DISSERTATION

BANKING EFFICIENCY IN THE GULF COOPERATION COUNCIL COUNTRIES: AN EMPIRICAL ANALYSIS USING DATA ENVELOPMENT ANALYSIS APPROACH

Submitted by

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY ABDULWAHAB ALSARHAN ENTITLED [BANKING EFFICIENCY IN THE GULF COOPERATION COUNCIL COUNTRIES: AN EMPIRICAL ANALYSIS USING DATA ENVELOPMENT ANALYSIS APPROACH] BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

BANKING EFFICIENCY IN THE GULF COOPERATION COUNCIL COUNTRIES: AN EMPIRICAL ANALYSIS USING DATA ENVELOPMENT ANALYSIS APPROACH

Measurement and analysis of banking efficiency has received increasing attention in applied economics in recent years due to the rapid globalization of the financial industry and consequently, increasing competitiveness in international financial markets. Efficiency in a general term in economics describes how well a system performs in generating the maximum output for given inputs. Efficiency in banking industry terms is measured as the difference between the bank's position and its best production frontier. There are two main techniques that are used to evaluate banking efficiency, parametric methods and non parametric methods. The debate on which approach is more convenient for analyzing the efficiency of the banking industry is still open and has been the subject of many applied works (Luciano and Regis 2007).

This study analyzed the technical efficiency of the banking sector in the six Gulf Cooperation Council (GCC) countries during the period from 2000 until 2007. The two-stage approach is applied as suggested by Coelli, Prasada, and Battese (1998). A nonparametric data envelopment analysis (DEA) is employed to estimate banking efficiency in 50 GCC banks in the first stage, with the assumption of variable return to scale (VRS). In the second stage, the Tobit regression model is used to regress the efficiency level obtained from the first stage on factors that could influence the efficiency score.

The finding of the first stage indicated a progress in average efficiency scores for the banking sector in GCC countries during the period of study. In addition, the result showed that the most efficient banks to be in Qatar, followed by banks in Bahrain and the UAE.

The result of the second stage showed that there is a positive relationship between efficiency scores and profitability level. In addition, the results suggested that Islamic banks were associated with higher efficiency scores.

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DEDICATION

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1.1 Introduction:

Measurement and analysis of banking efficiency has received increasing attention in applied economics in recent years due firstly, to the rapid globalization of the financial industry and secondly, to increasing competitiveness in international financial markets. Efficiency in a general term in economics describes how well a system performs in generating the maximum output for given inputs. Efficiency is improved if more outputs are generated without changing inputs or fewer inputs with the same amount of outputs. Efficiency in banking industry terms is measured as the difference between the bank's position and its best production frontier. There are two main techniques that are used to evaluate banking efficiency: parametric methods, such as the stochastic frontier approach, and non parametric methods, mainly data envelopment analysis. The debate on which approach is more convenient for analyzing the efficiency of the banking industry is still open and has been the subject of many applied works (Luciano and Regis 2007).

This study will analyze the technical efficiency of the banking sector in the Gulf Cooperation Council (GCC) countries during the period from 2000 until 2007. We will follow the two-stage approach as suggested by Coelli, Prasada, and Battese (1998). A nonparametric data envelopment analysis (DEA) is used to estimate banking efficiency in GCC countries in the first stage, with the assumption of variable return to scale (VRS).

DEA is a performance measurement technique that was first used by Charnes, Cooper, and Rhodes in 1978. In the second stage, the efficiency score measures that derived from the DEA estimations will be used as the dependent variable and then regressed upon environmental variables.

1.2 Study Contributions:

Several contributions are made by this dissertation. First, to my knowledge this is the first study of GCC banks' efficiency using the two-stage approach. Second, this study will define and employ a unique set of inputs and outputs that have not been used previously in GCC banking studies. Third, the study will examine the efficiency level of the GCC banking system as a whole, and compare the efficiency level among GCC countries. Fourth, most of the studies of banking efficiency in the GCC countries are based on one-year analyses, and one year is not sufficient to observe the efficiency level. Hence, this study will evaluate the efficiency level for eight years. Finally, this study will use the most current data of banks in GCC countries to reflect the most recent changes in the banking deregulation and the competition level. In addition, the sample of this study will include most banks that operate in all six GCC countries.

1.3 The Gulf Cooperation Council (GCC):

The Gulf Cooperation Council (GCC) is an oil-based region established in 1981. This region ranks as the largest producer as well as exporter of petroleum. In this context, it plays a leading role in the world in general and in the Organization of the Petroleum Exporting Countries (OPEC) in particular. The GCC union consists of six oil-producing nations: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. The GCC was established with the objective of fostering cooperation among member nations in fields such as economics, finance, trade, and administration.

The GCC countries' economy has rapidly increased in size during the period 2000 to 2007 due to high oil prices and growth in other sectors. Table 1.1 gives a brief economic description of each country in the GCC region.

Table 1.1: GCC Economic Indicators

Country	Gross Domestic Product (GDP) 2007 ($ billions)	GDP-real growth rate 2007	Inflation rate 2007	World Trade Organization (WTO) membership
Bahrain	18.44	6.70%	3.25%	Jan. 1995
Kuwait	111.76	4.70%	5.50%	Jan. 1995
Oman	40.39	5.60%	5.90%	Nov. 2000
Qatar	71.04	8.40%	13.76%	Jan. 1996
Saudi Arabia	381.94	3.50%	4.11%	Dec. 2005
United Arab Emirates	180.18	7.50%	11.12%	Apr. 1996

Source: IMF and WTO.

1.4 Banking Sector:

The banking sector of the GCC region is heavily dependent on oil sector activities and is characterized by product improvement, development in technology and increasing competitiveness. The strength of the financial systems of the Gulf countries is supported by a high level of liquidity, a high amount of capital, high profitability and a high level of supervision by authorities.

GCC banks have been protected from foreign competition through regulations imposing barriers to entry. However, in reality the banking sector is facing many common challenges that are likely to affect their ability to grow and operate within a more competitive environment. That challenge to GCC banks results from their eventual commitment to liberalize the banking sector, by virtue of their membership in the WTO. GCC banks are expected to face a high level of competitive pressure from foreign banks, which will be allowed to enter together with local banks. The ability of GCC banks to meet this challenge and to survive in a more competitive environment will depend on their level of efficiency.

1.5 Statement of the problem:

The efficiency of a banking system is one of the most important issues in the financial market. A major focus of programs of banking and financial reform in GCC and other developing countries is the improvement in bank efficiency that may result from

exposing domestic institutions and markets to greater competition. I believe that a study of the efficiency of the GCC banking system is important for five reasons.

First, since the GCC countries have become WTO members, the banking and financial sectors in GCC will face serious challenges in the near future because they are being considered for liberalization. The banking system in GCC will be affected by this challenging environment because, with banking liberalization, any inefficient banks will be forced out of the market by more efficient banks. To be able to meet these challenges, bank managers as well as regulators need to determine the level and sources of efficiency in the banking industry as an indicator of performance both of individual banks and of the industry as a whole.

Second, for over ten years the private sector in GCC has increased opportunities for investment in public utilities, and GCC governments have faced the challenges of reforming their economies, diversifying their sources of income, and adjusting expenditure to conform to developments in public revenues. To meet these challenges, the private sector needs to assume a larger role in economic activities. One vehicle through which the role of the private sector can be enhanced is privatization, i.e., the sale of public sector assets to the private sector. Privatization is meant to reduce the role of the public sector in the economy and to stimulate economic activities and development by increasing the contribution of the private sector. In this regard, the banking and financial sector is expected to play an active role in mobilizing national savings to finance the projects to be implemented under the privatization program. The more efficient the banks are, the better they can perform this

function.

Third, most of the studies concerning the efficiency of banking systems have focused on developed countries, such as those of Europe and the USA, while very few studies have been carried out examining developing countries such as the GCC nations.

Fourth, the efficiency of banks is very important for consumers, as more efficient banks have lower service charges, better loan rates, better deposit rates and better quality services.

Finally, the study of efficiency features is important in helping policy makers evaluate how banks will be affected by increasing competition so that they can formulate policies that affect the banking sector and the economy as a whole.

1.6 Questions of the Study and Hypotheses to Be Tested:

In this dissertation, we will investigate and analyze the level of efficiency in the GCC banking sector, and then determine the variables that have an impact on the efficiency of GCC banks. To achieve this, we shall focus our attention on the following questions:

1- Did the banking sectors in GCC countries perform at the same level of efficiency during the period of study?

In this regard, we will divide the banks into six groups (as GCC countries) and then compare the various efficiency levels. Subsequently, we will test the differences between the country dummy coefficients.

2- Did the banking sector in the GCC region improve during the period of study?

For this purpose, we will analyze the efficiency level for all banks in the sample (taken as a whole) for each year in the period of the study, and then compare among the average of those years.

3- Was bank efficiency enhanced in a more competitive market structure?

Some of the GCC countries have more foreign banks than others, and banks in these countries are more competitive than banks in the countries having fewer foreign banks. To answer this question, we will compare among these countries.

Bikker (1999) investigated bank efficiency among European countries, and he stated that the entry of new competitors has seriously affected the competitive environment of the European banking industry. Also, this competition will force banks to become more efficient to avoid being driven from the market.

4- Does the size of a bank influence its efficiency level?

For this question, we will use efficiency measures derived from the DEA estimations as the dependent variable. We will then regress the efficiency score on the bank size measured by total assets (TA). The sign of the coefficients of

total assets will indicate the direction of the influence. We will use the t-test for the null hypothesis H_0: $\beta_1 = 0$ in each year against the alternative hypothesis H_A: $\beta_1 \neq 0$ at different levels of significant.

Buchs and Mathisen (2005) analyzed the efficiency of 20 Ghanaian banks, and they found that the size of banks matters substantially in the Ghanaian banking system efficiency. Hence, the size factor could act as a serious constraint on market entry.

Ariff and Can (2008) investigated the cost and profit efficiency of 28 Chinese commercial banks, and they concluded that medium-sized banks are significantly more efficient than small and large banks.

5- Does bank profitability have an impact on efficiency level?

In this context, we will use the efficiency measures derived from the DEA estimations as the dependent variable. We will then regress the efficiency score on bank profitability measured by return on equity (ROE). The sign of the coefficients of return on equity will indicate the direction of the impact. We will use the t-test for the null hypothesis H_0: $\beta_2 = 0$ in each year against the alternative hypothesis H_A: $\beta_2 \neq 0$ at different level of significance.

Casu and Molyneux (2003) found that there is a positive relationship between bank profitability and efficiency score. Ariff and Can (2008) found that profitability has an impact on bank efficiency.

6- Are Islamic banks more efficient than their traditional counterparts?

In this regard, we will introduce the dummy variable Islamic bank in the second stage to investigate whether there are efficiency differences between Islamic banks and traditional banks. We will also use the t-test for the null hypothesis H_0: $\beta_3 = 0$ in each year against the alternative hypothesis H_A: $\beta_3 \neq 0$ at different level of significance, and the sign of the coefficients of this dummy variable will indicate the direction of the influence.

The major component of the Islamic economic system is the absence of the payment or receipt of fixed interest rates from all business transactions, including those within the banking sector. In place of the fixed interest-rate regime, Islamic banks operate under the profit-loss sharing arrangement and the prohibition of interest.

Islamic banking is one of the most important issues in the Islamic countries' financial market, and it is proliferating very fast, not only in the Islamic countries but throughout the world. Since the inception of Islamic baking about three decades ago, the number of Islamic financial institutions worldwide has risen from one in 1975 to over 300 today in more than 75 countries (El Qorchi, 2005). Islamic banks are concentrated in the Middle East and Southeast Asia, but they are also present as niche players in Europe and the United States (Cihak and Hesse, 2008). In recent years the number of Islamic banks has increased rapidly in the GCC countries, and some of the traditional banks are in the process of transferring to the Islamic system.

Hassan (2005) examined the cost, profit, revenue, and x-efficiency of Islamic banks throughout the world. He concluded that the Islamic banking industry is relatively less efficient compared to its conventional counterparts.

1.7 Organization of the Study:

This dissertation is organized as follows:

Chapter one gives a brief background of the dissertation. It also presents an explanation of the problem statement of the study. In addition, it details the study questions and hypotheses of the study that are to be tested. The chapter also outlines the structure of the economics and the banking sector in the GCC countries.

Chapter Two provides a brief analysis of the economic structure and main economic indicators of the GCC countries as a whole. In addition, it presents a summary of the creation of the monetary union and single currency in GCC. It also discusses the historical background and objectives surrounding the establishment and organizing of the GCC. The remainder of the chapter provides a brief review of the economic structure and banking sector for each nation in the GCC region.

Chapter Three reviews the literature relevant to this study. It includes a summary of existing literature on banking efficiency using parametric and nonparametric methods. The chapter consists of two sections, the first one related to efficiency around the world and the second concerning efficiency in the GCC and the Middle East countries.

Chapter Four discusses the methodology used to analyze the problem stated in the study. It describes both parametric and nonparametric methods, and how they determine banking efficiency level. It also describes the two-stage approach methods that will be used in the empirical part of this study. In addition, it gives the definition of inputs and outputs that will be used to measure the efficiency score.

Chapter Five addresses the empirical results. It presents the result of employing the two-stage method. In the first stage, it gives the measurements of the technical efficiency score of the banking system in GCC countries by using DEA. In the second stage, it presents the results from regressing the efficiency level obtained from the first stage on factors that could influence the efficiency of banks by using a Tobit regression model.

Chapter six provides the summary and conclusions of the study, including the implications of the findings and some recommendations for future studies.

2 CHAPTER TWO: An OVERVIEW OF THE GULF COOPERATION COUNCIL (GCC)

2.1 Introduction:

The main purpose of this chapter is to briefly analyze the economic structure and main economic indicator of the Gulf Cooperation Council (GCC) countries[1] as a whole. In addition, we present a summary of the creation of the monetary union and single currency in GCC. We also discuss the historical background and objectives surrounding the establishment and organizing of the GCC. The rest of the chapter provides a brief review of the economic structure and banking sector for each nation in the GCC region.

2.2 Establishment:

Since achieving independence from the United Kingdom, the Gulf countries have pursued the goal of cooperation in the areas of politics, economics, security, culture, health, the media, and education. Sheikh Jaber Al-Sabah, president (Amir) of Kuwait, began the effort in 1976 while traveling throughout the Gulf region to promote economic union and cooperation among the Gulf countries. His efforts have come to be known as the beginning of the GCC (Alkhuzaim 2005).

[1] The GCC countries are located in the Arabian Peninsula in West Asia, occupying the region lying between latitudes 15° and 35° north and longitudes of 35° and 60° east of Greenwich. Iraq and Jordan lie in the north. In the south, the Arab Republic of Yemen and the Arabian Sea border the GCC states. The eastern side overlooks the Arabian Gulf. To the west lies the Red Sea (Secretariat General of GCC 2007).

A few years after Sheikh Jaber Al-Sabah's trip, the foreign ministers of the six Gulf countries (the United Arab Emirates, the Sultanate of Oman, the Kingdom of Bahrain, the State of Qatar, the State of Kuwait, and the Kingdom of Saudi Arabia), met in Riyadh (the capital of Saudi Arabia) on February 4, 1981. The closing statement they issued at the end of the meeting read, "The ministers agreed to establish a council for cooperation between the states of the Arabian Gulf, to form a Secretariat-General to achieve this goal, and to convene regular summit meetings at the ministerial level so as to realize the desired goals of these countries and their people." (Secretariat General of GCC 2007) After that, the heads of the six Gulf Arab countries met in the UAE on May 25, 1981, and announced the establishment of the GCC for the Arab states of the Gulf region. In November 1981, the council adopted an economic agreement calling on the member states to coordinate their monetary, financial, and banking policies in order to pursue a monetary union in the future.

Since the initial establishment of the GCC, the organization has improved and grown. According to the Secretariat-General of the GCC, the council now consists of four main organs:

1- The Supreme Council:

The Supreme Council is the highest authority of the GCC. It comprises the heads of state of GCC member countries. Its presidency rotates according to the alphabetical order of the names of the countries. The Supreme Council conducts two annual

sessions, one ordinary and one consultative. It may also call emergency sessions. Meetings take place in the member states.

2. The Ministerial Council:

The Ministerial Council comprises the foreign ministers or their deputies of the member states of the GCC. The presidency of the Ministerial Council remains with the country that has assumed the presidency of the last ordinary session of the Supreme Council. The Ministerial Council convenes its ordinary sessions once every three months. It may also call emergency meetings.

3. The Consultative Commission of the Supreme Council:

The Consultative Commission of the GCC Supreme Council resolved to set up the Supreme Council of the GCC, consisting of 30 members (five from each country for a term of three years, subject to extension).

4. The Secretariat-General:

The secretary-general, aided by assistant secretaries-general and the supporting staff, heads the Secretariat-General. Its official headquarters is in Riyadh, and it comprises the following sectors:

- Secretary-General's Office.
- Political Affairs Sector.

- Economic Affairs Sector.
- Military Affairs Sector.
- Human and Environmental Affairs Sector.
- Legal Affairs Sector.
- Financial and Administrative Affairs Sector.

2.3 Objectives:

The GCC nations have been strongly pursuing the goals for which the GCC was established. The immediate objective was to protect the Gulf area from the risk posed by the Iran-Iraq war and Iranian revolution. Hence, the GCC countries launched efforts to form a joint command and a joint defense network to protect themselves. However, the goals of the GCC have grown over time.

The overall aim of the GCC is to strengthen regional coordination and cooperation among the member states since they are in one of the most economically important areas in the world. According the charter of the GCC, the main objectives of the council are as follows:

1. To achieve cooperation, coordination, integration, and cohesion among the member states in all fields, culminating in their unity.
2. To deepen and reinforce the bonds, links, and cooperation existing among their peoples.
3. To adopt similar systems/laws in various fields, including the following:

a. Economic and Financial Affairs.

b. Commerce, Customs, and Transportation.

c. Educational and Cultural Affairs.

d. Social and Health Affairs.

e. Media and Tourism.

f. Legislative and Administrative Affairs.

4. To push forward the wheel of scientific and technological progress in the field of minerals, agriculture, water, and animal resources; to build scientific research centers; to establish joint ventures; and to encourage cooperation in the private sector to benefit all citizens.

2.4 Economic Overview:

2.4.1 Oil and Gas:

The GCC region is an oil-based area that ranks as the largest producer and exporter of petroleum. The GCC is a very important part of the global economy, and it plays a leading role in the world in general and in the Organization of the Petroleum Exporting Countries (OPEC) in particular. This region holds about half of the known global oil reserves and a quarter of the natural gas reserves. The GCC accounted for approximately 18% of global oil production and 39% of oil exports in 2006 (GCC Chartbook 2008). Also, it produces 6.5% of the global gas output. All six members of the

GCC have benefited from high energy prices and experienced a broad-based economic boom in recent years, although significant differences exist among the countries.

2.4.2 Gross Domestic Product (GDP):

Driven since 2003 by high oil prices and growth in other sectors, the GCC countries' economy has rapidly increased in size during the years 2000 to 2007. Table 2.1 shows that the aggregate GDP in current prices for the GCC area was $803.75 billion in 2007 and it is expected to be $1075.9, $856.34 and $982.79 billion in 2008, 2009 and 2010, respectively, because of the world economic crisis. The average GDP growth for the GCC countries was 7.5% for the last three years during the period of study. The high economic performance in GCC countries is because of the strong global oil demand, especially from China, an improvement in privatization activities, the growth of assets of central banks, and the strength of the GCC corporate sector. Finally, we have to notice that the GCC member states differ significantly in terms of population and aggregate output; hence, the GDP per capita is affected directly in this regard (see Tables 2.1 and 2.2).

Table 2.1: Aggregate GDP (in constant and current price) and per capita GDP for GCC countries, 2000-2010

Country	Subject Descriptor	Units	Scale	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Bahrain	GDP, constant prices	Annual percent change		5.23	4.62	5.19	7.25	5.64	7.85	6.65	8.07	6.12	2.64	3.47
Kuwait	GDP, constant prices	Annual percent change		4.69	0.22	3.01	17.33	10.24	10.62	5.14	2.51	6.33	-1.14	2.39
Oman	GDP, constant prices	Annual percent change		5.49	7.51	2.57	2.01	5.33	6.02	6.79	6.38	6.18	3.02	3.80
Qatar	GDP, constant prices	Annual percent change		10.94	6.32	3.20	6.32	17.72	9.24	15.03	15.35	16.40	17.99	16.37
Saudi Arabia	GDP, constant prices	Annual percent change		4.87	0.55	0.13	7.66	5.27	5.55	3.03	3.52	4.63	-0.91	2.90
United Arab Emirates	GDP, constant prices	Annual percent change		12.38	1.70	2.65	11.89	9.69	8.19	9.39	6.34	7.41	-0.60	1.55
Average				**7.26**	**3.48**	**2.79**	**8.74**	**8.98**	**7.91**	**7.67**	**7.03**	**7.84**	**3.50**	**5.08**
Bahrain	GDP, current prices	U.S. dollars	Billions	7.97	7.97	8.49	9.75	11.23	13.46	15.85	18.44	21.24	18.13	19.91
Kuwait	GDP, current prices	U.S. dollars	Billions	37.72	34.90	38.14	47.84	59.44	80.80	101.56	111.76	158.09	106.21	121.20
Oman	GDP, current prices	U.S. dollars	Billions	19.87	19.95	20.33	21.78	24.77	30.92	35.73	40.39	52.58	43.07	49.02
Qatar	GDP, current prices	U.S. dollars	Billions	17.76	17.54	19.36	23.53	31.73	42.46	56.92	71.04	102.30	99.74	133.30
Saudi Arabia	GDP, current prices	U.S. dollars	Billions	188.69	183.26	188.80	214.86	250.67	315.76	356.63	381.94	481.63	374.00	423.84
United Arab Emirates	GDP, current prices	U.S. dollars	Billions	70.22	68.68	75.89	88.96	107.30	135.20	164.17	180.18	260.14	215.20	235.52
Total				**342.23**	**332.29**	**351.01**	**406.72**	**485.16**	**618.60**	**730.85**	**803.75**	**1075.98**	**856.34**	**982.79**
Bahrain	GDP per capita, current prices	U.S. dollars	Units	11889.89	11719.42	12127.44	13725.67	15601.16	18322.67	21156.85	24137.60	27247.79	22808.84	24548.71
Kuwait	GDP per capita, current prices	U.S. dollars	Units	17012.78	15114.33	15761.11	18783.06	21585.56	27012.51	31908.76	33759.99	45920.25	30040.62	33606.49
Oman	GDP per capita, current prices	U.S. dollars	Units	8270.79	8220.77	8316.08	8858.20	9994.32	12324.93	13864.58	14725.17	18987.76	15402.35	17365.99
Qatar	GDP per capita, current prices	U.S. dollars	Units	29290.36	27030.27	28354.80	32787.55	41949.31	53332.91	67921.63	76373.73	93204.05	81860.59	98567.68
Saudi Arabia	GDP per capita, current prices	U.S. dollars	Units	9216.39	8736.41	8785.13	9758.02	11126.52	13657.95	15049.62	15724.47	19345.26	14655.54	16203.74
United Arab Emirates	GDP per capita, current prices	U.S. dollars	Units	23446.15	21685.14	22660.97	25051.74	28530.59	32926.95	38818.89	40147.12	54606.51	43856.71	46600.82
Average				**16521.06**	**15417.72**	**16000.92**	**18160.71**	**21464.58**	**26262.99**	**31453.39**	**34144.68**	**43218.60**	**34770.77**	**39482.24**

Source: IMF; author estimates.
Shaded cells indicate IMF staff estimates.

