. (... = Not Available).

2.4.4 External debt and reserves of the Arabian countries during the 1990s

The external debt of the Arabian countries has averaged about $130 billions over 1990-98, with insignificant changes during this period (table 2.15). The debt of non-oil Arabian countries accounts for around 77% of the total debt over the whole period. The most indebted countries include Egypt, Morocco, Algeria and Syria.

Despite insignificant changes in the absolute figures of the external debt, the external debt as a percent of GDP (Table 2.16) has witnessed noticeable falls especially for the non-oil countries; it fell from about 6.7 percent to 5.7 percent over the period 1990-98. As a percent of GDP, the most indebted countries include those of Jordan, Mauritania, Morocco and Algeria.

Table 2-15: External debt of Arabian countries (US$, millions)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1990-98 Average*
Total Arabian countries*	**127,293**	**128,048**	**125,504**	**125,068**	**133,493**	**140,354**	**137,871**	**128,361**	**132,031**	**130,891**
Oil-exporter (Total)*	**28,816**	**28,443**	**27,829**	**27,162**	**30,786**	**33,679**	**33,708**	**31,277**	**30,697**	**30,266**
Iraq	...	...	...	...	...	...	...	...	...	...
Algeria	26416	25969	25489	24847	28178	31042	31062	28710	28469	27,798
UAE	...	...	...	...	...	...	...	...	...	...
Qatar	...	...	...	...	...	...	...	...	...	...
Kuwait	...	...	...	...	...	...	...	...	...	...
Libya	...	...	...	...	...	...	...	...	...	...
Oman	2400	2474	2340	2315	2608	2637	2646	2567	2228	2,468
Bahrain	...	...	...	...	...	...	...	...	...	...
Saudi Arabia countries	...	...	...	...	...	...	...	...	...	...
Non-Oil-exporter (Total)*	**98,477**	**99,605**	**97,675**	**97,906**	**102,707**	**106,675**	**104,163**	**97,084**	**101,334**	**100625**
Egypt	28,372	29,317	28,348	28,303	30,189	30,792	28,810	26,804	27,670	28,734
Syria	14,917	16,353	15,913	16,235	16,540	16,757	16,698	16,254	16,328	16,222
Morocco	23,101	20,792	21,030	20,680	21,530	22,085	21,134	18,978	19,325	20,962
Sudan	9,155	9,220	8,984	8,994	9,400	9,779	9,369	8,998	9,226	9,236
Tunisia	6,662	7,109	7,201	7,415	8,002	9,118	9,463	9,426	9,727	8,236
Jordan	7,043	7,458	6,922	6,770	6,883	7,023	7,091	6,960	7,388	7,060
Somalia	1,926	1,945	1,898	1,897	1,935	1,961	1,918	1,853	1,886	1,913
Yemen, Republic of	5,154	5,256	5,253	5,341	5,460	5,528	5,622	3,418	3,590	4,958
Lebanon	358	336	301	368	778	1,551	1,933	2,353	3,980	1,329
Mauritania	1,789	1,819	1,825	1,903	1,990	2,081	2,125	2,040	2,214	1,976
Djibouti	...	...	...	...	...	...	...	...	...	...
Comoros	...	...	...	...	...	...	...	...	...	...

Source: Arab Monetary Fund, 2002 (www.amf.org.ae). *For countries that have available data. (... = Not Available).

Table 2-16: External debt of Arabia as a % of GDP

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1990-98 Average*
Arabian countries*/ Average	**6.71**	**6.30**	**6.01**	**6.52**	**5.56**	**5.21**	**5.35**	**5.26**	**5.00**	**5.77**
Oil-exporter (Avg.)*	**9.95**	**12.29**	**11.25**	**11.03**	**7.81**	**6.47**	**6.57**	**5.50**	**6.85**	**8.63**
Iraq	...	...	...	...	...	...	...	...	...	...
Algeria	13.80	19.70	18.54	17.40	11.55	9.55	8.43	8.28	9.69	12.99
UAE	...	...	...	...	...	...	...	...	...	...
Qatar	...	...	...	...	...	...	...	...	...	...
Kuwait	...	...	...	...	...	...	...	...	...	...
Libya	...	...	...	...	...	...	...	...	...	...
Oman	6.11	4.87	3.96	4.67	4.06	3.38	4.71	2.72	4.00	4.27
Bahrain	...	...	...	...	...	...	...	...	...	...
Saudi Arabia countries	...	...	...	...	...	...	...	...	...	...
Non-Oil-exporter (Avg.)*	**6.06**	**5.10**	**4.97**	**5.52**	**5.06**	**4.93**	**5.08**	**5.20**	**4.58**	**5.17**
Egypt	7.01	6.70	5.19	3.93	3.60	3.40	2.77	2.08	1.87	4.06
Syria	8.57	3.06	1.57	1.26	1.49	0.93	0.70	2.56	1.08	2.36
Morocco	5.66	7.63	12.92	11.52	11.39	10.92	8.88	9.21	7.60	9.52
Sudan	0.19	0.18	0.43	0.30	0.05	0.18	0.00	0.00	0.02	0.15
Tunisia	9.91	8.69	7.83	8.36	8.62	7.58	6.76	6.66	6.22	7.85
Jordan	13.63	14.83	12.69	9.10	7.95	8.36	14.16	11.83	11.33	11.54
Somalia	1.85	0.00	0.00	...	...	...	...	...	...	0.62
Yemen, Republic of	1.23	2.31	1.60	1.72	1.53	1.86	1.44	1.30	1.97	1.66
Lebanon	1.36	1.06	1.17	0.90	1.33	1.42	1.66	4.05	1.58	1.61
Mauritania	11.24	6.52	6.26	12.61	9.55	9.67	9.34	9.14	9.58	9.32
Djibouti	...	...	...	...	...	...	...	...	...	...
Comoros	...	...	...	...	...	...	...	...	...	...

Source: Arab Monetary Fund, 2002 (www.amf.org.ae). *For countries that have available data. (... = Not Available).

While total external indebtedness remained at a similar level throughout the 1990s, Arabian countries reserves have witnessed an increase over the last 10 years, especially the non-oil countries (table 2.18). The non-oil Arab countries reserves increased from about $7.7 billion in 1990 to more than $36 billion by 1999. On the other hand, the reserves of Arab oil countries increased from about $28 billion in 1990 to reach around $48 billion by the end of the decade. This increase, in the reserves of Arab oil countries, came mainly from the recovery that followed the Gulf War. In particular, the total reserves of Saudi Arabia and Bahrain comprise more than 50 percent of the total Arab-oil countries reserves, while those of Egypt comprise more than 50% of those of non-oil countries. The Arabian countries that have witnessed a significant increase in their reserves over the last decade include the United Arab Emirates and Lebanon.

To conclude, the fall in external indebtedness as a percentage of GDP over the last decade, in addition to increases in external reserves, reflects the adoption of more prudential fiscal policies in various Arabian countries.

Table 2-17: Monetary reserves (excluding Gold) of Arabian countries 1990-99

Country (% of total)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**Avg. 1990-99**
Oil-countries (US $, mil.)	28,210	31,470	26,990	25,330	26,430	30,440	40,240	46,080	44,660	47,910	34,780
Saudi Arabia	41	37	22	29	28	28	36	32	32	35	33
Emirates	16	17	21	24	25	25	20	18	21	23	21
Libya	20	18	18	13	13	19	17	16	15	13	16
Kuwait	7	11	19	17	13	12	9	7	9	10	11
Algeria	3	5	5	6	10	7	11	17	15	9	10
Oman	6	5	7	4	4	4	3	3	2	3	4
Bahrain	4	5	5	5	4	4	3	3	3	3	4
Qatar	2	2	3	3	3	2	2	2	3	3	2
Iraq	...	...	...	...	...	...	...	...	...	......	
Non-oil countries (US$, mil.)	7,720	12,690	18,630	21,260	25,160	29,190	32,760	35,420	35,240	36,180	25,440
Egypt	35	42	59	61	54	55	53	53	51	40	51
Lebanon	9	10	8	11	15	16	18	17	19	21	16
Morocco	27	24	19	17	17	12	12	11	13	16	15
Tunisia	10	6	5	4	6	6	6	6	5	6	6
Syria	2	5	3	3	4	7	5	5	5	6	5
Jordan	11	7	4	3	2	1	2	5	3	6	4
Yemen	5	5	2	1	1	2	3	3	3	4	3
Mauritania	1	1	0	0	0	0	0	1	1	1	0
Sudan	0	0	0	0	0	1	0	0	0	0	0
Somalia	0	...	...	...	...	...	...	...	...	...	0
Total (US$, mil)	35,930	44,160	45,610	46,590	51,590	59,630	73,010	81,500	79,910	84,090	60,210

Sources: Arab Monetary Fund, 2002 (www.amf.org.ae); *For countries that have available data. (... = Not Available).

2.4.5 Investment indicators for Arabian countries during the 1990s

Fry (1988, pp. 131) indicates that the proportion of GNP allocated to capital formation should enhance economic growth as the bulk of domestic investment is usually provided from national savings.

The domestic investment in Arabia as a percent of GDP has increased but shown some volatility over 1995-99. The domestic investment as a percent of GDP in oil countries ranged from about 17 percent in 1996 to about 22 percent in 1998. The domestic investment in non-oil countries has stayed at a level of over 20 percent over the same period (see table 2.19). The countries that enjoyed high rates of domestic investment include Lebanon, Jordan, Syria, Tunisia and Algeria. These investment rates along with their improved growth over the last decade should have enhanced economic performance.

Regarding foreign investment, the available indicators suggest that there was an increase in foreign direct investment to oil and non-oil Arabian countries during the 1990s. Table 2.20 shows that foreign investment almost tripled between 1982-98 in non-oil exporting countries. Unfortunately, there is only limited information about foreign direct investment to oil-exporting Arabian countries. Based on available data, the top non-oil countries acquiring external investment are those of Egypt, Morocco, Tunisia and Jordan.

Bringing together the aforementioned indicators, many Arabian countries improved their economic stance during the 1990s, although there remain substantial differences across individual economies. The real GDP grew at around 4 percent annually over 1992-99 compared to 2 percent during 1982-91. Inflation rates were significantly reduced in many countries. External debt as a percent of GDP fell and the reserves, especially of non-oil exporting countries were significantly enhanced. Domestic and foreign investments within the Arab region have also improved. On the other hand, despite the improvement in trade balance of various Arabian countries; many non-oil countries are still suffering from substantial trade deficits.

Over the last twenty years or so, various initiatives have been implemented aimed at creating trading blocs in various regions of the Arab world. These initiatives are aimed at generating economic integration and therefore facilitating trade. These have already been referred to earlier in table 2.1. The following section briefly discusses the most important trading bloc in the Arab world, the Gulf Co-operation Council (GCC).

Table 2-18: Gross domestic investment of Arabian countries as % of GDP

	1995	1996	1997	1998	1999	1995-99 Average*
Oil-exporter (Average)*	**20**	**17**	**16**	**22**	**21**	**19**
Algeria	32	25	24	27	27	27
Saudi Arabia	21	18	20	21		20
Egypt, Arab Rep.	17	17	18	22	23	19
Kuwait	15	15	14	16	12	15
Bahrain	13	9	6	...	...	10
Iraq	...	...	...	...	...	...
Libya	...	...	...	...	...	...
Oman	...	...	...	...	...	...
Qatar	...	...	...	...	...	...
UAE	...	...	...	...	...	...
Non-oil Exporter (Average)*	**23**	**22**	**22**	**25**	**24**	**23**
Lebanon	33	30	27	28	...	29
Jordan	34	32	27	25	27	29
Syria	27	26	29	30	30	28
Tunisia	25	25	27	28	28	26
Yemen, Rep.	22	22	21	29	21	23
Morocco	21	20	21	23	23	21
Comoros	20	19	21	20	19	20
Mauritania	19	19	18	20	22	20
Djibouti	9	9	10	...	...	9
Somalia	...	...	...	...	...	...
Sudan	...	...	...	...	...	...
All Arabian countries (Average)*	**22**	**20**	**20**	**24**	**23**	**22**
Middle East & North Africa	**24**	**21**	**21**	**22**	**...**	**22**
World	**22**	**22**	**22**	**...**	**...**	**22**

Source: World Bank (2000); *for countries that have available data. (... = Not Available).

Table 2-19: Foreign direct investment in Arabian countries (US$, millions)

	Annual average						1995-98
	1982-87	1987-92	1995	1996	1997	1998	Average*
Oil-exporter (Total)*	16	15	6	24	3	9	8
Kuwait	0	0	1	19	1	3	5
Oman	11	6	5	4	2	5	3
Algeria	-1	...	1	0	0	0	0
Bahrain	3	3	...	...	...	...	...
Iraq	0	0	...	...	...	...	...
Libya	-12	3	...	...	...	...	...
Qatar	0	1	...	...	...	...	...
Saudi Arabia	11	-2	...	...	...	...	...
UAE	3	3	...	...	...	...	...
Non-oil Exporter (Total)*	84	86	93	76	97	142	92
Egypt, Arab Rep.	62	47	62	35	30	54	37
Morocco	3	12	10	20	37	16	21
Tunisia	12	9	28	13	11	33	17
Jordan	3	1	1	1	12	16	8
Yemen, Rep.	1	12	23	3	5	11	7
Sudan	0	0	0	0	3	19	5
Lebanon	0	0	4	4	5	10	5
Syria	1	4	10	5	3	4	4
Mauritania	0	0	1	0	0	0	0
Djibouti	...	...	0	0	0	0	0
Comoros	0	0	0	0	0	0	0
Somalia	1	0	0	0	0	0	0
Total Arabian countries	1,300	1,700	960	1,800	2,950	1,980	2,170
Middle East & North Africa	...	...	200	3,600	5,900	5,000	3,700

World Bank (2000) *for countries that have available data. (... = Not Available).

2.5 The Gulf Cooperation Council (GCC)*

This section outlines the main objectives and achievements of the Gulf Cooperation Council (GCC) over the last two decades, as two of the four countries under our study (Saudi Arabia and Bahrain) belong to this bloc.

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* The information in this section is adapted from publications of the Secretariat of the GCC Council (2002).

The GCC was founded in 1981 and includes six Arab countries: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. It aims to coordinate, integrate and inter-connect various policies among its member states. These include adopting similar regulations in various fields such as economy, finance, trade, customs, legislation and fostering technical progress among member states. The GCC council also works to coordinate the oil policies by adopting unified policy in the international markets, as the reserves of the GCC states comprise around 45% and 14% of the total world reserves of oil and gas, respectively.

In the economic area, the council signed the 'Unified Economic Agreement' in 1981 aiming at unifying various economic policies relating to agriculture, industry and other important economic areas. In addition, the GCC council approved, in 1999, a timetable to set up a customs union by 2005. The customs union plans to unify custom tariffs, abolish customs barriers among GCC States and exempt national products from customs duties. Other objectives include coordinating export and import policies and creating a collective negotiating position. Consistent with these objectives, the GCC Member States have set up a free trade zone among themselves since 1983.

In the investment area, the GCC council operates to reach a common investment policy that directs domestic and foreign investments, and to initiate joint investment among member countries. In this field, the GCC established the Gulf Investment Corporation in 1982. In terms of joint investment, the GCC set up the Gulf Investment Corporation in Kuwait, the Standardization and Metrology Organisation for GCC in Riyadh, the Technical Telecommunication Bureau in Bahrain, the Commercial Arbitration Centre for GCC in Bahrain, the Regional Committee for Electrical Energy Systems registered in Qatar, and the Electricity Grids Linking Commission in Saudi Arabia.

In the monetary area, the GCC council seeks to unify banking and monetary regulations, as well as to boost coordination between monetary agencies among member countries. A major accomplishment in this regard is the decision taken in 1997 permitting national banks to open branches in GCC Member States. This decision has helped facilitation cross-border experience by Gulf banks. The GCC also established the Gulf National ATM Network, and approved the Centrality of Risks Law, the Efficiency of Capital and Risks of Assets Law, and the Credit Concentration in GCC Banks Law. Furthermore, the GCC states agreed to collectively participate in the meetings of the Basle Committee and international conferences of banks, as well as to coordinate their participation in meetings of the International Monetary Fund and the World Bank. Furthermore, the GCC council approved a timetable for the monetary union to adopt the US$ as a common peg for their currencies before the end of 2002. It also undertook steps to reach an agreement before the end of 2005 on the standards of economic performance that would be necessary to ensure the success of the monetary union, so that a single currency could be launched by the year 2010 (similar in many ways to EMU and the introduction of euro in Europe).

2.6 Economies of Jordan, Egypt, Saudi Arabia and Bahrain

So far this chapter has provided an overview of the socio-economic features of the Arab world. However, the main empirical focus of this thesis is to investigate the efficiency of banks operating in four countries: Jordan, Egypt, Saudi Arabia and Bahrain. As such, it is important that we provide an overview of the economies of these countries. Jordan and Egypt belong to Arab Mashreq and they are non-oil exporting countries. The other two are members of the Arab Gulf Council and are oil-exporting. The four countries can be considered emerging economies because they have experienced efforts to enhance and upgrade their economic performance, similar to those of the world's developed nations. These countries have gone to considerable lengths to make their economies strong, more open to international investors and more competitive in global markets.

These countries, in particular, were selected for various reasons. Apart from Jordan, the banking systems in the countries under study are the largest in the Arab region. In addition, the banking systems operating in some Arabian countries such as Iraq, Libya and Syria are primarily government banking systems. Furthermore, the banking systems in Comoros, Djibouti and Somalia are substantially underdeveloped. Moreover, the banking systems in Kuwait and Lebanon have undergone extreme economic conditions as a result of wars during the 1990s and so, we believe, are less amenable to study. Finally, the lack of relevant information about banking systems in other Arab countries is the main reason for excluding them from detailed empirical study in this thesis.

This part of the chapter discusses the economic features of these countries (Jordan, Egypt, Saudi Arabia and Bahrain). The aim is to link the economic situation in these countries with the changes in financial trends (i.e., their impact on banking sector efficiency) that will be discussed later on. Initially, we review various socio-economic features such as demographic, human development and other indicators and then examine various economic reforms undertaken and evaluate their impact on the respective countries.

2.6.1 Demographic characteristics of Jordan, Egypt, Saudi Arabia and Bahrain

Jordan, Egypt, Saudi Arabia and Bahrain differ widely in terms of their socio-economic make-up. Table 2.20 shows some of these differences. Bahrain is the smallest in terms of both the country's area and population but is the most developed in terms of GDP per capita. At the opposite end of the scale is Egypt, with a population larger than any other Arabian country but with GDP per capita around US$ 1,010 over 1990-99. Both Saudi Arabia and Bahrain are oil-exporting countries and their people enjoy relatively high living standards, while those in Jordan and Egypt are considerably less prosperous.

Table 2-20: General indicators for Jordan, Egypt, Saudi Arabia and Bahrain

Indicators	Jordan	Egypt	Saudi Arabia	Bahrain
Area (000, Sq. Km)	90	1000	2150	1
Population (millions) /1999	5	60	20	1
Population density (persons/sq. km)/1998	50	60	10	900
Population growth (Average 1995-99)	12	7	13	15
Human poverty (% of population)/mid 1997	10	30		10
Life expectancy at birth	70	65	70	70
Adult Literacy %	85	55	75	85
Human development rank	Medium	Medium	Medium	High
GDP per capita (US$, average 1990-99)	1,410	1,010	6,880	9,700
Rates of Inflation (consumer prices, annual % change) (Average 1992-98)	4	10	1	1
Unemployment Rate, Average 1992-99	16	9	...	15

Source: Adapted from tables 2.3 to 2.6

Historically, Jordan's population has experienced three sharp increases due to immigration resulting from Middle East wars. Following the 1948 and 1967 wars, about 700,000 people moved from Palestine to Jordan and after the Gulf War in 1990, about 400,000 Palestinians left Kuwait to Jordan (Mohammed, 1994). Such events contributed largely to the high levels of unemployment experienced in this country, especially during the 1990s.

Alternatively, Egypt is a non-oil country and has the largest population in the Arabian World. This country has experienced high levels of poverty, illiteracy and unemployment despite the conducted structural reforms undertaken to mitigate the impacts of such factors over the last decade.

The population of Saudi Arabia has experienced substantial growth at around 3.5% per annum during the 1990s. This high growth rate makes around 50% of Saudi's population under the age of 18. While recent unemployment data are unavailable, Saudi Arabia expects serious pressures for job creation in the long run. In response, the Saudi government has pursued a programme of "Saudiization" whereby private companies are to increase the percentage of Saudi Arabian employees among their workforce by 5% per annum (US Embassy Riyadh, 2001).

In Bahrain, non-Bahrainis constitute about 35 percent of the population. Bahrain's government reported that unemployment was 2.35 percent in 1999 but the United Nations Development Programme (UNDP) estimates unemployment to be over 15 percent. Referring to the report of the World Trade Organisation (2000), Bahrain's authorities launched in early 1996 a Bahrainization policy that defines the percent of Bahraini employees to be employed by firms of varying sizes across varying sectors of economy.

The human development indicators shown in Table 2.20 illustrate other significant differences between the four countries. While Jordan and Bahrain have the lowest illiteracy ratios (at about 15 percent), Egypt has the highest illiteracy rate, affecting slightly less than half of its population. Poverty in both Bahrain and Jordan affects somewhere around 10 percent of the population, compared with around 33% in Egypt although there is little evidence of such hardship in Saudi Arabia. Whilst inflation has not been an economic problem in Saudi Arabia and Bahrain over the last decade, inflation rates are still relatively high in Egypt, averaging around 10 percent over the last decade.

In general, the people of Arab oil countries (Saudi Arabia and Bahrain) enjoy relatively high standards of living while those of the non-oil countries (Jordan and Egypt) have much lower living standards, as clear by various economic and social indicators (not least by the much lower per capita GDP levels experienced in these countries).

2.6.2 Economic reforms in Jordan, Egypt, Saudi Arabia and Bahrain

This section reviews the economic reforms undertaken in the countries under study over the last decade. The impact of these reforms on various macroeconomic indicators will be examined in the following section.

2.6.2.1 Jordan

Jordan's was established in 1921 on the East Bank of the Jordan River. It is defined by the UNDP (1999) as a middle-income country with a per capita GDP of about $ 1,400 over 1990-99. It has a small, open and mixed economy where the government performs a key role in basic economic activities (i.e., transportation, communications, electricity, large scale manufacturing, and the tourism sector). The size of the public sector in Jordan is large in relation to the level of domestic economic activity. According to the report of Bureau of Economic and Business Affairs – Jordan (1998), Jordan's government remains the country's largest single employer; for instance, its expenditure accounted for about 37% of GDP in 1999.

Historically, Jordan's economic performance was robust during the 1970s to the mid-1980s. Domestic prices were generally stable, with inflation averaging 5 percent until the mid-1980s. McDermott (1996) notes that real GDP rose by 9.5 percent a year between 1976 and 1980, and investment averaged 35 percent of GDP. However, the economic performance slowed since the mid 1980s and Jordan's government started to face imbalances between economic growth and population growth. Over this period, the flow of foreign grants from Arabian countries, and inflows of workers' remittances started to decline after a fall in oil prices. By the mid-1980s, Jordan's debt service reached 45 percent of exports and the country's fiscal deficit (excluding foreign grants) increased to 20 percent of GDP (ibid.). During the 1988-90, the cost of living index rose by 56%, the domestic currency lost 51% of its value against the dollar and the country's reserves declined sharply. The growth in budget deficits forced the authorities to borrow from domestic and foreign banks.

In addition to the aforementioned problems, Jordan's economic performance was impeded by its limited resources as well as by policy-induced structural weaknesses in various sectors. Jordan's trade regime was characterised by high tariff and non-tariff barriers and by institutional inefficiencies that severely hindered its exports and delayed the performance of the industrial sector (Alonso-Gamo et al., 1997a). Maciejewski and Mansur (1996) indicate that the Jordan budget was affected by high military expenditures and extensive subsidy programmes (including those on basic foods, energy, agricultural production and transportation). In the agriculture sector, subsidized water and the support of producer's prices contributed to an inefficient use of resources. The energy sector also suffered from inadequate pricing policies for oil products and electricity.

To face the pressing social needs, Jordan's government initiated various economic reforms in the 1990s onwards aimed at hastening economic growth, reducing unemployment, enhancing financial stability and promoting the role of the private sector in the process of economic development (Bureau of Economic and Business Affairs - Jordan, 1998). Over the 1991-92 period, many economic indicators improved; inflation fell to 3.5 percent averaging less than 5 percent during 1989-94. The fiscal deficit (excluding foreign grants) declined from about 18 percent of GDP in 1991 to less than 4 percent in 1992 (Maciejewski and Mansur, 1996). These improvements were associated with a revival in investment (from 22 percent in 1989 to 29 percent in 1994) and real GDP grew by more than 7 percent a year (McDermott, 1996).

However, the decision of the Arab Gulf States to limit economic ties with Jordan after the Gulf War in 1991/92 deprived it of the remittances of Jordanian workers in the Gulf, traditional export markets, a secure supply of oil and substantial foreign aid revenues. Moreover, absorbing up to 300,000 returnees from the Gulf countries exacerbated unemployment and strained the government's ability to provide essential services. Maciejewski and Mansur (1996) indicate that various structural measures were introduced, after the Gulf crisis in 1991, including tariff reforms, interest rate liberalisation and the introduction of flexible exchange rate policies.

As part of its public sector reforms, Jordan's government sold a large part of its shares in the company of Jordan Hotels and Tourism and completed the commercialisation of the Alia Gateway Hotels and duty-free shops at Amman International Airport in 1992. According to IMF reports (1996 & 2000), Jordan's real GDP grew by 16 percent in 1992 but the growth momentum slowed to 6 percent a year during 1993-95. In addition, inflation fell to 4-5 percent during this period, unemployment declined to 12-15 percent from about 25 percent in 1990, despite a high labour force growth. However, the economic performance during the period 1996-98 deteriorated. While the country maintained low inflation and started to build up its official foreign exchange reserves, the real GDP growth slowed to about 1%.

In 1998, Jordan's government reactivated its privatisation programme commenced in the early 1990s by selling parts of the Jordan Cement Factories Company and the Jordan Telecommunications Company to foreign investors. The Aqaba Railway Corporation was leased to an American consortium, and Jordan's first independent power project (IPP) was awarded to a Belgian firm(US Commercial Service-Jordan, 2001). In addition, the government sought a strategic foreign partner for 49% of Royal Jordanian (RJ) Airline's. Aqaba, a major Jordanian city, was designated as a Special Economic Zone (SEZ). Apart from the mining sector (Phosphate and Potash), Jordan's authorities plan to privatise most of remaining government-owned enterprises.

In 1999, Jordan's authorities introduced a further series of structural reforms (see table 2-21 for details). In the fiscal area, income tax reforms were introduced including the simplification of personal income tax, treatment of dividends and interest income and offering more investment incentives. Jordan also became a member of the WTO and as part of the membership process, several reforms in legislation were undertaken to harmonise the general sale tax (GST) on domestic and imported goods along with amendments to customs law (International Monetary Fund, Jordan, 2000). These reforms aimed at motivating foreign and private investment. The authorities also modified Investment Law in 2000, to allow equal treatment for foreign and local investors. Both Jordanian and foreign investors are permitted to invest in trade, services and industrial projects in the free zones. Investment incentives take the form of income tax and custom-duties exemptions, both of which are granted to Jordanian and foreign investors. The ceiling on all duties was brought down to 30% as of March 2000, with a 10% ceiling on materials used as industrial inputs (US Commercial Service-Jordan, 2001).

Referring to the report by US Commercial Service-Jordan (2001), Jordan's authorities have undertaken further steps to encourage investment in less-developed areas. These include dividing the country into three development areas: zones A, B and C. Investments in Zone C, the least developed areas of Jordan, receive the highest tax and custom duties exemptions. Here profits are exempt from income and services taxes for a period of 12 years and the goods imported to and/or exported from free zones are exempt from import taxes and custom duties.

Table 2-21: Major economic reforms in Jordan over the last decade

Date	The Event
1993	The Jordanian government signed an agreement with the IMF for an investment plan of $7.8 billion that relied on the Jordanian private sector to contribute between 61 percent and 67 percent of the required funding throughout the five-year period 1993-1997. The aim was to enhance domestic investment and the role of the private sector in the process of economic growth.
1994	The government enacted a general sales tax to replace a previously imposed consumption tax. The tax applies to all durable and consumer goods except food staples and health care and education-related products.
1996	Three main tariff reductions occurred as: the tariff on commodities between 5 and 50%; the tariffs on tobacco and alcohol between 60 and 120%; and on automobiles between 70 and 200%. The aim is to give more incentives for foreign investment.
1996	The government left importing basic foodstuffs (such as cereals, sugar, milk and frozen meat). The aim was to remove possible price distortions and to widen the role of the private sector.
1996	The Jordanian government issued a new income tax law; imposing a 35 percent maximum marginal rate. Taxes on individual incomes are between 5 percent (for annual incomes less than $3,000) and 30 percent (for annual incomes exceeding $22,500). Taxes are set at 35 percent for banks and financial institutions and 25 percent for companies engaged in brokerage and agency activities. The law exempts re-invested profits from income tax.
1997	The Jordanian government partially privatised the state-owned Jordan Cement Company and took steps to privatise the Aqaba railway.
1998	The government privatised the Aqaba Railway and partially privatised the state-owned cement company. Significant progress was made towards privatising the Jordan Telecommunications Company and Royal Jordanian, the national airline.
1999	Income tax reforms were introduced; this included the simplification of personal income tax and tax treatment of dividends and interest income and the rationalization of investment incentives.

Sources: Adapted from Bureau of Economic and Business Affairs 1993-1998 & International Monetary Fund 2000 & Central Bank of Jordan 1997 .

Overall, the Jordanian authorities have undertaken various economic reforms including widening the role of the private sector (by allowing more participation in various governmental utilities and projects) during the 1990s. Furthermore, more market-oriented regulations have been introduced aimed at encouraging external trade and foreign investment. Despite the difficulties that have faced Jordan's economic performance during 1990s (lack of natural resources and the increase in population resulting from the resettlement of Palestinian in Jordan), the authorities succeeded in improving various macroeconomic features of the economy.

2.6.2.2 Egypt

Egypt is a low-income country and its economic structure consists of a state sector (estimated at 30 percent of GDP) and a private sector. The country's economic performance was sluggish during the 1980s and early 1990s; for instance, annual real GDP growth averaged 3 percent during 1985/86 through 1992/93, inflation exceeded 20 percent and the budget deficit was about 15 percent of GDP. The country also suffered from a heavy burden of debt and weak exports. The fall of oil prices during 1980s had a further negative effect on Egypt, including lower remittances and aid (Handy et al., 1998). During this period, the Egyptian economy suffered from significant administrative restrictions including administered prices, interest rate ceilings, multiple official exchange rates and various restrictions on the private and foreign sectors. The financial sector suffered from segmentation, limits to competition, subsidised credit allocations and negative real interest rates.

Following the unfavourable economic conditions during the late 1980s and early 1990s, Egypt initiated an extensive structural reform programme in 1991/92. The programme aimed at privatising a substantial proportion of public entities, liberalising trade as well as strengthening the financial sector. Handy et al. (1998) indicate that the reform procedures were enhanced by the substantial capital inflows after the Gulf War in 1991. National reserves rose to over $11 billion for the three years beginning 1991/92. The reduction in interest rates between 1990 and 1992 helped mobilise capital to seek profitable investments. The tightening of credit conditions also played a role, as high interest rates created strong incentives for capital inflows. In 1991/92, the interest differential between Egypt and US interest rates rose to 14.2 percent, before declining to 10.5 percent by 1993/94. During 1994-96, capital inflows slowed, mainly because of the decline in the interest differential, but accelerated again in 1996.

The Egyptian government reduced tariff and non-tariff restrictions during 1990-96 to enhance the transparency of the trade regime. In 1991, the government instituted a general sales tax (GST) and adopted value-added tax. Varieties of non-tariff barriers that discriminated against foreign firms were eliminated in 1992. In 1997, the Egyptian government enacted legislation aimed at promoting foreign investment through packages of incentives to enhance the transparency of government regulations and strengthening intellectual property rights (Handy et al., 1998). By 1996/ 1997, the structural reforms had resulted in a decline in inflation to 6.2 percent (from 21 percent in 1990/91), and the country experienced current and capital account surpluses.

The Egyptian authorities also started to privatise large parts of the public sector which encompassed a wide variety of economic activities (estimated at about one-third of economic output and employment). By 1998, the government divested its shares in 42 industrial, agricultural, construction and tourism sectors (accounting for more than one-quarter of state-owned enterprises). The privatisation involved the sale of interests in 84 companies with a market value of about LE 17.7 billions (representing about 7 percent of Egypt's GDP) (Subramanian, A. 1997& Handy et al., 1998).

Referring to the report of US Commercial Service/Egypt (2001), the Egyptian reforms yielded an increase in real GDP growth (at 4-5% in the latter part of the 1990s), low inflation (3.8% by 1998/99) and enhanced foreign currency reserves. The country's debt rating in the international markets also enhanced (Moody's upgraded Egypt's sovereign rating from the speculative grade of Ba-1 to the investment grade of Baa-1, and Standard and Poor's rate Egypt's investment rating as BBB- but reduced its economic performance rating from stable to negative in July 2000).

Egypt's privatisation programme broadened in 1999 when the government opened maritime, telecommunications and infrastructure sectors to the private sector on a build-own-operate-transfer basis. In addition to awarding three contracts for power generation in 1998 and 1999, the Egyptian Electrical Authority named a consortium, led by Merrill Lynch and the Egyptian Investment Bank, to evaluate the country's seven state-owned power generation and distribution companies for privatisation. The estimated assets value of these is around $14 billion (US Commercial Service-Egypt, 2001). Referring to the report of Egypt Economics (2002), over the period 1993 through February 2002, 190 companies and utilities were privatized (for L.E. 16.9 billion), out of an aggregate of 314 companies which were held by the public sector. Only 181 companies are still in the possession of the public sector.

Overall, privatisation and other economic reforms (i.e., trade liberalisation, deregulation of the financial system and updating various commercial laws and regulations) improved Egypt's overall economic performance during the 1990s. Referring to the report by the Ministry of Planning & CAPMAS of Egypt (1999), the reforms helped reduce inflation from about 20 percent during 1986-92 to less than 10 percent in 1993/94 and to about 4 percent by 1997-99. Furthermore, unemployment rates that had ranged between 10 to 22 percent during the 1980s fell to 9.8 percent in 1993 and to less than 8 percent by 1998/99.

2.6.2.3 Saudi Arabia

Saudi Arabia's history dates back to its establishment in 1932 and it is known as a country that takes care of Muslim pilgrims who visit the two holy cities of Mecca and Medina. Referring to the report of US Embassy Riyadh (2001), Saudi Arabia is considered one of the wealthiest countries in the world as it has 261 billion barrels of proven oil reserves (more than one-quarter of the world total) and up to 1 trillion barrels of ultimately recoverable oil. It is the world's largest oil producer (at eight million barrels per day), and the country has enormous untapped gas potential.

Saudi Arabia's economy is based primarily on free market principles and consists of a mix of private ownership and a large state sector. The government maintains price controls for basic utilities, energy and agricultural products. The oil and government sectors have played major roles in developing different sectors of the economy. Since its boom in 1973, oil has helped the government to maintain an annual budget surplus until 1982 when there was a sharp decline in oil prices. The oil revenue has fallen from about SR 320 billions in 1980 to SR 76 billions in 1990, having recovered to SR 160 billions by 1997 (Al-Sahlawi, 1997& Saudi Arabia Monetary Agency, 1999).

Parastatal corporations have dominated the economic output of Saudi Arabia since the early 1970s. These firms include the oil firm of Saudi Arabia (ARMCO), the Saudi Arabia Basic Industries Corporation (SABIC), the Saudi Arabia Telephone Company, the Saudi Arabia Electricity Company and the Saline Water Conversion Corporation. Saudi Arabia Monetary Agency (1999) indicate that prior to the oil boom in the 1970s, parts or all of these firms, including ARMCO, were in private hands.

The Saudi Arabian Government imposes few taxes, relying on oil revenues, customs duties, and licensing fees for most government revenue. Saudi people do not pay income tax but are obliged to pay "zakat"; a voluntary tax set by Islamic law at 2.5 percent of net wealth. Foreign companies and self-employed foreign nationals pay an income tax but do not pay zakat. Business income tax rates range from 25 percent (on annual profits of less than $26,667) to a maximum rate of 45 percent (for profits of more than $266,667). Import tariffs are generally 12 percent ad valorem but certain specified essential commodities (e.g., defence purchases) are not subject to custom duties (Bureau of Economic and Business Affairs – Saudi Arabia, 1998).

Oil and its derivative products account for 90-95% of Saudi Arabian export earnings, and about 35-40% of GDP. The lack of diversity in sources of GDP, some have argued has delayed Saudi's economic development. Based on the report of US Embassy Riyadh (2001), Saudi's real GDP grew by only 0.5% in 1999 despite the recovery in oil prices. Saudi Arabian per capita GDP (current dollars) peaked in 1981 at about US

$28,600, while it is expected to be below $7,000 in the year 2000. As a result of rising public debt, declining capital expenditures, and sluggish economic growth, Saudi's government announced, in 1999, its intention to offer the private sector the opportunity to take a wider role in economic development (US Embassy Riyadh, 2001). The Saudi Arabia government has also begun to consider a series of structural reform measures aimed at boosting capital investment. These reforms include liberalizing trade and investment regimes, diversifying the economy, privatising parts of the (dominant) state sector and diversifying tax revenues away from the over-reliance on volatile oil prices.

The Saudi government approved a new foreign investment law in 1999 to enhance investment. The law permits foreign investment in all sectors and relaxes rules restricting foreign ownership in local businesses. The law allows foreign investors to transfer money freely from their enterprises outside of the country, allow joint venture companies to sponsor their foreign investors as well as their foreign employees; and permit foreign investors to own real property for company activities. The Saudi government has also undertaken legal reforms to provide increased transparency regarding such issues as the resolution of commercial disputes, clearer guarantees for the protection of intellectual property rights and improved guidance to potential investors regarding projects in which they cannot participate.

By the year 2001, Saudi had become a member of the WTO (US Embassy Riyadh, 2001). The accession to the WTO required Saudi Arabia to remove protection barriers, place ceilings on tariffs, open key services sectors to foreign participation, and improve intellectual property rights protection. These changes resulted in a more open, transparent and rules-based trade regime. Such procedures are expected to stimulate improved efficiencies levels, higher economic growth prospects and improve the investment climate for foreign and domestic investors.

Up to 1999, Saudi privatisation had been largely limited through allowing private firms to take on certain service functions, such as the management of seaports and airports, and the provision of some postal collection, health and education services.

Referring to the report of US Embassy/Riyadh (2001), the Saudi government declared, in 1999, its intention to sell its stake in the Saudi Arabia Telephone Company to a foreign strategic partner. Privatising the ownership of Saudi Arabia Basic Industries Corporation has not progressed beyond 30 percent for many years despite a mandate in the firm's constitution to become private. Other privatisation possibilities include Saudi Arabia airlines, hotels, municipal services, and grain mills and silos, as well as large minority stakes in banks.

Overall, the Saudi Arabian economy is still dependent on oil revenues that account for about one third of the country's GDP and more than 90 percent of its export earnings. However, the continued volatility in oil prices and the adverse consequences of the 1990 Gulf War has encouraged the Saudi authorities to diversify its economy by encouraging the private sector to play a wider role. This process is ongoing.

2.6.2.4 Bahrain

Bahrain history refers to its establishment in 1932. The country is an archipelago of 36 low-lying islands situated midway down the Arab Gulf. The three main islands are Bahrain (on which the capital Manama is located), Sitra, and Muharraq; these are joined by causeways and make up about 95% of the 707 square kilometres land area. Bahrain is a member of the Gulf Cooperation Council and works actively towards economic integration with the other members.

Prior to the discovery of oil in 1932, the people of Bahrain earned their livelihood from three main sources; pearl fishing, agriculture and trade. The first two were the industries largest employers but trade provided the major source of revenue to the State. Wilkenson and Atti (1997) indicate that there were many other smaller industries with less potential for employment; the most notable of these were weaving and embroidery, pottery, copper work and metal-smithing.

Throughout the oil boom years of the 1950s and 1960s, the country developed a solid modern infrastructure; the electricity and water utilities are well developed, telecommunications facilities are of a high standard and the financial sector offers a broad range of products and services. After independence in 1971, Bahrain has pursued a liberal trade and investment policy, and has integrated its economy closely with those of other countries in the region. In addition, Wilkenson and Atti (1997) note the well-developed and highly competitive trade encouraged expansion of the merchant sector where duties and tariffs on imports contributed effectively in the national budget.

Bahrain's oil reserves are limited compared to other Gulf countries but still constitute the main pillar to the economy. The oil and gas sectors have contributed around 50 percent of government revenues (at about 52 percent of its export and around 14 percent of its GDP) over the last decade (Arab Chamber of Commerce, 2000). The existence of natural gas in Bahrain has also opened the way to set-up related industries. As Bahrain's oil reserves are expected to last for a decade or so, efforts are being made to reduce the size of the public sector which dominates key economic activities and remains an important source of employment for Bahrain (public sector activities comprise petroleum, aluminium and telecommunications, although consolidated data on the sector is not available).

The need to encourage private investment has led to a liberal economic policy relating to free trade. US Commercial Service (2001) note that the Bahraini government has partially or fully privatised a number of state-owned companies, especially in industry during the 1990s. Private investment became allowed in petroleum refining, and in petroleum extraction, through production-sharing agreements with the Government of Bahrain. Liberalisation is proceeding in other service sectors including telecommunications, maritime and air transport, and tourism. In maritime transport, the authorities aim to develop Bahrain as a competitive regional distribution centre. In this regard, a new port is being developed to add to the existing capacity of port facilities at Mina Salman. Nowadays, Bahrain has one of the most diversified economies in the Gulf and has the largest collection of manufacturing industries and the biggest community of international bank branches in the region.

Monetary competence is apparent in Bahraini fiscal management. The convertible currency has been fixed at US$ 2.66 to the Bahraini dinar since 1986. The Bahrain Monetary Authority has held the country inflation rate at less than 3% for many years, thus encouraging stability and fair spreads in market-based interest rates. There have been no bank failures. Interest rates were partially decontrolled in 1988 and fully decontrolled in 1994 (Wilkenson and Atti, 1997).

Finance and banking is among the largest sectors in the Bahraini economy. It consists of a number of investment, commercial and specialized banks, offshore banking units and money changing companies (Arab Chamber of Commerce, 2000). The growth of Bahrain as an international financial centre is partially attributed to the disappearance of Beirut as a major banking centre during the 1980s as well as its stable macroeconomic climate. In 1989, the Bahrain Stock Exchange commenced operation and since then it has sought to extend its services to local and international companies and helped strengthening the economic ties with other GCC countries (Arab Chamber of Commerce, 2000).

Bahrain offers several advantages to foreign investors, including no personal or corporate taxation and no restriction on capital and profit repatriation. The Bahrain Development Bank was established in 1991, followed by the Bahrain Marketing and Promotion Office in 1992, both are geared to attract international private-sector investment. An office of the UN Industrial Development Organisation was opened in Bahrain in 1996 aimed at attracting foreign investment to realise joint ventures with local entrepreneurs (Arab Chamber of Commerce, 2000). Regulations now allow 100 percent foreign ownership in new industrial ventures or in service companies if their regional headquarters are located in Bahrain. The government also allows the establishment of representative offices or branches of foreign companies without local sponsors. Joint ventures allow for up to 49 percent foreign ownership.

Since 1999, additional reforms have taken place; foreign equity ownership limits on firms listed on the Bahrain Stock Exchange have been raised from 24% to 49%. In addition, efforts are being made to update the approval of foreign investment projects (World Trade Organization, 2000). Foreign firms receive the same investment incentives available to Bahraini companies, including personal corporate tax exemption, no restriction on capital and profit repatriation, and duty-free access to GCC member states for products manufactured in Bahrain (Arab Chamber of Commerce, 2000).

Referring to the report of the Arab Chamber of Commerce (2000), two free trade zones exist in Bahrain, used for temporary storage of imported goods set for re-export. Mina Salman, Bahrain's major port, provides a free transit zone to facilitate the duty-free import of equipment and machinery. The government of Bahrain continues to offer incentives to international firms to establish light and heavy industries and to deal freely on the island.

To sum up, the Bahraini authorities have undertaken various reforms aimed at diversifying further its economy. In particular, the country has taken the initiative to become a major trade centre in the Gulf region. The transition of the country from its dependency on oil can be noted by comparing the components of GDP in the 1980s, where oil accounted for about 35 percent of its GDP, to the current situation where oil contributed only about 17 percent in the late1990s. In addition, the financial sector has contributed more than 10 percent towards its GDP (on average) over the last decade. Bahrain's success is attributed mainly to liberal trade policies being pursued and the development of appropriate infrastructure services to foreign investors.

2.6.3 Economic performance of Jordan, Egypt, Saudi Arabia and Bahrain during the 1990s

This section examines the impact of the structural reforms that have taken place in the countries under study on the economic performance of these countries during the 1990s.

2.6.3.1 Economic Growth

The real GDP of Jordan and Egypt grew at around 8.5 and 14.8 percent annually between 1990-99. These rates of growth are higher than the average rate of growth for the non-oil Arab countries (5.1 per annum) over the period 1992-99. The real GDP growth of both countries was higher at the beginning of the 1990s but has experienced a slowdown towards the end of the decade. Alternatively, Saudi Arabia and Bahrain have experienced lower (and volatile) growth at 5.8 and 6.3 percent during 1990-99. These growth rates are slightly higher than the average rate of growth for Arab-oil countries at 5.6 percent over the period 1992-99.

Table 2-22: GDP indictors of Jordan, Egypt, Saudi Arabia and Bahrain over the last decade

Indicators	**Jordan**	**Egypt**	**Saudi Arabia**	**Bahrain**
Real GDP growth, annual % change, Average 1990-99	8.5	14.8	5.8	6.3
GDP per capita (1987 US$), Average 1990-97	1,410	1,020	6,880	9,700
Composition of GDP – Current prices (US$, Avg. 1990-99)	**5,990**	**58,510**	**126,280**	**6,620**
Commodity Sector (%)	28	47	59	37
Distribution Sector (%)	38	31	18	24
Services Sector (%)	20	17	21	35

Source: Arab Monetary Fund (2002) (www.amf.org.ae).

Concerning the GDP per capita in the four countries, table 2-9 shows that, apart from Egypt, the real GDP per capita has not shown favourable growth especially over the last decade. This attests to the imbalance between the growth in the population and the growth in economic performance in these countries over the last decade.

Concerning the contribution of different economic activities to the GDP of the countries under study, table 2.22 shows that, apart from Jordan where the distributive sector (commerce, transport, banking and finance) dominates economic activity, commodity sectors dominate other economic activities, especially in Saudi Arabia and Egypt.

Table 2-23: Distribution of GDP (current prices) to economic sectors for Jordan, Egypt, Saudi Arabia and Bahrain/ Average 1990-99

SECTOR	Jordan	Egypt	Saudi Arabia	Bahrain
Agriculture, Fishing & Forestry	5	16	6	1
Mining, Quarrying & Fuel	4	7	35	17
Manufacturing Industries	12	17	9	13
Electricity, Water and Gas	2	2	0	3
Construction	5	5	9	5
Total Commodity Sector	**28**	**47**	**59**	**38**
Commerce, Rest. And Hotels	9	1	7	10
Transport, Commercial and Storage	13	9	6	8
Finance, Insurance and Banking	16	20	4	8
Total Distributive Sector	**38**	**31**	**18**	**25**
Housing	...	2	2	9
Government Services	17	7	18	18
Other Services	3	8	2	7
Total Service Sector	**20**	**17**	**21**	**34**
GDP at factor cost	85	94	98	97
Net Indirect taxes	15	6	2	3
GDP at purchaser' values (US$ millions)	**5,990**	**58,508**	**126,780**	**5,577**

Source: Arab Monetary Fund, 2002 (www.amf.org.ae).

In Jordan, the government services sector, finance and banking sector and industry sector are the major sources of GDP, providing about one half of GDP during 1990-99. Reviewing the major changes that have taken place in the contribution of different economic activities in Jordan, we noted that the contribution of agriculture has fallen over time from around 7% in 1990 to 2% percent by 1999. On the other hand, the contribution of mining has grown substantially. Mineral production in Jordan is dominated by three industries: phosphate, potash and cement. The contribution of other economic sectors in Jordan's GDP have not shown noticeable changes since the early 1990s. Concerning the contribution of banking and finance, this sector has also not witnessed important changes over the last decade.

In Egypt, the banking and finance sector, the industrial sector and agriculture are the main economic activities contributing about 60 percent of GDP over the period 1990-99. The share of these economic areas has not shown noticeable changes during 1990-99. The tourism and the Suez Canal revenues dominate Egypt's services sector (Tourism revenues were $US 2.2 billion through the second quarter of 1999/00). As a result of the privatisation programme, the private sector's role has steadily expanded in key sectors such as metals (aluminium, iron, and steel), petrochemicals, cement, automobiles, textiles, consumer electronics, and pharmaceuticals (US Commercial Service-Egypt, 2001). Concerning the contribution of banking and finance to Egypt's GDP, the sector accounts for around 20% of the overall economy a share that appears to have remained stable during the 1990s.

In Saudi Arabia, the oil sector and government services sector are the major sources of GDP, accounting for about 55% during the 1990-99 period. Reviewing the changes in contribution of different economic activities in Saudi's GDP, the share of the oil sector has fallen from 36% in 1990 to around 31% in 1999. On the other hand, the contribution of the government sector increased from around 18% of GDP in 1990 to 20% by 1999. The banking and finance sector accounted for around 7% of the Saudi GDP throughout the 1990s.

In Bahrain, the government sector, oil industry and other industrial activities constitute around 50% of its GDP over 1990-99 (the contribution of the oil and natural gas industry has fallen over the past decade and accounted for around 55 percent of the industrial sector over the 1997-99 period). The manufacturing sector is mainly based on energy-intensive products, including aluminium, metal industries, and chemicals. The service sector also accounts for a substantial proportion of the Bahraini economy. The contribution of the banking and financial sector to GDP increased from around 8% in 1990 to 9% in 1999.

2.6.3.2 Exports, Imports and Trade Balance

In addition to various GDP indicators discussed earlier, one can examine another dimension of economic performance by viewing trade patterns. Trade activity indicators for the four countries under study are shown in Table 2-24.

Over the last decade, Jordan has suffered from permanent trade deficits. However, the annual growth in exports, at about 8%, has exceeded the 5% growth in imports. This has resulted in a fall in Jordan's trade deficits over the last decade. The trade deficit as a percent of GDP decreased from around 38% in 1990 to around 25% in 1999. It should be noted that Jordan's exports were dominated by traditional goods (raw materials such as potash and phosphates). Other important exports are pharmaceuticals, detergents and fertilizers. As the production base in Jordan's economy is narrow, *the economy is highly dependent on imports.*

In Egypt, both exports and imports have increased over the last decade but the annual increase in imports, at around 8%, has been twice the annual growth in exports. While the trade balance deficit has grown, it has fallen as a percentage of GDP from 19% in 1990 to around 14% by 1999, an indication that Egypt's GDP has increased over the last decade.

In Saudi Arabia, the trade surplus averaged around 16 percent of the GDP over the period 1990-99. However, Saudi exports have increased annually at around 1 percent over the period 1990-99 while its imports have increased at around 2 percent over the same period.

Bahrain's export has averaged around $3,960 million annually over 1990-99 while its imports averaged around $3,890 million. While exports experienced an annual increase of around 1 percent, imports fell by around 0.5 percent per annum. This resulted in Bahrain experiencing both trade deficits and surpluses during the 1990s (running a balanced trade budget for the 1990s period overall).

The above trade indicators reveal improved trade balance in the four countries under present study toward the second part of 1990s.

Table 2-24: Trade indictors of Jordan, Egypt, Saudi Arabia and Bahrain over the last decade

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Average 1990-99	Annual Growth %(Avg.)
Jordan												
Export	1,064	1,132	1,220	1,248	1,425	1,771	1,817	1,836	1,802	1,832	1,515	8.02
Import	2,601	2,513	3,257	3,542	3,381	3,696	4,293	4,102	3,828	3,717	3,493	4.77
Trade Balance	-1,537	-1,381	-2,037	-2,293	-1,957	-1,925	-2,476	-2,266	-2,026	-1,885	-1,978	2.52
Trade Bal. % of GDP	-38	-33	-40	-41	-32	-30	-37	-32	-28	-25	-33	
Egypt												
Export	2,569	3,620	3,054	3,121	3,472	3,451	3,539	3,919	3,206	3,546	3,350	4.23
Import	9,169	7,759	8,304	8,216	9,584	11,764	13,036	13,245	16,537	16,009	11,362	8.29
Trade Balance	-6,601	-4,139	-5,250	-5,095	-6,113	-8,312	-9,497	-9,326	-13,330	-12,463	-8,013	9.87
Trade Bal. % of GDP	-19	-12	-13	-11	-12	-14	-14	-12	-16	-14	-14	
Saudi Arabia												
Export	44,416	47,697	50,287	42,395	42,614	50,041	60,728	60,732	38,822	48,482	48,622	1.02
Import	24,069	29,085	33,273	28,202	23,364	28,087	27,765	28,743	30,013	28,032	28,063	1.83
Trade Balance	20,347	18,611	17,014	14,193	19,250	21,954	32,963	31,989	8,809	20,450	20,558	0.06
Trade Bal. % of GDP	19	16	14	12	16	17	23	22	7	15	16	
Bahrain												
Export	3,760	3,513	3,464	3,723	3,617	4,113	4,700	4,384	3,270	4,088	3,863	0.97
Import	3,712	4,115	4,263	3,858	3,748	3,716	4,273	4,026	3,566	3,588	3,886	-0.37
Trade Balance	49	-602	-799	-135	-131	397	427	358	-296	500	-23	103.04
Trade Bal. % of GDP	1	-13	-17	-3	-2	7	7	6	-5	8	0	

Source: Adapted from Arab Monetary Fund, 2002 (www.amf.org.ae).

2.6.3.3 External Debt and External Reserves

External debt of both Jordan and Egypt has been reduced over the last decade (see table 2.25). However, Jordan still carries a big external debt at about $7 billion at the end of April 2000 (about 92% of GDP). The Jordanian government has stated its plan to use some of the proceeds from privatisation to reduce its debt (US Commercial Service-Jordan, 2001). On the other hand, while the absolute figure of Egyptian's debt has not shown significant changes over the last decade (at around $ 29 billion over the

1990-98 period), this debt as a percent of GDP has fallen from around 80% in 1990 to 33% in 1998.

In contrast to Jordan and Egypt, Saudi Arabia* is considered to be one of the world's largest international creditors. The Saudi's average aid-to-GDP ratio averaged 4 percent of GDP per annum during the past three decades (US Embassy Riyadh, 2001). Bahrain is also an oil exporter country and used to have insignificant external debt.

Table 2-25: External debt indicators of Jordan and Egypt over the last decade

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1990-98 Average*
Jordan										
External Debt	7,043	7,458	6,922	6,770	6,883	7,023	7,091	6,960	7,388	7,060
External Debt as % of GDP	175	178	135	122	113	108	107	100	101	126
Egypt										
External Debt	28,372	29,317	28,348	28,303	30,189	30,792	28,810	26,804	27,670	28,734
External Debt as % of GDP	80	86	68	60	58	51	43	35	33	4

Source: Adapted from Arab Monetary Fund, 2002 (www.amf.org.ae).

The external reserves of the countries under study, especially Jordan and Egypt, have witnessed favourable growth over the last decade (table 2.26). The external reserves of Jordan and Egypt have grown at around 15% and 49% over the period 1990-99. On the other hand, the reserves of both Saudi Arabia and Bahrain have experienced modest growth. The external reserves of Saudi Arabia and Bahrain's, and perhaps their debts, were significantly impacted by the consequences of the Gulf War in 1991-1992.

Overall, the external debt and reserves for the countries under study (especially those of Jordan and Egypt) have shown significant improvement during the last decade.

* There were no official reports showing Saudi Arabia and Bahrain external indebtedness, especially over the last part of the 1990s (reports by the Arab Monetary Fund, 2002 and World Bank, 2000 do not provide data on the indebtedness of these countries).

Table 2-26: International reserves (excluding gold) of Jordan, Egypt, Saudi Arabia and Bahrain over 1990-99/ US$, millions

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Average	Annual Increase %
Jordan	849	825	769	595	431	427	697	1,693	1,170	1,991	945	15
Bahrain	1,235	1,515	1,259	1,149	1,104	1,274	1,265	1,362	1,349	1,371	1,288	1
Saudi Arabia	11,668	11,673	5,935	7,428	7,378	8,622	14,321	14,876	14,220	16,997	11,312	5
Egypt	2,684	5,325	10,936	13,040	13,476	16,192	17,400	18,667	18,114	14,481	13,031	49

Source: Adapted from Arab Monetary Fund, 2002 (www.amf.org.ae).

2.6.3.4 Investment

Domestic investment in Jordan has grown noticeably during 1995-99, averaging about 29% annually compared to 22% in the Middle East and other Arabian countries (table 2.27). However, domestic investment in Jordan has shown decreasing rates of growth after 1995; falling from about 34 percent, as a percentage of GDP, in 1995 to about 27 percent in 1999. The domestic investment in both Saudi Arabia and Egypt averaged slightly less than 20 percent over 1995-99. (There is no available data regarding the size of domestic investment as a percent of GDP for Bahrain).

Direct foreign investments to both Jordan and Egypt have witnessed significant increases over the last decade. In Jordan, foreign investment has increased from about US$ 13 million in 1995 to more than US$ 300 million in 1998, averaging about US$ 175 million over the whole period. However, there is no recent available data for Saudi Arabia and Bahrain.

Table 2-27: Investment activity in Jordan, Egypt, Saudi Arabia and Bahrain over 1995-99

Indicators	Jordan	Egypt	Saudi Arabia	Bahrain	Avg. Arab-oil countries	Avg. Arab non-oil countries
Gross domestic investment as % of GDP, Average 1995-99	29	N/A	20	10	19	23
Foreign direct investment, current US$ millions, Average 1995-98	175	800	N/A	N/A	8	92

Source: Adapted from tables 2.19 to 2.20

2.7 Conclusion

The Arabic region comprises 21 countries whose people speak the Arabic language and these countries can be classified economically into oil and non-oil exporting countries. Four Arabian blocs have appeared over the past years and these blocs share similar objectives; integrating and enforcing the economic and cultural ties between members' countries. These blocs include the council of Arab community, the Arab Maghreb union, the Gulf Cooperation Council (GCC) and the council of Arab Mashreq countries.

The area and population of individual Arabian countries vary considerably. The living standards for individual countries also vary widely particularly in terms of per capita GDP. Various Arabian countries, for instance, suffer in terms of their poverty levels, high rates of illiteracy and low levels of human development. Despite the variations in the economic resources of individual countries, Arabia is rich in natural resources, especially its oil reserves that account for two-thirds of the world's crude oil.

The economic growth of Arabian countries (as measured by real GDP) slowed over 1982-91, averaging 1.6 percent compared to 4 percent for other developing countries over the same period. This slowness led to low levels of investment and high levels of unemployment. This was also associated with rising levels of external indebtness and fiscal deficits, especially for non-oil exporting countries forcing many Arabian countries to undertake macroeconomic reforms to promote economic growth.

During the 1990s, Arabia's economic performance improved compared to the 1980s and the gap of economic growth compared to other developing countries reduced despite the difficult situation faced by some individual economies. The real GDP growth averaged 3.9 percent between 1992-1999 compared to 5.6 percent for all developing countries over the same period. The trade balance of Arab oil countries witnessed surpluses during the 1990s while those of the non-oil Arab countries witnessed deficits, but these deficits as a percent of GDP have been falling. Inflation rates have been reduced in many Arabian countries, especially in comparison with the 1980s levels. While the external debts of some Arabian countries are still high, external debt as a percentage of GDP appears to be following a declining trend. The total external reserves of the Arabian countries increased sharply during the 1990s, especially the reserves of the non-oil exporting countries. Investment levels have also witnessed improvement, especially foreign investment.

Concerning the economic position of the countries under study, various indicators, especially those for Jordan and Egypt have improved over the last decade. Specifically, the real GDP of Jordan and Egypt have grown faster than those for other non-oil Arab countries. Saudi Arabia and Bahrain have experienced slower growth rates, albeit still higher than the average for Arab-oil countries. The economic performance of Bahrain and Saudi Arabia were more affected by the consequences of The Gulf War. Other economic indicators relating to trade, investment levels, external indebtedness and levels of reserves suggest improved economic performance (to varying degrees) for the four countries under study.

The improvement in the general economic position of the countries under study is expected to be associated with enhanced performance being channelled into the financial institutions operating in these countries. This will be examined in the following chapter of this thesis.

Chapter 3: The Financial Systems of Jordan, Egypt, Saudi and Bahrain

3.1 Introduction

This chapter outlines the main characteristics of the financial systems of the countries under study; Jordan, Egypt, Saudi Arabia and Bahrain. The aim is to investigate factors that have impacted on the efficiency and competitive features of the financial institutions operating in these countries. Section 3.2 explains the role of financial institutions in the process of economic growth by describing briefly the major functions of the financial system. Section 3.3 outlines the role of financial liberalisation in enhancing the role of financial intermediaries. The section outlines the motives for regulating financial systems, the rationale behind financial deregulation, and exposes the requirements for more successful financial liberalisation.

Section 3.4 presents an overview of the financial systems of the countries under study; Jordan, Egypt, Saudi Arabia and Bahrain. The section examines briefly the financial reforms that have taken place in these countries. Particular attention is paid to reforms that have taken place in Jordan and Egypt over the last decade, as these countries have embarked on more radical financial sector deregulation compared to Saudi Arabia and Bahrain. Section 3.5 examines the changes in the financial structure of the countries under study over the last decade by presenting the relative importance of the commercial banks in the financial systems along with the major changes that have taken place in the distribution of these assets. It also describes other features of financial structure by discussing changes in banking sector market concentration. The section also outlines features of financial sector growth in the countries under study and notes the main changes in credit distribution to the main economic sectors.

Section 3.6 presents a preliminary appraisal concerning the impact of economic and financial reforms on the performance of financial institutions. We use a variety of financial development indicators, in particular those suggested by Goldsmith (1969), to examine the impact of economic and financial reforms on the depth of financial intermediation. Finally, section 3.5 draws some conclusion.

3.2 The role of financial intermediation in economic growth

The main functions of a financial system are to intermediate between saving and investing economic units. This includes selecting investment projects and the final users of financial resources according to their creditworthiness and monitoring the use of these resources. In particular, financial systems transform the maturity, liquidity, risk and return characteristics of the liabilities issued by borrowing units to meet the preferences of lenders.

Greenwood and Jovanovic (1990) emphasize the role of financial intermediaries in risk-pooling and monitoring functions. By pooling savings for diversified investment projects and by monitoring the behaviour of the borrowing firms, banks ensure higher expected rates of returns which help to promote economic growth.

The financial system ensures that citizens have the incentive to save and that savings are employed efficiently. Herring and Santomero (2000) argue that a well-functioning financial system makes a critical contribution to economic performance by facilitating transactions, mobilising savings and allocating capital across time and space. Financial institutions provide payment services and a variety of financial products that enable the corporate sector and households to cope with economic uncertainties by hedging, pooling, sharing and pricing risks. A stable, efficient financial sector reduces the cost and risk of investment. Financial markets also provide a crucial source of information that helps coordinate decentralised decisions throughout the economy. Rates of return in financial markets guide households in allocating income between consumption and savings, and in allocating their stock of wealth. Merton (1995) summarises that the overall objective of regulating the financial sector should be to ensure that the system functions efficiently, helping to deploy, transfer and allocate resources across time and space under conditions of uncertainty.

Seminal work by Schumpeter (1911, 1939) noted that financial intermediaries play an important role in promoting economic growth by redirecting funds toward innovative projects. Bencievenga and Smith (1991) and Diamond and Dybvig (1983) have also stressed the role of financial intermediaries in managing liquidity. Financial intermediaries reduce low-return investment due to premature liquidation and redirect funds into longer-term, high-yield projects, leading to faster growth. Therefore, economic growth is directly affected by the increase in the quality of aggregate investment through enhancing profitable opportunities, which is accomplished partly through the informational role of intermediation and according to how well technological frictions are overcome.

Levine (1991) incorporates both portfolio diversification and liquidity management aspects to show the role of financial intermediaries in pooling consumers' liquidity risks via the securities market and concludes that setting up a stock market enhances economic growth. Chen, Chiang and Wang (1996) also suggest that financial intermediation increases investment projects and spurs economic growth by utilising more sophisticated and specialised production processes.

In both developed and developing economies, banks are the principal source of non-market finance to the economy. Banks gather and assess information about prospective borrowers and their investment opportunities. The second function performed by banks is to serve as the principal repository for liquidity in the economy. By pooling the transaction balances of many different transactors, banks can acquire large, diversified portfolios of direct claims on borrowers which enable them to meet liquidity demands while still holding substantial amounts of illiquid assets. Furthermore, banks offer longer-term deposits that must compete directly with other instruments available in the financial markets. The return on deposits must be sufficient to compensate for the risk and delayed consumption associated with accepting deposit claims on the bank. Furthermore, banks transform the longer-term, risky, illiquid claims that borrowers prefer to issue into safer, shorter-term, more liquid demand and the savings deposits that savers prefer. This asset transformation often involves maturity transformation as well.

Financial intermediaries enhance economic efficiency by overcoming frictions through channelling resources toward the most efficient investment, giving households access to economies of scale in processing information that enables the identification of investment projects and ensures that businesses act in ways that do not conflict with saver's interests. Becsi and Wang (1997) note that while there is no single general model that explains why banks exist, fundamental market frictions are probably the main rationale for the existence of financial intermediaries. Market frictions can be classified into either technological or incentive. Technological frictions prevent individuals from having to access economies of scale in the processing of financial services relating to potential borrowers.

Gurley and Shaw (1960) introduce the role of financial intermediaries in overcoming technological frictions. They show that financial intermediaries transform bonds and stocks issued by firms into demand or savings deposits for households. They transform savings into investments by repackaging wealth and transferring capital and information. On the other hand, incentive frictions occur because information is costly and individuals are differentially informed and act in their self-interest. Moreover, contracts are incomplete because not all contingencies can be spelled out, not every action is accountable, and because of specific legal environment concerns.

The role of financial intermediaries in reducing technological frictions can take many forms (Becsi and Wang, 1997). Intermediaries help individual savers by providing access to large investment projects via fund-pooling mechanisms. Thus, financial intermediaries improve the efficiency of the economy by letting savers invest in large projects. Furthermore, intermediaries benefit small savers by making riskier investments available to them through the risk-pooling mechanism. The intermediary can offer this service at a lower cost than savers can manage individually. Savers therefore have access to economies of scale. Intermediaries can also help investors by providing access to long-term projects through liquidity management. The pooling mechanism provides financial economies of scale by reducing the cost of illiquid investments. In addition, intermediaries can improve investors' access to worthwhile investments by means of a screening mechanism. Financial intermediaries can therefore help capital move to its highest value, thus improving allocative efficiency.

The role of financial intermediaries in reducing incentive frictions arises as a result of conflicts of interest in the behaviour of savers and firms due to asymmetric information. Thus, if financial contracts were to apply equally to different types of firms, adverse selection might occur in that only firms with lower quality assets would demand contracts. Furthermore, moral hazards might arise as it is not always in a firms' best interest to behave honestly. Financial intermediaries can help reduce problems associated with asymmetric information or moral hazard by offering financial contracts that are not available in markets and by providing economies of scale in monitoring and control. Therefore, financial intermediaries perform a major role in mediating conflicting incentives between lenders and borrowers that arise from imperfect information and incomplete contracts.

Overall, financial intermediaries have major roles to play in the economy; in particular, they help overcome various sources of market frictions and therefore help transform financial resources to their most efficient use, thus enhancing economic growth.

3.3 Financial liberalisation and financial intermediation

This section outlines the grounds for regulating the financial system in general. In addition, it describes the forms and consequences of financial repression on economic performance and the financial system in particular. We then consider the rationale for wider financial liberalisation as a means for boosting economic growth and improving the competitive advantage of financial systems. Finally, this section outlines the main requirements suggested for successful financial liberalisation.

3.3.1 Rationale for regulating financial sectors

The financial sector, in general, is one of the most heavily regulated sectors of the economy. The origins for this relate to the viewpoint that the financial sector can be subject to systemic* collapse as characterised by the Great (Wall Street) Crash in 1929 and the bank failures that followed thereafter. In banking, the perceived riskiness of the intermediation process, the importance of banks as suppliers of credit in the economy and the special role of banks in operating the payments system are other reasons for the special regulatory attention paid to this business area.

Prudential regulations in banking aim mainly to protect individual investors and to enhance the stability and soundness of the financial system. Goodhart et al. (1998) note that the mere possibility that failures of individual financial institutions can propagate and become general, through contagion risk, combined with uncertainty about the conditions of the banks, can cause depositors and other creditors to lose confidence which may lead to a run on the banking system. This can have disastrous consequences for the real economy, and even large solvent banks can fail. Borrowers from failed banks also suffer as the informational capital they acquired through sustained dealings with the bank suddenly loses its value.

* Systemic risk is defined as the risk of a sudden, unanticipated event that would damage the financial system to such an extent that economic activity in the wider economy would suffer.

Herring and Santomero (2000) consider the rationale for regulating the financial system. Financial regulation aims to protect financial markets and institutions from shocks that might pose a systemic risk. Regulatory measures that might be taken to reduce systemic risk include asset restrictions, capital adequacy standards, deposit insurance and disclosure standards. Some measures, such as interest rate ceilings on deposits, were intended to prevent excessive competition. Other measures, however, such as geographic restrictions may increase exposure to systemic risk by impeding diversification. Second, protecting consumers is the second rationale for financial regulation. Such regulation is put in place to protect consumers from excessive prices or opportunistic behaviour by participants in financial markets. Competition policy also aims to protect monopolistic pricing and therefore to enhance the efficiency of the allocation of financial assets within the financial sector, and between the financial sector and the rest of the economy. As consumers face the problem of asymmetric information in their evaluation of financial service providers, they are vulnerable to adverse selection as well as to moral hazards, where agents put their own interests above those of the customers. To ease such problems, regulators often establish fit and proper tests for financial firms. Such enforcement of conduct provides firms with incentives to adopt procedures that ensure consumers are honestly served. The provision of insurance is another response to the asymmetric information problem. Reserve requirements, capital requirements and liquidity requirements are designed to ensure that a financial services firm will be able to honour its liabilities to its customers, and are also built into the system so as to safeguard against systemic risk.

A safe and sound banking system is therefore important because it not only minimises the likelihood of economic downturns resulting from financial panics but also because the avoidance of such events can limit the exposure of governments that often may have to bear a significant part of the costs of the bailout. Prudential regulation is meant to protect the banking system from these problems by inducing banks to invest prudently. One form of prudential regulation relates to capital requirements, typically related to international guidelines set by the Bank for International Settlements (BIS) (for example the Basle Accord). Capital requirements force banks to have more of their own capital at risk so that they internalise the inefficiency of investing in high-risk assets. Regulatory policies that can be used to generate improvements over using capital requirements alone include such things as portfolio restrictions, enhanced supervision of management and systems and the design of incentive-compatible safety nets. The goal of these policies is to limit the scope of the bank to engage in excessive risk taking and moral hazard behaviour while creating (franchise value) incentives for prudential bank behaviour (El-Shazly, 2001).

3.3.2 Regulated versus market-based financial systems

The central role of an economic system (including both the private and public sectors) is to coordinate economic activity across the various agents in the economy. Analysts of economic growth have long discussed the proper role of the government in promoting economic growth. There have been many arguments about whether the regulated or market based financial system is better in promoting development, and most economists agree that each system has its own benefits and drawbacks.

The market approach presumes that, in the absence of inefficient government intervention, the market generally functions efficiently, and so the government should act to ensure secure property rights and competition. In contrast, the government approach presumes that market failure is pervasive and thus government intervention is necessary to mobilize savings, allocate resources efficiently and promote technological catch-up.

Many developing countries financial systems are characterised by financial repression. Financial repression characterises excessive government intervention in the financial sector, resulting in non-market real rates of interest thus suppressing the role of the market for banking sector deposits and the intermediation process in general. Government intervention in the regulation of financial and economic sectors can take many forms. For instance, there may be selective or directed credit policies to implement planned sectoral investment programmes. Selective credit policies use interest rate ceilings and subsidies to direct investible funds through a non-price rationing system to priority investment projects. Brownbridge and Gayi (2000) argue that improved credit allocation can be attained by reducing government intervention in directing credit or setting interest rates so that banks allocate credit according to commercial criteria. More efficient and higher quality financial services can be attained through increased competition that comes from liberalised entry and/or the removal of regulations that restrict competition.

A substantial body of literature presented by McKinnon (1973) and Shaw (1973) has argued that financial liberalisation (market based system) increases savings, improves the efficiency with which resources are allocated among alternative investment projects and therefore raises the rate of economic growth. Financial liberalisation defines the process of freeing up interest rate controls, exchange rates and capital controls, the entry of foreign banks, deregulation of financial services and enhancing the supervisory re-regulation that accompanies deregulation.

McKinnon (1973) postulates that investors must accumulate money before undertaking investment. The higher the returns on financial assets, the greater the accumulation of money balances will be and the stronger the incentive for investment. Thus, liberalising interest rates encourages economic growth through the positive impact of complementarity of financial assets and physical capital.

Shaw (1973), on the other hand, emphasizes the benefits of an efficient and well-functioning system to improve a country's per capita income. He proposed that efficiency gains in the intermediation process would be attained if more individuals held their assets with banks. The increased institutionalisation of savings could increase the real return to savers and at the same time reduce the costs of lending to investors, improving efficiency of investment and hence economic growth. Put another way, higher real interest rates can improve the intermediation role of financial institutions (M. Fry, 1995, p 29).

The neoclassical economists argue that deregulation and liberalization in the financial sector can lead to more efficient allocation and higher economic growth. According to Hellmann et al. (1997), this is because a market-based system relies on a stock market that can generate efficient information about the real performance of firms. Thus, the stock market can play the role of effective monitoring, because firms' stock prices will fall with bad performances. However, various failures of financial liberalization, like those experienced by the Southern countries of Latin America dictate that in practice, neoclassical economists need to adopt a more balanced view concerning the impact of financial liberalization. The so-called New-Keynesians recognize the problem of incomplete information inherent in the financial market and the essential role of government regulation.

On the other hand, other economists think that a regulated financial system is better since it can induce longer-term investment in the real sector because market-based systems are too sensitive to stock market prices in the short-term. Moreover, government expansion policies can be carried out more easily as the regulated system provides governments with more measures (such as interest rate regulation and policy credit) to intervene in the financial sector than in market-based systems (Pollin, 1995). Moreover, heterodox economists are strongly against financial liberalization. They point out that financial liberalization induces a vicious cycle of stagflation. They argue that the availability of loanable funds will decrease with high interest rates after the liberalization program, and thus economic growth will be retarded.

In conclusion, recent arguments present a balanced view of both regulated and market based systems. The attractiveness of each approach depends on broader institutional settings, the stage of economic development and regulation policies. The benefit of the regulated system is favourable when the economy has severe information problems and the monitoring by banks is effective. This system has also the advantage of minimizing the problems of adverse selection and moral hazard with its better monitoring function, while market based may be better for resource allocation with the price signals it can provide. Since both approaches have advantages and disadvantages, the impact of the development of market-based or more regulated systems on economic growth by no means straightforward. Recent empirical evidence, by Levine et al. (2000), indicates that financial deepening itself, regardless of whether in a regulated or market-based system, can lead to higher growth.

3.3.3 The requirements for successful financial liberalisation

According to Fry (1995 and 1997), there are prerequisites for successful financial liberalisation. First, adequate prudential regulation is needed to enhance the stability of the financial system by constraining excessive risk-taking by financial institutions. Second, there needs to be successful monetary policy resulting in a reasonable degree of price stability. Third, governments should conduct fiscal policy in a disciplined manner in order to reduce their borrowing requirements. Fourth, banking institutions need to be competitive and efficient to increase savings and investment, and this ultimately should promote economic growth. Finally, the authorities need to reduce or abolish discriminatory taxes on the financial system, such as excessive reserve requirement in order to enhance competition within the financial system overall.

Furthermore, the timing and sequencing of liberalisation programmes need to be considered so as to avoid adverse consequences of macroeconomic instability. There is a growing agreement that policy should first seek to create macroeconomic and financial sector stability before financial liberalisation programmes are undertaken (Galbis, 1994 & Alawode and Ikhide, 1997). Namely, there should be substantial reductions in the size of fiscal deficits to lessen inflationary pressures and a strengthening of bank and financial sector supervision to reduce the possibilities of excessive risk-taking by financial institutions. Finally, liberalisation of the domestic financial sector should precede the liberalisation of external sectors to ensure that domestic banks can fast adapt to compete with international financial institutions

According to Miurin and Sommariva (1993), the imprudent privatisation or rapid expansion of new private sector financial institutions can increase the risk of systemic failure, which can stall or reverse progress towards financial liberalisation. The main issue connected with the privatisation of state-owned banks is the problem of existing portfolio losses. If banks are privatised before they are cleared of bad loans and adequately capitalised, perverse incentives will result.

In general, the main rationale for premeditated financial sector deregulation is to enhance the stability of this sector and to present favourable consequences of deregulation and market based policies as a means for mobilising economic resources to their most efficient uses. The brief snapshot of financial sector reform issues covered in this section provides a general indication for the motives for financial liberalisation in the four countries under study in this thesis.

3.4 An overview for the financial systems* in the countries involved in this study

This section outlines the development of the financial systems of the countries under study; Jordan, Egypt, Saudi Arabia and Bahrain over the last two decades or so.

3.4.1 Financial system of Jordan

The introduction of the banking system into Jordan dates back to the early 1920s when a British entity, the Ottoman Bank, opened in Amman and acted as a fiscal agent to the government in the absence of a central bank at that time. In 1936, the Arab Bank, which had its head office in Jerusalem, opened a branch in Amman and the Bank moved its head office from Jerusalem to Amman in 1949. The next foreign bank to open a branch in Amman was the British Bank of the Middle East in 1949. By 1949, the number of banks' offices operating in Jordan was five; located in the two largest cities (Amman and Irbid) and in that year steps were taken to create a local national currency (by establishing a Currency Board) that replaced the Palestinian Pound {Mohammed 1994 174 /id}. The process developed and led to the establishment of the

* The financial system is defined in this thesis to include various banking institutions (commercial, investment, Islamic and other specialised financial institutions) as well as other non-profit financial institutions that were established, by governmental authorities, to support certain economic sectors.

Central Bank in 1964. The next Jordanian bank to start operating, after the Arab Bank, was the National Bank in 1955. In 1960, two additional commercial banks were established, the Cairo Amman Bank and the Bank of Jordan.

Between 1959 and 1968, four specialized credit institutions were established to enhance economic development and to fill the gap in financing the main economic activities like agriculture, industry and housing. The government took the initiative of establishing these institutions to create a channel for collecting funds from a broad range of sources and to help investors benefit from the specialized services provided.

In 1970, the Jordanian banking system was underdeveloped and comprised eight commercial banks (four of them were branches of foreign banks). Twenty years later, the number of banks has increased threefold; the total number of branches has risen from 41 to more than 300 and are spread all over the country (El-Erian et al., 1996).

The Jordanian banking sector was heavily regulated until the end of the 1980s and entry into the industry was restricted (Karasneh et al., 1997). Jordan also experienced various banking crises, associated with one or more of its major banks in the late 1980s and/or beginning of the 1990s (Petra Bank, Islamic National Bank and Amman Bank). The deficiency of prudential regulation and supervisory capacities were among the reasons for these crises. Pre-reform weaknesses included insufficient minimum capital requirements, and the fact that classification and provisioning criteria of loans were not in agreement with international standards. Bank supervision that did take place focused on compliance with allocative controls on interest rates and foreign exchange rather than on prudential requirements.

To promote competitiveness competence of the banking system and enhance investment in local economic activities, the Jordanian authorities have undertaken various financial reforms including the restructuring and addition of new products to the Amman financial markets. The banking system that dominates the financial sector has also been the major focus of these reforms. During the 1990s, the supervisory framework was strengthened by increasing staff numbers and promoting technical qualifications (El-Erian et al., 1996). Furthermore, the Central Bank of Jordan (CBJ) engaged in various reforms concerning the foreign exchange market from 1988 onwards, as shown in Table 3.1.

Table 3-1: Liberalisation of foreign exchange in Jordan during the 1990s

Date	The Event
1992	Moneychangers were licensed to deal with foreign currency but the exchange rate for moneychangers was to be determined by the Central Bank of Jordan (CBJ).
1996	The CBJ liberalised the foreign exchange system. Under the new measures: The mandatory reserve requirement for foreign currency deposits held by banks was reduced from 35 percent to 14 percent; Banks must keep 80 percent of their mandatory reserves at the Central Bank but can use the remaining 20 percent in the inter-bank market; Foreign currency holders may engage in asset swap deals with banks on the spot (dinars-for-dollars) and on a forward (dollars-back-for-dinars) basis, with rollover options.
1997	The CBJ issued new measures to further liberalize the foreign exchange system. Under the new measures, a licensed bank may: Open non-resident accounts in dinars and/or in foreign currencies; Allow resident account holders to maintain up to one million dollars in foreign currency accounts. Transfer the value of imports to foreign beneficiaries without CBJ approval; Allow residents to take Jordanian dinar-denominated banknotes and payment instruments in and out of the Kingdom without restrictions and take out or transfer cash notes in foreign currencies up to the equivalent of JD 35,000 (approximately $US 50,000) to cover payments.
1997	All restrictions pertaining to the inflow and outflow of foreign currency (including gold) were rescinded. Banks may buy or sell an unlimited amount of foreign currency on a forward basis. Banks are permitted to engage in reverse operations involving the selling of foreign currency in exchange for JD on a forward basis for covering the value of imports. Ceilings related to amounts residents are permitted to transfer abroad have been scrapped.

{Bureau of Economic and Business Affairs 1998 127 /id}& {International Monetary Fund 2000 62 /id}&{Central Bank of Jordan 1997 29 /id}.

Interest rate ceilings were applied in Jordan on deposit and loan rates during the 1980s. These ceilings aimed to enhance the stability of the Jordanian dinar and to enhance international foreign reserves. The ceilings were amended several times and the first step toward freeing interest rates was taken in 1988 when those on deposit rates was abolished. The decision to complete the freeing of interest rates on loans was taken in 1990. After that, lending limits to the private and public sectors were eliminated in 1992 and 1993, respectively.

Jordan has also applied required reserve ratios on commercial banks, initially introduced in 1967 at 7 percent of banks' liabilities. This ratio was raised in subsequent years as a tool for inflation control and reached 13 percent by 1979. During the early 1980s, the reserve requirement ratio was reduced in order to encourage bank lending during a recession period. The ratio was further reduced by the Central Bank of Jordan and reached 6 percent in 1984. However, because of inflationary pressures in 1988, the ratio increased to 9 percent and had further rises reaching 15 percent by the end of 1993. In 1996, the Central Bank of Jordan changed the reserve requirement scheme by offering banks more flexibility to maintain a daily minimum balance of 80 percent of their reserve requirements with the central bank during a one-month maintenance period (the remaining 20 percent could be held on a period-average basis during the maintenance period) (El-Erian and Fennel, 1997). Moreover, to eliminate discrimination against intermediation in the Jordan dinar, reserve requirements on foreign currency deposits were lowered from 35 percent (remunerated) to 14 percent (non-remunerated).

In 1991, Treasury bill auctions were introduced in order to bring about a wider role for market forces to influence treasury bills rates and to facilitate the use of indirect techniques of monetary control (Central Bank of Jordan, 1997). These procedures were aimed to encourage new entrants to mobilise deposits from the public and to reassure depositors that their deposits were safe through the enforcement of a set of prudential guidelines.

Furthermore, in 1996 the Central Bank of Jordan abolished the distinction between resident and non-resident accounts (El-Erian and Fennell, 1997). This resulted in identical treatment of resident and non-resident foreign currency deposits (FCDs) with respect to current payments, elimination of the ceiling on residents' FCDs, permission being granted to the banks to manage investments in foreign currencies for both residents and non-residents, and the application of similar regulations governing margin foreign exchange transactions.

Moreover, the Central Bank of Jordan, in November 1996, permitted Swap operations in foreign exchange to enhance the efficiency of the foreign exchange markets by allowing bank clients to sell foreign exchange at the spot rate and repurchase it at a forward rate for any period of time (El-Erian and Fennell, 1997). Further, in June 1996, the central bank liberalized all transactions on foreign exchange. In an effort by the government to promote competition between banks and reduce lending rates, the central bank also required banks to publish their prime lending rates and deregulated commissions, and reserve requirements were reduced from 14 percent to 12 percent.

A new banking law aimed at improving the industry's efficiency and enhancing bank regulation and supervision was approved by the Jordanian Parliament in June 2000 ({US Commercial Service-Jordan 2001 178 /id}. This law is aimed at protecting depositors' interests while encouraging free market forces in the development of the financial market. In addition, the central bank has completed the drafting of a deposit insurance plan, which is currently under review in Parliament and due to be approved soon.

According to the report of US Commercial Service-Jordan (2001), Jordanian banks rely heavily on traditional banking activities, namely, the extension of direct credit facilities, as a main source of income. Credit facilities offered by banks include loans, discounted bills and overdraft facilities. Investment banks are not permitted to extend overdraft facilities. The corporate bond market remains under-developed, and continues to be over-shadowed by traditional direct lending. Some banks, however, have started adopting modern banking practices such as automated cheque clearing, and the use of magnetic check processors, unified reporting forms and electronic data-transmission networks. The Central Bank of Jordan has adopted policies aimed at stimulating the local capital market, particularly where long-term project finance is required. A number of banks have established mutual funds. In addition to long-term instruments, e-banking, securitization, short-selling, and treasury stocks are being introduced in some banks.

In 2000, Jordan's banking system comprised 13 commercial banks (of which five were branches of foreign banks), five investment banks, two Islamic banks, one industrial development bank, six specialized credit institutions and a number of financial institutions that do not accept deposits (including the Social Security Corporations*). There are also 18 insurance companies operating in the country (Central Bank of Jordan, 2001). Although the Central Bank distinguishes between "investment banks" and "commercial banks", there are no significant differences in their operations. The number of operating branches of these banks rose to 457 in 1999 compared with 451 in 1997. Despite the increase in the number of operating branches, density remained at the same level around ten thousand people per branch. The number of Jordanian banks' branches operating abroad, including representative offices, rose to 115 by the end of 1998, of which 49 operated in Palestinian territories.

3.4.2 Jordan's capital Market

The Amman Stock Exchange (ASE) is one of the leading capital markets in the Middle East. The stock exchange in Jordan commenced its operations in 1978 and deals mainly with securities, stocks, government and corporate bonds. The ratio of Jordan's market capitalisation to GDP, which stood at about 74 percent in 1994, exceeds that of most emerging markets and is similar to that of many industrial countries. Market

* The Social Security Corporation was established in 1978 to secure workers and employees, including those of the public sector, against most of the risks including providing retirement wages. The corporation, in its turn, receives the workers insurance instalments and re-invest them in various investment projects.

capitalisation remained at around $ 4.7 billion between 1992 and 1994(El-Erian et al., 1996) but exceeded $ 5 billion by the end of 1999.

The Amman Stock Exchange (ASE) was reorganized as a privately managed institution in 1999. In 2000, the ASE completed the transition to an electronic trading system. Listing requirements are being reviewed and updated, while an automated depository centre will be established as a custodian for all transaction contracts {US Commercial Service-Jordan 2001 178 /id}. Currently, there are 34 brokerage firms and 158 listed public-shareholding companies on the exchange. Forty-three percent of ownership is by non-Jordanian investors (37 percent by Arabs and six percent by non-Arabs).

With respect to ownership and participation in the major economic sectors in Jordan, there is no noticeable discrimination against foreign participation. In fact, many Jordanian businesses seek foreign partners, perceived as the key to increased competitiveness and provide entry into international markets.

To conclude, Jordan's financial system has witnessed major developments and reforms especially over the last decade. This includes the liberalisation of interest and exchange rates, the introduction of new financial regulations that are consistent with international standards and the modernisation of Jordan's capital market. The number of banks and branches in Jordan has increased over the last two decades leading to a more competitive environment and potentially more efficient banking system. This will be investigated in more detail in the empirical part of this thesis.

3.4.3 Financial system of Egypt

Between 1957 and 1973, the Egyptian authorities implemented a comprehensive wave of the nationalisation of all the country's 27 commercial and specialized banks, closed its stock market and consolidated the banking system into four non-competing state banks; each focusing on separate economic sectors. However, since 1970, high population growth and relatively poor economic performance has led to pressure for domestic investment on a larger scale and therefore steps were taken to permit foreign banks to reestablish themselves (in partnership with Egyptian banks) in the country. The Egyptian banking sector expanded markedly in the mid-1970s spurred by the country's outward-looking growth policies and greater emphasis placed on private sector development (Handy et al., 1998).

To promote economic reform within the country, Egypt's government enacted the Investment Law of 1974, allowing for the establishment of commercial and investment banks, with a minimum 51% domestic ownership, to enter the Egyptian market. Furthermore, a banking law enacted in 1975 defined what constituted banking businesses. This legislation identified three main types of banks operating in the Egyptian system: commercial banks that accepted deposits and provided finance for a wide variety of transactions; business and investment banks that performed medium- and long-term (lending) business and finance operations (these banks can also accept deposits and finance foreign-trade operations) and specialized banks which offered specific types of economic activities and accepted demand deposits.

All specialized banks are state owned and are assigned the task of providing long-term finance for priority sectors like real estate and agricultural and industrial development. There are also public sector commercial banks, private & joint venture banks and foreign banks (operating through branches). Foreign banks were all registered as business and investment banks, as their role was mainly to raise long-term funds. They were restricted from dealing in foreign currency business until 1993 when the banking law was modified to allow existing foreign banks to engage in such operations (US Commercial Service-Egypt, 2001). Since 1993, foreign banks operating in Egypt have received equal treatment to domestic banks.

Although the banking system has been opened to private sector banks since 1975, the four state-owned commercial banks have continued to dominate the market, where they account for around 50% of total banking sector assets. They have a significant market share in retail and corporate banking services through large branch networks and a close relationship with state-owned companies. They are also major participants in the equity capital of most joint-venture banks. Furthermore, during the 1970s and 1980s, the securities markets remained underdeveloped and hampered by the absence of a governing securities law and inadequate regulation. According to Handy et al. (1998), financial intermediaries such as mutual funds, finance companies, leasing companies, brokers, moneychangers, and market makers were lacking. In addition, the insurance sector was underdeveloped and largely state owned{Handy & Staff team 1998 55 /id}.

At the beginning of the economic stabilization programme in 1990/91, Egypt's financial system suffered heavily from long-standing structural weaknesses resulting from the unstable economic environment and over-regulated financial system. The imposed interest rate limits on bank deposits and loans were well below the rate of inflation. Furthermore, preferential interest rates were mandated for loans to public enterprises and to industrial and agricultural enterprises. The Central Bank of Egypt (CBE) also attempted to manage credit expansion to public and private sector companies using maximum loan-to-deposit ratios and bank-specific ceilings for certain types of credits. According to Subramanian (1997), these financial repression practices resulted in heavy losses and substantial non-performing loans for commercial banks in the early 1990s, when provisioning levels exceeded 18 percent of the total loans booked at the end of 1992. These losses contributed to a sharp deterioration in the capital-asset ratio of the banking system from 3.5 percent in 1985 to 2.4 percent in 1990.

In 1991, the Egyptian authorities undertook a series of financial reforms aimed at enhancing the efficiency of the financial system (see table 3.2 below). In 1991, the CBE established a capital adequacy ratio equivalent to 8 percent of risk-weighted assets, in accordance with the Basle guidelines. In 1992, minimum capital requirements for Egyptian banks were LE 100 million for authorized capital and LE 50 million for paid-up capital; branches of foreign banks were required to show a minimum capital base of not less than $15 million {Handy & Staff team 1998 55 /id}& (US Commercial Service-Egypt, 2001).

According to Handy et al. (1998), the new capital requirements of 1991, indicated earlier, produced a sharp recovery in the banks capitalisation to 4.3 percent. On a risk-adjusted basis, the capital adequacy ratio for the banking system reached 10.6 percent by the end of 1996. Subsequently, a gradual decline in provisioning appears to have signalled a parallel decline in non-performing loans (or vice versa). The level of non-performing loans fell from around 14.7 percent of total loans in June 1996 to 13.4 percent in June 1997 and total provisions were equivalent to about 80 percent of non-performing loans by the end of June 1997.

Table 3-2: Measures undertaken to enhance bank competition and performance in the Egyptian banking market since 1991

Measure	Details
Reserve and Liquidity Requirements	To reduce the implicit tax on banking activity, the non-interest-bearing reserve held by banks at the Central Bank of Egypt (CBE) were reduced (from 25 percent) to 15 percent of total Egyptian pound deposits. Alternatively, banks continued to hold with the CBE 15 percent of total foreign currency deposits as a reserve earning interest equivalent to LIBOR. Meanwhile, the liquidity ratio was reduced to 20 percent (down from 30 percent) and 25 percent for local- and foreign-currency balances, respectively.
Capital Adequacy Ratio	The banks' minimum capital requirements were increased in 1991 to 8 percent along the lines of the Basle Committee on Banking Supervision. Capital was defined to consist of two components: Primary capital, which includes paid-up capital and reserves. Other capital includes provisions for general banking risks.
Foreign-Exchange Exposure	The banks foreign-exchange exposures were limited; the ratio of foreign currency liabilities to foreign currency assets became subject to a maximum limit of 105 percent, and the open position for a single currency, for all currencies combined, became subject to limits of 10 percent and 20 percent, respectively, of bank capital.
Investment Concentration Abroad	Investment abroad by banks is subject to a limit of 40 percent of the bank capital. In addition, the bank's deposits held with single foreign correspondents should not exceed 10 percent of total investments abroad (or US$ 3 million, whichever is higher).
Credit Concentration	Since 1991, the CBE limit banks' single customer exposure of credit facilities to 30 percent of bank capital (and the exposure should not exceed 25 percent of a bank's paid-up capital and reserves). There is also surveillance by the CBE on geographical and sectoral concentrations of bank lending so as to diversify portfolio risk. For equity holdings, bank participation in the share capital of joint-stock companies is limited to 40 percent of the company's capital.
Loan Classification and Provisioning	Stricter loan classification and provisioning criteria were issued to ensure that individual banks act prudently. Non-performing loans are classified as substandard, doubtful or bad according to the delay in debt repayment.

Source: Adapted from El-Shazly, 2001; various pages.

To increase reliance on indirect monetary policy instruments, the central bank of Egypt introduced, from January 1991, weekly auctions of three-month treasury bills which helped to maintain the banks' viability (Subramanian, 1997). When the Treasury bill issues were initiated, the vast bulk of these were held by the commercial banks. Banks' holdings of securities as a share of their total assets increased from 13 percent at the end of 1991 to 23 percent by 1993, before easing to 16 percent at end of 1995. Moreover, the income from this source was tax exempt. Over time, the supply of debt to the market was increased and longer maturities were introduced.

To strengthen the banking system, new prudential guidelines (as already mentioned) were introduced in 1991 for foreign currency exposures, capital adequacy levels, asset classification and provisioning, bank liquidity and auditing rules. This was followed in 1992 by guidelines covering investment abroad, and in 1993 by regulations on credit concentration. Regulations that discriminated against private banks and inhibited a level playing field for all participants were removed. Branches of foreign-owned banks were allowed to operate in local currency and full entry of foreign banks through the establishment of local subsidiaries was authorized {Handy & Staff team 1998 55 /id}& (US Commercial Service-Egypt, 2001). Foreign partners were allowed majority equity-holdings in joint venture banks. Bank fees and charges, creditor and debtor rates, and transactions on the foreign exchange market were liberalized. Administrative credit allocations were phased out and Treasury bill auctions were used to manage liquidity and indirectly provide a reference interest rate to the financial markets.

In 1993, the monetary authority liberalized rates of interest on demand deposits and subsequently removed ceilings on bank lending to the private sector and bank-specific ceilings on lending to the public sector in the same year. Following the liberalization of interest rates that were initiated in 1991, nominal deposit rates reached 16 percent in 1991/92, but declined to 10 percent in 1995/96 and lending rates declined from 19 percent to 14 percent, reflecting improved intermediation (Subramanian, 1997& {Handy & Staff team 1998 55 /id}.

During the period 1993 to 1994, the authorities mandated public banks to divest their shares in the joint-venture banks with a maximum ownership of 20 percent to reduce market concentration and enhance competition. Furthermore, the government divested public holdings in two joint-venture insurance companies. By 1997, the state banks had limited their holdings to three joint-venture banks and reduced their holdings to below 20 percent in the majority of other institutions ({Handy & Staff team 1998 55 /id}& El-Shazly, 2001). Steps were also taken to reduce the competitive advantages of the public sector banks by allowing public sector companies to deal with all banks without prior permission from the central bank. By the end of June 2000, the public banks' ownership was above 20 percent in eight (out of twenty-three) joint venture banks, whose privatisation had been planned to be completed by the end of the same year. The authorities also plan to privatise the four public sector commercial banks and the necessary legislation was passed by the parliament in 1998, but none have so far been offered for sale.

On the market transparency front, public disclosure of financial information was generally poor. Before 1998, banks used to publish their financial statements only at the end of the fiscal year. Meanwhile, the income statements of some banks, especially the state owned banks, were brief with a couple of lines on revenues and expenditures that did not even show the amount of provisions. The public had better financial information only for banks which were listed on the stock exchange. These banks were mandated by the capital market law (Law 95/1992) to submit quarterly statements regarding their financial position to the Capital Market Authority, which made the information publicly available.

The evolution of the banking system during the past decade has been associated with changing patterns of credit allocation, both in terms of the economic sector and the type of borrower {Handy & Staff team 1998 55 /id}& Subramanian, 1997). Prior to financial liberalization before the 1990s, credit was focused mainly on the industrial and services sectors. From 1991/92 onwards credit to the agriculture and trade sectors increased substantially. The share of lending to the private sector has also grown sharply. As of January 1996, the share of credit to the private sector stood at 43 percent, compared with 29 percent in the early 1990s.

According to the 1999 report of the National Bank of Egypt, Egypt's banking sector consists of 7 public sector banks (3 specialized and 4 commercial), 31 investment and merchant banks (11 joint venture and 20 foreign bank branches) and 24 commercial banks, as well as 2 offshore registered banks (Table 3.3). Despite the emergence of new banking institutions, the big four state banks continued to account for over 75% of commercial bank deposits based on their extensive branch network, with a similar share of total lending. The new commercial banks focused on lending to the private sector and multinationals (US Commercial Service-Egypt, 2001).

Table 3-3: Structure of the Egyptian banking system as at 31/12/1999

		Number	Branches
Commercial Banks	Public Sector	4	918
	Private & Joint Venture	24	330
Business and Investment Banks	Private & Joint Venture	11	105
	Foreign Banks (Branches)	20	46
Specialised Banks	Industrial	1	14
	Real Estate	1	26
	Agriculture	1	1,005
Total		62	2,444

Source: El-Shazly, A. (2001); http://www.mafhoum.com/press/49E2b.htm (p. The Appendix).

3.4.4 Egypt's capital market

While banks are the main source of finance for projects in Egypt, Egyptian investors have begun considering the stock or bond markets to obtain capital. The Cairo and Alexandria stock exchanges, dormant since 1956, started gaining momentum in late 1992. The authorities made considerable progress in modernizing its capital markets since the passage of Law 95 in 1992 which aimed at finding alternative sources of financing to private and public firms (US Commercial Service-Egypt, 2001). In addition, the privatisation programme, particularly between 1995 and 1997, was a major spur for development of the capital markets and foreign investor interest.

As of May 2000, the market capitalization of the Cairo and Alexandria Stock Exchange was approximately US$ 38 billions with 1051 companies listed. Trading value for 1999 was $12.4 billion, of which $US 10.5 billion were in listed securities. This represents a trading volume of about 1.1 billion shares, largely confined to a few heavily traded companies. The capital markets sector, as of March 2000, consisted of 30 mutual funds (23 managed and traded in Egypt and 7 offshore), 24 portfolio investment management companies, 20 underwriters, 9 venture capital firms, 140 brokerage firms and one central depository for clearing and settlement (US Commercial Service-Egypt, 2001). The recent growth of the Egyptian stock market in terms of providing financing and promoting savings in the domestic economy.

To conclude, the Egyptian financial sector has witnessed many major reforms over the last decade. These include liberalising interest rates, enhancing bank capital requirements and prudential regulations in accordance with international standards; the introduction of new banking laws giving a wider role for foreign banks that boosted competition and promoted privatisation of the public banks. The new reforms , in general, have led to a stronger financial position for Egyptian banks.

3.4.5 Saudi Arabia's banking and financial system

The history of financial institutions in Saudi Arabia commenced in the 1900s when a few foreign based trading houses, including a branch of Algemene Bank Nederland, and some other money changers, provided most of the finance related services to meet the needs of the trading community and pilgrims visiting the country. After the discovery of oil in 1939, and following the Second World War, the Saudi government expenditures and revenues rose rapidly and foreign banks started entering its market (Al-Suhaimi, 2001). The French Banque de L'Indochine and Arab Bank opened branches in Jeddah in 1948; followed in 1950 by the British Bank of the Middle East, the National Bank of Pakistan and the Bank Misr of Egypt.

However, the modern history of the banking system in Saudi Arabia started in 1952 when the Saudi Arabia Monetary Agency (SAMA) was created to achieve a stable monetary mechanism. It opened offices in the main cities, but the government continued to use the payment services of the moneychanger (Al- Kaki and Bin Mahfouz Co.) to act as its agent. In 1953, the government permitted this moneychanger to start as the first commercial bank, under the name of the National Commercial Bank. More foreign banks followed later when Banque du Caire started operations in 1954, followed by Banque du Liban et d'Outre Mer and First National City Bank of New York. Riyad Bank commenced operations in 1957 and Bank Al-Watany in January 1958 (Bank for International Settlements, 2001).

Al-Sahlawi (1997) notes that before the establishment of SAMA, there was no Saudi currency until 1952 when the Saudi Riyal was issued. Over 1950-1956, there was a gradual introduction of paper money (in the form of Pilgrim receipts) which was covered by precious metals and foreign currencies. The proper issue of paper money was made at the start of 1960 and a par value for the Riyal was announced to the IMF.

In 1960, the Saudi financial system faced its first banking problem when Riyad Bank and Al-Watany Bank, which had commenced operations in 1957 and 1959 respectively, faced serious liquidity problems arising from mismanagement and the existence of a substantial problem loan portfolio. Board members in both banks had borrowed heavily from the banks and faced defaults on loan repayments. By 1960, Al-Watany Bank was technically insolvent and unable to settle the claims of local depositors which led SAMA to liquidate the bank and merge its operations with the Riyad Bank (Al-Suhaimi, 2001).

The above banking difficulty led to a new Banking Law in 1966, which gave SAMA wider supervisory powers. Banks were required to meet capital adequacy, liquidity and lending ratios, and reserve requirements. The Banking Law also permitted SAMA to recommend institutions for new licenses, issue rules and regulations, and to take actions against any violation of the Law. It also supported the concept of a universal banking model which permitted banks to provide a broad range of financial services

including banking, investments, securities, etc. Consequently, banks became primary licensed financial institutions and expanded rapidly, covering the entire country.
The Saudi government had encouraged foreign banks to open in the Kingdom since early banking activity and consequently ten international banks with 29 branches were present by the early 1970s. The government policy, however, changed in 1975 when it promoted a policy to convert foreign banks' branches into publicly traded companies, with the participation of Saudi nationals. By encouraging foreign banks to take large shareholdings in the newly incorporated banks, and by offering them management contracts, the foreign partners' position was strengthened as they could exercise significant management control while benefiting from national treatment equivalent to banks fully owned by Saudis (Saudi Monetary Agency, 1998).

The government of Saudi Arabia also took the initiative, during the 1970s, to establish five major lending institutions; namely Saudi Credit Bank, Saudi Agricultural Bank, Public Investment Fund, Saudi Industrial Development Fund and the Real Estate Fund {Al-Sahlawi 1997 3 /id}. These institutions finance medium and long-term projects to supplement the short-term funds provided by commercial banks. They provide development loans at relatively low cost with complete government financing, the duration of loans extended varies from one sector to another; industrial loans vary from 5 to 15 years while housing loans last for 25 years. The government of Saudi Arabia has also established other financial institutions for specific purposes. The most important of these institutions is the Saudi Fund for development that was established in 1974 to provide assistance to "friendly" developing countries. The Islamic Development Bank was also established in 1975 to provide loans to joint ventures in Islamic countries.

In the early 1980s, the Saudi banking system operated in a macroeconomic environment characterised by large imbalances. This was mainly because of the steep rise in government revenues over 1979-1981, followed by a decline in oil revenues over the following five years. Government oil revenue, which had risen to SR 333 billion by 1981, dropped to just SR 74 billion by 1987. Some banks expanded too rapidly, and did not have adequate credit assessment and monitoring procedures. Consequently, many banks faced difficulties recovering their loans and collateral. The banking system incurred many non-performing loans, which accounted for over 20 % of loans by 1986, and banks' profits suffered significantly – loan loss provisions were substantial. However, by 1988, most banks had made sufficient provisions for doubtful loans and the average provision for the banking system had risen to over 12 % of total lending (Bank for International Settlements, 2001).

According to the report of Bank for International Settlements (2001), the slow economic growth in the first half of the 1980s resulted also in the failure of many money-changing organisations which led the government to pass the Law for Moneychangers in 1982, requiring SAMA to license and regulate these institutions. Moneychangers were prohibited from deposit taking, lending and providing any other financial services except those specified in the Law. In 1985, SAMA issued rules that permitted banks to undertake stock brokerage activities.

In 1982, SAMA faced a major supervisory challenge when irregularities appeared in the operations of Saudi Cairo Bank. The managing director and the treasurer were involved in unauthorised trading in bullion between 1979 and 1981. The Bank had concealed accumulated losses that exceeded its share capital. SAMA required the bank to issue new shares and double its capital in 1986. This increase was taken up entirely by the Public Investment Fund (PIF). This event was followed by further precautionary procedures by SAMA to ensure the stability of the financial system and to help the banks to overcome the prolonged economic downturn (table 3.4 shows the details).

Table 3-4: Steps undertaken by SAMA during the 1980s and 1990s aimed at strengthening the stability of the Saudi financial system

Action	Details and implications
Dividend payments	Banks were required by SAMA to seek approval prior to announcing their dividends. The Banking Law required all banks to build their statutory reserves equal to their share capital.
Tax deductibility of provisions for doubtful accounts	In 1986, SAMA permitted the tax deduction of loan loss provisions on an accrual basis. Thus, banks could now receive favourable tax benefits at the time of making a provision and not just on write-offs of a loan. This encouraged banks to increase their loan loss provisions for doubtful accounts.
Withholding tax on inter-bank transactions	To encourage Saudi banks to increase their inter-bank dealings and to support the development of a Riyal inter- bank market, a tax ruling was obtained which exempted foreign banks from withholding taxes when carrying out inter- bank transactions with Saudi banks.
Creation of banking disputes committee	In 1987, Saudi authorities established a Banking Dispute Committee. The creation of this Committee aimed to handle disputes between banks and their customers.
Strengthening of the technological infrastructure	In 1986, an automated Clearing House was established followed in 1989 by the introduction of an Automated Teller machine system. These systems encouraged all Saudi banks to invest in technology and to improve their office operations.
Corporate governance	SAMA initiated steps to improve banks risk management and control procedures. This required banks to develop and strengthen their internal audit departments and issued minimum internal control guidelines. In addition, SAMA issued accounting standards for commercial banks that were in line with International Accounting Standards.
Exchange of information on large borrowers and on delinquent loans	In the early 1980s, SAMA established a credit information service that provided information to Saudi banks on all large exposures of the banking system. This better enabled banks to assess their credit position and riskiness of their big borrowers.

Source: Adapted from (Bank for International Settlements, 2001).

Despite the turbulent economic conditions during the 1980's, the Saudi banking system grew rapidly. The Saudi government allowed the establishment of three new banks (Al- Rajhi Banking and Investment Corporation, Saudi Investment Bank and United Saudi Investment Bank) to help boost the competitiveness and efficiency of the banking system. In addition, the United Saudi Commercial Bank emerged as a result of the takeover of three foreign banks in 1983. In general, the Saudi authorities also encouraged the banking system to improve its capital position. This is illustrated by various bank restructurings and moves to increase the capital position of the banking system (see tables 3.5 and 3.6 for details).

Table 3-5: Restructuring in the Saudi Arabian financial system during the 1980s

Bank Name	Restructuring procedures
United Saudi Commercial Bank	This bank was established in 1983 by the takeover of the three remaining branches of foreign banks (United Bank of Pakistan, Bank Melli Iran and Banque du Liban d'Outre Mer).
Saudi Investment Bank	This bank was established in 1976 as a special bank. It was given a full commercial license in 1984 and permitted to offer all banking services. There were changes in its ownership as some foreign shareholders sold their shares, reducing foreign ownership to 25 %.
Al- Rajhi Banking and Investment Corporation	In 1988, the government licensed the Al- Rajhi family (the largest money-changer) as a bank that became the third largest bank in the Kingdom. The floatation of Al- Rajhi as a bank raised SR 750 million in new capital and brought in approximately 100,000 new shareholders. In 1992, Al- Rajhi doubled its capital to SR 1.5 billion by the issue of bonus shares on a 1: 1 basis.

Source: Adapted from (Bank for International Settlements, 2001; various pages).

Table 3-6: Capital increases of various Saudi banks during 1980s and 1990s

Bank Name	Details of increasing capital
Riyad Bank	In 1992, Riyad Bank raised its capital from SR 100 million to SR 2,000 million by a share bonus and then by another SR 800 million by issuing of new shares. It also raised share premiums of over SR 3 billion on this issue.
Saudi Cairo Bank	Saudi Cairo Bank increased its capital from SR 150 million to SR 300 million in 1987. Moreover, in 1988, the Public Investment Fund (PIF) made a major investment of SR 300 million in the bank's capital that doubled the total share capital. In 1992, the bank issued 6 million shares at SR 350 per share and increased its capital by another SR 600 million. It also raised SR 1,500 million in share premium.
Saudi American Bank	Saudi American Bank doubled its capital to SR 600 million in 1988 by issuing bonus shares to its shareholders. In addition, in 1991, Citibank N. A. sold 1/4 of its 40 % stake in the bank to two public sector agencies. In 1992, the share capital was also increased to SR 1,200 million through capitalisation of its reserves.
Saudi British Bank	Saudi British Bank had increased its capital from SR 100 million to SR 300 million in 1979. In 1988, it further increased its capital to SR 400 million.
Saudi French Bank	Saudi French Bank increased its share capital from SR 100 million in 1977 to SR 200 million in 1979 and to SR 400 million in 1987. In 1992, the share capital increased to SR 900 million through bonus shares and an offering of 2 million shares at SR 100 and a premium of SR 470 million.
The National Commercial Bank	The National Commercial Bank in 1992 increased its capital from SR 30 million to SR 6 billion by a cash injection. In 1997, the bank reorganised from being a partnership bank to a limited joint-stock company, which widened its shareholder base.

Source: Adapted from (Bank for International Settlements, 2001; various pages).

In addition to the improved capitalisation of the system, other significant changes were made to modernise the banking system (Al-Suhaimi, 2001). These included the introduction of government bonds to provide investment instruments to banks and investors; the introduction of a national Automated Teller Machine System which permitted customers access to their accounts from any machine; the introduction of debit, credit and charge cards and the linking of Saudi Arabia with the SWIFT payments network.

By the beginning of the 1990s, the Saudi banking system had largely recovered from the difficulties of the mid-80s. However, the invasion of Kuwait by Iraq in 1990 dictated a new situation for the Saudi banking system. The crisis profoundly affected the monetary situation. Customer withdrawals of domestic deposits during August 1990 were 11 % of total customer deposits; these were largely converted into foreign currency and transferred abroad. By September 1990, the pressure had eased and withdrawal slowed down to 1.1 % of customer deposits. SAMA had provided banks access to additional liquidity through more liberal repo arrangements, placing additional Saudi riyal and foreign currency deposits with them, and by selling foreign currency in large volumes. Banks also coped well by liquidating their foreign assets (Bank for International Settlements, 2001). Following the resolution of the Gulf crisis there was a mini boom in the economy. During 1991, there was a massive surge of deposits to banks which accounted for about 20% of total deposits in the system. Banks' domestic loans and advances grew 90 % during the period 1990– 95 and all other banking indicators, such as returns on equity and returns on assets, continued to be positive with many banks making record profits during this period.

The restructuring of the banking system continued in the latter part of the 1990s when the United Saudi Commercial Bank and the Saudi Cairo Bank merged to form the United Saudi Bank in 1997. The banking system also took advantage of investments in new technologies, including the introduction of an electronic funds system in 1997, and widespread use of point-of-sale systems as well as the introduction of electronic share trading. Saudi banks are increasingly developed, they were managing about 100 investment funds with investments of over SR 22 billion by 1998, and they offer a wide range of international stock brokerage facilities. Moreover, by the end of 1998, Saudi banks were highly capitalised by international standards with risk asset ratios of over 21 %, mainly comprising tier 1 capital (Al-Suhaimi, 2001).

By 1999, the Saudi financial system comprised five types of financial institutions: the Saudi Arabian Monetary Agency (SAMA), 10 commercial banks, 4 investment banks and various specialised credit institutions (controlled by the Ministry of Finance). The number of bank branches increased from 1,011 in 1990 to 1,236 in 1998. The growth in the activities of the banking system in Saudi Arabia can be partly attributed to the absence of formal capital and money markets and so the commercial banks have taken the opportunity to mobilize the private capital among different sectors of the economy. All the commercial and investment banks have majority private ownership, with the exception of the National Commercial Bank (the largest in Saudi in terms of assets), which sold 50% of its shares to the government Public Investment Fund in 1999 {US Embassy Riyadh 2001 175 /id}.

To conclude, despite the downturns in the domestic economy resulting from the instability in oil prices and the Gulf War, the Saudi banking system has witnessed rapid progress over the past decade or so. Many Saudi banks have increased their capital substantially and there has been substantial restructuring. The Saudi authorities have also demonstrated their ability to effectively manage the soundness of the banking system by issuing various prudential regulations for the financial system aimed at providing stability.

3.4.6 Financial system of Bahrain

Banking started in Bahrain when a branch of the Eastern Bank opened in 1921. This was followed by the British Bank of the Middle East in 1944, the National Bank of Bahrain in 1957 and the Arab Bank Limited in 1960 (Wilkenson and Atti, 1997). These banks were sufficient to cater for the needs of the time by providing trade finance and deposit facilities for customers. These banks witnessed the gradual transition of the economy from fishing based to an oil-dependent economy and later on its transformation into a service centre In 1965, the Bahraini dinar was introduced to replace the Gulf rupee.

As the pace of economic activity gathered, the number of banks increased when 15 commercial banks opened in Bahrain between 1969 and 1977 focusing their efforts on attracting funds from other Gulf countries and reinvesting abroad {SERTCIC 1990 107 /id}. The rapid expansion in Bahrain banking activity in the 1970s and 1980s came from increasing regional oil revenues that made the Gulf countries recipients of substantial funds. This progress in banking activity brought to the surface the need for the direction, supervision and control of banks through a central monetary Currency Board. Therefore, the Bahrain Monetary Agency was created in 1973 as a legal entity with extensive central banking powers to replace the Currency Board that had been constituted in 1965.

A major step forward came in 1975 when the Bahrain Monetary Agency announced its plan to develop a centre in the Arab World for dealing in international liquidity that offered an attractive package to prospective participants in terms of regulatory and fiscal incentives as well as favourable working conditions including free exchange and trade controls. In particular, offshore banking units were exempted from maintaining reserves with the Agency and from observing liquidity ratios. No tax was to be paid on the banks' income, and this exemption continues to be effective up to now {SERTCIC 1990 107 /id}. Furthermore, in 1977 the Bahrain authorities decided to introduce an exempt company (EC) registration, which enabled companies to incorporate in Bahrain without a Bahraini shareholding as long as they did not conduct business in the domestic market.

Referring to the report of {SERTCIC 1990 107 /id}, there was an Arabisation of Bahrain's offshore banking sector when major Arab banks established their headquarters on the island during the 1980s. The number of licensed offshore banking units reached 76 in 1984, but the number had declined to 47 by 1994 in response to the international consolidation trend. In the same year, the Agency introduced a further category of banks to carry out investment business. The number of these investment banks grew from a small number in the 1970s to reach 23 banks in 1994. These banks were allowed to participate in traditional investment or merchant banking business, particularly securities business.

Bahrain's financial sector also includes two specialised banks, namely the Housing Bank and the Bahrain Development Bank. The Housing Bank was established in 1979 as a government entity to support the construction industry in line with the government's policy of providing adequate housing for Bahrain's steadily increasing population. The Bahrain Development Bank, on the other hand, was incorporated in 1991 to enhance business activity and industrialisation in the country {SERTCIC 1990 107 /id}.

According to the report of the {World Trade Organization 2000 176 /id}), Bahrain's financial services, especially offshore banking, are well developed and the Government has continued to pursue reforms to further enhance and strengthen the financial services sector. There are no foreign ownership restrictions for offshore banks, whereas up to 49% of the total equity of a local bank may be held by foreign nationals. The insurance sector, which is regulated and supervised by the Ministry of Commerce, is subject to similar restrictions with regard to foreign investment.

The Bahrain Monetary Agency has successfully introduced and enforced international standards practices in accounting, auditing, prudential regulation, and banking supervision and applies a comprehensive and effective off- and on-site monitoring system of financial institutions, complying in general with the standards set out in the Basle Core Principles for Effective Banking Supervision. The IMF noted that the Bahrain Monetary Agency had achieved full compliance with 24 of the 30 Core Principles of Basle and is largely compliant with another five (4 core and 1 sub-core) Principles. These 29 Principles cover virtually all of the supervisory factors that broadly encompass the fundamentals of a sound supervisory system {World Trade Organization 2000 176 /id}.

The government of Bahrain has identified Islamic banking* as one of the main economic growth areas. Islamic banking is growing rapidly in the region and is attracting investors due to its profit potential in addition to religious factors. Referring to the report of US{US Department of commerce 2001 177 /id}, Bahrain claims to be the hub of the Islamic banking market in the region, 17 out of 30 Islamic banks in the Gulf region are located in Bahrain. In November 1999, Bahrain signed a Memorandum of Understanding with Lubuan, the offshore financial centre in Malaysia and the Jeddah-based Islamic Development Bank to create an International Islamic Money Market. In an effort to create a secure market, the BMA has issued regulations specifically for Islamic banks to prevent and detect institutional weaknesses.

As of the end of 1999, the financial system in Bahrain comprised some 176 financial institutions. These included 19 full commercial banks, 48 offshore banking units, 33 investment banks including 11 Islamic banks, 2 specialized banks, 19 money changers, 36 representative offices of foreign banks and financial institutions, 6 foreign exchange and money brokers, and 13 investment advisory and other financial services {US Department of commerce 2001 177 /id}. The precious metals and commodities market is also active under the regulatory control of the Bahrain Monetary Agency.

3.4.7 Bahrain's capital market

The government of Bahrain established an organised stock market in Manama in 1989 to regulate the listing and trading of securities and to control the members of the market. The objectives of the stock exchange market are to enhance the exchange in a way that serves the country's economic and development policies. Foreign or non-

* Islamic banking has similar principles to conventional banking, with the only exception that they must conform to Islamic law. Islamic finance prohibits charging interest for the use of money and disallows dealing in prohibited commodities. Islamic banking falls under four main categories: Murabha is cost-plus financing--i.e., buying a product from a supplier and selling it to a customer for a profit; Musharaka is a profit sharing system that is similar to equity participation; Ijara involves leasing and Istisna is the financing of construction and manufacturing.

Bahraini companies listed on the BSE must be either joint stock companies or closed companies that have been incorporated at least three years prior to listing, and must have a paid-up capital of at least $US 10 million and have been making net profits from their principal activity three years before listing. Equities, bonds, mutual funds and currency warrants are currently the main listed securities on the exchange {US Department of commerce 2001 177 /id}. Efforts are under way to strengthen the role of the stock exchange in the economy by increasing the number of listed companies, introducing new investment instruments, cross-listing shares at the regional level, and developing automated depository, clearing and settlement procedures.

The BSE's operations became fully automated in 1999, a service that enhanced its regional links and other services. By the end of 1999, there were 41 listed companies, with a market capitalization amounting to around BD 2.7 billion. The exchange is heavily dominated by commercial banks, investment firms, and insurance companies. The top three firms in the market are Investcorp, the Bahrain Telecommunications Company and the Arab Banking Corporation which accounts for about half of the exchange's total capitalization {US Department of commerce 2001 177 /id}.

Overall, the Bahraini financial system has been set up to be a financial centre in the Arab World that plays a major role in attracting oil money and re-investing this in international markets. The participants in the Bahraini market, especially the offshore banking units, are offered attractive packages in terms of regulatory and fiscal incentives. Recently, the Bahraini authorities have introduced various international prudential regulations in line with the Basle supervisory core-principles. In addition, Islamic banking activity developments are well-advanced and are supported by the Bahraini authorities.

To conclude this section, the financial systems of the countries under study have witnessed major developments and reforms, especially over the last decade. These developments include the liberalisation of interest rates, the adoption of policies aimed at strengthening the financial capital of the banking and financial system, the introduction of prudential regulations in accordance with international standards and the modernization of stock markets aimed at providing a wider role in mobilising financial assets. These reforms have been aimed at improving the competitive advantage of the respective financial systems and enhancing the efficiency of the financial institutions operating in these countries.

3.5 Changes in the financial structure of Jordan, Egypt, Saudi Arabia and Bahrain

This section reviews the changes in the financial structure of the countries under study over the last decade. It outlines the developments in the relative importance of the banks in the respective financial systems, the level of market concentration, market shares of top banks, and the growth of the financial assets of the banking systems* under study.

Table 3-7 shows that the commercial banks in Jordan, Egypt, Saudi and Bahrain dominate other financial institutions, and their shares in the financial market have not changed significantly over the last decade. The next important type of financial institutions in the four countries are the central banks, their share of the countries financial assets ranged from about 2 percent in Bahrain to around 39 percent in Saudi Arabia (table 3.17 in the appendix shows the details). On this basis, the commercial banks are clearly the most important constituents of the financial system in these countries.

* The financial system includes different types of local financial institutions (commercial, investment, Islamic and other specialised financial institutions) but excludes the operations of foreign bank branches.

Table 3-7 The share of commercial banks of total assets, loans and deposits in Jordan, Egypt, Saudi Arabia and Bahrain (Average 1992-2000) (%)

Country	Total Assets	Total Loans	Total Customer deposits
Jordan	75	88	90
Egypt	62	85	90
Saudi Arabia	58	94	96
Bahrain	85	95	93

Source: Adapted from tables 3-17-3.19 in the appendix.

A commonly used measure of market structure is the n-firm concentration ratio (see Goddard et al., 2001). Concentration is usually defined as the extent to which the total assets, sources of funds (mainly customers' deposits) or loans are controlled by the largest institutions in the financial market, or how these funds are distributed among various financial institutions. Based on these measures, table 3-8 shows that the banking systems of the countries under study, especially those of Jordan and Bahrain, are rather concentrated markets. Market concentration becomes more noticeable if we look at the 5-firm concentration ratio (see tables 3.20-3.23 in the appendix).

Table 3-8: The 3-firm concentration in the financial sectors of Jordan, Egypt, Saudi Arabia and Bahrain (Average 1992-2000) (%)

Country	Total Assets	Total Loans	Total Customer Deposits
Jordan	79	82	78
Egypt	52	48	54
Saudi Arabia	49	47	50
Bahrain	78	84	83

Source: Adapted from tables 3-20 to 3-23 in the Appendix. Note, these ratios exclude the financial items of the respective central banks (and those of foreign banks' branches).

Table 3.9 also shows that financial sector concentration did not fall substantially between 1992 and 2000.

Table 3-9: The 3-firm concentration ratio (in terms of total assets; nominal values) in the financial sectors of Jordan, Egypt, Saudi Arabia and Bahrain over 1992-2000 (%)

Year	Jordan	Egypt	Saudi Arabia	Bahrain
1992	82	56	50	80
1993	80	56	49	78
1994	80	54	49	79
1995	79	52	48	80
1996	80	50	47	80
1997	78	50	48	79
1998	78	50	48	79
1999	78	49	54	72
2000	77	50	53	73

Source: Adapted from the detailed tables 3-20 to 3-23 in the appendix.

To illustrate the growth features of the respective countries financial systems, we evaluate changes in the consolidated balance sheet of the banking systems over the period 1992-2000. In particular, we analyse: total assets and asset quality, capital adequacy, profitability and other financial indicators (growth details of these indicators are shown in the appendix to this chapter). These items help to illustrate the growth of financial intermediation and provide an overview of the change in the soundness and performance of the banking systems over the last decade.

Table 3-10 shows that the banking sectors in the four countries under study witnessed considerable growth in the size of their assets, deposits, equity and loans (in terms of nominal values) during the 1990s. However, there were significant increases in the size of problem loans and loan loss reserves in these countries, this perhaps was attributed mainly to the change in classification of the debts according to international standards. The favourable growth in the size of equity, especially in Jordan and Egypt, outlines the move to strengthen the financial position of the banking sector in these countries.

Table 3-10: Average annual growth (%) of the main banking sector indicators (nominal values) for Jordan, Egypt, Saudi Arabia and Bahrain over 1992-2000

Country	Jordan	Egypt	Saudi Arabia	Bahrain
Asset Quality Indicators				
Total Assets	18.00	10.00	2.00	9.00
Loans (net)	14.00	20.00	6.00	6.00
Problem loans	15613.00	-13.00	688.00	216.00
Loan loss reserves	90.00	107.00	-	-6.00
Capital Adequacy Indicators				
Total Equity	25.00	23.00	7.00	10.00
Profitability Indicators				
Net Interest Revenue	6.79	65.34	21.30	14.91
Net income	8.87	54.17	10.42	15.29
Average Return on Assets	-2.59	13.92	-11.78	6.84
Average Return on Equity	-2.53	13.32	-9.07	0.67
Other Indicators				
Customer Deposits	15.00	18.00	5.00	7.00
Off-balance sheet items	-5.32	17.41	14.94	-4.78

Source: Adapted from table 3.24-3.34 in the appendix.

Concerning the profitability indicators, represented by net interest revenue, net income, return on average assets and return on average equity, most of these indicators, especially in Egypt, witnessed favourable progress during the 1990s despite the differences between the individual countries (see table 3.9).

In general, there has been positive progress in the financial structure indicators of the countries under study over the last decade, which reflects greater financial intermediation and a more sound financial position for the financial system. The profitability indicators also indicate improvements that reflect the ability of banks to better utilise their assets and improve their competitive advantage.

Table 3.11 shows the distribution of credit by the banking systems of the four countries during the 1990s. It can be seen that slightly less than half of the credit facilities granted by Jordanian banks are granted to the trade sector, and the shares of the other economic sectors remain relatively stable during the 1990s. In Egypt more than one third of banking credit facilities were granted to the industrial sector in the early 1990s although this has declined at the expense of the trade sector throughout the decade.

In Saudi Arabia, extension of credit is more evenly distributed. The share of the four major sectors in Saudi Arabia (trade, construction, industry and government) averaged about 54 percent of the total credit but with some changes in shares in individual sectors over the last decade. In Bahrain, credit facilities granted by the banking sector were distributed to the four major sectors of the economy and the shares of these sectors did not witness significant changes during the 1990s (see table 3.11).

Table 3-11: Distribution of credit to economic sectors in Jordan, Egypt, Saudi Arabia and Bahrain

Jordan	Trade %	Industry %	Construction %		Others %	Total (JD, mil.)
1994	45	13	21		21	3250
1995	46	13	20		18	3710
1996	46	13	20		20	3920
1997	47	13	19		21	3980
1998	46	14	18		22	4290
1999	46	15	17		21	4470
Average	46	14	19		21	3,940
Egypt	Trade %	Industry %	Households %	Services %	Agriculture %	Average (LE, mil.)
1989/90-90/91	15	53	7	23	3	2,340
1992/93-94/95	29	28	23	19	1	8,270
1995/96-96/97	34	27	12	24	3	12,510
Average	26	36	14	22	2	7,710
Saudi Arabia	Trade %	Industry %	Construction %	Govt. & Quasi Gov. %	Others %	Total (SR, mil.)
1990	22	8	16	0	54	67,100
1992	19	7	11	0	64	107,900
1995	25	9	10	18	38	137,900
1997	25	10	11	14	41	149,200
1998	26	12	11	13	38	178,800
1999	23	14	12	9	42	166,300
Average	23	10	12	9	46	134,530
Bahrain	Trade %	Industry %	Construction %	Personal %	Others %	Total (BD, mil.)
1992	17	17	16	29	21	630
1995	20	20	14	32	15	660
1997	20	14	16	31	19	940
1998	20	15	13	35	17	1,080
Average	22	16	12	35	15	1,170

Source: Central banks and monetary authorities in the respective countries.

This section shows that commercial banks dominate the financial systems of Jordan, Egypt, Saudi Arabia and Bahrain, ranging from 60 percent of total financial sector assets in Saudi Arabia to 85 percent in Bahrain. Furthermore, market structures are quite concentrated with the largest three banks accounts for 49 percent of Saudi Arabian and 79 percent of Jordanian banking sector assets over 1992-2000. The other main financial indicators, discussed earlier, suggest that all the countries under study have experienced improvements in financial intermediation and bank performance reflecting the positive impact of economic and financial reforms undertaken in these countries.

3.6 Preliminary appraisal of the financial reforms on banks' performance of the countries under study

This section presents an initial assessment of the impact of economic and financial reforms on the financial depth of the countries under study; Jordan, Egypt, Saudi Arabia and Bahrain. Such a preliminary evaluation might suggest the impact on efficiency levels of the financial systems in these countries.

The relationship between economic growth and the development in financial intermediation has been subject to substantial academic attention. Studies attempt to address whether economic growth enhances the process of financial intermediation. Meltzer (1998) refers to an early study of Bagehot (1873) who argued that financial intermediation was critical for the rapid industrialisation of England in the early nineteenth century and stressed the importance of financial intermediation in pooling funds, that were sufficiently large to fund risky and large-scale projects.

Goldsmith (1969) argued that financial superstructure accelerates economic growth and improves economic performance as it facilitates the migration of funds to the best users. Thus, economic and financial reforms might promote the growth of the financial system, and financial developments can be traced by linking the relationship between infrastructure and superstructure. Furthermore, changes in a country's financial structure can be noted by reviewing the sequence in which different types of financial institutions have appeared over time, and the relative importance of different financial instruments in the balance sheets of financial institutions.

Financial infrastructure is usually measured by national wealth and national product while financial superstructure is described by the presence, nature and relative size of financial instruments and financial institutions. The quantitative aspects of financial structure include the distribution of total financial assets and liabilities among financial institutions and non-financial economic units. In particular, change in the ratio of the financial assets of the financial sector to the total volume of total financial assets outstanding may reflect the institutionalisation of the process of savings and investment. Similarly, changes in the distribution of the total financial assets of financial institutions reveal the changes in the role of the banking system in the process of promoting saving (Al-Sahlawi, 1997).

Goldsmith (1969) analyses data from thirty-five countries over the period 1860 to 1963 and finds that financial growth and economic development are positively correlated over periods for several decades. He measured financial development by the financial intermediation ratio (the ratio of financial intermediary assets divided by gross national product). This indicator used also to capture the financial intermediaries' role in overcoming frictions and enhancing growth through quality enhancement (to the extent that these assets measure the provision of credit to firms as opposed to households and government, as the former, are argued to be more efficient in utilising financial assets). However, Goldsmith wonders whether financial development leads to economic growth or vice versa.

King and Levine (1992, 1993a,b) consider financial development over various periods starting in 1960 for a comprehensive cross section of countries. They expand the set of financial development measures to capture the various services provided by financial intermediaries. One measure approximates the liquidity-providing role of financial intermediaries through liquid liabilities (currency plus demand and interest-bearing deposits, or M2) as a percentage of a country's GDP. Another measure is the ratio of credit provision to private firms to GDP (to capture monitoring, screening and control activities as well as the pooling of funds and diversification of risks). The first measure approximates the intermediaries' role in overcoming technological frictions, while the second approximates their role in overcoming incentive frictions. King and Levine (ibid.) find that these measures are positively correlated with real GDP growth rates, even after controlling for initial conditions, government spending, inflation, political stability and some other policy measures. They also show that subsequent growth rates are positively correlated with initial liquidity ratios. This finding may suggest that financial development causes growth.

The following presents a similar set of economic and financial indicators to analyse the impact of financial and economic reforms on the financial systems under study over the last decade. These indicators were grouped into four categories based on their similarities in signalling the impact of reforms (see table 3.12).

Table 3-12: Summary of financial deepening ratios utilised in this study *

Currency Ratios	Include currency outside banks as % of money supply (M1) and as % of broader money supply (M2). When the ratios rise at the early stages of development, the real economy is expected to grow due to monetization (because of the safety of holding currency instead of tangible assets). However, these ratios are expected to decline as more financial instruments are created by financial institutions with more attractive attributes
Monetary Ratios	Include narrow money supply (M1), broader money supply (M2), demand deposits, time and saving deposits, and total deposits as a percentage of GDP. These ratios capture the evolution of the financial system. These ratios are also used as an indication of the velocities of circulation. The ratios increase gradually as the financial system and economy develop and progress ahead. Furthermore, the general increase in these ratios reflects higher confidence in the financial system.
Financial Ratios	Include the ratios of total financial system assets and the commercial banks' total assets as a percent of GDP; and the ratio of commercial banks' assets as percent of total financial assets. The first two ratios are used to measure the importance of the financial institutions in the financing process, while the last ratio reflects the importance of the banking system relative to the rest of the financial system.
% of credit to private sector	Total credit of the private sector as a percent of total credit of the financial system. The volume of credit to the private sector is used as a proxy to examine whether reforms have actually led to a more efficient allocation of credit, because it is assumed that the private sector uses resources more efficiently than the public sector.

Referring to table 3-13, the currency ratios in the four countries under study showed some decreases especially in Saudi Arabia and Bahrain over 1990-99. This suggests that the financial systems in these countries are not in the early stages of financial

* In addition to the studies referred to in this section, some or all of these indicators are utilised in previous PhD theses that have studied similar areas including those of Al-Sahlawi, 1997; Taher (1999) and Intarachote (2000).

development and these financial systems already provided various attractive financial instruments for savers and investors than merely holding funds at financial institutions. In the previous chapter, we noted that the central banks in Jordan, Egypt and Saudi Arabia introduced during 1990s various financial instruments aimed at motivating the public to invest directly and indirectly in these instruments. Moreover, in Jordan and Egypt, the central banks have introduced regular Treasury bill (TB) auctions leading to a steep rise in TB rates, sometimes surpassing time deposit rates, and this is likely to have led some larger depositors to substitute TBs for time deposits.