Table 2.2: Inflation rate, population and balance of payment for GCC countries, 2000-2010

Country	Subject Descriptor	Units	Scale	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Bahrain	Inflation	Annual percent change		-0.68	-1.22	-0.50	1.68	2.25	2.62	2.04	3.25	3.53	3.00	2.50
Kuwait	Inflation	Annual percent change		1.57	1.45	0.80	0.99	1.26	4.12	3.09	5.47	10.50	5.97	4.84
Oman	Inflation	Annual percent change		-1.20	-0.84	-0.33	0.17	0.67	1.85	3.44	5.89	12.61	6.20	6.00
Qatar	Inflation	Annual percent change		1.68	1.44	0.24	2.26	6.80	8.81	11.83	13.76	15.05	9.00	8.43
Saudi Arabia	Inflation	Annual percent change		-1.10	-1.14	0.23	0.59	0.36	0.63	2.31	4.11	9.87	5.50	4.48
United Arab Emirates	Inflation	Annual percent change		1.36	2.74	2.93	3.16	5.02	6.19	9.27	11.12	11.45	2.03	3.12
Average				**0.27**	**0.40**	**0.56**	**1.47**	**2.73**	**4.04**	**5.33**	**7.27**	**10.50**	**5.28**	**4.90**
Bahrain	Population	Persons	Millions	0.67	0.68	0.70	0.71	0.72	0.73	0.75	0.76	0.78	0.80	0.81
Kuwait	Population	Persons	Millions	2.22	2.31	2.42	2.55	2.75	2.99	3.18	3.31	3.44	3.54	3.61
Oman	Population	Persons	Millions	2.40	2.43	2.44	2.46	2.48	2.51	2.58	2.74	2.77	2.80	2.82
Qatar	Population	Persons	Millions	0.61	0.65	0.68	0.72	0.76	0.80	0.84	0.93	1.10	1.22	1.35
Saudi Arabia	Population	Persons	Millions	20.47	20.98	21.49	22.02	22.53	23.12	23.70	24.29	24.90	25.52	26.16
United Arab Emirates	Population	Persons	Millions	3.00	3.17	3.35	3.55	3.76	4.11	4.23	4.49	4.76	4.91	5.05
Total				**29.36**	**30.21**	**31.09**	**32.00**	**33.00**	**34.26**	**35.27**	**36.52**	**37.75**	**38.77**	**39.80**
Bahrain	BOP, Current account	U.S. dollars	Billions	0.85	0.23	-0.06	0.20	0.47	1.48	2.19	2.91	2.26	0.29	0.71
Kuwait	BOP, Current account	U.S. dollars	Billions	14.67	8.33	4.26	9.42	18.17	34.31	50.61	49.96	70.59	27.40	35.51
Oman	BOP, Current account	U.S. dollars	Billions	3.09	1.95	1.37	0.82	0.58	4.70	4.33	2.40	3.20	-0.10	1.04
Qatar	BOP, Current account	U.S. dollars	Billions	4.13	4.79	4.25	5.95	7.10	14.10	16.11	21.95	36.08	7.44	24.16
Saudi Arabia	BOP, Current account	U.S. dollars	Billions	14.34	9.37	11.89	28.09	52.10	90.60	99.63	95.76	139.04	-6.80	19.17
United Arab Emirates	BOP, Current account	U.S. dollars	Billions	12.14	6.54	3.76	7.59	9.80	24.29	37.08	28.99	41.09	-12.03	-2.47
Total				**49.21**	**31.20**	**25.47**	**52.05**	**88.22**	**169.47**	**209.95**	**201.97**	**292.26**	**16.20**	**78.11**

Source: IMF; author estimates.
Shaded cells indicate IMF staff estimates.

2.4.3 Inflation:

Table 2.2 shows that the inflation rate in the GCC region was very low at the beginning of the decade, especially until 2004. The percentage from 2000 to 2004 was between 0.27% and 2.73%. However, the area witnessed an explosive rate of inflation averaging 7.7% in the last few years. That rate is expected to decrease to 5.28 and 4.9 in 2009 and 2010, respectively, due to the wise and timely policies of the nations of the region, but inflation is still the biggest challenge for the GCC countries due to an excess amount of liquidity coming from large current account surpluses (Table 2.2).

2.4.4 Monetary Union:

"A factor indicative of an advanced stage of economic integration is a monetary union. The theory of an optimum currency area (OCA), introduced mainly by Mundell in 1961, is a major framework available to economists for assessing the feasibility of a monetary union. An OCA can be defined as a region that exhibits key elements necessary for, and which would profit by, having its own currency and its own monetary policy. The theory predicts that it is beneficial for countries to join a monetary union if they are highly economically integrated (Mundell, 1961)."[2]

The establishment of a monetary union has been the primary target of the GCC since the beginning of the organization. During the initial phase, the organizers paid attention to the economic convergence among member countries and the coordination of their monetary policies. The GCC states have pursued a monetary union for a long time, and

[2] Alsuhaibani 2004.

they are gathering information from the experiences of other monetary unions around the world.[3] This kind of union has several associated benefits: being able to prepare better for globalization challenges, to lower transaction costs, to increase cross-border trade and financial transactions, to sustain diversification, to improve risk awareness, and to boost foreign investment. In creating a monetary union, the GCC states have to decide on the exchange rate regime for the single currency. Accordingly, the states have already taken reform steps. On January 1, 2003, the GCC countries formally pegged their currencies to the dollar as a first step towards a monetary union, which they hope to establish by 2010. On the same date, they introduced a common external tariff, and on January 1, 2008, the GCC launched the common market, which provides equal treatment to GCC citizens in all economic activities. In December 2008, GCC heads of state signed an agreement to create a monetary council to manage the transition to a single currency and to eventually evolve into a regional central bank. The GCC countries are also becoming increasingly more integrated in international markets.

On the other hand, some unanticipated setbacks to achieving the monetary union have evolved. Oman decided at the end of 2006 not to join the single currency by the 2010 deadline, and in May 2007 Kuwait declared that it was moving from the dollar peg to an undisclosed currency basket, although it reaffirmed its commitment to join the union. Lastly, in May 2009 the UAE government decided not to participate in the planned GCC monetary union, citing its disappointment that the GCC had chosen to

[3] Presently there are five monetary unions in the world. Three of these unions are in Africa, one is in the Caribbean, and one is in Europe. The Caribbean and European unions, created a new currency. In the Southern African Common Monetary Area (CMA), the rand is the common currency in circulation (Khan 2009).

base the group's central bank in Riyadh instead of in the UAE. Although Oman and now the UAE both decided against joining the monetary union and Kuwait moved away from the dollar peg, Saudi Arabia, Bahrain, Kuwait, and Qatar agreed in June 2009 to proceed and to issue the GCC common currency by the year 2010 or possibly 2013. They would like to see Oman and the UAE change their decision and join the union in the near future.

2.5 GCC States' background, economics, and banking sector overview:

Because the GCC states occupy an important position in the world economy, we believe that it is important to provide brief basic general, economic, and banking sector information about the six member states of the GCC.

2.5.1 Bahrain:

The Kingdom of Bahrain is the smallest among the GCC countries, comprising approximately 40 islands[4] with a total area of 735.8 square kilometers. Its capital is Al-Manama, and it is located in the middle of the Arabian Gulf approximately 20 miles from the eastern coast of Saudi Arabia. Bahrain has been influenced by some of the European maritime powers. Portugal figured prominently in the 16th century, and the British gradually extended their power in the Gulf region during the 19th century. On August 14, 1971, the country became a member of the United Nations (Ali 1980).

[4] Bahrain Island is the largest island, and it gives the kingdom its name. The island occupies a land area of 600.92 square kilometers. It is linked by a bridge to Al-Moharraq Island, the location of the Bahrain international airport.

Economy:

During the 19th century and at the beginning of the 20th century, Bahrain's main sources of income were pearl diving, fishing, and seaward traditional trade. The discovery of oil in the Gulf area in 1932 improved the economy rapidly. Since then, Bahrain has made a number of economic achievements in the manufacturing and services sectors. These accomplishments have increased welfare and stability in the nation, and the living standards of the citizens have improved as well.

Bahrain's GDP grew at a rate of 8.07% in 2007, and in the last four years the average annual growth rate has been 7.17%. The GDP reached $18.44 billion in 2007, jumping from $0.635 billion in 1960. Oil is the main source of Bahrain's revenue although its dependence on oil has never been more than 26% in the past few years. Because Bahrain is less dependent on oil than other GCC country, it is the least affected when the price of oil drops. Bahrain has pushed to diversify its national economic base, and it has indeed become the most diversified economy in the Gulf region, particularly in its banking and financial sectors. Bahrain's economy is also supported by a strong fiscal policy characterized by controls on current expenditures and improvements in total revenue. In addition, the country became a World Trade Organization (WTO) member in January 1995 in order to increase its integration in international markets.

Monetary Policy:

A monetary policy is the means by which a central bank stabilizes the demand/supply disequilibrium. By regulating the volume and price of money and credit, a monetary policy helps achieve macroeconomic objectives in the form of low and stable inflation, high and sustainable growth, and financial stability[5].

The Monetary Policy Committee (MPC) was formed and authorized by the central bank of Bahrain to manage the monetary policy in the nation. The MPC monitors economic, financial, and liquid developments and sets interest rates for the facilities provided by the central bank.

In light of domestic and global economic and financial developments, a number of monetary decisions have been taken. For example, the MPC frequently influenced the interest rate in 2007 and 2008 (Table 1.3).

Table 2.3: Interest Rates in Bahrain, 2007-2008

	2007				2008			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Three Months Inter-Bank	5.1%	5.3%	5.4%	4.9%	3.3%	2.8%	3.2%	2.4%
Savings	0.32%	0.31%	0.36%	0.36%	0.31%	0.31%	0.35%	0.23%
Less Than Three Months	4.49%	4.27%	4.22%	3.78%	1.78%	1.68%	1.81%	1.16%
Three to 12 Months	5.23%	5.07%	4.17%	3.47%	1.64%	1.78%	1.88%	1.29%

Source: Central Bank of Bahrain

[5] Central Bank of Oman Report (2007).

The money supply in Bahrain has grown consistently since 2002; M1, M2, and M3[6] increased from $1.72bn, $6.91bn, and $8.08bn in 2002 to $5.05bn, $17.90bn, and $21.22bn in 2008, respectively. M1, M2, and M3 have exhibited a consistent positive growth trend in the past few years.

Banking Sector:

Bahrain's banking sector has grown rapidly in recent years and has became one of the main engines for economic growth. The improvement of the banking sector in Bahrain was marked by a gradual process that benefited from the area's financial needs in the mid-1970s (Grigorian and Manole 2005). Since then, the banking and financial institution sectors have remained the highest contributor to the country's GDP after the oil and gas sector, with a contribution of 25.5% at the end of 2006. The Central Bank of Bahrain (CBB) replaced the Bahrain Monetary Agency (BMA) on September 7, 2006, with the objective of strengthening the regulatory framework in Bahrain and further developing the banking and financial sector. The CBB also aims to raise confidence and prepare for further advancement. The CBB has granted more new licenses to

[6] Narrow Definition of Money Supply (M1): Currency in circulation with the public + sight deposits (private deposits). Money Supply in its Broad Definition (M2): M1 + Savings deposits + time deposits + foreign currency deposits + CDs. Money Supply in its Broader Definition (M3): M2 + private sector deposits + deposit-accepting investment companies.

international banks to offer a diverse range of banking activities. The total number of banks and financial institutions at the end of December 2008 was 415, including 124 banking institutions, 167 insurance firms, 48 investment business firms, 14 capital market brokers, and 34 specialized licensee firms (Hasan, Tanwar, and Shah 2009). The number of retail local and foreign banks was 9 and 15, respectively. In addition there were 64 wholesale banks and 36 representative offices.

The rapid rise in the number of banks in Bahrain led to a sharp jump in banking sector assets. Retail banks continued performing well in the period from 2004 to 2008. Table 1.4 shows that the total assets of retail banks in Bahrain grew by 300.34% (from $14.584bn. to $63.323bn.) from 2004 to 2008. It is important to note that the percentage of foreign assets to total assets at the end of 2008 (i.e., 53.3%) was higher than the percentage of all other assets to total assets (i.e., 46.7%).

Table 2.4: **Aggregate Balance Sheet of Banks in Bahrain, 2004-2008**

US$ Million

	2004	2005	2006	2007	2008
Assets					
Cash	105	110.9	137.9	136.3	176.7
Central Bank of Bahrain	680.1	914.9	937.9	2788.6	2471.4
Banks	2074.5	1976.9	2895.2	3879.6	6873.5
Private Non-Banks	5763.4	6957.6	8282.5	11468.7	16466
General Government	1373.7	1442.2	1508.2	1625.5	1832.9
Other Assets	359.9	446.8	714.9	1417.5	1713.3
Foreign Assets	4227.6	4643	8539.3	28037.9	33789.7
Total Assets	**14584.2**	**16492.3**	**23015.9**	**49354.1**	**63323.5**
	2004	**2005**	**2006**	**2007**	**2008**
Liabilities					
Central Bank of Bahrain	164.5	258.1	99.5	258.4	590.5
Banks	1182.8	1114.9	2843.2	5350.9	7081.7
Private Non-Banks	7068.4	8688.3	10149.3	14195.2	16825.7
General Government	1804.5	1753.3	2046.9	2523.3	3526.3
Other Liabilities	285.7	375.1	470.3	925.7	1071.4
Capital and Reserves	1229.4	1499.7	2115.4	3778.8	3768.4
Foreign Liabilities	2849.1	2802.9	5291.2	22321.8	30459.4
Total Liabilities	**14584.4**	**16492.3**	**23015.8**	**49354.1**	**63323.4**

Source: Central Bank of Bahrain

2.5.2 Kuwait:

The state of Kuwait is located in the northwest region of the Arabian Gulf, and its capital is Kuwait City. The eastern side of Kuwait overlooks the Arabian Gulf, and north of Kuwait lies the Republic of Iraq to the southwest is the Kingdom of Saudi Arabia. Kuwait used to be known as Qarin, which means an elevated area, in the early nineteenth century. The name Kuwait is derived from "koot," which denotes a fortress or castle and means a fortress-like structure built by the sea. Kuwait is considered the

gate to the northeast part of the Arabian Peninsula. The state includes some islands, one of which (Failakah) used to be inhabited before the Iraq invasion of Kuwait. The total area of the state is 17,818 square kilometers of mostly desert land, and the scarcity of water is one of the major physical problems.[7] Kuwait became an independent state on June 19, 1961, when Sheikh Abdullah Al-Salem Al-Sabah, president (Amir) of Kuwait at that time, cancelled the treaty signed on January 23, 1899, between Kuwait and Britain.

On August 2, 1990, more than 100,000 Iraqi soldiers backed up by 700 tanks invaded Kuwait in the early hours of the morning (BBC news on that day). The invasion sparked strong condemnation from leaders around the world. The United Nations Security Council, in an emergency session, called for the immediate and unconditional withdrawal of Iraqi forces from Kuwait, but the Iraqi regime headed by Saddam Hussein refused the order. On January 16, 1991, the Gulf War (known as the Desert Storm Operation) began expelling Iraqi troops from Kuwait. Led by U.S. forces, 12 countries joined the Gulf states in the war, and Kuwait was liberated on February 26, 1991. Kuwait celebrates this day every year along with its national day on February 25th.

[7] At the beginning of the 20th century, Shatt Al-Arab brought fresh water in boats to Kuwait. In 1939 a company was established to manage the fleet of boats to transport water from the Shatt al-Arab, where three reservoirs were built on the shore of the Gulf to collect and store water brought in boats at a rate of 8,500 gallons per day. In 1951 the Kuwait government established a small distillery seawater station in Mina Al-Ahmadi with a production capacity of 80,000 gallons of fresh water daily. Now, there are several seawater stations with a production of 256.2 million gallons a day as of 1998 (Ministry of Electricity and Water of Kuwait). http://www.mew.gov.kw

Economy:

Before the oil era, Kuwait's people got their income from pearling, fishing, boat building, and sea-going trade. However, due to the discovery of oil and the growth of the cultured pearl industry, led by Japan, the job opportunities have expanded and people have been drawn away from their traditional jobs. The appearance of Kuwait as an oil country has transformed the nation from one of a low per-capita income to one of a high per-capita income in a short time.

The Kuwait economy is now mostly dependent on oil. Petroleum accounts for nearly half of the GDP. National data show that the GDP increased from $37.72bn to $111.76bn between 2000 and 2007. The rise in oil prices during 2008, especially during the first half, supported the high GDP growth rate. In the past few years, the average annual growth rate of the GDP was 5.15%.

The balance of payment has also increased rapidly in the last few years. The booming oil prices as well as the expanding economy have both played a major role in the Kuwaiti economy. Hence, exports have grown faster than imports, resulting in a positive increase for the balance of payment. Moreover, increasing government revenues from oil exports have had a positive impact on the Kuwait government's budget.

Monetary Policy:

The central bank of Kuwait wants to develop a monetary policy for its banking and financial sector units to establish monetary stability in the country, control inflationary

pressures, and create conditions conducive to strengthening the sound financial positions of the local banking and financial system units in the state. The country also wants the monetary policy to be in line with the objectives of the general economic policies of Kuwait.

The interest rate on T-bonds, deposits, and lending is restricted by the central bank. Table 1.5 shows the declining interest rates in different categories in 2008. Interest rates in the Kuwaiti banking system also went down in 2008. The average lending rate dropped to 7.59% for 2008 compared to 8.54% for 2007. Also, the average deposit rate declined from 5.45% to 4.81% in 2007 and 2008, respectively.

Table 2.5: Interest Rates in Kuwait, 2001-2008

	One-Year T-Bonds	Average Deposit Rate	Average Lending Rate
2001	5.07%	4.54%	7.90%
2002	3.44%	3.15%	6.48%
2003	2.75%	2.42%	5.42%
2004	2.93%	2.65%	5.64%
2005	4.09%	3.47%	7.50%
2006	5.66%	4.92%	8.58%
2007	5.27%	5.45%	8.54%
2008	2.40%	4.81%	7.59%

Source: Central Bank of Kuwait

"Money Supply in its broad definition (M2) recorded a noticeable rise of KD 3263.4 million or 19.1% to KD 20393.5 million at end of the fiscal year 2007/08, against KD 17130.1 million at the end of the fiscal year 2006/07. This rise in supply resulted from the rise in both Quasi-money by KD 2428.5 million or 18.5% (from KD 13108.8 million to

KD 15537.2 million) and money (the narrow definition of money supply M1) by KD 835 million or 20.8% (from KD 4021.3 million to KD 4856.3 million)."[8]

Banking Sector:

The banking sector is the core of the financial system in Kuwait. The central bank of Kuwait is pushing to make banking regulation and supervision meet international standards. Banks in Kuwait have benefited from strong economic growth during the past few years due to high oil prices and production. The increasing of domestic demand for raw materials and other consumer items has fueled momentum in non-oil activities, especially in the banking sector. Furthermore, the government's efforts to diversify the economy and improve the investment climate through regulatory and structural measures in various sectors have augured well for the banking sector. In addition to the central bank of Kuwait, the banking sector includes 10 local banks[9] and seven branches from abroad.[10]

The total assets of local banks witnessed a noticeable rise of 28% at end of the fiscal year 2007/08 to reach $129.6 billion compared to $101.2 billion at end of the fiscal year

[8] The Annual Report of the Central Bank of Kuwait for the Fiscal Year 2007/08.

[9] Local banks consist of **six commercial banks** (National Bank of Kuwait [NBK], Commercial Bank of Kuwait [CBOK], Gulf Bank [GB], Al-Ahli Bank of Kuwait [ABK[, Bank of Kuwait and the Middle East [BKME], and Burgan Bank [BB]); **one specialized bank** (Industrial Bank of Kuwait [IBK[); **and three Islamic banks** (Kuwait Finance House [KFH[, Boubyan Bank [Boubyan], and Kuwait International Bank [KIB]).

[10] The branches from abroad are the Bank of Bahrain and Kuwait, the BNP Paribas Bank, the HSBC Middle East Bank, the National Bank of Abu Dhabi ,the Doha Bank (DB), the Qatar National Bank(QNB), and Citibank of New York.

2006/07. This increase resulted from several developments on the balance sheet. For example, there was a 36.4% rise in claims in the private sector to $81.37 billion at end of the fiscal year 2007/08 compared to $59.63 million at the end of the fiscal year 2006/07. This rise resulted from an increase in the both credit facilities for residents and in domestic investments. The 74.3% growth in total assets also resulted from the rise in foreign assets of local banks by $11.03 billion, from $14.85 billion at the end of 2006/07 to $25.89 in the following fiscal year.

Table 2.6: Aggregate Balance Sheet of Banks in Kuwait, 2005-2007

US $ Million

	2005/06	2006/07	2007/08
Assets:			
Cash	320.508	377.232	341.388
Claims on CBK	347.304	3194.64	3898.296
Time Deposits with CBK	3777.54	9612.108	2291.58
Local Inter-Bank Deposits	4284.576	4221.24	6603.3
Claims on the Government	8384.712	6827.064	6241.728
Claims on the Private Sector	47495.74	59626.32	81371.45
Foreign Assets	14923.28	14855.08	25888.42
Other Assets	1859.364	2556.06	2939.904
Total Assets	**81393.02**	**101269.7**	**129576.1**
	2005/06	**2006/07**	**2007/08**
Liabilities:			
Private Sector Deposits	48541.48	57388.33	68652.4
Government Deposits	3401.004	5400.96	6690.996
Local Inter-Bank Deposits	3842.268	4340.256	6392.064
Shareholders' Equity	10121.58	11538.64	16539.4
Foreign Liabilities:	9399.132	14981.75	22988.18
Other Liabilities	6087.564	7619.808	8312.328
Total Liabilities	**81393.02**	**101269.7**	**129575.4**

Source: Central Bank of Kuwait and author estimates

2.5.3 Oman:

The Sultanate of Oman is situated in the southeastern part of the Arabian Peninsula. It has borders with the UAE in the northwest, Saudi Arabia in the west, and Yemen in the southwest. Oman has a coastline of 1,700 kilometers, beginning from the farthest point in the southeast where the Arab Sea and the gateway to the Indian Ocean lie, extending up to the Gulf of Oman, and ending at the Hormuz Strait, which is the gateway to the Arabian Gulf. Oman's total area is estimated at 309,500 square kilometers, and its capital is Muscat.