Table 3-13: Currency ratios in Jordan, Egypt, Saudi Arabia and Bahrain over 1990-99

%	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Jordan										
Currency outside banks/M1	70	62	58	61	61	60	62	60	59	62
Currency outside banks/M2	32	27	24	23	22	20	18	18	16	16
Egypt										
Currency outside banks/M1	68	68	68	69	102	68	67	67	69	71
Currency outside banks/M2	15	14	13	14	14	14	14	14	14	14
Saudi Arabia										
Currency outside banks/M1	44	37	35	35	36	35	32	32	32	35
Currency outside banks/M2	24	21	20	19	12	11	10	10	16	18
Bahrain										
Currency outside banks/M1	41	32	28	28	31	31	31	30	26	27
Currency outside banks/M2	11	9	8	8	8	7	7	6	5	6

Source: Adapted from Arab Monetary Fund, 2002.

On the other hand, monetary ratios, which measure the velocity of currency circulation (M1 and M2 as percent of GDP), have shown little movement over the last decade (table 3.14). The other monetary ratios (deposit ratios as a percent of GDP) suggest some increases in Jordan, Saudi Arabia and Bahrain, indicating an increase in financial deepness in these countries.

Table 3-14: Monetary ratios in Jordan, Egypt, Saudi Arabia and Bahrain over 1990-99

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Jordan										
M1/GDP	54	57	48	44	41	38	33	33	31	34
M2/GDP	117	131	118	114	114	112	110	113	116	127
Demand dep./GDP	16	21	20	17	16	15	12	13	13	13
Time and Saving dep. /GDP	63	75	70	70	73	74	77	80	85	94
Egypt										
M1/GDP	25	17	16	16	11	16	16	16	16	16
M2/GDP	114	85	82	82	83	78	78	79	79	80
Demand dep./GDP	8	5	5	5	5	5	5	5	5	5
Time and Saving dep. /GDP	88	67	66	66	66	61	62	62	63	64
Saudi Arabia										
M1/GDP	26	27	27	27	28	26	25	26	29	30
M2/GDP	48	49	47	51	87	81	79	83	59	58
Demand dep./GDP	15	17	18	18	18	17	17	17	20	19
Time and Saving dep. /GDP	22	22	20	24	24	24	24	24	29	28
Bahrain										
M1/GDP	15	18	20	19	16	15	15	15	16	17
M2/GDP	55	66	67	65	64	66	65	67	81	79
Demand dep./GDP	9	12	14	13	11	10	10	10	12	13
Time and Saving dep. /GDP	39	49	48	46	48	51	50	53	65	61

Source: Adapted from Arab Monetary Fund, 2002.

Alternatively, commercial banks' assets as a percent of GDP increased in Jordan, Saudi Arabia and Bahrain during the 1990s (table 3.15 shows the details). The other financial ratios which measure the assets of commercial banks as a percent of financial system assets has also indicated noticeable increases in the four countries over the 1990-99 period. Taken together, these indicators suggest a growing role for financial institutions in the financing process and a wider role for commercial banks relative to the rest of players in these financial systems.

Table 3-15: Financial ratios for Jordan, Egypt, Saudi Arabia and Bahrain over 1990-99

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Jordan										
Total financial assets/GDP	141	154	135	131	133	134	134	139	148	144
Commercial Banks assets/GDP	153	198	178	172	177	183	188	196	202	218
Commercial Banks assets/T. assets	109	129	132	131	133	136	140	141	136	152
Egypt										
Total financial assets/GDP	126	102	99	99	101	96	98	97	98	100
Commercial Banks assets/GDP	138	110	104	100	100	95	96	96	94	93
Commercial Banks assets/T. assets	110	108	106	102	100	99	98	98	96	93
Saudi Arabia										
Total financial assets/GDP	105	93	86	89	89	83	80	83	9	31
Commercial Banks assets/GDP	59	58	60	72	74	71	68	70	84	80
Commercial Banks assets/T. assets	56	63	70	81	83	86	84	84	924	258
Bahrain										
Total financial assets/GDP	65	70	77	75	70	75	71	72	86	81
Commercial Banks assets/GDP	110	116	115	116	125	119	117	131	141	150
Commercial Banks assets/T. assets	168	165	149	155	180	159	165	182	164	186

Source: Adapted from Arab Monetary Fund, 2002.

Concerning the growth of credit to the private sector, table 3.16 shows that lending to the private sector as a proportion of total credit (and as a percent of GDP) has increased in the four countries. This suggests that the financial institutions are more efficient in employing their sources of funds, as the private sector is assumed to be more efficient than the public sector. Furthermore, such ratios capture the efficiency of financial intermediaries in monitoring, screening and controlling for credit risks.

Overall, all utilised financial development ratios suggest that the financial systems under study have deepened during the 1990s. It is also clear that banks operating in these countries play a major role in mobilising financial assets and directing investment to supposedly efficient uses.

Table 3-16: Growth of credit to the private sector in Jordan, Egypt, Saudi Arabia and Bahrain (US$, millions) over the last decade

	Credit to Private Sector	Total Credit	GDP (current prices)	Credit to private /T. credit	Credit to private /T. GDP
Jordan					
1990	2.487	4.219	4.021	59	62
1991	2.673	3.939	4.194	68	64
1992	2.933	4.430	5.139	66	57
1993	3.290	4.957	5.570	66	59
1994	3.951	5.633	6.078	70	65
1995	4.514	6.166	6.508	73	69
1996	4.743	6.298	6.645	75	71
1997	4.986	6.474	6.976	77	71
1998	5.462	7.473	7.306	73	75
1999	5.729	6.496	7.465	88	77
Egypt					
1990	14.701	36.302	35.489	40	41
1991	9.080	30.235	34.228	30	27
1992	10.913	31.617	41.755	35	26
1993	12.823	33.245	46.896	39	27
1994	16.575	37.629	51.661	44	32
1995	22.287	43.835	60.457	51	37
1996	28.080	50.432	67.305	56	42
1997	35.204	59.604	75.617	59	47
1998	44.676	70.522	82.710	63	54
1999	53.029	81.812	88.964	65	60
Saudi Arabia					
1990	17.437	10.254	104.671	170	17
1991	19.653	11.535	118.034	170	17
1992	22.991	28.491	123.204	81	19
1993	27.210	33.511	118.516	81	23
1994	30.227	41.282	120.167	73	25
1995	32.363	43.605	127.811	74	25
1996	33.004	42.724	141.322	77	23
1997	35.701	50.547	146.494	71	24
1998	42.911	60.053	128.377	71	33
1999	43.311	43.000	139.206	101	31
Bahrain					
1990	1.283	-23	4.529		28
1991	1.628	511	4.616	319	35
1992	1.799	1.147	4.751	157	38
1993	2.177	1.316	5.201	165	42
1994	2.434	1.374	5.566	177	44
1995	2.521	1.620	5.849	156	43
1996	2.539	1.499	6.102	169	42
1997	2.857	1.811	6.349	158	45
1998	3.096	2.234	6.184	139	50
1999	3.464	2.848	6.621	122	52

Sources: Adapted from Arab Monetary Fund, 2002.

Other factors that may have contributed to promoting financial deepness in the countries under study include the globalisation of financial services that one would expect to increase competition and lead to improvements in the quality of financial services provision. A number of innovations have occurred, new products have been introduced, such as credit and debit cards, automated teller machines, interest bearing current accounts and cheque clearing has been speeded up. Competition for deposits has been broadened in urban areas with anecdated evidence of increases in both price and non-price competition. Other feature that can explain the improvement in financial sector developments in Saudi Arabia and Bahrain (in particular) is the greater macroeconomic stability in these two countries.

3.7 Conclusion

This chapter reviews the main features of the financial systems under study; Jordan, Egypt, Saudi Arabia and Bahrain. In general, these countries have experienced various financial reforms aimed at liberalising their financial systems. Jordan and Egypt, in particular, have witnessed major financial reforms over the last decade, aimed at replacing financial repression and excessive regulation with a more competitive environment. The reforms procedures in the four countries have included improving bank capitalisation in accordance with Basle standards and introducing new prudential guidelines. Apart from Saudi Arabia, stock markets have been upgraded and they have begun to play a wider role in financing various economic sectors within their respective countries.

Despite the appearance of new financial institutions in the four countries, commercial banks still dominate the financial systems, where their share of the financial assets ranged from about 58 percent in Saudi to about 85 percent in Bahrain during 1992-2000. However, the market share of commercial banks has not grown during the 1990s. In addition, the banking systems of Jordan, Egypt, Saudi Arabia and Bahrain are quite concentrated where the share of the largest three institutions of the financial systems total assets ranged from about 49 percent in Saudi to about 79 percent in Jordan over 1992-2000.

The banks in the countries under study also showed favourable growth in terms of their asset quality, capital adequacy and profitability during the 1990s. Such indicators reflect an enhanced role for financial intermediaries in the process of economic growth and exhibit the positive impact of economic and financial reforms undertaken in these countries. Furthermore, financial systems have deepened in these countries and the proportion of credit allocated to the private sector as a percent of GDP has increased in the four countries, suggesting that the financial institutions are more efficient in allocating the financial resources to the most efficient users.

Taken together, this suggests that the efficiency of the financial and banking systems under study is likely to have improved during the 1990s. Although it is difficult to say specifically whether this improvement is a result of reforms in the general macroeconomic environment, perhaps one can at least suggest that the reform process has had some positive influence. The aim of the remaining chapters is to empirically investigate the efficiency of the respective banking systems in order to see if we can corroborate the above general observations.

Appendix to Chapter 3

Table 3-17: Distribution of financial assets to financial institutions in Jordan, Egypt, Saudi Arabia and Bahrain (%) over 1992-2000

Specialisation	1992	1993	1994	1995	1996	1997	1998	1999	2000	Average
Jordan										
Central Bank	0	20	20	19	18	18	16	17	17	16
Commercial Bank	89	70	71	73	74	74	76	75	75	75
Investment/Securities Bank	6	5	4	4	4	4	4	4	4	4
Islamic Bank	4	4	4	4	3	3	3	3	3	4
Others	1	1	1	1	1	1	1	1	1	1
Total (US $, millions)	14,850	19,780	21,820	24,240	26,330	28,490	30,120	32,930	36,710	26,140
Egypt										
Central Bank	35	40	39	0	36	33	32	31	31	31
Commercial Bank	60	55	55	88	57	59	60	60	60	62
Investment/Securities Bank	1	1	1	2	1	2	2	2	1	1
Islamic Bank	3	2	2	3	2	2	2	2	2	2
Others	2	2	3	6	4	4	4	6	6	4
Total (US $, millions)	75,560	88,610	93,260	64,300	107,420	117,840	123,610	131,300	137,460	104,370
Saudi Arabia										
Central Bank	45	41	39	38	39	39	35	40	29	39
Commercial Bank	53	56	58	59	57	57	60	56	67	58
Investment/Securities Bank	1	1	1	1	2	2	2	2	2	2
Others	1	1	2	2	2	2	2	2	2	2
Total (US $, millions)	147,690	148,270	148,150	153,740	162,400	172,980	174,130	191,280	174,880	163,720
Bahrain										
Central Bank	0	3	3	3	3	3	3	3	3	2
Commercial Bank	88	83	85	85	86	85	85	82	84	85
Investment/Securities Bank	10	11	10	9	9	10	10	11	10	10
Islamic Bank	1	2	3	2	2	2	2	3	3	2
Others	1	1	1	0	0	0	0	0	0	1
Total (US $, millions)	34,540	36,550	38,560	41,520	43,970	46,480	50,110	55,550	58,810	45,120

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions.

Table 3-18: Distribution of customer deposits to financial institutions in Jordan, Egypt, Saudi Arabia and Bahrain (%) over 1992-2000

Specialisation (General)	1992	1993	1994	1995	1996	1997	1998	1999	2000	Average
Jordan										
Commercial Bank	90	89	90	90	91	91	91	91	90	90
Investment/Securities Bank	6	6	5	5	5	5	5	5	5	5
Islamic Bank	4	5	5	4	4	4	4	4	4	4
Others	1	1	1	0	0	0	0	0	0	0
Total (US $, millions)	13,627	16,340	17,466	19,493	21,438	23,015	24,173	26,362	29,446	21,260
Egypt										
Commercial Bank	92	92	91	89	91	91	90	88	88	90
Investment/Securities Bank	1	2	2	2	2	2	2	2	2	2
Islamic Bank	4	3	3	3	3	2	3	3	3	3
Others	3	3	4	6	4	4	4	7	7	5
Total (US $, millions)	40,371	60,745	63,487	53,795	74,458	84,122	88,555	93,514	99,501	73,170
Saudi Arabia										
Commercial Bank	97	96	96	96	95	95	95	95	95	96
Investment/Securities Bank	2	2	2	2	3	3	3	3	3	2
Others	1	1	2	2	2	2	2	2	2	2
Total (US $, millions)	84,569	91,176	92,605	97,074	100,305	107,590	114,889	112,245	120,741	102,360
Bahrain										
Commercial Bank	94	92	92	94	94	93	94	91	92	93
Investment/Securities Bank	6	6	6	4	5	5	5	6	5	5
Islamic Bank	0	2	2	2	2	2	2	3	4	2
Others	0	0	0	0	0	0	0	0	0	0
Total (US $, millions)	28,169	28,340	30,346	32,141	33,528	35,274	38,858	42,270	43,997	34,770

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions.

Table 3-19: Distribution of customer loans to financial institutions in Jordan, Egypt, Saudi Arabia and Bahrain (%) over 1992-2000

Specialisation (General)	1992	1993	1994	1995	1996	1997	1998	1999	2000	Average
Jordan										
Commercial Bank	88	85	87	88	88	89	90	90	90	88
Investment/Securities Bank	5	6	4	4	4	3	3	4	4	4
Islamic Bank	6	7	7	7	7	6	5	5	5	6
Others	2	2	2	2	2	2	2	2	1	2
Total (US $, millions)	5,649	6,541	7,606	8,837	9,715	10,702	11,442	11,676	12,149	9,370
Egypt										
Commercial Bank	85	88	86	84	85	85	85	83	83	85
Investment/Securities Bank	1	1	2	3	3	3	3	3	2	2
Islamic Bank	8	6	5	5	5	4	4	4	4	5
Others	6	5	7	8	8	8	8	11	11	8
Total (US $, millions)	25,578	27,000	29,314	28,652	38,549	43,188	48,150	59,319	66,359	40,680
Saudi Arabia										
Commercial Bank	95	95	96	95	94	93	93	93	92	94
Investment/Securities Bank	2	2	2	2	3	3	3	4	4	3
Others	3	2	2	2	3	4	3	3	4	3
Total (US $, millions)	32,318	36,280	39,738	41,162	39,515	44,517	49,918	47,529	48,287	42,140
Bahrain										
Commercial Bank	94	93	95	95	96	96	96	95	95	95
Investment/Securities Bank	5	4	2	2	1	1	1	1	1	2
Islamic Bank	1	3	3	3	3	3	3	4	4	3
Others	0	0	0	0	0	0	0	0	0	0
Total (US $, millions)	16,625	16,028	16,908	17,159	17,980	19,124	21,109	23,128	24,379	19,160

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions.

Table 3-20: Concentration ratios in Jordanian's banking sector over 1992-2000 (Totals in US$, million)

Year	Bank Name	Total Assets	Total Loans (net)	Customer Deposits
1992	**Total**	**14,845**	**5,649**	**13,627**
	Largest 1	68	67	72
	Largest 3	82	83	83
	Largest 5	88	89	89
1993	**Total**	**15,836**	**6,206**	**14,034**
	Largest 1	67	61	75
	Largest 3	80	84	78
	Largest 5	86	89	85
1994	**Total**	**17,376**	**7,266**	**14,842**
	Largest 1	67	62	61
	Largest 3	80	76	79
	Largest 5	87	84	86
1995	**Total**	**19,606**	**8,491**	**16,716**
	Largest 1	67	62	62
	Largest 3	79	74	79
	Largest 5	87	87	86
1996	**Total**	**21,513**	**9,383**	**18,335**
	Largest 1	68	76	63
	Largest 3	80	87	76
	Largest 5	87	92	86
1997	**Total**	**23,276**	**10,370**	**19,470**
	Largest 1	65	71	64
	Largest 3	78	84	76
	Largest 5	87	88	87
1998	**Total**	**25,351**	**11,116**	**21,015**
	Largest 1	65	71	63
	Largest 3	78	84	75
	Largest 5	86	88	86
1999	**Total**	27,393	11,303	22,612
	Largest 1	65	71	63
	Largest 3	78	82	76
	Largest 5	86	89	85
2000	**Total**	**30,475**	**11,496**	**25,212**
	Largest 1	64	70	62
	Largest 3	77	81	75
	Largest 5	85	88	84

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions and excludes the share of the central banks.

Table 3-21: Concentration ratios in Egyptian's banking sector over 1992-2000 (Totals in US$, million)

Year	Bank Name	Total Assets	Total Loans (net)	Customer Deposits
1992	**Total**	**49,184**	**16,846**	**40,371**
	Largest 1	27	20	28
	Largest 3	56	43	58
	Largest 5	71	63	71
1993	**Total**	**53,085**	**20,408**	**44,757**
	Largest 1	25	25	24
	Largest 3	56	54	57
	Largest 5	68	64	69
1994	**Total**	**56,652**	**23,533**	**47,617**
	Largest 1	22	23	22
	Largest 3	54	53	55
	Largest 5	67	64	67
1995	**Total**	**64,304**	**28,652**	**53,795**
	Largest 1	22	23	21
	Largest 3	52	50	53
	Largest 5	65	61	66
1996	**Total**	**69,167**	**33,185**	**59,486**
	Largest 1	21	20	21
	Largest 3	50	48	52
	Largest 5	63	61	65
1997	**Total**	**78,687**	**38,437**	**66,712**
	Largest 1	20	20	21
	Largest 3	50	46	52
	Largest 5	62	59	65
1998	**Total**	**83,972**	**42,315**	**71,255**
	Largest 1	21	20	21
	Largest 3	50	44	52
	Largest 5	62	57	64
1999	**Total**	**91,044**	**50,633**	**76,730**
	Largest 1	21	20	21
	Largest 3	49	44	51
	Largest 5	60	57	62
2000	**Total**	**95,092**	**53,446**	**81,016**
	Largest 1	23	23	23
	Largest 3	50	48	52
	Largest 5	61	60	63

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions and excludes the share of the central banks.

Table 3-22: Concentration ratios in Saudi's banking sector over 1992-2000 (Totals in US$, million)

Year	Bank Name	Total Assets	Total Loans (net)	Customer Deposits
1992	**Total**	**81,063**	**32,318**	**69,883**
	Largest 1	21	21	21
	Largest 3	50	43	50
	Largest 5	68	69	68
1993	**Total**	**86,747**	**36,280**	**74,487**
	Largest 1	20	20	21
	Largest 3	49	42	49
	Largest 5	67	68	68
1994	**Total**	**90,210**	**39,738**	**77,091**
	Largest 1	20	22	21
	Largest 3	49	46	50
	Largest 5	67	70	67
1995	**Total**	**94,595**	**41,162**	**80,278**
	Largest 1	21	26	22
	Largest 3	48	48	49
	Largest 5	66	71	66
1996	**Total**	**98,800**	**39,515**	**83,269**
	Largest 1	21	26	22
	Largest 3	47	46	48
	Largest 5	65	70	65
1997	**Total**	**105,823**	**44,517**	**89,593**
	Largest 1	22	28	23
	Largest 3	48	47	48
	Largest 5	65	71	66
1998	**Total**	**112,315**	**49,918**	**95,156**
	Largest 1	22	28	23
	Largest 3	48	49	49
	Largest 5	66	65	67
1999	**Total**	**114,534**	**47,529**	**97,372**
	Largest 1	21	21	22
	Largest 3	54	50	55
	Largest 5	73	71	73
2000	**Total**	**124,308**	**48,287**	**105,067**
	Largest 1	21	21	23
	Largest 3	53	50	54
	Largest 5	72	69	73

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions and excludes the share of the central banks.

Table 3-23: Concentration ratios in Bahrain's banking sector over 1992-2000 (Totals in US$, million)

Year	Bank Name	Total Assets	Total Loans (net)	Customer Deposits
1992	**Total**	**34,536**	**16,625**	**28,169**
	Largest 1	56	63	59
	Largest 3	80	85	85
	Largest 5	88	91	91
1993	**Total**	**35,480**	**16,028**	**28,168**
	Largest 1	52	61	55
	Largest 3	78	83	84
	Largest 5	86	88	90
1994	**Total**	**37,518**	**16,908**	**30,194**
	Largest 1	52	62	54
	Largest 3	79	85	84
	Largest 5	87	90	90
1995	**Total**	**40,255**	**17,159**	**31,827**
	Largest 1	53	62	56
	Largest 3	80	84	85
	Largest 5	89	90	92
1996	**Total**	**42,760**	**17,980**	**33,290**
	Largest 1	54	63	57
	Largest 3	80	85	86
	Largest 5	89	91	92
1997	**Total**	**45,144**	**19,124**	**34,975**
	Largest 1	52	63	56
	Largest 3	79	85	85
	Largest 5	88	91	92
1998	**Total**	**48,856**	**21,109**	**38,673**
	Largest 1	53	62	58
	Largest 3	79	87	85
	Largest 5	89	91	91
1999	**Total**	**54,057**	**23,128**	**41,986**
	Largest 1	45	56	49
	Largest 3	72	80	76
	Largest 5	82	86	84
2000	**Total**	**57,278**	**24,379**	**43,702**
	Largest 1	47	58	50
	Largest 3	73	81	78
	Largest 5	83	86	84

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions and excludes the share of the central banks.

Table 3-24: Financial assets of the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain (US$ million, 1992-2000)

Year	Bahrain	Egypt	Jordan	Saudi Arabia	Total
1992	34,540	75,560	14,850	147,690	272,630
1993	36,550	88,610	19,780	148,270	293,210
1994	38,560	93,260	21,820	148,150	301,800
1995	41,520	64,300	24,240	153,740	283,810
1996	43,970	107,420	26,330	162,400	340,130
1997	46,480	117,840	28,490	172,980	365,790
1998	50,110	123,610	30,120	174,130	377,980
1999	55,550	131,300	32,930	191,280	411,050
2000	58,810	137,460	36,710	174,880	407,860
Avg. Annual growth %	9	10	18	2	6
Total	406,090	939,370	235,270	1,473,520	3,054,260
No. of banks	27	45	18	16	106

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions and excludes the share of the central banks.

Table 3-25: Customer loans of the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain (US$ million, 1992-2000)

Year	Bahrain	Egypt	Jordan	Saudi Arabia	Total
1992	16,630	25,580	5,650	32,320	80,170
1993	16,030	27,000	6,540	36,280	85,850
1994	16,910	29,310	7,610	39,740	93,570
1995	17,160	28,650	8,840	41,160	95,810
1996	17,980	38,550	9,720	39,520	105,760
1997	19,120	43,190	10,700	44,520	117,530
1998	21,110	48,150	11,440	49,920	130,620
1999	23,130	59,320	11,680	47,530	141,650
2000	24,380	66,360	12,150	48,290	151,170
Avg. Annual growth %	6	20	14	6	11
Total	172,440	366,110	84,320	379,260	1,002,130
No. of banks	27	45	18	16	106

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions and excludes the share of the central banks.

Table 3-26: Problem loans of the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain (US$ million, 1992-2000)

Year	Bahrain	Egypt	Jordan	Saudi Arabia	Total
1992	40	30	1	80	150
1993	50	30	20	70	170
1994	1,220	0	420	3,730	5,380
1995	1,410	0	510	4,300	6,220
1996	2,010	0	630	4,940	7,570
1997	1,680	0	750	4,970	7,400
1998	2,070	0	830	2,170	5,070
1999	1,470	0	1,120	4,760	7,350
2000	730	0	1,250	4,480	6,450
Avg. Annual growth %	216	-13	15,613	688	525
Total	10,680	60	5,520	29,500	45,770
No. of banks	27	45	18	16	106

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions and excludes the share of the central banks.

Table 3-27: Loan-loss reserves of the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain (US$ million, 1992-2000)

Year	Bahrain	Egypt	Jordan	Saudi Arabia	Total
1992	2,150	580	100		2,830
1993	2,430	970	250		3,640
1994	2,120	990	520		3,620
1995	2,100	1,150	520		3,770
1996	2,000	3,000	540		5,540
1997	1,910	4,160	590		6,660
1998	2,140	4,610	700		7,440
1999	1,430	5,020	820		7,260
2000	1,050	5,560	820		7,430
Avg. Annual growth %	-6	107	90		20
Total	17,320	26,020	4,860		48,200
No. of banks	27	45	18	16	106

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions and excludes the share of the central banks.

Table 3-28: Net income of the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain (US$ million, 1992-2000)

Year	Bahrain	Egypt	Jordan	Saudi Arabia	Total
1992	310	150	120	1,120	1,700
1993	540	220	160	1,270	2,200
1994	410	310	160	1,310	2,190
1995	530	380	190	1,530	2,640
1996	600	470	180	1,660	2,910
1997	730	610	200	1,880	3,410
1998	520	730	240	1,970	3,460
1999	640	840	190	1,080	2,750
2000	530	800	220	2,490	4,040
Avg. Annual growth %	9	54	10		17
Total	4,800	4,510	1,660	14,320	25,290
No. of banks	27	45	18	16	106

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions and excludes the share of the central banks.

Table 3-29: Return on average assets of the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain (*%, 1992-2000*)

Year	*Bahrain*	*Egypt*	*Jordan*	*Saudi Arabia*	*Total*
1992	1.35	0.63	0.96	1.29	0.98
1993	2.49	0.99	0.48	0.85	1.26
1994	1.78	1.27	0.70	1.31	1.31
1995	2.29	1.48	0.86	1.61	1.60
1996	2.61	1.45	0.54	1.92	1.65
1997	2.89	1.62	0.50	2.15	1.81
1998	2.10	1.67	0.64	1.81	1.62
1999	2.02	1.63	0.47	1.45	1.50
2000	1.07	1.33	0.06	2.00	1.14
Avg. Annual growth %	-2.59	13.92	-11.78	6.84	1.95
Total	2.09	1.37	0.57	1.60	1.44
No. of banks	27	45	18	16	106

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions and excludes the share of the central banks.

Table 3-30: Return on average equity of the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain (%, 1992-2000)

Year	Bahrain	Egypt	Jordan	Saudi Arabia	Total
1992	6.12	6.52	15.33	16.16	9.67
1993	10.63	12.25	24.54	5.82	12.95
1994	8.17	14.08	15.87	10.91	12.35
1995	9.24	17.07	14.92	13.65	14.27
1996	10.02	17.29	6.46	13.50	13.32
1997	11.76	16.36	4.82	14.73	13.24
1998	9.08	15.72	6.68	14.23	12.54
1999	9.69	14.67	3.87	10.87	11.25
2000	4.88	13.47	4.21	17.03	10.42
Avg. Annual growth %	-2.53	13.32	-9.07	0.67	0.96
Total	8.94	14.43	10.71	12.96	12.28
No. of banks	27	45	18	16	106

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions and excludes the share of the central banks.

Table 3-31: Net interest revenue of the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain (US$ million, 1992-2000)

Year	Bahrain	Egypt	Jordan	Saudi Arabia	Total
1992	700	220	270	1,450	2,640
1993	760	180	350	1,560	2,850
1994	760	770	390	1,500	3,420
1995	730	760	460	1,390	3,330
1996	840	950	460	2,400	4,650
1997	930	1,050	510	2,780	5,260
1998	860	1,160	610	3,030	5,670
1999	1,020	1,340	580	2,930	5,860
2000	1,080	1,370	730	3,180	6,360
Avg. Annual growth %	7	65	21	15	18
Total	7,670	7,800	4,350	20,220	40,040
No. of banks	27	45	18	16	106

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions and excludes the share of the central banks.

Table 3-32: Banks' equity in the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain (US$ million, 1992-2000)

Year	Bahrain	Egypt	Jordan	Saudi Arabia	Total
1992	4,070	2,570	810	8,660	16,110
1993	5,090	3,510	940	9,650	19,190
1994	4,910	3,740	1,050	10,100	19,810
1995	5,310	3,470	1,250	10,650	20,670
1996	5,660	4,940	1,410	11,600	23,610
1997	6,020	6,020	1,820	12,050	25,910
1998	6,200	6,690	2,050	12,540	27,490
1999	7,340	7,340	2,190	12,190	29,060
2000	7,380	7,220	2,420	13,220	30,250
Avg. Annual growth %	10	23	25	7	11
Total	51,980	45,510	13,940	100,660	212,090
No. of banks	27	45	18	16	106

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions and excludes the share of the central banks.

Table 3-33: Customers in the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain (US$ million, 1992-2000)

Year	Bahrain	Egypt	Jordan	Saudi Arabia	Total
1992	28,170	40,370	13,630	84,570	166,740
1993	28,340	60,750	16,340	91,180	196,600
1994	30,350	63,490	17,470	92,610	203,900
1995	32,140	53,790	19,490	97,070	202,500
1996	33,530	74,460	21,440	100,300	229,730
1997	35,270	84,120	23,010	107,590	250,000
1998	38,860	88,550	24,170	114,890	266,470
1999	42,270	93,510	26,360	112,240	274,390
2000	44,000	99,500	29,450	120,740	293,680
Avg. Annual growth %	7	18	15	5	10
Total	312,920	658,550	191,360	921,190	2,084,030
No. of banks	27	45	18	16	106

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions and excludes the share of the central banks.

Table 3-34: Off-balance sheet items in the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain (US$ million, 1992-2000)

Year	Bahrain	Egypt	Jordan	Saudi Arabia	Total
1992	24,030	11,280	3,940	71,980	111,240
1993	30,880	12,420	4,330	91,140	138,760
1994	35,720	15,400	5,270	91,530	147,910
1995	14,590	18,120	6,100	100,920	139,720
1996	15,820	20,670	5,490	51,010	92,990
1997	16,990	23,260	6,470	30,430	77,150
1998	15,770	27,050	6,790	34,890	84,500
1999	14,860	27,480	7,210	41,100	90,660
2000	13,810	26,990	8,650	44,450	93,900
Avg. Annual growth %	-5	17	15	-5	-2
Total	182,460	182,670	54,250	557,450	976,840
No. of banks	27	45	18	16	106

Source: Bankscope (2002), the figure based on the consolidated balance sheets (nominal values) of the local financial intuitions and excludes the share of the central banks.

Chapter 4: Efficiency in banking: A theoretical Overview

4.1 : Introduction

This chapter presents a theoretical overview of the banking efficiency literature. Section 4.2 presents a basic description of the concept of efficiency and draws attention to the significance of empirical efficiency studies. It shows that the desire to investigate the efficiency characteristics of financial services institutions has received attention by various groups including academics and policymakers as well as bankers. In particular, the seminal studies of Aigner and Chu (1968), Afriat (1972) and Richmond (1974) emphasise the importance of efficiency measurement using parametric frontier production functions.

Section 4.3 describes the concepts of economies of scale and X-efficiency as these will be used in the present study to estimate efficiency levels in the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain. Section 4.4 reviews the area of productive efficiency which dominates efficiency studies. Productive efficiency (or X-efficiency) defines the relationship between the production levels and some desirable objective function such as the cost, revenue or profit function given a certain level of production technology. It also describes how overall efficiency can be decomposed into technical and allocative efficiency. In its turn, technical efficiency can be investigated further and decomposed into pure technical efficiency and scale efficiency. Furthermore, this section outlines the technical change that deal with the consequences of shifts in the production function due to such factors as experience, increased knowledge, innovations and improved production techniques.

Section 4.5 presents the three main economic functional forms from which efficiency and productivity estimates can be derived; cost, standard and alternative profit function. These will be utilised in the present study to estimate the efficiency levels in several Arabian banking sectors. Finally, section 4.6 draws the conclusion.

4.2 Importance of studying banks' efficiency

The desire to investigate efficiency characteristics of financial services firms has received concern by different groups including academics and policymakers as well as bankers. These groups attempt to link efficiency levels to the characteristics of financial institutions as this is expected to provide an insight into the profitability of financial firms and should result in lower prices and improve service quality for consumers and should also result in greater safety and soundness if efficiency savings are directed toward improving capital buffers that absorb risks. These are the main reasons why the study of banking sector efficiency is regarded important.

In general, banking industry structure is greatly influenced by the nature of production economies. If an industry's technology allows for both economies of scale and scope, the industry tends to be made up of large diversified firms (see Clark, 1988). These firms will be able to produce at lower per-unit costs than smaller specialized firms and can potentially use this cost advantage to gain market share. On the other hand, if technology neither allows economies of scale nor scope, small-specialized firms will tend to dominate the industry. A mixture of larger diversified firms and smaller specialized firms will develop in the absence of significant economies of scale and scope.

In particular, bank efficiency represents a social optimal target since it reduces the costs of financial intermediation which drives down the drainage of real resources through transferring funds efficiently from savers to producers (see Resti, 1996). For this reason, regulatory authorities are interested in fostering more efficient operating practices that results in a market equilibrium that promote the maximum productive efficiency. On the other hand, the economic theory of the firm assumes that production should take place in an environment where the managers aim to maximize profits by operating in the most efficient manner. The competitive model suggests that firms which fail to do so will be driven from the market by ones that are more efficient. However, when natural entry barriers or regulations weaken competitive forces, inefficient firms may continue to prosper.

Rhoades (1998) distinguishes between cost reductions and efficiency improvements. Reductions in expenses may result from cutting the number of employees, closing branches and so on. Such reductions in expenses do not automatically translate into improvements in efficiency which can be measured by some expense ratios, such as expenses to assets or revenues. Reductions in expenses that are accompanied by corresponding reductions in assets and revenues represent shrinkage of the firm rather than efficiency improvements. An improvement in efficiency occurs when the reduction in costs are more than the decline in revenues.

The seminal studies of Aigner and Chu (1968), Afriat (1972) and Richmond (1974) turn the focus to the importance of efficiency measurement. These studies are concerned with estimating parametric frontier production functions by assuming a function that gives maximum possible output given a certain amount of inputs. For a given firm:

$y_i = f(x_i; \beta)$,

where y_i is the maximum output attainable from x_i (a vector of non-stochastic inputs) and β (an unknown parameter vector to be estimated). Therefore, to determine the degree of efficiency, the technology of the firm should be modelled through the production function, or equivalently through a cost function. A simple expression of a cost function is

$C = f(Y, W, t)$,

where C is total cost, Y is output, W is input price, and t is time. The producer's objective is to produce its output Y at minimum cost. The cost function (frontier) then can then be defined as the minimum attainable cost for each level of output.

To summarise, the efficiency of the banking system is of interest to many parties as improvements in efficiency are expected to improve profitability, lower prices, improve services quality that ultimately result in greater safety and soundness.

4.3 Types of efficiency

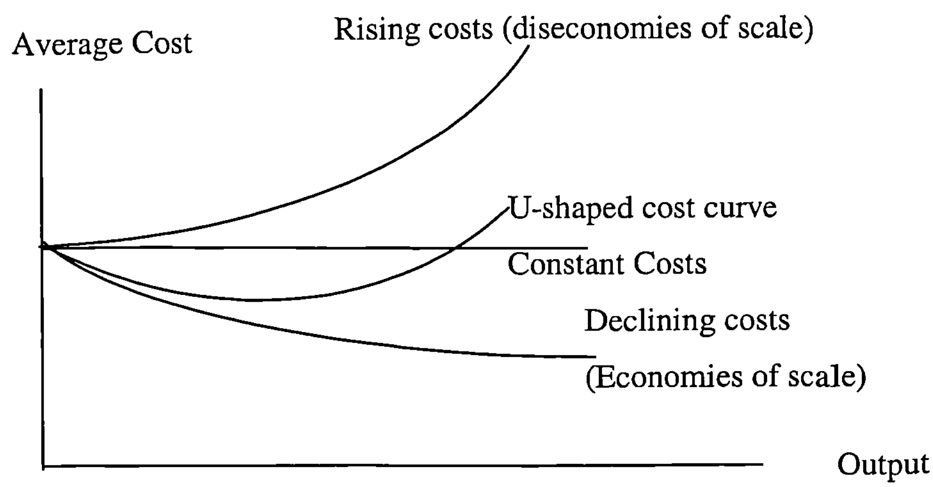
This section describes the main types of efficiency that are investigated extensively in the banking literature. In particular, this section focuses on the economies of scale and X-efficiency, as these concepts will be utilised to estimate efficiency levels in the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain, later in this thesis.

4.3.1 Economies of scale

Economies of scale refer to the rate at which output changes as all factor quantities are varied. It measures whether firms with similar production and managerial technologies are operating at optimal economies of scale. Clark (1988) describes that firms can realize economies of scale, for a single product firm, if technology allows production costs to rise proportionately less than output when output increases. That is, economies of scale exist if average production costs per unit decline as output rises. This is measured by the ratio of the percentage change in costs relative to the percentage change in output. If the economies of scale ratio is smaller than one, economies of scale arise because average long-run cost is declining. If the ratio is equal to one, no economies of scale are present since average cost is constant and when the ratio exceeds one, diseconomies of scale exist as average cost is increasing.

Sinkey (1992) notes that a bank is said to be producing at constant returns to scale if, for a given mix of products, a proportionate increase in all its outputs would increase its costs in the same proportion. A bank is experiencing economies of scale if a proportionate increase in its outputs would lead to a less than proportionate increase in cost. On the other hand, scale diseconomies arise when a proportionate increase in bank outputs would lead to a more than proportionate increase in costs. These alternative relationships between costs and output are shown in figure 4-1 below.

Figure 4-1: Economies of scale and the shape of average cost curves



Source: Sinkey (1992, p 306)

Therefore, scale economies are measured by the elasticity of cost with respect to output. Given the total cost function defined by $TC = f(Q)$, where Q is an output then average cost can be derived as $ATC = f(Q)/Q$ and marginal cost is $\partial TC / \partial Q$. The average cost will decline as long as the marginal cost lies under average cost, so economies of scale (SE) is *ATC/MC* (see Altunbas et al., 1996, p. 139) which is the elasticity of cost with respect to output. Therefore, when $SE \geq 1, SE = 1$ and $SE \leq 1$, we are experiencing increasing, constant or decreasing returns to scale respectively.

Scale efficiencies can increase profits as the unit cost of production falls with increased size. More specifically, it can improve cost efficiency by reducing costs per unit of output for a given set of output quantities and input prices. Second, it may increase profits through improvements in profit efficiency that involves superior combinations of inputs and outputs resulting from larger size. Third, it may improve profits through the exercise of additional market power in setting prices (see Akhavein et al., 1997a for details).

4.3.1.1 Economies of scale for multiproduct firms

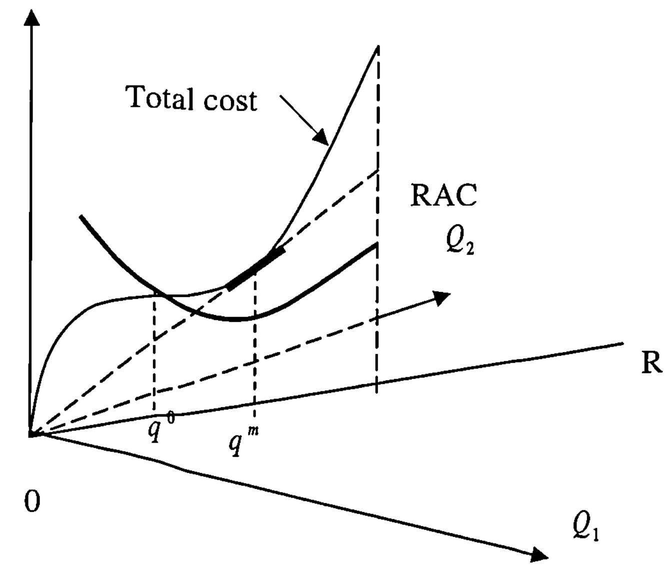
While the concept of economies of scale for a single product firm applies to the behaviour of total costs as output increases, the concept of average cost for multiproduct firms is more complicated. The problem lies in how to measure output for multiproduct firms. Baumol et al. (1982) show that the multiproduct cost function possesses no natural scalar quantity over which costs may be averaged. That is, we cannot construct a measure of the magnitude of multiproduct output without adding non-homogeneous outputs. One alternative when facing this problem is to refer to the single-product case by fixing output proportions and considering the behaviour of costs as the size of the resulting output is varied.

Baumol et al. (1982) proposes the concept of the Ray Average Cost (RAC) to measure economies of scale for multiproduct firms. RAC requires that firms expand all outputs at the same rate while mixing inputs optimally. RAC is a generalisation of single product average cost and defined as

$$TC(Q)/\sum Q_i = TC(tq^0)/t$$

where q^0 is the unit bundle for a particular mixture of outputs and $tq^0 = Q$. This gives the average cost of the composite commodity whose unit is vector q^0 and whose scale output is given by the scalar *t*. Ray average cost is said to be increasing (decreasing) at Q if *RAC(Q)* is an increasing (decreasing) function of the scalar T. At $T = 1$. *RAC* is said to be minimized at q if *RAC(q)<RAC(Tq),* for all positive $T \neq 1$. With this definition, *RAC* can be represented in the cross-section hyperplane that defines the composite commodity (figure 4.2). Figure 4.2 shows the behaviour of total cost along the ray, *OR*. The lower part is the outputs space which is produced in proportion given by the ray 0R. The point of minimum *RAC*, the output bundle q^0, corresponds to the most efficient scale for the firm producing (for instance, loans and securities) in the proportion specified by the ray QR. Thus, the degree of economies of scale at q^0 is defined as the elasticity output with respect to cost which is equal to 1/(1-e), where e is the elasticity of the relevant average cost curve. This degree of economies of scale is greater than, less than or equal to one as returns to scale are locally increasing, decreasing or constant and as the *RAC* curve's slope is negative, positive, or zero, respectively (see Molyneux et al., 1996 for the details).

Figure 4-2: Economies of scale for multiproduct firm: the concept of RAC



Source: Molyneux et al. (1996), p141

4.3.1.2 Overall versus product-specific economies of scale

The concept of multi-product economies of scale explains the behaviour of costs as output increases or decreases along a given ray, but it may not explain the full behaviour of costs as output bundles change. Panzar and Willig (1977) show how total costs change as output of one-commodity changes, which is called product-specific economies. Product-specific economies of scale are the average incremental cost (*AIC*) and defined as the extra cost of adding the production of a given product at a specific level of output as compared with not holding it at all, divided by the output of that product.

The product-specific economies arise from increases in the production of individual products while the overall economies of scale arise from increases in all of a firm's output. For multi-product firms, overall economies of scale occur if total costs increase proportionately less than output when there is a simultaneous and equal percentage increase in each of the firm's products (see Clark, 1988). With overall economies of scale, average costs decline as the firm expands production while maintaining a constant product mix. Product-specific economies of scale are present if a decline in the per-unit cost of producing a specific product occurs as the output of that product increases.

Alternatively, overall economies of scale are measured by computing the sum of the output cost elasticises of individual products. The output cost elasticity for a product is the percentage change in production costs that occurs for a given percentage change in the output of the product. In addition, the sum of the individual output cost elasticities is equivalent to the percentage change in costs that results from an equal percentage change in the output of all products. When this measure of overall economies of scale is equal to one at a given level of overall output, there are constant returns to scale. If this measure of overall economies of scale is significantly less than one, then there are increasing returns to scale and production efficiencies will be realized in this range of production. Conversely, if this measure is significantly greater than one, there are decreasing returns to scale and production inefficiencies will be realized.

4.3.2 Economies of scope

Economies of scope arise if two or more products can be jointly produced at a lower cost than that is incurred in their independent production; $TC(Q_1,Q_2) < TC(Q_1) + TC(Q_2)$. If the inequality is reversed, then diseconomies of scope are said to exist. A measure of economies of scope is: SCOPE = $[TC(Q_1) + TC(Q_2) - TC(Q_1,Q_2)]/ TC(Q_1,Q_2)$.

Economies of scope generate cost savings from delivering multiple goods and services jointly through the same organisation rather than through specialised providers. Molyneux et al. (1996) sum up that there are two groups of potential economies of scope. Firms can realise internal scope economies through joint production and marketing, while consumers can realise external scope economies through joint consumption. On the production side, scope economies appear available where facilities devoted to one objective or to serving a single market are not fully utilised and are capable of being deployed simultaneously to serve other targets and other markets. On the consumption side, scope economies exist where multiple productions at a single location or through a single firm saves consumers the time and expense of searching for and purchasing these items through specialised providers. Sinkey (1992) attributes the existence of economies of scope to interproduct or cost complementarities. For a multiproduct-banking firm, cost complementarities refer to the extent to which the costs of producing a particular financial service or product may vary with the output levels of other products or services.

Clark (1988) clarifies the disparity between global economies and the product-specific economies of scope. Global economies are identified by comparing the costs of both joint production and separate production while assuming a given scale for each product. For a given product mix, if the total costs from joint production of all products in the product mix are less than the sum of the costs of producing each product independently, global economies of scope are present. On the other hand, product-specific economies of scope refers to economies that arise from the joint production of a particular product with other products; i.e. enhancing production efficiency by adding a particular product to a given product mix. So, if the cost of producing a product independently from the other products in the product mix exceeds the cost of producing it jointly, product-specific economies of scope can be realized from joint production. Global economies of scope are measured by computing the cost differential that would arise between the independent and joint production of specific output levels of all products. This cost differential is then scaled by dividing by total costs of joint production. This measure is greater than one when there are global economies of scope. Product-specific economies of scope are measured in several ways. One common measure is to compute the cost increase or decrease that arises from producing a specific product both independently from, and jointly with, the remaining product mix and expressing it as a percentage of the costs of joint production. If this ratio is greater than one, product specific economies of scope are said to exist.

On the other hand, Berger et al (1987) developed alternative scale and product mix measures: Expansion Path Scale Economies (EPSCE) and the Expansion Path Subadditivity (EPSUB) measures which compare the costs of firms that differ in both scale and product mix simultaneously. Berger et al. (ibid) identified the following potential sources of scope and product mix economies: spreading fixed costs; information economies; risk reduction; consumer cost economies.

Berger et al (1993) point out that there are three major problems related to estimating scope economies. First, the translog functional form, on which many studies have been based, is not sufficiently flexible to describe an industry with increasing returns to scale up to some point and constant returns thereafter. It also has difficulties when firms tend to change product mix significantly as they change scale. The translog and the Box-Cox approximation perform poorly in estimating scope economies because they have trouble with estimations at or near zero. Second, there is often little or no data on firms' specialisation. Third, it is difficult to evaluate scope economies using data that are not on the frontier. In order to address these limitations, Berger et al. proposed the concept of 'optimal scope economies', based on the profit function instead of the cost function. This incorporates the revenue effects of output choices as well as the cost effects of input choices, providing at a least partial solution to the above limitations.

4.3.3 Sources of scale and scope economies

Firms attain economies in scale or scope from various sources. First, they may have excess capacity of some inputs so that an increase in output cannot require a proportionate increase in all inputs over the entire production period. Specifically, the existence of indivisibility in some inputs may help reduce costs per unit of output as the output level is increased. Furthermore, spreading fixed costs over large levels of output are usually the predominant source of economies of scale. Clark (1988) concludes that most economies of scope arise from the joint usage of a fixed resource.

In addition, the greater size allows for a more efficient organisation of resources (see Molyneux, 1996). Large banks may divide tasks so that employees and machines can be used in more than one facet of their operation. Besides, the law of large numbers accounts for certain economies. Moreover, larger banks are seemingly better able to diversify their assets and reduce risk. Likewise, some types of technological innovations may be economically more feasible for large banks. Thus, according to asset size, banks could employ different compositions of inputs with varying efficiencies.

Furthermore, when financial intermediaries grow in size and intensify their diversification, they can lower delegation costs by mitigating the asymmetric distribution of information between borrowers and lenders. In addition, the increase in size may improve organisational and strategic flexibility that lead to greater cost minimization, better management and more efficiency for fixed costs, and the diversification of assets and liabilities can reduce income variability. Alternatively, on the demand side, consumers may benefit through "package-acquisition behaviour" that favour output diversification via cost savings or in terms of the perception of a quality advantage.

Finally, information technology may raise efficiency when an increase in firm's size results in imperfect divisibility of investments. Alternatively, size may help through the availability of more advanced professional skills necessary to integrate complex technologies. Furthermore, size provides more flexibility in production process that helps reduce scale barriers (Girardone, 2000).

4.4 X-efficiency as a measure of productive efficiency

Productive efficiency defines the relationship between production and some desirable objective function such as cost minimisation or revenue and profit maximisation given certain levels of technology. The firm normally faces a degree of competitiveness in input and output markets, and its rational economic behaviour aims to maximise the production by choosing either optimal input mix under cost minimisation or optimal outputs under the revenue maximisation objective.

The production frontier (signifies the overall efficiency) shows the minimum inputs required to produce a given level of output where the firm or firms on this frontier are operating with full efficiency. Forsund et al. (1980) expresses the transformation of inputs into outputs by the production function $f(x)$, which shows the maximum output obtainable from various input vectors. Under certain regularity conditions, an equivalent representation of efficient production technology is provided by the cost function:

$$c(y,w) = min_x\{wx / f(x) \geq y, x \geq 0\}$$

which shows the minimum expenditure required to produce output y at input prices w. A similar equivalent representation of efficient production technology is provided by the profit function which shows the maximum profit available at output price p and input prices w.

While the concept of productive efficiency is rather straightforward, various difficulties arise when attempting to measure it. Essentially, it is necessary to derive the best practice on production frontier which depicts the maximum attainable level of performance. Ideally, actual firm performance would be compared with their 'true' frontier (Casu and Molyneux, 2001). The latter is unobservable, however, and the best that can be achieved is an empirical or 'best practice' frontier generated from the researcher's data set.

X-efficiency is usually utilised to measure productive efficiency and depicts how effectively firms are in using inputs to produce a given level of output. Specifically, X-efficiency envelops each firm's technical and allocative efficiencies as distinguished from scale and scope efficiencies (see Berger and Humphrey, 1992). It measures the deviation of a bank's costs from the efficiency or "best practice" frontier. However, there is no consensus as to the best method of estimating X-efficiency.

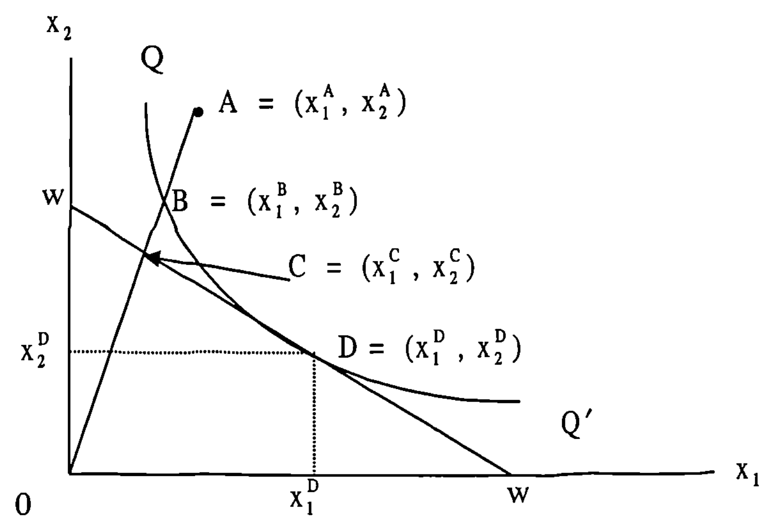
4.4.1 Technical and Allocative efficiency

Overall efficiency can be decomposed into technical and allocative efficiency. Koopmans (1951) formally defined technical efficiency as an event when an increase in any output requires a reduction in at least one other output or an increase in at least one input, and if a reduction in any input requires an increase in at least one other input or a reduction in at least one output. Coelli et al. (1998) refer to Nunamaker (1985) who defines technical efficiency as a measure of the ability of a decision-making unit (DMU) to avoid waste by producing as much output as long as input usage will allow, or using as little input as output level will allow.

Allocative efficiency, on the other hand, measures the ability of a DMU to avoid waste by producing a level of output at the minimal possible cost (the ability to combine inputs and outputs in optimal proportions in the light of prevailing prices).

The measures of overall economic efficiency can be graphically represented. Figure 4.3 shows the isoquant for a firm with one output and two inputs, x_1 and x_2. The firm's production function y = $f(x_1, x_2)$ is characterised by constant returns to scale. Given the technology and the input prices represented by the slope of ww, cost minimisation occurs at point D. The isoquant QQ' represents the various combinations of the two inputs required to produce a fixed amount of the single output using the best available technology. The firms operating on the isoquant are considered technically efficient. The firm can improve its efficiency by moving to a place on the frontier (i.e., by adopting a new technology).

Figure 4-3: Farell Technical and Allocative Efficiency



(Source: Coelli et al., 1998, p 135)

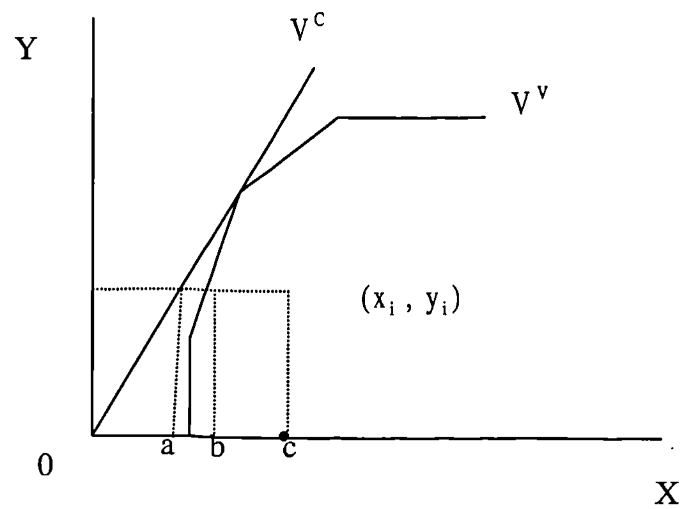
With reference to figure 4.3, Cummins and Weiss (1998) show that the measure of Farrell technical efficiency as the ratio of 0B to 0A (the proportion by which the firm could radially reduce its input usage by adopting the best technology). The inefficiency can also result from the firm's not using the cost minimising combination of inputs (allocative inefficiency). The firm is also allocatively inefficient if it is not using its inputs in the correct proportions. The measure of allocative efficiency is the ratio 0C/0B. The optimal operating point is represented by the tangency (point D) between the isoquant QQ' and the isocost line ww'. A firm operating at this point is considered fully cost efficient. The firm operating at point A = (x_1^A, x_2^A) exhibits both technical and allocative inefficiency.

4.4.2 Pure technical and scale efficiency

Technical efficiency can be investigated further and decomposed into pure technical efficiency and scale efficiency. Webster et al. (1998) define scale efficiency as the case where the firm can produce its current level of output with fewer inputs assuming constant return to scale (the measure of the ability to avoid waste by operating on the most productive scale). Pure technical efficiency measures the proportional reduction in inputs that could be achieved if the firm operated on the variable returns to scale frontier. If the firm is able to achieve this, then further input reductions could be achieved by operating on the constant returns to scale frontier.

The decomposition of overall efficiency can be depicted graphically. Figures 4.4 shows frontier V^C that represents a constant return to scale (CRS), which measures the optimal level of output which can be produced for given input levels. To measure scale efficiency, the constant returns to scale assumption is dropped and a variable returns to scale frontier is developed V^V. When a firm is operating at point (x_i, y_i), pure technical efficiency is measured relative to the VRS frontier and is equal to 0b/0c. This measures the proportional reduction in input usage that is achieved if the firm is operating at constant returns to scale. However, a firm operating on the VRS frontier at same output level is also scale inefficient because it is not operating on the CRS frontier. Its scale efficiency is measured by the ratio 0a/0b (This measure of scale efficiency can be derived from measures of technical and pure technical efficiency). For multiple output and inputs, the estimation of efficiency measures requires a non-parametric linear programming solution.

Figure 4-4: Pure technical and scale efficiency



Source: Aly et al. (1990, pp. 212).

4.4.3 Technological change and productivity growth

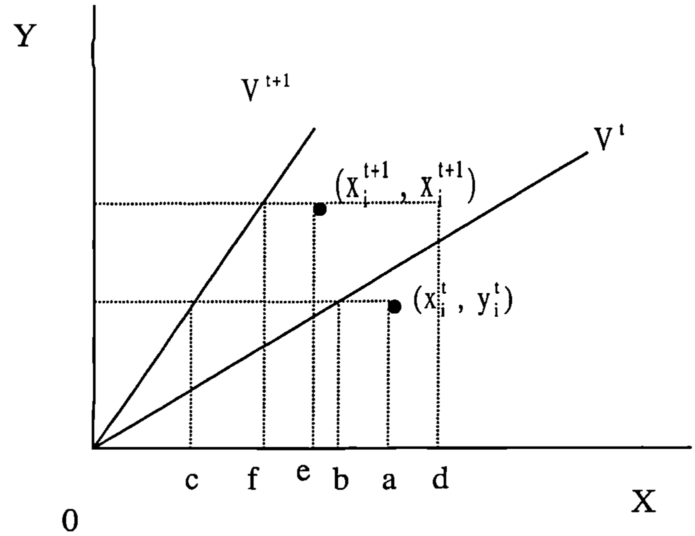
Both production and cost functions are estimated under the assumption of constant technology. Hunter and Timme (1986) show that technical change deals with the processes and consequences of shifts in the production function. This is brought about by the adoption of new outputs that can be produced from any given set of inputs increases over time due to factors such as experience, increased knowledge, innovation and improved production techniques. Revell (1983) suggests that technological advances could also bring about greater scope economies.

Productivity growth can be measured as the proportional change in cost or profit due to changes in a given set of business conditions (the business conditions are the exogenous variables specified in the cost or profit function). Productivity growth may be decomposed into movement of the best-practice frontier and the change in the average degree of efficiency or the dispersion of firms away from this frontier. The movements of the frontier may be driven by technological change, such as improvements in information-processing technologies or improvements in applied finance that allow banks to make better investments at lower cost. The frontier may also shift due to regulatory changes that affect costs or profits, such as the deregulation of interest rates or relaxation of geographic entry barriers. The location of the best-practice frontier also depends on competitive conditions, since even the managers of the best-practice banks may reduce effort, pursue goals other than cost minimization or profit maximization if competition is lax. It is possible for the efficient frontier to either improve or worsen over time, and prior literature has found movements in both directions (see Berger and Mester, 1997).

Molyneux et al. (1996) note that the effects of greater technological advances on bank average costs can be visible. They show how the U-shaped average curve could become flatter because of technological effects reducing average costs. Humphrey (1985) indicates that technological change is appeared at two levels of operation, the plant-level and firm-level. Economies of scale may be gained at either the plant or multi-plant level or both.

To derive accurate efficiency estimates, it is therefore necessary to net 'overall efficiency' measure from the shift in technological changes using Farrell's (1957) definition of micro level efficiency and the Malmquist index approach to efficiency measurement of Fare et al. (1994). The two production situations (x^t, y^t) and (x^{t+1}, y^{t+1}) can be compared by taking into account the changes observations as well as changes in the technologies. Figure 4.5 below shows graphically production frontiers for periods t and t+1 for a single-input single-output firm. The frontier for period t+1 lies to the left of the frontier for period t which implies productivity gains between the two periods. The firm operating at point (x_i^t, y_i^t) in period t becomes more productive and more efficient at point (x_i^{t+1}, y_i^{t+1}) in period t+1. In period t+1, the firm is utilising all available technology (technical efficiency), while those to the right are not using this technology. In reference to the distance function introduced by Shepherd (1970), the distance function for the firm's operation at point (x_i^t, y_i^t) is given by $D^t(x_i^t, y_i^t) =$ 0a/0b, where D indicate the period of the frontier from which the distance is computed. The distance function is used to compare firm's efficiencies in periods t and t+1 ($D^{t+1}(x_i^{t+1}, x_i^{t+1}) < D^t(x_i^t, y_i^t)$) or (0e/0f < 0a/0b).

Figure 4-5: Productivity and efficiency change



The Malmquist input productivity index compares periods t and t+1 and can be defined using distance functions that represent the four combinations of adjacent time periods,

$$m_i(y^{t+1},x^{t+1},y^t,x^t)=\sqrt{\frac{d_i^t(x^{t+1},y^{t+1})}{d_i^t(x^t,y^t)}\frac{d_i^{t+1}(x^{t+1},y^{t+1})}{d_i^{t+1}(x^t,y^t)}}$$

following Fare et al. (1994), an equivalent way of writing the above equation is

$$m_i(y^{t+1},x^{t+1},y^t,x^t)=\frac{d_i^{t+1}(x^{t+1},y^{t+1})}{d_i^t(x^t,y^t)}\cdot\left[\sqrt{\frac{d_i^t(x^{t+1},y^{t+1})}{d_i^{t+1}(x^{t+1},y^{t+1})}\cdot\frac{d_i^t(x^t,y^t)}{d_i^{t+1}(x^t,y^t)}}\right]$$

where the ratio outside the brackets measures the change in relative efficiency between period t and $t+1$ and the geometric mean of the ratios in the brackets measures the shift in technology between the two periods.

To summarise, this section reviewed the theory on productive efficiency, which underpins the empirical efficiency literature. Productive efficiency defines the relationship between production levels and some desirable objective function such as cost minimisation or revenue and profit maximisation given certain levels of technology. The section also describes how overall productive efficiency can be decomposed into technical and allocative efficiency. Technical efficiency can be investigated further and decomposed into pure technical efficiency and scale efficiency. We also outline the concept of technological change and show how this relates to shifts in the production.

4.5 Economic functions utilised to estimate efficiency

Efficiency estimates can be derived using two main types of methodological approaches – parametric and non-parametric. The non-parametric approach involves linear-programming techniques, such as Data Envelopment Analysis (DEA) whereas the parametric approach stipulates an underlying functional form from which estimates are attained. In terms of the parametric approach, there are three main economic functional forms from which efficiency and productivity estimates can be derived; cost, standard and alternative profit function. This section reviews these concepts following Berger and Mester (1997), as these will be utilised later to estimate efficiency levels in the Arabian banking systems under study.

4.5.1 The Cost function approach

The cost function shows how close a bank's cost is to a best-practice bank's cost that produces the same output bundle under the same condition. The cost function relates variable costs to the prices of variable inputs and the quantities of variable outputs and any *fixed netputs (inputs or outputs)*, environmental factors, and random error, as well as *efficiency:*

$$\ln C = f_C(w,y,z,v) + \ln u_C + \ln \varepsilon_C$$

where C measures the variable costs, f_C is some functional form, w is the vector of prices of variable inputs, y is the vector of quantities of variable outputs, z indicates the quantities of any fixed netputs, v is a set of environmental variables that may affect performance, u_c denotes the inefficiency factor that may raise costs above the best-practice level, and ε_C denotes random error.

The term $\ln u_C + \ln \varepsilon_C$ is treated as a composite error term, and the various efficiency measurement techniques differ in how they distinguish the inefficiency term ($\ln u_C$) from the random error term ($ln\ \varepsilon_C$). The inefficiency factor u_c incorporates both allocative inefficiencies (from failing to react optimally to relative prices of inputs (w)) and technical inefficiencies (from employing too many inputs to produce output).

The cost efficiency of bank b is the estimated cost needed to produce bank b's output vector if the bank were as efficient as the best-practice bank in the sample facing the same exogenous variables (w,y,z,v), divided by the actual cost of bank b, adjusted for random error, i.e.,

$$\text{Cost EFF}^b = \frac{\hat{C}^{min}}{\hat{C}^b} = \frac{\exp\left[\hat{f}_C(w^b, y^b, z^b, v^b)\right] \times \exp\left[ln\, \hat{u}_C^{min}\right]}{\exp\left[\hat{f}_C(w^b, y^b, z^b, v^b)\right] \times \exp\left[ln\, \hat{u}_C^b\right]} = \frac{\hat{u}_C^{min}}{\hat{u}_C^b}$$

where $\hat{u}_C^{min}$ is the minimum $\hat{u}_C^b$ across all banks in the sample. Cost efficiency ranges over [0,1], and equals one for a best-practice firm.

4.5.2 The Standard profit function

The standard profit function measures how close a bank is to producing the maximum possible profit given a particular level of input prices and output prices (and other variables). It is based on a comparison with the best-practice point of profit maximization within the data set, whereas the cost (efficiency) function evaluates performance while holding output constant at its current level. A firm that is relatively cost efficient at its current output, may or may not be cost efficient at its optimal output, which typically involves a different scale and mix of outputs.

The standard profit function specifies variable profits in place of variable costs and takes variable output prices as given but allows output quantities to vary, so that it accounts for revenues that can be earned by varying outputs as well as inputs:

$$\ln(\pi, \theta) = f_{a\pi}(w, y, p, z, v) + \ln u_\pi + \ln \varepsilon_\pi,$$

π is the variable profits of the firm, which includes all the interest and fee income earned on the variable outputs minus variable costs, θ is a constant added to every firm's profit so that the natural log is taken of a positive number; p is the vector of prices of the variable outputs; $ln\ \varepsilon_\pi$ represents random error; and $ln\, u_\pi$ represents inefficiency that reduces profits.

Standard profit efficiency is the ratio of the predicted actual profits to the predicted maximum profits of a best-practice bank facing the same business conditions, net of random error:

$$\text{Std}\,\pi\ \text{EFF}^b = \frac{\hat{\pi}^b}{\hat{\pi}^{max}} = \frac{\exp\left[\hat{f}_\pi(w^b, y^b, z^b, v^b)\right]\times\exp\left[ln\,\hat{u}_\pi^b\right]-\theta}{\exp\left[\hat{f}_\pi(w^b, y^b, z^b, v^b)\right]\times\exp\left[ln\,\hat{u}_\pi^{max}\right]-\theta}$$

where $\hat{u}_\pi^{max}$ is the maximum value of u_π^b in the sample. Profit efficiency ranges over [-∞, 1], and equals one for a best-practice firm within the observed data.

4.5.3 The Alternative profit function

The alternative profit function employs the same dependent variable as the standard profit function and the same exogenous variables as the cost function but it measures how close a bank comes to earning maximum profits given its output levels rather than output prices. The alternative profit function in log form can be written as:

$$\ln(\pi+\theta) = f(w, y, z, v) + \ln u_{a\pi} + \ln\varepsilon_{a\pi},$$

which is identical to the standard profit function except that *y* replaces *p* in the function, *f*, yielding different values for the inefficiency ($\ln u_{a\pi}$) and random error term ($\ln \varepsilon_{a\pi}$). The alternative profit efficiency function is the ratio of predicted actual profits to the predicted maximum profits for a best-practice bank.

The alternative profit function accounts for the additional revenue earned by high-quality banks, allowing it to offset their additional costs of providing the higher service levels. The alternative profit efficiency measure may be helpful when firms exercise some market power in setting output prices because it takes output prices as given and embodies the assumption that the bank can sell as much output as it wishes without having to lower its prices. On the other hand, a scale bias may occur in the standard profit function unless the (*w,p,z,v*) variables give a strong prediction about the size of the bank.

4.6 Conclusion

This chapter presents a theoretical overview on efficiency measurement in banking, as this will support the empirical framework for studying efficiency levels in various Arabian banking sectors outlined in the following chapters. The chapter focuses on economies of scale and productive efficiency – the most important areas concerning efficiency in banking. Economies of scale refer to the rate at which output changes as all factor quantities are varied. Productive efficiency defines the relationship between output levels and some desirable objective function such as cost minimisation or revenue and profit maximisation given certain levels of technology. We show how the overall productive efficiency can be decomposed into technical and allocative efficiency. Allocative efficiency measures the ability of a firm (DMU) to avoid waste by producing a level of output at the minimal possible cost (the ability to combine inputs and outputs in optimal proportions in the light of prevailing prices). Technical efficiency can be investigated further and decomposed into pure technical efficiency and scale efficiency. Pure technical efficiency measures the proportional reduction in inputs that could be achieved if the firm operated on the variable returns to scale frontier. Alternatively, technical changes deals with the processes and consequences of shifts in the production function because of the adoption of new efficient outputs that can be produced from any given set of input increases over time due to such factors as experience, increased knowledge, innovations, and better production techniques. The final part of the chapter discusses various types of functional form – cost, profit and alternative profit, that can be estimated to derive efficiency measures as these will be used later in this thesis. The following chapters will explain in more detail both the parametric and non-parametric approaches utilised in the recent banking literature.