Oman was isolated from the outside world for many years, but since Sultan Qaboos came to the power in 1970 the plans and objectives of the government have been transformed, and the society has changed rapidly in almost every respect. Oman had never entered into agreements with Britain as did other countries in the Gulf. The British government had been closely involved in Oman since the middle of the 19th century, but Britain was under no official obligation to defend it.

November 18th is Oman's national day, and the Omani people celebrate it every year. This celebration is referred as Oman's renaissance, and it honors the efforts of Sultan Qaboos.

Economy:

Before 1970, the Omani economy was inactive, and the society was poor. The citizens got their income from the production of a few agricultural products, from fishing, and from herding. However, in the late 1960s, oil came to Oman, and with the change of leadership and the massive increases in the price of oil in 1973, the country had a chance to tackle its backwardness rapidly and more effectively. Since then, Oman's national economy has grown.

The development strategy resulted in a high real average GDP growth rate of 5.3% from 2000 to 2007 and a low inflation rate averaging 1.2% annually during the same period. Oman has also registered surpluses in both its overall fiscal position and balance of payments. An increasing focus on non-oil sectors for future growth is playing an important role in driving the GDP growth. The oil sector accounted for 45.3% of Oman's GDP in 2007. The non-oil sector contributed approximately 14.3% of the nominal GDP at the same time, and the services sector share was 39%. With a population of 2.74 million in 2007 and a per capita income of $14,725, Oman's social challenge was to provide more employment opportunities for its citizens. The government continues to tackle this need.

Monetary Policy:

The fine-tuned monetary policy of the central bank of Oman has supported the financial system's strength and resilience, aided the development of financial products and markets, and led to steady financial deepening in the economy.

For liquid-management purposes, the banks use a number of direct and indirect instruments. The central bank of Oman raised the reserve requirement from 3 percent to 5 percent effective in February 2008. In June 2008, the bank raised the reserve requirement to 8 percent. With a view to containing fast growth in credit, the central bank of Oman decided to reduce the lending-to-deposit ratio from 87.5 percent to 82.5 percent in June 2008. Furthermore, the central bank's certificates of deposits (CDs) and interest rate ceiling of 8 percent have helped absorb excess liquidity.

The narrow money (M1) representing the aggregate currency with public and demand deposits increased by 56.3% between 2006 and 2007. The broad money (M2) comprising narrow money and quasi money increased by 37.2% in 2007. The quasi money's savings time deposits, margins, and foreign currency deposits registered an average growth of 16% from 2002 to 2007.

Table 2.7: Money Supply in Oman, 2003-2007

	M1		M2	
	US $ Million	**% of Change**	**US $ Million**	**% of Change**
2003	2090.66	4.5	7361.38	2.5
2004	2359.24	12.8	7655.18	4
2005	2933.06	24.3	9290.06	21.4
2006	3196.96	9	11599.38	24.9
2007	4995.38	56.3	15911.48	37.2

Source: Central Bank of Oman and author estimates.

Banking Sector:

The banking sector in Oman is the smallest in the GCC countries (six local banks, ten foreign banks and three specialized banks), with the top four banks holding approximately 80% of the total banking assets. On the whole, commercial banks operating in the nation have experienced positive growth. Because of active expansion on the real estate and industry fronts, the banks' total credit increased by 38.3% to reach $16.9bn in 2007, compared to $12.2bn in the previous year. The cumulative assets of Omani's commercial banks increased 42.5% from $18.85 billion in 2006 to $26.87 billion in 2007. Asset growth was evident along with an improvement in the quality of assets. Asset quality for all Omani banks improved significantly on the heels of strong macro-economic fundamentals (El-Quqa, Hasan, Ahmed, and Shenoy 2008).

Table 2.8: Aggregate Balance Sheet of Banks in Oman, 2003-2007

US $ Million

	2003	2004	2005	2006	2007	% Change 2006-2007
Assets:						
Cash and Deposits with CBO	347.62	436.28	364.78	647.14	1733.42	167.9
Due from Banks Abroad	911.3	1418.56	1927.38	3144.96	3510.52	11.6
Total Credit	8601.58	9114.82	10130.64	12227.8	16914.04	38.3
Securities	1414.4	1308.06	1553.5	1880.06	3643.9	93.8
Fixed assets	95.16	92.04	97.24	94.9	191.88	102.4
Other assets	305.5	340.86	564.2	860.34	878.8	2.1
Total Assets	**11675.56**	**12710.62**	**14637.74**	**18854.94**	**26872.56**	**42.5**
	2003	**2004**	**2005**	**2006**	**2007**	**% Change 2006-2007**
Liabilities:						
Total Deposits	7416.76	8003.58	9779.9	12180.74	16877.64	38.6
Due to Banks Abroad	1037.14	815.1	506.22	1402.96	2887.3	105.8
Core Capital and Reserves	1426.62	1526.98	2032.42	2340	3791.32	62
Supplementary Capital	286.26	260.78	309.92	319.28	735.02	130.1
Specific Provisions and Reserved Interest	965.12	928.2	723.06	665.34	563.42	-15.3
Other Liabilities	543.66	1175.98	1286.22	1946.36	2018.12	3.7
Total Liabilities	**11675.56**	**12710.62**	**14637.74**	**18854.94**	**26872.82**	**42.5**

Source: Central Bank of Oman and author estimates.

2.5.4 Qatar:

The State of Qatar is a small peninsula of about 11,521 square kilometers lying along the west coast of the Arabian Gulf, and its capital is Doha. It has a number of islands, the most important of which are Halool, Shiraaw, and Al-Ashat. Qatar has a land border with Saudi Arabia at the west neck of the peninsula. Its landscape consists of desert with some limestone outcrops in the Dukhan area in the north.

Qatar signed a protection agreement with Britain in 1916. This agreement lasted until September 3, 1971, when the government of Qatar cancelled it and became independent. Qatar celebrates that day every year on December 18th. On June 27, 1995, Hamad bin Khalifa Al-Thani deposed his father Amir Khalifa Al-Thani (president of Qatar) in a bloodless coup. An unsuccessful counter-coup was staged in 1996. The new Amir (Hamad bin Khalifa Al-Thani) announced his intention for Qatar to move toward democracy. Since then, he has permitted a free and more open press and has instituted municipal elections as a precursor to expected parliamentary elections.

Economy:

During the pre-oil period, Qatar's economy was based on the traditional jobs of pearl diving, fishing, and herding. Economic development began after the discovery of oil in 1939, with the first shipment going out in 1949. The exports increased sharply during the last third of the 20th century. Since then, the government of Qatar has been the major force behind the country's economic development.

The Qatari economy registered a significant growth in the past few years and has been one of the fastest growing economies of the region. The average GDP growth rate of 14.75% for the last five years was the greatest in all the GCC countries. Consequently, the GDP per-capita rate was lifted to a record level of $76,373.73 in 2007. Thus, Qatar has continued to be one of the top 10 countries in the world and the first in the GCC region to have its GDP per-capita rate exceeding the $70,000 level. However, this improvement in growth has been heavily dependent on oil and gas, which account for

about 60% of the GDP. The Qatar government's economic policy has focused on increasing private and foreign investment in non-energy sectors. Qatar has launched an imposing domestic investment program aimed at diversifying its economy. The ongoing diversification plans will play a major role in balancing the risks of the declining oil and gas prices facing the world.

Monetary Policy:

Since its establishment in 1993, the Qatar Central Bank (formerly called the Qatar Monetary Agency) has had full powers over the monetary policies of the state. The main objective of the central bank is to regulate monetary strategies and banking policies in accordance with the general plans of the country and to support the national economy as a whole.

The bank reduced the deposit rate of 5.15% in 2006 to 4% in 2007.The lending rate is the key rate used to convey signals to the market and to reveal adjustments to the country's monetary policy stance. The central bank kept its 2006 lending rate and repo rate 5.5% in 2007.

Table 2.9: Interest Rates in Qatar, 2003-2007

	Repo Rate	Lending Rate	Deposit Rate
2003	1.53%	1.33%	1.23%
2004	3.15%	2.6%	2.5%
2005	5.1%	4.5%	4.4%
2006	5.55%	5.5%	5.15%
2007	5.55%	5.5%	4%

Source: Qatar National Bank

As of 2007, the broad money supply (M2) reached $32.34bn, up from $24.37bn the previous year. M1, which consists of currency in circulation, and demand deposits increased to a new record level of $9.72bn by the end of 2007. Thus, it reported a high growth rate of 26.8% over the $7.66bn reported in 2006. M2 increased by 32.6% on the heels of the growth in both M1 and Quasi Money by 26.8% and 35.3%, respectively. Qatar liquidity increased greatly during the period 2002-2007. This provided different sectors with huge credit facilities for growth and expansion.

Table 2.10: Money Supply in Qatar, 2002-2007
US $ Million

	Money Supply (M1)	Quasi Money	Money Supply (M2)
2002	1729.22	7109.92	8839.14
2003	3100.92	7133.92	10237.59
2004	4013.98	8322.10	12336.08
2005	6148.71	11523.22	17671.93
2006	7666.74	16710.80	24377.54
2007	9726.57	22618.10	32344.67

Source: Qatar Central Bank and author estimates.

Banking Sector:

According to the Qatar National Bank, one of the main highlights of the Qatari banking system in 2007 was the rapid expansion of banks both regionally and internationally involving branches, representative offices, equity stakes, joint ventures, and acquisitions.

The Qatari banking sector comprises a combination of national and foreign banks. A total of 17 banks currently operate in Qatar, including ten local banks (six commercial

banks, three Islamic banks, and one specialized government bank which provides financing to the small and medium scale industries) and seven foreign banks. The Qatar Central Bank has introduced major international standards applicable to banking supervision and regulations.

The banking sector in Qatar would be one of the major beneficiaries of the diversification program established by the government. During the last few years, banks in Qatar have extensively focused on improving their quality of assets. The Qatar Central Bank supports this plan, which should boost investors' confidence in the banking sector.

During the period 2003 to 2007, the total assets of the local banks grew at an average of 40.9%. The total assets of domestic banks increased from $52.099 billion in 2006 to $80.93 billion in 2007, a growth of 55.3%. According to El-quqa, Hasan, Bhatt, and Rout (2008), a major portion of this growth in assets came from foreign assets (banks abroad, credit outside Qatar, and investments abroad), which grew at a steep rate of 59.2%. In addition, the banking sectors' domestic credit portfolio, which grew by $40.7, accounted for 50.0% of the total banking assets.

Table 2.11: Total Assets of Banks in Qatar, 2003-2007

$ Million

	Total Assets = Total Liabilities
2003	20832.07
2004	25206.46
2005	35705.21
2006	52099.97
2007	80930.65

Source: Qatar Central Bank and author estimates.

2.2.5 Saudi Arabia:

The Kingdom of Saudi Arabia is situated in southwestern Asia and occupies four-fifths of the Arabian Peninsula, with a total area of approximately 2,250,000 square kilometers. It has land borders with all states in the GCC region except Bahrain, which has a sea border connected by a bridge with Saudia Arabia. Furthermore, it is bordered by Jordan on the northwest, Iraq on the north and northeast, and Yemen on the south. Riyadh is the capital. Saudi Arabia is the birthplace of Islam (the world's second-largest religion) and home to Islam's two holiest places, Mecca and Al-Medina. Saudi Arabia's efforts to take care of these two holy places and to provide comfort and safety to visitors have grown each year. The Saudi king's official title is "Custodian of the Two Holy Mosques." The modern Saudi state was founded and named Saudi Arabia in 1932 by Abul-Aziz Bin Abdul-Rahman Bin-Saud after a 30-year campaign to unify most of the Arabian Peninsula. Since then, the Independence Day of Saudi Arabia is celebrated September 23rd each year.

Economy:

Before the discovery of oil in the Arabian Peninsula, the Saudi Arabian economy was troubled. Before the 1930s, the region that would later come under the control of the Saudi state was comprised of several regions that lived off specific resources and relied on different sources of income. The western area, for example, depended on subsistence agriculture, some long-distance trade, herding, and services rendered to

pilgrims traveling to the holy cities. A plantation economy that grew dates and other cash crops dominated the eastern area. Because of the scarcity of water, many people were forced to travel from place to place rather than having permanent habitation.

The discovery of oil in 1938 came just six years after the establishment of the Kingdom of Saudi Arabia. The emergence of the nation as an oil country has transformed it to one of the largest producers and exporters in the world.

The Saudi Arabian economy draws 75% of its budget revenues and 90% of its export earnings from the oil industry, which comprises approximately 35% of Saudi Arabia's GDP. In this regard, Saudi's GDP recorded a growth rate of 3.52% in 2007. From 2003 to 2007, the average annual growth rate was 6.25%. The GDP reached $381 billion in 2007 (which is the largest amount in the GCC region) It was just $188 billion in 2000. Saudi Arabia's economic performance has been significant over the years. With more than 20% of the world's oil reserves, Saudi Arabia remains committed to economic diversification throughout the country.

Monetary Policy:

The Saudi Central Bank (called the Saudi Arabian Monetary Agency) has continued to pursue its conservative monetary policy in recent years to maintain price stability, support domestic economic activity, and keep up with national and international economic developments.

Interest rates on deposits in Saudi Arabia declined in 2007 in line with the general trend of interest rates in the international financial markets. The average interest rate decreased by 23 basis points to 4.79 percent during 2007.

As a result of rising inflation in 2007, the Saudi Arabian Monetary Agency raised the statutory reserve requirement for banks from 7 percent to 9 percent of their demand deposits. The purpose of this action was to absorb part of the surplus liquidity in the banking system and also to curtail the lending capacity of banks, with a view to relieving inflationary pressures.

The annual M1, M2, and M3 growth rose from 10.3%, 20%, and 19.3 (between 2005 and 2006) to 22.6%, 23.7%, and 19.5% (between 2003 and 2007), respectively. According to the monetary agency, the increase in the growth rate of money in 2007 was the result of the 21.4% hike in bank claims in the private sector and the substantial growth in the net domestic expenditures of the government on development projects and social services during the year.

Table 2.12: Money Supply in Saudi Arabia, 2002-2007
US $ Million

	M1	M2	M3
2002	53822.17	82557.62	103853.6
2003	59323.85	89483.46	111045.7
2004	72166.6	108521.6	131962.1
2005	75421.37	119382.1	147277.6
2006	83189.37	143312.6	175715.1
2007	102026.2	177319.9	210074.8

Source: Saudi Arabian Monetary Agency and author estimates.

Banking Sector:

The Kingdom has a profitable and stable banking sector, closely regulated by the Saudi Arabian Monetary Agency. The banking sector comprises 13 Saudi-owned banks and eight branches of foreign banks. In addition to those banks, which meet general banking needs, the nation has five government-developed credit institutions (which support real estate, industry, agriculture and public investment),designed to meet private and corporate financing needs.

Saudi's banking sector has recorded good growth rates in its financial positions. Saudi banks are expected to benefit from positive economic conditions currently prevailing in the region. Oil revenues are at an all-time high, and the government continues to focus its efforts on increasing the non-oil sectors' participation in the country's economic development and growth.

During the period from 2003 to 2007, the total assets of the Saudi banks grew at an average of 18.5%. In 2007, claims on the private sector accounted for 53.7% of the total assets while foreign assets accounted for 13.7%. However, foreign assets rose by 82% for the period from 2003 to 2008. For the last two years shown in Table 2.13, domestic banking's total assets amounted to $286 billion at the end of 2007, compared to $229 billion at the end of 2006, a growth rate of 24.8%.

Table 2.13: Aggregate Balance Sheet of Banks in Saudi Arabia, 2003-2007

US $ Million

	2003	2004	2005	2006	2007
Assets:					
Reserves	7092.358	8521.31	8683.836	13848.23	28891.32
Foreign Assets	21567.81	24684.27	24320.38	34525.74	39291.39
Public Sector Enterprises	46966.56	46761.2	42421.15	42085.99	48309.06
Claims on the Private Sector	60777.28	83504.85	115956.3	126621.3	153716.6
Claims on Non-Monetary Financial Institutions	119.434	124.754	143.108	222.642	380.114
Other Assets	8501.892	10735.23	10389.43	11746.03	15420.29
Total Assets	**145025.3**	**174331.6**	**201914**	**229049.4**	**286008.8**
	2003	**2004**	**2005**	**2006**	**2007**
Liabilities:					
Banking Deposits	96297.32	115966.7	130176.9	157274.9	190872
Foreign Liabilities	10656.76	12168.97	17300.64	15746.93	27986.66
Capital and Reserves	12508.12	13895.31	17717.73	21265.9	28202.92
Profits	3234.028	4408.684	6812.526	9220.89	8050.224
Other Liabilities	22328.84	27892.23	29906.11	25541.05	30896.96
Total Liabilities	**145025.3**	**174331.6**	**201914**	**229049.4**	**286008.8**

Source: Saudi Arabian Monetary Agency and author estimates

2.5.6 United Arab Emirates (UAE):

The United Arab Emirates (UAE) is a federation of seven former states including Abu-Dhabi (which the capital of the UAE), Dubai, Ajman, Al-Fujairah, Ras Al-Khaimah, Al-Sharjah, and Umm Al-Qaiwain. Each entity preserves its separate identity with its own rules. The Emirates were established December 2, 1971 (with that day celebrated each year), after the British withdrew from the country and awarded independence to the UAE. After World War II, Britain granted internal independence to the Trucial States (Emirates), and a council of the Trucial States was formed in 1952. Following the

promise by the British government that it would end its influence in the Gulf by late 1971, a discussion of the federation began in January 1968, and the Trucial States became a federation known as the UAE in 1971. Sheikh Zayed Bin Sultan Al-Nahyan became the president of the UAE at that time, and Sheikh Rashid bin Saeed Al Maktoum, Emir of Dubai, became the UAE vice president and prime minister. Shiekh Khalifa Bin Zayed has been the president of the UAE since 2004.

The total area of the UAE is approximately 83,600 square kilometers, bordered by Saudi Arabia on the south and west, Oman on the east, and the Arabian Gulf on the north.

Economy:

Before the discovery of oil in the area in 1965, pearling, fishing, boat building, sea trading, and a limited amount of farming in a few locations (where fresh water was available) were the principle jobs of people in the separate emirates.

The discovery and export of oil resulted in a major transformation of the emirates' economies. Oil revenues, especially from Abu Dhabi and Dubai, supported local development and gradually became the main engine of growth for the area.

The UAE has the second largest economy in the GCC after Saudi Arabia. It boasts one of the most open and integrated economies in the region, with a high per-capita income and a healthy annual trade surplus. During 2007, the economy grew well, with the GDP increasing by 9.75% to reach $180.16 billion. Nearly 40% of the GDP is still directly based on oil and gas output. The UAE, however, has launched a diversification and

liberalization program to reduce its dependency on oil and to transform its economy from a traditional, labor-intensive system to one based on knowledge, technology, and skilled workers. The UAE has invested heavily in sectors such as aluminum production, tourism, aviation, re-export commerce, and telecommunications.

Monetary Policy:

The central bank of the UAE formally launched on December 11, 1980, in order to manage monetary, credit, and banking policies and to supervise their implementation to help support the national economy and stability of the currency.

For liquid-management purposes, the central banks of the UAE use a number of instruments. The interest on three months of inter-bank deposits increased from 4.81% in Q1-2006 to 5.38% by the end of 2006. However, the interest rates declined to 5.14% by the end of 2007. Following the same trend, the lending rates and deposit rates for the three-month period also inched up during 2006 and then gradually came down in 2007.

Table 2.14: Interest Rates in the UAE, 2006-2007

	2006				
	Q1	Q2	Q3	Q4	Average
Three-Month Inter-Bank Rate (average)	4.81%	5.17%	5.48%	5.38%	5.21%
Lending Rate to Business (average)	7.93%	8.12%	8.02%	8.05%	8.03%
Three-Month AED Deposit Rate	3.91%	4.16%	4.44%	4.43%	4.24%
	2007				
	Q1	Q2	Q3	Q4	Average
Three-Month Inter-Bank Rate (average)	5.38%	5.26%	5.17%	5.14%	5.24%
Lending Rate to Business (average)	8.14%	7.47%	7.77%	7.98%	7.84%
Three-Month AED Deposit Rate	4.34%	4.30%	4.22%	4.23%	4.27%

Source: Central Bank of the UAE and author estimates.

The monetary and banking indicators rose during 2007. The money supplies, as measured by the M1, M2, and M3, have exhibited consistent positive trends during the past few years. As of 2007, the M1, M2, and M3 reached $49.05 billion, $152.7 billion, and $187.98 billion, and ncreased by 51%, 41%, and 37%, respectively. According to the central bank of the UAE, a review of the factors influencing broad money (M2) shows that the effect of net foreign assets was expansionary. Likewise, the effect of net domestic credit on broad money (M2) was expansionary.

Table 2.15: Money Supply in UAE, 2004-2007

US $ Million

	2004	2005	2006	2007
M1	21820.86	28201.23	32405.13	49049.28
M2	65405.34	87497.28	107809.1	152739.5
M3	82121.58	112153.4	136793.1	187981.8

Source: Central Bank of UAE and author estimates.

Banking Sector:

The UAE has a remarkably large number of banks. The number of local banks operating in the country increased during 2007 to a total of 22 banks, compared to 21 banks at the end of 2006. The UAE banking sector consists of the UAE Central Bank, commercial banks (local and foreign), and other specialized banks and financial institutions. Banks play a critical role in the UAE economy, and the banking system is strong and developed, technologically advanced, and integrated into the world economy. Due to a relatively low interest rate environment, high oil prices, and a flourishing economy, banking sector total assets registered 42% growth, increasing from $232.085 billion in 2006 to $330.229 billion in 2007. The UAE banking sector is the largest one in the Gulf States.