Chapter 5: Parametric and non-parametric approaches to Efficiency Measurement in Banking

5.1 Introduction

This chapter reviews both the parametric and non-parametric approaches utilised in the banking literature to measure efficiency. The focus is mainly on the parametric approach as this methodology will be used, later on, to estimate efficiency levels in the four Arabic banking markets (Jordan, Egypt, Saudi Arabia and Bahrain) that are the focus of this thesis. Section 5.2 presents the different approaches utilised in the banking literature for measuring efficiency. Generally, these can be classified according to the way in which the frontier is specified and estimated; parametric or non-parametric and whether the specified frontier is deterministic or stochastic. Section 5.3 briefly outlines the advantages of frontier efficiency approaches for the evaluation of the performance of financial institutions.

The main differences between parametric and non-parametric approaches are discussed in section 5.4. Section 5.5 presents the stochastic frontier approach (SFA) that will be utilised in this thesis. The SFA is obtained by estimating a cost (or a profit) function with a composite error term, the sum of a two-sided error term representing random fluctuations in cost (profit) and a one-sided positive error term representing inefficiency. Section 5.6 briefly reviews the other major parametric approaches utilised to measure efficiency in banking markets and section 5.7 covers the linear programming Data Envelopment Analysis (DEA) method; the main non-parametric approach. The DEA can estimate efficiency scores for decision-making units (firms) based on the assumption of constant return to scale or variable return to scale. However, the nonparametric nature of DEA estimates considers any deviations from the efficient frontier as inefficiencies given the absence of random error. Section 5.8 discusses the bank production process and notes that the banking literature is still divided concerning how one defines bank inputs and outputs. In general, researchers adopt one of two approaches labelled either the 'intermediation' or 'production' approach. Afterwards, section 5.9 presents the empirical studies that investigate banking sector efficiency in the US, Europe and other developing countries. Finally, section 5.10 draws the conclusion.

5.2 An overview of the approaches utilised to measure efficiency

Several approaches have been developed in the banking literature for measuring bank (firm) level efficiency, ranging from simple financial ratios to complex econometric models. Forsund et al. (1980) sums up that efficiency studies can be classified according to the way in which the frontier is specified and estimated. First, the frontier may be specified as a parametric function of inputs, or it may not. Second, an explicit statistical model of the relationship between the observed output and the frontier may be specified, or it may not. Finally, the frontier itself may be specified as deterministic or random. Several permutations of these possibilities have been considered.

In general, there have been two major types of frontier approaches utilized in most prior efficiency studies; deterministic and stochastic. The deterministic approach assumes that all firms share a common technology and therefore face common production and cost frontiers and all variation in firm performance is attributed to variation in firm efficiencies relative to these common frontiers. However, the notion of a deterministic frontier shared by all firms ignores the possibility that a firm's performance may be affected by factors outside its control as well as by factors under its control (inefficiency). The stochastic approach, on the other hand, assumes that firms may deviate from the minimum attainable cost levels for purely exogenous reasons as well as through inefficiency effects (see for instance, Forsund et al., 1980 and Cummins and Weiss, 1998).

Berger and Humphrey (1997) note that efficiency estimation techniques can be broadly categorized into parametric and non-parametric methods. However, no consensus exists as to the preferred method for determining the best-practice frontier against which relative efficiencies are measured. The most commonly used non-parametric methods are known as Data Envelopment Analysis (DEA) and the Free Disposable Hull (FDH). On the other hand, the most commonly used parametric methods are the Stochastic Frontier Approach (SFA), the Thick Frontier Approach (TFA) and the Distribution Free

Approach (DFA). These approaches differ primarily in the assumptions imposed on the data in terms of the functional form of the best-practice frontier.

5.3 Why use frontier methodology to estimate efficiency in banking?

According to Berger and Humphrey (1997), frontier approaches are superior, for most regulatory purposes, to standard financial ratio analysis because they use programming or statistical techniques that remove the effects of differences in input prices and other exogenous market factors affecting the standard performance of firms. This, they argue, provides more accurate estimates of the underlying performance of firms and their managers. Therefore, frontier efficiency has been used extensively in regulatory analysis to measure the effects of mergers and acquisitions, capital regulation, deregulation of deposit rates, removal of geographic restrictions on branching and holding company acquisitions, and on financial institution performance in general (Bauer et al., 1997).

In addition, frontier efficiency models are preferred by researchers over other performance indicators primarily because these models result in an objectively determined quantified measure of relative performance that removes many exogenous factors (Barr et al., 1999). This permits the researcher to focus on quantified measures of costs, inputs, outputs, revenues, profits, etc. to impute efficiency relative to the best practice institutions in the population. Previous studies have examined efficiency and associated effects on financial institution performance from several different perspectives. These include the effects of mergers and acquisitions, institutional failure, and deregulation on banking sector efficiency.

Siems and Barr (1998) state that the use of frontier efficiency techniques yields useful comparative and benchmarking information that can provide impetus for significant improvements and can alert institutions to new practices and new paradigms. Simple ratio-based analysis that is used for benchmarking can provide important insights but, they argue, are limited in scope because they take a one-dimensional view of a service, product, or process and ignore any interactions, substitutions, or trade-offs between key variables. Thus, a more inclusive multiple-input, multiple-output framework for evaluating productive efficiency, that provides benchmarking information on how to become a well-managed bank, seems essential to improve decision making processes (especially at poorly managed banks).

In addition, frontier methodologies can also provide helpful guidance to regulators and policy makers in various areas. For instance, frontier analysis may help regulators to understand more about efficiency effects of financial deregulation and disruption; efficiency issues relating to institutional failure, risk-taking, problem lending and management quality; efficiency issues associated with market structure and concentration; and the efficiency effects of mergers and acquisitions (Cummins and Weiss, 1998; Berger and Humphrey, 1997). Frontier methodologies can also be applied to help inform management about the effects of policies, procedures, strategies, and technologies adopted by the firm. Furthermore, frontier analysis can be used to track the evolution of a firm's productivity and efficiency over time and to compare the performance of different sections within the firm.

From an academic perspective, frontier efficiency methods are useful for testing various economic hypotheses. For example, both agency theory and transactions cost economies generate predictions about the likely success of firms with different characteristics in attaining objectives such as cost minimisation or profit maximisation under various economic conditions. In general, greater knowledge of productive efficiency also allows one to address various important research areas ({Intarachote 2000 173 /id}. For example, current methodological areas of research focus on how efficiency varies with different frontier approaches, output definitions and overtime in order to demonstrate the consistency of different types of efficiency estimates. Furthermore, measuring bank efficiency may be useful to evaluate whether bank management maximize shareholder value (SWM). Greater bank-level efficiency, in turn, is expected to improve financial products and services, increase the volume of intermediated funds and should lead to a more responsive financial system with improved risk taking capabilities (if efficiency gains are channelled to enhance capital adequacy positions).

5.4 Parametric versus non-parametric approaches to measuring efficiency

The main advantage of the parametric approach to the non-parametric approach for measuring bank efficiency relates to the ability of the latter to characterize the frontier technology in a simple mathematical form, and the ability to accommodate non-constant returns to scale. However, the non-parametric frontier method truly envelops a data set but makes no accommodation for noise (Fried et al., 1993). In addition, non-parametric models are subject to certain assumptions about the structure of production technology and can be categorized according to the type of data available (cross-sectional or panel), and according to the type of variables used (quantities only, or quantities and prices). With quantities only, technical efficiency can be calculated while with both quantities and prices, economic efficiency can be calculated and decomposed into its technical and allocative components.

Alternatively, the parametric approach requires the specification of a production, cost, revenue, or profit function as well as assumptions about the error term(s). Cummins and Zi (1997) mention that the advocates of the parametric approach disagree about distributional assumptions imposed on the error term and note that debate still exists as to the most appropriate choice. Moreover, this methodology can lead to different results as a consequence of the choice of functional form or type of error term(s). In addition, the parametric method has also been criticized for confounding estimation of efficiency with specification errors. Nonetheless, an argument in favour of the parametric approach is that it allows for random error, so these methods are less likely to misidentify measurement error, or transitory differences in cost, or specification error as inefficiency. The primary challenge in implementing the parametric approach is determining how best to separate random error from inefficiency, since neither is observed. Furthermore, the main parametric methods; the stochastic frontier approach (SFA), thick frontier approach (TFA) and distribution free approach (DFA); differ in the distributional assumptions imposed to accomplish this disentanglement.

The choice of estimation method has been an issue of debate with some researchers preferring the parametric approach (e.g. Berger, 1993) and others the non-parametric method (e.g., Seiford and Thrall, 1990). Despite dispute over the preferred methodological approach, the emerging viewpoint suggests that it is not necessary to have a consensus as to one single (best) frontier approach for measuring firm-level efficiency. Instead, there should be a set of consistency conditions for the efficiency measures derived from various approaches to meet. If efficiency estimates are consistent across different methodologies then these measures will be convincing and therefore valid (or believable) estimates for regulators and other decision-makers (Bauer et al. ,1997).

Efficiency estimates derived from different approaches should be consistent by generating analogous efficiency levels and rankings concerning the identification of best and worst firms. These should also be consistent over time and in line with the competitive conditions of the market, and also with standard non-frontier measures of performance. These consistency conditions measure the degree to which different approaches are mutually consistent and the degree to which the efficiencies generated by the different approaches are consistent with reality.

To conclude this section, we refer back to Eisenbeis et al. (1999) who sums up that each main efficiency approach has its advantages and disadvantages. While, the parametric approach has the virtue of allowing for noise in the measurement of inefficiency, this approach requires assumptions about the particular form of the economic function being estimated and the distribution of efficiency. The programming approach requires no specification for functional form or distributional forms. However, the non-parametric approach suffers from the drawback that all deviations from the frontier are attributed to inefficiency with no allowance made for noise in the standard models.

5.5 The Stochastic Frontier Approach (SFA)

This section presents a theoretical framework of the SFA as this approach will be utilised later in this thesis to examine the efficiency levels in the banking systems of Jordan, Egypt, Saudi Arabia and Bahrain. The stochastic frontier production function was independently proposed by Aigner et al. (1977), and Meeusen and Van den Broeck (1977), and it has been widely used in the banking efficiency literature. The SFA postulates that firms face various technical inefficiencies in producing a particular level of output. For a given combination of input levels, it is assumed that the realized production of a firm is bounded by the sum of a parametric function of known inputs, involving unknown parameters, and a random error, associated with measurement error of the level of production or other factors. The greater the amount the realized production falls below the production frontier, the greater the level of technical inefficiency.

The frontier approach labels a bank as inefficient if its costs (profits) are higher (lower) than those predicted for an efficient bank producing the same input/output combination and the difference cannot be explained by statistical noise. The cost frontier is obtained by estimating a cost function with a composite error term, the sum of a two-sided error term representing random fluctuations in cost and a one-sided positive error term representing inefficiency. The single-equation stochastic cost function model can be given as:

$$TC = TC(y_i, w_i) + \varepsilon_i$$

where *TC* is observed total cost, y_i is a vector of output, and w_i is an input-price vector. Following Aigner et al. (1977), the error of the cost function is:

$$\varepsilon = u + v$$

where *u* and *v* are independently distributed; u is assumed to be distributed as half-normal; $u = N(0, \sigma_u^2)$, that is, a positive disturbance capturing the effects of inefficiency, and *v* is assumed to be distributed as two-sided normal with zero mean and variance, σ_v^2, capturing the effects of the statistical noise.

Observation-specific estimates of the inefficiencies, *u*, can be estimated by using the conditional mean of the inefficiency term, given the composed error term, as proposed by Jondrow et al. (1982). The mean of this conditional distribution for the half-normal model is shown as:

$$E(u_i / \varepsilon_i) = \frac{\sigma\lambda}{1+\lambda^2}\left[\frac{f(\varepsilon_i\lambda/\sigma)}{1-F(\varepsilon_i\lambda/\sigma)} + \left(\frac{\varepsilon_i\lambda}{\sigma}\right)\right]$$

where $\lambda = \sigma_u / \sigma_v$ and total variance, $\sigma^2 = \sigma_u^2 + \sigma_v^2$; F(.) and *f*(.) are the standard normal distribution and the standard normal density function, respectively. (u_i / ε_i) is an unbiased but inconsistent estimator of u_i since regardless of the number of observations, *N*, and the variance of the estimator remains nonzero (see Greene, 1991,p. 80-82). Jondrow et al. (1982) have shown that the ratio of the variability (standard deviation, σ) for *u* and *v* can be used to measure a bank's relative inefficiency, where $\lambda = \sigma_u / \sigma_v$, is a measure of the amount of variation stemming from inefficiency relative to noise for the sample. Estimates of this model can be computed utilising the maximum likelihood procedure directly (see Olson et al., 1980).

Bauer et al. (1997) refers to Greene's (1990) argument that alternative distributions for inefficiency may be more appropriate than the half-normal, and the application of different distributions sometimes 'do matter' to the average efficiencies for financial institutions. If panel data are available, however, some distributional assumptions can be relaxed, and the distribution-free approach (DFA) may be used. The distribution-free method assumes that there is a core efficiency or average efficiency for each firm over time. The core inefficiency is distinguished from random error (and any temporary fluctuations in efficiency) by assuming core inefficiency as persistent over time, while random errors tend to average out over time. In particular, a cost or profit function is estimated for each period of a panel data set. The residual in each separate regression is composed of both inefficiency (ln u) and random error (ln v) but the random component is assumed to average out over time. Furthermore, an adjustment (called truncation) is assigned to the average of a bank's residuals from all of the regressions (ln u^*). This is done so as to assign less extreme values of $\ln u^*$ to these banks, since extreme values may indicate that random error has not been completely purged by averaging. The resulting ln $u^*$for each bank is used to compute its core efficiency.

The distributional assumptions of the stochastic frontier approach are rather arbitrary. Two prior studies (Bauer and Hancock, 1993; Berger, 1993) found that when the inefficiencies were unconstrained, they behave much more like symmetric normal distributions than half-normal, which would invalidate the identification of the inefficiencies. Carbo et al. (2000) summarize the specification of previous studies that modelled bank inefficiencies. Allen and Rai (1996) and Kaparakis et al. (1994), and Mester (1996) all use the half-normal specification to test for inefficiency differences between financial institutions. Cebenoyan et al. (1993) uses the truncated normal model. Mester (1993) in common with many studies uses the half-normal distribution. Stevenson (1980) and Greene (1990) have used the normal and gamma model, respectively. Altunbas and Molyneux (1994b) note that efficiency estimates are relatively insensitive to different distributional assumptions when testing the half normal, truncated normal, exponential and gamma efficiency distributions, as all distributions yield similar inefficiency levels for the German banking market. Vennet (1998) uses both the half-normal and exponential distributions to derive efficiencies in European banking, but notes that there was little difference between the two and so reports only the half-normal estimates.

5.6 The other main parametric approaches utilised to measure efficiency

This section briefly reviews the other main parametric approaches used to measure efficiency in banking markets.

5.6.1 The thick frontier approach (TFA)

The TFA divides banks in a sample into four quartiles based on the total cost per unit of assets. The estimated cost function for banks in the least average cost quartile is used to construct the cost frontier (the banks in this quartile are assumed to be the most efficient) while the estimated cost function for banks in the highest average cost quartile are assumed to have less than average efficiency. The differences between the cost functions estimated for banks in the least average cost quartile and banks in the highest average cost are assumed to reflect differences in efficiency alone.

Bauer et al. (1997) note that TFA assumes that deviations from predicted performance values within the highest and lowest performance quartiles of firms represent only random error, while deviations in predicted performance between the highest and lowest average-cost quartiles represent inefficiencies plus exogenous differences in the regressors. Thus, the measured inefficiencies are embedded in the difference in predicted costs between the lowest and highest cost quartiles. This difference may occur either in the intercepts or in the slope parameters.

A benefit of the thick-frontier approach is that it requires less specificity in the maintained statistical assumptions (Berger and Humphrey, 1992). First, the assumption that the inefficiencies are uncorrelated with the regressors, maintained in the econometric approach, is not needed. Second, the assumption that the error terms for the quartiles satisfy standard regression properties, seems no worse than (a) the econometric approach assumption that inefficiencies are from an arbitrary (half-normal) distribution, or (b) the

DEA assumption that random error is zero. Third, even if the error terms within quartiles represent inefficiencies, rather than only random error as maintained, the thick-frontier approach remains a valid comparison of the average inefficiencies of high and low cost firms. Finally, the cost quartiles are quite stable over time and are inversely related to long-term profits, both of which are consistent with the cost differences between quartiles reflecting long-term inefficiencies.

However, the TFA provides estimate of efficiency differences between the best and worst quartile but does not indicate the general level of overall efficiency and does not provide point estimates of efficiency for all individual firms. Furthermore, Berger and Humphrey (1991) point out that assumptions about the error term do not hold exactly and are sensitive to whether banks are divided into quartiles, quintiles, or any alternative number of groups. Further, there is a potential for parametric problems, since banks are pre-sorted using average cost, which is essentially a dependent variable.

5.6.2 The distribution free approach (DFA)

The DFA specifies a functional form for the cost function but it does not impose a specific shape on the distribution of efficiencies but assumes that there is a core efficiency or average efficiency for each firm that is constant over time, while random error tends to average out overtime (Bauer et al., 1997). Unlike the other approaches, a panel data set is required, and therefore only panel estimates of efficiency over the entire time interval are available (DFA-P). The panel efficiency estimates may be derived using three different techniques.

The first DFA technique, known as DFA-P WITHIN, is a fixed-effects model which estimates inefficiency from the value of a firm-specific dummy variable (derived by measuring the firm cost function variables relative to deviations from firm-specific means). Efficiency is estimated using the deviation from the most efficient firm's intercept term and single sets of parameters are to be obtained so inefficiency is fixed over time. However, since inefficiency is no longer a separately specified element in a composed error term, we do not need an assumption that inefficiency is uncorrelated with the regressors (as in SFA) and we adjust for possible first-order serial correlation.

The second DFA technique, known as DFA-P GLS, applies generalized least squares to panel data, obtains a single set of parameters, assumes that bank inefficiencies are fixed over time and that inefficiency is uncorrelated with the regressors. In the cost function, which is also corrected for first-order serial correlation, a separate intercept for each is recovered from the panel estimates as the average residual for that firm over time. The firm with the smallest average residual is presumed to be the most efficient firm and the inefficiency of all the other firms is measured relative to this benchmark.

The third DFA technique, known as DFA-P TRUNCATED, estimates the cost function separately for each year. The efficiency estimates are based on the average residuals for each bank, since some noise might also be persistent over time. Berger (1993) truncates the residuals at both the upper and lower 1% of the distribution, thus limiting the effects of extreme average residuals at both ends.

The DFA implicitly assumes that inefficiency is the only time-invariant fixed effect. The levels of the DFA efficiency estimates may be influenced by somewhat arbitrary assumptions; mainly the measurement of the core efficiency means that efficiency variations over time for an individual firm tend to be averaged out with the random error.

5.7 The Data Envelopment Analysis Approach to measuring efficiency

5.7.1 Background Information about DEA

The DEA nonparametric or mathematical programming approach is an alternative method to estimate productive efficiency in the financial sector. This approach was originally proposed by Farell (1957) and received wider attention after Charnes et al. (1978) developed an estimable model that had an input orientation assuming constant returns to scale (CRS). Charnes, Cooper and Rhodes (1978) reformulated Farrell's original idea into a mathematical programming problem that construct a non-parametric piece-wise frontier that envelops the input and output data relative to which costs are minimised allowing for the calculation of efficiency' scores for each observation in the sample. The calculated score is defined as the percentage reduction in the use of all inputs that can be achieved to make an observation comparable with the best observation(s) in the sample with no reduction in output.

DEA is non-parametric in the sense that it simply constructs the frontier of the observed input-output ratios by linear programming techniques (Fare, Grosskopf, and Lovell, 1985). This procedure is not based on any explicit model of the frontier or the relationship of the observations to the frontier other than the fact that observations cannot lie below the frontier. This approach shows how a particular decision making unit (DMU) operates relative to other DMUs in the sample and so it provides a benchmark for best practice technology based on the experience of those banks in the sample.

DEA can estimate efficiency under the assumption of constant return to scale and variable returns to scale. The CRS assumption is only appropriate when all DMUs are operating at optimal scale. However, factors like imperfect competition and constraints in finance may cause a DMU not to operate at optimal scale. As a result, the use of the CRS specification, when some DMUs are not operating at optimal scale, confuses measures of technical and scale efficiency. Banker et al.'s (1984) seminal work proposed a variable returns to scale and an output-oriented model.

Bauer et al.(1997) note that the usual radial form of DEA are based on technological efficiency where efficient firms are those for which no other firm or linear combination of firms produces as much or more of every output (given inputs) or uses as little or less of every input (given outputs). The efficient frontier is composed of these undominated firms and the piecewise linear segments that connect the set of input/output combinations of these firms, yielding a convex production possibility set.

To match firms in so many dimensions, other constraints are often imposed on DEA linear programming problems. Other constraints that may be specified in the financial institutions research can include such factors like quality controls (such as the number of branches or average bank account size) or environmental variables (such as bank ownership or state regulatory controls). However, matching firms in so many dimensions can result in firms being measured as highly efficient solely because no other firms or few other firms have comparable values of inputs, outputs or other constrained variables. That is, some firms may be self-identified as 100% efficient not because they dominate other firms, but because there are only a few other observations, with which they are comparable. The problem of self-identifiers or near self-identifiers most often arises when there are a small number of observations relative to the number of inputs, outputs, and other constraints, so that a large proportion of the observations are difficult to match in all dimensions.

5.7.2 The favourable features of DEA

DEA uses sample data to derive the efficiency frontier against which each firm (in the sample) are evaluated. No explicit functional form for the production needs to be specified. Instead, the production frontier comprises piecewise linear segments that assign relative efficiency scores for each firm. Another important feature of DEA scores is independency of units of measurement (of both inputs and outputs) as long as these units are the same for all observations. These characteristics make the DEA methodology relatively flexible.

Siems and Barr (1998) point that the DEA methodology is a valuable tool for strategic, policy, and operational decision problems, particularly in the service and non-profit sectors. They argue that this approach provides an analytical, quantitative benchmarking tool for measuring relative efficiency. In contrast to statistical procedures that are based on central tendencies, DEA reveals best-practice frontiers by analysing each decision-making unit DMU separately and then measures relative productive efficiency with respect to the entire population being evaluated.

In addition, even though DEA focuses on technological or productive efficiency rather than economic efficiency, it can be adapted to examine economic efficiency by observing the costs to produce a set of outputs given the best-practice technology and input prices. The productive efficiency focuses on levels of inputs relative to levels of output. To be productively efficient, a firm must either maximize its outputs given inputs or minimize its inputs given outputs. Economic efficiency, on the other hand, is broader and requires both productive and allocative efficiency. It involves optimally choosing the levels and mixes of inputs and/or outputs based on reactions to market prices.

Cummins and Zi (1997) and Cummins and Weiss (1998) show that DEA focuses on the technological aspects of production and is used therefore to estimate production, cost and revenue frontiers. It provides a convenient way for decomposing cost efficiency into pure technical, scale and allocative efficiency without requiring estimates of input and output prices. If estimates of input prices are available, cost efficiency can also be measured (e.g., Aly, et al., 1990, and Ferrier and Lovell, 1990).

5.7.3 The unfavourable features of DEA

In DEA, the objective function constructs the frontier that minimizes total cost. However, as Drake and Simper (1999) make clear, the nonparametric nature of DEA considers any deviations from the efficient frontier as inefficiencies given the absence of random error. Furthermore, DEA does not allow for random error due to measurement problems (associated with using accounting data), luck (that temporarily raises or lowers inputs or outputs) and specification error (such as excluded inputs and outputs). These typically result in lower average efficiency, because there is more dispersion in the data, unless there is some unusual statistical association between random error and true efficiency. This effect may be quite large, since the random error in a single observation affects the measured efficiency of all of the firms that are compared to any linear combination on the frontier involving this firm. Hence, there is possibility that DEA actually overstates inefficiency levels by failing to allow for bad luck, measurement error and so on.

In addition Colwell and Davis (1992) stress that the efficiency frontier of DEA is sensitive and defined by the outliers rather than the whole sample and may therefore be particularly susceptible to extreme observations and measurement error. This possibility arises because the efficient frontier is derived from actual input/output configurations of the sample units. Hence, the level of efficiency may be largely determined in the case of outliers as there may be no similar units in the relevant input/output region from which to form the efficient production frontier. Besides, inadequacies in data or sample size may invalidate DEA results.

Finally, although the basic DEA models (CRS and VRS) have been improved in a number of ways in recent years, the non parametric methods suffer from the difficulty of drawing statistical inference and the lack of a definite functional form encapsulating the production technology (Casu and Molyneux, 1999).

5.7.4 The other non-parametric approaches utilised to estimate efficiency

The Free Disposal Hull approach (FDH), developed by Deprins et al (1984), is a special case of DEA. Here the hypothesis of convexity of the production possibility set (PPS) is abandoned, and the PPS is composed only of the DEA vertices and the free disposal hull points interior to these vertices. Because FDH frontier is either congruent or interior to the DEA frontier, FDH will typically generate larger efficiency estimates than DEA. DEA is a more efficient estimator than FDH, but only if the assumption of convexity is correct (Tulkens, 1993).

Like DEA, FDH permits efficiency to vary over time, requires no prior assumptions regarding the form of the distribution of inefficiencies across observations, except that the undominated observations are 100% efficient (Berger and Humphrey, 1997).

In addition to FDH, Casu and Molyneux (1999) indicate that there have been a number of attempts to generalise and extend the standard DEA non-parametric approach. These include the polyhedral cone-ratio DEA model (Charnes et al, 1990; Brockett et al, 1997; Resti, 1996); the assurance region DEA model (Thompson et al, 1997; Taylor et al, 1997); the non-parametric Malmquist Index method of productivity measurement (Griffell-Tatjé and Lovell, 1994); and tests of the sensitivity of DEA and FDH efficiency models to different radial and non-radial measurement techniques (Ferrier et al, 1994; Pastor, 1995; DeBorger et al, 1995).

To summarise, this section briefly reviewed the main features of the DEA methodology for estimating efficiency. DEA is the main non-parametric approach that can be used to estimate efficiency, utilising assumptions about constant returns to scale and variable returns to scale. A major drawback of the nonparametric approach is that it considers any deviations from the efficient frontier as inefficiencies given the absence of random error. In addition, this approach also suffers from the difficulty of drawing statistical inference and the lack of a definite functional form encapsulating the production technology.

5.8 Specification of bank's inputs, outputs and costs

Following the discussion on the main parametric and non-parametric approaches that have been utilised to estimate efficiency levels in banking, this section outlines the choice of bank inputs and outputs that have been used in the bank efficiency literature.

A financial firm is an entity engaged in the intermediation of services between borrowers and lenders. These services are related directly or indirectly to the financial assets and liabilities held by this firm such as loans and deposits. In addition, financial institutions such as banks are naturally multi-product firms, many of their services are jointly produced and so certain kinds of costs are jointly related to production of a variety of services. Furthermore, financial firms provide services rather than readily identifiable physical products, and there is no consensus as to the precise definition of what banks produce and how service output can be measured.

Intermediation theories do not provide a clear cut view regarding bank's output and input and therefore do not present precise indication as to how to define bank's costs. Allen and Santomero (1998) argue that many current theories of intermediation are too narrow and focus on functions of institutions that are no longer crucial in many developed financial systems. Bhattacharya and Thakor (1993) provides a review of the relevant literature where such theories are often unable to account for those activities that have become more central to many institutions such as risk management and cost-reduction oriented activities (see Casu and Molyneux, 2001).

Casu and Molyneux (2001) note that the earliest cost studies in banking applied a variety of different banking output indicators. Some early studies proxied bank services by a single index that combined all services into a uni-dimensional measure; others measured each bank service separately. In addition, some researchers chose to measure output in terms of bank assets and liabilities by focussing either on only one side of the balance sheet, or on both sides at the same time. Others have used bank revenues to measure bank output. Greenbaum (1967), for example, used the dollar market value of services rendered to measure output in an attempt to estimate the real social value of banking services.

While the multi-product nature of the banking firm is recognised, there is still no agreement as to the definition and measurement of bank inputs and outputs. The banking literature is divided concerning the issue of bank cost and there is no agreement concerning the variables that provide good proxy for bank costs. Benston, Hanweck, and Humphrey (1982) have summarized the issue into three viewpoints: economists tend to view bank's output as dollars of deposits or loans, monetary economists see banks as producers of money-demand deposits, while others see banks as producing loans, with demand and time deposits being analogous to raw materials. In general, researchers take one of two approaches labelled the 'intermediation approach' and the 'production approach'.

5.8.1 The Intermediation approach

The intermediation approach views bank as an intermediator of financial services. This approach was suggested by Sealey and Lindley (1977) and assumes that bank collect sources of funds (deposits and purchased funds with the assistance of labour and capital) and transform these into loans and other assets. The deposits are treated as inputs along with capital and labour and the volumes of earning assets are defined as measures of output. Consistent with this approach, costs are defined to include both interest expense and total costs of production. Some authors support the exclusion of interest expense from total costs, reasoning that interest costs are purely financial and not pertinent in measuring efficiency. Others have argued that excluding interest costs disregards the process of financial technology by which deposits are transformed into loans (for these viewpoints, see *for instance, Miller and Noulas, 1996, Aly. et al., 1990 and Clark, 1988*).

{Intarachote 2000 173 /id} summarises the advantages of the intermediation over other approaches. This approach treats deposits as inputs which are more convincing since banks use deposits as well as other funds to make loans and investment. This view is in accord with Mehdian and Elyasiani (1990) who support the idea that banks buy rather than sell deposits. Furthermore, the unit of bank inputs and outputs, under the intermediation approach, are measured in terms of monetary values that can determine the market share of individual banks. In addition, some services cannot be measured in terms of number of accounts such as investment in securities. Moreover, the intermediation approach includes interest expenses on deposits and other purchased funds which comprise the bulk of bank costs. Finally, the intermediation approach has been the most widely used in the empirical bank efficiency literature.

Berger, Leusner and Mingo (1997b) indicate that the intermediation approach has the advantages of being more inclusive and captures the role of banking institution. It emphasizes the overall costs of banking and is appropriate for addressing questions related to the cost minimization of banks (Ferrier and Lovell, 1990). Studies using this approach include Elyasiani and Mehdian (1990 a&b), Miller and Noulas (1996), Mester (1996), Altunbas and Molyneux (1997) and DeYoung (1998).

5.8.2 The Production approach

The production approach views banks as producers of loan and deposit services using capital and labour. The number of accounts of each type is the appropriate definition of outputs. The total costs under this approach are exclusive of interest expense and outputs are measured by the number of accounts serviced as opposed to dollar values, thus considering only operating but not interest costs (Clark, 1988, Miller and Noulas, 1996, Aly. et al., 1990). Studies that have used this approach include Sherman and Gold (1985), Ferrier and Lovell (1990) and Berger and DeYoung (1997).

5.8.3 The other approaches used to define bank's inputs and outputs

There are three other forms of the intermediation approach suggested by Berger and Humphrey (1992). These forms define bank inputs and outputs according to bank activities.

The first is the asset approach which considers banks as financial intermediaries between liability holders and those who receive funds. The outputs are therefore defined by assets and loans while the inputs are defined as deposits and other liabilities. The main shortcoming of this approach is that it does not take into account the other services provided by banks. Studies utilising this approach include English et al. (1993) and Favero and Papi (1995).

The second is known as the value-added approach where both assets and liabilities are considered to have some output characteristics and bank inputs and outputs are defined based on their share of value added. Outputs are classified from activities that create high value-added such as loans, demand deposits and time and saving deposits. Others outputs are considered unimportant, intermediate products or inputs. The studies that use this approach include those of Berg et al. (1992), Clark (1996), Grifell-Tatje and Lovell (1996) and Bhattacharyya et al. (1997).

The third approach is known as the user-cost approach which determines whether the final product is an input or an output based on its contribution to bank revenue. On this basis, the transaction is defined as an output if the financial return (e.g. return on asset or equity) exceeds the opportunity cost of the funds, or defined as a cost (liability) if financial cost is less than the opportunity cost of those funds. The drawback of this approach is that it is often difficult to obtain accurate data on prices and revenues (Favero and Papi, 1995). Studies that use this approach include Aly et al. (1990), Fixler and Ziechang (1993) and Resti (1997).

Finally, some researchers model bank inputs and outputs according to assumed bank objectives (see Intarachote 2001 for details). For example, Leightner and Lovell (1998) specified outputs such as net interest income and non-interest income assuming that banks' main objective is to maximise revenue. Bergendahl (1998) assumes that banks have two input-saving objectives of risk management and service provision. For the risk management objective, output is measured by gross revenues while bank input is measured by credit losses. For a service provision objective, output can be captured by the volume of lending or deposits, and inputs can be measured by personnel and other capital costs.

To conclude this section, both the intermediation and production approach have received most attention in the banking efficiency literature but there is no consensus as to the 'best' approach. Berger and Humphrey (1997) indicate that both approaches are imperfect because neither fully captures the dual role of financial institutions, which includes both the provision of transaction and document processing services, and the transfer of funds from savers to borrowers. The 'production approach' may be somewhat better for evaluating the efficiencies of branches of financial institutions, because branches process primarily customers documents for the institution as a whole, and branch managers typically have little influence over bank funding and investment decisions. On the other hand, the 'intermediation approach' may be more appropriate for evaluating entire financial institutions because this approach is inclusive of interest expenses, which often account for between one-half and two-thirds of total costs. Moreover, the 'intermediation approach' may be superior for evaluating the importance of frontier efficiency to the profitability of financial institutions, since the minimisation of total costs (and not just production costs) is needed to maximise profits.

This thesis will utilise the intermediation approach as suggested by Sealey and Lindley (1977), where inputs include labour, physical capital and deposits and these are used to produce earning assets and interest costs are included in the definition of total costs. The total costs are proxied by the sum of labour, capital, and loanable funds expenditures incurred by the banks in the production of outputs and services. Consistent with the intermediation approach, all outputs are measured in dollars. As indicated earlier, this approach is followed by many other studies like those of Mester (1996), and Berger and Mester (1997).

5.9 Efficiency in banking: empirical evidence*

This section reviews the previous literature that has investigated the efficiency characteristics of banking systems in various countries. Nowadays, a substantial literature addressing efficiency in banking has emerged on both developing and developed countries. These studies investigate such things as the impact of mergers and acquisitions and the consequences of economic reforms and financial deregulation on banking sector efficiency.

5.9.1 Studies on scale and scope efficiency

The first methodical study of scale economies in banking was carried out by Alhadeff (1954) who utilised earning assets (loans and investment) as the measure of bank output. He focused on cost differences between branch and unit banks of different sizes in California State over the years 1938-50. He found that there were economies of scale in banking; increasing returns for small banks, constant returns for the middle range and increasing returns for the largest banks.

However, the use of earning assets as a measure of output was criticised since it did not include all assets, this omission tended to exaggerate the average unit cost of large banks. Later on, Schweiger and McGee (1961), and Gramley (1962) used total assets as a measure of bank output. Schweiger and McGee (1961) found that large banks had a cost advantage over small and medium-sized banks. Gramley (1962) found that average cost

* This section reviews selective efficiency studies that have significantly contributed to the bank efficiency literature while the tables included in this chapter provide more detailed summary of the broad literature.

decreased as bank size increased and, therefore, larger banks had a cost advantage over small banks.

Benston (1965a,b) utilised the Cobb-Douglas cost function to study scale economies in banking. His studies initiated a new stage in utilising more advanced techniques to study costs structure in banking. Benston found that economies of scale were present, but were small for all banking services. Greenbaum (1967) reviewed the early literature on bank costs, and concluded that economies of scale were generally exhausted after banks' asset size exceeded $10 million. Banks with more than $10 million in assets were therefore inefficient, because of high overhead unit costs, high transaction costs, and the lack of sufficient specialisation and limited diversification.

Casu and Molyneux (2001) have noted that studies during the 1970s sought to take into account technological change and other developments affecting the banking industry (Schweitzer, 1972; Murphy, 1972; Daniel et al, 1973; Kalish and Gilbert, 1973; Longbrake and Haslem, 1975; Mullineaux, 1975, 1978). From these studies, it emerged that if there were economies of scale in banking, they were not sufficient to preclude small and medium-sized banks from viable competition. On the other hand, many of these studies which used the Cobb-Douglas functional form, to estimate economies of scale, used modest samples in which large banks were under represented. Furthermore, the Cobb-Douglas functional form allows neither for a U-shaped average cost curve, nor for the computation of economies of scope.

To overcome the disadvantages of the Cobb-Douglas functional form, Benston (1982b) introduced the translog functional form to estimate scale economies. The translog offered at least two important advantages over the Cobb-Douglas approach. First, it allows for a U-shaped average cost curve, or more generally for a cost curve that is not uniform for all sizes. Second, it allows one to test the hypothesis that input elasticities are not equal to one, an implicit assumption in the Cobb-Douglas functional form. It also imposes fewer constraints on the structure of costs than the CES production function (Forestieri, 1993). In general, the translog functional form was accepted in the literature, as it appeared to be a more suitable in representing the 'true' nature of the activity of financial institutions.

Casu and Molyneux (2001) note that the increasing use of the translog functional form led to a reappraisal of earlier bank efficiency results. The majority of studies from the 1980s, using either the production or the intermediation approach, reported the existence of scale economies up to a very low level of output (typically around $100 million). The estimated average cost function was often U-shaped, but optimal bank size was typically small (Benston et al, 1982b; Benston et al, 1983; Gilligan et al, 1984; Berger et al, 1987; Humphrey, 1987; Mester, 1987). With the exception of Gilligan et al (1984), these studies found little evidence of substantial scope economies.

A new trend in the study of banking sector efficiency was commenced by Humphrey (1987), who examined scale economies through investigating cost dispersion among banks of similar size. He noted that variations in costs among banks had two sources; scale economies across different sized banks and cost differences across similar sized banks. Utilising cost data on 13,959 banks in the USA over 1980, 1982 and 1984, Humphrey found that cost economies were dominated by differences in average cost levels. Specifically, the difference in average costs between banks with the highest cost and banks with the lowest was two to four times greater than the observed variation in average cost across bank size classes. Therefore, the existence of scale economies provided little competitive advantage for large banks over smaller institutions.

Gilligan et al. (1984) examined economies of scale and scope using data for 714 banks from the Federal Reserve's Functional Cost Analysis (FCA) programme for the year 1978. They found that economies for small banks with less than US $ 25 million in deposits but diseconomies beyond US$ 100 million deposits. Moreover, they also found that bank output was characterised by scope economies. Gilligan and Smirlock (1984) examined economies of scale and scope by using data from the Federal Reserve Bank of Kansas City for more than 2700 unit banks for years 1973-78. They found that there were slight economies of scale for banks with less than US$ 10 million deposits and diseconomies above US$ 50 million deposits. Kolari and Zardkoohi (1987) examine the scale and scope economies for a sample of banks using data drawn from the FCA programme of the Federal Reserve over 1979-83. Their main findings were that cost curves were U-shaped and that unit banks benefited from greater scope economies than branch banks.

Berger et al. (1987) formulated two new multi-product measures of cost economies, expansion-path scale economies and expansion-path subadditivity. They used the translog functional form and obtained 1983 FCA data from the Federal Reserve Banks' system for 413 branching state banks and for 214 unit state banks. Their results indicate that there was evidence of scale economies in general where branch banks showed slight scale economies at the branch level and slight diseconomies of scale at the level of the banking firm, whereas unit state banks showed large diseconomies of scale for large banks. Furthermore, the study concludes that there are diseconomies of scope in banking. (For more evidence on studies in US banking, see Table 5.1 below). In addition to the US studies on economies of scale in banking, there have also been a number of European studies; these are covered below.

Table 5-1: Review of scale and scope efficiency studies in US banking

Author	Year	Data	Model	Findings
Alhadeff	1954	Data drawn from the FED of San Francisco for the years 1938-50 on 210 Californian banks	Financial Ratios with Earning Assets as output	Increasing return to scale for large and small banks and constant return to scale for mid-sized banks.
Horvitz	1963	Data from annual reports of the Federal Deposit Insurance Corporation	Financial Ratios with Earning Assets as output	Average cost decreases from the smallest bank to the largest, economies of scale for small and large banks and constant returns to scale for mid-sized banks.
Schweiger and McGee	1961	6,233 Federal Reserve member banks in 1958	Multiple Regression Analysis	Large banks seem to have a cost advantage over small and medium-sized banks.
Gramely	1962	270 Tenth Federal Reserve District small unit banks over 1956-59	Multiple Regression Analysis	Real economies of scale were responsible for the negative relationship between unit costs and bank size.
Benston	1965a	From the FCA programme of the Federal Reserve Bank of Boston for the period 1959-61	Cobb-Douglas Cost Function	Significant economies of scale existed for demand deposits and mortgage loans. Time deposits and instalment loans showed significant diseconomies of scale. Branch banks have higher operating costs than unit banks.
Benston	1965b	From the FCA programme of the Federal Reserve Bank of Boston for the period 1959-61	Cobb-Douglas Cost Function	Economies of scale exist for branch banks.

Table 5-1: Review of scale and scope efficiency studies in US banking (continued)

Author	Year	Data	Model	Findings
Greenbaum	1965	From the Fifth and Tenth Federal Reserve Districts, for 413 and 745 banks respectively	Weighted Output Index	Evidence of U-shaped average cost curve, indicating that average cost declined for small sized banks, but increased for large banks. Branch bank operating costs seemed to be higher than unit bank costs.
Bell and Murphy	1968	From the FCA programme of the Federal Reserve Bank of New York, Philadelphia and Boston for 283 banks	Cobb-Douglas cost Function	Economies of scale exist for demand deposits and real estate loans. Slight diseconomies of scale exist for time deposits and instalment loans. Branch banks have higher operating cost than unit banks.
Schweitzer	1972	A large sample of small banks from the Ninth Federal Reserve District, for 1964, from the Call and Income data	Cobb-Douglas cost Function	Evidence of a U-shaped cost curve. Economies of scale appear to exist for banks with total assets less than US $3.5m.
Murphy	1972	FCA data for 1968 on 967 banks	Cobb-Douglas Cost Function	Banks seemed to be characterised by constant returns to scale.
Daniel, Longbrake and Murphy	1973	FCA data for 1968 on 967 banks	Cobb-Douglas Cost Function	Large banks can improve operating efficiency by using computer technology.
Kalish and Gilbert	1973	FCA data for 1968 on 898 banks	Cobb-Douglas Cost Function	Evidence of U-shaped average cost curve. Unit banks have the lowest operating costs, followed by affiliated banks and branch bank.

Table 5-1: Review of scale and scope efficiency studies in US banking (continued)

Author	Year	Data	Model	Findings
Longbrake and Haslem	1975	FCA data for 1968 on 967 banks	Cobb-Douglas Cost Function	Unit banks have the lowest average operating costs; all banks have economies of account size; the number of branch bank offices did not affect the cost of producing demand deposit services.
Mullineaux	1975	FCA data for 1970 from the Federal Reserve Bank of Boston, New York and Philadelphia	Cobb-Douglas Cost Function	Larger economies of scale are found for unit banks.
Mullineaux	1978	FCA data for 1971 on 892 banks and for 1972 on 859 banks	Cobb-Douglas Cost Function	Banks in branching states had constant returns to scale, while increasing returns were found in unit banking states.
Benson, Berger, Hanweck and Humphrey	1983	FCA data for 1978 on commercial banks up to US$ 1 billion in deposits	Translog cost function	Evidence of scale economies for branch banks at the banking office level for all sizes and for unit banks at office level only up to US$ 75-100 billion deposits. Constant return to scale for small unit banks at firm level. Slight evidence of scope economies either for unit and branch banks.
Clark	1984	Data on 1205 unit banks for the period 1972-77	Translog (Box-Cox transformation) and Cobb-Douglas (Box-Cox transformation)	Limited evidence of scale economies. The scale elasticity seems independent from the choice of the cost function and from the output definition.
Gilligan and Smirlock	1984	Data from the FED of Kansas City for the period 1973-78 on more than 2700 unit banks	Translog cost function	Evidence of scale economies in banks with less than US$ 25 million deposits.

Table 5-1: Review of scale and scope efficiency studies in US banking (continued)

Author	Year	Data	Model	Findings
Hunter and Timme	1986	Data from Bank Compustat for the period 1972-82 on 91 BHC operating in 28 states	Translog Cost Function	Evidence of scale economies with respect to operational costs.
Shaffer and David	1986	Data from the Call and Income Reports on the 100 largest US banks with asset size over US$ billion	Translog cost Function	Evidence of economies of scale for large banks.
Berger, Hanweck and Humphrey	1987	FCA data for 1983 on 413 branch banks and 214 unit banks	Translog Cost Function	Evidence of economies of scale for banks up to US $ 50 million, diseconomies of scale above $50 millions. Evidence of scope economies only for very small banks.
Kolari and Zardkoohi	1987	FED-FCA data for the period 1979-1983	Translog Cost Function	Economies of scale for banks with up to US $50 million deposits and decreasing return to scale beyond $ 50 million. Diseconomies of scope in general; economies of scope in loans and deposits.
Hunter, Timme and Yang	1990	Data from the Call and Income Reports on 311 largest US commercial banks	Translog Cost Function	Results suggest that large banks would be better off if they would break up production into groups of specialist banks. No strong evidence on cost subadditivity.

Table 5-1: Review of scale and scope efficiency studies in US banking (continued)

Author	Year	Data	Model	Findings
Aly, Grabowski, Pasurka and Rangan	1990	A sample of 322 independent banks drawn from the Federal Deposit Insurance for the year 1986.	Non-parametric Approach	The results indicated a low level of overall efficiency; 0.65. The main source of inefficiency was technical in nature, rather than allocative. The calculated scale efficiency was 0.97.
Noulas, Ray and Miller	1990	Data from the Income and Condition Reports on 309 branch banks with assets over US$ 1 billion	Translog Cost Function	Evidence of scale economies for banks with assets between US$ 1 billion and $ 3 billion, diseconomies of scale for banks with assets above $ 3 billion.
Mester	1992	Data from Reports on Condition and Income on 328 branch banks with more than US$ 1 billion of assets	Translog Cost Function	Evidence of global scale economies for all size banks. Significant scope economies.
Pulley, Berger and Humphrey	1994	Data on a panel of 683 US banks located in states that had some form of within state branching during 1980s and having assets over $ 100 million are used in 1978 and 1984. The sample was extended to 1990 by including an overlapping group of 626 banks for this period	A combination of a quadratic structure multiple outputs + log-quadratic Translog for input prices	No evidence of statistical significant consumption from revenue complementarities over 1978-90. Furthermore, no significant scope economies among the set of revenue efficient banks. Finally, weak evidence is found of significant revenue ray scale economies for small banks.

Notes: FCA: Functional Cost Analysis
Sources: Berger and Humphrey (1997), Intarachote (2000), Casu (2000), Girardone (2000) and author's own updates.

Fanjul and Maravall (1985), and Rodriguez et al (1993) found evidence of both scale and scope economies for medium-sized saving banks and diseconomies of scale and scope for larger institutions in Spain. Gathon and Grosjean (1991) found decreasing returns to scale for the four largest Belgian banks, with assets above 50 million BF, and increasing returns to scale in all other banks. Pallage (1991) found evidence of scale economies for small Belgian institutions, and diseconomies of scale as size increases, confirming the results of Pacolet (1986). In addition, evidence of scope economies was found for the five largest Belgian banks.

UK studies in their turn have focused mainly on the building society sector. Gough (1979), and Barnes and Dodds (1983) both estimated linear average cost functions, and found no evidence of scale economies for UK building societies, using data covering the periods 1972-79 and 1970-78 respectively. Cooper (1980) found evidence of scale economies for building societies with assets size of less than £100 million, and diseconomies of scale for larger societies. Hardwick (1989, 1990) found evidence of scale economies for relatively smaller building societies and no evidence of scope economies.

Drake (1992) uses the translog form for a sample of 76 building societies of UK in 1988. His results suggest mild economies of scale for societies in the £120-500 million asset size but find no evidence of economies of scope. Drake (1995) extends his previous study by re-specifying the translog to include more parameters to control for expense-preference behaviour. He again finds no evidence of either economies of scale or scope.

Sheldon and Haelger (1993) and Sheldon (1994) find that Swiss bank with diversified product mixes are more inefficient than specialised banks. Lang and Welzel (1994) use the standard translog to estimate cost economies for the German cooperative bank sector using a sample of over 700 banks. They find evidence of scope economies especially for the largest cooperative banks.

McKillop and Glass (1994) employed a hybrid translog cost function to obtain measures of overall economies of scale, product-specific scale economies and economies of scope. The data were obtained from the 1991 annual returns for a sample of 89 national, regional and local building societies. There was evidence of significant augmented economies of scale for both national and local societies, but only constant returns to scale for those societies that are regionally based. There was no evidence of economies of scope or cost complementarities.

Molyneux et al. (1996) used the hybrid translog cost function to examine economies of scale and scope in France, Germany, Italy and Spain. They found differences in cost characteristics between countries (scope and scale economies appeared to be evident in each country, however, over a wide range of bank output levels). (More evidence on studies on European banking is presented in Table 5.2 below).

Table 5-2: Review of scale and scope efficiency studies in European banking

Author	Year	Data	Model	Findings
Levy-Garboua and Renard	1977	Data on 94 France banks in 1974	Cobb-Douglas Cost Function	The study finds evidence of increasing return to scale.
Gouch	1979	Data on UK building societies for the period 1972-76	Linear Average Cost Function	The study finds no evidence of economies of scale.
Cooper	1980	Data on UK building societies for 1977	Cobb-Douglas Cost Function	The study finds evidence of scale economies for societies with asset size less than £100 million; diseconomies of scale for larger societies.
Barnes and Dodd	1983	Data on UK building societies for the period 1970-78	Linear Average Cost Function	The study finds no evidence of economies of scale.
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; constant return to scale relating to the number of branches.
Dietsch	1988	Data on 243 France banks for 1986	Translog Cost Function	Limited evidence of overall scale economies; however, there were significant potential scale economies to be obtained.

Table 5-2: Review of scale and scope efficiency studies in European banking (Continued)

Author	Year	Data	Model	Findings
Cossutta et al.	1988	Data on 226 Italy banks for 1984	Translog Cost Function	Evidence of scale economies at office level for the medium-large sized office and for large banks. Constant return to scale for all other sizes. Evidence of scope economies.
Lanciotti e Raganelli	1988	Data on 359 Italy commercial banks for 1984	Translog Cost Function/Box-Cox Transformation	The study finds evidence of scale economies.
Hardwick	1989	Data on 97 UK building societies for 1985	Translog Cost Function	Evidence of economies of scale for societies with assets under £280 million and diseconomies of scale for those with assets over £1,500 million.
Baldini e Landi	1990	Data on 294 Italy banks for 1987	Translog Cost Function	Evidence of scale economies when the number of offices is fixed; no evidence of scope economies.
Cardani et al.	1990	Data for 94 Italy banks for 1986	Econometric estimate of Cost Frontier	Evidence of scale economies for small banks.
Landi	1990	Data on 295 Italy banks for 1987	Translog Cost Function	Evidence of scale economies for all bank sizes. Evidence of scope economies only if separate production needs more branches. Reductions of branches imply cost saving of scope economies.

Table 5-2: Review of scale and scope efficiency studies in European banking (Continued)

Author	Year	Data	Model	Findings
Hardwick	1990	Data on 97 UK building societies for 1985	Translog Cost Function	Evidence of statistically significant scale economies for societies with assets under £5,500 million. No evidence of scope economies.
Conigliani et al.	1991	Data on 256 Italy banks for the period 1975-90	Translog Cost Function	Evidence of scale economies only for small size banks and for banking groups. Scope economies not relevant in general but positive for banking groups.
Gathon and Grosjean	1991	Data on 24 Belgium private banks from the Association Belge des Banques and Annual Reports	Translog Cost Function	Evidence of scale diseconomies for the four big banks (assets beyond 50 million BF); scale economies in all other banks.
Pallage	1991	Data on 57 Belgium commercial banks, 24 savings banks and 3 public credit institutions	Translog Cost Function	Evidence of scale economies for small institutions; decreasing return to scale when size grows. Evidence of scope economies for the five big banks.
Conti e Maccarinelli	1992	Commercial banks among the first 2,000 in size in Europe, US and Japan	Correlation Analysis	Evidence of scale economies for small banks.
Martin and Sassenou	1992	Data on French banks for 1987	CES-Quadratic Function	Small banks benefit from large economies of scale and scope. Bigger banks incur relatively large-scale diseconomies depending on their output scale and their degree of specialisation.

Table 5-2: Review of scale and scope efficiency studies in European banking (Continued)

Author	Year	Data	Model	Findings
Drake	1992	Data from the Bank of Ireland on UK banks for the period 1972-90	Hybrid Translog Cost Function	The bank was characterised by overall diseconomies of scale; product specific scale economies were reported to be decreasing for investments and increasing for loan.
Rodriguez, Alvarez and Gomez	1993	Data on 645 Spanish Savings banks for 1990	Hybrid Translog Cost Function	Evidence of scale and scope economies for medium-sized savings banks and diseconomies of scale for larger institutions.
Dietsch	1993	Data on 343 French banks for 1987	Translog Cost Function	Strong evidence of economies of scale across all output ranges; scope economies were not observed at a high level for all combinations of outputs.
McKillop and Glass	1994	Data on 89 UK building societies (local, regional and national) for 1991	Hybrid Translog Cost Function	Evidence of significant augmented economies of scale for both national and local societies, but only constant return to scale for those societies that are regionally based. No evidence of economies of scope or cost complementarities.
Drake	1995	Data on 76 UK building societies for 1988	Translog Cost Function	No evidence of scale economies when expense-preference behaviour is taken into account. Lack of evidence on the existence of scope economies.
Lang and Welzel	1996	Data on over 700 German cooperative banks	Translog Cost Function	Evidence of scope economies especially for large banks.

Table 5-2: Review of scale and scope efficiency studies in European banking (Continued)

Author	Year	Data	Model	Findings
Molyneux et al.	1996	Data on 201 French, 196 German, 244 Italian and 209 Spanish banks for 1988	Hybrid Translog Cost Function	The results indicated noticeable differences in cost characteristics across European banking markets; scope and scale economies appeared to be evident in each country over a wide range of bank output levels.
European Commission	1997	Balance sheet and income statement data from 1987 (295 banks) to 1994 (1451 banks) obtained from the IBCA Bankscope database for 10 EU countries	Translog Cost Function	The analysis showed that in all countries there was evidence of both economies and diseconomies of scale. The preponderance of increasing return to scale was found generally with the small banks, particularly in the case of Germany and France. Strong evidence of significant and apparently large economies of scope for the biggest banks.
Ashton	1998	A sample of 99 UK building societies over 1990-95	Fourier flexible + Translog	The mean scale efficiency is 76% using the Fourier flexible and 72.5% using the Translog form.
Casu and Girardone	1998	Data on 32 Italian banking groups and 78 bank parent companies and subsidiaries for 1995	Translog Cost Function	Slight evidence on the existence of scale economies; strong evidence on the existence of scope economies, especially for banking groups.

Sources: Berger and Humphrey (1997), Intarachote (2000), Casu (2000), Girardone (2000) and author's own updates.

Taking the US and European literature on scale economies together, the overall finding is that average cost curves have a relatively flat U-shape, with medium-sized banks being slightly more scale efficient than either very large or very small firms (Humphrey, 1991 and Berger, 1995). The translog studies suggest that average cost curves in US banking are U-shaped where economies of scale exist only up to relatively low levels of output (between $25 and $200 million in deposit size). Studies that used samples including large US banks generally found evidence of scale economies at higher output levels, well beyond $100-200 million in the deposit size range (Hunter and Timme, 1986; Shaffer and David, 1986; Kim, 1986; Hunter et al, 1990; Noulas et al, 1990). None of these studies, however, find much evidence on scope economies in banking.

5.9.2 Studies on productive efficiency in banking

This section presents empirical evidence on X-efficiency in banking. The following section 5.9.3 reviews literature that focuses on the consequences of economic and financial reforms on bank efficiency levels, as this thesis will examine the impact of economic and financial reforms, undertaken in various Arabian countries, on the performance of operating banks in these countries.

5.9.2.1 Banking studies that use the parametric approach to study X-efficiency

As indicated earlier, Leibenstein (1966) was the first to identify X-efficiency. He stated that while microeconomic theory focused on the possibilities of optimal allocative efficiency, it must also focus on the identification of X-efficiencies that reveal the differences in costs and revenues between firms. Efficiencies that are not related to size (scale) and product-mix (scope) are X-efficiencies. These are related to such things as superior management and the use of better technology. We already have shown in the previous chapter how X-inefficiency can be measured by estimating the deviation from best (cost or profit) practice.

Utilising the distribution-free approach for measuring banking efficiency derived from profit function estimates, Berger et al. (1993) find that larger US banks are more X-efficient, in general, than smaller banks (efficiency estimates ranged from 0.52 to 0.66) over the period 1984-89. Kaparakis et al. (1994) used the stochastic cost frontier methodology to measure efficiency for a sample of 5,548 US banks. They find that the overall efficiency is around 90% and banks become less efficient with greater size.

Altunbas et al. (1994a) evaluate inefficiencies for the German banking market by utilising the stochastic frontier analysis for a sample of 196 banks for the year 1988. The study finds that inefficiency levels are around 24%. Altunbas et al. (1994b) estimate levels of technical inefficiency in the Italian credit cooperative sector between 1990 and 1992 where they find that inefficiency ranged from 13.1% in 1990 to 17.6% in 1992. Moreover, they find insignificant inefficiency differences across Italian banks operating in different geographical regions.

Altunbas et al. (1995a) use the stochastic frontier approach to examine efficiency for the UK banks in 1993. They find that inefficiency is around 6% and the banks are more efficient than their building society competitors. Altunbas et al. (1995b) use the stochastic frontier to examine the relative efficiency of banks operating in Turkey over 1991-93. The study finds that inefficiency is relatively high; 46%, 32%, and 49% for the years 1991, 1992 and 1993 respectively. Furthermore, no significant efficiency differences were found between public and private banks.

Allen and Rai (1996) used both the SFA and DFA on a sample of 194 banks from 14 OECD countries (including 9 in the EU) for the period 1988-92. Large banks operating in countries that prohibited the functional integration of commercial and investment banking, had the largest inefficiency measures, amounting to 27.5 per cent of total costs.

Using banks' balance sheet and income statement data for the period 1987-94, EC (1997) estimated a pooled time-series cost frontier for all the main EU banking sectors. In general, the study found average inefficiencies of around 20%. Results for individual countries, calculated from the pooled EU estimates, showed that Luxembourg banks appeared to be relatively more efficient (0.88) than their counterparts in other banking systems.

Dietsch and Weill (1998) use unconsolidated accounting data of 661 commercial, mutual and savings banks from 11 EU countries covering the period 1992-96, to estimate changes in efficiency and productivity. The results suggest an increase in efficiency using both a cost and a profit frontier. This trend, however, was not observed in all countries;

France, Italy, Luxembourg and UK experienced decreasing efficiency measured in terms of costs. Productivity results showed an increase in total productivity, mainly due to technological change.

In a study of the cost characteristics of banking in European countries over 1988-95 using the Fourier-flexible functional form, Altunbas et al. (1999) find that economies of scale are widespread across banking markets and across different size classes of banks. The estimated cost functions are relatively flat with scale economies typically in the region of 5 per cent. In contrast, the X-inefficiency measures vary largely and, on average, are around 25 per cent. The authors also do not find that large banks are significantly more X-efficient than their smaller counterparts, although some banking markets do appear to be systematically more efficient than others.

Maudos et al. (1999) examined efficiency for a sample of banks from 11 EU countries with data covering the period 1993–96, using both cost and profit frontiers and taking into account firms' specialisations in the measurement of efficiency. Using the cost frontier, the average efficiency score for the whole sample was 0.44, compared with 0.74 when estimation of separate frontiers was carried out. Differences in product mix therefore seem to be important in explaining variation in banking sector efficiency. (Further empirical evidence on productive efficiency, in various banking sectors, is exposed in tables 5.3-5.5, at the end of this section).

5.9.2.2 Studies that utilise the non-parametric approaches to estimate X-efficiency in banking

Aly et al. (1990) explore various measures of efficiency for 322 randomly chosen independent US banks in 1986. Employing three inputs (i.e., labour, capital, and loanable funds) and five outputs (i.e., commercial and industrial, consumer, real estate, and other loans; and demand deposits), they discover that scale inefficiency is a minor problem when compared to pure technical inefficiency. In the second stage regression analysis, bank size and efficiency are positively related while product diversity and efficiency are negatively related.

Elyasiani and Mehdian (1990) investigate bank efficiency, as well as technological change, for a sample of 191 US banks with assets in excess of $300 million in both 1980 and 1985. Employing a four input (i.e., labour, capital, demand deposits, and savings and time deposits) and four output (i.e., commercial and industrial, real estate, and other loans; and investments) approach, they find that because of technological progress between 1980 and 1985, the same level of output can be produced with 10.45 to 22.29 percent fewer inputs.

Ferrier and Lovell (1990) use both econometric and programming techniques to evaluate bank efficiency for a sample of 575 US banks in 1984. Employing three inputs (i.e., total number of employees, occupancy costs and expenditure on furniture and equipment, and expenditure on materials) and five outputs (i.e., the number of demand deposits and time deposit accounts, and the number of real estate, instalment, and industrial loans), they report an overall technical inefficiency of 16.04 percent using the non-stochastic production frontier. They find, unlike the other studies, that small banks under $25 million in assets are the most efficient.

Yue (1992) evaluates the efficiency of the 60 largest Missouri banks for the period 1984 through 1990. Employing four inputs (i.e., interest and non-interest expense, and transactions and non-transactions deposits) and three outputs (i.e., interest and non-interest income, and total loans), he reports that pure technical inefficiency provides the major source of technical inefficiency.

Berg et al's (1993) utilise DEA to study bank efficiency in Finland, Norway and Sweden in 1990. Within countries, efficiency differences between banks were most important in Finland and Norway and least important in Sweden. The largest Swedish banks were among the most efficient units in the pooled sample, whereas only one large Finnish bank and no large Norwegian bank had efficiency scores above 0.90. More recently, Berg et al (1995) used DEA to investigate efficiency in the banking sectors of Denmark, Finland, Norway and Sweden. The study found that the largest Danish and Swedish banks were among the most efficient units in the pooled sample. Danish and Swedish banks appeared to be in the best position to expand in a common Nordic banking market.

Grabowski et al. (1994) consider the efficiency for a group of 670 US banks in 1979, 1983 and 1987. Employing three inputs (i.e., labour, capital, and loanable funds) and five outputs (i.e., commercial and industrial, consumer, and real estate loans; securities; and demand deposits), they conclude that pure technical inefficiency provides the main source of technical inefficiency. In addition, efficiency was the highest in 1983 for the various measures considered, except for scale efficiency that remained constant over the three years of observation. Finally, banks with deposits in excess of $1 billion had the highest technical efficiency.

Pastor et al (1995) analysed efficiency and differences in technology using non-parametric methods for eight European countries in 1992. France, Spain and Belgium appeared to have the most efficient banking sectors (with average efficiency scores of 0.950, 0.822 and 0.806 respectively), while the UK (0.537), Austria (0.608) and Germany (0.650) were the least efficient. Elyasiani et al. (1995) employed a flexible non-parametric approach to measure the productive efficiency of a sample of small and large banks to examine the relationship between size and productive performance in banking industry and to check whether the progress in relative efficiency over 80s. Their findings suggest that in the pre-deregulation period, small banks were more efficient while in the deregulated, small and large banks are equally efficiency. Moreover, the dispersion in the efficiency measures of the small banks was found to have increased substantially while that of large banks changed little over the sample period.

Wheelock and Wilson (1995) undertook DEA estimation of two specifications; the intermediation and production approach. They use the production approach but replace the number of deposits and loans accounts with their dollar amounts to check if this affects the estimated efficiency scores. They find that efficiency scores are the same applying both input/output specifications. (Further empirical evidence on banking productive efficiency is exposed in tables 5.3-5.5).

To summarise the findings of previous two subsections, while there are differences in productive efficiency estimates at the level of individual markets, it safe to say that the results of the above studies concur with Evanoff and Israilevich (1991) who survey the productive efficiency literature in the US and find that mean inefficiency levels typically range between 13-51%. This is also in agreement with Berger et al. (1993) survey who show that X-inefficiencies account for about 20% or more of the costs of banking, while scale and product mix inefficiencies are usually found to account for less than 5% of the costs. This general finding also concurs with later reviews, such as the extensive Berger and Humphrey (1997) survey of 130 efficiency studies that finds that average bank efficiency of studies that use DEA and other non-parametric methods are typically around 0.70 while those studies that employ parametric methods report overall mean efficiencies of 0.84 in US banking. On the other hand, the European efficiency studies, in particular, disagree somehow about the levels of X-inefficiency depending on the study period and the countries concerned but most studies suggest that cost X-inefficiency are around 20%.

Table 5-3: Review of X-efficiency studies in US banking

Author	Year	Data	Model	Findings
Sherman and Gold	1985	Data on savings bank branch with 14 offices for 1982	DEA	DEA identified 6 of the 14 banks to be relatively inefficiency, with an average efficiency of the sample equal to 0.96.
Parkan	1987	Data on 35 branches of a major Canadian bank	DEA	DEA identified 11 of the 35 branches to be relatively inefficient.
Rangan, Grabowski, Aly and Pasurka	1988	Data on 215 independent banks	DEA	The average value of efficiency for the sample was 0.70.
Aly et al.	1990	322 US banks in 1986	DEA	The efficiency estimates ranged from 0.75 to 0.81.
Elyasiani and Mehdian	1990a	Data on a random sample of 144 US banks for the period 1980-85	DEA	The average value of efficiency of the sample was 0.90.
Elyasiani and Mehdian	1990b	Data on a sample of 191 large US banks for the period 1980-85	DEA	The average value of efficiency of the sample was 0.88, revealing an inward shift of the frontier due to technological advancement.

Table 5-3: Review of X-efficiency studies in US banking (continued)

Author	Year	Data	Model	Findings
Aly, Grabowski, Pasurka and Rangan	1990	Data on a sample of 322 independent banks from the call reports for 1996	DEA	The results indicate a low level of overall inefficiency, which was more technical (0.75) rather than allocative (0.81).
Ferrier and Lovell	1990	Data on 575 banks for 1984	DEA & SFA	Overall inefficiency was 21% according to DEA and 26% according to SFA.
Berger and Humphrey	1991	Data on US banks for 1984	TFA	The authors suggested that their efficiency results (0.81) showed operational inefficiencies.
Yue	1992	Data on 60 Missouri banks for the period 1984-90	DEA	Overall efficiency of 0.8; it appeared that scale inefficiency was not a major source of inefficiency.
Elyasiani and Mehdian	1992	80 minority-owned US banks in 1988	DEA	The average efficiency estimates is 0.89.

Table 5-3: Review of X-efficiency studies in US banking (continued)

Author	Year	Data	Model	Findings
English et al.	1993	442 US banks in 1982	DEA	The average efficiency estimates were 0.75 and 0.76.
Pi and Timme	1993	112 banks in 1988-1990	SFA	The average efficiency estimate was 0.87.
Bauer, Berger and Humphrey	1993	Panel data on 683 large US branching state banks for the period 1984-89	SFA & TFA	The average efficiency of the sample was 0.87; the levels of efficiency were found to be reasonably consistent between the two approaches and over time.
Elyasiani and Mehdian	1995	150 US banks, for years 1979 and 1986	DEA	The average annual efficiency estimates were 0.97, 0.95, 0.95 and 0.96.
Berger, Hancock and Humphrey	1993	Data on US commercial banks from the Call Report for the period 1984-89	DFA	Inefficiencies in US banks appear to be quite large (0.52 small banks; 0.65 medium banks; 0.66 large banks); larger banks appear to be substantially more efficient than smaller banks.