Table 2.16: Aggregate Balance Sheet of Banks in the UAE, 2003-2007

US $ Million

	2003	2004	2005	2006	2007
Assets:					
Cash and Deposits with CB	7366.41	10399.05	12686.49	17122.05	63950.04
Due from Resident Banks	4147.74	4602.42	7928.82	9394.11	11981.79
Foreign Assets	30166.29	34049.16	47257.56	62623.26	53161.92
Claims on Government	5305.5	7879.68	10612.62	12928.95	15768.54
Claims on Official Entities	3298.05	3369.33	6278.58	8508.51	10752.21
Claims on Private Sector	43947.63	54483.03	76438.08	101565.9	138325.3
Claims on Other Financial Institutions	613.44	945.27	2018.25	5020.38	9974.07
Domestic Investments	1859.22	2712.42	5182.65	8671.32	14371.02
Unclassified	2360.88	2991.33	3860.19	6250.5	11944.8
Total Assets	**99065.16**	**121431.7**	**172263.2**	**232085**	**330229.7**
	2003	**2004**	**2005**	**2006**	**2007**
Liabilities:					
Monetary Deposits	12008.79	17560.8	23470.29	26509.14	42044.94
Quasi-Monetary Deposits	37337.76	43584.48	59296.05	75403.98	103690.3
Foreign Liabilities	9465.93	13174.11	23008.05	47975.76	86661.9
Government Deposits	10642.86	13843.98	21378.33	25293.6	30936.33
Government Lending Funds	6.21	4.86	4.59	4.32	4.32
Due to Central Bank	44.01	4.86	56.43	45.36	25.38
Capital and Reserves	12002.85	14165.01	21095.64	28104.03	35338.14
Due to Resident Banks	4832.73	5293.89	8044.65	10367.19	12427.02
Unclassified Liabilities	12724.02	13799.7	15909.21	18381.6	19101.42
Total Liabilities	**99065.16**	**121431.7**	**172263.2**	**232085**	**330229.7**

Source: Central Bank of UAE and author estimates

2.6 Conclusion:

As we have discussed, the banking and financial sector of the GCC region is characterized by product improvement, developments in technology, and increasing

competitiveness. The strength of the financial systems of the Gulf countries is supported by high-level liquidity, a high amount of capital, high profitability, and a high level of supervision by authorities.

It is important to note, however, that the GCC banks have been protected from foreign competition through regulations imposing barriers to entry. However, the banking sector faces many common challenges that are likely to affect its ability to grow and operate within a more competitive environment. The challenges to GCC banks come from their commitment to liberalize the banking sector and by virtue of their membership in the WTO. GCC banks are expected to face a high level of competitive pressure from foreign banks, which will be allowed to partner with local banks. The ability of GCC banks to survive in a more competitive environment will depend on what level of efficiency they have or how efficient they are.

3 CHAPTER THREE: REVIEW OF THE LITERATURE

3.1 Introduction:

Efficiency is a general term in economics describing how well a system is performing in the generation of maximum outputs for given inputs. Efficiency is improved if more outputs are generated without changing inputs or if the same outputs are generated with fewer inputs.

The efficiency of the banking system is one of the most important issues in the financial market because the efficiency of banks can affect the stability of the banking industry and thus the effectiveness of the whole monetary system. Bank efficiency is measured by different methods that estimate the production/cost frontier. These methods include nonparametric DEA and the SFA, using parametric frontier models.

In financial research, there is a huge body of literature that focuses on the efficiency of banking systems. This chapter reviews some of those studies, including both parametric and nonparametric approaches. We can divide studies on the banking efficiency into two broad categories. The first category is efficiency around the world. The second category is efficiency in the GCC and the Middle East countries, which have almost the same atmosphere in the banking system. In each category, studies on the banking efficiency of a group of countries are presented first, followed by studies of efficiency in single countries.

3.2 First: Efficiency around the world:

3.2.1 Efficiency of a group of countries:

Berger and Humphrey (1997) reviewed 130 studies that relate the analysis of frontier efficiency to financial institutions in 21 countries. They covered studies of different types of financial institutions such as commercial banks, savings and loans institutions, credit unions, and firms in the insurance industry. The main goal of this paper is to summarize and review empirical estimates of financial institution efficiency and to attempt to arrive at a consensus view.

The average of efficiency that Berger and Humphrey found was approximately 77% (median 82%), with a standard deviation of 13 percentage points. They found that the efficiency estimates from nonparametric studies (DEA and FDH) were mostly the same as those from parametric frontier models (the SFA, the DFA, and the TFA). They also found that the nonparametric methods generally yielded lower mean efficiency estimates and seemed to have a larger spread than the results of the parametric methods, probably because there is a different assumption about the error terms in both approaches. The authors found that the deregulation of financial institutions could either increase or decrease efficiency levels, depending on industry conditions before the deregulation. They concluded that the majority of the studies on banking efficiency focused on the banks of developed countries (about 95% and most of them in the U.S.), so they suggested that more research was needed in other countries.

Casu and Molyneux (2003) used the non-parametric DEA approach to investigate whether the efficiency degree of the European banking system (this study covered five European countries: France, Germany, Italy, Spain, and the United Kingdom) improved between 1993 and 1997. They also evaluated the determinants of the efficiency of European banking by using the Tobit regression model approach in order to analyze the influence of various countries' specific and environmental factors relating to bank efficiency. They used the intermediation approach to specify two outputs (total loans and other earning assets) and two inputs (total costs and total customers and short-term funding) for their study.

Casu and Molyneux found that the DEA results showed low average efficiency levels during the period of study. They reported that there was a slight improvement in the average efficiency levels over the period 1993-1997 for all banking systems in the sample except Italy's banking system. They concluded that there was a difference in the efficiency level across European banking systems and that this difference was due to each country's specific factors relating to banking technology.

Bikker (1999) applied the stochastic cost frontier approach and production approach to some of the European banks to measure the X-efficiency of those banks. He measured the cost efficiency of banks in nine European countries by using the data for these banks from 1989 to 1997.

He found that the less efficient banks were Spanish banks, followed by French and Italian banks. Banks in Germany, the Netherlands, and the U.K. were in the middle level of efficiency. However, the most efficient banks were in Luxemburg, followed by banks in Belgium and Switzerland. He said that the banking systems in Luxemburg and Switzerland most likely benefited from the kind of favorable conditions that come from bank secrecy and tax regimes. He also estimated the cost levels and found that Spanish banks had a higher cost level of 33% above the European average, although the banks in Luxemburg were 34% below the European average. Finally, the author suggested that merging between banks was important to improve the banking industry in the European countries.

Kessy (2007) analyzed the banking efficiency of three east African countries (Tanzania, Kenya, and Uganda) and how this efficiency related to their economic growth. He used DEA in his study of banking efficiency for 88 banks for the period between 1994 and 2005. He determined outputs (loans and debt securities) and inputs (fixed capital, labor, and deposits) by using the intermediation approach.

He found that there was a difference in the banking sector efficiencies across the three countries. Also, he reported that the efficiency level increased during the period of study. However, the result suggested that banks in Uganda were more efficient than banks in Tanzania, and that banks in Tanzania were more efficient than banks in Kenya. He concluded that the banking sectors were associated with faster economic growth.

Yildirim and Philippatos (2007) evaluated the efficiency level of commercial banks in 12 central and eastern Europe (CEE) countries for the period between 1993 and 2000. The countries they considered in the study were the Czech Republic, Estonia, Croatia, Hungary, Latvia, Lithuania, FYR of Macedonia, Poland, Romania, Slovenia, the Slovak Republic, and the Russian Federation. They employed two techniques — the SFA and the DFA — to estimate cost and profit efficiency for a panel of 325 banks over an eight-year period for the 12 CEE countries. Then they regressed the efficiency level that they found to determine the factors upon which the efficiency levels depended. They determined three outputs (loans, investments, and deposits) and three inputs (borrowed funds, labor, and physical capital) in their analysis.

Yildirim and Philippatos found that the average cost efficiency level for twelve countries was 72% with DEA and 77% with the SFA. Also, they found that the most cost-efficient countries were Poland and Slovenia and that the Russian Federation, Lithuania, Latvia, and Estonia were the least efficient countries. They reported that the cost efficiency levels were significantly higher than the profit efficiency levels. The authors concluded that foreign banks were more cost efficient and less profit efficient than domestic banks and that competition in banking markets was positively related to cost efficiency and negatively related to profit efficiency.

Mausos and Pastor (2001) analyzed profit efficiency and cost efficiency in a sample of 16 countries in the Organization for Economic Cooperation and Development (OECD), with 14 of them from the European Union, Japan, and the U.S. The sample they used in their study included the banking systems in Austria, Belgium, Denmark, Finland, France, Germany, Greece, Holland, Italy, Luxembourg, Portugal, Spain, Sweden, the U.K., Japan, and the U.S. They used the SFA and employed three outputs (loans, other earning assets, and deposits) and two inputs (net income and profit before tax) in their study.

The evidence showed that the efficiency level of the banking sector in the U.S. improved from 1986 to 1995 and that the efficiency level of the banking sector in Japan decreased sharply from 1988 to 1995. The banking sector in Europe was stable during the period of study. Finally, Mausos and Pastor reported that the increase in the completion led to improving the profit efficiency in the U.S. and Europe but not in the Japanese banking system. They also said that efficiency was a very important source of improvement in profitability.

Pastor, Perez, and Quesada (1997) compared the productivity, efficiency, and differences in the technology of different European and U.S. banking systems for the year 1992. The sample they chose contained 168 banks in the U.S., 45 banks in Austria, 59 banks in Spain, 22 banks in Germany, 18 banks in the U.K., 31 banks in Italy, 17 banks in Belgium, and 67 banks in France. They used DEA and a non-parametric approach to estimate the efficiency level in their study. They chose three outputs (loans, other

productive assets, and deposits) and two iuputs (non-interest expenses and personal expenses) to estimate the efficiency level in their study.

Pastor, Perez, and Quesada found that there was a difference in the efficiency level of the banking systems among the countries in the sample. The most efficient banks were in France, Spain, and Belgium, while the less efficient banks were in the the U.K., Austria, and Germany. They also found that the Austrian, German and U.S. banking systems showed evidence of scale inefficiencies. There was no trace of scale inefficiency in banking systems in France and the U.K.

3.2.2 Efficiency in a single country:

Havrylchyk (2006) analyzed the efficiency of the Polish banks from 1997 to 2001. The sample he used was the most comprehensive database on the Polish banking system compared to the other study because it covered approximately 95% of all banking assets. He used DEA in his study to estimate cost, allocative, technical, pure technical, and scale efficiency. Then, he compared the foreign versus the domestic banks' efficiency. He applied the intermediation approach, specifying three outputs (loans, government bonds, and off-balance sheet items) and three inputs (capital, labor, and deposits).

He found that the average efficiency was 52.92% for the domestic banks and 73.23% for the foreign banks. He also found that the efficiency in the banking system in Poland did not improve during the period of the study.

Chen, Skully, and Brown (2005) examined the impact of bank deregulation on the cost, technical, and allocative efficiency of Chinese banks during the period between 1993 and 2000. They also investigated whether the efficiency of the banking system in China improved during the period of study and whether size played an important role in efficiency levels. They applied frontier analysis (X-efficiency) using DEA to evaluate the cost efficiency of Chinese banks. They used the intermediation approach to specify three outputs (loans, deposits, and non-interest income) and four inputs (price of deposits, interest expenses, non-interest expenses, and price of capital) in their study.

Chen, Skully, and Brown found that the deregulation initiated in 1995 had a positive impact on the efficiency of Chinese banks in the first and second years after deregulation. However, in the third and fourth year's post-deregulation, the efficiency level declined. They also found that large banks and small banks were most efficient. They concluded that the efficiency level of the Chinese banking system improved from the early 1990s until 1996 but that Chinese banking efficiency dropped gradually from 1997 to 2000 due to both international and domestic factors.

Altunbas, Liu, Molyneux, and Seth (2000) used the stochastic cost frontier methodology to evaluate scale and X-inefficiencies to examine the impact of risk and quality factors on bank costs in Japanese commercial banks between 1993 and 1996. They specified three outputs (total loans, total securities, and total off-balance sheet items) and three inputs (price of labor, price of funds, and price of physical capital) in their study by using the intermediation approach.

The authors found strong evidence of scale economies across a wide range of bank sizes, even for the largest firms. They also found that the financial capital influenced the scale efficiency estimates because of the reflection of the decline in capital strength of the banking system in Japan during the period of study. They reported that the X-inefficiency estimates varied between 5% and 7% and showed less response to risk and quality factors. In addition, they found that the scale efficiency estimates were more sensitive to risk and quality factors than the X-inefficiencies. Finally, they suggested that the largest banks could be more efficient in reducing costs by decreasing output rather than improving X-efficiency.

Fung (2006) used DEA in his study to measure the X-efficiency to see if less productive banks were catching up to more productive ones in the U.S. by examining the convergence of productivity among bank holding companies (BHCs). He specified two outputs (total loans and non-interest incomes) and three inputs (fixed assets, liquid assets, and labor input) to measure the efficiency level in his study.

He found that each BHC possessed its own steady-state productivity to which it was converging. In other words, differences in X-efficiency between BHCs could create permanent differences in productivity between them. The author concluded that all BHCs were converging to a minimum efficient scale; however, this scale was conditional on the level of X-efficiency. In addition, the BHCs reached the upper rank of X-efficiency because technological improvements, higher management incentives, and further specialized banking activities enlarged the minimum efficient scale.

Munyama (2004) analyzed the effects of mergers on U.S. commercial bank efficiencies. He used the SFA based on profit function by employing cross-sectional data during 1997. He measured whether mergers improved profit efficiency and determined factors that explained differences in measured efficiencies between banks.

He found that increasing diversification in banks improved the efficiency level, so if a merger improved bank diversification we could say that mergers improved efficiency. Also, the more concentrated the market was, the more technically efficient the banks became.

Allen and Liu (2005) investigated cost efficiency and the economies of scale of the six largest banks in Canada using quarterly data from 1983 to 2003. They estimated four econometric models: a time-varying fixed-effects panel model, a stochastic cost-efficiency frontier model, a system of seemingly unrelated regressions model, and a

time-varying fixed-effects model. They used the intermediation approach to specify five outputs (consumer loans, non-mortgage loans, mortgage loans, security investment, and non-traditional banking activities) and three inputs (labor, capital, and deposits).

The authors found that the changes in regulatory policies aided the reduction of the banks' production costs. They also found that the inefficiency of Canadian banks was approximately 10% and that the ranking of efficiency suggested that larger banks were more cost efficient than smaller banks.

Shanmugam and Das (2004) analyzed the technical efficiency of 94 banks in four different ownership groups in India (the State banks of India group, the nationalized banks group, the privately owned domestic group, and the foreign banks group). They applied the stochastic frontier function methodology, using panel data for the period between 1992 and 1999. They determined four outputs (net interest margin, non-interest income, credits, and investments) and four inputs (deposits, borrowings, labor, and fixed assets). They stated that there were variations in the efficiency among the sample banks for four outputs: interest margin, non-interest income, investment, and credit.

Their empirical results pointed out that the technical efficiency of raising interest margins varied widely across sample banks and was time-invariant. The results also noted that the banking sector in India showed an improvement in its efficiency level during the period of study due the increase of non-interest income, investments, and credits. Shanmugam and Das concluded that 50% of the banks had technical efficiency

and also that the state bank group and private-foreign group banks were more efficient than other groups.

Luciano and Regis (2007) reviewed the most important empirical studies for the efficiency features of the Italian banking system during a 15-year period. They found that two different techniques could be used to evaluate the efficiency level of banks: the SFA (parametric approach) and DEA (non-parametric approach). Some of the empirical studies that the authors reviewed are as follows:

- Favero and Papi (1995) used a sample of 174 banks. They tried to determine which of the two DEA models was better: CRS or VRS), and they found that the VRS model was more appropriate to describe the efficiency level than the CRS model. They also regressed the efficiency level on a dummy which discriminated between banks located in the northern, in the central or in the southern part of Italy, and they found that the banks in southern Italy had the lowest level of efficiency.
- Resti (1994) used a sample consisting of 45 banks for the period of 1988-1991. He included the ratio of bad loans to total loans in the DEA model. He found that inefficient banks did not improve their score when the ratio of bad loans to total loans was included in the model. So, there was a negative correlation between the inefficiency level and bad loans on the total loans ratio.
- Casu and Girardone (2002a) used the data envelopment approach to study the efficiency of the Italian banking system. They compared banking groups and

parent companies (the institutions leading the groups, taken individually). They found that the banking groups had a lower mean efficiency level than parent companies and subsidiaries taken individually. They also found that there was no evidence of scale economies either in the sample of groups or in the one composed by the parent and subsidiaries taken individually.

Hahn (2005) applied the internal technical efficiency approach, focusing on environmental and non-controllable factors affecting banking efficiency. The sample consisted of 800 Austrian banks for the period from 1995 to 2002. He used a four-stage DEA methodology by employing a slacks-based DEA model in combination with a Tobit regression and then the Bootstrap method in order to eliminate the dependency problem in the DEA technique. He employed the profit-oriented approach by specifying three outputs (net interest revenue, net commission revenue, and other income) and three inputs (employee expenses, other non-interest expenses, and risk-weighted assets). He also applied the intermediation approach by using two outputs (total loans and other earnings) and two inputs (first, total cost covering interest expenses, non-interest expenses, and employee expenses, and second, total deposits).

Hahn reported that controlling for the impact of environmental factors raised the average efficiency and reduced the average range of volatility during the period of study. Also, he stated that a decomposition of the initial and environment-adjusted efficiency scores of the Austrian banking system yielded that the managerial efficiency

of the commercial banks tended to be overrated because of favorable environmental factors. Finally, he found that saving banks and mortgage banks were unaffected by changing environmental conditions.

Kirkwood and Nahm (2006) applied DEA to estimate the efficiency of producing revenue-generating banking services and the efficiency of producing profit in Australian banks. This paper was the first paper analyzing Australian bank efficiency to consider efficiency in producing profit. They used a sample for 10 banks listed on the Australian Stock Exchange for the period of 1995 to 2002. They employed two models, the banking service efficiency model and the profit efficiency model. For the first, they specified two outputs (interest-bearing assets and non-interest income). The second model had two outputs as well (profit before tax and abnormal items). In both models they used the same inputs (number of full-time equivalent employees and property and interest-bearing liabilities). For the first and the second models they applied the intermediation approach.

Kirkwood and Nahm stated that banking service and profit efficiency scores improved in the major banks because the banking service efficiency remained unchanged and the profit efficiency decreased for the regional banks. They also found that changes in profit efficiency were statistically significant in determining the stock return of banks.

Jemric and Vujcic (2002) used the DEA approach to analyze the relative efficiency of banks in the Croatia banking system for the period between 1995 and 2000 according to size, ownership structure, date of establishment, and quality of assets. They applied both operation and intermediation approaches. For the operating approach, they used two outputs (interest and related revenues as well as non-interest revenues) and four inputs (interest and related costs, commissions for services and related costs, labor-related administrative costs, and capital-related administrative costs). For the intermediation approach, two outputs (total loans extended and short-term securities issued by official sectors) and three inputs (fixed assets, number of employees, and total deposits received) were employed.

The authors found that the foreign-owned banks were more efficient than their counterparts. They also reported that the new banks were more efficient than the old ones and large banks appeared to be locally efficient while smaller banks were globally efficient. They concluded that there was a strong equalization in terms of average efficiency in the Croatian banking system during the period of study.

3.3 Second: Efficiency in the GCC and the Middle East countries:

3.3.1 Efficiency of a group of countries:

Limam (2001) estimated the technical efficiency of GCC banks for the year 1999. He used two methods in his analysis. The first method consisted of constructing a non-

parametric linear frontier using linear programming (DEA). The second method consisted of estimating a parametric frontier using a correcting ordinary least square (COLS). He adopted the intermediation approach to define two outputs (all types of loans provided by banks as well as investments and deposits made by banks) and three inputs (fixed assets, the number of bank employees, and financial capital incorporating deposits, borrowings, and any liabilities not classified under deposits or borrowings) in his study.

The result showed that the banks in Bahrain and Saudi Arabia were more technically efficient than other banks in GCC countries due to the fact that the environment in which banks operated in Bahrain and Saudi Arabia were more conducive to better efficiency. Limam reported that the larger bank size and higher share of equity capital in assets were associated with higher technical efficiency. Finally, he found that there was a weak link between technical efficiency and profitability as well as and between technical efficiency and the date of establishment. He argued that this weak link was due to the regulatory environment in which GCC banks operated and to the government intervention in the economy in general and in the banking sector in particular.

Mostafa (2007) investigated the efficiency levels of the GCC countries' banks in Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates using 2005 operation data. He used DEA and specified three outputs (net profit, rate on assets

{ROA}, and rate on equity {ROE}) and two inputs (assets and equity) by using the intermediation approach.

The evidence indicated that the efficiency levels ranged between 13 and 100%, with an average of 55% and a 22.1 standard deviation when using CRS. Although the efficiency levels when using VRS ranged from 20 and 100%, with an average of 73 percent and a standard deviation of 21.8, Mostafa suggested that efficiency could be better evaluated through the analysis of average efficiencies across time rather than just for one year.

Grigorian and Manole (2005) compared the efficiency scores of banks in Bahrain with other countries (Kuwait, Qatar, the United Arab Emirates, and Singapore) for the period of 1997 to 2002 using DEA. They used the intermediation approach by specifying three outputs (revenues equaling the sum of interest and non-interest income, net loans, and liquid assets, which are the sum of cash and treasure bill holdings) and three inputs (personnel expenditure, fixed assets, and interest expenditures).

The authors found that Singapore had the highest average in the overall technical efficiency index and that Bahrain appeared to be ahead of the GCC countries, followed by the United Arab Emirates, Qatar, and then Kuwait. They reported that if they used the scale efficiency index that the United Arab Emirates, Bahrain, and Qatar appeared to be at least as strong as Singapore. They also found that there was no statistically significant difference between the efficiency scores for traditional and Islamic banks.

3.3.2 Efficiency in a single country:

Ariss (2008) investigated the banking efficiency of the Lebanese banking sector by using a unique data set in post-war Lebanon. She applied SFA in her analysis to evaluate banking efficiency in Lebanon from 1990 to 2001 (following a period of financial liberalization). She followed the intermediation approach to pick three outputs (loans to customers and discounts, liquid assets, and net fees and commissions) and three inputs (unit price of capital, unit cost of funds, and unit price of labor).

Ariss found that the average efficiency level in the banking system improved by about 10% during the period of study and that the efficiency level could increase more by improving competition between banks. In addition, the deregulation obtained by monetary authorities appeared to improve bank efficiency. Last, the author found that large domestic banks could effectively control the costs level in order to face increasing competition and deregulation.