Table 5-3: Review of X-efficiency studies in US banking (continued)

Author	Year	Data	Model	Findings
Grabowski et al.	1994	669 banks, 1979, 1983 and 1987	DEA	The efficiency estimates were 0.74, 0.76 and 0.73 for the years under study.
Kaparakis, Miller and Noulas	1994	Data on 5,548 banks with assets over US $ 50 million, for 1986.	SFA	Overall estimated inefficiency amounted to be 10%.
Berger, Leusner and Mingo	1994	Data on 760 branches of an anonymous US bank over the period 1989-91	DFA	Total efficiency averages 0.90 and 0.66 for the intermediation and the production approaches.
Wheelock and Wilson	1994	Data on 269 banks participating to the FCA program for 1993	DEA	Results show considerable inefficiencies among banks in the sample (around 50%).
Hunter and Timme	1995	Data on 317 banks with assets over US$ 1 billion, over the period 1985-1990	DFA	Overall inefficiencies in the range of 23%- 36%.

Table 5-3: Review of X-efficiency studies in US banking (continued)

Author	Year	Data	Model	Findings
Kwan and Eisenbeis	1995	Data on 254 bank holding companies, based on semi-annual data from 1986 to 1991	SFA	The average small size firm is found to be relatively less efficient (0.81) than their larger counterpart (0.92). The average X-inefficiency appears to be declining over time.
Clark	1996	440 US banks, 1988-91	TFA	The annual average efficiency was 0.73 and 0.90.
DeYoung and Nolle	1996	1812 US banks, 1985-90	DFA	The annual average efficiency was 0.56 and 0.73.
Mahajan et al.	1996	US multinational banks, 1987-90	TFA	The average annual efficiency was 0.77 and 0.88.
Mester	1996	Data on 214 banks of the Third Federal Reserve District for the years 1991-92	SFA	Evidence of a flat cost frontier (constant returns to scale). Average X-inefficiency on the order of 6 to 9 percent.
Spong, Sullivan and DeYoung	1996	Data on 143 state banks for 1994	SFA	The average bank in the least efficient group has an efficiency index of 0.71 while the average efficiency index for a bank in the most efficient group is 0.94.

Table 5-3: Review of X-efficiency studies in US banking (continued)

Author	Year	Data	Model	Findings
Miller and Noulas	1996	201 US banks, 1984-90	DEA	The average annual efficiency was 0.97.
Berger et al.	1997	832 US bank branches, 1989-1991	DFA	The efficiency estimates were 0.94 and 0.79
Berger and DeYoung	1997	Data on US commercial banks over the period 1985-94	SFA	Overall average efficiency of 0.92 over the entire sample period.
Mester	1997	6630 US banks, 1991-92	SFA	The efficiency estimates were 0.93, 0.92, 0.85, 0.87, 0.89, 0.88, 0.86 and 0.85 (for different US districts).
Perstiani	1997	US banks, 1980-90	DFA	The efficiency estimates were 0.79, 0.79, 0.77, 0.81, 0.81 and 0.77 (for different US districts).
Humphrey and Pulley	1997	Data on a panel of 683 US banks, all having assets over US$ 100 million in 1988 dollars. three time periods: 1977-80; 1981-84; 1985-88	TFA	Overall average efficiency of 0.81, 0.82 and 0.85 respectively in the three periods. Apparently, deregulation brought about an improved business environment.

Table 5-3: Review of X-efficiency studies in US banking (continued)

Author	Year	Data	Model	Findings
Berger and Mester	1997	Data on 6,000 US commercial banks over the period 1990-95	DFA	Failure to account for the equity position of a bank makes large banks appear to be more efficient than small banks.
Thompson, Brinkmann, Dharmapala, Gonzalez-Lima and Thrall	1997	Data on a panel of the US's 100 largest banks in asset size over the period 1986-91	DEA/AR	High levels of inefficiency were found: 0.81; 0.71; 0.61; 0.62; 0.57 and 0.65 for the years of analysis
Brockett, Charnes, Cooper, Huang and Sun	1997	Data on 16 largest banks in Texas over the period 1984-85	DEA/AR	Overall average efficiency scores of 0.97 in both 1984 and 1985 for the CCR DEA and 0.91 for 1984 and 0.89 for 1985 for the cone ratio DEA model.
DeYoung et al.	1998	3997 US banks, 1992	SFA	Mean efficiency of 0.66
Rogers	1998	A sample of more than 10,000 commercial banks in US from 1991-95	SFA	On average, cost efficiency ranged from 71% to 76% for the model compared to 65% to 66% for the restricted model. Mean revenue efficiency ranged from 41-44% and 50-51% for the restricted and unrestricted models respectively. Profit efficiency ranged from 69-71% and 65-68% for the restricted and unrestricted models respectively.

Notes: DEA= Data Envelopment Analysis; SFA=Stochastic Frontier approach; DFA=Distribution Free approach; TFA=Thick Frontier approach; FCA=Functional Cost Analysis.
Sources: Berger and Humphrey (1997), Intarachote (2000), Casu (2000), Girardone (2000) and author's own updates.

Table 5-4: Review of X-efficiency studies in European banking

Author	Year	Data	Model	Findings
Vassiloglou and Giolias	1990	Data on 20 Greek bank branches located in the vicinity of Athens	DEA	Average annual efficiency estimate of 0.91.
Aly, Grabowski, Pasurka and Rangan	1990	A sample of 322 independent banks drawn from the Federal Deposit Insurance for the year 1986.	Non parametric approach	The results indicated a low level of overall efficiency; 0.65. The main source of inefficiency was technical in nature, rather than allocative.
Berg, Forsund and Jansen	1992	264 Norwegian banks, 1980-89	DEA	Most efficient banks are belong to the smallest quartile of the sample.
Fukuyama	1993	143 Japanese banks for the year 1990	DEA	The average annual efficiency was 0.86.
Drake and Howcroft	1993	Data on a sample of 190 branches drawn from one of the six largest UK clearing banks	DEA	Overall average efficiency of 0.92, although there is considerable diversity across branches (St. deviation equal to 0.51).
Berg, Claussen and Forsund	1993	Data on 763 banks for the year 1990, of which 502 Finnish, 141 Norwegian and 120 Swedish	DEA + Malmquist Index	Overall average efficiency of 0.58 for Finland, 0.78 for Norway and 0.89 for Sweden.

Table 5-4: Review of X-efficiency studies in European banking (continued)

Author	Year	Data	Model	Findings
Berg, Forsund, Hjalmarsson and Suominen	1993	Data on 502 Finnish, 126 Swedish and 150 Norwegian banks for the year 1990	DEA	Overall average efficiency of 0.53 for Finland, 0.57 for Norway and 0.78 for Sweden.
Tulkens	1993	Data on 773 branches of a large publicly owned Belgian bank for the month of January 1987.	FDH	Out of 773 branches, 136 are found to be efficient; inefficiency seems to be more frequent in small branches than in large ones. Average efficiency appears to be quite high (0.97) due to the large percentage of observation that 199% efficient.
Berg and Kim	1994	173 Norwegian banks for the year 1988	TFA	The average annual efficiency was 0.81.
Altunbas, Molyneux and DiSalvo	1994	Data on 516, 452, 483 Italian credit co-operative banks for the years 1990, 1991 and 1992 respectively	SFA	The mean inefficiency score was 13.1% in 1990, 15.9% in 1991 and 17% in 1992.
Grifell-Tatje and Lovell	1995b	Data on nearly all Spanish savings banks over the period 1986-91	DEA + Malmquist	Overall average efficiency of 0.78, 0.78, 0.79, 0.83 and 0.83 for the five years of investigation. Average Malmquist Index 0.97.
Grifell-Tatje and Lovell	1995c	Data on nearly all Spanish savings banks over the period 1986-91	DEA + Malmquist Index	Overall average efficiency of 0.75, 0.74, 0.75, 0.80, 0.77, 0.80 for the five years of investigation. Average Malmquist Index 0.95.

Table 5-4: Review of X-efficiency studies in European banking (continued)

Author	Year	Data	Model	Findings
Berg, Forsund and Bukh	1995	Data on 714 banks of 4 Nordic countries for 1993	DEA	Largest Danish and Swedish banks are the most efficient.
Maudos, Pastor and Quesada	1995	Data on a panel of Spanish savings banks over the period 1985-94	SFA	The estimated average impact of technical change of average costs corresponds to an annual rate of 68%.
Pastor, Perez and Quesada	1995	Data on 168 US, 45 Australian, 59 Spanish, 22 Germans, 18 UK, 31 Italian, 17 Belgian and 67 French banks for 1992.	DEA + Malmquist Index	Overall weighted average efficiency estimates of 0.81 for the US, 0.89 for Spain, 0.93 for Germany, 0.92 for Italy, 0.92 for Austria, 0.54 for the UK, 0.95 for France and 0.92 for Belgium.
Favero e Papi	1995	Data on a sample of 174 Italian banks for 1991	DEA	Overall average efficiency equal to 0.96 for the production approach and 0.95 for the intermediation approach.
Allen and Rai	1996	Data on 194 banks from 11 OECD countries (9 EU countries) for the periods 1988-92	DFA & SFA	Prevalence of cost inefficiencies on diseconomies of scale and scope. Input inefficiency amounting to 27.5% of total costs.
Resti	1997	Data on a panel of 270 Italian banks over the period 1988-92	SFA & DEA	Overall average efficiency of 0.69 for the SFA and 0.74 for the DEA model.

Table 5-4: Review of X-efficiency studies in European banking (continued)

Author	Year	Data	Model	Findings
Dietsch and Vivas	1996	A sample of 223 French banks and 101 Spanish banks over the period 1988-92	DFA	Cost efficiency ranged from 47%-96% in France and 7%-96% in Spain depending on different models assumption.
Altunbas et al.	1997	4659 German banks for the years 1988-95	SFA	The average annual efficiency ranged from 0.93 to 0.95 for the years under study.
Altunbas and Molyneux	1997	13603 European banks for the years 1988-1995	SFA	The average annual efficiency estimates ranged from 0.72 to 0.76 for the years under study.
Lovell and Pastor	1997	Data on 545 branch offices of a large anonymous Spanish bank for the first semester of 1995	DEA	Overall average efficiency of 0.92, 60 branches out of 545 were found efficient.
Athanassopoulos	1997	Data on a sample of 68 commercial branches of a large bank in Greece	DEA	The estimated efficiency of the bank branches was equal to 0.90.

Table 5-4: Review of X-efficiency studies in European banking (continued)

Author	Year	Data	Model	Findings
European Commission	1997	Balance sheet and income statement data from 1987 (295 banks) to 1994 (1451 banks), obtained from the IBCA Bankscope database for 10 EU countries	SFA & DEA	Average efficiency levels in the EU of 0.72, 0.71, 0.73, 0.75 and 0.77 respectively for the 5 years under investigation, according to the SFA. According to the DEA, average efficiency levels are decreasing from 0.96 in 1990 to 0.93 in 1994.
Pastor, Lozano and Pastor	1997	Data for 1993 for 24 Belgian, 29 Danish, 150 French, 203 German, 26 Italian, 68 Luxembourgian, 26 Dutch, 17 Portuguese, 28 Spanish and 45 British banks	DEA	Average efficiency scores: 0.78 for Belgium, 0.71 for Denmark, 0.37 for France, 0.51 for Germany, 0.85 for Italy, 0.59 for Luxembourg, 0.71 for the Netherlands, 0.85 for Portugal, 0.82 for Spain and 0.56 for the UK.
Leightner and Lovell	1998	31 Thai banks for the years 1989-1994	SFA	The average annual efficiency estimates were 0.42, 0.51, 0.55, 0.58, 0.66 and 0.69 for the years under study.
Casu and Girardone	1998	Data on 32 Italian banking groups and 78 bank parent companies and subsidiaries for the year 1995	DEA & SFA	SFA efficiency estimates equal to 0.927 for banking groups and 0.947 for bank parent companies and subsidiaries; DEA efficiency estimates equal to 0.887 for banking groups and 0.903 for bank parent companies and subsidiaries.

Table 5-4: Review of X-efficiency studies in European banking (continued)

Author	Year	Data	Model	Findings
Maudos, Pastor, Perez and Quesada	1998	Data on 879 European banking firms over the period 1993-96	DFA	The results at 5% level truncation show a level of cost efficiency of 0.91 in average for 11 EU countries considered.
Dietsch and Weill	1998	Data on 661 commercial, mutual and savings from 11 EU countries for the period 1992-96	DEA + Malmquist + Profit efficiency	The results showed an increase in both cost and profit efficiency over the period. Increase in total productivity mainly due to positive technical progress.
Altunbas, Gardener, Molyneux and Moore	1999	Data for a sample of European banks for the period 1988-95	Fourier Flexible	The country estimates show that the relative inefficiency of various banking markets has increased over time, averaging around 25% of total costs
Maudos, Pastor, Perez and Quesada	1999	Data for a sample of banks (879 banks) from 11 EU countries for the period 1993-96	Cost and Profit Translog function	Average cost efficiency value obtained for the whole sample equal to 0.44: this value is increasing to 0.74 when bank specialisation is taken into account
Casu and Molyneux	1999	A sample of 750 from Germany, France, Italy, Spain and UK over the period 1993-97	DEA	The overall results suggest low levels of efficiency; ranging from .61 to .69 (based on variable return to scale assumption).

Notes: DEA= Data Envelopment Analysis; SFA=Stochastic Frontier approach; DFA=Distribution Free approach; TFA=Thick Frontier approach; FCA=Functional Cost Analysis.
Sources: Berger and Humphrey (1997), Intarachote (2000), Casu (2000), Girardone (2000) and author's own updates.

Table 5-5: Review of X-efficiency studies in other banking markets

Author	Year	Data	Model	Findings
Oral and Yolalan	1990	Turkish Bank Branches	DEA	Estimated efficiency ranged from 0.53 and 0.87.
Fukuyama	1995	462 Japanese banks for the years 1989-91	DEA	The average annual efficiency was 0.46, 0.46 and 0.44.
Zaim	1995	95 Turkish banks for the years 1981 and 1990	DEA	The annual efficiency was 0.83 and 0.94 for the years under study.
Schaffinit, Rosen and Paradi	1997	Data on 291 Ontario based branches of a large Canadian bank, subdivided into 4 groups according to size for 1993	DEA/AR	Overall average efficiency for the basic DEA model of 0.72 and 0.54 for refined DEA model.
Taylor, Thompson, Thrall and Dharmapala	1997	Data on 13 Mexican commercial banks over the period 1989-91	DEA/AR	The average efficiency is 0.75, 0.72 and 0.69 for the 3 years of analysis.
Bhattacharyya, Lovell and Sahay	1997	Data on 70 Indian commercial banks over the period 1986-91	DEA	Overall efficiency of 0.80; publicly owned banks seem to be more efficient (0.87) than their privately owned (0.75) and foreign-owned counterparts.

Table 5-5: Review of X-efficiency studies in other banking markets (continued)

Author	Year	Data	Model	Findings
Altunbas, Liu, Molyneux and Seth	1999	Data for Japanese banks (130 in 1993 and 1994 and 121 in 1995)	Fourier Flexible + SFA	Diseconomies of scale found when risk and quality factors taken into account; inefficiency estimates are similar in the two models and ranged between 5 and 7 percent
Hao, Hunter and Yang	1999	19 private Korean banks from 1985 to 1995	SFA	The efficiency estimated ranged from 0.85 to 0.91 over the years under study.
Intarachote and Brown	2000	Un-balanced sample of 15 Thai banks, 14 foreign banks working in Thai and some finance and specialised institutions. Working in Thai	DEA	The overall cost efficiency ranged from 26-48% for the local banks, 33-50% for the foreign banks, and 6-14% for the other financial institutions over the study under study.

Notes: DEA= Data Envelopment Analysis; SFA=Stochastic Frontier approach; DFA=Distribution Free approach; TFA=Thick Frontier approach.
Sources: Berger and Humphrey (1997), Intarachote (2000), Casu (2000), Girardone (2000) and author's own updates.

5.9.3 Financial liberalisation and productive efficiency

As indicated earlier, the financial systems in developing countries have typically been characterised by excessive control by their regulatory authorities. Gruben and McComb (1997), for instance, state that developing countries have historically been more aggressive than industrialised countries in their detailed bank control where the governments have imposed far higher requirements to regulate the resources of the banking sector.

Financial liberalisation involves breaking down these barriers. This includes nullifying regulations that limit entry and exit of firms into the banking industry and offering the firms pricing and other flexibility. Such reforms are aimed at enhancing competition, improving efficiency, upgrading service quality and extending the range of available financial instruments at lower costs to customers.

Bhattacharya et al. (1997) examines the impact of liberalisation on the productive efficiency of Indian commercial banks, utilising DEA, over the period 1986-91. Beginning in 1985, the Indian Reserve bank relaxed restrictions by adopting a system of flexible exchange rates, freeing lending and deposit rates and allowing certain mergers between various banks. Furthermore, the regulatory authorities adopted a liberalisation program that allowed industrial and businesses to enter the banking sector. Furthermore, the authorities stipulated that Indian banks had to attain 8% capital adequacy requirements in line with Basle Committee norms. The study concluded that publicly owned banks were the most efficient and privately owned banks the least efficient. The differences in the efficiency levels were linked to differences between regulations controlling the workings of each category of banks. Foreign banks were the least efficient at the beginning of the sample period but they were nearly as efficient as the publicly owned banks by the end of the period.

Zaim (1995) examine the effect of post-1980 financial liberalisation on the efficiency of Turkish commercial banks utilising a non-parametric methodology. He indicates that before the stabilisation programme in Turkey, the banking sector was characterised by restricted entry and regulated deposit and loan rates. The lack of interest rate competition in the sector forced banks to compete for deposits by establishing branch networks. This led to over-branching and overstaffing in the commercial banking industry. The main target of government reforms of the 1980s was to create a more competitive environment and thereby enhance the efficiency in the sector. Liberalisation policies allowed new entry of both domestic and foreign banks into the sector and deregulated interest rates, commissions and fees. As a result, unprofitable branches were closed and the number of staff reduced. The author concludes that financial reforms succeeded in stimulating commercial banks to take measures that would enhance both technical and allocative efficiency. Furthermore, state banks were found to be more efficient than their private sector counterparts. In addition, banks experienced considerable scale adjustment and were successful in achieving optimal scale.

Hao et al. (1999) studied the productive efficiency of private Korean banks over 1985-95 following the programme of deregulation initiated by the government in the early 1980s and augmented in the early 1990s. The authors refer to the period 1960-80 where the Korean government had extensive involvement in the banking and financial markets which led to imbalances in these markets and in the industrial structure of the economy. The financial repression that was associated with excessive regulation affected adversely the efficiency of the financial system and resource allocation. Restrictions on bank lending which favoured loans to family controlled industrial conglomerates caused small and medium sized firms to turn to the informal sector for lending. Furthermore, excessive government involvement in the banking system led to the erosion of effective credit evaluation and risk assessment policies. Following the privatisation period of the 1980s and the mid-1990s, banks dramatically changed their mix of inputs and outputs. These changes combined with technological developments led to significant improvement in the productivity of the banking sector. The results, in general, show that banks with higher rates of asset growth, fewer employees, larger amounts of core deposits, and lower expense ratios were more efficient. In addition, banks which branched nationwide were found to be more efficient. The major financial deregulation of 1991, however, was found to have had little or no significant effect on the level of bank efficiency.

In a seminal study on the impact of deregulation on banking sector efficiency in the US, Humphrey and Pulley (1997) outline banks' responses to deregulation of interest rates in the early 1980s. They use a profit function approach to separate the internal, bank initiated adjustments to deregulation from the external, contemporaneous changes in banks' business environment. They find that the consequences of deregulation were broad and included the raising of fees for deposit services, reduced operating costs at the branch level, changing asset mix towards floating-rate loans, and banks were seen to take on greater asset risk in search of higher revenue. Bank-initiated adjustments to deregulation took three main forms: cost offset and reduction, cost shifting, and revenue augmentation. Profits were stabilised, but at a lower rate than had existed previously, and annual rates of return did not attain their pre-deregulation levels until 1992. While the cost offset, cost reduction, and cost shifting responses to deregulation were quite successful, attempts to augment loan revenues were more than completely reversed by unexpectedly large loan losses. Furthermore, the results indicated that large banks (those with assets over $ 500 million) bore the brunt of adjustment to deregulation. Between 1977-80 and 1981-84, these banks adjusted deposit and loan output prices and their use of labour and capital inputs to minimize the negative impact on profits from the deregulation-induced rise in funding costs. The effects of changes in the business environment during this period included changes in the level of deposit and loan outputs and prices of inputs. Between 1981-84 and 1985-88, the situation was reversed for large banks and an improved business environment was the major reason for profit improvements that occurred.

The above studies present some empirical evidence that suggests that financial liberalisation can enhance competition in the financial industry (that in turn may improve efficiency levels). On this basis, we expect to find improved levels of efficiency in the Arabian banking markets under study in the following chapter, as these countries have initiated major economic and financial reforms aimed at improving the performance of their banking sectors. It should be noted, however, that the impact of financial deregulation on the banking efficiency can be mixed, as pointed by Berger and Humphrey (1997). Some studies point out that financial deregulation brings about higher levels of bank efficiency (Berg et al., 1992; Zaim, 1995; Bhattacharya et al., 1997; Leightner and Lovell, 1998). Other studies, however, argue that there was no noticeable impact of deregulation on bank efficiency (Bauer et al., 1993; Elyasiani and Mehdian, 1997; Griffell-Tatjé and Lovell, 1997; Humphrey and Pulley, 1997).

5.10 Conclusion

This chapter outlines the main methodological approaches used to estimate efficiency in banking sectors and provides extensive empirical evidence on the banking efficiency literature. It shows that frontier methodology has been extensively used to estimate banking efficiency as it removes the effects of differences in input prices and other exogenous market factors affecting the standard performance measures of firms. Frontier methodology can be broadly classified into parametric and nonparametric approaches. The parametric approach has the virtue of allowing for noise in the measurement of inefficiency but this approach requires assumptions about the particular form of the economic function being estimated and the distribution of efficiency. The programming approach, on other hand, requires no specification for functional form or its distributional forms. However, the non-parametric approach suffers from the drawback that all deviations from the frontier are attributed to inefficiency with no allowance made for noise in the standard models.

The chapter also shows that there is still no agreement as to the definition and measurement of bank inputs and outputs. In addition, the banking literature is divided concerning the issue of bank cost and there is no agreement concerning the variables that provide precise proxy for the production process. In general, researchers take one of two approaches labelled the 'intermediation approach' and the 'production approach'. However, both approaches are imperfect because neither fully captures the dual role of financial institutions, which includes both the provision of transaction and document processing services, and the transfer of funds from savers to borrowers.

Concerning the empirical findings of the bank efficiency literature, the chapter shows that X-efficiency dominates scale economies in banking and scope economies are illusive. The chapter covers evidence from both parametric and non-parametric studies and reviews briefly the empirical evidence of the impact of economic and financial reforms on banking efficiency. While evidence on the impact of deregulation on banking sector efficiency is mixed, the general view is that liberalisation reforms should ultimately bring about more competitive and efficient banking markets. Taken together, these main areas – banking sector efficiency and the influence of financial sector reforms – will be examined in the context of Arabian banking in the following chapter 6.

Chapter 6: Methodology and empirical results

6.1 Introduction

This chapter is the main empirical part of this thesis which investigates the efficiency levels in the banking sectors of various Arabian countries; Jordan, Egypt, Saudi Arabia and Bahrain over the 1992-2000 period. The empirical evidence on bank efficiency aims to highlight the features associated with the role of economic development and financial reforms that have taken place in these countries over the past decade. It is expected that the macroeconomic reforms, financial liberalisation and the market-oriented policies implemented in these countries over the last decade or so should have increased competition in the financial sector and therefore generated higher levels of banking sector efficiency.

Section 6.2 describes the sample which comprises data for 82 banks operating in the financial systems of Jordan, Egypt, Saudi Arabia and Bahrain over 1992-2000. This sample constitutes about 78%, 88%, 63% and 55% respectively, of the total assets of the financial systems (excluding the assets of foreign branches and central banks) of Jordan, Egypt, Saudi Arabia and Bahrain, respectively. Section 6.3 outlines the main characteristics of the Fourier-flexible functional form which is utilised to estimate the efficiency measures in the countries under study. Section 6.4 outlines the DEA methodology that is also utilised to estimate the efficiency measures in the countries under study in order to test for 'consistency' of the former stochastic frontier results. Section 6.5 explains the structural tests employed to obtain the most accurate model that describes efficiency levels for the banks in the countries under study. Based on chosen preferred models for cost, standard profit and alternative profit functions specifications, we report different efficiency measures for the banks in the countries under study. We then present the results of efficiency measures obtained utilising the DEA procedure comparing the result with those obtained utilising the stochastic frontier approach. Finally, section 6.7 is the conclusion.

6.2 Data and sample characteristics

Our data comprises a representative sample of the banks operating in Jordan, Egypt, Saudi Arabia and Bahrain and consists of 82 banks over the 1992-2000 period. This sample represents around 78%, 88%, 63% and 55% of the financial systems of these countries (excluding the assets of foreign branches and central banks) (Table 6.1 below shows the details).

Table 6-1: Size of the study sample relative to the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain over 1992-2000 (US$ million, figures rounded to nearest 2 digits)

	Bahrain			**Egypt**			**Jordan**			**Saudi Arabia**		
Country / Year	Sample Assets	Total. Banking Assets	%	Sample Assets	Total Banking Assets	%	Sample Assets	Total Banking Assets	%	Sample Assets	Total Banking Assets	%
1992	34,200	77,500	44	52,200	62,500	84	6,900	9,100	75	77,600	129,600	60
1993	34,300	68,400	50	54,300	60,900	89	7,100	9,600	74	82,700	142,800	58
1994	37,000	73,700	50	57,200	62,300	92	8,000	10,700	75	85,400	146,300	58
1995	40,000	73,700	54	63,900	69,800	92	9,100	11,900	77	89,600	150,100	60
1996	42,500	76,600	55	67,600	77,100	88	9,800	12,500	79	93,900	156,400	60
1997	44,900	83,500	54	77,200	89,100	87	11,100	13,700	81	105,000	163,900	64
1998	48,700	99,400	49	82,600	97,300	85	12,000	14,800	81	111,500	171,400	65
1999	55,200	102,100	54	88,700	103,300	86	13,000	16,300	80	121,700	172,200	71
2000	57,400	106,400	54	93,800	103,600	90	14,500	18,900	77	131,900	181,300	73
Average	43,800	84,600	52	70,800	80,600	88	10,200	13,100	78	99,900	157,100	63

Source: The total assets were extracted from the annual financial reports of the monetary agencies in the countries under study (the consolidated financial statements of the banks) while the sample was drawn from the London Bankscope database (January, 2000 & 2002).

Our sample represents the major financial institutions that have consistently published their financial statements over the last ten years in the countries under study. The relative size of Bahrain's banks sample looks small and the reason is that the financial system in this country has been dominated by offshore banking units which are excluded from the sample as these belong to large international financial institutions and their data are unavailable. In Saudi Arabia, the specialised government institutions, while important, do not publish detailed financial statements and so these are not included in the sample.

Table 6.2 shows the specialisation of the banks included in the sample. The number of commercial banks comprises around 66% of the total sample. The percent of commercial banks operating in each country varies; ranging from 42% in Bahrain to 77% in Saudi Arabia.

Table 6-2: Specialisation of banks under study, 1992-2000

% of total	Bahrain	Egypt	Jordan	Saudi Arabia	All
Commercial	44	76	57	77	**66**
Investment	28	8	29	8	**16**
Islamic	17	5	7	0	**7**
Other	11	11	7	15	**11**
Total Number	**18**	**37**	**14**	**13**	**82**

Source: Bankscope (Jan. 2000 & 2002)

Table 6.3 shows that the size of total assets of all the banks included in the present study increased from about US$ 180 billion in 1992 to about US$ 310 billion in 2000 and averaged about US$ 235 billion over the whole period. Dividing these financial institutions into nine size categories, the share of the largest banks (with assets size greater than US$ 5 billion) constituted around 70 percent of the total assets of all the banks over the period 1992-2000.

Table 6-3: Distribution of banks' assets in Jordan, Egypt, Saudi Arabia and Bahrain, 1992-2000

	1992	1993	1994	1995	1996	1997	1998	1999	2000	Avg.
	%	%	%	%	%	%	%	%	%	*US$, mil.*
1-99.9	0.11	0.08	0.14	0.16	0.14	0.10	0.06	0.02	0.02	202
100-199.9	1.16	1.05	0.78	0.35	0.31	0.18	0.21	0.29	0.27	1,073
200-299.9	1.76	1.35	1.10	1.78	1.04	0.80	0.67	0.36	0.32	2,173
300-499.9	3.78	4.08	3.47	2.79	2.92	2.75	2.49	2.04	1.58	6,422
500-999.9	2.56	2.73	4.64	4.57	4.51	3.53	3.67	3.47	3.29	8,569
1,000-2,499.9	11.87	11.50	9.89	13.09	10.02	11.31	11.84	10.51	10.15	25,911
2,500-4,999.9	8.29	8.56	4.68	4.94	7.12	6.65	6.50	7.66	8.26	16,470
5,000-9,999	18.22	19.28	24.51	26.23	24.40	26.82	14.88	19.13	9.28	46,196
10,000+	52.26	51.37	50.78	54.22	49.54	47.85	59.67	56.53	66.83	129,190
T. Assets (US$, mil., nominal values)	179,033	186,975	197,046	213,044	225,426	250,325	267,943	292,855	313,209	

Source: Bankscope (Jan. 2000 & 2002)

This study employs the intermediation approach, as indicated earlier, for defining bank inputs and outputs. Following Aly et al. (1990), the inputs used in the calculation of the various efficiency measures are deposits (w_1), labour (w_2) and physical capital (w_3). The deposits include time and savings deposits, notes and debentures, and other borrowed funds. The price of loanable funds was derived by taking the sum of interest expenses of the time deposits and other loanable funds divided by loanable funds. Labour is measured by personnel expenses as a percent of total assets*. Bank physical capital is measured by the book value of premises and fixed assets (including capitalised leases). The price of capital was derived by taking total expenditures on premises and fixed assets divided by total assets. The three outputs used in the study includes total customer loans (y_1), all other earning assets (y_2), and off-balance sheet items (y_3), measured in millions of US dollars.

* As staff numbers were not available for the banks in the sample, we used this measure instead. This measure for staff costs has been used in various previous studies including Altunbas et al. (1996) and (1999).

The off-balance sheet items (measured in nominal terms) were included as a third output. Although the latter are technically not earning assets, these constitute an increasing source of income for banks and therefore should be included when modelling the banks' cost characteristics; otherwise, total banks' output would tend to be understated (Jagtiani and Khanthavit, 1996). Furthermore, these items are included in the model because they are often effective substitutes for directly issued loans, requiring similar information-gathering costs of origination and ongoing monitoring and control of the counterparts, and presumably similar revenues as these items are competitive substitutes for direct loans.

The definitions, means, standards of deviation of the input and output variables used in the stochastic frontier estimations are reported in table 6.4. The table shows that the average bank had US$ 1.26 billion in loans, US$ 1.39 billion other earning assets and US$ 1.32 billion of balance sheet items over 1992-2000. The cost of input variables averaged about 7.0 percent for purchased funds, 2.0 percent for labour and 1.0 percent for physical capital over the period 1992-2000. On the other hand, the prices of banks output averaged about 15.0 percent for loans*; 5.0 percent for other earning assets and 1.0 percent for off-balance sheet items over the same period.

* This may be an over statement as interest earned on bonds is also included in this figure.

Table 6-4: Descriptive statistics of the banks' inputs and outputs for Jordan, Egypt, Saudi Arabia and Bahrain over 1992-2000

Variables	Description	Mean	St. Dev	Min.	Max.
TC	Total cost (includes Interest expense, Personnel expense, Commission expense, Fee expense, Trading expense, other operating expense) (US$ millions).	170	300	0	1,720
W1	Price of funds (%) (total interest expense/ total customer deposits (demand, saving and time deposits)).	0.07	0.09	0.00	1.98
W2	Price of labour (%) (total personnel expense/total assets).	0.02	0.01	0.00	0.21
W3	Price of physical capital (Non-interest expense/ Total assets).	0.01	0.01	0.00	0.21
Y1	The US $ value of total aggregate loans (all types of loans) (US$ millions).	1,260	2,280	1	15,060
Y2	The US $ value of total aggregate other earning assets (short-term investment, equity and other investment and public sector securities (US$ millions)).	1,390	2,470	1	13,600
Y3	The US $ value of the off-balance sheet activities (nominal values, US$ millions).	1,320	3,510	1	26,740
p1	Price of loans (%) (total earned interest/ Total loans).	0.15	0.07	0.01	0.87
p2	Price of other earning assets (%) (Trading income and other operating income excluding commission and fees income/Other earning assets).	0.05	0.04	0.01	0.33
P3	Price of off-balance sheet items (%) (Commission and fees income/ off-balance sheet items).	0.01	0.02	0.00	0.20

Source: Bankscope (Jan. 2000 & 2002)

In addition to the above input and output variables, the present study employs a variety of control and environmental variables* to rule out the effect of other factors that might

* The control variables enter into the stochastic frontier model in the same way as the input variables (as betas) and these variables are fully interactive with other parameters of the model; On the other hand, the

explain differences among efficiency estimates for the banks under study. The three control variables included in our model include the size of loan loss reserves as a percent of bank's credit portfolio, the capital adequacy ratio, and a time trend (see table 6.5 below for details). The loan loss reserves as a proportion of gross loans ranged between 0.01 and 19.68 percent, the latter figure suggests that some banks faced substantial credit quality problems. The total banks' capital as a percentage of total assets averaged around 14.0 percent with a standard deviation of 12.0 percent, this reflects sizeable differences in the capital adequacy of the banks under study.

The size of loan loss reserves as a proportion of gross loans is added to the model to control for the bank's risk structure. It is also used as a measure of bank's asset quality and as a measure of the bank's management efficiency in monitoring the credit portfolio. A lack of diversity in a bank's asset portfolio may be associated with increases in problem loans without sufficient provisioning, exposing bank's capital to risk and potential bankruptcy that might be closely related to the quality of bank management. Banks facing financial distress have been found to carry large proportions of nonperforming loans (Whalen, 1991). Furthermore, studies on bank failures suggest a positive relationship between operating inefficiency and failure rates (see for example, Cebenoyan, Cooperman, and Register, 1993; Hermalin and Wallace, 1994; Wheelock and Wilson, 1995). Barr, Seiford and Siems (1994) found that this positive relationship between inefficiency and failure is evident a number of years ahead of eventual failure. Kwan and Eisenbeis (1994) report that problem loans are negatively related to efficiency even in non-failing banks. Berger and DeYoung (1997) found a link between management quality and problem loans by reporting that an increase in management quality reduces the bank's problem loans.

Hughes et al. (1996a, b) and Mester (1996) included the volume of nonperforming loans as a control for loan quality in studies of US banks, and Berg et al. (1992) included loan

environmental variables are not interactive with other model parameters and added to the model as delta (as will be shown later).

losses as an indicator of loan quality evaluations in a DEA study of Norwegian bank productivity. Whether it is appropriate to include nonperforming loans and loan losses in bank's cost, standard and alternative profit functions depends on the extent to which these variables are exogenous. Such variables would be exogenous if caused by negative economic shocks "bad luck", but they could be endogenous, either because management is inefficient in managing its portfolio "bad management" or because it has made a conscious decision to reduce short-run expenses by cutting back on loan origination and monitoring resources "skimping". Berger and DeYoung (1997) tested the bad luck, bad management, and skimping hypotheses and found mixed evidence on the exogeneity of nonperforming loans.

Another important aspect of efficiency measurement is the treatment of financial capital. A bank's insolvency risk depends on the financial capital available to absorb portfolio losses, as well as on the portfolio risk themselves. Even apart from risk, a bank's capital level directly affects costs by providing an alternative to deposits as a funding source for loans. On the other hand, raising equity typically involves higher costs than raising deposits. If the first effect dominates, measured costs will be higher for banks using a higher proportion of debt financing; if the second effect dominates, measured costs will be lower for these banks. Large banks depend more on debt financing to finance their portfolios than small banks do, so failure to control for equity could yield a scale bias. The specification of capital in the cost and profit functions also goes part of the way toward accounting for different risk preferences on the parts of banks. Therefore, if some banks are more risk averse than others, they may hold a higher level of financial capital than maximising profits or minimising costs. If financial capital is ignored, the efficiency of these banks would be mismeasured, even though they behave optimally given their risk preferences. Hughes et al. (1996a, b, 1997) and Hughes and Moon (1995) tested and rejected the assumption of risk neutrality for banks. Clark (1996) included capital in a model of economic cost and found that it eliminated measured scale diseconomies in production costs alone. The cost studies of Hughes and Mester (1993) and the Hughes et al. (1996a, 1997) profit studies incorporated financial capital and found increasing returns to scale at large-asset-size banks. A possible reason is that large size confers diversification benefits that allow large banks to have lower capital ratios than smaller banks. Akhavein et al. (1997a) controlled for equity capital and found that profit efficiency increases as a result of mergers of large banks. Bank's capital is also included in the model of Berger and Mester (1997) who find that well-capitalised firms are more efficient. This positive relationship between capital and efficiency may indicate that inefficient banks with lower capital have less to lose in taking more risky projects than an efficient bank. This is consistent with moral hazard and agency conflict between mangers and shareholders where less monitored mangers with lower equity have incentives to expense preference.

The environmental variables (or efficiency correlates) were also added to the model to investigate the reason for the differences in efficiency scores across banks under study. These include variables that control for market structure and organisational characteristics, geographical segmentation and bank liquidity. We identify variables to account for bank specialisation, bank size and concentration in the respective banking industries. Financial institutions in each country are divided into four categories; commercial, investment, Islamic and other financial institutions (that perform various bank functions). Furthermore, we employ the 3-firm asset concentration ratio which is widely used to test for monopoly characteristics. Furthermore, we include a dummy variable to control for bank geographical (countries) location (Table 6.5 shows descriptive statistics of the control and environmental variables).

Table 6-5: Descriptive statistics of the banks' control and environmental variables for Jordan, Egypt, Saudi Arabia and Bahrain over 1992-2000

Variables	Description	Mean	St. Dev	Min	Max
The control Variables					
K	Capital Adequacy (%) (Total equity/ Total Assets)	0.14	0.12	0.01	0.72
S	Asset quality (Loan Loss Reserve / Gross Loans)	0.22	0.81	0.01	19.68
T	Time Trend	5.00	2.58	1.00	9.00
The Environmental Variables					
TA	Total Assets (US$ millions)	2,881	4,966	35	26,700
B	Dummy variable for Bahrain	0.22	0.41	0.00	1.00
J	Dummy variable for Jordan	0.17	0.38	0.00	1.00
E	Dummy variable for Egypt	0.45	0.50	0.00	1.00
Com.	Dummy variable for commercial banks	0.66	0.47	0.00	1.00
Inv.	Dummy variable for investment/ securities banks	0.16	0.37	0.00	1.00
Isl.	Dummy variable for Islamic banks	0.07	0.26	0.00	1.00
L	Liquidity ratio (%) (Total liquid assets/ Total Assets)	0.14	0.16	0.00	0.71
3-FCR	Three firm concentration ratio (%) (the largest 3 banks total assets of /Total assets of all banks in the bank country for the respective years)	0.62	0.14	0.48	0.81
MS	Bank assets market share (%) for each year	0.05	0.10	0.00	0.68

Source: Bankscope (Jan., 2000, 2002)

The total assets variable is used to control for bank size where bank size should be strongly associated with efficiency as size may be required to utilise scale and (maybe) scope economies (if large banks are more diversified). Furthermore, larger banks may have more professional management teams and/or might be more cost conscious due to greater pressure from owners concerning the bottom line profits (Evanoff and Israilevich, 1991). Berger et al. (1993) found that most of the efficiency differences among large banks was on the output side as larger banks might be better able to reach their optimal mix and scale of outputs. On the other hand, Hermalin and Wallace (1994), Kaparakis et al. (1994), DeYoung and Nolle (1996) found significant negative relationships. Other studies, however, report no significant relationship between bank size and efficiency, such as Aly et al. (1992), Cebenoyan et al. (1993), Mester (1993), Pi and Timme (1993), Mester (1996), Berger and Hannan (1995), Berger and Mester (1997), and Chang et al. (1998).

The 3-firm concentration ratio and market share variables were included to control for oligopoly behaviour along the lines of the traditional structure-conduct-performance paradigm (see Molyneux et al., 1996) and as an indicator of the characteristics of the respective banking industry structures. The Cournot model of oligopolistic behaviour suggests that there is a positive relationship between concentration and profitability. Consistent with this model, some studies have found a positive relationship between market concentration and profitability (Berger and Hannan, 1997; Berger and Mester, 1997). The market power that prevails in the less competitive markets enable some banks to charge higher prices for their services and make supernormal profits. Banks may exert their own market power through size as noted by Berger (1995) and so we include a market share variable to control for what Berger refers to as 'relative market power'.

Dummy variables for bank specialisation are also included in the model so as to control for the product diversity as efficiency might associated with firm's strength in carefully targeting its market niches. The cost of producing various products might be lower when specialised banks produce them rather than when a single bank produces all the products due to diseconomies of scope. There are number of studies that have examined the impact of product diversity on efficiency. Aly et al. (1990) found a negative relationship between product diversity and cost efficiency. Ferrier, Grosskopf, Hayes and Yaisawarng (1993) found that banks with greater product diversity tend to have lower cost efficiency. Chaffai and Dietsch (1995) compared the efficiency of universal versus non-universal (more specialised) banks in Europe and found the former to be less cost efficient.

Finally, the liquidity ratio is included to account for bank's liquidity risk. Banks that hold more liquidity may be expected to have lower liquidity risk but may be less profit efficient as liquid assets tend to yield lower returns. In contrast, as liquid assets are controlled in outputs, one would expect banks with higher liquid assets (all other things being equal) to be more cost efficient.

6.3 The Fourier-flexible functional form

The stochastic frontier, with the Fourier-flexible functional form, is the main methodology to be employed to derive efficiency measures in the countries under study. While the translog functional form has been probably the most widely utilised to derive efficiency estimates, the Fourier-flexible has received more focus in the recent efficiency literature. This section presents the main features of the Fourier-functional form and shows how to derive scale economies and scale inefficiencies estimates using this functional form.

6.3.1 The advantage of the Fourier-flexible (FF) versus the translog functional form

The most widely used functional form in the bank efficiency literature is the translog; however, it is subject to certain limitations, namely it does not necessarily fit well the data that are far from the mean in terms of output size or mix. In addition, McAllister and McManus (1993), and Mitchell and Onvural (1996) show that some of the differences in results of scale economies across studies may be due to the ill fit of the translog function across a wide range of bank sizes, some of which may be underrepresented in the data. The translog functional form for a cost function represents a second-order Taylor series approximation of any arbitrary, twice-differentiable cost function at a given (local) point. This restrictive property of the translog form is part of White's (1980) appraisal, which led Gallant (1981) to propose the Fourier flexible functional form (FF) as a preferred alternative.

This methodology was first proposed by Gallant (1981, 1982), discussed later by Elbadawi, Gallant and Souza (1983), Chalfant and Gallant (1985), Eastwood and Gallant (1991), Gallant and Souza (1991) and applied to the analysis of bank cost efficiency by Spong et al. (1995), Mitchell and Onvural (1996) and Berger et al. (1997). It has been shown (Tolstov, 1962), that a linear combination of the sine and cosine function, namely the Fourier series, can fit exactly any well-behaved multivariate function.

The Fourier-flexible functional form is preferred over the translog because its better approximates the underlying cost function across broad range of outputs as suggested by Spong et al. (1995), Mitchell and Onvural (1996). The semi-nonparametric Fourier functional form has desirable mathematical and statistical properties because an infinite Fourier series is capable of representing any function exactly and even truncated Fourier series can approximate a function reasonably well throughout its entire range. When using the Fourier functional form, one avoids holding any maintained hypothesis by allowing the data to reveal the true cost function through a large value of fitted parameters.

Besides, Berger and Mester (1997) note that the local approximations of the translog may distort scale economy measurements since it imposes a symmetric U-shaped average cost curve. This aspect of the translog might not fit very well data that are far from the mean in terms of output size or mix. The FF alleviates this problem since it can approximate any continuous function and any of its derivatives (up to a fixed order). Any inferences that are drawn from estimates of the FF are unaffected by specification errors (Ivaldi et al., 1996). Carbo et al. (2000) indicate that since the FF is a combination of polynomial and trigonometric expansions, the order of approximation can increase with the size of the sample size. This is due to the mathematical behaviour of the sine and cosine functions which are mutually orthogonal over the [0, 2π] interval and function space-spanning.

Finally, the FF has several appealing properties in terms of modelling bank cost structures as pointed out by Williams and Gardener (2000). Unlike other commonly used functional forms such as the translog, the FF form is unaffected by specification errors. Furthermore, it has been widely accepted that the global property is important in banking where scale, product mix and other inefficiencies are often heterogeneous, therefore, local approximations (such as those generated by the translog function) may be relatively poor approximation to the underlying true cost (or profit) function. Specifically, the Fourier-flexible functional form augments the translog by including Fourier trigonometric terms.

6.3.2 The Fourier-flexible functional form

The stochastic cost model for a sample of N firms can be written as:

$$\ln TC_i = \ln TC(y_i, w_i, z_i; B) + u_i + v_{i,}, \quad i = 1, ..., N,$$

where TC_i is observed cost of bank i, y_i is the vector of output levels and w_i is the vector of input prices for bank i. z_i represents a vector of control variables which in the case of our estimates includes the quality of bank's output (q_i), the level of its financial capital (k_i) and the time trend (T_i). B is a vector of parameters, v_i is a two-sided error term representing the statistical noise (assumed to be independently and identically distributed and have a normal distribution with mean 0 and variance σ_v^2).

u_i are non-negative random variables that account for technical inefficiency. In case of Battese and Coelli (1995) model, u_i are assumed to be independently distributed as truncations at zero of the $N(m_i, \sigma_u^2)$ distribution; where $m_i = \delta_i d$, where δ_i is a set of environmental variables (defined in the previous section) which are employed to control for firm's specific factors that may contribute to explain the differences in the efficiency estimates, and d is a vector of parameters to be estimated. In case of Battese and Coelli (1992) model, u_i are assumed to be iid as truncations at zero of the $N(\mu, \sigma_u^2)$ distribution.

The translog functional form for the cost frontier is specified as*:

$$\ln(C/w_3)=\alpha+\sum_{i=1}^{2}B_i\ln(w_i/w_3)+\sum_{k=1}^{3}\gamma_k\ln y_k+\sum_{r=1}^{3}\psi_r\ln z_r$$
$$+\frac{1}{2}\left[\sum_{i=1}^{2}\sum_{j=1}^{2}B_{ij}\ln(w_i/w_3)\ln(w_j/w_3)\right]+\frac{1}{2}\left[\sum_{k=1}^{3}\sum_{m=1}^{3}\gamma_{km}\ln y_k\ln y_m\right]$$
$$+\frac{1}{2}\left[\sum_{r=1}^{3}\sum_{s=1}^{3}\psi_{rs}\ln z_r\ln z_s\right]+\sum_{i=1}^{2}\sum_{k=1}^{3}\eta_{ik}\ln(w_i/w_3)\ln(y_k)$$
$$+\sum_{i=1}^{2}\sum_{r=1}^{3}\rho_{ir}\ln(w_i/w_3)\ln(z_r)+\sum_{k=1}^{3}\sum_{r=1}^{3}\tau_{kr}\ln y_k\ln z_r+u_{it}+v_{it}$$

By augmenting the previous translog form by Fourier trigonometric terms, we get the Fourier-flexible functional form written as:

$$\ln(C/w_3)=\alpha+\sum_{i=1}^{2}B_i\ln(w_i/w_3)+\sum_{k=1}^{3}\gamma_k\ln y_k+\sum_{r=1}^{3}\psi_r\ln z_r$$
$$+\frac{1}{2}\left[\sum_{i=1}^{2}\sum_{j=1}^{2}B_{ij}\ln(w_i/w_3)\ln(w_j/w_3)\right]+\frac{1}{2}\left[\sum_{k=1}^{3}\sum_{m=1}^{3}\gamma_{km}\ln y_k\ln y_m\right]$$
$$+\frac{1}{2}\left[\sum_{r=1}^{3}\sum_{s=1}^{3}\psi_{rs}\ln z_r\ln z_s\right]+\sum_{i=1}^{2}\sum_{k=1}^{3}\eta_{ik}\ln(w_i/w_3)\ln(y_k)$$
$$+\sum_{i=1}^{2}\sum_{r=1}^{3}\rho_{ir}\ln(w_i/w_3)\ln(z_r)+\sum_{k=1}^{3}\sum_{r=1}^{3}\tau_{kr}\ln y_k\ln z_r$$
$$+\sum_{n=1}^{8}\left[\phi_n\cos(x_n)+w_n\sin(x_n)\right]+$$
$$\sum_{n=1}^{8}\sum_{q=n}^{8}\left[\phi_{nq}\cos(x_n+x_q)+w_{nq}\sin(x_n+x_q)\right]$$
$$+\sum_{n=1}^{8}\left[\phi_{nnn}\cos(x_n+x_n+x_n)+w_{nnn}\sin(x_n+x_n+x_n)\right]+u_{it}+v_{it}$$

where *lnC* is the natural logarithm of total costs (operating and financial); $\ln\ y_i$ is the natural logarithm of bank outputs (i.e. loans, securities, off-balance sheet items); $\ln w_i$ is the natural logarithm of *i*th input prices (i.e. wage rate, interest rate and physical

* As indicated in the previous chapter, for the case of the standard profit function, we specify variable profits in place of variable costs and take variable output prices as given but allow output quantities to vary. On the other hand, the alternative profit function employs the same dependent variable as the standard profit function and the same exogenous variables as the cost function but it measures how close a bank comes to earning maximum profits given its output levels rather than its output prices.

capital price); the x_n terms, n=1,...,8 are rescaled values of the $\ln(w_i / w_3)$, i=1,2, $\ln(y_k)$, k=1,2,3, and $\ln(z_r)$, r=1,2,3, such that each of the x_n span the interval [0, 2π], and π refers to the number of radians here (not profits), and $\alpha, \beta, \gamma, \psi, \rho, \tau, \eta, d, \omega, \phi$ and *t* are coefficients to be estimated.

Since the duality theorem requires that the cost function be linearly homogeneous in input prices and continuity requires that the second order parameters are symmetric, the following restrictions apply to the parameters of the cost function in the equation above: $\sum_{i=1}^{3} \beta_j = 1$; $\sum_{i=1}^{3} B_{ij} = 0$; $\sum_{i=1}^{3} \eta_{ij} = 0$; $\sum_{i=1}^{n} \rho_{ij} = 0$ for all *j*. Moreover, the second order parameters of the cost function must be symmetric, that is, $B_{ij} = B_{ji}$ and $\eta_{ik} = \eta_{ki}$, for all *i, k.* The scaled log-output quantities; x_i are calculated as in Berger and Mester (1997) by cutting *10% off each end of the [0, 2π] interval so that the z_i span [0.1 x 2π,* .9x 2π] to reduce approximation problems near endpoints. The formula for z_i is [0.2π - μ x a + μ x variable], where [a, b] is the range of the variable being transformed, and μ ≡ (0.9 x 2π − 0.1 x 2π/ (9b-a)). This study applies Fourier terms only for the outputs, leaving the input price effects to be defined entirely by the translog terms, following Berger and Mester (1997). The primary aim is to maintain the limited number of Fourier terms for describing the scale and inefficiency measures associated with differences in bank size. Moreover, the usual input price homogeneity restrictions can be imposed on logarithmic price terms, whereas they cannot be easily imposed on the trigonometric terms.

The maximum-likelihood estimates for the parameters in the Fourier-flexible stochastic frontier for Cost, Standard and Alternative profit efficiency functions; that includes efficiency correlates, are estimated using the computer program FRONTIER Version 4.0 (see Coelli 1996). This computer program uses three steps to obtain the maximum likelihood estimates. The first step involves obtaining ordinary least squares (OLS) estimates of the equation. These estimates are unbiased because of the non-zero expectation of u_{it}. The second step involves evaluating the log-likelihood function for a number of values of γ between zero and one. During this procedure, d_i are set to zero and the values of B_0 and σ^2 are adjusted according to the corrected ordinary least squares formulae for the half-normal model. The estimates corresponding to the largest log-likelihood value in this second step are used as starting values in the iterative maximisation procedure in the third and final part of the estimation procedure.

6.3.3 Calculation of within-sample scale elasticities

This thesis also estimates scale elasticities for the banks under study. As indicated earlier, scale elasticity for the cost function (i.e., scale economies) refer to the proportional increase in cost resulting from a small proportional increase in the level of output (the elasticity of total cost with respect to output). Within the sample scale elasticities are calculated as in Mester (1996) and Altunbas et al. (1998) and are evaluated at the mean output, input price, asset quality and financial capital levels for the respective size quartiles. The degree of scale elasticities is given by the sum of individual cost elasticities. For the case of FF cost function, the measure of overall economies of scale (SE) is given by the following cost elasticity by differentiating the cost function in the above equation with respect to output;

This gives us: $SE = \sum_{i=1}^{3} \frac{\partial \ln TC}{\partial \ln y_i}$

$$= \sum_{k=1}^{3} \gamma_k + \sum_{k=1}^{3} \sum_{m=1}^{3} \gamma_{km} \ln y_m + \sum_{i=1}^{2} \sum_{k=1}^{3} \eta_{ik} \ln(w_i / w_3) + \sum_{k=1}^{3} \sum_{r=1}^{3} \tau_{kr} \ln z_r +$$

$$\sum_{n=1}^{8} [-\phi_n \sin(x_n) + \omega_n \cos(x_n)] + \sum_{n=1}^{8} \sum_{q=n}^{8} [-\phi_{nq} \sin(x_n + x_q) + \omega_{nq} \cos(x_n + x_q)]$$

$$+ \sum_{n=1}^{8} [-\phi_{nnn} \sin(x_n + x_n + x_n) + \omega_{nnn} \cos(x_n + x_n + x_n)]$$

If the calculated SE is less than 1 then increasing returns to scale, implying economies of scale. On the other hand, if SE = 1 then constant returns to scale and if SE < 1 then decreasing returns to scale, implying diseconomies of scale.

6.3.4 Calculation of Scale inefficiency

Recently Evanoff and Israilevich (1995) have noted that comparing scale economies (scale elasticities) with x-inefficiencies are mis-leading as the former is an elasticity and the latter is a relative efficiency measure. While many authors compare scale economies and x-inefficiencies, Evanoff and Israilevich suggest one should calculate scale inefficiencies for accurate comparisons.

The scale elasticity measure, $\varepsilon = \partial \ln C / \partial \ln Y$, is an elasticity associated with a particular output level and indicates the relative change in cost associated with an increment change from this output level. Scale inefficiency (I), on other hand, can be measured as the aggregate cost of N inefficient firms ($\varepsilon \neq 1.0$) relative to the cost of a single efficient firm ($\varepsilon = 1.0$); that is $I = [N * C_I / C_E]-1.0$, where C_I and C_E are the cost of production at the inefficient and efficient firms, respectively.

Therefore, the two concepts differ because elasticity is related to incremental changes in output, and inefficiency related to the change in output required to produce at the minimum efficient scale. The inefficiency measure is typically associated with significantly larger output changes as it measures the difference in total or average cost at distinct output levels. Furthermore, the cost savings realised by an incremental increase in output by a scale inefficient firm is irrelevant for measuring inefficiency since this is not the savings realised by producing at the efficient scale.

Given the following simple representation for the cost function:

$\ln C = a + b (\ln Y) + .5 c (\ln Y)^2$,

then the scale elasticity for inefficient firms $= \varepsilon_I = \partial \ln C_I / \partial \ln Y_I = b$, on the other hand the scale elasticity for the efficient firms = 1.0; by definition.

The scale inefficiency (see Evanoff and Israilevich, 1995) then can be written as:

$$I = e^{(.5/c)(1-\varepsilon_I)^2} - 1.0,$$

that is scale inefficiency is a function of the first and second derivatives of the function (cost function as well as other functional forms) with respect to output (the second derivation aims to reach c which is the key for inefficiency calculation).

Furthermore, if the estimated scale elasticity value is insignificantly different from unity, this does not imply scale inefficiency is insignificantly different from zero because the statistical difference of the elasticity measure from a value of unity depends entirely on the standard error of the estimated coefficient b.

For completeness, this thesis estimates x-inefficiencies, scale inefficiencies and scale economies for our sample of Arabic banks.

6.4 Utilising DEA to measure efficiency

In order to test for the consistency of the aforementioned parametric x-efficiency estimates, we also use the non-parametric DEA approach to estimate efficiency so the results derived by different methodologies can be compared. This section describes the steps utilised to derive cost efficiency in the countries under study using the linear programming DEA approach. This methodology, unlike the stochastic frontier, does not allow us to include the control and environmental variables directly into the model. Therefore, we confine our analysis to the CRS and VRS DEA approaches using the same inputs and outputs specification to calculate efficiency measures but without utilising the control and environmental variables.

6.4.1 Constant returns to scale DEA model

Efficiency measures derived using DEA are simply based on maximising the ratio of all output over all the inputs. Assuming a data set that includes K inputs (k = 1,...,K), M outputs (m = 1,...,M) for N firms (j =1,...,N). Then for the *i*th observation, the set of input and output can be represented by the column of input vector x_i and the column of output vector y_i and the sets of inputs and outputs for the *i*th observation are x_{ik}, and y_{im},. The input matrix X = [K×N], and the output matrix Y = [M×N] represent the data for all N firms. The optimal weights are obtained by solving the mathematical programming problem:

$$\max_{u,v}(u'y_i / v'x_i),$$
$$\text{s.t. } u'y_j / v'x_j \leq 1,\ j = 1,2,\ldots, N, \qquad (1)$$
$$u, v \geq 0.$$

The aim is to obtain a measure of efficiency (the ratio of all outputs over all inputs) such as $u'y_i / v'x_i$ is maximised, where u is a vector of output weights [Mx1] and v is a vector of input weights [Kx1]. The inequality equation requires that the weights are positive. DEA selects the weights that maximise each firm's productive efficiency score as long as no weight is negative and the weights are universal.

To avoid the problem of the infinite number of solutions in the problem, the constraint $v'x_i = 1$ is imposed to provide the multiplier form of the DEA linear programming problem:

$$\max_{\mu,v}(\mu' y_i),$$
$$\text{s.t. } v'x_i = 1,$$
$$\mu' y_j - v'x_j \leq 0,\ j = 1,2,\ldots,N, \qquad (2)$$
$$\mu, v \geq 0,$$

where the change of notation from u and v to μ and v is used to reflect the transformation.

The dual envelopment form of the input-oriented CRS DEA linear program of equation (2) can be written as:

$$\min_{\theta,\lambda},$$

$$\text{s.t.} \quad -y_i + Y\lambda \geq 0, \qquad (3)$$
$$\theta x_i - X\lambda \geq 0,$$
$$\lambda \geq 0,$$

where θ is a scalar and λ is an N×1 vector of constants. The objective function seeks to minimise the efficiency score, θ, which represents the amount of radial reduction in the use of each input. The first constraint (the output constraint) implies that the production of the *rth* output by observation *i* cannot exceed any linear combination of output *r* by all firms in the sample. The second constraint involves the use of input *s* by observation *i*, and implies that the radially reduced use of input *s* by firm *i* cannot be less than the same linear combination of the use of input *s* by all firms in the sample. The value of θ obtained will be the efficiency score for the i-th firm that satisfy: $\theta \leq 1$. When θ value is 1 (the point is on the frontier), the firm is technically efficient according to the Farrell (1957) definition. Equation (3) must be solved N times, once for each firm in the sample and then a value of θ is obtained for each firm (see Coelli et al., 1998).

Equation (3) above assumes that constant returns to scale are imposed on every observation in the sample. It does not take into account factors which make firms unique beyond the simple input-output mix (such as inefficiencies which result from operating in areas of increasing or decreasing returns to scale due to size constraints).

6.4.2 VRS model and decomposition of technical efficiency

Banker, Charnes and Cooper (1984) suggested an extension to the CRS model to account for variable returns to scale (VRS) when not all firms are operating at an optimal scale. If calculated technical efficiency (CRS) is different from the technical efficiency (VRS), then this indicates that the firm has scale inefficiency. Therefore, the use of the VRS specification permits the calculation of technical efficiency devoid of the scale efficiency effect (decomposing technical efficiency into pure technical and scale efficiency; that is $\theta_{CRS} = \theta_{VRS} \cdot \theta_{Scale}$). The CRS linear programming problem can be modified to account for VRS by adding the convexity constraint to provide:

$$\begin{aligned} &\min_{\theta,\lambda}\theta, \\ &\text{st} \quad -y_i + Y\lambda \geq 0, \\ &\qquad \theta x_i - X\lambda \geq 0, \\ &\qquad N1'\lambda = 1 \\ &\qquad \lambda \geq 0, \end{aligned} \tag{4}$$

where N1 is an N×1 vector of ones. This approach forms a convex hull of interesecting planes which envelope the data points more tightly than the CRS . The convexity constraint $N1'\lambda = 1$ ensures that an inefficient firm is only benchmarked against firms of similar size.

6.4.3 Non-increasing returns to scale

Coelli et al. (1998) show that the measure of scale efficiency using the VRS modelling approach does not indicate whether the firm is operating in the area of increasing or decreasing returns to scale. To determine whether the firm is operating in the area of increasing or decreasing returns to scale, an additional DEA problem with non-increasing returns to scale formulation (NIRS) is required. This is executed by modifying the VRS constraint from equality that governs the sum of linear combination parameters to a constraint of less than or equal to one (by substituting the $N1'\lambda = 1$ resrtiction with $N1'\lambda \leq 1$) to provide:

$$\begin{aligned} &\min_{\theta,\lambda}\theta, \\ &\text{st} \quad -y_i + Y\lambda \geq 0, \\ &0x_i - X\lambda \geq 0, \\ &NI'\lambda \leq 1 \\ &\lambda \geq 0, \end{aligned} \tag{5}$$

The nature of the scale inefficiencies due to increasing or decreasing returns to scale for a particular firm can be determined by considering whether the NIRS TE score is equal to the VRS TE score. If they are unequal, then increasing returns to scale exist for that firm but if they are equal then decreasing returns to scale apply.

6.4.4 Technical and Allocative efficiency

If information about prices are available and we want to consider a behavioural objective such as cost minimisation or revenue maximsation, then we can estimate measures of both technical and allocative efficiency. For the case of VRS cost minimisation, we run the input-oriented DEA model (defined by (4)) to obtain technical efficiencies (TE), and then we need to solve the following cost minimisation DEA:

$$\begin{aligned} &\min_{\lambda, x_i^*} w_i' x_i^*, \\ &\text{st} \quad -y_i + Y\lambda \geq 0, \\ &x_i^* - X\lambda \geq 0, \\ &N1'\lambda = 1, \\ &\lambda \geq 0, \end{aligned} \tag{6}$$

where w_i is a vector of input prices for the i-th firm and x_i^* is the cost minimisation vector of input quantities for the i-th firm, given the input prices w_i and the output levels y_i. The total cost (economic) efficiency of the i-th firm is calculated as: $EE = w_i' x_i^* / w_i' x_i$. (the ratio of minimum cost to observed cost , for the i-th firm), then the allocative efficiency is calculated as AE = CE / TE.

To summarise, the above section describes how DEA will be utilised to derive the efficiency measures under the assumption of constant return to scale, variable return to scale and shows how to identify whether firms are operating at increasing or decreasing return to scale. Finally, the section shows how to split cost efficiency into technical and allocative efficiency measures. The following section report both parametric and non-parametric estimates (as outlined earlier) of efficiency for the Arabic banking systems under study.

6.5 Stochastic frontier: Preferred models specifications and efficiency levels

This section presents the steps undertaken to get the preferred cost, standard and alternative profit models. This includes employing different models utilised in the banking efficiency literature based on different assumptions concerning the distribution of efficiency terms. In addition, various hypotheses are tested, given different combination of control and environmental variables, to arrive at the preferred models based on maximum likelihood estimation*. Based on the preferred model, subsection 6.5.2 through 6.5.3 present technical efficiency, scale elasticity and scale efficiency measures for the banks under study.

6.5.1 The preferred stochastic model based on the specification of the cost function

There are three stages undertaken to arrive at the preferred model for our cost function estimates. The first stage involves utilising Battese and Coelli's (1995) approach that allows us to include the efficiency correlates directly in the model estimation. The second stage involves utilising Battese and Coelli's (1992) time-varying efficiency approach that gives flexibility to examine different assumptions concerning the distribution of efficiency terms, comparing time-variant versus time-invariant models but it does not allow for the inclusion of efficiency correlates in the model. Finally, stage 3 compares the best specified models in stage 1 and stage 2 to arrive at a single preferred model from the two stages and provides the basis for the model choice.

* The Maximum Likelihood (ML) and Log-likelihood (LL) functions are the basis for deriving parameters estimates, given certain data. While the shapes of these two functions are different, they have their maximum point at the same value. Both seek to estimate the value of p (the unknown parameter in the model) that maximises the ML or LL function given the data z. The MLE have many statistical appealing features especially when the sample size is large. First, consistency: as the sample size increases, the MLEs converge to the true parameters values. Second, asymptotic normality and efficiency (i.e., as the sample size increases, the sampling distribution of the MLE converges to normality with least possible variance (Hence, estimates obtained typically have the smallest confidence intervals)). The MLE of unknown parameter, p^* is the value of p that corresponds to the maximum of L(p/z) that is most likely to have produced from data z. Since it is easier to deal with addition rather than multiplication, the problem is generally tackled in the log form. This is called the log likelihood function that truly maximises the sum of the log likelihoods by choosing the parameters that give identical results to maximising the untransformed likelihood. The log likelihood takes the following form:

$$\log(L) = -(n/2)\log(2\pi) - (n/2)\log(\sigma_u^2) - (1/2)\sigma_u^2 \sum_i (Y_i - a - bX_i)^2$$

Stage 1: Estimating the cost frontier models that include efficiency correlates

This stage estimates the stochastic frontier for the cost function, given the Fourier-flexible functional form that includes efficiency correlates. This stage follows Dietsch and Lozano-Vivas (2000) who emphasise the importance of including country and other specific information in common frontier estimations of bank efficiency. This stage is conducted using the approach suggested by Battese and Coelli's (1995) technical inefficiency effects model that allows us to include firm-specific (and country-specific variables) directly into the model as these might explain some of the efficiency differences between banks as well as the variation in bank inefficiency overtime.

Battese and Coelli's (1995) model defines the inefficiency term u_{it} as non-negative variables that account for technical inefficiency and are assumed to be independently and identically distributed (iid) as truncations at zero of the $N(\delta_{it}d, \sigma^2_{u_{it}})$ distribution. This methodology follows Kumbhakar, Ghosh and McGukin (1991) and Reifschneider and Stevenson (1991) and Battese and Coelli (1991) who propose a stochastic model in which u_i are stated as an explicit function of a vector of firm-specific variables and random error. According to Coelli (1996), this specification proves to be better than that of Pitt and Lee (1981) who have estimated stochastic frontiers and predicted firm-level efficiencies using these estimated functions, and then regressed the predicted efficiencies upon firm-specific variables (such as managerial experience, ownership characteristics, etc.) in an attempt to identify some of the reasons for differences in predicted efficiencies between firms. Furthermore, the two-stage procedure utilised by Pitt and Lee (1981) has been recognised as one which is inconsistent in its assumptions regarding the independence of the inefficiency effects in the two estimation stages.

In order to derive the bank efficiency model that includes firm-specific variables, we employ the control and environmental variables detailed earlier. The control variables include the loan loss reserves as a percent of loans, capital strength and a time trend. The loan loss reserve as a percent of gross loans is included to control for asset quality.