Yildirim (2002) used non-parametric DEA to analyze the efficiency performance of the Turkish banking sector from 1988 to 1999. He chose this period because the unstable macroeconomic environment was at a high level. He applied the intermediation approach to specify three outputs (total loans, interest income, and non-interest income) and four inputs (total demand deposits, total time deposits, total interest

expense, and total non-interest expense) in his study. Yildirim stated that the technical efficiency measure showed a large variation with the absence of sustained efficiency gains.

The analysis indicated that the efficient banks were more profitable than the inefficient banks and that the size of a bank was positively related to the technical and scale inefficiencies. Yildirim also found that the public banks were better than private banks with respect to scale efficiency because of larger loan portfolios in public banks. During the period he considered, he reported that the instability of the macroeconomic environment had a profound influence on the efficiency measures.

Erdem, C and Erdem, M (2008) estimated the technical, allocative, and economic efficiency levels of the commercial banks in the Republic of Turkey. They used (DEA) to estimate the efficiency level for the period between 1998 and 2004. They specified one output (profit before tax) and three inputs (number of full-time employees, physical capital, and interest-bearing liabilities) by using the intermediation approach in their study. Their goal was to investigate whether a period of crises (2000, 2001, and 2003) affected the efficiency levels in Turkey's banking system. They also related the efficiency levels on the banking stock price to determine whether there was a descriptive power of efficiency levels on stock price returns.

Erdem, C. and Erdem, M. found that six banks appeared to be technically efficient at least once during the period of study. They also found a decrease in the average

efficiency level from 1999 to 2001 (from 0.781 to 0.504), which started to improve after 2001 but not during 2003. They concluded that the average efficiency level of the banking sector in Turkey was affected by the financial crises Turkey experienced in 2000, 2001, and 2003. Also, there was no statistical significance in explaining the relationship between the efficiency level and the stock price return movement.

Barakat (2003) investigated evidence scale and scope economies and analyzed the competitive conditions of the 21 Jordanian banks for the period between 1990 and 2000. He used SFA to measure the efficiency level and the intermediation approach to determine the outputs (loans and investments) and inputs (labor, capital, and deposits).

He found that increasing returns to scale were observed in all but two banks. Also, he found that cost curves on the Jordanian banks were downward sloping in the period of study, so he supported the central bank of Jordan's policy of encouraging banks to merge because merger policies increased the scale of banks. He reported that the banking system experienced diseconomies of scope during the period of study. For the competition analysis, he found that a decrease in competition had a negative impact on efficiency, and hence recommended that the policymakers in Jordan make a judgment about the extent to which diminished competition can arise from merger policy.

Ahmad (2000) analyzed the efficiency of the banking system in Jordan. He also examined possible sources of efficiency in the Jordanian banks. The data he used was

for 20 banks during the period between 1990 and 1996. He determined two outputs (loans and investments) and two inputs (labor and deposits) by using the intermediation approach for DEA. He used both the parametric SFA and non-parametric DEA in his analysis.

He found that the average cost efficiency in the Jordanian banks was 77.5% based on the SFA and 73.5% based on DEA. He also found that foreign banks were more efficient than national banks and small banks were more efficient than medium- and large-size banks. Furthermore, he reported that large banks were most profit efficient, followed by medium banks and then small banks. He suggested some policies in his study, such as encouraging foreign investment in the banking sector, increasing the supervision level from the central bank of Jordan, increasing competitiveness in the banking system, and increasing the capital of banks by means other than mergers, as mergers would decrease the number of banks and lead to a lower level of competition.

Limam (2004) estimated the technical efficiency of eight Kuwaiti banks for the period from 1994 to 1999. He used the stochastic cost frontier based on the concept of the stochastic production frontier method. He applied the intermediation approach to specify one output (earning assets) and three inputs (fixed and unspecified assets, the number of bank employees, and financial capital incorporating deposits, borrowings, and any liabilities not classified under deposits or borrowings).

Limam found that the Kuwaiti banks produced earning assets at constant returns to scale and hence the increasing of bank size through mergers did not substantially enhance the technical efficiency of the merged banks. He provided that larger bank size, a higher share of equity capital in assets, and greater profitability were associated with better efficiency.

Aly, Alshamsi, and Bassiouni (2006) estimated the efficiency level of the United Arab Emirates (UAE) banking system by using DEA. They determined two outputs (loans and investments) and three inputs (labor, capital, and deposits) by using the intermediation approach.

The authors found that the average cost efficiency levels of the UAE banks were lower than those reported for developed countries. They also found that these low levels came from allocative inefficiency rather than technical inefficiency. Finally, they stated that an increasing number of branches would lead UAE banks to use their input resources more efficiently and that on average newer banks were more efficient than older banks.

Alfaraj, Bubshait, and Almuhammad (2006) assessed the efficiency level of the Saudi commercial banking industry by applying DEA for the year 2002. They used the intermediation approach to determine two outputs (net interest income and non-

interest income) and two inputs (interest expenses and non-interest expenses) in order to evaluate nine Saudi commercial banks.

The authors compared the technical efficiency score that they obtained with the world mean efficiency scores, and they found that the mean efficiency score of the Saudi commercial banking industry was higher than the world's mean efficiency. They recommended that Saudi commercial banks obtain a higher level of efficiency by continuing to offer new services, such as insurance services, mortgage financing, and Islamic products.

3.4 Conclusion:

In view of the literature discussed, we can say that empirical studies in banking efficiency have been conducted extensively for U.S. and European commercial banks but that few studies have been done to investigate banking efficiency in developing countries, especially in GCC countries. Therefore, more empirical work is needed on the banking efficiency in GCC countries, and one of the major objectives of this study is to evaluate banking efficiency in the GCC by applying non-parametric DEA to fill the gap of literature in this region.

Overall, the literature of measuring banking efficiency that has been presented here yields useful comparatives and provides information that can lead to significant

improvements and that can alert banks to new business practices. Furthermore, the literature enables us to choose convenient inputs and outputs to use in this study.

4 CHAPTER FOUR: METHODOLOGY

4.1 Introduction:

In recent years, the measuring of efficiency has received increased attention. It has potentially important significance for bank managerial strategies because the overall effectiveness of banks in general provides information about the performance of individual banks. Furthermore, efficiency measurement may also offer information about how the banking industry is related to the national economy and hence how it affects public policy.

In general, a measurement of efficiency score is obtained by comparing observed inputs and outputs and consequently recognizing the optimal values. The efficiency of commercial banks has been studied using different measures of efficiency, such as technical efficiency, allocative efficiency, economic efficiency, and scale efficiency.

4.1.1 Technical Efficiency (TE):

According to Bauer, Berger, Ferrier, and Humphrey (1997), technical efficiency (or X-efficiency) focuses on the physical relationship of levels of inputs relative to levels of outputs, so it requires only the input and output data without the prices. A firm can be

technically efficient if it either minimizes its inputs given its outputs or maximizes its outputs given its inputs. In general, the purpose of measuring technical efficiency is to determine whether a firm uses the best available technology in its production process. In this dissertation we will assess the technical efficiency of the Gulf Cooperation Council (GCC) banks.

4.1.2 Allocative Efficiency:

In allocative efficiency the optimal inputs and outputs are chosen based on both the production technology and the relative prices in the market. According to Thanassoulis (2003), the allocative efficiency of a firm is the ratio of the minimum cost at which a firm could secure its outputs to the cost of its technical efficient input levels for its input mix (for given input prices).

4.1.3 Economic Efficiency (EE):

Economic efficiency is a broader concept than technical efficiency; it involves optimally choosing the levels and mixes of inputs and outputs based on reactions to market prices. So, it requires price data for input and output. A firm can be economically efficient if it has chosen and mixed its input and output levels to optimize an economic goal, usually cost minimization or profit maximization. Economic efficiency requires both technical and allocative efficiency. Technical efficiency usually is higher on average than

economic efficiency because economic efficiency sets a higher standard that includes allocative efficiency.

4.1.4 Scale Efficiency (SE):

Scale efficiency (SE) measures a firm's productivity at a given point with respect to what it could accomplish if it operated at the most productive scale size, where the average productivity reaches a maximum level (Kounetas and Tsekouras 2007). In this sense, scale efficiency can be obtained from the ratio of technical efficiency in the case of constant return to scale (CCR model) to the pure technical efficiency in the case of variable return to scale (BCC model)[11].

$$SE = TE_{CCR} / TE_{BCC} \qquad (4.1)$$

According to Schmidt (1985), the measurement for technical, allocative, and overall (total economic) efficiency was developed by Farrell (1957) in simple analysis. He assumed that there is a production frontier:

$$Y = f(X1, X2) \qquad (4.2)$$

Where X1 and X2 are the inputs and Y is the output. The frontier is characterized by the efficient unit isoquant that graphed as UU' in Figure 4.1 with notice that the horizontal axis is X1 and the vertical axis is X2.

[11] We will discuss the BCC and CCR model in the DEA part of this chapter.

The firm uses X1, X2 to produce output Y, and A represents the point (X1/Y, X2/Y), which by definition cannot be below UU' in Figure 4.1 The technical efficiency of the firm is OB/OA, which measures the proportion of X1 and X2 to produce Y. Hence, the technical inefficiency of a firm measured by 1 – (OB/OA) measures the proportion by which X1 and X2 could be reduced without reducing output.

Now let's say that PP' represents the ratio of input prices, so the cost-minimizing point is C. Since the cost at D is the same as the cost at C, the allocative efficiency of the firm is defined as OD/OB and the allocative inefficiency as 1 – (OD/OB).

Finally, the overall (total economic) efficiency of the firm defined as OD/OA and the economic inefficiency defined as 1 – (OD/OA) measure the possible reduction in cost from moving from A to C.

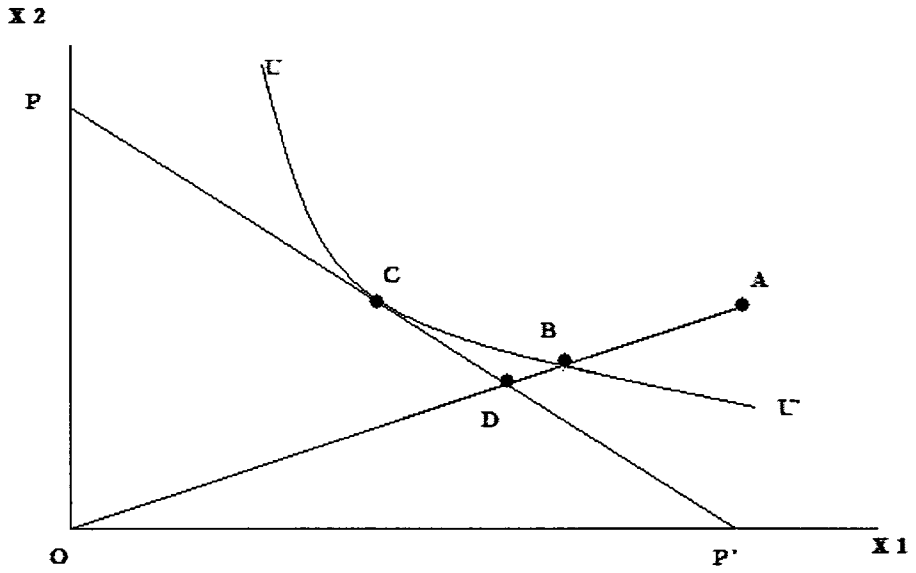

Figure 4.1: Technical, Allocative and Overall Efficiency

4.2 Efficiency Measurement Methods:

As shown in Chapter Three, bank efficiency is measured by different techniques. Pastor, Perez, and Quesada (1997) stated that the techniques used in estimating the frontier are based on parametric methods (when some hypotheses are introduced on the frontier functional form, based on their properties) and non-parametric methods (when observational criteria based on programming techniques are used to construct the frontier). Also, the methods can be classified by dealing with the error term. If a method does not include the error term in the model, then the method is called deterministic. Alternatively, if the method includes the error term in the model, then the method is called stochastic.

4.2.1 Parametric Method:

The parametric method is an econometric model in which specifying a functional form and the error term are included. It usually measures economic efficiency.

For the parametric method, the literature emphasizes three main approaches: stochastic frontier approach (SFA), thick frontier approach (TFA), and the distribution free approach (DFA).

Stochastic Frontier Approach (SFA):

SFA has its starting point in the stochastic production frontier models simultaneously introduced by Aigner, Lovell, and Schmidt (1977) and Meeusen and Van den Broeck (1977). "SFA posits a composed error model where inefficiencies are assumed to follow an asymmetric distribution, usually the half-normal, while random errors follow a symmetric distribution, usually the standard normal. The logic is that the inefficiencies must have a truncated distribution because inefficiencies cannot be negative. Both the inefficiencies and the errors are assumed to be orthogonal to the input, output, or environmental variables specified in the estimating equation. The estimated inefficiency for any firm is taken as the conditional mean or mode of the distribution of the inefficiency term, given the observation of the composed error term."[12]

[12] Berger, A.N. and Humphrey. D.B.1997. Efficiency of financial institutions: International survey and directions for future research. European Journal of Operational Research 98.

Aigner, Lovell, and Schmidt (1977), Battese and Corra (1977), and Meeusen and Broek (1977) independently supplied a model to estimate an SFA. The model is denoted in logs as:

$$\ln (yj) = \ln xj\, \beta + vj - uj \qquad (4.3)$$

Where:

yj = an output vector for firm j

xj = an input vector for firm j

vj = a random error added to the non-negative inefficiency term

uj = an inefficiency term

β = is a vector of coefficients that need to be estimated

The random error term vj measures error and other random factors affecting the value of the output variable, together with the combined effects of unspecified input variables in the production function. We call the model stochastic due to the fact that the right-hand side is determined by the stochastic variable:

$$\exp (x_j \beta + v_j) \qquad (4.4)$$

The random error term vj can be negative or positive, and so the stochastic frontier outputs vary relative to the deterministic part of the frontier model:

$$\exp (x_j \beta) \qquad (4.5)$$

The functional form is needed to estimate the stochastic frontier model, but the specification of a functional form is not practical since the banking industry is a multi-output industry. Thus, a cost frontier can be specified.

The stochastic cost frontier has the following form:

$$\ln c_j = f (\ln y_{r,j} , \ln c_{ij}) + \varepsilon_j \qquad (4.6)$$

Where:

c_j = the total cost for firm j

$y_{r,j}$ = the rth output of firm j

$c_{i,j}$ = the price of the ith input of firm j

εj = the error term

The error term εj consists of two elements, random error term vj and inefficiency term uj. The random error term vj is assumed to have non-negative distribution vj ~ N (0, $\sigma 2v$) and to be independent of the explanatory variables. The inefficiency term uj is also assumed to have non-negative distribution uj ~ N (0, $\sigma 2v$) and to be independent of the vj (Fiorentino, Karmann and Koetter 2006).

Thick Frontier Approach (TFA):

As in SFA, TFA also specifies a functional form and includes the error term. The TFA, however, does not require distributional assumptions in the efficiency and random error term. According to Bauer, Berger, Ferrier, and Humphrey (1997), building the thick frontier is needed to put the sample of banks into separate classes according to their asset size, and then their average cost over the entire time period can be computed. The best performers from those banks in each size class have a thick frontier. The banks in the lowest average cost class are predicted to have above-average efficiency to form a thick frontier.

Any deviation from predicted performance values within the highest and lowest performance class of banks is assumed to be a random error. However, any deviation in predicted performance between the highest and lowest average cost class is assumed to be inefficiency.

Usually, TFA provides estimated efficiencies between the highest and lowest class to indicate the general level of efficiency, so it determines the efficiency for the industry as a whole. However, it does not give point estimates of efficiency for all individual banks.

Distribution Free Approach (DFA):

Like SFA and TFA, DFA specifies a functional form for the frontier, but DFA separates inefficiencies from random error terms in a different way. Bauer, Berger, Ferrier, and Humphrey (1997) stated that unlike SFA, DFA does not assume any specific shape on the distribution of the efficiency. Also, DFA does not impose that deviation within a performance group is random error, nor does it assume that deviation between performance groups is inefficiency. DFA imposes that there is a constant core efficiency every time for each firm since the random error term tends to average out over time.

Unlike other parametric approaches, a panel data is required in DFA. So, only efficiency estimates over the entire sample period are provided. "These estimates may be derived using three different techniques. First, DFA-P WITHIN is a fixed effects model that estimates inefficiency from the value of a firm-specific dummy variable. Efficiency is estimated using the deviation from the most efficient firm's intercept term. A single set of parameters is obtained, so inefficiency is fixed over time. Second, 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 assumes that inefficiency is uncorrelated

with the regressors. Third, DFA-P TRUNCATED estimates the cost function separately for each year. The efficiency estimates are based on the average residuals for each bank."[13]

4.2.2 Nonparametric Method:

The nonparametric method is a mathematical model, and it doesn't recognize the error term. It usually measures technical efficiency.

For the nonparametric method, the literature emphasizes two main approaches: data envelopment analysis (DEA) and Free Disposal Hull (FDH).

Data Envelopment Analysis (DEA):

DEA is a nonparametric method that measures efficiency by using linear programming techniques, occasionally called frontier analysis. DEA is a performance measurement technique, first used by Charnes, Cooper, and Rhodes in 1978. According to Berger and Humphrey (1997), DEA is a linear programming technique in which the set of frontier observations are decision-making units (DMUs) for which no other DMU produces as much or more of every output (given input) or uses as little or less of every input (given output). In other words, DEA is commonly used to evaluate the efficiency of

[13] Bauer, Paul, Berger, Allen, Ferrier, Gary and Humphrey, David. 1997. Consistency Conditions for Regulatory Analysis of Financial Institutions: A Comparison of Frontier Efficiency Methods. Working paper, Federal Reserve Board, Washington DC, 1997.

a number of producers or DMUs. The production process for each producer is to take a set of inputs and produce a set of outputs. Each producer has a varying level of inputs and gives a varying level of outputs. The ratio of outputs to inputs is a commonly used measure of efficiency:

Efficiency = output / input (4.7)

Figure 4.2 shows a set of DMUs, a, b, c, d, e, f, and g, with each unit consuming a single input x to produce a single output y. We may identify b and e as the most efficient DMUs since they are located on the efficient frontier line, while the DMUs a, c, d, f, and g are inefficient because they appear below the efficient frontier line.

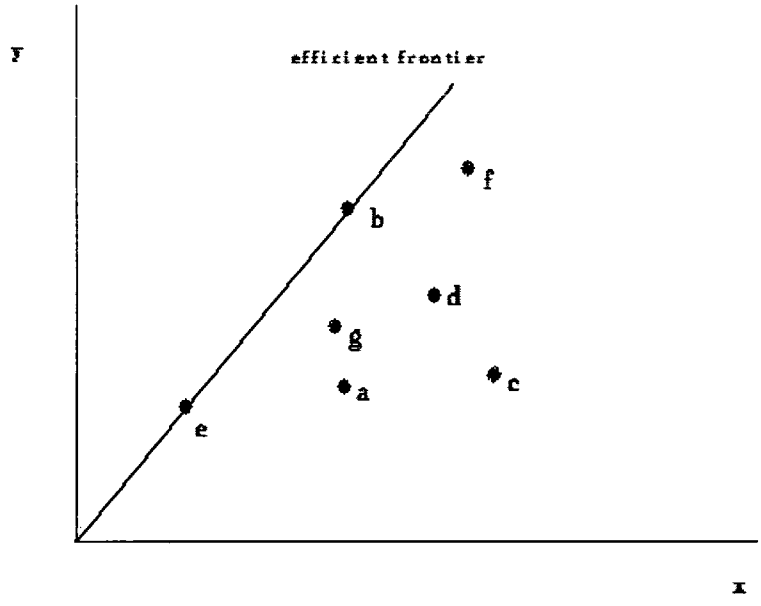

Figure 4.2: DEA Model with Single Input and Single Output

Now let us present a case of one input and two outputs. Figure 4.3 shows a set of DMUs, a, b, c, d, e, f, and g, with each consuming the same amount of a single input and producing a different amount of two outputs (y1 and y2). Applying the DEA approach to this set of DMUs will identify a, e, g, and f as efficient DMUs because they are on the efficient frontier line. Also, those DMUs provide an envelope around the entire data set. The DMUs b, d, and c are below the efficient frontier line (within the envelope), hence they are inefficient.

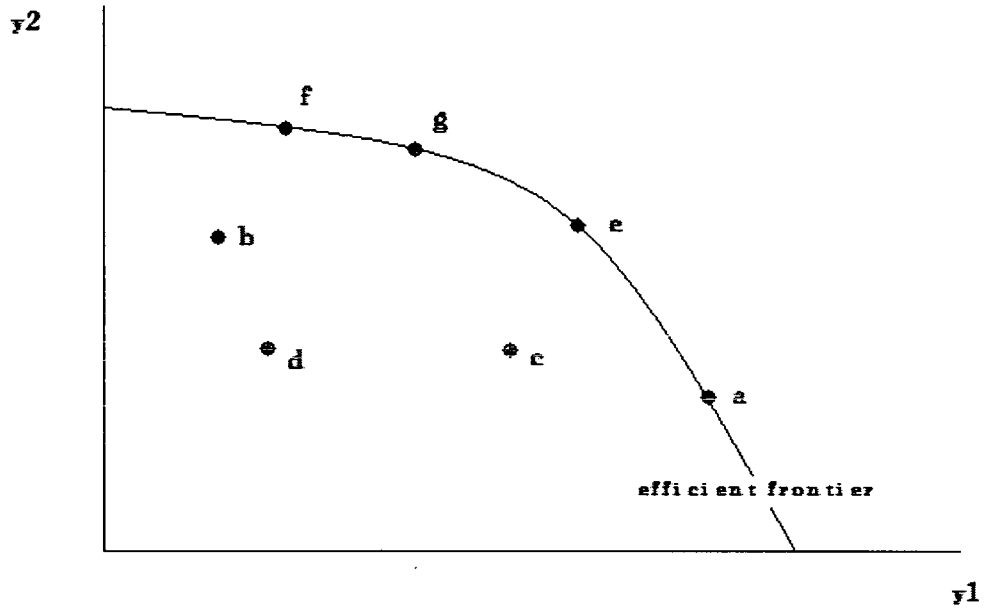

Figure 4.3: DEA Model with Single Input and Two Outputs

Charnes, Cooper, and Rhodes (1978) proposed a DEA model (CCR model) with the assumption of constant return to scale (CRS). Later, Banker, Charnes, and Cooper (1984)

used an alternative assumption in their DEA model (BCC model), which is a variable return to scale (VRS) (Casu and Molyneux 2003).

The CRS (CCR model) and the VRS (BCC model) can be described as the following:[14]

CCR Model:

Charnes, Cooper, and Rhodes (1978) introduced a measure of efficiency for each DMU that is obtained as the maximum of a ratio of weighted outputs to weighted inputs. So, the efficiency scores for DMUs are a function of the weights of inputs and outputs combinations, and they have to be less than or equal to unity.

Suppose that there are n DMUs to be evaluated. Each DMU consumes varying amounts of m different inputs to produce s different outputs. For example, DMU_j consumes amount x_{ij} of input i and produces amount y_{rj} of output r. The ratio of outputs to inputs obtains the relative efficiency of the $DMU_j = DMU_0$ to evaluate the ratios of all the j = 1, 2, ..., n DMU_j. The efficiency score for DMU_0 can be obtained by solving the following mathematical programming problem:

[14] The discussion here follows Cooper, Lawrence, and Zhu (2004) and Jemric and Vujcic (2002).

max $$h_0(u,v) = \sum u_r y_{r0} / \sum v_i x_{i0} \quad (4.8)$$

subject to

$$\sum u_r y_{rj} / \sum v_i x_{ij} \leq 1, \quad j = 1, 2, \ldots, j_0, \ldots, n \quad (4.9)$$

$$u_r \geq 0, \quad r = 1, 2, \ldots, s \quad (4.10)$$

$$v_i \geq 0, \quad i = 1, 2, \ldots, m \quad (4.11)$$

Where:

x_{ij} = the observed amount of input of the i_{th} type of the j_{th} DMU ($x_{ij} > 0$, $i = 1, 2, \ldots, m$, $j = 1, 2, \ldots, n$)[15].

y_{rj} = the observed amount of output of the r_{th} type for the j_{th} DMU ($y_{rj} > 0$, $r = 1, 2, \ldots, s$, $j = 1, 2, \ldots, n$)[16].

ur = the weight that determines output.

[15] Assumption that the DMU has at least one positive input.
[16] Assumption that the DMU has at least one positive output.

vi = the weight that determines input.

r = indicates s different outputs.

i = denotes m different inputs.

j = indicates n different DMUs.

This problem yields an infinite number of solutions because if (u*, v*) is optimal, then (αu*, αv*) is optimal for positive α. According to Charnes and Cooper (1962), for linear fractional programming we should select a representative solution (u, v) for which:

$$\sum v_i x_{i0} = 1 \qquad (4.12)$$

And then obtain a linear programming problem that is equivalent to the mathematical programming problem 4.8 – 4.11. Hence, the denominator in 4.8 is set to equal one, and the transformed linear programming problem can be written as:

max $$z_0 = \sum u_r y_{r0} \quad (4.13)$$

subject to

$$\sum u_r y_{rj} - \sum v_i x_{ij} \leq 0, \quad j = 1, 2, \ldots, n \quad (4.14)$$

$$\sum v_i x_{i0} = 1 \quad (4.15)$$

$$u_r \geq 0, \quad r = 1, 2, \ldots, s \quad (4.16)$$

$$v_i \geq 0, \quad i = 1, 2, \ldots, m \quad (4.17)$$

The linear programming dual problem can be written as:

$$\min_{\lambda} z_0 = \Theta_0 \quad (4.18)$$

Subject to:

$$\sum \lambda_j y_{rj} \geq y_{r0}, \; r = 1,2,\ldots,s \quad (4.19)$$

$$\Theta_0 x_{i0} - \sum \lambda_j x_{ij} \geq 0, \; i = 1,2,\ldots,m \quad (4.20)$$

$$\lambda_j \geq 0, \; j = 1,2,\ldots n \quad (4.21)$$

Where:

Θ_0 = the technical efficiency of DMU_0.

λj = the weight of the jth DMU.

Both the primal and dual linear programming problems listed here yield an optimal solution for technical efficiency Θ. The weight λ_j has a positive condition, so the problem obtains the CRS. Technical efficiency Θ should be less than or equal to one. Furthermore, for a DMU with technical efficiency, $\Theta j < 1$ is considered as inefficient, and the efficiency $\Theta j = 1$ shows the efficient DMU placed on the efficiency frontier.

BCC Model:

To allow for VRS, the constraints for the weights λ_j should be added ($\lambda_j = 1$). The DEA model in this case is called a BCC model that exhibits variable return to scale, and it can be written as:

$$\min z_0 = \Theta_0 \qquad (4.22)$$

$$\lambda$$

Subject to:

$$\sum \lambda_j y_{rj} \geq y_{r0}, r = 1,2,...,s \qquad (4.23)$$

$$\Theta_0 x_{i0} - \sum \lambda_j x_{ij} \geq 0, i = 1,2,...,m \qquad (4.24)$$

$$\sum \lambda_j = 1 \qquad (4.25)$$

$$\lambda_j \geq 0, j = 1,2,...n \qquad (4.26)$$

By running this model we can obtain the BCC efficiency scores (which are called pure technical efficiency scores)[17] for each DMU. "Under CRS, we assume that outputs change in direct proportion to the change in inputs regardless of the size of the DMU. When we have a group composed of DMUs with a large scale of operations, the CRS may be inappropriate. The VRS assumes that changing inputs does not result in a proportional change in outputs. That is, as a DMU becomes larger, its average cost would either fall or rise."[18]

[17] These scores are called pure technical efficiency scores because they are obtained from the model that allows variable return to scale and hence eliminates the scale part of the efficiency from the analysis Jemric and Vujcic (2002).

[18] Kessy (2007).

Constant return to scale assumption (CCR model) is only suitable when all DMUs are operating at an optimal scale. However, if we have imperfect competition, a DMU may not operate at optimal scale (Casu and Molyneux 2003). Hence, this study will follow the VRS assumption (BCC model) in order to measure the efficiency score for the banking sector in GCC countries. Also, technical efficiency obtained from VRS will be greater than or equal to that measured by using CRS because VRS envelops the data points more tightly than the CRS. The VRS has been most commonly used in recent years, and it provides a better reflection of the actual observations found in the real world.

Free Disposal Hull (FDH):

FDH is a special case of the DEA model (Berger and Humphrey 1997), and the efficiency scores are always higher with FDH than with the DEA (Tulkens 1993). The FDH model was first formulated by Deprins, Simar, and Tulkens (1984). They assume that the frontier of the production set is simply the boundary of the FDH of the data set. The strong disposability of inputs and outputs is constant and there is a VRS, but the convexity hypothesis is not required in this model. The frontier is obtained by comparing outputs and inputs to determine the main points. The inefficiency appears if there are some points dominated by other points, that is, a mean produce with more outputs and less inputs. Consequently, if points are not dominated by any other points the FDH efficiency will be obtained (Sousa and Schwengber 2005).

Figure 4.4 presents the difference in the efficient frontier line between DEA and the FDH with the assumption of one input and one output. The staircase line (abcdef) is the efficient frontier line for the FDH. (abcef) is the efficient frontier line for DEA in the case of the VRS, while the efficient frontier line for DEA in the case of a constant and decreasing return to scale is represented by (0cef).

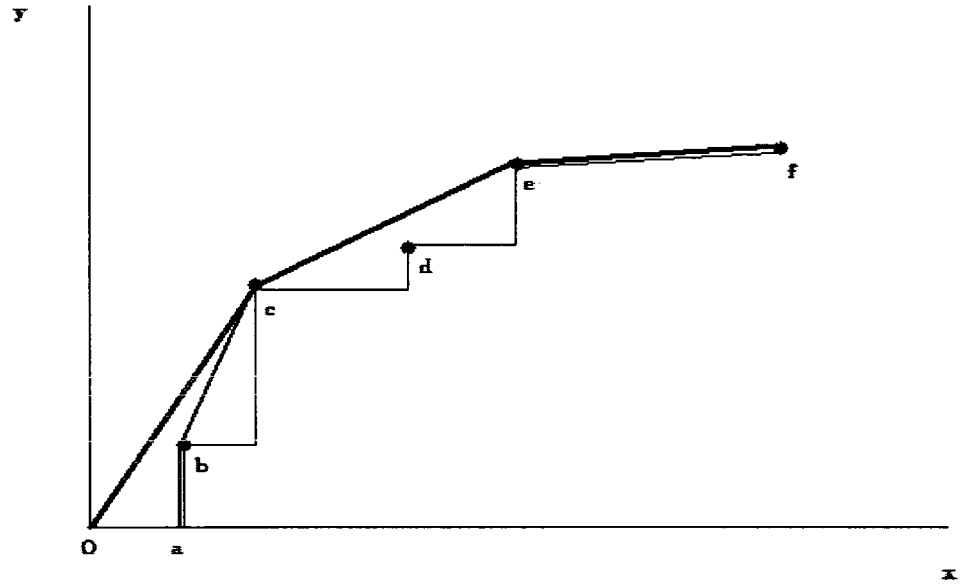

Figure 4.4: DEA and FDH Models with Single Input and Single Output

In this dissertation, we use nonparametric DEA to estimate bank efficiency in GCC countries with the assumption of a VRS. The reason for choosing DEA is because the SFA requires a large sample size to make reliable estimates (Havrylchyk 2006). On the other hand, DEA works well with a small sample size and does not necessitate the knowledge

of any functional form of the frontier. That will help us in our analysis due to the small number of GCC banks with available data. Berger and Humphrey (1997) found that 69 applications use DEA and 60 applications use the SFA in their study of 130 frontier efficiency studies of financial institutions in 21 countries. So, the number of applications of the two approaches is very close in practice. In addition, DEA does not require a cost minimizing or profit maximization condition, and it does not require any data on prices. This is convenient for those cases in which there are data problems, as in the situation of GCC.

4.3 Data:

The data we apply in our analysis are annual panel data for 50 banks that comprise the sample of GCC countries' banks listed in the stock markets of those countries for the years 2000–2007. We have excluded banks that were established after 2000 and banks for which some data were missing. The data set is from the Zughaibi and Kabbani Financial Consultants (ZKFC)[19] and institute of banking studies[20] (GCC banks reports) .The sample is formed by a study of the following banks: five in Bahrain, eight in Kuwait, five in Oman, six in Qatar, nine in Saudi Arabia, and seventeen in the United Arab Emirates.

[19] ZKFC is a source of detailed financial information on the joint stock companies in the GCC region (Kingdom of Saudi Arabia , United Arab Emirates , State of Kuwait, Kingdom of Bahrain , Sultanate Oman and State of Qatar).

[20] Institute of banking studies in Kuwait provides annually GCC banks report, which is a comprehensive reference guide and convenient source in GCC countries.

4.4 Inputs and outputs:

We have to know that the choice of output and input variables is a difficult one that must be addressed by any study on banking efficiency. However, there is no agreement in the literature on what represents banks' inputs and outputs. The choice is influenced by the selected concept of banking firms and by the availability of reliable information. According to Berger and Humphrey (1997), there are two main approaches to defining input and output variables the production approach and the intermediation approach.

4.4.1 Production Approach:

The production approach views banks as primarily services producing for customers. The banks generate transactions and process documents for customers as an output, such as loans applications, credit reports, checks, or other payment instruments, while the input includes only the physical variables, such as the number of employees and the physical capital. Under this approach, inputs are best measured by physical units, and outputs are best measured by the number and type of transactions or documents processed over a given time period. In the production approach, a deposit is treated as an output.

4.4.2 Intermediation Approach:

The intermediation approach treats the work of banks as primarily intermediating funds between savers and investors (depositors and borrowers). The banks use operating and interest expenses to produce major assets. For instance, they use labor

and capital as inputs to produce loans, investments, and other means of financing as outputs. Under the intermediation approach, a deposit is treated as an input.

This study will follow the intermediation approach to determine outputs and inputs because the detailed transaction flow data that is used in the production approach is proprietary and not generally available, particularly in GCC countries.

4.4.3 Input Variables:

Deposits: represent customers' deposits with banks, which may be time deposits, call deposits, or current accounts.

Capital: represents the value of shares as authorized in articles of association (issued and subscribed).

General Administration Expenses: represents the costs of operating a business and costs incurred to generate revenues.

4.4.4Output Variables:

Investments: represents banks, securities, investment funds, and stocks.

Total Operating Income: includes income from the operations of a business.

4.5 Two-Stage Approach:

In our analysis, we will follow the two-stage approach as suggested by Coelli, Prasada, and Battese (1998). In the DEA efficiency score measurement literature the two-stage approach is the most prominent. This approach uses the efficiency score measured by the DEA model as the dependent variable in a regression model with the explanatory variables supposed to capture the impact of the external factors (Hahn 2005). This approach involves solving a DEA problem in a first-stage analysis. We will investigate the efficiency score involving traditional outputs and inputs for eight years by using Frontier Analyst software version 4.[21]

In the second stage, the efficiency score measures that derived from the DEA estimations (first stage) will be used as the dependent variable and then regressed upon environmental variables. The coefficients of the environmental variables will be evaluated to investigate how they would affect the efficiency score. After that, the hypothesis will be tested to investigate the strength of the relationship between the efficiency score and environmental variables. To investigate the progress of the efficiency score in the period of study, we will compare the average of the efficiency score for all banks in the sample for each year. Then we will estimate the following Tobit[22] regression model:

[21] The Frontier Analyst software version 4 enhances the efficiency score using the data envelopment analysis (DEA) technique. This software is offered by BANXIA SOFTWARE.

[22] The Tobit Model is a model proposed by James Tobin (1958). It estimates a linear regression model for a left-censored dependent variable, further, it uses likelihood ratio to determine the p-value associated with a fitted parameter.

$$\Theta = \beta 1\ TA + \beta 2\ ROE + \beta 3\ IB + \beta 4\ BH + \beta 5\ KU + \beta 6\ OM + \beta 7\ QT + \beta 8\ UAE + \epsilon i \qquad (4.27)$$

Where:

Θ = the efficiency score.

TA = the total assets, which represent current assets, stock, fixed assets, and other assets.

ROE = the return on equity, which represents the percentage of net profits to the owner's equity.

IB = a dummy variable (= 1 if the bank is Islamic, = 0 otherwise). The dummy variable IB is introduced in order to detect whether there are efficiency differences between Islamic banks and traditional banks.

BH (Bahrain), KU (Kuwait), OM (Oman), QT (Qatar), and UAE (United Arab Emirates) are dummy variables (taking Saudi as a base) indicating the country of origin of a bank (= 1 if based in the country, = 0 otherwise). These dummies are used to distinguish between the countries of origin of the banks in the sample.

4.6 Conclusion:

As we shown above, there are two main methods that measures the efficiency scores nonparametric linear programming approach which includes data envelopment analysis (DEA) and Free Disposal Hull (FDH); and parametric (econometric) approach which includes stochastic frontier approach (SFA), thick frontier approach (TFA) and distribution free approach (DFA). There is no consensus on the best method or set of methods for measuring efficiency score, and the choice of method may affect the policy conclusions that are drawn from the analysis (Bauer, Berger, Ferrier and Humphrey 1997). In this dissertation, we use nonparametric DEA to estimate bank efficiency in GCC countries. The reason for choosing DEA is because the SFA, TFA and DFA require a large sample size to make reliable estimates. On the other hand, DEA works well with a small sample size and does not necessitate the knowledge of any functional form of the frontier.

5 CHAPTER FIVE: EMPIRICAL RESULT

5.1 Introduction:

In this chapter, we present an analysis employing the two-stage method of the findings of the efficiency study in the Gulf Cooperation Council (GCC) banking sector. In the first stage, we estimate the efficiency level of 50 GCC banks by using the Data Envelopment Analysis (DEA) approach to investigate whether the technical efficiency of the GCC banking system improved between 2000 and 2007 and to compare the efficiency scores of the financial sectors of GCC countries, namely, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE. Finally, we try to find out how trends involving the number of efficient banks and banks with low efficiency scores changed during the period of study.

In the second stage, we regress the efficiency level obtained from the first stage on factors that could influence the efficiency of banks by using a Tobit regression model for each year during the period of study. (In this scenario, total assets indicate the size of each bank, and the return on equity indicates the profit. We consider an Islamic bank as a dummy variable and indicate the country through dummy variables.) In addition, we

apply data as panel data for eight years and use the same Tobit regression model to estimate the coefficients for variables that could influence the efficiency score.

5.2 Stage One Results:

To estimate the efficiency levels for 50 banks in GCC countries, we used an input-output DEA approach for each year as follows:

Max $$\theta = \frac{\mathbf{Y1} + \mathbf{Y2}}{X1 + X2 + X3} \qquad (5.1)$$

Subject to

Bank1 $$\frac{\mathbf{Y1} + \mathbf{Y2}}{X1 + X2 + X3} \leq 1 \qquad (5.2)$$

Bank2 $$\frac{\mathbf{Y1} + \mathbf{Y2}}{X1 + X2 + X3} \leq 1 \qquad (5.3)$$

-

-

-

Bank50 $$\frac{\mathbf{Y1} + \mathbf{Y2}}{X1 + X2 + X3} \leq 1 \qquad (5.4)$$

Where:

Y1 = Investments.

Y2 = Total Operating Income.

X1 = Deposits.

X2 = Capital.

X3 = General Administration Expenses.

Table 5.1: Summary Statistics for Input and Output Variables, 2000-2007

US $'000

	2000				
	TOI	Investments	GAE	Capital	Deposits
Mean	170677	1160771	55878	221387	2791548
Median	97498	196959	32737	155695	1516631
Maximum	991482	10612562	276083	1066800	14965531
Minimum	6305	950	2551	24741	5615
Std. Dev.	209008	2319707	67511	221946	3212538
	2001				
	TOI	Investments	GAE	Capital	Deposits
Mean	184586	1291436	59223	228775	3032330
Median	97292	270087	36653	155695	1621391
Maximum	912621	11633162	278487	1066800	15914787
Minimum	7800	5595	3338	27490	5615
Std. Dev.	213595	2420315	68338	225178	3423339
	2002				
	TOI	Investments	GAE	Capital	Deposits
Mean	195678	1426440	63552	238133	3312209
Median	113423	302878	39175	155695	1738521
Maximum	901088	12819408	295321	1066800	15668943
Minimum	9805	4765	3679	27490	26437
Std. Dev.	215444	2621308	72264	231154	3657014
	2003				
	TOI	Investments	GAE	Capital	Deposits
Mean	225325	1550432	70236	249919	3662683
Median	125139	308736	41022	176874	2047799
Maximum	1103491	14499230	331609	1066800	16473610
Minimum	12462	5860	3970	34363	44067
Std. Dev.	245492	2853180	78884	229701	3968602

Continued Table 5.1: Summary Statistics for Input and Output Variables, 2000-2007
US $'000

	2004				
	TOI	**Investments**	**GAE**	**Capital**	**Deposits**
Mean	275267	1760497	77466	272046	4354330
Median	153926	388061	47480	202125	2575660
Maximum	1383028	17322973	328818	1066800	17880813
Minimum	13087	24700	4482	42953	80779
Std. Dev.	295402	3216092	83647	230350	4600117
	2005				
	TOI	**Investments**	**GAE**	**Capital**	**Deposits**
Mean	431315	1975481	92048	349310	5430452
Median	269207	447452	48739	256630	3288946
Maximum	2067310	21371920	379880	1600200	22733570
Minimum	16034	35894	4638	54600	113292
Std. Dev.	440442	3652148	99537	331434	5457097
	2006				
	TOI	**Investments**	**GAE**	**Capital**	**Deposits**
Mean	536751	2335584	123213	443530	6701366
Median	350645	675261	62063	312616	4130145
Maximum	2536290	23886502	496959	1800225	25298056
Minimum	17854	29133	6395	54600	136705
Std. Dev.	557791	4258597	133393	400489	6505884
	2007				
	TOI	**Investments**	**GAE**	**Capital**	**Deposits**
Mean	614573	2868293	149359	548206	8526627
Median	423460	829827	86849	334220	5710483
Maximum	2850838	27970281	569919	3600450	30886868
Minimum	19887	70514	7217	133000	162162
Std. Dev.	619535	5166777	150020	590001	8011135

TOI = Total Operating Income. GAE = General Administration Expenses.

Table 5.1 gives summary statistics. It includes descriptive statistics pertaining to the outputs (total operating income and investment) and inputs (general administrative expenses, capital, and deposits) of the sample during the period of study. As is shown, the banking sector in GCC countries grew significantly from 2000 to 2007, mainly as a result of a relatively low interest rate environment, high oil prices, and a flourishing economy. The GCC countries' banks achieved a whopping 200% growth in average deposits for the period from 2000 to 2007. During those years, GCC banks focused extensively on improving their quality of investment, which resulted in a 147% increase in the investment averages in the sample, from $1.160 billion to $2.868 billion. In addition, the average amount of capital over the sample period reflected the same high growth path of 147%, with $548 million in 2007 compared to $221 million at the end of 2000.

Table 5.2 presents the technical efficiency averages for all GCC countries' banks in each year of study, with the assumption of constant return to scale (CRS), variable return to scale input-based (VRS-I), and variable return to scale output-based (VRS-O).[23] Our analysis is based on the assumption of VRS-I because the input quantities appear to be the primary decision variables and because most studies choose the VRS-I assumption. Table 5.2 shows the relative position of each region on the GCC countries' frontier. Under VRS-I the data indicate progress in the average efficiency scores for

[23] In the VRS-I assumption the DEA method seeks to identify the efficiency level as a proportional reduction in input usage, while in the VRS-O assumption the DEA seeks to identify the efficiency level as a proportional increase in output production. Both of these assumptions provide the same frontier and identify the same number of efficient DMUs. It is only the efficiency measures associated with the inefficient DMUs that may differ between the two assumptions (Casu and Molyneux 2003).

almost all samples during the period of study. The efficiency score average of the Qatar banking system appeared stable and had the highest overall score except for in the years 2006 and 2007. The average increased by 1.42% during the period of study. The country that improved its banking industry the most was Bahrain, where the average of the efficiency score increased by 22.26% from 2000 to 2007. Furthermore, the average efficiency score in Kuwait, Oman, and the UAE were close to each other, improving by 19.14%, 16.5%, and 13.12%, respectively, within the eight years. The only country that recorded a decrease in its average efficiency score was Saudi Arabia. It showed progress in the years 2001, 2002, and 2003, but the average declined after that, especially in 2007, which led the efficiency score average to decrease by 17.42% during the complete period of study. Overall, the results show an improvement in the average efficiency scores for all GCC countries except Saudi Arabia.

According to the results shown in Table 5.2 and based on VRS-I, we found that the most efficient banks were in Qatar, followed by banks in the UAE and Bahrain. However, the least efficient banks were Omani banks, followed by Saudi and Kuwaiti banks. Given the relatively well developed nature of the banking industry in Qatar, the UAE, and Bahrain, this result does not come as a surprise. It can be partly attributed to increased foreign participation and improved in banking regulation in those countries to face up the future challenges.