Capital strength is measured by the ratio of equity to total asset ratio. A time trend variable is included in the model (table 6.5 show descriptive statistics of these variables). Environmental variables are employed, as a set of explanatory variables, to control for organisational characteristics, geographical location. Organisational characteristics refer to the structure of the financial systems in the countries under study. We identify three ratios to test these characteristics; dummy variables for bank specialisation, bank market share and concentration in the pertinent banking systems. The banks in each country are divided into four categories; commercial, investment, Islamic and other financial institutions. Furthermore, we employ the 3-firm concentration ratio which is widely used to test for monopoly characteristics in the pertinent market. Furthermore, we include dummy variables to control for bank geographical (country) location.

To reach the best-specified model in this stage, we have examined many hypotheses which can be summarised in the following steps:

Step 1**: *Estimating the Fourier-truncated with different combination of control variables*** (see table 6.6 below for details)*:*

1.1. The unrestricted Fourier-flexible model is estimated assuming inefficiency to be truncated. This model includes all the control variables (bank's capital, bank's asset quality and the time trend) and all the efficiency correlates (the environmental variables). This general model will be compared later with some other models to decide upon (based on maximum-likelihood ratio tests) preferred model specifications utilising different combinations of control variables.

1.2. The Fourier-truncated model that includes the efficiency correlates is estimated but without the time parameters. This is done to examine whether there has been any technical change over the sample period. This involves restricting all the coefficients associated with the time trend equal to zero. Next, we estimate the model but without the capital parameters. Then, we estimated the model without the risk (bank's asset quality) parameters.

At this point, there are three null hypotheses to be examined. The first null hypothesis is that the specification of the truncated model without time parameters is better than that of the unrestricted model in (*1.1*). The second null hypothesis states that the specification of the truncated model without the risk parameters is better than that of the unrestricted model. The third null hypothesis states that specification of the truncated model without capital parameters is better than that of the unrestricted model. The alternative hypothesis (Ha) against these hypotheses is that the full model (*1.1*) is better specified than these restricted models.

As table 6.6 below shows, based on the log-likelihood one-sided ratio*, the null hypothesis that the model without time-parameters is better specified model is rejected at the critical value of 5% while the other two null hypotheses are not rejected. In other words, the value of the generalised likelihood-ratio statistics compared with those of the

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* The Maximum likelihood (ML) provides a convenient way to tests the hypotheses in the form of the Log-likelihood ratio (LR) that examine whether a reduced model provides the same fit as a full model. This ratio allows us to test whether the likelihood estimates for parameters are significantly different from other fixed values. It permits to compare the likelihood of the data under one hypothesis against the likelihood of the data under another (more restricted) hypothesis. The LR shows whether the data are significantly less likely to have arisen if the null hypothesis is true than if the alternate hypothesis is true?. The difference between the likelihoods is multiplied by a factor of 2 for technical reasons, so that this quantity will be distributed as the familiar χ^2 statistic. The LR test statistic is given by $LR = -2[L(\hat{\Theta}_r / z) - L(\hat{\Theta} / z)]$ where $L(\hat{\Theta} / z)$ is the likelihood function evaluated at the MLE where $L(\hat{\Theta}_r / z)$ is the maximum if the likelihood function, subject to the restriction that r unconstrained parameters in the full likelihood analysis are assigned fixed values. For sufficiently large sample size, the LR test statistic is χ_r^2-distributed, a χ^2 with r degrees of freedom (Wald, 1943). The degrees of freedom equal the difference in the number of parameters being estimated under the alternate and null models.

upper five per cent point for χ-square (for the appropriate degree of freedom) were not in favour of accepting these null hypotheses. This means that the model without risk and the model specified without the capital parameters are better specified than the unrestricted model (*1.1* above).

1.3. The Fourier-truncated model that includes the efficiency correlates is estimated without time and capital parameters simultaneously. Next, the model is estimated without time and risk parameters. Then, the model is estimated without risk and capital parameters.

Again here, we have three null hypotheses that need to be examined. The first null hypothesis states that the Fourier-truncated that includes the efficiency correlates but without time and capital parameters is specified better than the models in ***1.1*** and ***1.2*** above. The second null hypothesis states that the truncated model without time and risk parameters is better specified than those in ***1.1*** and ***1.2***. Finally, the third null hypothesis states that the truncated model without risk and capital parameters is better specified than those in ***1.1*** and ***1.2*** . Based on the log-likelihood ratio, only the null hypothesis that specifies the Fourier-flexible without time and capital is a better specified model is not rejected (table 6.6 shows the details).

1.4. The Fourier-truncated that includes the efficiency correlates is estimated but without any of the control variables (capital, risk and time) in the model. In this case, the null hypothesis states that Fourier-truncated model excluding the control variables is specified better than the models specified in ***1.1, 1.2*** and ***1.3*** above. Based on the maximum likelihood ratio, this model is not rejected at critical level of 5%. Therefore, the best specified model up to this step is the Fourier-truncated that excludes all the control variables.

Step 2: Comparing Fourier specification with translog specification

In this step, we will compare the best Fourier specifications concluded from ***step 1*** with identical translog specifications. The null hypothesis in this step states that translog specifications are more appropriate than the Fourier specifications for estimating efficiency. The alternative hypothesis states that translog specification is not better than that of the Fourier. Based on the log-likelihood ratio, the null hypothesis is rejected at the 5% significance level. This means that the data is better specified utilising the Fourier than the translog form.

Table 6.6: Hypotheses testing of the cost function (stage 1)

Model Description	Restrictions	Log likelihood	LR test of 1-sided error	DF	Critical value for α =5%	Decision
<u>**Stage 1: Models estimation including environmental variables**</u>						
- Fourier-truncated without restrictions		108.02				
- Fourier-truncated without time parameters	$\psi_3=\psi_{r3}=\psi_{3S}=\rho_{i3}=\tau_{k3}=\phi_8=\omega_8=\phi_{n8}=\phi_{8q}=\omega_{8q}=\omega_{n8}=\phi_{888}=\omega_{888}=0$, r=S=k= 1, 2,3; i=1,2; n=q≈ 1, 2,...,8.	193.42	633.19	29	42.56	Reject Ho
- Fourier-truncated without capital parameters	$\psi_1=\psi_{r1}=\psi_{1S}=\rho_{i1}=\tau_{k1}\approx\phi_6=\omega_6=\phi_{n6}=\phi_{6q}=\omega_{6q}=\omega_{n6}=\phi_{666}=\omega_{666}=0$, r=S=k= 1, 2,3; i=1,2; n=q≈ 1, 2,...,8.	13.29	30.86	29	42.56	Do not reject Ho
- Fourier-truncated without risk parameters	$\psi_2=\psi_{r2}=\psi_{2S}=\rho_{i2}=\tau_{k2}=\phi_7=\omega_7=\phi_{n7}=\phi_{7q}=\omega_{7q}=\omega_{n7}=\phi_{777}=\omega_{777}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	69.07	8.98	29	42.56	Do not reject Ho
- Fourier-truncated without time and capital parameters	$\psi_1=\psi_3=\psi_{r1}=\psi_{r3}=\psi_{1S}=\psi_{3S}=\rho_{i1}=\rho_{i3}=\tau_{k1}=\tau_{k3}=\phi_6=\phi_8=\omega_6=\omega_8=\phi_{n6}=\omega_{n8}=\phi_{n8}=\phi_{6q}=\phi_{8q}=\omega_{6q}=\omega_{8q}=\omega_{n6}=\omega_{n8}=\phi_{666}=\phi_{888}=\omega_{666}=\omega_{888}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-80.17	27.45	55	73.11	Do not reject Ho
- Fourier-truncated without time and risk parameters	$\psi_2=\psi_3=\psi_{r2}=\psi_{r3}=\psi_{2S}=\psi_{2S}=\rho_{i2}=\rho_{i3}=\tau_{k2}=\tau_{k3}=\phi_7=\phi_8=\omega_7=\omega_8=\phi_{n7}=\omega_{n8}=\phi_{n8}=\phi_{7q}=\phi_{8q}=\omega_{7q}=\omega_{8q}=\omega_{n7}=\omega_{n8}=\phi_{777}=\phi_{888}=\omega_{777}=\omega_{888}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	161.26	374.14	55	73.11	Reject Ho
- Fourier-truncated without capital and risk parameters	$\psi_1=\psi_3=\psi_{r1}=\psi_{r2}=\psi_{1S}=\psi_{2S}=\rho_{i1}=\rho_{i2}=\tau_{k1}=\tau_{k2}=\phi_6=\phi_7=\omega_6=\omega_7=\phi_{n6}=\omega_{n7}=\phi_{n7}=\phi_{6q}=\phi_{7q}=\omega_{6q}=\omega_{7q}=\omega_{n6}=\omega_{n7}=\phi_{666}=\phi_{777}=\omega_{666}=\omega_{777}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	ols		55	73.11	Reject Ho
*- Fourier-truncated without time, capital and risk parameters**	$\psi_r=\psi_{rS}=\rho_{ir}=\tau_{kr}=\phi_6\approx\phi_7=\phi_8=\omega_6=\omega_7=\omega_8=\phi_{n6}=\phi_{n7}=\phi_{n8}=\phi_{6q}=\phi_{7q}=\phi_{8q}=\omega_{6q}=\omega_{7q}=\omega_{8q}=\omega_{n6}=\omega_{n7}=\omega_{n8}=\phi_{666}=\phi_{777}=\phi_{888}=\omega_{666}=\omega_{777}=\omega_{888}=0$, *r≈S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.*	*-113.44*	*16.22*	*78*	*99.62*	*Do not reject Ho*

Model Description	Restrictions	Log likelihood	LR test of 1-sided error	DF	Critical value for α =5%	Decision
Step 2: Fourier-truncated versus translog-truncated						
- Translog-truncated without time, capital and risk parameters	$\psi_r = \psi_{rS} = \rho_{ir} = \tau_{kr} = \phi_n = \omega_n = \phi_{nq} = \omega_{nq} = \phi_{nnn} = \phi_{qqq} = 0$, n=q= 1, 2,...,8.	128.89	1204.14	104	128.80	Reject Ho
Step 3: Fourier truncated without environmental and control variables	$\psi_r = \psi_{rS} = \rho_{ir} = \tau_{kr} = \phi_n = \omega_n = \phi_{nq} = \omega_{nq} = \phi_{nnn} = \phi_{qqq} = \delta_i = 0$, n=q= 1, 2,...,8.	-81.26			180.57	Reject Ho
Step 4: Fourier –truncated without efficiency term	$\psi_r = \psi_{rS} = \rho_{ir} = \tau_{kr} = \phi_n = \omega_n = \phi_{nq} = \omega_{nq} = \phi_{nnn} = \phi_{qqq} = \delta_i = \lambda = 0$, n=q= 1, 2,...,8.	ols				Reject Ho

Source: Author's own estimation.

*The grey shade indicates the best model in this stage.

Step 3: Examining the impact of efficiency correlates (the environmental variables) on the model specification

The best specified model up to ***step 1*** and ***2*** above is the Fourier-truncated that includes the efficiency correlates (environmental variables) but does not include any of the control variables. In the following, we estimate the Fourier-truncated without including the efficiency correlates. In this case, the null hypothesis states that the specified truncated model without efficiency correlates is better than the model that includes them. The alternative hypothesis, on the other hand, states that the model that excludes the efficiency correlates is not specified better than the model that includes them. Based on the log-likelihood ratio, the null hypothesis is rejected in favour of the alternative hypothesis that necessitates the existence of such variables in the model (see table 6.6 for details).

Step 4: Examining the impact of inefficiency-terms on the model specification

In this step, the best specified model selected until ***step 3*** will be compared with the model that excludes the inefficiency term from the model. The null hypothesis here states that the inefficiency effects in the cost function are not present, and so the banks are fully technically efficient. If this is the case, the technical inefficiency error term, U_{it}, would be removed from equation, and the resulting model would be appropriately estimated using OLS. This hypothesis is rejected and so, the model which accounts for technical inefficiency is warranted in these instances (see table 6.6 for details).

Based on the results of the steps above, the best specified model from ***stage 1*** is the Fourier-truncated model that excludes the control variables (time trend, capital adequacy and asset quality) but includes the efficiency correlates (table 6.6 shows the details).

Stage 2: Estimating the cost frontier models that excludes efficiency correlates

This stage estimates the stochastic frontier, given the Fourier-flexible functional form that excludes efficiency correlates. The models in this stage are estimated utilising Battese and Coelli's (1992) time-varying approach. This approach gives some flexibility concerning the distribution of inefficiency term in the stochastic frontier; truncated or half normal. Furthermore, it allows us to examine the time-varying efficiency model against the time-invariant model. Therefore, one of the advantages of the time-varying inefficiency model is that the technical inefficiency changes overtime can be distinguished from technical change, provided the latter is specified in the model parameters, in the frontier function. This discrimination is only possible given that the technical inefficiency effects are stochastic and have the specified distributions. However, this approach does not allow us to add the efficiency correlates directly into the model.

The inefficiency term u_{it} s in this model is assumed to be an exponential function of time, involving only one unknown parameter. The technical inefficiency effects are assumed to be defined by

$u_{it} = \{exp[-\eta(t-T)]\}u_i$, i = 1,2,...,N; t = 1,2,...,T;

where u_{it} s are assumed to be independently and identically distributed (i.i.d.) as the generalised truncated-normal random variable and η is an unknown scalar parameter to be estimated. The major disadvantages of this time-varying model is that the technical inefficiency effects of different firms at any given time period, t, are equal to the identical exponential function ($exp[-\eta(t-T)] \equiv exp[\eta(T-t)]$) of the corresponding firm-specific inefficiency effects at the last period of the panel (the u_{it} s). This implies that the ordering of the firms according to the magnitude of the technical inefficiency effects is the same at all time periods. Thus, the time-varying model of the equation does not account for situations in which some firms may be relatively inefficient initially but become relatively more efficient in subsequent periods.

In our search for the best model specification utilising this model, we follow studies that assume no restriction to be imposed on the distributional features of the inefficiency term. These studies include Cebenoyan et al. (1993) who use the truncated normal model, Stevenson (1980) and Greene (1990) who use the normal and gamma distribution respectively. Then, we restricted Mu (μ) to be zero to obtain Pitt and Lee's (1981) half-normal model. The studies that use the half-normal specification to model inefficiency in banking include Allen and Rai (1996), Kaparakis et al. (1994) and Mester (1996). Next, we restrict both Mu (μ) and Eta (η) to be zero to get the time-invariant model as outlined in Battese, Coelli and Colby (1989). All the above models assume that the inefficiency term to be independently and identically as truncations at zero of the N(μ, σ_u^2) distribution. This definition of the inefficiency term conforms to the original definition of the stochastic frontier, which was proposed by Aigner, Lovell and Schmidt (1977) and Meeusen and Van de Broeck (1977).

The following steps summarise the procedures followed to arrive at the most appropriate model specifications in this stage using Battese and Coelli's (1992) approach:

Step 1: Comparing the Fourier-truncated time-variant with time-invariant model: The specification of the estimated truncated time-variant model is compared with the truncated time-invariant model and the better specified model is chosen based on the log-likelihood ratio test. The null hypothesis in this step states that the specification of Fourier-truncated time-invariant model is better than the time-variant model. The null hypothesis in this step is rejected, as the time-invariant model cannot be specified using the stochastic frontier methodology (see table 6.7 for details).

Step 2: Fourier truncated time-variant versus Fourier half-normal time variant model:

The specification of the truncated time-variant model chosen from step 1 is compared with the half-normal time-variant model. Here, the null hypothesis states that the half-normal time-variant model specification is better than the specification of the truncated time-variant model. Utilising the log-likelihood ratio, the null hypothesis is rejected given the appropriate degree of freedom.

Step 3: Fourier-truncated with different combinations of control variables: The Fourier-truncated time-variant model is estimated with different combinations of control variables to see if we can accept simpler model specification for our data. In this step, there are seven hypotheses examined. The first one states that the specification of the Fourier-truncated time-variant model without time parameters is better than the model specified in ***step 1*** and ***2*** above. The second hypothesis examines the model without risk parameters and the third examines the model without the capital parameters. The fourth hypothesis examines the model without time and risk parameters at the same time. The fifth hypothesis examines the model without time and capital parameters. The sixth hypothesis examines the model without capital and risk parameters. Finally, the seventh hypothesis examines the model specification without any of the control variables (capital, risk and time trend). Comparing the estimated models in this step and based on the log-likelihood ratio, the most appropriate model is the Fourier-truncated time-variant model without the control variables (see table 6.7 for details).

Step 4: Comparing the Fourier-specification with translog specification: In this step, we compare the Fourier-truncated model specifications selected in ***step 3*** above with the translog form given an identical specification. At this point, the null hypothesis states that the translog specification is more appropriate than the Fourier specification. The null hypothesis is not rejected and so, the best specified model in this stage is the translog-truncated without the control variables.

Table 6.7: Hypotheses testing of the cost function (stage 2)

Model Description	Restrictions	Log likelihood	LR test of 1-sided error	DF	Critical value for α =5%	Decision
Stage 2: Models estimation excluding environmental variables						
Step 1: Time-variant versus time-invariant models						
- Truncated time-variant model that includes all the control variables		114.42				
- Truncated time-invariant model that includes all the control variables	$\eta = 0$	ols				Reject Ho
Step 2: Truncated versus half-normal models						
-Half-normal time-variant model that includes all the control variables	$\mu = 0$	111.19	7.45	1	3.841	Reject Ho
Step 3: Truncated time-variant model with different combination of the control variables						
- Fourier-truncated without time parameters	$\psi_3 = \psi_{r3} = \psi_{3S} = \rho_{i3} = \tau_{k3} = \phi_8 = \omega_8 = \phi_{n8} = \phi_{8q} = \omega_{8q} = \omega_{n8} = \phi_{888} = \omega_{888} = 0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-6.70	0.82	29	42.56	Do not reject Ho
- Fourier-truncated without capital parameters	$\psi_1 = \psi_{r1} = \psi_{1S} = \rho_{i1} = \tau_{k1} = \phi_6 = \omega_6 = \phi_{n6} = \phi_{6q} = \omega_{6q} = \omega_{n6} = \phi_{666} = \omega_{666} = 0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	29.10	6.24	29	42.56	Do not reject Ho
- Fourier-truncated without risk parameters	$\psi_2 = \psi_{r2} = \psi_{2S} = \rho_{i2} = \tau_{k2} = \phi_7 = \omega_7 = \phi_{n7} = \phi_{7q} = \omega_{7q} = \omega_{n7} = \phi_{777} = \omega_{777} =0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	8.45	39.81	29	42.56	Do not reject Ho

Model Description	Restrictions	Log likelihood	LR test of 1-sided error	DF	Critical value for α =5%	Decision
- Fourier-truncated without time and capital parameters	$\psi_1=\psi_3=\psi_{r1}=\psi_{r3}=\psi_{1S}=\psi_{3S}=\rho_{i1}=\rho_{i3}=\tau_{k1}=\tau_{k3}=\phi_6=\phi_8=\omega_6=\omega_8=\phi_{n6}=\omega_{n8}=\phi_{n8}=\phi_{6q}=\phi_{8q}=\omega_{6q}=\omega_{8q}=\omega_{n6}=\omega_{n8}=\phi_{666}=\phi_{888}=\omega_{666}=\omega_{888}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-83.88	20.02	55	73.11	Do not reject Ho
- Fourier-truncated without time and risk parameters	$\psi_2=\psi_3=\psi_{r2}=\psi_{r3}=\psi_{2S}=\psi_{2S}=\rho_{i2}=\rho_{i3}=\tau_{k2}=\tau_{k3}=\phi_7=\phi_8=\omega_7=\omega_8=\phi_{n7}=\omega_{n8}=\phi_{n8}=\phi_{7q}=\phi_{8q}=\omega_{7q}=\omega_{8q}=\omega_{n7}=\omega_{n8}=\phi_{777}=\phi_{888}=\omega_{777}=\omega_{888}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-17.11	17.38	55	73.11	Do not reject Ho
- Fourier-truncated without capital and risk parameters	$\psi_1=\psi_3=\psi_{r1}=\psi_{r2}=\psi_{1S}=\psi_{2S}=\rho_{i1}=\rho_{i2}=\tau_{k1}=\tau_{k2}=\phi_6=\phi_7=\omega_6=\omega_7=\phi_{n6}=\omega_{n7}=\phi_{n7}=\phi_{6q}=\phi_{7q}=\omega_{6q}=\omega_{7q}=\omega_{n6}=\omega_{n7}=\phi_{666}=\phi_{777}=\omega_{666}=\omega_{777}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	3.44	94.67	55	73.11	Reject Ho
- Fourier-truncated without time, capital and risk parameters	$\psi_r=\psi_{rS}=\rho_{ir}=\tau_{kr}=\phi_6=\phi_7=\phi_8=\omega_6=\omega_7=\omega_8=\phi_{n6}=\phi_{n7}=\phi_{n8}=\phi_{6q}=\phi_{7q}=\phi_{8q}=\omega_{6q}=\omega_{7q}=\omega_{8q}=\omega_{n6}=\omega_{n7}=\omega_{n8}=\phi_{666}=\phi_{777}=\phi_{888}=\omega_{666}=\omega_{777}=\omega_{888}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-111.56	19.98	78	99.62	Do not reject Ho
Step 3: Fourier-truncated versus translog						
- Translog-truncated without time, capital and risk parameters	$\psi_r=\psi_{rS}=\rho_{ir}=\tau_{kr}=\phi_n=\omega_n=\phi_{nq}=\omega_{nq}=\phi_{nnn}=\phi_{qqq}=0$, n=q= 1, 2,...,8.	-468.15	10.06	104	128.80	Do not reject Ho

Source: Author's own estimation.

Stage 3: Comparing the models from stage 1 and stage 2

It should be noted that we cannot formally compare directly the results of ***stage 1*** and ***stage 2*** above because we utilise Battese and Coelli's (1995) approach in the first stage and Battese and Coelli's (1992) approach in the second stage. The first approach does not have the second approach as a special case, and neither does the converse apply. Thus, these two model specifications are non-nested and hence no set of restrictions can be defined to permit a test of one specification versus the other.

However, the second approach suffers from a main weakness as indicated earlier; that is the technical inefficiency effects of different firms at any given time period, t, are equal to the same exponential function $(exp[-\eta(t-T)] \equiv exp[\eta(T-t)])$ of the corresponding firm-specific inefficiency effects at the last period of the panel (the u_{it} s). This implies that the ordering of the firms according to the magnitude of the technical inefficiency effects is the same at all time periods. Thus, the time-varying model of equation does not account for situations in which some firms may be relatively inefficient initially but become relatively more efficient in subsequent periods. (Furthermore, as Battese and Coelli (1995) indicated, a small error was detected in the first partial derivative with respect to η in the 1992 model of the program. This error would have only affected results when η was assumed to be non-zero).

Therefore, if the above two stages lead more or less to the same model specifications, we will take the efficiency estimates of the first stage which utilises the 1995 approach. However, if the two stages lead to different preferred model specifications, we will report the results of two stages and then compare the efficiency estimates result from each stage.

In the case of the cost function, the first stage leads us to select the Fourier-truncated without control variables but with efficiency correlates. The second stage leads us to select the translog-truncated without control variables as well. As such, it is plausible to assume that the inclusion of efficiency correlates in the first stage is the reason for the selection of the Fourier over translog in the first stage. Furthermore, as the second stage is estimated utilising Battese and Coelli's (1992) approach which does not allow us to include directly the efficiency correlates in the model and since there is no major differences between the specifications of the two stages, we will choose the result of ***stage 1*** as the cost preferred model; the Fourier-truncated model excluding control variables (capital, risk and time trend) but including all the efficiency correlates(the parameter estimates of the preferred model are shown in Table 6-8).

Table 6-8: Maximum likelihood estimates of the preferred cost function model

	The variables (all are logged)	coefficient	standard-error	t-ratio
α		115.71	0.97	118.76
γ1	lny1	0.54	0.54	1.00
γ2	lny2	0.78	0.90	0.87
γ3	lny3	0.17	0.38	0.44
β1	Lnw1/w3	-14.15	0.65	-21.92
β2	lnw2/w3	28.76	0.45	63.58
γ11	lny1lny1	0.08	0.08	1.05
γ12	lny1lny2	-0.15	0.08	-1.77
γ13	lny1lny3	-0.05	0.08	-0.65
η11	lny1lnw1/w3	0.07	0.19	0.38
η12	lny1lnw2/w3	0.18	0.27	0.65
γ22	lny2lny2	0.01	0.13	0.09
γ23	lny2lny3	0.07	0.07	0.97
η21	lny2lnw1/w3	0.02	0.24	0.08
η22	lny2lnw2/w3	0.03	0.05	0.57
γ33	lny3lny3	-0.02	0.03	-0.59
η31	lny3lnw1/w3	-0.01	0.14	-0.09
η32	lny3lnw2/w3	-0.08	0.30	-0.27
β11	lnw1/3lnw1/w3	3.16	0.40	7.97
β12	lnw1/w3lnw2/w3	-1.69	0.36	-4.65
β22	lnw2/w3lnw2/w3	-16.62	0.38	-43.26
ϕ1	Cos(y1)	-0.19	0.27	-0.70
ω1	Sin(y1)	0.03	0.38	0.08
ϕ2	Cos(y2)	0.02	0.28	0.08
ω2	Sin(y2)	0.03	0.22	0.13
ϕ3	Cos(y3)	0.03	0.30	0.10
ω3	Sin(y3)	0.00	0.17	0.00

	The variables (all are logged)	coefficient	standard-error	t-ratio
ϕ4	Cos(w1/w3)	-4.00	0.56	-7.10
ω4	Sin(w1/w3)	3.87	0.51	7.56
ϕ5	Cos(w2/w3)	-15.04	0.78	-19.18
ω5	Sin(w2/w3)	-14.05	0.76	-18.46
ϕ11	Cos(y1+y1)	0.00	0.02	-0.13
ω11	Sin(y1+y1)	-0.03	0.04	-0.68
ϕ12	Cos(y1+y2)	0.04	0.08	0.55
ω12	Sin(y1+y2)	-0.05	0.09	-0.54
ϕ13	Cos(y1+y3)	0.00	0.06	0.02
ω13	Sin(y1+y3)	0.00	0.04	0.11
ϕ14	Cos(y1+w1/w3)	-0.03	0.26	-0.12
ω14	Sin(y1+w1/w3)	0.08	0.12	0.63
ϕ15	Cos(y1+w2/w3)	0.05	0.21	0.24
ω15	Sin(y1+w2/w3)	-0.03	0.27	-0.10
ϕ22	Cos(y2+y2)	-0.01	0.07	-0.13
ω22	Sin(y2+y2)	0.04	0.01	5.96
ϕ23	Cos(y2+y3)	0.00	0.03	0.03
ω23	Sin(y2+y3)	0.00	0.04	-0.07
ϕ24	Cos(y2+w1/w3)	-0.01	0.20	-0.03
ω24	Sin(y2+w1/w3)	-0.10	0.16	-0.61
ϕ25	Cos(y2+w2/w3)	0.03	0.09	0.36
ω25	Sin(y2+w2/w3)	0.03	0.34	0.10
ϕ33	Cos(y3+y3)	0.01	0.00	1.67
ω33	Sin(y3+y3)	0.00	0.04	-0.02
ϕ34	Cos(y3+w1/w3)	-0.01	0.10	-0.13
ω34	Sin(y3+w1/w3)	0.01	0.33	0.03
ϕ35	Cos(y3+w2/w3)	-0.02	0.20	-0.08
ω35	Sin(y3+w2/w3)	-0.02	0.14	-0.17
ϕ44	Cos(w1/w3+w1/w3)	0.09	0.33	0.29
ω44	Sin(w1/w3+w1/w3)	1.14	0.42	2.70
ϕ45	Cos(w1/w3+w2/w3)	0.96	0.51	1.89
ω45	Sin(w1/w3+w2/w3)	0.14	0.24	0.57
ϕ55	Cos(w2/w3+w2/w3)	0.24	0.50	0.49
ω55	Sin(w2/w3+w2/w3)	3.81	0.42	9.05
ϕ111	Cos(y1+y1+y1)	-0.01	0.05	-0.25
ω111	Sin(y1+y1+y1)	0.02	0.02	0.65
ϕ222	Cos(y2+y2+y2)	0.00	0.02	-0.21

	The variables (all are logged)	coefficient	standard-error	t-ratio
ω222	Sin(y2+y2+y2)	0.00	0.03	-0.10
ϕ333	Cos(y3+y3+y3)	0.01	0.02	0.36
ω333	Sin(y3+y3+y3)	0.00	0.03	-0.06
ϕ444	Cos(w1/w3+w1/w3+w1/w3)	0.33	0.17	1.90
ω444	Sin(w1/w3+w1/w3+w1/w3)	0.23	0.22	1.01
ϕ555	Cos(w2/w3+w2/w3+w2/w3)	0.32	0.28	1.11
ω555	Sin(w2/w3+w2/w3+w2/w3)	-0.58	0.19	-2.99
δ0		-0.05	0.57	-0.08
δ1	L	0.13	0.56	0.23
δ2	TA	0.00	0.00	0.34
δ3	B	-0.09	0.23	-0.40
δ4	J	0.13	0.69	0.18
δ5	E	0.11	0.25	0.43
δ6	Com	0.01	0.61	0.01
δ7	Inv.	0.05	0.47	0.10
δ8	Isl.	-0.06	0.39	-0.16
δ9	3-FCR	-0.02	0.16	-0.12
δ10	MS	-0.17	1.26	-0.14
sigma-squared (S)		0.08	0.01	9.42
gamma		0.008	0.006	1.263
Sigma-squared		0.001		
Sigma-squared (v)		0.082		
Lambda		0.089		
The relative contribution of the inefficiency effect to the total variance term		0.003		
Log likelihood function		-113.444		
LR test of the one-sided error		16.219		
[note that this statistic has a mixed chi-squared distribution]				

Source: Author's own estimation

6.5.2 The preferred models based on the specification of the standard and alternative profit functions

Following similar procedures to those of the cost function discussed above, the preferred model for both the standard and alternative profit functions is the Fourier-truncated model that includes both the control variables (capital, risk and time trend) as well as the efficiency correlates (Tables 6.19-6.22 in the appendix details the steps undertaken to arrive at the preferred models for the standard and alternative profit functions, and tables 6.23-6.24 in the appendix shows the details of these preferred models).

6.5.3 Coefficients of efficiency correlates in the preferred models

The maximum likelihood estimates of the Fourier-flexible preferred model of cost, standard and alternative profit efficiency defined earlier are presented in table 6.8 earlier and in tables 6.23 & 6.24 (in the appendix). Asymptotic standard errors are presented beside each estimate.

The t-ratios which define the ratio of the estimated coefficients to their corresponding standard errors, indicates the significance of the coefficients and therefore some of the t-ratios of important coefficients of the cost, standard and alternative profit functions will be discussed based on the chosen preferred models. However, it should be noted that the consideration of these individual t-tests separately may lead to the omission of some important coefficients, this is because multicollinearity resulting from the inclusion of the squared and interaction terms may contribute to the high standard errors observed. As this is the case, the consideration of these individual t-tests may lead to the omission of some important coefficients, resulting in misspecification of the model (see Coelli, 1996 for details).

Therefore, the more appropriate testing procedure would be to test simultaneously the significance of groups of coefficients. In this study, this likelihood ratio testing procedure is used in the previous section in the course of examining different hypotheses (see Greene, 1993 for details). This involves the calculation of

$$\lambda = -2[\mathrm{LLF}(H_0) - \mathrm{LLF}(H_A)],$$

where LLF(H_0) and LLF(H_A) are the values of the log-likelihood function under the null and alternative hypotheses, respectively. This λ statistic has an asymptotic chi-square distribution, with degrees of freedom equal to the number of restrictions imposed under the null hypothesis.

Looking at the coefficients associated with the firm-specific variables given the cost function specification, we can notice that most of the B coefficients for these variables have t-ratios less than one in absolute value. However, the B coefficients for the total assets variable, the countries' dummy variables and liquidity have relatively high t-ratios. This implies that those variables are relatively more important than the other variables in the model specification. Alternatively, given the standard profit function, we can notice that the B coefficients associated with the specialisation's dummy variables, the concentration and market share variables are important; some have t-ratios close to one in absolute value. Concerning the alternative profit function, we can notice that most of the B coefficients for these variables have significant t-ratios in absolute value and there is a very high correlation between the sign and magnitude of these variables. This suggests that the environmental variables are important and should be included in our models. Therefore, we can say the set of efficiency correlates variables utilised in this study improved our models specification overall.

To summarise, after checking the different assumption about the distribution of efficiency terms and employing various model specifications, preferred models are selected based on maximum likelihood results. For cost efficiency, the preferred model is the Fourier-truncated that exclude control variables but includes the efficiency correlates (environmental) variables. Concerning the standard and alternative profit efficiency, the preferred model is the Fourier-truncated that includes both the control as well as the efficiency correlate variables.

6.5.4 Estimated levels of technical efficiency

Technical inefficiency estimates for the cost, standard and alternative profit efficiency, derived from the preferred models, are summarised in tables 6.9, 6.10 and 6.11 below.

Given the preferred cost function, technical efficiency estimates for banks in the countries under study averaged 95% and these estimates have slightly varied over time from 95% in 1992 to 94% in 2000. This suggests that the same level of output could be produced with approximately 95% of current inputs if banks under study were operating on the most efficient frontier. This level of technical inefficiency is somewhat less than the range of 10-15% for the 130 studies surveyed by Berger and Humphrey (1997)* and Berger and DeYoung (1997). These results are also less than the level of inefficiency found in European studies including Carbo et al.'s (2000) whose findings for a sample of banks, from twelve countries, show mean cost inefficiency of around 22 % for the period 1989 to 1996.

Referring to table 6.9, the average technical efficiency based on bank specialisation ranged from 93% for investment banks to 98% for Islamic banks. The efficiency scores based on geographical location, ranged from 89% in Jordan to 99% in Bahrain. Finally, based on asset size, the differences among technical efficiency scores are not significant where optimal bank size is between US$ 2.5-5.0 billion and the largest banks seems to be somehow more efficient. These results are noticeably different from Carbo et al.'s (2000) findings on European savings banks who find that the least X-efficient banks were the largest in asset size.

* Of these, 60 parametric studies found that the mean technical inefficiency is smaller than 15%.

Table 6-9: Cost efficiency in Jordan, Egypt, Saudi Arabia and Bahrain banking over 1992-2000

	1992	1993	1994	1995	1996	1997	1998	1999	2000	*All*
Bahrain	100	100	100	100	100	99	99	99	99	*99*
Egypt	94	94	94	94	94	93	93	93	93	*94*
Jordan	90	89	89	89	89	89	89	88	88	*89*
Saudi Arabia	97	97	97	97	97	97	97	97	96	*97*
Commercial	95	95	95	95	94	94	94	94	94	*94*
Investment	93	93	93	93	93	93	93	93	93	*93*
Islamic	98	98	98	98	99	99	98	98	98	*98*
Other	97	96	96	96	96	96	96	96	96	*96*
All	**95**	**95**	**95**	**95**	**95**	**94**	**94**	**94**	**94**	*95*

Asset Size (US$ million)

	1-199	200-299	300-499	500-999	1,000-2,499	2,500-4,999	5,000-9,900	10000+		*All*
Bahrain	100	99	100	99	99	99	99	99		*99*
Egypt	95	94	94	94	94	93	92	90		*94*
Jordan	88	87	88	91	90			91		*89*
Saudi Arabia				98	98	98	98	95		*97*
All	95	93	94	95	95	96	96	94		*95*

Asset Size (US$ million)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	*All*
1-199.9	94	94	95	95	96	96	95	96	95	*95*
200-299	93	94	92	93	92	92	95	95	95	*93*
300-499	95	95	95	95	94	94	92	92	91	*94*
500-999	96	94	94	94	94	95	96	95	96	*95*
1,000-2,499	96	96	95	96	96	94	94	94	94	*95*
2,500-4,999	95	96	99	96	96	96	96	96	96	*96*
5,000-9,999	98	98	97	96	96	96	95	96	95	*96*
10000+	95	95	94	94	94	93	94	93	94	*94*
All	*95*	*95*	*95*	*95*	*95*	*94*	*94*	*94*	*94*	*95*

Source: Author's own estimation

As indicated in the previous chapters, the bank efficiency literature considers the estimation of both cost and profit efficiencies to reveal more accurate information about firm-level performance (see Berger and Mester, 1999). Referring to tables 6.10 and 6.11, the standard and alternative profit functions results show average technical efficiency estimates are around 66% and 58% respectively over the period 1992-2000. It should be noted that this level of technical inefficiency is somehow similar to the typical range of profit efficiency found in US studies which is about half of the industry's potential profits, according to Berger and Humphrey (1997). Profit inefficiencies in Arabic banking are less than those found in European banking. For instance, William's and Gardener (2000) estimate profit efficiency to be 79.7% in European banking during the 1990s. The mean profit efficiency given the standard profit function suggests that banks under study lose around 34% of profits that could be earned by a best practice institution. The profit efficiency given both the standard profit and alternative profit function has witnessed volatility over the period 1992-2000. While over the period 1993-99, the efficiency estimates derived from both profit function specifications fluctuate slightly around their average, the year 2000 exhibits fall in profit efficiency across banks under study. This might reflect the response of economic and financial activities to the instability in the oil prices and the political instability aroused from recent conflict aggravation in Palestine and the Gulf.

Given the standard profit function, profit efficiency ranged from around 61% in Jordan to 68% in Bahrain. Based on specialisation, the results show that the efficiency scores ranged from 56% for investment banks to 75% for the Islamic banks (see table 6.10 for details). This result might explain the increase in Islamic banking activities especially in Bahrain over the past few years; as the cost of funds for Islamic banks is relatively cheaper than the cost of funds for other financial institutions. The Islamic banks, in general, do not pay interest but rather a mark-up which is a profit margin based on the way in which the funds are utilised; as indicated in chapter 3. Given the geographical location, Jordan is a relatively much poorer country compared to Saudi and Bahrain (oil-producing countries) and banks may be able to sell higher profit generating products in these markets. This might explain why the Jordanian banks are relatively less profit efficient than the banks in other countries under study.

Based on the size of assets, apart from the smallest banks (US $ 1-199 millions) which are the most profit efficient, larger banks seems to be more profit efficient, in general. This result supports the theory that large banks enjoy several advantages compared to small banks. These advantages include the ability of large banks to utilise more efficient technology with less cost, the ability of these banks to prepare more specialised staff for the most profitable activities and their ability to provide higher quality output resulting in higher prices.

Similar results are obtained from the alternative profit function estimates where profit efficiency ranges from 49% in Jordan to 61% in Bahrain. Based on specialisation, Islamic banking is again the most profit efficient while investment banking is the least efficient. Based on asset size, the largest banks also seem to be the most efficient. Overall, the results of both the standard and alternative profit function, while varying in absolute efficiency levels, are exactly identical in terms of profit efficiency ranking in terms of country, specialisation and bank asset size.

To summarise the main findings, cost efficiency levels averaged around 95 percent over the period 1992-2000 without noticeable change over the 1992-99 period but have experienced a fall in 2000. On the other hand, both standard (and alternative) profit efficiency averaged around 66% (and 56%) over the sample period. Standard profit and alternative profit efficiency of Arabic banking systems have not witnessed significant changes over the 1993-99 but have also experienced a fall in 2000. That is profit efficiency has recently fallen.

Profit efficiency estimates for the Arabic banks under study are not noticeably different from those observed from previous studies on the US and European banking industries. Islamic banks are found to be the most cost and profit efficient while investment banks are the least efficient. This result may partially explain the motives behind the increase in Islamic banking activities over the past few years; as the cost of funds for Islamic banks is relatively cheaper than the cost of funds for other financial institutions. On the other hand, intense competition between investment and commercial banks might explain the competitive disadvantages of the investment banks in terms of their market share and expose the motives for increased mergers and consolidation activity between such banks.

Based on assets size, large banks seems to be relatively more cost and profit efficient, in general. This result suggests that large banks enjoy several advantages compared to small banks. These include the ability of large banks to utilise more efficient technology with less cost, the ability of these banks to set up more specialised staff for the most profitable activities and the ability of these banks to provide better quality output and therefore charge higher prices. Geographically, Bahrain is the most cost and profit efficient banking systems while Jordan is the least cost and profit efficient.

Finally, while the countries under study have implemented many economic and financial reforms over the last twenty years or so as indicated earlier, these reforms do not appear to have had much impact on banking sector efficiency. Given our findings, it seems that more reform may be needed to improve (especially) their profit efficiency. Perhaps the move to create a single GCC market may help to facilitate these developments as the creation of a similar European Single market appears to have had a positive impact on European bank efficiency (see European Commission (1997)).

Table 6-10: Standard profit efficiency in Jordan, Egypt, Saudi Arabia and Bahrain banking over 1992-2000

	1992	1993	1994	1995	1996	1997	1998	1999	2000	*All*
Bahrain	69	78	67	71	66	72	67	68	57	***68***
Egypt	66	64	66	70	66	64	65	73	63	***66***
Jordan	84	60	61	61	63	56	56	59	50	***61***
Saudi Arabia	67	68	66	69	69	65	59	63	63	***65***
Commercial	70	67	68	72	69	65	62	68	62	***67***
Investment	65	69	55	55	48	51	57	60	43	***56***
Islamic	83	73	78	79	75	80	67	67	76	***75***
Other	64	58	57	61	64	73	74	78	55	***65***
All	**70**	**67**	**65**	**68**	**66**	**65**	**63**	**68**	**59**	***66***

Asset Size (US$ million)

	1-199	200-299	300-499	500-999	1,000-2,499	2,500-4,999	5,000-9,900	10000+	*All*
Bahrain	75	67	71	62	66	66	78	56	***68***
Egypt	74	59	60	70	69	70	58	72	***66***
Jordan	53	66	56	73	53			68	***61***
Saudi Arabia				43	62	65	68	68	***65***
All	70	63	62	68	65	67	67	67	***66***

Asset Size (US$ million)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	*All*
1-199.9	72	68	75	70	65	70	76	70	56	***70***
200-299	65	75	60	65	62	60	57	63	44	***63***
300-499	71	65	60	60	58	63	59	64	55	***62***
500-999	61	66	62	76	71	64	63	75	66	***68***
1,000-2,499	78	62	64	66	65	67	66	67	56	***65***
2,500-4,999	59	49	79	79	78	63	64	77	62	***67***
5,000-9,999	65	73	71	72	64	60	61	70	64	***67***
10000+	70	73	64	73	76	71	60	61	63	***67***
All	***70***	***67***	***65***	***68***	***66***	***65***	***63***	***68***	***59***	***66***

Source: Author's own estimation

Table 6-11: Alternative profit in Jordan, Egypt, Saudi Arabia and Bahrain Banking over 1992-2000

	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	***All***
Bahrain	58	72	60	66	58	64	51	61	58	***61***
Egypt	65	58	60	62	59	60	56	68	55	***60***
Jordan	59	51	54	53	49	39	42	52	46	***49***
Saudi Arabia	56	56	54	51	61	59	51	61	61	***57***
Commercial	60	59	61	63	63	58	53	62	56	***60***
Investment	55	61	52	50	43	46	46	62	44	***51***
Islamic	76	57	60	64	54	63	51	55	78	***62***
Other	69	62	47	53	48	63	56	67	47	***57***
All	**61**	**60**	**58**	**60**	**58**	**57**	**52**	**62**	**55**	***58***
Asset Size (US$ million)										
	1-199	**200-299**	**300-499**	**500-999**	**1,000-2,499**	**2,500-4,999**	**5,000-9,900**	**10000+**		***All***
Bahrain	63	66	59	54	55	59	86	68		***61***
Egypt	59	55	54	63	64	61	64	78		***60***
Jordan	42	46	46	59	43			74		***49***
Saudi Arabia				23	50	65	56	63		***57***
All	56	55	54	59	57	62	61	69		***58***
Asset Size (US$ million)										
	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	***All***
1-199.9	61	47	57	68	49	62	63	55	48	***56***
200-299	56	72	47	58	57	45	46	59	46	***55***
300-499	58	64	56	52	50	57	44	53	44	***54***
500-999	62	53	55	61	63	55	51	70	56	***59***
1,000-2,499	70	57	63	54	49	57	50	64	53	***57***
2,500-4,999	58	50	66	66	64	52	55	73	66	***62***
5,000-9,999	58	55	67	64	64	58	63	65	56	***61***
10000+	62	80	62	74	84	77	60	62	68	***69***
All	*61*	*60*	*58*	*60*	*58*	*57*	*52*	*62*	*55*	*58*

Source: Author's own estimation

6.5.5 Estimated levels of scale elasticities

Productive efficiency requires optimising behaviour with respect to outputs as well as inputs as indicated earlier. Regarding outputs, optimal behaviour relates to producing the level of outputs that correspond to the lowest cost per unit. For the cost function, the optimal output level is possible if economies and diseconomies exist at different output levels; that is at some point, there will be constant returns defining the optimal level of production. Economies of scale exist if, over a given range of output, per unit costs decline as output increases. Increases in per unit cost correspond to decreasing returns to scale. A scale efficient firm will produce where there are constant returns to scale; that is, changes in output result in proportional changes in costs (Evanoff and Israilevich, 1991).

Given the cost function specification, the scale economy measure is a cost elasticity; the percent change in cost with respect to a percent change in output. On this basis, the results suggest existence of scale diseconomies across the banks under study and the scale diseconomies for these banks ranged from around 3% in 1992 to 6% in 2000 and averaged 5% over the 1992-2000 period (table 6.12 shows the details*). Thus, a 100 percent increase in the level of outputs would lead to about 105% percent increase in total costs. The magnitude of these scale diseconomies estimates is not different from other banking literature that finds evidence of diseconomies in the US banking market. For example, see Berger et al. (1993), Hughes et al. (1995) and McAllister and McManus (1993).

Based on the size of banks' assets, the optimal bank size are those in the ranges of US$ 5-10 billion where banks in this category experience increasing returns to scale. In addition, scale economies increase with size, and optimal bank size is inexhaustible which supports an argument for further consolidation. Based on geographical location, Saudi Arabian and (to a lesser extent) Egyptian banks seem to have the largest unrealised scale economies (see table 6.12 for details).

* see table 6.12's footnote to observe if these values are statistically significant from unity.

Table 6-12: Scale elasticities in the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain over 1992-2000

	1992	1993	1994	1995	1996	1997	1998	1999	2000	*All*
Bahrain	1.23	1.25	1.22	1.24	1.27	1.22	1.22	1.21	1.26	***1.23***
Egypt	0.92	0.97	0.92	0.90	0.96	1.00	1.02	1.03	1.00	***0.97***
Jordan	1.14	1.09	1.16	1.23	1.21	1.20	1.17	1.15	1.07	***1.16***
Saudi Arabia	0.94	0.90	0.88	0.92	0.89	0.92	0.90	0.93	0.97	***0.92***
Commercial	0.94	0.95	0.92	0.92	0.94	0.95	0.95	0.95	0.94	***0.94***
Investment	1.15	1.15	1.16	1.24	1.22	1.27	1.31	1.28	1.30	***1.23***
Islamic	1.19	1.30	1.34	1.40	1.49	1.42	1.39	1.31	1.29	***1.35***
Other	1.26	1.29	1.25	1.17	1.25	1.27	1.24	1.32	1.29	***1.26***
All	1.03	1.04	1.02	1.03	1.06	1.07	1.07	1.07	1.06	***1.05***
Asset Size (US$ million)										
	1-199	**200-299**	**300-499**	**500-999**	**1,000-2,499**	**2,500-4,999**	**5,000-9,900**	**10000+**		*All*
Bahrain	1.33	1.15	1.25	1.38	1.42	1.23	1.15	0.46		***1.23***
Egypt	0.79	0.88	0.92	0.97	1.17	1.15	0.97	0.67		***0.97***
Jordan	1.06	1.15	1.15	1.25	1.29			0.90		***1.16***
Saudi Arabia				0.83	1.03	1.15	0.95	0.69		***0.92***
All	1.05	1.01	1.06	1.13	1.19	1.16	0.98	0.67		***1.05***
Asset Size (US$ million)										
	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	*All*
1-199.9	1.01	1.11	1.10	1.03	1.09	0.98	0.94	1.06	1.03	***1.05***
200-299	1.01	1.08	0.92	1.05	1.02	1.07	1.07	0.93	0.81	***1.01***
300-499	1.07	1.04	1.06	1.09	1.08	1.10	1.01	1.02	1.02	***1.06***
500-999	1.09	1.02	1.00	1.09	1.16	1.07	1.24	1.19	1.18	***1.13***
1,000-2,499	1.05	1.10	1.19	1.14	1.19	1.29	1.26	1.23	1.23	***1.19***
2,500-4,999	1.13	1.05	0.94	1.10	1.05	1.06	1.20	1.33	1.33	***1.16***
5,000-9,999	0.99	0.96	0.99	0.84	0.97	0.99	1.06	1.01	1.04	***0.98***
10000+	0.90	0.81	0.73	0.69	0.66	0.57	0.62	0.55	0.62	***0.67***
All	***1.03***	***1.04***	***1.02***	***1.03***	***1.06***	***1.07***	***1.07***	***1.07***	***1.06***	*1.05*

Note: The scores that fall within the ranges [0.983-1.016] and [0.966-1.033] are not statistically different from one at 5 percent and 1 percent level respectively for two-tailed test.
Source: Author's own estimation.

In order to examine the responsiveness of bank profits to size, we also estimate standard profit and alternative profit 'scale' elasticities. This is done by using the same approach as for the cost elasticity but this time profits and alternative profits functions are used.

Given the standard profit function, the profits scale elasticity is around 87%. This implies increasing the scale of operation for the banks under study by 87% will result in an increase in their profits by 100%. On the other hand, the scale elasticity given the alternative profit function is about 95% which is clearly not far away from unity*. Given both the standard and alternative profit function, the Egyptian banks scale appear the most profit efficient. On the other hand, profit elasticities for the investment banks are the lowest. Furthermore, the scale of operation for large banks especially given the standard profit functions seems to be larger than for smaller banks (table 6.13 and 6.14 show the details).

To summarise, (cost) scale elasticity estimates for the banking systems under study is around 105% and this did not noticeably change over 1992-2000. This implies that increasing the size of operations by 100 percent results in an increase in cost by 105 percent. In other words, scale diseconomies predominate. Nevertheless, we do not find evidence of significant scale economies for the largest banks in the sample. On the other hand, profit (scale elasticities) averaged around 90%. This result suggests that increasing the size of banks through mergers and consolidation would tend to increase the profitability of the banks under study. Overall, it appears that scale elasticities are most prevalent for commercial banks and for the largest banks in general.

* see tables 6.13 and 6.14 to observe if these value are statistically significant from unity.

Table 6-13: Standard profit scale elasticity estimates for the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain over 1992-2000

	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	***All***
Bahrain	0.67	0.77	0.77	1.19	0.69	0.79	0.97	0.58	0.59	0.78
Egypt	0.95	1.09	0.87	1.00	1.04	1.22	0.34	0.69	1.24	0.94
Jordan	0.56	0.97	0.93	0.88	0.89	0.96	0.36	0.86	1.04	0.83
Saudi Arabia	0.69	0.72	1.23	0.60	0.97	1.01	0.21	0.85	1.12	0.82
Commercial	0.82	0.97	0.93	0.94	0.90	1.06	0.44	0.79	1.10	0.88
Investment	0.70	0.78	0.82	1.04	0.88	1.03	0.45	0.61	0.87	0.80
Islamic	0.72	0.89	0.73	1.16	0.91	1.10	0.67	0.54	0.97	0.85
Other	0.71	1.04	1.07	0.83	1.15	0.99	0.47	0.61	0.98	0.87
All	0.78	0.94	0.91	0.96	0.93	1.05	0.46	0.72	1.04	0.87
Asset Size (US$ million)										
	1-199	**200-299**	**300-499**	**500-999**	**1,000-2,499**	**2,500-4,999**	**5,000-9,900**	**10000+**		***All***
Bahrain	0.76	0.83	0.83	0.77	0.73	0.67	0.71	0.81		0.78
Egypt	0.98	0.91	0.97	0.91	0.96	0.81	0.86	0.96		0.94
Jordan	0.72	0.85	0.79	0.88	0.90			0.89		0.83
Saudi Arabia				1.07	0.78	0.71	0.75	0.96		0.82
All	0.84	0.88	0.89	0.88	0.88	0.75	0.77	0.93		0.87
Asset Size (US$ million)										
	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	***All***
1-199.9	0.80	1.00	0.80	0.81	0.87	0.80	0.89	0.69	0.76	***0.84***
200-299	0.69	0.85	0.88	1.05	0.98	0.97	0.50	0.79	1.18	***0.88***
300-499	0.79	1.04	0.87	1.06	0.91	1.08	0.51	0.69	1.13	***0.89***
500-999	0.83	1.02	0.95	0.98	0.97	1.12	0.52	0.54	1.01	***0.88***
1,000-2,499	0.96	0.81	0.97	1.03	0.99	1.05	0.31	0.78	1.13	***0.88***
2,500-4,999	0.39	0.77	0.79	0.57	0.59	1.36	0.54	0.64	0.89	***0.75***
5,000-9,999	0.65	0.78	0.90	0.71	0.96	1.00	0.10	0.62	1.12	***0.77***
10000+	0.81	1.01	1.20	0.97	0.92	0.95	0.46	1.07	1.05	***0.93***
All	***0.78***	***0.94***	***0.91***	***0.96***	***0.93***	***1.05***	***0.46***	***0.72***	***1.04***	***0.87***

Note: The scores that fall within the ranges [0.979-1.020] and [0.959-1.041] are not statistically different from one at 5 percent and 1 percent level respectively for two-tailed test.
Source: Author's own estimation.

Table 6-14: Alternative profit scale elasticity for the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain over 1992-2000

	1992	1993	1994	1995	1996	1997	1998	1999	2000	*All*
Bahrain	0.53	1.11	0.19	0.94	0.49	0.37	1.70	0.45	1.16	0.77
Egypt	1.33	1.42	0.90	0.67	0.45	0.92	0.71	1.09	2.29	1.09
Jordan	0.77	1.12	0.80	0.32	0.19	1.08	1.04	0.78	1.39	0.83
Saudi Arabia	0.41	0.67	1.37	0.31	0.85	0.31	0.67	1.77	1.98	0.93
Commercial	1.01	1.23	0.85	0.56	0.48	0.65	0.94	1.15	1.86	0.97
Investment	0.65	0.96	0.47	0.61	0.42	0.65	0.93	0.86	1.74	0.81
Islamic	0.60	1.29	0.84	1.01	0.49	1.14	1.10	0.63	1.59	0.97
Other	0.91	1.15	0.95	0.64	0.56	1.01	1.18	0.61	2.01	1.00
All	0.91	1.18	0.80	0.61	0.48	0.73	0.98	1.01	1.84	0.95

Asset Size (US$ million)

	1-199	200-299	300-499	500-999	1,000-2,499	2,500-4,999	5,000-9,900	10000+		*All*
Bahrain	0.71	0.87	0.77	0.82	0.71	1.06	0.66	0.67		0.77
Egypt	1.23	0.88	1.08	0.98	1.17	1.26	0.88	1.19		1.09
Jordan	0.71	0.67	1.00	0.78	0.86			0.97		0.83
Saudi Arabia				1.01	0.71	0.72	0.96	1.17		0.93
All	0.92	0.82	0.98	0.90	0.97	1.02	0.91	1.07		0.95

Asset Size (US$ million)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	*All*
1-199.9	1.03	1.40	0.48	0.43	0.26	0.49	1.23	0.95	1.79	***0.92***
200-299	0.67	0.88	0.82	0.67	0.46	0.66	1.10	0.68	2.46	***0.82***
300-499	1.14	1.41	0.80	0.67	0.44	0.70	1.14	0.91	1.77	***0.98***
500-999	0.90	1.21	0.87	0.49	0.44	1.10	1.13	0.56	1.53	***0.90***
1,000-2,499	0.88	0.95	0.75	0.80	0.62	0.93	0.70	1.02	1.82	***0.97***
2,500-4,999	0.85	0.96	0.84	0.05	0.35	0.76	1.13	0.95	2.15	***1.02***
5,000-9,999	0.47	0.95	0.87	0.94	0.55	0.43	0.89	1.45	2.03	***0.91***
10000+	0.88	1.22	1.24	0.31	0.69	0.24	0.77	1.73	1.87	***1.07***
All	***0.91***	***1.18***	***0.80***	***0.61***	***0.48***	***0.73***	***0.98***	***1.01***	***1.84***	***0.95***

Note: The scores that fall within the ranges [0.961-1.038] and [0.923-1.076] are not statistically different from one at 5 percent and 1 percent level respectively for two-tailed test.
Source: Author's own estimation.

6.5.6 Estimated levels of scale efficiency

The scale elasticity measure, as indicated earlier, is an elasticity associated with a particular output level and indicates the relative change in cost associated with an increment change from this output level. Scale inefficiency (I), on other hand, can be measured as the aggregate cost of F inefficient firms ($\varepsilon \neq 1.0$) relative to the cost of a single efficient firm ($\varepsilon = 1.0$).

Given the following representation for the cost function: ln C = a + b (ln Y) + .5 c (ln Y)^2, then the scale elasticity for inefficient firms $= \varepsilon_I = \partial \ln C_I / \partial \ln Y_I = b$. On this basis, scale inefficiency can be written as: $I = e^{(.5/c)(1-\varepsilon_I)^2} -1.0$, that is scale inefficiency is a function of the first and second derivatives of the function with respect to output (the second derivation helps to reach c which is the key for calculation of inefficiency). Note, if the estimated scale elasticity is insignificantly different from unity, this does not imply scale inefficiency is insignificantly different from zero because the statistical difference of the elasticity measure from a value of unity depends entirely on the standard error of the estimated coefficient b.

Given the cost function specification of the stochastic frontier, scale efficiency averaged around 65% for banks under study over 1992 to 2000. Furthermore, there is a significant drop in scale efficiency over time when it decreased from around 72% in 1992 to reach 60% percent in 2000. According to geographical location, the efficiency scores ranged from 72% for Jordan and Saudi Arabian banks to 51% for Bahrain banks. Furthermore, commercial banks are the most efficient with cost efficiencies around 70% while the least efficient are the Islamic banks (table 6.15). Furthermore, the results generally show that some categories of small and large banks are scale efficient while other ranges do have similar efficiency levels.

Table 6-15: Cost Scale inefficiency for the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain over 1992-2000

	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	***All***
Bahrain	47	49	44	51	53	53	49	46	52	49
Egypt	24	24	31	33	32	35	36	41	40	33
Jordan	21	26	25	34	31	34	30	27	25	28
Saudi Arabia	20	21	27	27	23	29	30	36	40	28
Commercial	24	25	30	34	29	31	30	33	33	30
Investment	32	30	30	42	39	44	45	40	42	38
Islamic	34	47	50	59	74	77	71	65	55	59
Other	38	43	31	25	38	46	46	57	70	44
All	28	29	32	36	35	38	37	39	40	35
Asset Size (US$ million)										
	1-199	**200-299**	**300-499**	**500-999**	**1,000-2,499**	**2,500-4,999**	**5,000-9,900**	**10000+**		***All***
Bahrain	44	27	41	54	75	54	17	79		49
Egypt	44	26	17	28	51	23	28	50		33
Jordan	21	20	21	39	47			20		28
Saudi Arabia				25	26	27	16	43		28
All	38	24	24	37	49	31	19	48		35
Asset Size (US$ million)										
	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	***All***
1-199.9	30	32	39	37	40	46	46	46	51	***38***
200-299	20	33	19	28	25	24	24	16	26	***24***
300-499	25	19	19	29	33	35	21	20	14	***24***
500-999	30	35	33	40	37	35	44	35	37	***37***
1,000-2,499	42	47	49	47	53	55	50	51	47	***49***
2,500-4,999	25	16	54	24	3	13	28	48	49	***31***
5,000-9,999	10	10	19	37	20	22	12	14	23	***19***
10000+	30	29	40	43	46	52	50	69	56	***48***
All	***28***	***29***	***32***	***36***	***35***	***38***	***37***	***39***	***40***	***35***

Source: Author's own estimation

As in the case of scale elasticities reported in the previous section, we also calculated scale efficiency using both standard and alternative profit functions. Scale efficiency given the standard and alternative profit functions were 56% and 61% respectively but with rather dissimilar movements for efficiency scores for both sets of measures overtime. The scale efficiency estimates, given both profit functions, show high fluctuation overtime with some years exhibiting relatively high scale efficiency scores and others relatively low efficiency scores. Based on geographical location, Saudi Arabia banks appear to be the most scale efficient while the Jordan's banks are the least profit scale efficient. Based on specialisation, the profit efficiency scores for Islamic and commercial banks seem to be better than those of other banks. Furthermore, the scale profit efficiency scores for large banks, given alternative profit function in particular, are higher than the smaller banks (see table 6.16 & 6.17 for details).

Table 6-16: Standard profit scale inefficiency of the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain over 1992-2000

	1992	1993	1994	1995	1996	1997	1998	1999	2000	*All*
Bahrain	40	37	53	27	42	67	29	42	40	*42*
Egypt	35	45	59	54	66	51	9	40	62	*47*
Jordan	25	74	14	57	60	81	9	37	82	*49*
Saudi Arabia	43	54	29	18	21	27	4	43	68	*34*
Commercial	34	50	42	46	54	54	12	44	64	*44*
Investment	43	38	45	47	41	79	12	37	64	*45*
Islamic	42	58	52	34	50	48	14	29	46	*41*
Other	33	61	60	25	63	37	15	33	54	*42*
All	**36**	**50**	**45**	**43**	**52**	**56**	**13**	**40**	**61**	**44**

Asset Size (US$ million)

	1-199	200-299	300-499	500-999	1,000-2,499	2,500-4,999	5,000-9,900	10000+		*All*
Bahrain	46	40	46	42	29	34	30	55		*42*
Egypt	47	53	47	43	44	41	57	48		*47*
Jordan	49	43	56	46	46			48		*49*
Saudi Arabia				29	30	32	32	42		*34*
All	48	48	48	43	40	36	38	46		*44*

Asset Size (US$ million)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	*All*
1-199.9	29	62	32	56	70	55	26	63	54	*48*
200-299	38	35	59	50	53	81	12	34	69	*48*
300-499	23	53	58	48	58	65	18	47	70	*48*
500-999	42	69	41	47	57	58	12	28	45	*43*
1,000-2,499	62	39	47	29	46	48	8	23	63	*40*
2,500-4,999	10	27	55	23	32	30	13	48	63	*36*
5,000-9,999	38	52	31	24	40	48	0	45	67	*38*
10000+	39	49	30	50	50	47	12	62	70	*46*
All	*36*	*50*	*45*	*43*	*52*	*56*	*13*	*40*	*61*	*44*

Source: Author's own estimation

Table 6-17: Alternative profit scale inefficiency of the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain over 1992-2000

	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	***All***
Bahrain	53	51	17	31	42	32	30	44	40	***38***
Egypt	39	25	39	46	45	30	64	46	10	***38***
Jordan	76	57	30	30	18	67	55	37	33	***45***
Saudi Arabia	41	51	22	29	48	28	49	42	16	***36***
Commercial	47	39	32	37	40	34	56	42	21	***39***
Investment	64	45	37	33	37	54	39	39	24	***41***
Islamic	57	52	19	56	41	23	48	52	22	***41***
Other	34	34	12	33	45	37	57	51	21	***36***
All	**49**	**40**	**30**	**37**	**40**	**37**	**53**	**44**	**22**	***39***

Asset Size (US$ million)

	1-199	**200-299**	**300-499**	**500-999**	**1,000-2,499**	**2,500-4,999**	**5,000-9,900**	**10000+**		***All***
Bahrain	35	31	37	43	43	36	43	36		***38***
Egypt	31	48	35	37	37	40	60	37		***38***
Jordan	50	54	46	34	47			32		***45***
Saudi Arabia				15	49	28	41	27		***36***
All	37	46	38	37	42	35	46	31		***39***

Asset Size (US$ million)

	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	***All***
1-199.9	41	45	20	43	27	50	42	40	26	***37***
200-299	67	36	45	36	46	55	45	65	5	***46***
300-499	44	33	31	39	38	38	51	40	23	***38***
500-999	38	28	26	37	41	30	57	52	21	***37***
1,000-2,499	45	47	33	39	51	34	63	40	24	***42***
2,500-4,999	84	23	31	7	29	31	51	48	12	***35***
5,000-9,999	47	72	37	52	40	40	57	46	24	***46***
10000+	47	42	19	23	38	20	40	30	24	***31***
All	*49*	*40*	*30*	*37*	*40*	*37*	*53*	*44*	*22*	*39*

Source: Author's own estimation

6.6 Efficiency estimates using DEA

In order to test the consistency of the efficiency estimates derived in section 6.5, this section reports the efficiency measures obtained utilising DEA.

As indicated earlier, DEA can be used to estimate efficiency under the assumptions of constant and variable return to scale. The CRS assumption is only appropriate when all DMUs are operating at an optimal scale. However, factors like imperfect competition and constraints on finance may cause a DMU not to operate at optimal scale. As a result, the use of the CRS specification when some DMUs are not operating at the optimal scale confuses measures of technical and scale efficiency. Therefore, Banker et al. (1984) proposed a variable returns to scale approach.

The cost efficiency results using DEA, assuming constant and variable returns to scale averaged around 0.51 and 0.68 respectively for the financial institutions under study over 1992-2000. When we split the cost efficiency further, assuming CRS, we find that technical efficiency estimates averaged around 0.84 while the allocative efficiency averaged around 0.61 over the sample period. On the other hand, splitting the cost efficiency into technical and allocative, assuming VRS, we get 0.91 and 0.75 for the technical and allocative efficiency measures respectively (tables 6.23 in the appendix shows the details)

The difference between cost efficiency estimates under CRS and VRS is attributed to scale efficiency; as indicated earlier. The scale efficiency averaged around 0.93 for the financial institutions in the countries under study over (1992-2000) the sample period.

Comparing the estimates of DEA with those of SFA, the results from both methodologies are somewhat different. Utilising both Pearson and Spearman rank correlations, both of these two measures report a correlation of around 40% between the scores from both methodologies. Referring to table 6.18, both methodologies are consistent in ranking Egypt and Jordan in the third and fourth position, in terms of cost efficiency, but there is a difference between the two methodologies concerning the ranking of Bahrain and Saudi Arabia in the first and second place where the SF rank Bahraini banks as the most efficient and DEA ranks Saudi Arabian banks as the most efficient.

Furthermore, both methodologies were consistent in ranking commercial and investment banks as the least efficient, in terms of cost efficiency, but they rank the Islamic banks and other financial institutions differently (see table 6.18 for details). Finally, both approaches ranked the smallest banks the same as the least cost efficient, but the two methodologies vary concerning the ranking of large and very large institutions.

Table 6-18: Comparing the cost efficiency results of the SF with those of DEA

	Technical Efficiency		
Country	**DEA**	**SF**	**Rank**
Bahrain	76	99	
Egypt	62	94	3
Jordan	55	89	4
Saudi	88	97	
Specialisation			
Commercial	67	94	3
Investment	60	93	4
Islamic	77	98	
Other	81	96	
Asset size			
1-999	58	94	4
1,000-4,999	74	94	3
5,000-9,999	90	96	
10,000	97	94	

Source: Author's own estimation

While the correlation between the results of both methodologies is relatively modest, the differences between scores of both methodology results are attributed mainly to the differences in the assumptions, detailed earlier, necessary by each methodology to obtain the efficiency estimates. Technical efficiency using the SFA approach averaged around 0.95 for the financial institutions under study while the results from DEA assuming VRS, estimates cost efficiency to be around 0.68. This result is not strange because DEA assumes all the deviation from the efficient frontier as inefficiency and therefore the DEA method known to give higher inefficiency scores compared to the SFA approach.

6.7 Conclusion

This chapter investigates the levels of cost and profit efficiency in Jordan, Egypt, Saudi Arabia and Bahrain over the 1992-2000 period and utilises a sample that consists of 82 banks from these countries.