Table 5.2: The Technical Efficiency Averages for GCC Countries' Banks, 2000-2007

		2000			2001		
	# of banks	CRS	VRS-I	VRS-O	CRS	VRS-I	VRS-O
Bahrain	5	50.18%	61.60%	63.52%	50.34%	64.20%	69.52%
Kuwait	8	40.91%	53.69%	67.65%	43.53%	54.24%	70.93%
Oman	5	49.80%	58.62%	75.28%	51.00%	64.34%	84.72%
Qatar	6	69.17%	81.27%	78.37%	73.00%	90.33%	88.92%
Saudi Arabia	9	64.57%	68.62%	71.37%	65.31%	71.34%	76.86%
UAE	17	51.52%	62.57%	74.34%	55.38%	65.12%	75.97%
		2002			**2003**		
	# of banks	CRS	VRS-I	VRS-O	CRS	VRS-I	VRS-O
Bahrain	5	58.32%	70.94%	81.40%	61.58%	72.28%	76.94%
Kuwait	8	63.94%	66.33%	77.88%	76.14%	79.30%	82.43%
Oman	5	72.76%	78.74%	89.72%	61.42%	68.08%	72.36%
Qatar	6	80.90%	93.10%	94.45%	86.27%	92.83%	92.87%
Saudi Arabia	9	66.99%	71.74%	78.14%	69.00%	70.44%	75.78%
UAE	17	71.91%	78.22%	80.72%	71.29%	76.00%	75.98%
		2004			**2005**		
	# of banks	CRS	VRS-I	VRS-O	CRS	VRS-I	VRS-O
Bahrain	5	54.62%	70.54%	73.38%	43.92%	67.66%	56.54%
Kuwait	8	66.31%	71.53%	74.60%	59.14%	62.88%	66.53%
Oman	5	48.16%	62.40%	63.32%	27.00%	49.74%	48.18%
Qatar	6	71.80%	80.40%	75.72%	59.17%	71.73%	68.15%
Saudi Arabia	9	64.54%	67.54%	72.84%	53.90%	55.59%	67.94%
UAE	17	67.44%	76.11%	73.43%	56.89%	66.05%	67.54%
		2006			**2007**		
	# of banks	CRS	VRS-I	VRS-O	CRS	VRS-I	VRS-O
Bahrain	5	52.26%	78.34%	76.48%	49.24%	83.86%	82.38%
Kuwait	8	65.20%	69.81%	68.24%	58.91%	72.83%	64.53%
Oman	5	33.46%	61.80%	52.42%	27.38%	75.12%	52.96%
Qatar	6	66.73%	74.20%	70.98%	65.48%	82.70%	78.12%
Saudi Arabia	9	63.18%	68.17%	74.51%	44.42%	51.20%	62.88%
UAE	17	53.25%	65.78%	62.28%	53.53%	75.69%	67.73%

Table 5.3 presents yearly summary statistics of technical efficiency scores for GCC countries as a whole with the assumptions of CRS, VRS-I, and VRS-O as well. When we consider VRS-I, we find that the movement trend of the mean of technical efficiency was quite different during the period of study. However, all the sample banks in each year appeared to be performing reasonably well, with the annual mean of technical efficiency scores for the GCC banking sector ranging between 0.628 in 2005 and 0.763 in 2003. As the table shows, the technical efficiency improved slightly in the first year from 0.63 to 0.69 (2000-2001), and then obtained the highest level of the sample period in 2002 and 2003 (0.76). In 2004, the efficiency score mean moved to the opposite direction by 4%, reaching 0.72, and it continued to fall in 2005 until it reached the lowest efficiency score mean (0.62) during the period of study. The mean of efficiency score increased, however, in 2006, reaching 0.68. In the final year (2007) of the sample period, the efficiency score improved to 0.72, which led to a cumulative 8.4% rise in the mean in the GCC banking sector during the sample period.

Table 5.3: Summary Statistic of Efficiency Score for GCC Banks with the assumptions of CRS, VRS-I and VRS-O, 2000-2007

	2000			2001		
	CRS	VRS-I	VRS-O	CRS	VRS-I	VRS-O
Mean	0.53982	0.6399	0.72228	0.56444	0.67356	0.77106
Median	0.504	0.627	0.6785	0.534	0.65	0.756
Maximum	1	1	1	1	1	1
Minimum	0.162	0.252	0.416	0.215	0.273	0.463
Std. Dev.	0.264008	0.242518	0.182821	0.246044	0.250177	0.169346
Skew	0.477808	0.15424	0.302708	0.471161	0.03349	0.044436
Kurtosis	2.003175	1.849399	1.919798	2.057047	1.611538	1.792821
	2002			**2003**		
	CRS	VRS-I	VRS-O	CRS	VRS-I	VRS-O
Mean	0.69554	0.76262	0.82416	0.71492	0.76384	0.78734
Median	0.684	0.772	0.84	0.6765	0.7425	0.7785
Maximum	1	1	1	1	1	1
Minimum	0.316	0.37	0.478	0.375	0.38	0.473
Std. Dev.	0.199462	0.195087	0.1525	0.196869	0.197119	0.181022
Skew	0.134167	-0.229601	-0.390903	0.227228	-0.05727	-0.12489
Kurtosis	1.923172	1.867266	2.058186	1.69346	1.569301	1.544187
	2004			**2005**		
	CRS	VRS-I	VRS-O	CRS	VRS-I	VRS-O
Mean	0.6405	0.7242	0.7277	0.52698	0.6287	0.64486
Median	0.5895	0.726	0.7	0.472	0.545	0.576
Maximum	1	1	1	1	1	1
Minimum	0.317	0.382	0.402	0.153	0.265	0.271
Std. Dev.	0.215302	0.190283	0.194512	0.264974	0.236841	0.238459
Skew	0.437545	0.125937	0.119055	0.692941	0.519871	0.304139
Kurtosis	2.092832	1.891789	1.773835	2.357694	1.924261	1.844783
	2006			**2007**		
	CRS	VRS-I	VRS-O	CRS	VRS-I	VRS-O
Mean	0.5649	0.68722	0.66912	0.51142	0.72424	0.67578
Median	0.525	0.6465	0.6345	0.429	0.7035	0.6325
Maximum	1	1	1	1	1	1
Minimum	0.128	0.341	0.245	0.14	0.357	0.247
Std. Dev.	0.277876	0.216975	0.241633	0.264059	0.215064	0.232056
Skew	0.347364	0.252231	0.0644	0.792059	-0.084259	0.153036
Kurtosis	1.931377	1.761585	1.738673	2.413094	1.738174	1.783626

Figures 5.1 through 5.8 illustrate the frequency distribution of the average efficiency scores for each year during the sample period, and they also show how the situation changed in subsequent years. The number of efficient banks in GCC countries rose from 10 to 12 banks in the first year, and the banks in the efficiency score interval between 0.41 and 0.50 decreased from six to two banks. In 2002 and 2003 the number of efficient banks increased to 14, which is the highest number for the sample period. Just one bank had an efficiency score of less than 0.50. In 2004 the number of efficient banks fell to 11, and the number of banks that had low scores (between 0.31 and 0.50) rose to six. Year 2005 was the worst year of the period of study, with three banks settled between 0.21 and 0.30 on the efficiency score interval, six banks between 0.31 and 0.40, five banks between 0.41 and .50, and only 10 banks proving to be efficient. In the last two years of the sample period (2006 and 2007), 16 banks and 14 banks had low efficiency scores (less than 0.50), respectively, and the number of efficient banks was 12 in both years.

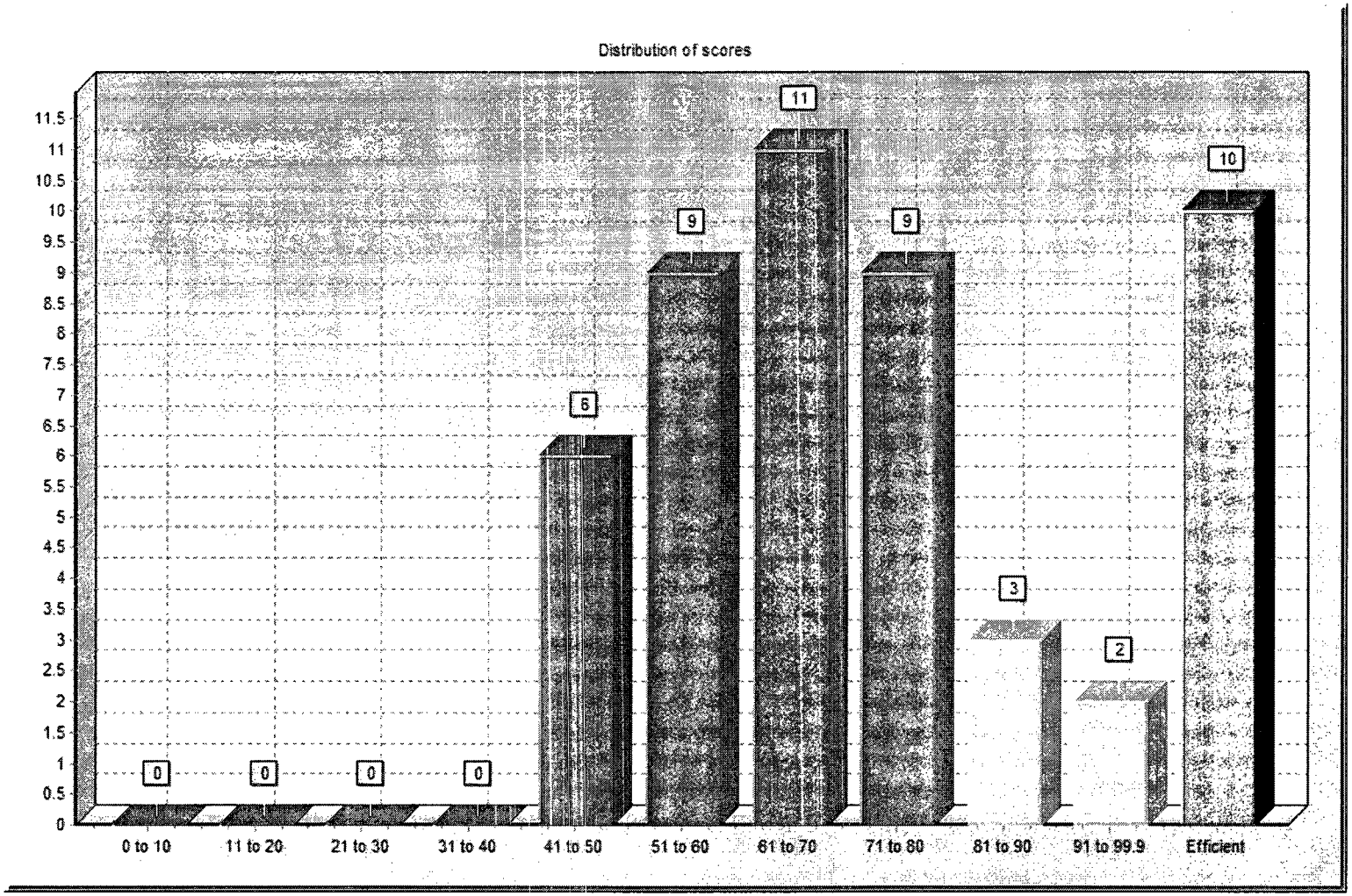

Figure 5.1: Frequency Distribution of the Efficiency Scores for GCC Banks (2000)

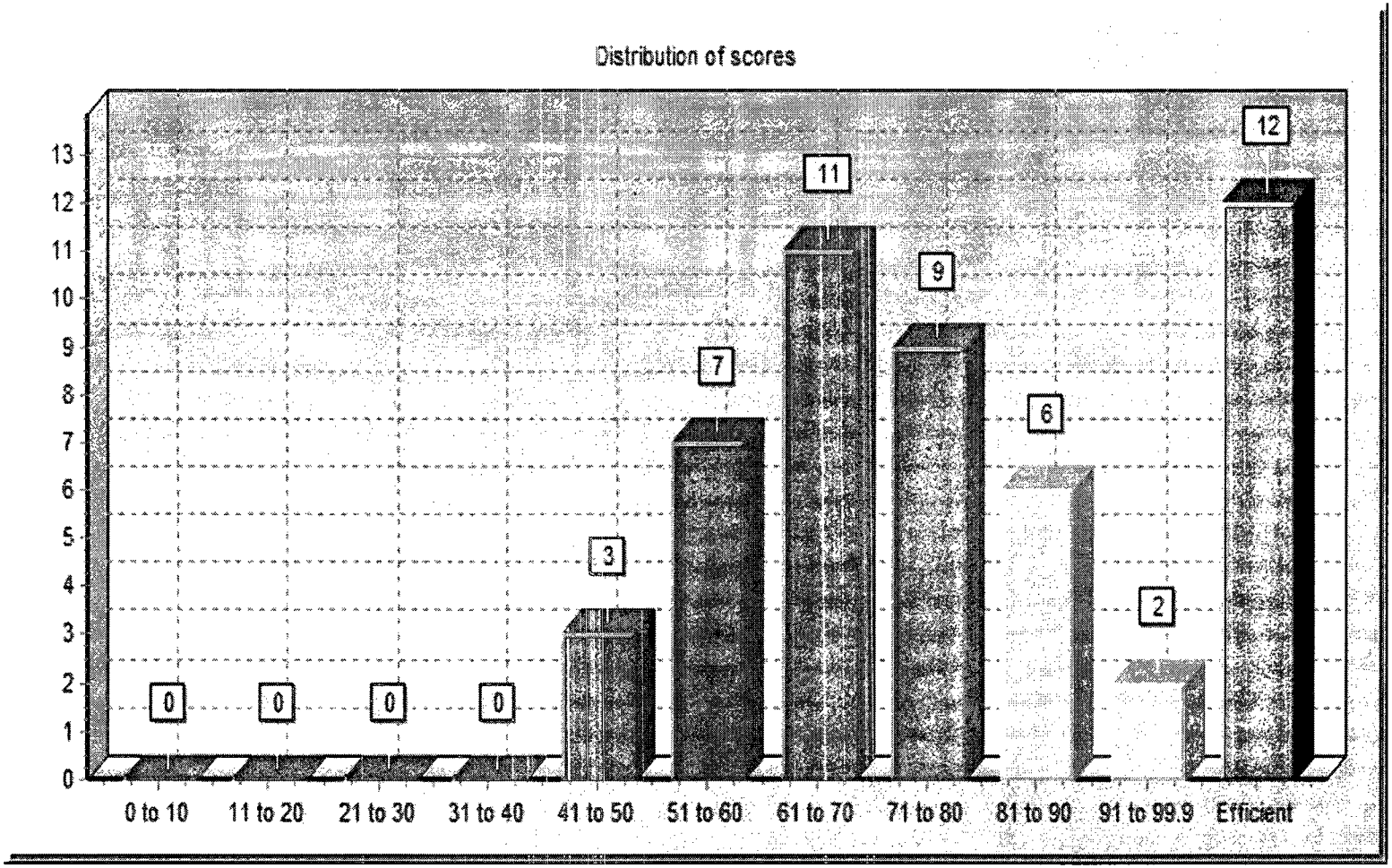

Figure 5.2: Frequency Distribution of the Efficiency Scores for GCC Banks (2001)

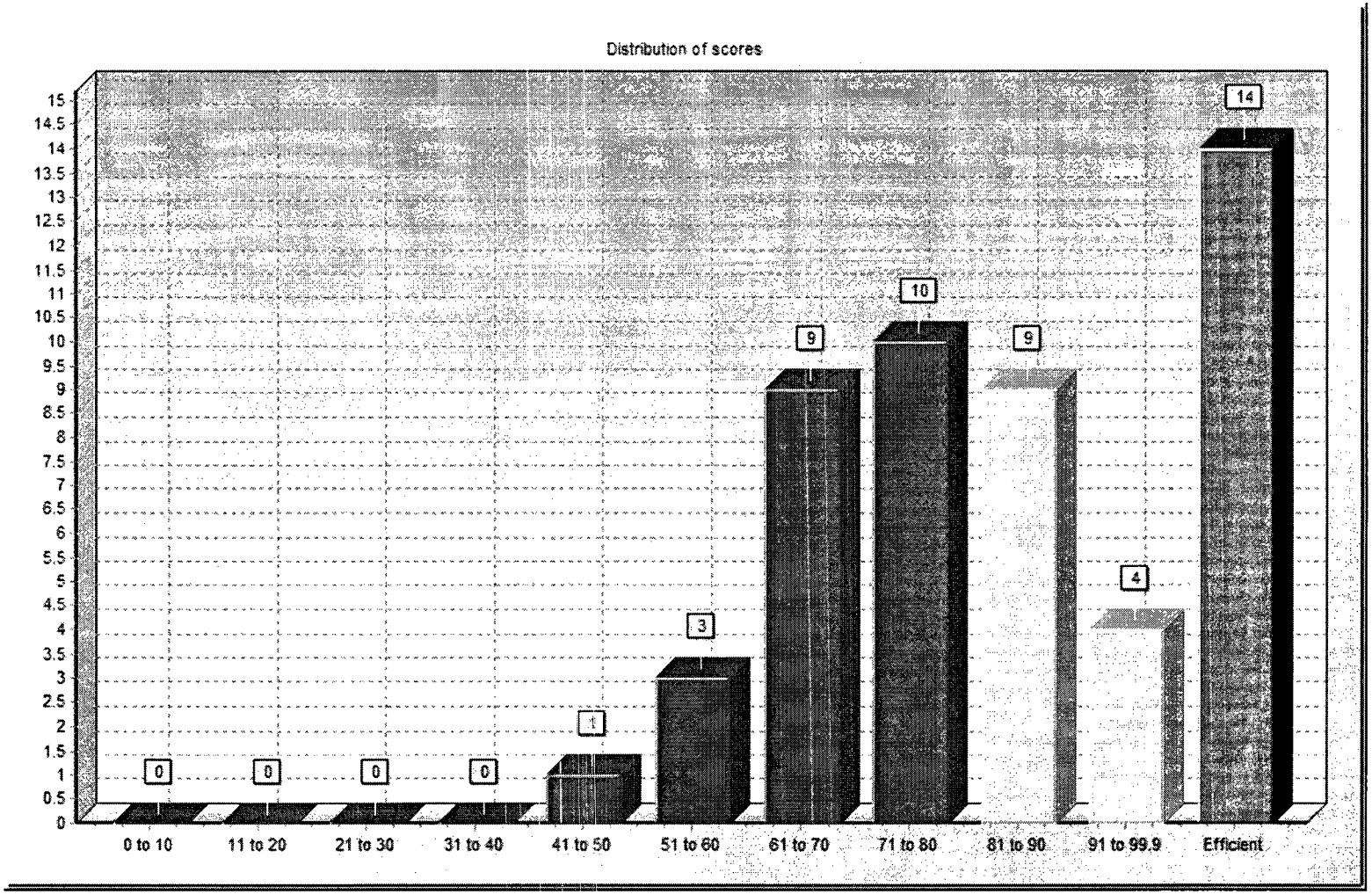

Figure 5.3: Frequency Distribution of the Efficiency Scores for GCC Banks (2002)

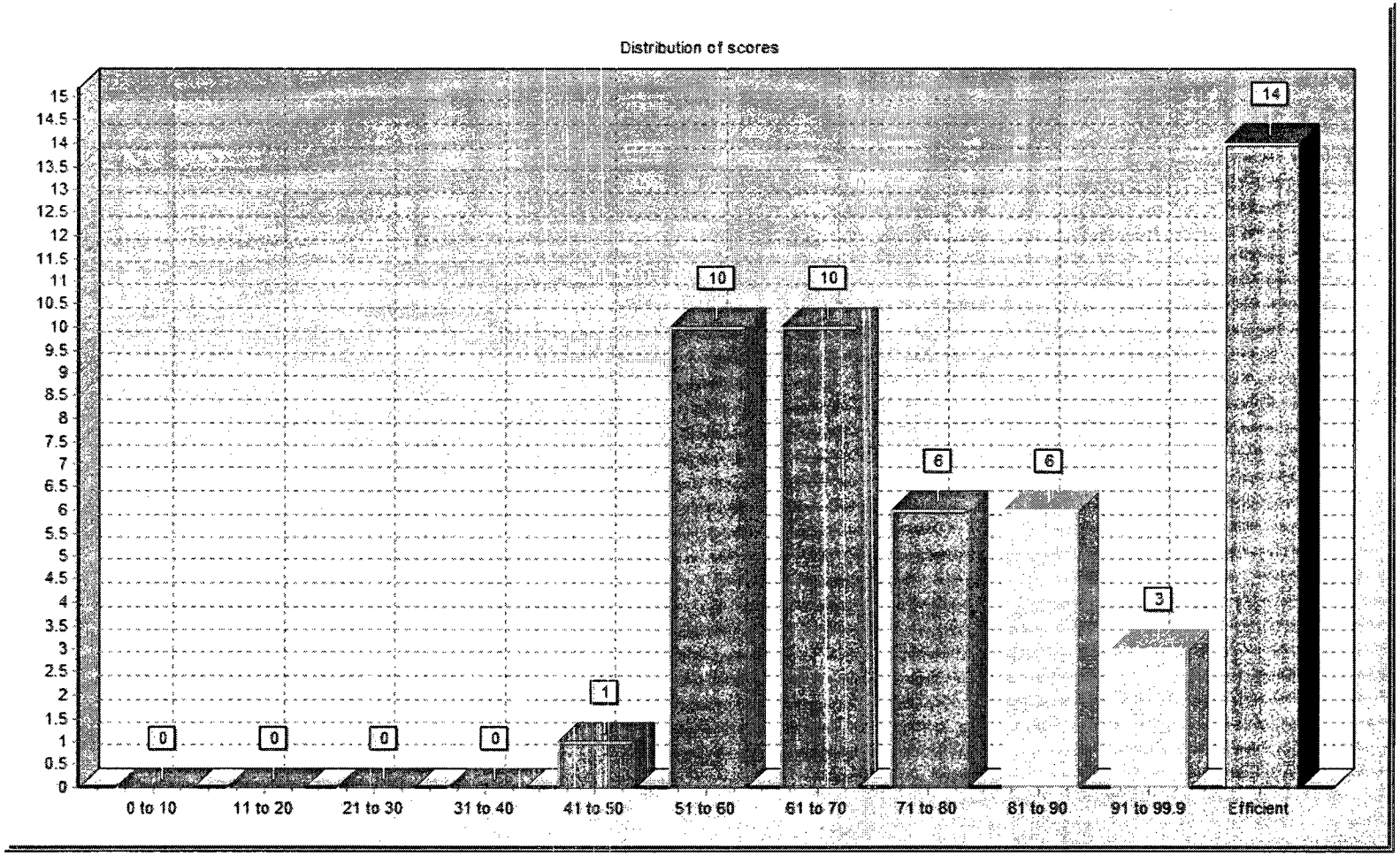

Figure 5.4: Frequency Distribution of the Efficiency Scores for GCC Banks (2003)