At the beginning, we present the theoretical justification for utilising the Fourier flexible functional form (FF) over other approaches to estimate efficiency measures. The Fourier-flexible functional form is preferred because it better approximates the underlying cost function across a broad range of outputs and the FF form is unaffected by specification errors. In addition, we utilise the non-parametric data envelopment analysis (DEA) approach to cross-check the robustness of the efficiency results obtained from the parametric approach.

The process of obtaining a preferred stochastic model follows recent banking efficiency methodologies and proceeds in a step-wise fashion aimed at obtaining the most appropriate model specification. Model choice is determined by using the maximum likelihood estimates, on various models specifications, that suggests the most appropriate model fit. The various stochastic models are assessed employing different combination of control and environmental variables and the preferred models are selected based on maximum likelihood estimates.

Based on the preferred models for cost, standard profit and alternative profit, different efficiency measures are reported for the banks in the countries under study. Given cost efficiency estimates, the preferred model is the Fourier-truncated that excludes control variables (capital adequacy, asset quality and the time trend) but includes the environmental variables. Given the standard and alternative profit function, the preferred model is the Fourier-flexible that includes the control as well as the environmental variables.

Based on the results of the preferred models, technical cost efficiency averaged around 95% over the 1992-2000 period with insignificant changes over this period. Given the standard and alternative profit function, the technical efficiency averaged 66% and 58% respectively over the same period. The technical efficiency estimates utilising the standard and alternative profit functions have shown insignificant volatility in the efficiency scores over 1993-99 but both have reported significant falls in efficiency for the year 2000. The Islamic banks are found to be the most cost and profit efficient while the investment banks are the least (cost and profit efficient). This result perhaps explains the motives behind the increase in Islamic banking activities over the past few years. It also indication of the fact that the cost of funds for Islamic banks is relatively cheaper than the cost of funds for other financial institutions.

Large banks seem to be relatively more cost and profit efficient. This result suggests that large banks enjoy several advantages compared to small banks. This includes the ability of large banks to utilise more efficient technology with less cost, the ability of these banks to set up more specialised staff for the most profitable activities and the ability of these banks to provide (presumably) better quality outputs for which they can charge higher prices. Geographically, Bahrain banks are the most cost and profit efficient while Jordanian banks are the least (cost and profit efficient).

Based on the estimated preferred models, we also report scale elasticity and scale efficiency measures for the banks under study. The cost scale elasticity estimates reveals diseconomies of around five percent and the cost scale inefficiency estimates also suggest that banks are 65% scale efficient (Given profit and alternative profit functions, scale elasticities ranged, on average, between 5% to 13% while scale inefficiencies tend to be, on average, around 35 percent to 44 percent). Islamic and commercial banks are again found to be the most cost and profit scale efficient. Large banks are also generally found to be more efficient than smaller institutions. In addition, geographically, Saudi Arabian and Egyptian banks seem to be the most cost and profit scale efficient.

Finally, while the countries under study have implemented many economic and financial reforms over the last decade or so, these do not appear to have noticeable positive impact on the efficiency of the respective banking systems under study. Diseconomies of scale are prevalent and profit inefficiencies, in general, are substantial. Both Islamic and commercial (in particular the largest in terms of assets' value) banks appear to be the most efficient forms of banks operating in the Arabic countries under study. It seems that future reforms should be geared to facilitating further consolidation in the sector to realise greater efficiency. In addition, the growth of Islamic banking practices may also help improve the performance of the banking systems under study. Finally, the operation of a single banking market in the GCC (Saudi Arabia, Bahrain, Kuwait, Qatar, Oman, UAE) may also force greater merger and acquisition activity in the financial sector that could result in the realisation of larger economies and greater efficiency for their banking and financial systems.

Appendix to chapter 6
Table 6-19: Hypotheses testing for the standard profit function-stage 1

Model Description	Restrictions	Log likelihood	LR test of 1-sided error	DF	Critical value for α =5%	Decision
Stage 1: Models estimation including environmental variables						
- Fourier-truncated without restrictions*		-797.05				
- Fourier-truncated without time parameters	$\psi_3=\psi_{r3}=\psi_{3S}=\rho_{i3}=\tau_{k3}=\phi_8=\omega_8=\phi_{n8}=\phi_{8q}=\omega_{8q}=\omega_{n8}=\phi_{888}=\omega_{888}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-715.53	698.25	29	42.56	Reject Ho
- Fourier-truncated without capital parameters	$\psi_1=\psi_{r1}=\psi_{1S}=\rho_{i1}=\tau_{k1}=\phi_6=\omega_6=\phi_{n6}=\phi_{6q}=\omega_{6q}=\omega_{n6}=\phi_{666}=\omega_{666}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-771.06	640.71	29	42.56	Reject Ho
- Fourier-truncated without risk parameters	$\psi_2=\psi_{r2}=\psi_{2S}=\rho_{i2}=\tau_{k2}=\phi_7=\omega_7=\phi_{n7}=\phi_{7q}=\omega_{7q}=\omega_{n7}=\phi_{777}=\omega_{777}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-771.42	697.36	29	42.56	Reject Ho
- Fourier-truncated without time and capital parameters	$\psi_1=\psi_3=\psi_{r1}=\psi_{r3}=\psi_{1S}=\psi_{3S}=\rho_{i1}=\rho_{i3}=\tau_{k1}=\tau_{k3}=\phi_6=\phi_8=\omega_6=\omega_8=\phi_{n6}=\omega_{n8}=\phi_{n8}=\phi_{6q}=\phi_{8q}=\omega_{6q}=\omega_{8q}=\omega_{n6}=\omega_{n8}=\phi_{666}=\phi_{888}=\omega_{666}=\omega_{888}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-688.12	875.28	55	73.11	Reject Ho
- Fourier-truncated without time and risk parameters	$\psi_2=\psi_3=\psi_{r2}=\psi_{r3}=\psi_{2S}=\psi_{2S}=\rho_{i2}=\rho_{i3}=\tau_{k2}=\tau_{k3}=\phi_7=\phi_8=\omega_7=\omega_8=\phi_{n7}=\omega_{n8}=\phi_{n8}=\phi_{7q}=\phi_{8q}=\omega_{7q}=\omega_{8q}=\omega_{n7}=\omega_{n8}=\phi_{777}=\phi_{888}=\omega_{777}=\omega_{888}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-623.76	994.85	55	73.11	Reject Ho
- Fourier-truncated without capital and risk parameters	$\psi_1=\psi_3=\psi_{r1}=\psi_{r2}=\psi_{1S}=\psi_{2S}=\rho_{i1}=\rho_{i2}=\tau_{k1}=\tau_{k2}=\phi_6=\phi_7=\omega_6=\omega_7=\phi_{n6}=\omega_{n7}=\phi_{n7}=\phi_{6q}=\phi_{7q}=\omega_{6q}=\omega_{7q}=\omega_{n6}=\omega_{n7}=\phi_{666}=\phi_{777}=\omega_{666}=\omega_{777}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-655.37	987.05	55	73.11	Reject Ho

Model Description	Restrictions	Log likelihood	LR test of 1-sided error	DF	Critical value for α =5%	Decision
- Fourier-truncated without time, capital and risk parameters	$\psi_r = \psi_{rS} = \rho_{ir} = \tau_{kr} = \phi_6 = \phi_7 = \phi_8 = \omega_6 = \omega_7 = \omega_8 = \phi_{n6} = \phi_{n7} = \phi_{n8} = \phi_{6q} = \phi_{7q} = \phi_{8q} = \omega_{6q} = \omega_{7q} = \omega_{8q} = \omega_{n6} = \omega_{n7} = \omega_{n8} = \phi_{666} = \phi_{777} = \phi_{888} = \omega_{666} = \omega_{777} = \omega_{888}$ =0, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-611.35	1120.35	78	99.62	Reject Ho
Step 2: Fourier-truncated versus translog-truncated						
- Translog-truncated including time, capital and risk parameters	$\phi_n = \omega_n = \phi_{nq} = \omega_{nq} = \phi_{nnn} = \phi_{qqq}$ =0, n=q= 1, 2,...,8.	-610.39	1105.77	104	128.80	Reject Ho
Step 3: Fourier truncated included control but without environmental variables	$\phi_n = \omega_n = \phi_{nq} = \omega_{nq} = \phi_{nnn} = \phi_{qqq} = \delta_i$ =0, n=q= 1, 2,...,8.	-784.48	507.45		180.57	Reject Ho
Step 4: Fourier –truncated without efficiency term	$\phi_n = \omega_n = \phi_{nq} = \omega_{nq} = \phi_{nnn} = \phi_{qqq} = \delta_i = \lambda$ =0, n=q= 1, 2,...,8.	-860.61	355.19			Reject Ho

Source: Author's own estimation.

*The grey shade indicates the best model in this stage.

Table 6-20: Hypotheses testing for the standard profit function- stage 2

Model Description	Restrictions	Log likelihood	LR test of 1-sided error	DF	Critical value for α =5%	Decision
Stage 2: Models estimation excluding environmental variables						
Step 1: Time-variant versus time-invariant models						
- Truncated time-variant model that includes all the control variables		-1037.78				
- Truncated time-invariant model that includes all the control variables	$\eta = 0$	-1037.47	95.21			Reject Ho
Step 2: Truncated versus half-normal models						
-Half-normal time-variant model that includes all the control variables	$\mu = 0$	-1036.97	96.21	1	3.841	Reject Ho
Step 3: Truncated time-variant model with different combination of the control variables						
- Fourier-truncated without time parameters	$\psi_3 = \psi_{r3} = \psi_{3S} = \rho_{i3} = \tau_{k3} = \phi_8 = \omega_8 = \phi_{n8} = \phi_{8q} = \omega_{8q} = \omega_{n8} = \phi_{888} = \omega_{888} = 0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-1063.45	3.49	29	42.56	Do not reject Ho

Model Description	Restrictions	Log likelihood	LR test of 1-sided error	DF	Critical value for α =5%	Decision
- Fourier-truncated without capital parameters	$\psi_1=\psi_{r1}=\psi_{1S}=\rho_{i1}=\tau_{k1}=\phi_6=\omega_6=\phi_{n6}=\phi_{6q}=\omega_{6q}=\omega_{n6}=\phi_{666}=\omega_{666}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	ols		29	42.56	Do not reject Ho
- Fourier-truncated without risk parameters	$\psi_2=\psi_{r2}=\psi_{2S}=\rho_{i2}=\tau_{k2}=\phi_7=\omega_7=\phi_{n7}=\phi_{7q}=\omega_{7q}=\omega_{n7}=\phi_{777}=\omega_{777}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-1083.20	38.87	29	42.56	Do not reject Ho
- Fourier-truncated without time and capital parameters	$\psi_1=\psi_3=\psi_{r1}=\psi_{r3}=\psi_{1S}=\psi_{3S}=\rho_{i1}=\rho_{i3}=\tau_{k1}=\tau_{k3}=\phi_6=\phi_8=\omega_6=\omega_8=\phi_{n6}=\omega_{n8}=\phi_{n8}=\phi_{6q}=\phi_{8q}=\omega_{6q}=\omega_{8q}=\omega_{n6}=\omega_{n8}=\phi_{666}=\phi_{888}=\omega_{666}=\omega_{888}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-1118.83	13.84	55	73.11	Do not reject Ho
- Fourier-truncated without time and risk parameters	$\psi_2=\psi_3=\psi_{r2}=\psi_{r3}=\psi_{2S}=\psi_{2S}=\rho_{i2}=\rho_{i3}=\tau_{k2}=\tau_{k3}=\phi_7=\phi_8=\omega_7=\omega_8=\phi_{n7}=\omega_{n8}=\phi_{n8}=\phi_{7q}=\phi_{8q}=\omega_{7q}=\omega_{8q}=\omega_{n7}=\omega_{n8}=\phi_{777}=\phi_{888}=\omega_{777}=\omega_{888}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-1109.56	23.21	55	73.11	Do not reject Ho
- Fourier-truncated without capital and risk parameters	$\psi_1=\psi_3=\psi_{r1}=\psi_{r2}=\psi_{1S}=\psi_{2S}=\rho_{i1}=\rho_{i2}=\tau_{k1}=\tau_{k2}=\phi_6=\phi_7=\omega_6=\omega_7=\phi_{n6}=\omega_{n7}=\phi_{n7}=\phi_{6q}=\phi_{7q}=\omega_{6q}=\omega_{7q}=\omega_{n6}=\omega_{n7}=\phi_{666}=\phi_{777}=\omega_{666}=\omega_{777}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-1128.69	40.42	55	73.11	Reject Ho
- Fourier-truncated without time, capital and risk parameters	$\psi_r=\psi_{rS}=\rho_{ir}=\tau_{kr}=\phi_6=\phi_7=\phi_8=\omega_6=\omega_7=\omega_8=\phi_{n6}=\phi_{n7}=\phi_{n8}=\phi_{6q}=\phi_{7q}=\phi_{8q}=\omega_{6q}=\omega_{7q}=\omega_{8q}=\omega_{n6}=\omega_{n7}=\omega_{n8}=\phi_{666}=\phi_{777}=\phi_{888}=\omega_{666}=\omega_{777}=\omega_{888}=0$, *r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.*	*-1153.01*	*37.01*	*78*	*99.62*	*Do not reject Ho*
Step 3: Fourier-truncated versus translog						
- Translog-truncated without time, capital and risk parameters	$\psi_r=\psi_{rS}=\rho_{ir}=\tau_{kr}=\phi_n=\omega_n=\phi_{nq}=\omega_{nq}=\phi_{nnn}=\phi_{qqq}=0$, n=q= 1, 2,...,8.	-1209..29	143.89	104	128.80	Do not reject Ho

Source: Author's own estimation.

Table 6-21: Hypotheses testing for the alternative profit function- stage 1

Model Description	Restrictions	Log likelihood	LR test of 1-sided error	DF	Critical value for α =5%	Decision
Stage 1: Models estimation including environmental variables						
- Fourier-truncated without restrictions*		-792.45				
- Fourier-truncated without time parameters	$\psi_3=\psi_{r3}=\psi_{3S}=\rho_{i3}=\tau_{k3}=\phi_8=\omega_8=\phi_{n8}=\phi_{8q}=\omega_{8q}=\omega_{n8}=\phi_{888}=\omega_{888}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-703.15	750.54	29	42.56	Reject Ho
- Fourier-truncated without capital parameters	$\psi_1=\psi_{r1}=\psi_{1S}=\rho_{i1}=\tau_{k1}=\phi_6=\omega_6=\phi_{n6}=\phi_{6q}=\omega_{6q}=\omega_{n6}=\phi_{666}=\omega_{666}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-694.88	797.56	29	42.56	Reject Ho
- Fourier-truncated without risk parameters	$\psi_2=\psi_{r2}=\psi_{2S}=\rho_{i2}=\tau_{k2}=\phi_7=\omega_7=\phi_{n7}=\phi_{7q}=\omega_{7q}=\omega_{n7}=\phi_{777}=\omega_{777}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-694.88	797.56	29	42.56	Reject Ho
- Fourier-truncated without time and capital parameters	$\psi_1=\psi_3=\psi_{r1}=\psi_{r3}=\psi_{1S}=\psi_{3S}=\rho_{i1}=\rho_{i3}=\tau_{k1}=\tau_{k3}=\phi_6=\phi_8=\omega_6=\omega_8=\phi_{n6}=\omega_{n8}=\phi_{n8}=\phi_{6q}=\phi_{8q}=\omega_{6q}=\omega_{8q}=\omega_{n6}=\omega_{n8}=\phi_{666}=\phi_{888}=\omega_{666}=\omega_{888}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-730.52	826.94	55	73.11	Reject Ho
- Fourier-truncated without time and risk parameters	$\psi_2=\psi_3=\psi_{r2}=\psi_{r3}=\psi_{2S}=\psi_{2S}=\rho_{i2}=\rho_{i3}=\tau_{k2}=\tau_{k3}=\phi_7=\phi_8=\omega_7=\omega_8=\phi_{n7}=\omega_{n8}=\phi_{n8}=\phi_{7q}=\phi_{8q}=\omega_{7q}=\omega_{8q}=\omega_{n7}=\omega_{n8}=\phi_{777}=\phi_{888}=\omega_{777}=\omega_{888}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-653.12	929.85	55	73.11	Reject Ho

Model Description	Restrictions	Log likelihood	LR test of 1-sided error	DF	Critical value for α =5%	Decision
- Fourier-truncated without capital and risk parameters	$\psi_1=\psi_3=\psi_{r1}=\psi_{r2}=\psi_{1S}=\psi_{2S}=\rho_{i1}=\rho_{i2}=\tau_{k1}=\tau_{k2}=\phi_6=\phi_7=\omega_6=\omega_7=\phi_{n6}=\omega_{n7}=\phi_{n7}=\phi_{6q}=\phi_{7q}=\omega_{6q}=\omega_{7q}=\omega_{n6}=\omega_{n7}=\phi_{666}=\phi_{777}=\omega_{666}=\omega_{777}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-701.82	940.42	55	73.11	Reject Ho
- Fourier-truncated without time, capital and risk parameters	$\psi_r=\psi_{rS}=\rho_{ir}=\tau_{kr}=\phi_6=\phi_7=\phi_8=\omega_6=\omega_7=\omega_8=\phi_{n6}=\phi_{n7}=\phi_{n8}=\phi_{6q}=\phi_{7q}=\phi_{8q}=\omega_{6q}=\omega_{7q}=\omega_{8q}=\omega_{n6}=\omega_{n7}=\omega_{n8}=\phi_{666}=\phi_{777}=\phi_{888}=\omega_{666}=\omega_{777}=\omega_{888}=0$, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-705.73	979.80	78	99.62	Reject Ho
Step 2: Fourier-truncated versus translog-truncated						
- Translog-truncated including time, capital and risk parameters	$\phi_n=\omega_n=\phi_{nq}=\omega_{nq}=\phi_{nnn}=\phi_{qqq}=0$, n=q= 1, 2,...,8.	-672.51	1009.06	104	128.80	Reject Ho
Step 3: Fourier truncated included control but without environmental variables	$\phi_n=\omega_n=\phi_{nq}=\omega_{nq}=\phi_{nnn}=\phi_{qqq}=\delta_i=0$, n=q= 1, 2,...,8.	-756.23	572.23		180.57	Reject Ho
Step 4: Fourier –truncated without efficiency term	$\phi_n=\omega_n=\phi_{nq}=\omega_{nq}=\phi_{nnn}=\phi_{qqq}=\delta_i=\lambda=0$, n=q= 1, 2,...,8.	-844.78	395.11			Reject Ho

Source: Author's own estimation.

*The grey shade indicates the best model in this stage.

Table 6-22: Hypotheses testing for the alternative profit function- stage 2

Model Description	Restrictions	Log likelihood	LR test of 1-sided error	DF	Critical value for α =5%	Decision
<u>**Stage 2: Models estimation excluding environmental variables**</u>						
Step 1: Time-variant versus time-invariant models						
- Truncated time-variant model that includes all the control variables		-1036.93				
- Truncated time-invariant model that includes all the control variables	$\eta = 0$	-1040.53	175.51			Reject Ho
Step 2: Truncated versus half-normal models						
-Half-normal time-variant model that includes all the control variables	$\mu = 0$	-1063.66	183.86	1	3.841	Reject Ho
Step 3: Truncated time-variant model with different combination of the control variables						
- Fourier-truncated without time parameters	$\psi_3 = \psi_{r3} = \psi_{3S} = \rho_{i3} = \tau_{k3} = \phi_8 = \omega_8 = \phi_{n8} = \phi_{8q} = \omega_{8q} = \omega_{n8} = \phi_{888} = \omega_{888} =$ 0, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-1077.91	1.03	29	42.56	Do not reject Ho
- Fourier-truncated without capital parameters	$\psi_1 = \psi_{r1} = \psi_{1S} = \rho_{i1} = \tau_{k1} = \phi_6 = \omega_6 = \phi_{n6} = \phi_{6q} = \omega_{6q} = \omega_{n6} = \phi_{666} = \omega_{666} =$ 0, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-1111.19	6.32	29	42.56	Do not reject Ho

Model Description	Restrictions	Log likelihood	LR test of 1-sided error	DF	Critical value for α =5%	Decision
- Fourier-truncated without risk parameters	$\psi_2=\psi_{r2}=\psi_{2S}=\rho_{i2}=\tau_{k2}=\phi_7=\omega_7=\phi_{n7}=\phi_{7q}=\omega_{7q}=\omega_{n7}=\phi_{777}=\omega_{777}$ =0, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-1084.14	19.04	29	42.56	Do not reject Ho
- Fourier-truncated without time and capital parameters	$\psi_1=\psi_3=\psi_{r1}=\psi_{r3}=\psi_{1S}=\psi_{3S}=\rho_{i1}=\rho_{i3}=\tau_{k1}=\tau_{k3}=\phi_6=\phi_8=\omega_6=\omega_8$ $=\phi_{n6}=\omega_{n8}=\phi_{n8}=\phi_{6q}=\phi_{8q}=\omega_{6q}=\omega_{8q}=\omega_{n6}=\omega_{n8}=\phi_{666}=\phi_{888}=\omega_{666}=$ ω_{888} =0, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-1113.04	9.89	55	73.11	Do not reject Ho
- Fourier-truncated without time and risk parameters	$\psi_2=\psi_3=\psi_{r2}=\psi_{r3}=\psi_{2S}=\psi_{2S}=\rho_{i2}=\rho_{i3}=\tau_{k2}=\tau_{k3}=\phi_7=\phi_8=\omega_7=$ $\omega_8=\phi_{n7}=\omega_{n8}=\phi_{n8}=\phi_{7q}=\phi_{8q}=\omega_{7q}=\omega_{8q}=\omega_{n7}=\omega_{n8}=\phi_{777}=\phi_{888}=$ $\omega_{777}=\omega_{888}$ =0, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-1111.31	13.47	55	73.11	Do not reject Ho
- Fourier-truncated without capital and risk parameters	$\psi_1=\psi_3=\psi_{r1}=\psi_{r2}=\psi_{1S}=\psi_{2S}=\rho_{i1}=\rho_{i2}=\tau_{k1}=\tau_{k2}=\phi_6=\phi_7=\omega_6=\omega_7$ $=\phi_{n6}=\omega_{n7}=\phi_{n7}=\phi_{6q}=\phi_{7q}=\omega_{6q}=\omega_{7q}=\omega_{n6}=\omega_{n7}=\phi_{666}=\phi_{777}=\omega_{666}=$ ω_{777} =0, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.	-1142.88	58.31	55	73.11	Do not reject Ho
- *Fourier-truncated without time, capital and risk parameters*	$\psi_r=\psi_{rS}=\rho_{ir}=\tau_{kr}=\phi_6=\phi_7=\phi_8=\omega_6=\omega_7=\omega_8=\phi_{n6}=\phi_{n7}=\phi_{n8}=$ $\phi_{6q}=\phi_{7q}=\phi_{8q}=\omega_{6q}=\omega_{7q}=\omega_{8q}=\omega_{n6}=\omega_{n7}=\omega_{n8}=\phi_{666}=\phi_{777}=\phi_{888}$ $=\omega_{666}=\omega_{777}=\omega_{888}$ *=0, r=S=k= 1, 2,3; i=1,2; n=q= 1, 2,...,8.*	*-1172.84*	*45.59*	*78*	*99.62*	*Do not reject Ho*
Step 3: Fourier-truncated versus translog						
- Translog-truncated without time, capital and risk parameters	$\psi_r=\psi_{rS}=\rho_{ir}=\tau_{kr}=\phi_n=\omega_n=\phi_{nq}=\omega_{nq}=\phi_{nnn}=\phi_{qqq}$ =0, n=q= 1, 2,...,8.	-124.06	143.82	104	128.80	Reject Ho

Source: Author's own estimation.

Table 6-23: Maximum Likelihood estimates of the preferred Standard Profit Function model: the Fourier truncated with capital, risk and time parameters

	The variable (all are logged)	coefficient	standard-error	t-ratio
α		-79383.60	1.00	-79506.77
γ1	lny1	0.72	0.98	0.74
γ2	lny2	0.26	0.97	0.26
γ3	lny3	0.25	0.79	0.32
β1	Lnp1/p3	-0.26	0.99	-0.27
β2	Lnp2/p3	3.50	0.97	3.61
ψ1	lnk	-206.91	0.99	-209.28
ψ2	lnS	0.13	0.96	0.13
ψ3	lnT	-41047.01	0.99	-41658.40
γ11	lny1lny1	0.00	0.30	0.00
γ12	lny1lny2	-0.12	0.45	-0.26
γ13	lny1lny3	0.04	0.38	0.11
η11	lny1lnp1/p3	0.05	0.61	0.08
η12	lny1lnp2/p3	-0.10	0.60	-0.17
τ11	lny1lnk	-0.07	0.69	-0.11
τ12	lny1lns	0.05	0.37	0.13
τ13	lny1lnT	0.09	0.70	0.13
γ22	lny2lny2	0.05	0.38	0.14
γ23	lny2lny3	-0.06	0.39	-0.14
η21	lny2lnp1/p3	0.05	0.55	0.08
η22	lny2lnp2/p3	-0.06	0.59	-0.10
τ21	lny2lnk	-0.01	0.71	-0.01
τ22	lny2lns	-0.05	0.38	-0.13
τ23	lny2lnT	0.10	0.72	0.15
γ33	lny3lny3	0.02	0.11	0.15
η31	lny3lnp1/p3	-0.03	0.50	-0.06
η32	lny3lnp2/p3	-0.01	0.51	-0.03
τ31	lny3lnk	0.01	0.63	0.02
τ32	lny3lns	0.01	0.25	0.03
τ33	lny3lnT	-0.06	0.61	-0.10
β11	lnp1/p3lnp1/p3	-0.10	0.60	-0.17
β12	lnp1/p3lnp2/p3	-0.05	0.75	-0.07
ρ11	lnp1/p2lnk	-0.01	0.77	-0.02
ρ12	lnp1/p2lns	-0.04	0.45	-0.09
ρ13	lnp1/p2lnT	0.01	0.64	0.02
β22	lnp2/p3lnp2/p3	-1.07	0.76	-1.42
ρ21	lnp2/p2lnk	-0.07	0.69	-0.10

	The variable (all are logged)	coefficient	standard-error	t-ratio
ρ22	lnp2/p2lns	0.05	0.60	0.08
ρ23	lnp2/p2lnT	-0.06	0.83	-0.07
ψ11	lnklnk	-44.76	0.69	-64.53
ψ12	lnklns	0.06	0.62	0.10
ψ13	lnklnT	-0.19	0.90	-0.21
ψ22	lnslns	0.00	0.53	-0.01
ψ23	lnSlnT	0.05	0.70	0.07
ψ33	lnTlnT	15804.95	0.91	17419.03
ϕ1	Cos(lny1)	0.02	0.67	0.03
ω1	Sin(lny1)	0.05	0.68	0.07
ϕ2	Cos(lny2)	-0.04	0.71	-0.06
ω2	Sin(lny2)	-0.02	0.69	-0.03
ϕ3	Cos(lny3)	0.06	0.66	0.09
ω3	Sin(lny3)	-0.03	0.59	-0.05
ϕ4	Cos(lnp1/p2)	-0.02	0.81	-0.03
ω4	Sin(lnp1/p2)	-0.49	0.81	-0.60
ϕ5	Cos(lnp2/p2)	-0.67	0.84	-0.80
ω5	Sin(lnp2/p2)	-0.94	0.85	-1.11
ϕ6	Cos(lnk)	35.26	0.92	38.34
ω6	Sin(lnk)	38.15	0.94	40.65
ϕ7	Cos(lnS)	-0.14	0.65	-0.21
ω7	Sin(lnS)	-0.08	0.80	-0.10
ϕ8	Cos(lnT)	4688.58	0.92	5074.55
ω8	Sin(lnT)	15748.63	0.92	17029.03
ϕ11	Cos(y1+y1)	0.01	0.40	0.02
ω11	Sin(y1+y1)	0.04	0.33	0.13
ϕ12	Cos(y1+y2)	-0.04	0.44	-0.10
ω12	Sin(y1+y2)	-0.02	0.50	-0.04
ϕ13	Cos(y1+y3)	-0.03	0.41	-0.08
ω13	Sin(y1+y3)	0.02	0.41	0.04
ϕ14	Cos(y1+p1/p3)	-0.06	0.54	-0.12
ω14	Sin(y1+p1/p3)	-0.10	0.53	-0.19
ϕ15	Cos(y1+p2/p3)	-0.03	0.47	-0.07
ω15	Sin(y1+p2/p3)	0.03	0.52	0.05
ϕ16	Cos(y1+k)	-0.03	0.54	-0.05
ω16	Sin(y1+k)	0.15	0.64	0.23
ϕ17	Cos(y1+S)	0.02	0.43	0.04
ω17	Sin(y1+S)	0.10	0.39	0.26
ϕ18	Cos(y1+T)	0.05	0.44	0.12

	The variable (all are logged)	coefficient	standard-error	t-ratio
ω18	Sin(y1+T)	0.04	0.56	0.07
φ22	Cos(y2+y2)	0.01	0.40	0.02
ω22	Sin(y2+y2)	-0.02	0.43	-0.04
φ23	Cos(y2+y3)	0.02	0.42	0.06
ω23	Sin(y2+y3)	-0.01	0.41	-0.04
φ24	Cos(y2+p1/p3)	0.00	0.60	0.00
ω24	Sin(y2+p1/p3)	0.06	0.56	0.11
φ25	Cos(y2+p2/p3)	0.00	0.56	0.01
ω25	Sin(y2+p2/p3)	-0.04	0.54	-0.07
φ26	Cos(y2+k)	0.06	0.59	0.10
ω26	Sin(y2+k)	-0.04	0.64	-0.06
φ27	Cos(y2+S)	-0.02	0.47	-0.04
ω27	Sin(y2+S)	-0.03	0.48	-0.07
φ28	Cos(y2+T)	-0.02	0.49	-0.03
ω28	Sin(y2+T)	0.03	0.62	0.04
φ33	Cos(y3+y3)	-0.02	0.35	-0.05
ω33	Sin(y3+y3)	0.00	0.23	0.00
φ34	Cos(y3+p1/p3)	0.01	0.52	0.02
ω34	Sin(y3+p1/p3)	-0.03	0.51	-0.06
φ35	Cos(y3+p2/p3)	-0.02	0.47	-0.04
ω35	Sin(y3+p2/p3)	-0.05	0.53	-0.10
φ36	Cos(y3+k)	0.01	0.57	0.02
ω36	Sin(y3+k)	-0.02	0.54	-0.04
φ37	Cos(y3+S)	-0.03	0.40	-0.08
ω37	Sin(y3+S)	-0.03	0.32	-0.10
φ38	Cos(y3+T)	-0.01	0.52	-0.01
ω38	Sin(y3+T)	-0.01	0.54	-0.02
φ44	Cos(p1/p3+p1/p3)	-0.07	0.66	-0.10
ω44	Sin(p1/p3+p1/p3)	-0.03	0.72	-0.05
φ45	Cos(p1/p3+p2/p3)	-0.03	0.60	-0.05
ω45	Sin(p1/p3+p2/p3)	0.03	0.58	0.05
φ46	Cos(p1/p3+k)	0.10	0.65	0.15
ω46	Sin(p1/p3+k)	0.06	0.73	0.08
φ47	Cos(p1/p3+S)	-0.05	0.51	-0.09
ω47	Sin(p1/p3+S)	0.00	0.43	0.00
φ48	Cos(p1/p3+T)	-0.04	0.53	-0.08
ω48	Sin(p1/p3+T)	0.00	0.69	0.00
φ55	Cos(p2/p3+p2/p3)	-0.10	0.58	-0.17
ω55	Sin(p2/p3+p2/p3)	0.23	0.45	0.51

	The variable (all are logged)	coefficient	standard-error	t-ratio
$\phi56$	Cos(p2/p3+k)	0.05	0.59	0.09
$\omega56$	Sin(p2/p3+k)	0.13	0.55	0.24
$\phi57$	Cos(p2/p3+S)	0.00	0.56	0.00
$\omega57$	Sin(p2/p3+S)	-0.04	0.57	-0.06
$\phi58$	Cos(p2/p3+T)	0.09	0.55	0.16
$\omega58$	Sin(p2/p3+T)	-0.02	0.64	-0.03
$\phi66$	Cos(k+k)	-1.05	0.72	-1.45
$\omega66$	Sin(k+k)	8.06	0.80	10.10
$\phi67$	Cos(k+S)	0.06	0.53	0.12
$\omega67$	Sin(k+S)	-0.02	0.45	-0.05
$\phi68$	Cos(k+T)	-0.07	0.76	-0.10
$\omega68$	Sin(k+T)	0.11	0.67	0.17
$\phi77$	Cos(S+S)	-0.04	0.46	-0.09
$\omega77$	Sin(S+S)	-0.06	0.61	-0.10
$\phi78$	Cos(S+T)	-0.01	0.41	-0.04
$\omega78$	Sin(S+T)	-0.02	0.53	-0.03
$\phi88$	Cos(T+T)	1554.48	0.78	1983.37
$\omega88$	Sin(T+T)	-913.30	0.80	-1144.71
$\phi111$	Cos(y1+y1+y1)	0.03	0.16	0.17
$\omega111$	Sin(y1+y1+y1)	0.01	0.19	0.03
$\phi222$	Cos(y2+y2+y2)	-0.01	0.22	-0.06
$\omega222$	Sin(y2+y2+y2)	0.02	0.20	0.10
$\phi333$	Cos(y3+y3+y3)	0.00	0.17	0.02
$\omega333$	Sin(y3+y3+y3)	-0.02	0.13	-0.17
$\phi444$	Cos(p1/p3+p1/p3+p1/p3)	0.04	0.45	0.08
$\omega444$	Sin(p1/p3+p1/p3+p1/p3)	0.05	0.43	0.11
$\phi555$	Cos(p2/p3+p2/p3+p2/p3)	0.07	0.23	0.32
$\omega555$	Sin(p2/p3+p2/p3+p2/p3)	-0.01	0.29	-0.03
$\phi666$	Cos(k+k+k)	-1.02	0.53	-1.93
$\omega666$	Sin(k+k+k)	0.59	0.40	1.46
$\phi777$	Cos(S+S+S)	0.01	0.37	0.04
$\omega777$	Sin(S+S+S)	-0.05	0.29	-0.18
$\phi888$	Cos(T+T+T)	-109.24	0.60	-182.66
$\omega888$	Sin(T+T+T)	-111.71	0.44	-256.71
$\delta0$		-0.47	0.79	-0.59
$\delta1$	L	0.30	0.99	0.31
$\delta2$	TA	0.00	0.00	-0.24
$\delta3$	B	-0.20	0.97	-0.20
$\delta4$	J	0.48	0.97	0.50

	The variable (all are logged)	coefficient	standard-error	t-ratio
δ5	E	-0.62	0.86	-0.71
δ6	Com	-0.08	0.91	-0.09
δ7	Inv.	0.98	0.97	1.02
δ8	Isl.	-0.22	0.99	-0.22
δ9	3-FCR	-0.44	0.92	-0.48
δ10	MS	-0.68	1.00	-0.67
sigma-squared (S)		1.53	0.48	3.21
gamma		0.99	0.05	20.05
Sigma-squared		1.52		
Sigma-squared (v)		0.02		
Lambda		9.93		
The relative contribution of the inefficiency effect to the total variance term		0.97		
Log likelihood function		-797.05		
LR test of the one-sided error		576.05		
[note that this statistic has a mixed chi-squared distribution]				

Source: Author's own estimation

Table 6-24: Maximum Likelihood estimates of the Alternative Profit Function model: the Fourier truncated with capital, risk and time parameters

	The variable (all are logged)	coefficient	standard-error	t-ratio
α		-121836.72	1.00	-122016.40
γ1	lny1	0.81	0.97	0.84
γ2	lny2	1.30	0.96	1.35
γ3	lny3	0.13	0.73	0.17
β1	Lnw1/w3	38.55	0.99	39.03
β2	Lnw2/w3	-73.80	0.98	-74.92
ψ1	lnk	-256.84	0.99	-260.01
ψ2	lnS	-0.15	0.93	-0.16
ψ3	lnT	-62698.63	0.98	-63780.28
γ11	lny1lny1	-0.05	0.25	-0.21
γ12	lny1lny2	-0.23	0.43	-0.54
γ13	lny1lny3	0.08	0.31	0.27
η11	lny1lnw1/w3	-0.18	0.59	-0.31
η12	lny1lnw2/w3	0.33	0.69	0.48
τ11	lny1lnk	-0.50	0.66	-0.75
τ12	lny1lns	0.08	0.23	0.37
τ13	lny1lnT	0.19	0.59	0.32
γ22	lny2lny2	0.09	0.34	0.27
γ23	lny2lny3	-0.07	0.35	-0.20
η21	lny2lnw1/w3	0.13	0.59	0.22
η22	lny2lnw2/w3	-0.53	0.67	-0.80
τ21	lny2lnk	0.08	0.66	0.12
τ22	lny2lns	-0.01	0.30	-0.03
τ23	lny2lnT	0.03	0.64	0.04
γ33	lny3lny3	0.02	0.12	0.13
η31	lny3lnw1/w3	-0.14	0.58	-0.24
η32	lny3lnw2/w3	0.06	0.61	0.10
τ31	lny3lnk	0.03	0.59	0.05
τ32	lny3lns	-0.02	0.21	-0.08
τ33	lny3lnT	-0.06	0.41	-0.14
β11	lnw1/w3lnw1/w3	-11.06	0.66	-16.83
β12	lnw1/w3lnw2/w3	1.39	0.80	1.75
ρ11	lnw1/w2lnk	-0.24	0.82	-0.29
ρ12	lnw1/w2lns	0.11	0.57	0.20
ρ13	lnw1/w2lnT	-0.10	0.85	-0.12
β22	lnw2/w3lnw2/w3	50.95	0.88	57.65
ρ21	lnw2/w2lnk	-0.70	0.86	-0.82

	The variable (all are logged)	coefficient	standard-error	t-ratio
ρ22	lnw2/w2lns	-0.07	0.68	-0.11
ρ23	lnw2/w2lnT	-1.08	0.88	-1.23
ψ11	lnklnk	-56.42	0.74	-76.35
ψ12	lnklns	0.03	0.53	0.06
ψ13	lnklnT	-0.10	0.85	-0.11
ψ22	lnslns	-0.02	0.35	-0.06
ψ23	lnSlnT	0.01	0.51	0.03
ψ33	lnTlnT	24161.34	0.90	26830.91
ϕ1	Cos(lny1)	-0.10	0.74	-0.14
ω1	Sin(lny1)	0.00	0.74	0.00
ϕ2	Cos(lny2)	0.20	0.70	0.28
ω2	Sin(lny2)	0.00	0.67	-0.01
ϕ3	Cos(lny3)	0.03	0.64	0.04
ω3	Sin(lny3)	0.03	0.66	0.05
ϕ4	Cos(lnw1/w2)	2.94	0.89	3.31
ω4	Sin(lnw1/w2)	-13.50	0.85	-15.88
ϕ5	Cos(lnw2/w2)	46.85	0.90	52.32
ω5	Sin(lnw2/w2)	39.38	0.92	42.93
ϕ6	Cos(lnk)	43.38	0.88	49.12
ω6	Sin(lnk)	48.32	0.95	51.10
ϕ7	Cos(lnS)	-0.28	0.67	-0.42
ω7	Sin(lnS)	0.04	0.74	0.06
ϕ8	Cos(lnT)	7205.73	0.92	7808.18
ω8	Sin(lnT)	24096.48	0.91	26419.79
ϕ11	Cos(y1+y1)	0.02	0.24	0.07
ω11	Sin(y1+y1)	0.08	0.26	0.30
ϕ12	Cos(y1+y2)	-0.03	0.40	-0.07
ω12	Sin(y1+y2)	-0.05	0.39	-0.13
ϕ13	Cos(y1+y3)	-0.08	0.41	-0.20
ω13	Sin(y1+y3)	0.00	0.33	-0.01
ϕ14	Cos(y1+w1/w3)	-0.25	0.58	-0.44
ω14	Sin(y1+w1/w3)	0.08	0.55	0.14
ϕ15	Cos(y1+w2/w3)	0.15	0.67	0.23
ω15	Sin(y1+w2/w3)	-0.15	0.66	-0.23
ϕ16	Cos(y1+k)	0.15	0.58	0.27
ω16	Sin(y1+k)	0.14	0.62	0.22
ϕ17	Cos(y1+S)	0.00	0.34	-0.01
ω17	Sin(y1+S)	0.07	0.26	0.28
ϕ18	Cos(y1+T)	0.06	0.42	0.14

	The variable (all are logged)	coefficient	standard-error	t-ratio
ω18	Sin(y1+T)	0.07	0.48	0.13
φ22	Cos(y2+y2)	-0.02	0.38	-0.06
ω22	Sin(y2+y2)	0.06	0.44	0.14
φ23	Cos(y2+y3)	0.06	0.33	0.18
ω23	Sin(y2+y3)	-0.04	0.44	-0.08
φ24	Cos(y2+w1/w3)	0.09	0.60	0.15
ω24	Sin(y2+w1/w3)	-0.08	0.46	-0.17
φ25	Cos(y2+w2/w3)	-0.21	0.68	-0.31
ω25	Sin(y2+w2/w3)	-0.10	0.61	-0.16
φ26	Cos(y2+k)	0.05	0.53	0.09
ω26	Sin(y2+k)	0.01	0.47	0.02
φ27	Cos(y2+S)	-0.05	0.33	-0.16
ω27	Sin(y2+S)	0.00	0.36	-0.01
φ28	Cos(y2+T)	-0.06	0.41	-0.15
ω28	Sin(y2+T)	0.05	0.45	0.11
φ33	Cos(y3+y3)	-0.02	0.25	-0.09
ω33	Sin(y3+y3)	0.00	0.23	-0.01
φ34	Cos(y3+w1/w3)	-0.06	0.44	-0.13
ω34	Sin(y3+w1/w3)	0.00	0.51	0.01
φ35	Cos(y3+w2/w3)	0.05	0.54	0.09
ω35	Sin(y3+w2/w3)	-0.06	0.54	-0.11
φ36	Cos(y3+k)	0.06	0.30	0.19
ω36	Sin(y3+k)	-0.01	0.52	-0.01
φ37	Cos(y3+S)	-0.06	0.29	-0.21
ω37	Sin(y3+S)	-0.06	0.19	-0.34
φ38	Cos(y3+T)	0.03	0.27	0.11
ω38	Sin(y3+T)	-0.05	0.43	-0.12
φ44	Cos(w1/w3+w1/w3)	-2.18	0.67	-3.27
ω44	Sin(w1/w3+w1/w3)	-1.08	0.68	-1.58
φ45	Cos(w1/w3+w2/w3)	-0.81	0.72	-1.13
ω45	Sin(w1/w3+w2/w3)	0.15	0.76	0.20
φ46	Cos(w1/w3+k)	0.01	0.67	0.01
ω46	Sin(w1/w3+k)	-0.05	0.66	-0.08
φ47	Cos(w1/w3+S)	-0.18	0.49	-0.37
ω47	Sin(w1/w3+S)	-0.02	0.57	-0.04
φ48	Cos(w1/w3+T)	0.04	0.64	0.07
ω48	Sin(w1/w3+T)	-0.11	0.61	-0.18
φ55	Cos(w2/w3+w2/w3)	-2.29	0.79	-2.92
ω55	Sin(w2/w3+w2/w3)	-10.40	0.77	-13.54

	The variable (all are logged)	coefficient	standard-error	t-ratio
ϕ56	Cos(w2/w3+k)	-0.13	0.73	-0.17
ω56	Sin(w2/w3+k)	0.17	0.75	0.23
ϕ57	Cos(w2/w3+S)	0.12	0.46	0.27
ω57	Sin(w2/w3+S)	-0.06	0.64	-0.09
ϕ58	Cos(w2/w3+T)	0.08	0.79	0.11
ω58	Sin(w2/w3+T)	-0.32	0.58	-0.55
ϕ66	Cos(k+k)	-1.64	0.69	-2.38
ω66	Sin(k+k)	9.93	0.77	12.81
ϕ67	Cos(k+S)	0.03	0.53	0.06
ω67	Sin(k+S)	-0.08	0.47	-0.17
ϕ68	Cos(k+T)	-0.05	0.68	-0.08
ω68	Sin(k+T)	0.08	0.57	0.15
ϕ77	Cos(S+S)	-0.13	0.40	-0.33
ω77	Sin(S+S)	0.00	0.43	-0.01
ϕ78	Cos(S+T)	0.00	0.33	0.01
ω78	Sin(S+T)	0.00	0.38	-0.01
ϕ88	Cos(T+T)	2384.44	0.81	2960.94
ω88	Sin(T+T)	-1410.35	0.81	-1746.00
ϕ111	Cos(y1+y1+y1)	0.03	0.16	0.18
ω111	Sin(y1+y1+y1)	0.00	0.10	0.02
ϕ222	Cos(y2+y2+y2)	-0.02	0.15	-0.10
ω222	Sin(y2+y2+y2)	0.01	0.18	0.07
ϕ333	Cos(y3+y3+y3)	0.00	0.12	0.00
ω333	Sin(y3+y3+y3)	-0.03	0.15	-0.23
ϕ444	Cos(w1/w3+w1/w3+w1/w3)	-0.41	0.37	-1.11
ω444	Sin(w1/w3+w1/w3+w1/w3)	0.28	0.45	0.62
ϕ555	Cos(w2/w3+w2/w3+w2/w3)	-0.65	0.54	-1.19
ω555	Sin(w2/w3+w2/w3+w2/w3)	1.64	0.44	3.69
ϕ666	Cos(k+k+k)	-1.29	0.45	-2.85
ω666	Sin(k+k+k)	0.64	0.40	1.63
ϕ777	Cos(S+S+S)	0.00	0.27	0.01
ω777	Sin(S+S+S)	-0.08	0.23	-0.35
ϕ888	Cos(T+T+T)	-170.22	0.56	-304.33
ω888	Sin(T+T+T)	-172.00	0.40	-428.84
δ0		0.28	0.79	0.35
δ1	L	0.40	0.99	0.40
δ2	TA	0.00	0.00	-0.84
δ3	B	-1.16	0.98	-1.19
δ4	J	0.03	0.98	0.03

	The variable (all are logged)	coefficient	standard-error	t-ratio
δ5	E	-1.42	0.88	-1.61
δ6	Com	0.10	0.91	0.11
δ7	Inv.	0.95	0.98	0.97
δ8	Isl.	-0.24	1.00	-0.24
δ9	3-FCR	-0.53	0.92	-0.58
δ10	MS	-1.50	1.00	-1.49
sigma-squared (S)		1.72	0.42	4.10
gamma		0.99	0.03	35.16
Sigma-squared		1.71		
Sigma-squared (v)		0.01		
Lambda		13.00		
The relative contribution of the inefficiency effect to the total variance term		0.98		
Log likelihood function		-792.45		
LR test of the one-sided error		671.70		
[note that this statistic has a mixed chi-squared distribution]				

Source: Author's own estimation

Table 6-25: Cost Efficiency levels for Jordan, Egypt, Saudi Arabia and Bahrain Banks over 1992-2000 – Individual Bank Estimates

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
Al Baraka IS BSC	100	100	100	100	100	100	100	100	100	100
Al-Ahli United Bank (Bahrain) B.S.C.	99	100	100	100	100	100	100	100	100	100
Alubaf Arab International Bank	100	99	99	100	99	99	99	99	99	99
Arab Banking Corporation BSC	100	100	100	99	99	99	99	99	99	99
Arab Financial Services Company - AFS	100	99	100	100	100	99	99	99	99	99
Bahrain Development Bank B.S.C.	100	100	100	100	100	100	100	100	100	100
Bahrain International Bank E.C.	99	99	99	99	99	99	99	99	99	99
Bahrain IS B.S.C.	-	100	100	100	100	100	100	100	100	100
Bahraini Saudi Bank (The) BSC	100	100	100	100	100	100	100	100	100	100
Bank of Bahrain and Kuwait B.S.C.	100	99	100	100	100	100	100	99	99	100
BMB Investment Bank - BMEB	99	99	99	99	99	99	99	99	99	99
Commercial Bank of Bahrain B.S.C.	100	100	100	100	100	99	99	99	99	100
Gulf International Bank BSC	100	100	100	99	99	99	99	99	99	99
Investcorp Bank EC	99	99	99	99	99	99	99	99	99	99
National Bank of Bahrain	100	100	100	100	100	100	100	100	99	100
Shamil Bank of Bahrain EC	-	100	100	100	100	100	100	100	100	100
TAIB Bank E.C.	99	99	99	99	99	99	99	99	99	99
United Gulf Bank (BSC) EC	99	99	99	99	99	99	99	99	99	99
Al Watany Bank of Egypt	94	94	94	94	94	94	94	94	94	94
Alexandria Commercial and Maritime Bank SAE	94	94	94	94	94	94	94	94	94	94
Arab African International Bank	93	93	94	94	94	94	94	94	94	94
Arab Banking Corporation - Egypt	-	-	91	91	91	91	91	91	91	91
Arab International Bank	-	94	93	94	94	94	93	93	93	93
Arab Investment Bank - FABFDI	91	91	91	91	91	90	90	90	90	91
Bank of Alexandria	94	93	93	93	93	92	92	92	92	93
Bank of Commerce & Development	94	94	94	94	94	94	94	94	94	94
Banque du Caire	95	93	93	92	92	92	91	91	91	92
Banque du Caire et de Paris SAE	94	95	95	94	94	94	94	94	94	94
Banque Misr	92	92	91	91	90	89	89	89	88	90
Cairo Barclays Bank SAE	96	94	93	94	94	94	94	94	94	94
Cairo Far East Bank	94	94	94	94	93	94	94	94	94	94
Commercial International Bank (Egypt) S.A.E.	94	94	94	94	93	91	91	91	90	92
Credit Agricole Indosuez Egypte	94	94	94	94	94	94	94	94	94	94
Delta International Bank	94	94	94	94	94	94	94	94	94	94
Egyptian American Bank	94	94	94	94	94	94	94	94	94	94
Egyptian Arab Land Bank	95	95	95	95	94	94	94	94	94	94
Egyptian Gulf Bank	94	94	94	94	94	94	94	94	94	94
Egyptian Saudi Finance Bank	98	98	98	98	98	98	98	98	98	98
Export Development Bank of Egypt	95	95	95	95	95	95	95	94	94	95
Faisal IS of Egypt	97	97	97	97	98	98	98	97	97	97
Housing and Development Bank	95	95	94	94	94	94	94	94	95	94

Firm\Year	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**00**	**Avg.**
HSBC Bank Egypt S A E	94	94	94	94	94	94	94	94	94	94
Misr America International Bank	94	95	94	94	90	90	90	90	91	92
Misr Exterior Bank	94	94	94	94	94	94	94	94	94	94
MISR International Bank	94	94	94	94	94	93	93	93	93	94
MISR Iran Development Bank	95	95	95	95	95	94	95	95	95	95
Misr Romanian Bank	94	95	94	94	94	94	94	94	94	94
Mohandes Bank	94	94	94	94	94	94	94	94	94	94
National Bank for Development	94	94	94	94	94	94	94	94	93	94
National Bank of Egypt	91	91	91	90	90	89	88	87	86	89
National Societe Generale Bank SAE	91	91	91	91	90	90	90	90	90	90
Nile Bank (The)	94	94	94	94	94	94	94	94	94	94
Port Said National Bank for Development	-	94	94	94	94	95	94	94	94	94
Société Arabe Internationale de Banque	94	94	94	94	94	94	94	94	94	94
Suez Canal Bank	94	94	94	94	94	92	92	92	92	93
Arab Bank PLC	96	96	91	90	90	90	89	88	87	91
Arab Banking Corporation (Jordan)	87	88	88	88	88	88	87	87	87	88
Arab Jordan Investment Bank	87	87	87	87	87	87	86	87	87	87
Bank of Jordan Plc	88	88	88	88	87	87	87	88	87	88
Cairo Amman Bank	89	90	90	90	90	89	87	89	87	89
Housing Bank for Trade & Finance (The)	93	90	91	91	91	89	89	87	87	90
Industrial Development Bank	94	90	91	91	92	93	93	93	91	92
Jordan Gulf Bank	-	88	89	90	90	89	89	89	89	89
Jordan Investment & Finance Bank	81	82	83	83	84	83	84	84	84	83
Jordan IS for Finance and Investment	95	95	96	96	96	96	96	96	96	96
Jordan Kuwait Bank	93	93	88	88	88	89	90	89	90	90
Jordan National Bank Plc	93	89	88	89	89	89	90	89	88	89
Philadelphia Investment Bank	85	84	85	85	86	85	85	85	85	85
Union Bank for Savings & Investment	86	86	87	87	87	87	87	87	86	87
Al Bank Al Saudi Al Fransi	97	98	98	97	97	97	97	98	97	97
Al-Rajhi Banking & Investment Corporation	98	98	98	98	98	98	94	94	92	96
Arab Investment Company SAA (The)	99	99	98	98	99	99	99	99	98	99
Arab National Bank	97	97	97	96	96	97	97	97	97	97
Arab Petroleum Invest. Corp.	99	99	99	99	99	99	99	99	99	99
Bank Al-Jazira	97	98	98	98	98	98	97	98	98	98
National Commercial Bank (The)	95	95	95	94	94	93	93	92	91	94
Riyad Bank	95	95	95	94	94	95	95	95	95	95
Saudi American Bank	97	97	97	97	97	97	97	95	93	97
Saudi British Bank (The)	98	98	98	98	98	98	97	97	97	98
Saudi Hollandi Bank	98	98	98	98	98	98	98	98	98	98
Saudi Investment Bank (The)	97	96	96	96	96	97	96	97	97	96
United Saudi Bank	98	98	98	98	98	98	98	98	98	98
Avg.	**95**	**95**	**95**	**95**	**95**	**94**	**94**	**94**	**94**	**95**

Source: Author's own estimation

Table 6-26: Standard Profit Efficiency levels for Jordan, Egypt, Saudi Arabia and Bahrain Banks over 1992-2000 – Individual Bank Estimates

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
Al Baraka IS BSC	72	58	82	91	88	90	89	30	70	74
Al-Ahli United Bank (Bahrain) B.S.C.	79	88	74	91	67	62	58	65	54	71
Alubaf Arab International Bank	66	89	56	41	56	54	91	81	84	69
Arab Banking Corporation BSC	57	70	39	86	83	82	30	52	48	61
Arab Financial Services Company - AFS	80	66	87	91	57	91	80	84	42	75
Bahrain Development Bank B.S.C.	64	49	59	79	82	73	86	74	80	72
Bahrain International Bank E.C.	52	88	50	61	30	58	57	37	4	49
Bahrain IS B.S.C.	-	80	83	73	71	82	89	86	85	82
Bahraini Saudi Bank (The) BSC	85	84	80	64	62	80	85	90	49	75
Bank of Bahrain and Kuwait B.S.C.	81	94	83	79	79	97	61	78	65	80
BMB Investment Bank - BMEB	0	88	71	73	79	87	79	93	0	63
Commercial Bank of Bahrain B.S.C.	86	81	78	67	85	74	81	93	87	82
Gulf International Bank BSC	90	94	80	75	71	55	47	35	45	66
Investcorp Bank EC	66	66	54	35	37	45	80	60	25	52
National Bank of Bahrain	90	95	77	63	74	64	66	84	79	77
Shamil Bank of Bahrain EC	-	76	75	72	65	93	0	31	57	61
TAIB Bank E.C.	73	43	39	49	51	23	37	62	88	52
United Gulf Bank (BSC) EC	36	85	31	83	51	91	87	92	60	68
Al Watany Bank of Egypt	41	93	92	89	82	49	72	94	80	77
Alexandria Commercial and Maritime Bank SAE	46	48	47	91	96	90	88	92	23	69
Arab African International Bank	19	32	87	81	28	55	55	94	70	58
Arab Banking Corporation - Egypt	-	-	90	74	69	84	82	70	82	79
Arab International Bank	-	67	70	50	79	79	82	72	81	74
Arab Investment Bank - FABFDI	64	29	38	33	28	29	38	46	36	38
Bank of Alexandria	56	34	56	60	33	45	48	44	63	49
Bank of Commerce & Development	42	62	33	34	32	25	25	16	22	32
Banque du Caire	91	45	47	72	52	63	80	91	59	67
Banque du Caire et de Paris SAE	94	84	71	61	29	52	32	48	36	56
Banque Misr	54	65	67	81	80	85	68	89	95	76
Cairo Barclays Bank SAE	87	75	71	83	73	67	42	86	70	73
Cairo Far East Bank	78	92	84	56	49	57	56	77	58	67
Commercial International Bank (Egypt) S.A.E.	89	62	85	92	64	52	61	75	72	73
Credit Agricole Indosuez Egypte	63	92	94	87	78	79	65	54	39	73
Delta International Bank	0	38	71	30	23	88	95	95	92	59
Egyptian American Bank	90	85	86	91	84	79	63	78	55	79
Egyptian Arab Land Bank	38	27	27	43	43	57	92	93	69	54
Egyptian Gulf Bank	50	34	54	60	66	62	41	42	43	50
Egyptian Saudi Finance Bank	93	86	74	93	72	90	66	91	89	84
Export Development Bank of Egypt	66	77	78	72	78	40	70	80	58	69
Faisal IS of Egypt	75	60	68	56	70	60	85	94	95	74
Housing and Development Bank	50	53	58	72	88	76	85	82	57	69

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
HSBC Bank Egypt S A E	76	65	79	59	71	68	51	60	66	66
Misr America International Bank	69	74	96	93	85	91	89	89	43	81
Misr Exterior Bank	89	88	70	87	83	82	81	0	16	66
MISR International Bank	91	67	42	81	93	94	92	97	88	83
MISR Iran Development Bank	59	29	63	43	53	75	75	86	66	61
Misr Romanian Bank	52	85	34	72	82	78	69	82	55	68
Mohandes Bank	22	44	29	97	97	18	22	31	30	43
National Bank for Development	84	88	92	95	59	59	64	92	81	79
National Bank of Egypt	95	70	53	69	71	52	56	84	61	68
National Societe Generale Bank SAE	88	89	90	77	77	89	73	93	77	83
Nile Bank (The)	64	58	36	45	53	30	36	54	88	51
Port Said National Bank for Development	-	92	90	85	83	67	86	92	84	83
Société Arabe Internationale de Banque	75	62	74	50	50	45	50	68	55	59
Suez Canal Bank	50	23	54	70	73	57	62	73	58	58
Arab Bank PLC	68	61	77	64	71	68	68	80	55	68
Arab Banking Corporation (Jordan)	85	76	91	86	65	55	77	80	67	76
Arab Jordan Investment Bank	94	63	31	28	34	24	21	39	30	41
Bank of Jordan Plc	90	68	28	59	93	61	50	55	95	66
Cairo Amman Bank	89	62	57	71	94	89	78	81	54	75
Housing Bank for Trade & Finance (The)	83	33	26	47	40	39	48	78	41	48
Industrial Development Bank	91	46	49	32	87	86	90	88	0	63
Jordan Gulf Bank	-	0	93	91	77	94	1	23	73	60
Jordan Investment & Finance Bank	61	75	76	73	61	41	33	45	38	56
Jordan IS for Finance and Investment	96	80	84	87	85	63	72	73	59	78
Jordan Kuwait Bank	87	64	91	77	76	57	94	95	83	81
Jordan National Bank Plc	95	82	74	82	65	67	46	0	24	59
Philadelphia Investment Bank	92	78	35	42	20	44	58	51	43	51
Union Bank for Savings & Investment	51	44	34	16	11	0	48	42	33	31
Al Bank Al Saudi Al Fransi	31	53	65	64	58	61	56	70	52	57
Al-Rajhi Banking & Investment Corporation	83	90	74	83	78	57	75	88	88	79
Arab Investment Company SAA (The)	43	90	40	42	48	82	72	61	68	61
Arab National Bank	73	79	82	76	88	58	37	53	43	65
Arab Petroleum Invest. Corp.	86	83	54	73	38	78	19	59	51	60
Bank Al-Jazira	79	0	0	47	58	57	63	92	67	52
National Commercial Bank (The)	72	87	68	69	85	79	48	0	93	67
Riyad Bank	56	78	46	59	67	64	59	78	56	63
Saudi American Bank	85	80	94	86	73	65	74	39	66	73
Saudi British Bank (The)	49	48	93	73	67	56	73	77	57	66
Saudi Hollandi Bank	72	69	72	76	67	61	52	61	51	65
Saudi Investment Bank (The)	85	75	79	72	76	46	53	51	39	64
United Saudi Bank	53	48	88	80	88	87	86	94	84	79
Avg.	**70**	**67**	**65**	**68**	**66**	**65**	**63**	**68**	**59**	**66**

Source: Author's own estimation

Table 6-27: Alternative Profit Efficiency levels for Jordan, Egypt, Saudi Arabia and Bahrain Banks over 1992-2000 – Individual Bank Estimates

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
Al Baraka IS BSC	66	54	88	93	92	88	86	25	86	76
Al-Ahli United Bank (Bahrain) B.S.C.	41	94	72	94	79	40	45	56	36	62
Alubaf Arab International Bank	34	32	48	31	60	60	69	76	83	55
Arab Banking Corporation BSC	90	90	46	93	94	90	46	75	51	75
Arab Financial Services Company - AFS	75	88	71	65	26	85	53	14	16	55
Bahrain Development Bank B.S.C.	88	76	52	83	44	38	68	87	79	68
Bahrain International Bank E.C.	40	94	49	58	38	59	21	14	3	42
Bahrain IS B.S.C.	-	44	33	49	52	49	45	53	89	51
Bahraini Saudi Bank (The) BSC	71	68	66	56	58	75	69	83	44	65
Bank of Bahrain and Kuwait B.S.C.	91	88	69	50	62	97	44	60	59	69
BMB Investment Bank - BMEB	0	76	65	88	49	55	69	96	0	55
Commercial Bank of Bahrain B.S.C.	39	57	55	73	71	82	78	93	83	70
Gulf International Bank BSC	90	88	89	88	90	74	63	28	46	73
Investcorp Bank EC	31	35	53	46	26	38	31	62	81	45
National Bank of Bahrain	73	94	56	45	45	36	47	55	81	59
Shamil Bank of Bahrain EC	-	88	79	65	71	93	0	46	90	68
TAIB Bank E.C.	53	40	47	33	21	14	27	87	71	44
United Gulf Bank (BSC) EC	41	88	38	84	73	85	61	85	47	67
Al Watany Bank of Egypt	86	84	92	73	83	51	60	92	62	76
Alexandria Commercial and Maritime Bank SAE	25	50	46	83	97	96	82	86	19	65
Arab African International Bank	23	27	49	46	18	34	29	89	45	40
Arab Banking Corporation - Egypt	-	-	86	60	72	69	52	47	63	69
Arab International Bank	-	70	79	51	45	42	48	68	88	64
Arab Investment Bank - FABFDI	48	20	31	24	33	29	25	32	26	30
Bank of Alexandria	75	30	81	68	28	63	58	63	37	56
Bank of Commerce & Development	84	26	20	27	38	29	28	48	27	36
Banque du Caire	55	43	61	79	58	64	84	91	58	66
Banque du Caire et de Paris SAE	85	88	70	85	24	44	23	27	20	52
Banque Misr	83	92	86	86	89	70	64	90	93	84
Cairo Barclays Bank SAE	92	67	66	81	92	85	43	91	63	75
Cairo Far East Bank	44	44	46	49	24	49	39	39	34	41
Commercial International Bank (Egypt) S.A.E.	95	53	88	66	48	43	40	57	66	62
Credit Agricole Indosuez Egypte	62	82	95	69	69	73	56	50	30	65
Delta International Bank	0	36	61	20	19	90	89	97	91	56
Egyptian American Bank	94	84	94	89	83	79	59	87	47	80
Egyptian Arab Land Bank	45	36	32	26	53	75	88	93	52	56
Egyptian Gulf Bank	47	50	81	50	56	56	37	30	33	49
Egyptian Saudi Finance Bank	95	28	37	89	37	86	82	68	76	66
Export Development Bank of Egypt	92	85	62	44	52	31	52	62	59	60
Faisal IS of Egypt	81	51	44	38	26	34	56	95	89	57
Housing and Development Bank	65	63	63	76	88	63	91	88	65	74

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
HSBC Bank Egypt S A E	48	83	51	70	91	81	49	55	50	64
Misr America International Bank	85	68	93	68	68	85	78	92	40	75
Misr Exterior Bank	74	68	68	74	55	83	75	0	10	56
MISR International Bank	82	48	53	57	90	87	78	97	73	74
MISR Iran Development Bank	62	32	35	41	51	77	80	78	55	57
Misr Romanian Bank	27	77	30	46	63	56	49	56	45	50
Mohandes Bank	23	78	30	95	97	16	18	28	33	47
National Bank for Development	77	80	91	94	42	45	51	81	71	70
National Bank of Egypt	91	88	36	86	80	51	50	91	82	73
National Societe Generale Bank SAE	89	92	88	75	72	90	70	95	65	82
Nile Bank (The)	85	61	27	27	37	24	22	32	88	45
Port Said National Bank for Development	-	26	14	82	94	83	94	86	81	66
Société Arabe Internationale de Banque	35	42	51	28	44	30	32	49	42	39
Suez Canal Bank	41	19	87	87	73	55	60	69	53	60
Arab Bank PLC	32	52	71	92	91	82	78	84	85	74
Arab Banking Corporation (Jordan)	34	31	48	79	45	38	35	45	38	44
Arab Jordan Investment Bank	39	48	42	38	32	34	36	50	41	40
Bank of Jordan Plc	47	62	22	46	53	47	43	64	96	53
Cairo Amman Bank	70	55	29	32	87	74	72	85	85	66
Housing Bank for Trade & Finance (The)	62	37	33	27	32	23	37	46	32	37
Industrial Development Bank	79	71	44	86	37	50	40	44	0	50
Jordan Gulf Bank	-	0	94	44	94	15	2	29	24	38
Jordan Investment & Finance Bank	82	76	64	70	58	45	34	51	48	59
Jordan IS for Finance and Investment	95	80	79	52	45	27	34	44	41	55
Jordan Kuwait Bank	30	88	94	74	29	39	67	85	69	64
Jordan National Bank Plc	80	54	84	75	64	42	21	0	20	49
Philadelphia Investment Bank	91	23	23	13	11	28	36	62	43	37
Union Bank for Savings & Investment	40	36	28	11	10	0	55	42	21	27
Al Bank Al Saudi Al Fransi	14	28	39	41	45	46	41	58	58	41
Al-Rajhi Banking & Investment Corporation	59	23	53	68	91	11	44	51	70	52
Arab Investment Company SAA (The)	40	25	28	18	30	81	18	56	45	38
Arab National Bank	88	90	66	59	83	75	42	52	43	66
Arab Petroleum Invest. Corp.	73	79	33	40	51	63	15	80	53	54
Bank Al-Jazira	84	0	0	34	23	26	47	88	51	39
National Commercial Bank (The)	50	86	57	33	88	90	57	0	96	62
Riyad Bank	40	73	46	51	66	64	59	81	56	60
Saudi American Bank	48	77	93	78	77	89	88	53	86	77
Saudi British Bank (The)	41	45	78	45	53	49	52	52	43	51

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
Saudi Hollandi Bank	79	92	50	53	63	50	37	43	43	57
Saudi Investment Bank (The)	64	75	67	55	58	45	77	89	66	66
United Saudi Bank	46	37	93	87	60	80	92	93	85	75
Avg.	**61**	**60**	**58**	**60**	**58**	**57**	**52**	**62**	**55**	**58**

Source: Author's own estimation

Table 6-28: Cost Efficiency scale elasticities estimates for Jordan, Egypt, Saudi Arabia and Bahrain Banks over 1992-2000 – Individual Bank Estimates

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
Al Baraka IS BSC	0.92	1.03	1.04	1.10	1.14	0.69	0.73	0.76	0.80	0.91
Al-Ahli United Bank (Bahrain) B.S.C.	0.94	0.93	1.01	1.16	1.01	0.96	0.94	1.03	1.12	1.01
Alubaf Arab International Bank	1.26	1.44	1.17	0.93	1.19	1.14	1.15	1.14	1.12	1.17
Arab Banking Corporation BSC	0.40	0.45	0.32	0.30	0.22	0.16	0.12	0.13	-0.09	0.22
Arab Financial Services Company - AFS	1.58	1.48	1.29	1.05	1.19	1.06	0.86	1.26	1.30	1.23
Bahrain Development Bank B.S.C.	2.32	2.71	2.37	1.88	2.01	1.69	1.56	1.69	1.63	1.98
Bahrain International Bank E.C.	1.31	1.35	1.35	1.56	1.53	1.35	1.66	1.73	1.85	1.52
Bahrain IS B.S.C.	-	1.17	1.22	1.32	1.33	1.33	1.28	1.34	1.55	1.30
Bahraini Saudi Bank (The) BSC	1.01	0.99	1.05	1.05	1.03	1.15	1.14	1.15	1.12	1.08
Bank of Bahrain and Kuwait B.S.C.	1.53	1.48	1.53	1.45	1.39	1.38	1.29	1.30	1.36	1.41
BMB Investment Bank - BMEB	1.21	1.10	1.27	1.36	1.49	1.63	1.96	1.98	2.06	1.56
Commercial Bank of Bahrain B.S.C.	1.07	1.02	1.05	1.12	1.12	1.14	1.11	1.07	1.12	1.09
Gulf International Bank BSC	1.14	1.10	1.11	1.19	1.18	1.18	1.14	1.15	1.23	1.16
Investcorp Bank EC	2.07	1.91	2.01	1.93	2.06	2.02	1.93	1.77	1.81	1.94
National Bank of Bahrain	0.68	0.56	0.52	0.65	0.71	0.83	1.06	1.04	1.13	0.80
Shamil Bank of Bahrain EC	-	1.28	1.02	1.11	1.45	1.35	1.31	0.81	0.89	1.17
TAIB Bank E.C.	0.90	0.88	1.01	1.45	1.25	1.39	1.29	1.16	1.34	1.19
United Gulf Bank (BSC) EC	1.45	1.63	1.59	1.62	1.51	1.49	1.38	1.27	1.29	1.47
Al Watany Bank of Egypt	0.83	0.84	0.83	0.88	0.95	1.03	1.18	1.24	1.24	1.00
Alexandria Commercial and Maritime Bank SAE	0.75	0.87	0.90	0.89	0.90	0.90	0.90	0.96	0.96	0.89
Arab African International Bank	1.34	0.66	0.57	0.58	0.71	0.66	0.74	0.67	0.69	0.74
Arab Banking Corporation - Egypt	-	-	0.87	0.86	0.84	0.87	0.86	0.85	0.87	0.85
Arab International Bank	-	0.26	0.19	0.23	0.44	0.50	0.47	0.36	0.44	0.35
Arab Investment Bank - FABFDI	0.88	0.96	0.93	0.89	0.83	0.82	0.88	0.89	0.89	0.89
Bank of Alexandria	0.96	1.06	1.23	1.24	1.08	1.21	1.22	1.24	1.21	1.16
Bank of Commerce & Development	0.71	1.05	0.76	0.82	0.75	0.75	0.77	0.77	0.81	0.80
Banque du Caire	0.97	0.98	1.02	-0.19	1.01	0.95	0.88	0.76	0.74	0.79
Banque du Caire et de Paris SAE	0.57	0.73	0.62	0.56	0.80	0.82	0.82	0.79	0.86	0.73
Banque Misr	1.14	0.93	0.88	0.81	0.74	0.73	0.84	0.66	0.47	0.80
Cairo Barclays Bank SAE	0.60	0.78	0.68	0.71	0.82	0.86	0.83	0.80	0.82	0.77
Cairo Far East Bank	0.93	0.89	0.77	0.64	0.52	0.67	0.69	0.68	0.68	0.72
Commercial International Bank (Egypt) S.A.E.	0.92	0.97	1.03	1.08	1.07	1.12	1.19	1.15	1.14	1.07
Credit Agricole Indosuez Egypte	0.77	0.82	0.78	0.78	0.88	0.86	0.84	0.83	0.79	0.82
Delta International Bank	0.93	0.95	0.92	0.90	0.84	0.85	0.87	0.89	0.93	0.90
Egyptian American Bank	0.75	0.85	0.84	1.05	1.10	1.16	1.20	1.19	1.18	1.03
Egyptian Arab Land Bank	1.18	1.40	1.23	1.22	1.50	1.74	1.73	1.55	1.46	1.44
Egyptian Gulf Bank	1.00	1.10	1.13	1.02	0.85	0.97	1.09	1.00	0.89	1.01
Egyptian Saudi Finance Bank	0.95	1.34	1.72	1.74	1.77	1.88	1.88	1.88	1.89	1.67
Export Development Bank of Egypt	0.88	0.91	0.96	0.95	1.01	1.11	1.17	1.34	1.37	1.08
Faisal IS of Egypt	1.63	1.62	1.62	1.68	1.69	1.74	1.68	1.71	1.30	1.63
Housing and Development Bank	1.40	1.45	1.44	1.35	1.54	1.58	1.57	1.60	1.57	1.50

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
HSBC Bank Egypt S A E	0.68	0.75	0.69	0.75	0.77	0.75	0.98	1.03	0.92	0.81
Misr America International Bank	0.83	0.89	1.00	0.95	0.87	0.84	0.83	0.81	0.84	0.87
Misr Exterior Bank	1.03	1.00	0.82	0.82	0.91	1.20	1.29	1.35	1.31	1.08
MISR International Bank	1.01	0.99	0.85	0.99	1.02	1.08	1.15	1.21	1.16	1.05
MISR Iran Development Bank	0.84	0.88	0.91	0.90	0.82	0.76	0.78	0.81	0.82	0.84
Misr Romanian Bank	0.89	1.74	0.85	0.85	0.81	0.81	0.86	1.00	0.99	0.98
Mohandes Bank	0.87	0.82	0.97	1.00	1.15	1.28	1.34	1.42	1.42	1.14
National Bank for Development	1.01	1.06	1.16	1.19	1.21	1.29	1.32	1.40	1.41	1.23
National Bank of Egypt	1.05	0.88	0.74	0.60	0.57	0.44	0.36	0.15	-0.02	0.53
National Societe Generale Bank SAE	0.98	0.92	0.85	0.88	0.94	1.00	1.02	1.06	1.03	0.96
Nile Bank (The)	0.99	1.00	0.97	0.99	0.97	0.85	0.90	1.15	1.15	1.00
Port Said National Bank for Development	-	0.97	0.63	0.60	0.65	0.69	0.67	0.72	0.70	0.74
Société Arabe Internationale de Banque	0.90	0.90	0.82	0.88	0.88	0.94	0.87	0.83	0.85	0.87
Suez Canal Bank	0.88	1.05	0.94	1.10	1.20	1.15	1.18	1.26	1.30	1.12
Arab Bank PLC	1.00	0.97	1.13	1.05	0.96	0.83	0.76	0.71	0.69	0.90
Arab Banking Corporation (Jordan)	1.04	0.49	1.05	1.09	1.09	1.06	1.03	1.03	0.97	0.98
Arab Jordan Investment Bank	1.17	1.13	1.25	1.30	1.25	1.31	1.26	1.24	1.24	1.24
Bank of Jordan Plc	1.20	1.23	1.19	1.25	1.10	1.19	1.17	1.17	1.16	1.19
Cairo Amman Bank	1.18	1.12	1.17	1.24	1.09	1.12	1.10	1.15	1.03	1.13
Housing Bank for Trade & Finance (The)	1.08	1.36	1.49	1.44	1.58	1.46	1.28	1.26	1.15	1.34
Industrial Development Bank	1.16	1.01	1.08	1.12	1.08	1.05	1.04	1.07	0.61	1.02
Jordan Gulf Bank	-	1.04	1.20	1.90	1.66	1.37	1.17	1.21	1.24	1.32
Jordan Investment & Finance Bank	0.88	0.92	0.95	1.06	1.06	1.09	1.11	1.12	1.08	1.03
Jordan IS for Finance and Investment	1.23	1.33	1.41	1.48	1.55	1.50	1.45	1.37	1.29	1.40
Jordan Kuwait Bank	1.05	1.06	1.07	0.89	1.12	1.13	1.18	1.10	1.03	1.07
Jordan National Bank Plc	1.35	1.20	1.23	1.32	1.32	1.38	1.44	1.31	1.22	1.31
Philadelphia Investment Bank	1.38	1.33	0.95	1.05	0.92	1.09	1.13	1.20	1.16	1.13
Union Bank for Savings & Investment	1.06	1.02	1.10	1.02	1.10	1.21	1.24	1.12	1.05	1.10
Al Bank Al Saudi Al Fransi	1.05	1.01	1.06	1.08	1.06	1.06	0.99	0.96	0.96	1.03
Al-Rajhi Banking & Investment Corporation	0.81	0.75	0.50	0.51	0.30	0.24	0.57	0.45	0.55	0.52
Arab Investment Company SAA (The)	0.93	0.79	0.93	0.99	1.10	1.17	1.10	1.25	1.31	1.06
Arab National Bank	1.04	0.96	1.00	1.02	1.09	1.10	1.09	0.99	0.98	1.03
Arab Petroleum Invest. Corp.	1.09	1.02	1.02	1.05	1.05	1.30	1.31	1.33	1.56	1.19
Bank Al-Jazira	0.77	0.72	0.66	0.68	0.66	0.75	0.78	0.94	1.10	0.78
National Commercial Bank (The)	0.51	0.41	0.25	0.13	0.13	-0.08	-0.21	0.56	0.52	0.25
Riyad Bank	1.09	0.96	0.89	1.01	0.94	0.91	0.76	0.79	0.78	0.90
Saudi American Bank	1.11	1.04	0.92	0.93	1.04	1.03	0.83	0.37	0.39	0.85
Saudi British Bank (The)	0.91	0.97	1.00	1.06	1.08	1.12	1.00	0.93	0.95	1.00
Saudi Hollandi Bank	1.24	1.28	1.39	1.38	1.08	1.05	1.11	1.12	1.11	1.19
Saudi Investment Bank (The)	0.90	0.94	0.97	1.16	1.09	1.21	1.25	1.27	1.29	1.12
United Saudi Bank	0.78	0.86	0.90	0.94	0.99	1.05	1.12	1.09	1.10	0.98
Avg.	**1.03**	**1.04**	**1.02**	**1.03**	**1.06**	**1.07**	**1.07**	**1.07**	**1.06**	**1.05**

Source: Author's own estimation

Table 6-29: Standard Profit Efficiency scale elasticities for Jordan, Egypt, Saudi Arabia and Bahrain Banks over 1992-2000 – Individual Bank Estimates

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
Al Baraka IS BSC	0.42	0.93	0.64	0.69	0.68	0.52	1.53	0.16	0.92	0.72
Al-Ahli United Bank (Bahrain) B.S.C.	0.42	0.99	0.81	0.70	0.92	0.51	1.41	0.08	0.67	0.72
Alubaf Arab International Bank	0.41	1.09	0.91	0.66	0.94	0.63	1.31	0.88	0.52	0.82
Arab Banking Corporation BSC	0.42	1.23	0.94	0.77	0.89	0.64	1.39	0.81	0.70	0.87
Arab Financial Services Company - AFS	0.45	1.28	1.09	0.63	0.80	1.00	1.28	0.86	0.26	0.85
Bahrain Development Bank B.S.C.	0.31	1.34	1.13	0.52	1.08	0.20	1.24	0.79	0.32	0.77
Bahrain International Bank E.C.	0.33	1.36	1.13	1.34	1.65	0.96	1.25	0.76	0.91	1.07
Bahrain IS B.S.C.	-	1.29	0.80	1.61	0.59	0.85	1.25	0.77	0.70	0.91
Bahraini Saudi Bank (The) BSC	0.28	0.58	0.69	1.74	0.53	0.77	1.29	0.80	0.71	0.82
Bank of Bahrain and Kuwait B.S.C.	0.66	0.50	0.63	1.74	0.51	0.77	1.32	0.74	0.72	0.84
BMB Investment Bank - BMEB	0.78	0.29	0.58	1.72	0.50	0.88	1.30	0.72	0.83	0.84
Commercial Bank of Bahrain B.S.C.	0.81	0.42	0.39	1.71	0.45	0.88	1.36	0.33	0.92	0.81
Gulf International Bank BSC	0.82	0.55	0.38	1.63	0.03	0.81	0.31	0.83	0.76	0.68
Investcorp Bank EC	1.03	0.54	0.42	1.71	0.02	0.83	0.24	0.60	0.57	0.66
National Bank of Bahrain	1.04	0.26	0.50	1.94	0.69	0.85	0.18	0.38	0.32	0.69
Shamil Bank of Bahrain EC	-	0.19	0.45	0.62	0.56	1.00	0.24	0.45	0.25	0.55
TAIB Bank E.C.	1.16	0.21	1.22	0.78	0.70	1.08	0.26	0.24	0.33	0.67
United Gulf Bank (BSC) EC	1.17	0.75	1.05	0.86	0.81	1.06	0.31	0.16	0.29	0.72
Al Watany Bank of Egypt	0.73	0.63	0.88	0.95	0.54	1.10	0.22	0.28	0.78	0.68
Alexandria Commercial and Maritime Bank SAE	0.01	0.59	1.05	1.27	0.85	1.21	0.28	0.47	1.71	0.83
Arab African International Bank	0.39	0.58	0.84	1.31	0.78	1.24	0.28	0.98	1.72	0.90
Arab Banking Corporation - Egypt	-	-	1.13	1.18	1.15	1.14	0.21	0.52	1.27	0.84
Arab International Bank	-	0.57	1.02	1.25	1.23	0.97	0.19	0.48	1.58	0.85
Arab Investment Bank - FABFDI	0.31	0.61	1.07	1.20	1.30	0.97	0.29	0.45	1.47	0.85
Bank of Alexandria	0.28	0.59	0.90	1.23	1.05	1.09	0.22	0.40	1.41	0.80
Bank of Commerce & Development	0.16	0.57	0.85	1.11	1.05	1.06	0.01	0.51	1.56	0.76
Banque du Caire	0.24	1.38	0.78	0.88	1.07	1.12	0.06	0.53	1.26	0.81
Banque du Caire et de Paris SAE	1.77	1.32	0.60	0.82	1.23	1.23	0.16	0.66	1.33	1.01
Banque Misr	1.66	1.28	0.81	0.99	1.28	1.20	0.10	0.92	1.40	1.07
Cairo Barclays Bank SAE	1.60	1.27	0.79	0.87	1.28	1.13	0.11	0.15	1.39	0.96
Cairo Far East Bank	1.82	1.26	0.63	0.88	1.20	1.06	0.36	1.05	1.23	1.05
Commercial International Bank (Egypt) S.A.E.	1.81	1.24	0.65	1.00	1.09	1.58	0.21	1.01	1.21	1.09
Credit Agricole Indosuez Egypte	1.83	1.27	0.59	0.93	1.30	1.75	0.21	0.93	1.09	1.10
Delta International Bank	1.87	1.34	0.14	1.36	1.31	1.73	0.28	0.93	1.11	1.12
Egyptian American Bank	1.77	1.37	1.09	1.42	1.35	1.69	0.24	0.82	1.18	1.22
Egyptian Arab Land Bank	1.83	0.95	1.09	1.48	1.39	1.58	0.21	0.73	1.12	1.15
Egyptian Gulf Bank	0.90	1.00	0.79	1.47	1.23	1.61	0.24	0.62	1.11	1.00
Egyptian Saudi Finance Bank	0.68	0.93	0.85	1.50	1.22	1.61	0.25	0.65	1.36	1.01
Export Development Bank of Egypt	1.03	1.00	1.15	1.46	1.23	1.69	0.26	0.74	1.28	1.09
Faisal IS of Egypt	1.08	0.71	1.09	1.36	1.27	1.77	0.42	0.49	1.20	1.04
Housing and Development Bank	0.96	0.74	1.16	1.36	1.18	0.75	0.35	0.30	1.01	0.87

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
HSBC Bank Egypt S A E	1.23	0.79	0.92	1.35	0.92	0.77	0.47	0.36	0.94	0.86
Misr America International Bank	1.16	0.98	0.86	0.87	0.73	1.13	0.61	0.23	1.16	0.86
Misr Exterior Bank	1.30	1.02	0.98	0.82	0.84	1.24	0.61	0.00	1.31	0.90
MISR International Bank	1.18	1.64	0.63	0.60	0.70	1.35	0.52	0.13	1.19	0.88
MISR Iran Development Bank	0.25	1.52	0.62	0.62	0.81	1.37	0.44	0.17	1.24	0.78
Misr Romanian Bank	0.55	1.51	0.71	0.65	1.09	1.48	0.36	0.21	1.51	0.90
Mohandes Bank	0.57	1.48	0.67	0.68	1.09	1.50	0.31	1.63	1.18	1.01
National Bank for Development	0.72	1.48	0.70	0.69	1.18	1.49	0.66	1.55	1.10	1.06
National Bank of Egypt	0.61	1.44	0.41	0.48	1.06	0.78	0.48	1.30	1.11	0.85
National Societe Generale Bank SAE	0.63	1.45	0.41	0.26	0.89	0.79	0.45	1.23	1.02	0.79
Nile Bank (The)	0.85	1.44	0.40	0.74	0.92	0.80	0.59	1.11	0.96	0.87
Port Said National Bank for Development	-	1.43	1.65	0.71	0.52	0.76	0.57	1.03	1.05	0.96
Société Arabe Internationale de Banque	0.76	1.26	1.78	0.64	0.54	0.62	0.72	1.08	1.07	0.94
Suez Canal Bank	0.96	1.15	1.58	0.71	0.54	0.69	0.71	1.03	1.06	0.94
Arab Bank PLC	0.67	1.22	1.55	0.63	0.54	0.64	0.62	1.05	1.04	0.89
Arab Banking Corporation (Jordan)	0.45	0.92	1.72	0.61	0.55	0.81	0.64	1.08	0.99	0.86
Arab Jordan Investment Bank	0.61	1.19	1.53	0.66	0.44	0.86	0.60	1.17	0.80	0.87
Bank of Jordan Plc	0.34	0.94	1.52	0.70	0.35	1.03	0.33	1.53	0.84	0.84
Cairo Amman Bank	0.53	0.84	1.38	0.66	0.84	1.03	0.43	1.46	0.96	0.90
Housing Bank for Trade & Finance (The)	0.80	0.66	1.67	0.66	0.88	1.14	0.30	1.52	1.05	0.96
Industrial Development Bank	0.71	0.59	0.51	0.81	1.00	1.13	0.33	1.41	1.02	0.83
Jordan Gulf Bank	-	1.11	0.03	0.78	0.98	0.94	0.33	0.73	1.01	0.70
Jordan Investment & Finance Bank	0.68	1.22	0.52	0.80	1.14	0.82	0.26	0.81	0.99	0.81
Jordan IS for Finance and Investment	0.64	1.28	0.53	1.18	1.13	0.85	0.35	0.70	1.42	0.90
Jordan Kuwait Bank	0.50	0.77	0.72	1.13	1.15	0.89	0.32	0.19	1.42	0.79
Jordan National Bank Plc	0.50	0.94	0.50	1.22	0.96	0.86	0.20	0.07	1.23	0.72
Philadelphia Investment Bank	0.51	0.84	0.48	1.30	0.78	1.28	0.34	0.05	0.92	0.72
Union Bank for Savings & Investment	0.50	1.01	0.36	1.14	1.70	1.15	0.05	0.30	0.90	0.79
Al Bank Al Saudi Al Fransi	0.61	1.20	0.58	0.32	1.53	0.80	0.05	0.23	0.91	0.69
Al-Rajhi Banking & Investment Corporation	0.57	0.77	0.52	0.34	1.35	0.57	0.06	0.68	0.90	0.64
Arab Investment Company SAA (The)	0.14	1.09	1.57	0.14	1.46	0.59	0.09	0.16	0.85	0.68
Arab National Bank	0.65	1.03	1.51	0.38	1.35	0.51	0.03	0.21	0.83	0.72
Arab Petroleum Invest. Corp.	0.67	0.81	1.29	0.41	1.36	0.58	0.05	0.38	1.76	0.81
Bank Al-Jazira	0.69	0.98	1.49	0.61	1.39	0.62	0.07	1.52	1.66	1.00
National Commercial Bank (The)	0.80	0.83	1.54	0.95	1.31	0.70	0.67	1.43	1.36	1.07
Riyad Bank	0.87	0.74	1.52	1.35	1.32	1.32	0.43	1.36	1.32	1.14
Saudi American Bank	0.62	0.30	1.60	1.59	0.03	1.39	0.32	1.24	1.22	0.92
Saudi British Bank (The)	0.58	0.37	1.63	0.15	0.33	1.58	0.20	1.07	0.99	0.77
Saudi Hollandi Bank	0.64	0.43	1.11	0.50	0.33	1.48	0.32	0.93	0.90	0.74
Saudi Investment Bank (The)	0.88	0.12	0.82	0.50	0.41	1.54	0.32	0.90	0.95	0.72
United Saudi Bank	1.30	0.69	0.75	0.61	0.44	1.51	0.16	0.94	0.91	0.82
Avg.	**0.78**	**0.94**	**0.91**	**0.96**	**0.93**	**1.05**	**0.46**	**0.72**	**1.04**	**0.87**

Source: Author's own estimation

Table 6-30: Alternative Profit Efficiency scale elasticities estimates for Jordan, Egypt, Saudi Arabia and Bahrain Banks over 1992-2000 – Individual Bank Estimates

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
Al Baraka IS BSC	0.48	1.28	0.09	0.55	0.13	0.12	1.13	0.94	2.80	0.83
Al-Ahli United Bank (Bahrain) B.S.C.	0.64	1.36	0.22	0.21	0.01	0.08	1.16	0.97	0.30	0.55
Alubaf Arab International Bank	0.68	1.51	0.10	0.05	0.05	0.03	1.31	0.48	0.57	0.53
Arab Banking Corporation BSC	0.82	1.63	0.01	0.03	0.22	0.19	1.51	0.07	1.39	0.65
Arab Financial Services Company - AFS	0.92	1.73	0.10	0.18	0.34	0.86	1.74	0.05	1.51	0.82
Bahrain Development Bank B.S.C.	0.46	1.91	0.15	0.33	0.64	0.11	3.06	0.21	1.77	0.96
Bahrain International Bank E.C.	0.43	1.89	0.18	0.73	1.22	1.31	3.24	0.24	0.66	1.10
Bahrain IS B.S.C.	-	2.03	0.59	1.47	1.24	0.29	2.95	0.25	0.69	1.11
Bahraini Saudi Bank (The) BSC	0.32	0.56	0.31	1.36	1.17	0.26	3.06	0.30	0.32	0.85
Bank of Bahrain and Kuwait B.S.C.	0.23	0.68	0.11	1.40	1.07	0.32	3.06	0.31	0.59	0.86
BMB Investment Bank - BMEB	0.40	0.88	0.06	1.89	1.00	0.15	3.08	0.27	0.49	0.91
Commercial Bank of Bahrain B.S.C.	0.09	1.10	0.01	1.75	0.93	0.13	3.07	0.14	0.27	0.83
Gulf International Bank BSC	0.84	1.01	0.02	1.68	0.08	0.33	0.11	0.68	1.31	0.67
Investcorp Bank EC	0.17	0.63	0.13	1.93	0.14	0.93	1.03	0.32	1.71	0.78
National Bank of Bahrain	0.59	0.55	0.15	1.76	0.16	0.74	0.24	0.79	1.82	0.76
Shamil Bank of Bahrain EC	-	0.45	0.30	1.35	0.06	0.25	0.10	0.54	1.57	0.58
TAIB Bank E.C.	0.62	0.41	0.26	0.15	0.23	0.48	0.37	0.69	1.64	0.54
United Gulf Bank (BSC) EC	0.74	0.39	0.64	0.17	0.14	0.07	0.44	0.89	1.49	0.55
Al Watany Bank of Egypt	0.48	0.26	1.14	0.37	0.04	0.30	0.44	0.84	0.83	0.52
Alexandria Commercial and Maritime Bank SAE	1.77	0.05	1.09	0.20	0.12	0.34	0.49	0.96	1.83	0.76
Arab African International Bank	1.00	0.19	0.51	0.10	0.27	0.35	0.46	0.36	1.87	0.57
Arab Banking Corporation - Egypt	-	-	0.92	0.42	0.33	0.42	0.09	0.07	2.65	0.65
Arab International Bank	-	0.34	0.86	0.60	0.65	0.03	0.21	0.28	2.86	0.77
Arab Investment Bank - FABFDI	1.01	0.19	0.87	0.75	0.11	0.28	0.52	0.49	2.63	0.76
Bank of Alexandria	0.97	0.13	0.83	1.45	0.30	0.35	0.58	0.51	2.73	0.87
Bank of Commerce & Development	1.07	0.17	1.00	1.32	0.37	0.58	0.54	0.79	2.67	0.95
Banque du Caire	0.99	2.17	0.84	1.32	0.52	0.53	0.81	0.73	0.85	0.97
Banque du Caire et de Paris SAE	2.75	2.34	0.04	0.54	0.63	0.41	0.72	0.81	0.84	1.01
Banque Misr	2.88	2.27	0.69	1.20	0.80	0.46	0.97	1.16	2.04	1.39
Cairo Barclays Bank SAE	2.92	2.39	0.59	0.99	0.73	0.51	1.04	1.25	2.16	1.40
Cairo Far East Bank	2.96	2.45	0.20	0.87	0.74	0.61	0.38	1.57	2.74	1.39
Commercial International Bank (Egypt) S.A.E.	2.89	2.64	0.14	0.90	0.16	2.15	0.60	1.55	2.86	1.54
Credit Agricole Indosuez Egypte	2.88	2.60	0.06	0.86	0.78	2.09	0.61	1.15	2.65	1.52
Delta International Bank	2.95	2.38	0.33	0.76	0.58	2.13	0.73	0.92	2.69	1.50
Egyptian American Bank	3.02	2.45	1.63	1.00	0.54	2.31	0.58	0.39	2.80	1.64
Egyptian Arab Land Bank	2.68	0.61	1.78	0.76	0.28	2.66	0.92	0.65	2.71	1.45
Egyptian Gulf Bank	0.88	0.76	1.83	0.57	0.53	2.67	0.73	0.45	2.73	1.24
Egyptian Saudi Finance Bank	0.54	0.92	2.01	1.27	0.49	2.62	0.55	0.50	1.90	1.20
Export Development Bank of Egypt	0.37	1.38	2.01	1.64	0.56	2.67	0.50	0.60	2.06	1.31
Faisal IS of Egypt	0.41	1.35	1.94	1.32	0.56	2.71	0.57	0.25	2.50	1.29
Housing and Development Bank	0.25	1.55	2.11	1.64	0.61	0.29	0.54	0.07	2.69	1.09

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
HSBC Bank Egypt S A E	0.37	1.69	2.19	1.78	1.10	0.53	0.52	0.02	2.63	1.20
Misr America International Bank	0.45	1.46	2.17	0.49	0.58	0.17	0.80	0.43	1.73	0.92
Misr Exterior Bank	1.77	1.58	1.00	0.34	0.83	0.42	0.97	0.72	2.05	1.07
MISR International Bank	2.16	1.17	0.04	0.00	0.40	0.46	0.98	0.83	2.48	0.95
MISR Iran Development Bank	2.43	2.00	0.05	0.10	0.14	0.71	1.05	0.72	2.59	1.09
Misr Romanian Bank	0.85	1.96	0.07	0.07	0.27	0.75	1.08	0.75	1.77	0.84
Mohandes Bank	0.45	2.10	0.02	0.09	0.07	0.79	1.09	2.08	2.08	0.97
National Bank for Development	0.65	1.93	0.04	0.01	0.26	0.84	0.34	2.18	2.24	0.94
National Bank of Egypt	0.21	2.09	0.01	0.08	0.59	0.41	0.48	2.66	2.46	1.00
National Societe Generale Bank SAE	0.39	1.81	0.02	0.15	0.97	0.39	0.62	2.76	2.18	1.03
Nile Bank (The)	0.33	1.81	0.05	0.32	0.65	0.44	0.66	2.71	2.03	1.00
Port Said National Bank for Development	-	1.96	1.51	0.02	0.09	0.33	0.87	2.69	2.61	1.15
Société Arabe Internationale de Banque	0.15	0.66	1.23	0.08	0.09	0.17	1.58	2.78	2.85	1.07
Suez Canal Bank	1.15	0.51	1.40	0.24	0.08	0.01	1.51	2.80	2.78	1.17
Arab Bank PLC	0.50	0.64	1.56	0.30	0.08	0.11	1.97	2.81	0.78	0.97
Arab Banking Corporation (Jordan)	0.03	0.95	1.38	0.55	0.11	1.30	2.23	0.03	0.92	0.83
Arab Jordan Investment Bank	0.86	1.64	1.63	0.48	0.15	1.43	0.03	0.01	1.69	0.88
Bank of Jordan Plc	0.51	1.54	1.75	0.36	0.15	1.74	0.94	0.29	1.78	1.01
Cairo Amman Bank	0.72	1.58	1.67	0.39	0.38	1.66	1.02	0.24	1.89	1.06
Housing Bank for Trade & Finance (The)	1.03	0.76	1.22	0.03	0.03	1.74	0.99	0.36	1.85	0.89
Industrial Development Bank	0.92	0.63	0.32	0.15	0.01	1.25	1.46	0.63	1.92	0.81
Jordan Gulf Bank	-	0.51	0.26	0.09	0.15	0.85	1.30	1.47	1.95	0.86
Jordan Investment & Finance Bank	1.16	1.09	0.11	0.07	0.04	0.89	1.31	1.55	2.02	0.92
Jordan IS for Finance and Investment	1.06	1.72	0.14	0.09	0.49	0.82	1.33	1.31	0.10	0.78
Jordan Kuwait Bank	0.94	0.36	0.36	0.43	0.54	0.74	1.08	0.18	0.32	0.55
Jordan National Bank Plc	0.69	1.40	0.21	0.46	0.04	0.76	0.11	0.31	0.98	0.55
Philadelphia Investment Bank	0.65	1.38	0.29	0.50	0.05	0.91	0.19	0.69	1.43	0.68
Union Bank for Savings & Investment	0.59	1.44	0.32	0.64	0.51	0.99	0.58	1.00	1.81	0.88
Al Bank Al Saudi Al Fransi	0.46	1.51	0.38	0.78	0.56	0.68	1.85	1.02	1.60	0.98
Al-Rajhi Banking & Investment Corporation	0.49	1.08	0.08	0.56	0.82	0.18	1.37	1.18	1.76	0.84
Arab Investment Company SAA (The)	0.03	0.35	1.76	0.60	1.01	0.10	0.88	1.11	1.82	0.85
Arab National Bank	0.04	0.20	1.61	0.50	1.51	0.34	0.41	1.26	1.85	0.86
Arab Petroleum Invest. Corp.	0.13	0.20	0.27	0.39	1.44	0.43	0.50	1.41	1.00	0.64
Bank Al-Jazira	0.24	0.41	1.91	0.13	1.35	0.31	0.59	1.14	1.63	0.86
National Commercial Bank (The)	0.63	0.14	1.99	0.23	1.44	0.31	0.73	1.88	2.20	1.06
Riyad Bank	0.68	0.74	2.09	0.12	1.62	0.15	0.36	2.52	2.45	1.19
Saudi American Bank	0.40	1.01	2.32	0.18	0.12	0.08	0.03	2.65	2.35	1.02
Saudi British Bank (The)	0.54	0.95	2.36	0.29	0.04	0.02	0.22	1.94	2.24	0.96
Saudi Hollandi Bank	0.44	1.36	1.75	0.02	0.37	0.17	0.39	1.91	2.25	0.96
Saudi Investment Bank (The)	0.78	0.51	0.72	0.12	0.52	0.25	0.59	2.21	2.26	0.89
United Saudi Bank	0.54	0.18	0.61	0.14	0.28	1.00	0.83	2.79	2.28	0.96
Avg.	**0.91**	**1.18**	**0.80**	**0.61**	**0.48**	**0.73**	**0.98**	**1.01**	**1.84**	**0.95**

Source: Author's own estimation

Table 6-31: Cost Efficiency scale Inefficiency levels for Jordan, Egypt, Saudi Arabia and Bahrain Banks over 1992-2000 – Individual Bank Estimates

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
Al Baraka IS BSC	6	1	1	8	15	54	44	36	28	21
Al-Ahli United Bank (Bahrain) B.S.C.	3	4	0	19	0	1	3	1	10	5
Alubaf Arab International Bank	42	79	21	4	25	14	17	15	12	25
Arab Banking Corporation BSC	95	91	97	98	99	100	100	100	100	98
Arab Financial Services Company - AFS	93	84	50	2	25	3	14	41	51	40
Bahrain Development Bank B.S.C.	100	100	100	100	100	98	92	98	96	98
Bahrain International Bank E.C.	53	62	64	92	90	62	97	99	100	80
Bahrain IS B.S.C.	-	21	32	56	59	59	48	62	91	49
Bahraini Saudi Bank (The) BSC	0	0	2	2	1	16	15	17	12	7
Bank of Bahrain and Kuwait B.S.C.	89	85	90	80	71	69	50	51	65	72
BMB Investment Bank - BMEB	29	8	44	65	85	96	100	100	100	70
Commercial Bank of Bahrain B.S.C.	4	0	2	11	11	15	9	4	11	8
Gulf International Bank BSC	15	8	10	25	23	22	15	17	36	19
Investcorp Bank EC	100	100	100	100	100	100	100	99	99	100
National Bank of Bahrain	57	79	84	62	50	21	3	1	13	41
Shamil Bank of Bahrain EC	-	47	0	10	80	63	54	26	10	38
TAIB Bank E.C.	7	11	0	81	40	71	49	19	60	38
United Gulf Bank (BSC) EC	80	96	94	96	88	85	70	43	49	78
Al Watany Bank of Egypt	21	19	22	12	2	1	22	37	37	19
Alexandria Commercial and Maritime Bank SAE	40	12	8	10	8	7	7	1	1	10
Arab African International Bank	61	60	77	76	48	61	42	58	55	60
Arab Banking Corporation - Egypt	-	-	12	15	18	12	14	16	12	16
Arab International Bank	-	99	99	99	92	87	89	96	92	95
Arab Investment Bank - FABFDI	11	1	4	9	21	22	11	10	10	11
Bank of Alexandria	1	3	35	37	5	30	31	36	29	23
Bank of Commerce & Development	48	2	38	24	40	40	34	35	26	32
Banque du Caire	1	0	0	100	0	2	11	38	43	22
Banque du Caire et de Paris SAE	77	45	68	78	28	22	24	29	15	43
Banque Misr	14	4	12	24	42	45	19	61	89	35
Cairo Barclays Bank SAE	72	32	56	48	23	15	21	27	23	35
Cairo Far East Bank	4	10	34	64	85	58	55	57	56	47
Commercial International Bank (Egypt) S.A.E.	5	1	1	5	3	10	26	16	14	9
Credit Agricole Indosuez Egypte	35	23	33	33	12	15	19	20	29	24
Delta International Bank	4	2	5	7	19	17	12	9	4	9
Egyptian American Bank	40	17	19	2	7	19	28	24	23	20
Egyptian Arab Land Bank	23	72	35	33	86	99	99	91	81	69
Egyptian Gulf Bank	0	8	12	0	16	1	6	0	9	6
Egyptian Saudi Finance Bank	2	61	98	99	99	100	100	100	100	84
Export Development Bank of Egypt	11	6	2	2	0	10	20	60	67	20
Faisal IS of Egypt	96	95	96	97	98	99	98	98	51	92
Housing and Development Bank	72	80	80	64	90	94	93	94	93	84

Firm\Year	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**00**	**Avg.**
HSBC Bank Egypt S A E	56	40	53	40	35	40	0	1	5	30
Misr America International Bank	20	10	0	2	13	19	21	24	19	14
Misr Exterior Bank	1	0	23	23	6	29	50	62	54	27
MISR International Bank	0	0	16	0	0	5	17	30	19	10
MISR Iran Development Bank	18	12	6	8	22	36	32	24	23	20
Misr Romanian Bank	10	99	16	17	26	25	15	0	0	23
Mohandes Bank	13	24	1	0	17	47	60	75	75	35
National Bank for Development	0	3	18	26	30	49	55	72	74	36
National Bank of Egypt	2	11	41	72	77	92	96	100	100	66
National Societe Generale Bank SAE	0	5	16	10	3	0	0	3	1	4
Nile Bank (The)	0	0	1	0	1	16	8	16	17	6
Port Said National Bank for Development	-	1	67	73	62	55	58	47	53	46
Société Arabe Internationale de Banque	8	7	24	12	11	3	12	20	17	13
Suez Canal Bank	10	2	3	8	28	16	22	42	51	20
Arab Bank PLC	0	1	13	2	2	22	37	49	54	20
Arab Banking Corporation (Jordan)	1	88	2	7	6	2	1	1	1	12
Arab Jordan Investment Bank	20	12	39	52	40	54	43	36	36	37
Bank of Jordan Plc	28	35	26	40	7	26	20	22	19	25
Cairo Amman Bank	23	10	21	37	7	11	7	16	1	15
Housing Bank for Trade & Finance (The)	6	64	85	79	93	81	46	41	17	57
Industrial Development Bank	18	0	5	11	5	2	1	3	70	13
Jordan Gulf Bank	-	1	28	100	97	67	21	30	38	44
Jordan Investment & Finance Bank	11	5	2	3	3	6	10	11	5	6
Jordan IS for Finance and Investment	34	59	74	84	91	87	80	67	50	70
Jordan Kuwait Bank	2	3	4	9	11	12	23	8	1	8
Jordan National Bank Plc	62	28	35	57	57	69	79	54	33	53
Philadelphia Investment Bank	69	57	2	2	5	7	12	26	19	22
Union Bank for Savings & Investment	3	0	8	0	7	31	37	10	2	11
Al Bank Al Saudi Al Fransi	2	0	3	5	3	3	0	1	1	2
Al-Rajhi Banking & Investment Corporation	25	39	86	86	98	99	77	91	81	76
Arab Investment Company SAA (The)	4	30	4	0	8	22	8	39	54	19
Arab National Bank	1	2	0	0	6	8	6	0	0	3
Arab Petroleum Invest. Corp.	6	0	0	2	2	51	55	58	92	29
Bank Al-Jazira	35	47	60	56	61	40	33	3	7	38
National Commercial Bank (The)	85	94	99	100	100	100	100	79	85	93
Riyad Bank	6	1	10	0	3	7	38	30	32	14
Saudi American Bank	10	2	5	4	1	1	20	96	95	26
Saudi British Bank (The)	6	1	0	3	5	11	0	3	2	4
Saudi Hollandi Bank	36	46	71	69	4	2	9	10	10	29
Saudi Investment Bank (The)	8	3	1	18	6	29	40	45	49	22
United Saudi Bank	31	14	8	3	0	2	10	6	8	9
Avg.	**28**	**29**	**32**	**36**	**35**	**38**	**37**	**39**	**40**	**35**

Source: Author's own estimation

Table 6-32: Standard Profit scale Inefficiency levels for Jordan, Egypt, Saudi Arabia and Bahrain Banks over 1992-2000 – Individual Bank Estimates

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
Al Baraka IS BSC	6	96	34	46	42	15	10	0	95	38
Al-Ahli United Bank (Bahrain) B.S.C.	7	100	74	48	95	14	26	0	41	45
Alubaf Arab International Bank	6	93	94	40	97	32	46	89	15	57
Arab Banking Corporation BSC	6	64	97	65	91	34	29	75	49	57
Arab Financial Services Company - AFS	8	53	93	33	72	100	53	84	1	55
Bahrain Development Bank B.S.C.	2	39	86	15	95	1	63	69	2	41
Bahrain International Bank E.C.	2	35	88	40	3	99	60	62	93	53
Bahrain IS B.S.C.	-	49	73	5	25	83	60	66	47	46
Bahraini Saudi Bank (The) BSC	1	23	46	1	17	64	49	73	50	36
Bank of Bahrain and Kuwait B.S.C.	39	13	32	1	14	66	43	57	52	35
BMB Investment Bank - BMEB	66	2	24	1	13	89	48	52	80	42
Commercial Bank of Bahrain B.S.C.	74	7	5	2	8	89	35	2	94	35
Gulf International Bank BSC	77	19	4	4	0	75	2	79	63	36
Investcorp Bank EC	99	18	7	2	0	79	1	28	22	28
National Bank of Bahrain	99	1	13	0	46	83	0	5	2	28
Shamil Bank of Bahrain EC	-	0	9	30	21	100	1	8	1	27
TAIB Bank E.C.	80	1	68	69	49	95	1	1	3	41
United Gulf Bank (BSC) EC	79	60	98	85	75	97	2	0	2	55
Al Watany Bank of Egypt	55	34	89	98	17	92	1	1	66	50
Alexandria Commercial and Maritime Bank SAE	0	25	98	54	83	71	1	10	2	38
Arab African International Bank	5	24	81	46	68	63	1	100	1	43
Arab Banking Corporation - Egypt	-	-	87	77	83	85	1	15	56	47
Arab International Bank	-	21	100	60	64	99	0	11	7	41
Arab Investment Bank - FABFDI	2	29	96	71	48	99	2	8	16	41
Bank of Alexandria	1	25	92	65	98	94	1	5	25	45
Bank of Commerce & Development	0	22	83	90	98	97	0	14	8	46
Banque du Caire	1	31	68	90	96	89	0	17	57	50
Banque du Caire et de Paris SAE	1	43	26	76	64	65	0	38	42	40
Banque Misr	3	54	74	100	54	71	0	95	27	53
Cairo Barclays Bank SAE	5	54	70	88	52	88	0	0	28	43
Cairo Far East Bank	0	59	32	90	71	97	3	98	64	57
Commercial International Bank (Egypt) S.A.E.	0	62	38	100	94	7	1	100	71	52
Credit Agricole Indosuez Egypte	0	54	25	96	47	1	1	96	93	46
Delta International Bank	0	38	0	34	45	1	1	96	91	34
Egyptian American Bank	1	33	93	24	36	2	1	77	76	38
Egyptian Arab Land Bank	0	98	94	15	29	6	1	55	88	43
Egyptian Gulf Bank	92	100	70	16	64	5	1	31	90	52
Egyptian Saudi Finance Bank	44	96	83	12	67	5	1	38	34	42
Export Development Bank of Egypt	99	100	83	18	64	2	1	56	52	53
Faisal IS of Egypt	95	50	94	35	56	1	7	12	73	47
Housing and Development Bank	99	58	81	34	76	59	3	2	100	57

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
HSBC Bank Egypt S A E	64	70	95	38	95	66	10	4	97	60
Misr America International Bank	80	100	86	87	56	87	30	1	81	67
Misr Exterior Bank	47	100	100	77	81	61	28	0	46	60
MISR International Bank	77	4	32	27	48	38	15	0	73	35
MISR Iran Development Bank	1	11	30	31	75	33	8	0	62	28
Misr Romanian Bank	19	12	51	38	93	15	3	1	11	27
Mohandes Bank	21	15	40	44	94	13	2	4	77	34
National Bank for Development	52	15	47	46	77	14	39	8	93	43
National Bank of Egypt	30	21	6	11	97	66	11	48	91	42
National Societe Generale Bank SAE	33	20	6	1	91	71	8	64	100	44
Nile Bank (The)	82	20	5	56	95	72	25	91	99	61
Port Said National Bank for Development	-	22	3	51	15	63	22	99	98	52
Société Arabe Internationale de Banque	62	57	1	35	18	30	52	95	96	50
Suez Canal Bank	99	84	7	51	17	46	49	99	97	61
Arab Bank PLC	42	67	8	33	17	36	30	98	99	48
Arab Banking Corporation (Jordan)	8	95	1	28	18	75	35	95	100	51
Arab Jordan Investment Bank	28	74	10	40	8	85	28	80	73	47
Bank of Jordan Plc	3	97	11	48	3	99	2	10	81	39
Cairo Amman Bank	16	82	32	38	82	99	7	18	99	52
Housing Bank for Trade & Finance (The)	71	39	3	39	89	85	2	11	98	49
Industrial Development Bank	51	25	14	74	100	88	3	25	100	53
Jordan Gulf Bank	-	91	0	67	99	97	3	54	100	57
Jordan Investment & Finance Bank	44	67	16	73	85	77	1	75	100	60
Jordan IS for Finance and Investment	34	54	16	77	87	83	3	48	23	47
Jordan Kuwait Bank	13	65	52	86	84	91	2	0	24	46
Jordan National Bank Plc	13	97	13	68	99	86	1	0	65	49
Philadelphia Investment Bank	15	81	11	47	67	53	3	0	95	41
Union Bank for Savings & Investment	13	100	3	86	2	84	0	2	91	42
Al Bank Al Saudi Al Fransi	29	73	24	2	10	71	0	1	93	34
Al-Rajhi Banking & Investment Corporation	22	66	16	3	37	22	0	43	92	33
Arab Investment Company SAA (The)	0	94	7	0	17	25	0	0	83	25
Arab National Bank	38	99	12	5	37	14	0	1	79	32
Arab Petroleum Invest. Corp.	40	75	50	6	34	23	0	4	1	26
Bank Al-Jazira	46	100	14	28	29	31	0	11	3	29
National Commercial Bank (The)	73	79	9	98	45	49	42	22	34	50
Riyad Bank	88	57	11	37	42	43	7	35	44	40
Saudi American Bank	30	2	5	6	0	28	2	62	68	23
Saudi British Bank (The)	24	4	4	0	2	7	1	96	100	26
Saudi Hollandi Bank	34	7	91	12	3	15	2	96	92	39
Saudi Investment Bank (The)	88	0	76	13	6	9	2	93	98	43
United Saudi Bank	48	45	61	29	8	12	0	98	94	44
Avg.	**36**	**50**	**45**	**43**	**52**	**56**	**13**	**40**	**61**	**44**

Source: Author's own estimation

Table 6-33: Alternative Profit scale Inefficiency levels for Jordan, Egypt, Saudi Arabia and Bahrain Banks over 1992-2000 – Individual Bank Estimates

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
Al Baraka IS BSC	44	79	8	54	10	10	95	99	0	44
Al-Ahli United Bank (Bahrain) B.S.C.	68	67	16	15	5	8	92	100	23	44
Alubaf Arab International Bank	74	45	9	7	7	6	75	44	57	36
Arab Banking Corporation BSC	91	30	5	6	16	14	46	7	63	31
Arab Financial Services Company - AFS	98	20	9	13	26	95	19	7	46	37
Bahrain Development Bank B.S.C.	41	8	11	26	68	9	0	15	17	22
Bahrain International Bank E.C.	37	9	13	80	86	75	0	17	70	43
Bahrain IS B.S.C.	-	4	60	52	84	22	0	18	75	40
Bahraini Saudi Bank (The) BSC	25	56	24	68	91	19	0	22	24	37
Bank of Bahrain and Kuwait B.S.C.	17	73	9	61	99	24	0	24	60	41
BMB Investment Bank - BMEB	34	96	7	9	100	11	0	20	45	36
Commercial Bank of Bahrain B.S.C.	8	97	5	19	99	10	0	11	20	30
Gulf International Bank BSC	92	100	5	25	8	26	9	73	74	46
Investcorp Bank EC	12	66	10	7	11	98	100	25	21	39
National Bank of Bahrain	60	54	12	18	12	82	18	88	13	40
Shamil Bank of Bahrain EC	-	40	23	70	7	18	8	52	37	36
TAIB Bank E.C.	65	35	19	11	17	45	30	75	29	36
United Gulf Bank (BSC) EC	82	33	67	13	11	7	39	96	48	44
Al Watany Bank of Egypt	44	19	94	31	6	23	39	92	91	49
Alexandria Commercial and Maritime Bank SAE	17	6	98	15	10	27	46	100	12	37
Arab African International Bank	100	13	48	9	20	28	42	30	10	33
Arab Banking Corporation - Egypt	-	-	98	36	26	36	8	7	0	33
Arab International Bank	-	27	94	62	69	6	16	21	0	43
Arab Investment Bank - FABFDI	100	14	95	82	9	21	50	46	0	46
Bank of Alexandria	100	10	92	54	22	28	58	49	0	46
Bank of Commerce & Development	99	13	100	73	30	58	53	88	0	57
Banque du Caire	100	2	92	74	50	51	89	80	94	70
Banque du Caire et de Paris SAE	0	0	6	52	67	34	79	90	93	47
Banque Misr	0	1	75	88	89	41	100	92	4	54
Cairo Barclays Bank SAE	0	0	60	100	80	49	100	83	2	53
Cairo Far East Bank	0	0	14	95	81	63	31	38	0	36
Commercial International Bank (Egypt) S.A.E.	0	0	11	97	12	2	62	40	0	25
Credit Agricole Indosuez Egypte	0	0	7	94	86	3	64	94	0	39
Delta International Bank	0	0	26	84	59	2	80	98	0	39
Egyptian American Bank	0	0	30	100	53	1	58	32	0	30
Egyptian Arab Land Bank	0	63	16	85	21	0	98	69	0	39
Egyptian Gulf Bank	96	84	13	58	51	0	80	41	0	47
Egyptian Saudi Finance Bank	53	98	5	80	45	0	54	47	9	43
Export Development Bank of Egypt	30	65	5	29	56	0	47	62	3	33
Faisal IS of Egypt	34	69	7	73	56	0	57	18	0	35
Housing and Development Bank	19	40	2	29	63	22	53	8	0	26

Firm\Year	92	93	94	95	96	97	98	99	00	Avg.
HSBC Bank Egypt S A E	30	24	1	16	97	51	50	5	0	30
Misr America International Bank	40	53	2	45	58	13	88	38	20	40
Misr Exterior Bank	17	36	100	27	91	36	100	79	4	54
MISR International Bank	2	92	6	5	34	42	100	92	0	41
MISR Iran Development Bank	0	5	7	9	11	77	99	79	0	32
Misr Romanian Bank	93	6	7	7	20	82	98	83	17	46
Mohandes Bank	40	3	6	8	7	87	97	3	3	28
National Bank for Development	68	7	6	5	19	92	27	2	1	25
National Bank of Egypt	15	3	5	8	60	35	44	0	0	19
National Societe Generale Bank SAE	32	14	6	11	100	33	65	0	1	29
Nile Bank (The)	25	14	6	25	69	38	70	0	4	28
Port Said National Bank for Development	-	6	45	5	8	26	95	0	0	23
Société Arabe Internationale de Banque	11	71	85	8	8	12	36	0	0	26
Suez Canal Bank	93	48	61	18	8	5	46	0	0	31
Arab Bank PLC	47	68	39	23	8	9	6	0	87	32
Arab Banking Corporation (Jordan)	6	99	65	54	9	76	1	6	98	46
Arab Jordan Investment Bank	94	29	30	44	11	57	6	5	24	33
Bank of Jordan Plc	48	41	19	30	11	19	99	22	16	34
Cairo Amman Bank	79	36	26	33	32	27	100	17	9	40
Housing Bank for Trade & Finance (The)	100	85	86	6	6	19	100	29	11	49
Industrial Development Bank	98	67	25	11	5	83	53	67	8	46
Jordan Gulf Bank	-	48	19	8	12	93	76	51	6	45
Jordan Investment & Finance Bank	92	97	9	7	6	97	75	41	4	48
Jordan IS for Finance and Investment	99	21	11	8	46	90	72	75	9	48
Jordan Kuwait Bank	99	29	29	38	52	81	98	13	24	52
Jordan National Bank Plc	75	62	15	41	6	84	9	23	100	46
Philadelphia Investment Bank	69	65	22	46	6	97	13	75	57	50
Union Bank for Savings & Investment	60	56	25	68	48	100	58	100	14	59
Al Bank Al Saudi Al Fransi	41	46	31	87	56	73	12	100	34	53
Al-Rajhi Banking & Investment Corporation	45	98	8	56	91	13	66	91	17	54
Arab Investment Company SAA (The)	6	28	18	62	100	9	96	96	13	48
Arab National Bank	6	15	33	47	46	27	34	81	12	33
Arab Petroleum Invest. Corp.	10	14	20	32	56	38	47	60	100	42
Bank Al-Jazira	18	35	8	10	69	24	60	94	30	39
National Commercial Bank (The)	67	11	5	16	56	23	81	10	1	30
Riyad Bank	74	81	3	9	32	11	29	0	0	27
Saudi American Bank	33	100	1	13	9	8	6	0	0	19
Saudi British Bank (The)	52	99	0	21	6	6	16	7	1	23
Saudi Hollandi Bank	38	68	18	5	31	12	33	8	1	24
Saudi Investment Bank (The)	86	49	79	10	49	19	61	1	1	39
United Saudi Bank	52	13	64	11	21	100	92	0	1	39
Avg.	**49**	**40**	**30**	**37**	**40**	**37**	**53**	**44**	**22**	**39**

Source: Author's own estimation

Table 6-34: DEA estimates of Cost Efficiency for the banking sectors of Jordan, Egypt, Saudi Arabia and Bahrain over 1992-2000 (pooled data)

Firm	CRS			VRS			SE	NIRS
	TE	AE	CE	TE	AE	CE		
Al Baraka IS BSC	100	100	100	100	100	100	100	-
Al-Ahli United Bank (Bahrain) B.S.C.	71	72	51	72	79	57	98	drs
Alubaf Arab International Bank	100	52	52	100	70	70	100	-
Arab Banking Corporation BSC	85	82	70	100	100	100	85	drs
Arab Financial Services Company - AFS	100	100	100	100	100	100	100	-
Bahrain Development Bank B.S.C.	86	38	32	100	73	73	86	irs
Bahrain International Bank E.C.	100	37	37	100	37	37	100	-
Bahrain IS B.S.C.	100	79	79	100	96	96	100	-
Bahraini Saudi Bank (The) BSC	90	69	62	90	82	74	100	drs
Bank of Bahrain and Kuwait B.S.C.	66	71	46	76	90	69	86	drs
BMB Investment Bank - BMEB	65	49	32	68	69	47	95	drs
Commercial Bank of Bahrain B.S.C.	88	50	44	97	46	45	90	irs
Gulf International Bank BSC	90	48	43	100	85	85	90	drs
Investcorp Bank EC	100	100	100	100	100	100	100	-
National Bank of Bahrain	84	43	36	94	66	62	90	drs
Shamil Bank of Bahrain EC	70	96	68	74	93	69	95	irs
TAIB Bank E.C.	100	97	97	100	99	99	100	-
United Gulf Bank (BSC) EC	97	81	79	97	82	80	100	drs
Al Watany Bank of Egypt	83	58	49	85	57	49	98	irs
Alexandria Commercial and Maritime Bank SAE	84	63	53	87	62	54	97	irs
Arab African International Bank	91	82	74	100	100	100	91	drs
Arab Banking Corporation - Egypt	76	73	56	77	78	60	99	irs
Arab International Bank	68	37	25	87	84	73	78	drs
Arab Investment Bank - FABFDI	75	50	38	76	55	42	99	drs
Bank of Alexandria	100	45	45	100	82	82	100	-
Bank of Commerce & Development	81	84	69	83	83	69	98	irs
Banque du Caire	100	47	47	100	87	87	100	-
Banque du Caire et de Paris SAE	83	39	33	87	39	34	95	irs
Banque Misr	88	33	29	100	91	91	88	drs
Cairo Barclays Bank SAE	67	88	59	68	96	65	99	drs
Cairo Far East Bank	100	20	20	100	21	21	100	-
Commercial International Bank (Egypt) S.A.E.	86	49	42	90	77	69	95	drs
Credit Agricole Indosuez Egypte	97	62	61	100	62	62	97	irs
Delta International Bank	80	50	40	82	59	48	98	drs
Egyptian American Bank	88	29	25	98	53	52	90	drs
Egyptian Arab Land Bank	90	77	70	100	87	87	90	drs
Egyptian Gulf Bank	92	37	34	93	42	39	99	drs
Egyptian Saudi Finance Bank	100	39	39	100	50	50	100	-

Firm	CRS			VRS			SE	NIRS
	TE	AE	CE	TE	AE	CE		
Export Development Bank of Egypt	88	74	65	93	84	78	94	drs
Faisal IS of Egypt	99	61	61	100	85	85	99	drs
Housing and Development Bank	100	64	64	100	84	84	100	-
HSBC Bank Egypt S A E	77	76	59	77	76	59	100	drs
Misr America International Bank	85	45	38	86	52	45	98	drs
Misr Exterior Bank	92	27	25	100	39	39	92	drs
MISR International Bank	80	44	35	88	67	59	90	drs
MISR Iran Development Bank	62	78	49	65	83	54	96	drs
Misr Romanian Bank	100	46	46	100	48	48	100	-
Mohandes Bank	84	58	49	84	64	54	100	irs
National Bank for Development	81	68	55	89	83	74	91	drs
National Bank of Egypt	71	54	38	100	100	100	71	drs
National Societe Generale Bank SAE	89	47	42	89	50	44	100	drs
Nile Bank (The)	71	60	43	75	71	53	95	drs
Port Said National Bank for Development	84	76	63	100	92	92	84	irs
Société Arabe Internationale de Banque	90	31	28	90	34	30	100	irs
Suez Canal Bank	100	42	42	100	67	67	100	-
Arab Bank PLC	82	49	40	100	89	89	82	drs
Arab Banking Corporation (Jordan)	60	76	46	60	77	46	100	-
Arab Jordan Investment Bank	76	35	27	78	42	32	98	drs
Bank of Jordan Plc	77	50	39	78	64	50	98	drs
Cairo Amman Bank	72	47	33	74	62	46	96	drs
Housing Bank for Trade & Finance (The)	87	46	40	96	66	63	91	drs
Industrial Development Bank	100	69	69	100	70	70	100	-
Jordan Gulf Bank	100	53	53	100	55	55	100	-
Jordan Investment & Finance Bank	60	47	28	100	29	29	60	irs
Jordan IS for Finance and Investment	65	74	48	73	86	63	89	drs
Jordan Kuwait Bank	75	48	36	77	57	44	98	drs
Jordan National Bank Plc	73	60	44	78	74	57	94	drs
Philadelphia Investment Bank	55	93	51	100	91	91	55	irs
Union Bank for Savings & Investment	73	48	35	74	48	36	98	irs
Al Bank Al Saudi Al Fransi	80	79	63	89	100	89	90	drs
Al-Rajhi Banking & Investment Corporation	90	81	73	100	100	100	90	drs
Arab Investment Company SAA (The)	63	98	62	90	91	81	71	drs
Arab National Bank	74	58	43	93	94	88	80	drs
Arab Petroleum Invest. Corp.	92	71	65	100	100	100	92	drs
Bank Al-Jazira	69	50	34	79	75	60	86	drs
National Commercial Bank (The)	68	90	61	100	100	100	68	drs
Riyad Bank	81	81	66	100	100	100	81	drs
Saudi American Bank	100	73	73	100	100	100	100	-

Firm	CRS			VRS			SE	NIRS
	TE	AE	CE	TE	AE	CE		
Saudi British Bank (The)	100	100	100	100	100	100	100	-
Saudi Hollandi Bank	69	54	37	84	89	75	82	drs
Saudi Investment Bank (The)	97	61	59	100	78	78	97	drs
United Saudi Bank	100	57	57	100	76	76	100	-
Avg.	**84**	**61**	**51**	**91**	**75**	**68**	**93**	

Source: Author's own estimation

Chapter 7: Conclusion and Limitations

7.1 Introduction and Summary

This thesis investigates the efficiency levels of various Arabian banking markets; Jordan, Egypt, Saudi Arabia and Bahrain. These countries are emerging markets where the governmental authorities have implemented major economic and financial reforms, especially over the last decade. The empirical evidence on bank efficiency in these markets aims to highlight the features associated with the role of economic development and financial reforms that have taken place (in these countries).

The first part of this thesis (chapters 2 and 3) sets the scene by examining the main features of Arabic economies, placing developments in Jordan, Egypt, Saudi Arabia and Bahrain in context. The Arabian nation comprises 21 countries whose people speak the Arabic language and these countries can be classified economically into oil and non-oil exporting countries. The area, population and living standards for individual countries vary widely particularly in terms of per capita GDP and many of these countries suffer in terms of their poverty levels, high rates of illiteracy and low levels of human development. During the period 1982-91, the economic growth of Arabian countries (as measured by real GDP) slowed averaging 1.6 percent compared to 4 percent for other developing countries over the same period. Slow economic growth led to low levels of investment and high levels of unemployment, also associated with rising levels of external indebtedness and fiscal deficits, especially for non-oil exporting countries. As a result, many of the Arabian countries have undertaken macroeconomic reforms to promote economic growth and to face a new economic climate.

Over the last decade, the economic performance indicators of Arabia, including those under present study (Jordan, Egypt, Saudi Arabia and Bahrain), have generally improved compared to the 1980s, despite the difficult situation faced by various individual economies. Annual real GDP growth for the Arabic countries averaged 3.9 percent between 1992-1999 compared to 5.6 percent for all the world's developing countries over the same period. The other main economic performance indicators including those on trade, investment levels, rates of inflation, external debts and external reserves have all witnessed improvements over the same period.

The financial sectors of Jordan, Egypt, Saudi Arabia and Bahrain have witnessed major financial reforms over the last decade. The reforms include liberalising the financial systems, boosting banks' capitalisation in accordance with Basle standards, enhancing the systems of banking supervision and updating regulatory frameworks. The main aim of such deregulation is to improve the efficiency of banking firms as these reforms are expected to enhance competition leading to price falls, output increases, greater levels of innovation and improved productive efficiency. To date, however, empirical studies provide mixed evidence on the impact of deregulation on bank performance (European Commission, 1997; Cecchini, 1988; Gardener et al., 1988).

The financial systems of Jordan, Egypt, Saudi Arabia and Bahrain are characterised by the dominance of commercial banks in the financial system; for instance, their share of financial assets ranges from about 58 percent in Saudi Arabia to about 85 percent in Bahrain. In addition, the banking systems of these countries are concentrated (for instance, the share of the largest three banks ranged from about 49 percent of the banking sector in Saudi Arabia to about 79 percent in Jordan over the last decade). During the 1990s, the financial performance of banks operating in the countries under study have shown improvements in terms of their asset quality, capital strength and profitability. Furthermore, the financial sectors of these countries have become deeper according to various financial sector indicators.

The second part of this thesis (chapters 4 and 5) presents a theoretical overview and empirical evidence on banking efficiency. The focus is on economies of scale and productive efficiency – the most important areas relating to banking efficiency. Productive efficiency defines the relationship between output levels and some desirable objective functions such as cost minimisation, or revenue and profit maximisation given certain levels of technology. Chapter 4 and 5 discusses various types of methodological approaches that can be used to estimate cost, profit and alternative profit efficiency in banking, these are used later in the empirical part of this thesis. Finally, we provide an overview of the findings of the main empirical literature. Overall, X-efficiency dominates scale economies in banking, and scope economies are illusive. Our empirical evidence covers both parametric and non-parametric studies and outlines briefly the impact of banking sector reforms on efficiency.

7.2 The results and contribution to knowledge

A major aim of this thesis is to estimate efficiency levels in various Arabic banking sectors by applying various statistical analyses to a data set on Jordan, Egypt, Saudi Arabia and Bahrain. As pointed out by Berger and Humphrey (1997), there have been many studies that investigate banking sector efficiency using varying data periods, methodologies and countries but, at the same time, there is no consensus on the sources of the sizeable variation in measured efficiency. The undue variations in the bank efficiency studies undertaken so far make it impossible to determine how important the different efficiency concepts, measurement techniques and correlates used are related to the outcomes of these studies.

This thesis, in its turn, employs three distinct economic efficiency concepts (cost, standard profit, and alternative profit efficiencies), using a number of different measurement methods (including the stochastic frontier approach, specification of the Fourier-flexible functional form versus the translog form, and inclusion of bank's asset quality and financial capital in a number of different ways) to a single data set. As far as we are aware, this is the first comprehensive analysis of banking sector efficiency in Jordan, Egypt, Saudi Arabia and Bahrain.

In choosing the 'preferred' cost and profit models, we follow the recent efficiency methodologies that proceed by testing various model specifications to arrive at the preferred model. Based on these preferred models for cost, standard profit and alternative profit, different efficiency measures are reported for the banks in the countries under study. Given cost efficiency, the preferred model is the Fourier-truncated form that excludes the control variables (capital adequacy, asset quality and the time trend) but includes all the environmental variables. Given the standard and alternative profit function, the preferred model is the Fourier-flexible which includes the control as well as the environmental variables.

Overall, this thesis finds that efficiency levels differ according to the three various efficiency concepts that are used (cost, profit and alternative profit) and each method adds some independent informational value. A somewhat interesting result is that the choices made concerning the efficiency measurement method leads to somewhat similar model specifications. Furthermore, the correlation between efficiency levels, utilising the stochastic frontier and data envelopment analysis approaches, were around 40 percent despite the major differences in assumptions underlying each approach. These findings suggest that the cost efficiency estimates are robust to differences in methodology.

Based on the chosen preferred model, cost efficiency averaged around 95% over the 1992-2000 period. Given the standard and alternative profit function, technical efficiency averaged 66% and 58% respectively over the same period. Islamic banks are found to be the most cost and profit efficient, while investment banks are the least (cost and profit efficient). Based on bank asset size, large banks seem to be relatively more cost and profit efficient. Geographically, Bahrain is the most cost and profit efficient while Jordan is the least (cost and profit efficient). It should be noted that these results, in general, are similar to those found in other US and European banking studies. The results on scale efficiency also suggest that large banks are the most cost and profit efficient. Saudi Arabian, and to a lesser degree the Egyptian, banks are found to be the most cost and profit scale efficient.

Another major finding of this thesis is that there is little evidence to suggest that the major economic and financial reforms undertaken in Jordan, Egypt, Saudi Arabia and Bahrain over the last decade have had a noticeable impact on improvement in banking sector efficiency. The main policy recommendation from this study, therefore, is that these countries need to continue the reform process in order to enhance financial sector performance.

7.3 Limitations of the present study

Although this thesis employs various contemporary methodologies in the field of parametric frontier efficiency analysis, not all the different efficiency measurement approaches [such as the Distribution Free Approach, Allen and Rai (1996); Berger and Mester (1997); Berger et al. (1997) and the Thick Frontier Approach, Berger and Humphrey (1991 and 1992a); Bauer et al. (1993); Berger (1993)] are used in the study. A comparison of the results derived using these measures would provide stronger support for our findings.

The thesis could also have used measures of economies of scope to calculate whether there is product cost synergies in the banking systems. This research does not include such calculations because of the limitations associated with scope economies estimate. For instance, the main problem in estimating economies of scope concerns the complexity of the estimation techniques used, insufficient data about firms specialisation, and the risk of using data that are not on the efficient frontier, thus confusing scope economies and X-efficiencies (see for example, Berger, Hunter and Timme, 1993).

Another shortcoming of the present study may relate to the sample size which is confined to only four Arabian countries. It might be interesting to carry out the same research over a larger number of Arabian countries to compare banking sector efficiency across different Arabian regions. However, the lack of publicly available data on various Arabic banking markets made this impractical.

Finally, one should always bear in mind that while frontier efficiency models have advantages over traditional measures of efficiency, they must also be regarded as imperfect measures. For instance, it is not possible to include every item or dimension of a bank's output in model specifications, and banks that are producing a wide range of outputs or providing specialised services could, therefore, be judged less efficient than they really are (as these models do not take into account factors such as service or product quality). While the multi-product nature of a banking firm is widely recognised, there is still no agreement as to the explicit definition and measurement of banking inputs and outputs. Usually, each definition carries with it a particular set of banking concepts, relating to the production characteristics of the industry; in bank efficiency studies, the way output is defined and measured may influence considerably the results obtained (Berger and Humphrey, 1997). It should also be noted that this thesis uses the intermediation approach, however the well-known production approach could have been used for comparison purposes.

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