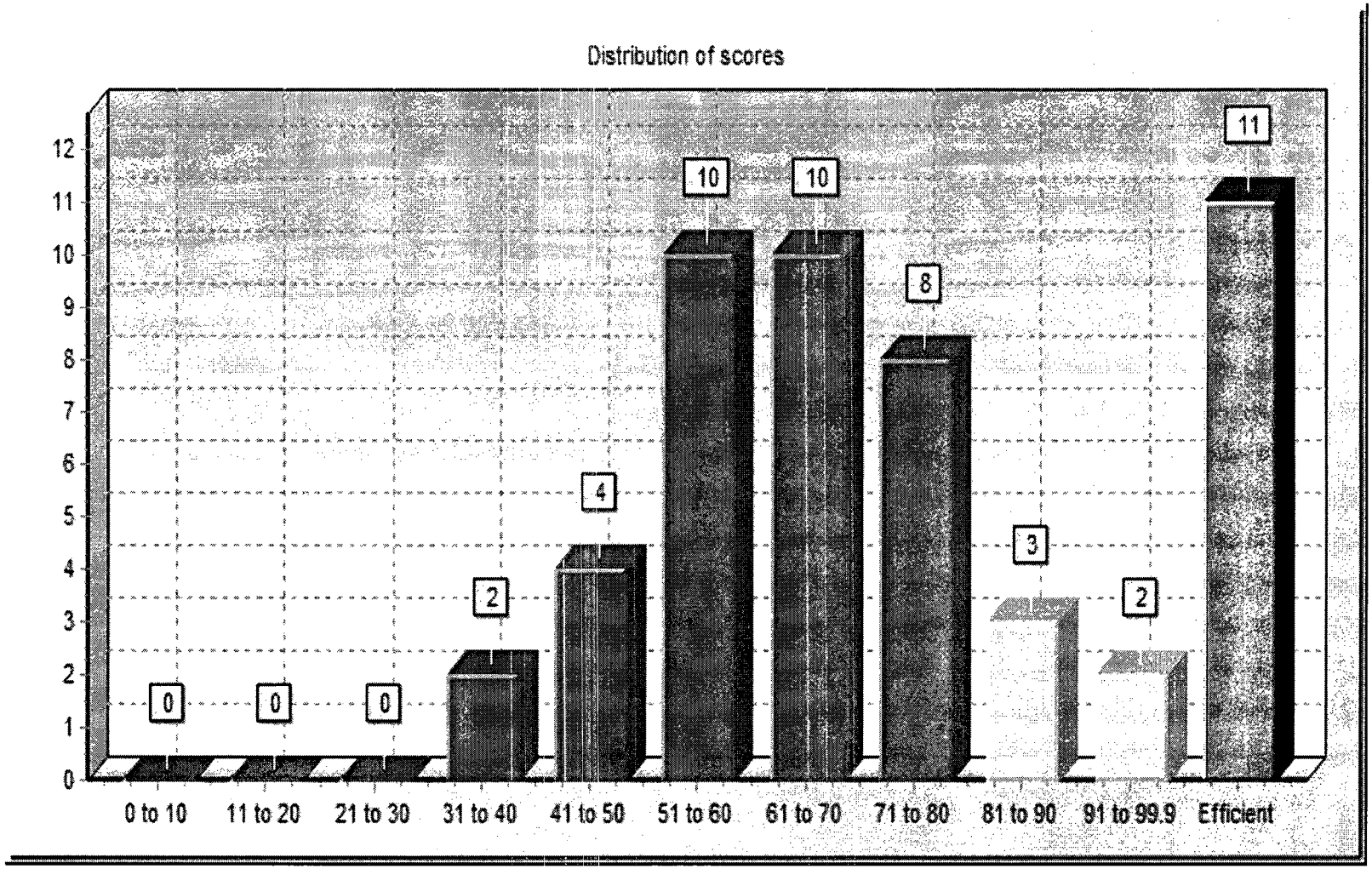

Figure 5.5: Frequency Distribution of the Efficiency Scores for GCC Banks (2004)

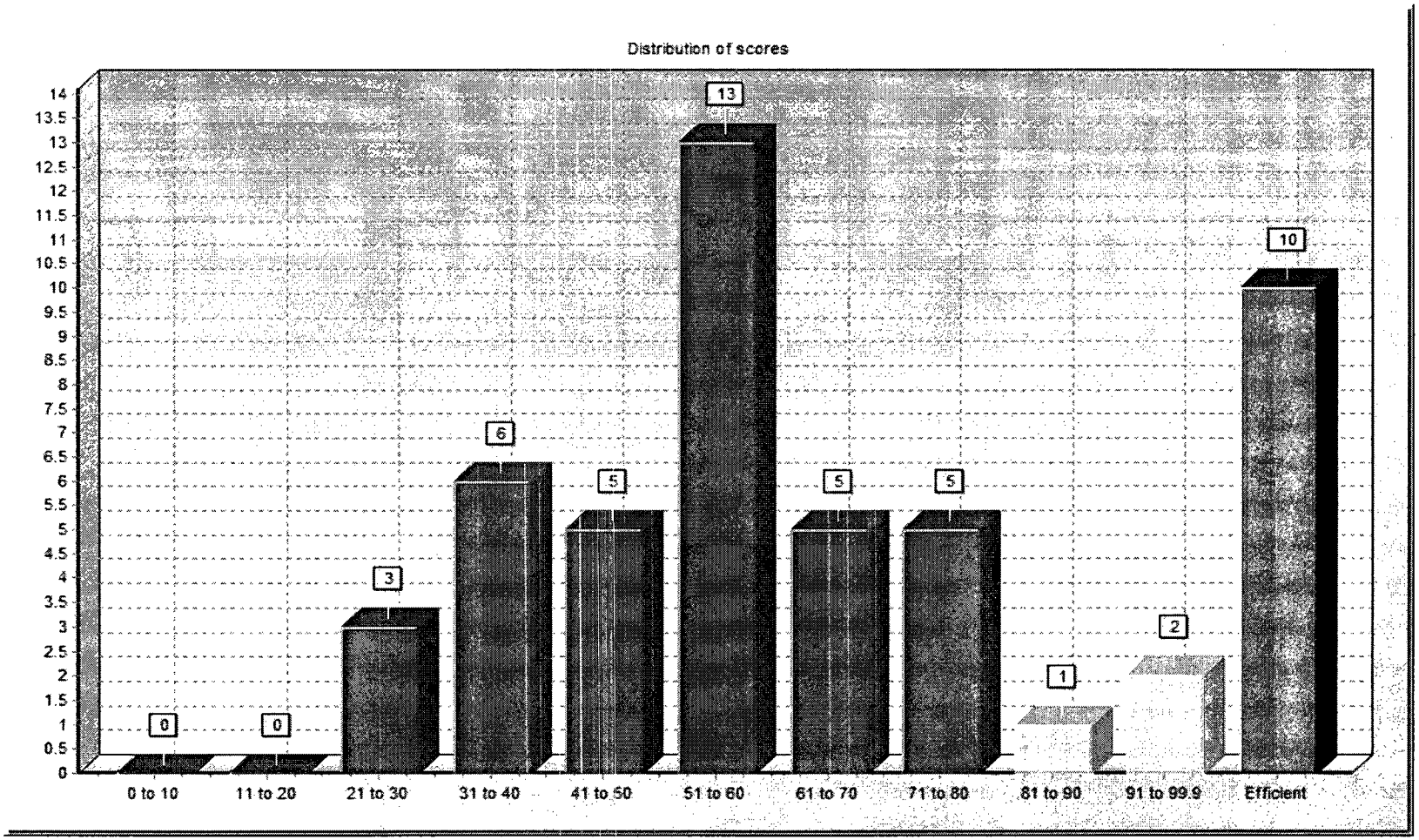

Figure 5.6: Frequency Distribution of the Efficiency Scores for GCC Banks (2005)

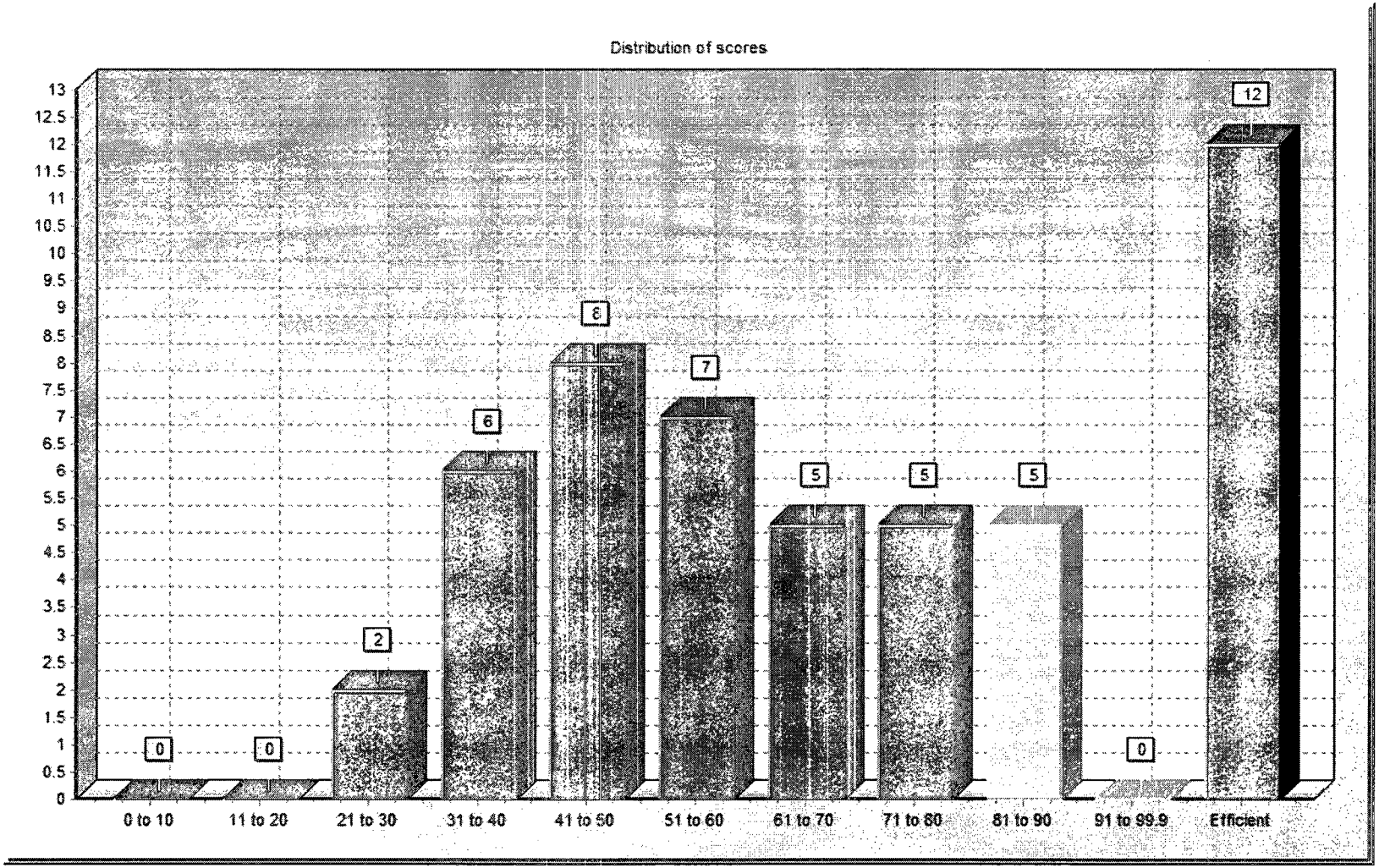

Figure 5.7: Frequency Distribution of the Efficiency Scores for GCC Banks (2006)

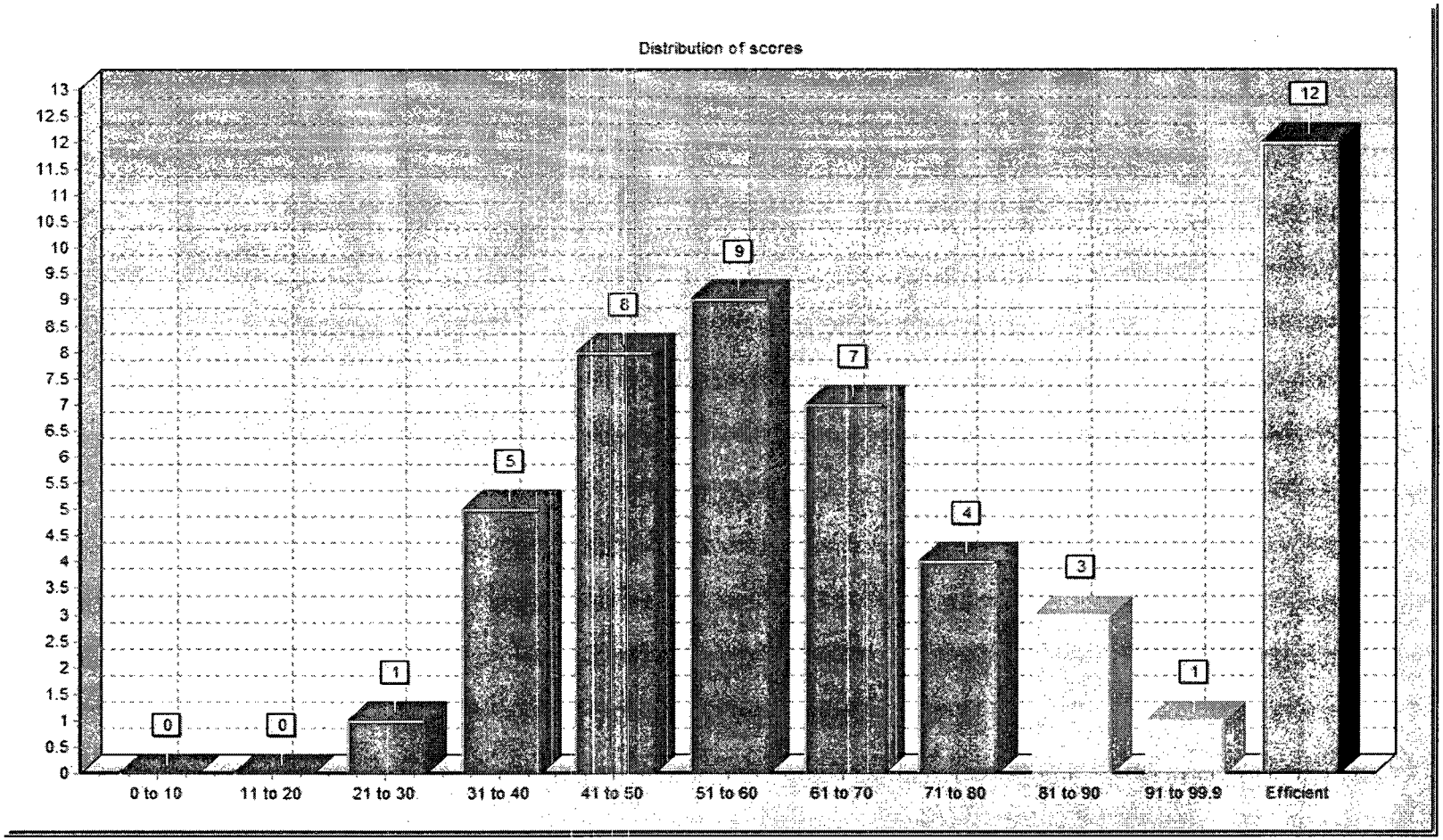

Figure 5.8: Frequency Distribution of the Efficiency Scores for GCC Banks (2007)

5.3 Stage Two Results:

In addition to estimating the DEA efficiency scores in stage one; we constructed an econometric regression model based on the efficiency scores as a dependent variable to detect the relationship between efficiency and some of the determinants. Due to the limited nature of our efficiency measure, which ranged from 0 to 1, we estimated our models using Tobit-regression onto a vector of explanatory variables in order to explain the variation in the efficiency scores obtained from stage one.

Tables 5.4 to 5.11 used Tobit regression to give the estimated results for each year. The second and third columns of these tables reveal estimated coefficients and standard errors from Tobit regression for regressing technical efficiency change on the vector of explanatory variables. We examine the effect of four groups of factors on technical efficiency scores as the following model:

$$\Theta = \beta 1\ TA + \beta 2\ ROE + \beta 3\ IB + \beta 4\ BH + \beta 5\ KU + \beta 6\ OM + \beta 7\ QT + \beta 8\ UAE + \epsilon i \qquad (5.5)$$

Table 5.4: Tobit Censored Regression Result, 2000

Dependent Variable: EFFICIENCY SCORE
Included observations: 50
Left censoring (value) series: 0
Right censoring (value) series: 1

	Coefficient	Std. Error	t-Statistic	Prob.
Total Assets	2.71E-08	1.09E-08	2.487047	0.0129
Return On Equity	0.016750	0.007057	2.373669	0.0176
Islamic Banks	0.338643	0.092531	3.659769	0.0003
Bahrain	0.345198	0.132218	2.610823	0.0090
Kuwait	0.050980	0.113388	0.449605	0.6530
Oman	0.386513	0.130092	2.971068	0.0030
Qatar	0.392537	0.146235	2.684280	0.0073
Emirates	0.298882	0.101082	2.956821	0.0031

Left censored obs	0	Right censored obs	10
Uncensored obs	40	Total obs	50

Table 5.5: Tobit Censored Regression Result, 2001

Dependent Variable: EFFICIENCY SCORE
Included observations: 50
Left censoring (value) series: 0
Right censoring (value) series: 1

	Coefficient	Std. Error	t-Statistic	Prob.
Total Assets	1.76E-08	1.17E-08	1.500467	0.1335
Return On Equity	0.024188	0.007556	3.200983	0.0014
Islamic Banks	0.318153	0.095855	3.319110	0.0009
Bahrain	0.312356	0.134657	2.319644	0.0204
Kuwait	-0.012899	0.116344	-0.110869	0.9117
Oman	0.459392	0.129509	3.547169	0.0004
Qatar	0.464017	0.154462	3.004075	0.0027
Emirates	0.244859	0.106605	2.296876	0.0216

Left censored obs	0	Right censored obs	12
Uncensored obs	38	Total obs	50

Table 5.6 Tobit Censored Regression Result, 2002

Dependent Variable: EFFICIENCY SCORE
Included observations: 50
Left censoring (value) series: 0
Right censoring (value) series: 1

	Coefficient	Std. Error	t-Statistic	Prob.
Total Assets	1.88E-08	9.03E-09	2.079244	0.0376
Return On Equity	0.021957	0.006141	3.575578	0.0003
Islamic Banks	0.236335	0.086727	2.725041	0.0064
Bahrain	0.438620	0.121662	3.605225	0.0003
Kuwait	0.154371	0.105197	1.467455	0.1423
Oman	0.503689	0.133224	3.780776	0.0002
Qatar	0.468962	0.157761	2.972608	0.0030
Emirates	0.415990	0.092925	4.476628	0.0000

Left censored obs	0	Right censored obs	14
Uncensored obs	36	Total obs	50

Table 5.7: Tobit Censored Regression Result, 2003

Dependent Variable: EFFICIENCY SCORE
Included observations: 50
Left censoring (value) series: 0
Right censoring (value) series: 1

	Coefficient	Std. Error	t-Statistic	Prob.
Total Assets	9.20E-09	7.93E-09	1.159441	0.2463
Return On Equity	0.026487	0.005532	4.787755	0.0000
Islamic Banks	0.275708	0.083228	3.312661	0.0009
Bahrain	0.373483	0.113769	3.282833	0.0010
Kuwait	0.267975	0.100435	2.668148	0.0076
Oman	0.371031	0.116878	3.174520	0.0015
Qatar	0.421244	0.138654	3.038094	0.0024
Emirates	0.340529	0.080359	4.237623	0.0000

Left censored obs	0	Right censored obs	15
Uncensored obs	35	Total obs	50

Table 5.8: Tobit Censored Regression Result, 2004

Dependent Variable: EFFICIENCY SCORE
Included observations: 50
Left censoring (value) series: 0
Right censoring (value) series: 1

	Coefficient	Std. Error	t-Statistic	Prob.
Total Assets	-9.06E-10	6.46E-09	-0.140235	0.8885
Return On Equity	0.028483	0.004755	5.989698	0.0000
Islamic Banks	0.283366	0.067209	4.216165	0.0000
Bahrain	0.325576	0.094336	3.451227	0.0006
Kuwait	0.144827	0.084126	1.721547	0.0852
Oman	0.274141	0.094871	2.889627	0.0039
Qatar	0.264360	0.100692	2.625433	0.0087
Emirates	0.274345	0.071307	3.847377	0.0001

Left censored obs	0	Right censored obs	11
Uncensored obs	39	Total obs	50

Table 5.9: Tobit Censored Regression Result, 2005

Dependent Variable: EFFICIENCY SCORE
Included observations: 50
Left censoring (value) series: 0
Right censoring (value) series: 1

	Coefficient	Std. Error	t-Statistic	Prob.
Total Assets	8.90E-09	5.83E-09	1.526528	0.1269
Return On Equity	0.012305	0.003690	3.334890	0.0009
Islamic Banks	0.215525	0.088032	2.448263	0.0144
Bahrain	0.477633	0.113376	4.212809	0.0000
Kuwait	0.246992	0.099517	2.481901	0.0131
Oman	0.299726	0.118784	2.523297	0.0116
Qatar	0.322327	0.123613	2.607547	0.0091
Emirates	0.313274	0.084811	3.693784	0.0002

Left censored obs	0	Right censored obs	10
Uncensored obs	40	Total obs	50

Table 5.10: Tobit Censored Regression Result, 2006

Dependent Variable: EFFICIENCY SCORE
Included observations: 50
Left censoring (value) series: 0
Right censoring (value) series: 1

	Coefficient	Std. Error	t-Statistic	Prob.
Total Assets	2.57E-09	4.13E-09	0.621563	0.5342
Return On Equity	0.019501	0.003402	5.731558	0.0000
Islamic Banks	0.276468	0.077831	3.552163	0.0004
Bahrain	0.489095	0.096550	5.065693	0.0000
Kuwait	0.180911	0.083697	2.161509	0.0307
Oman	0.270633	0.101166	2.675140	0.0075
Qatar	0.197359	0.101195	1.950294	0.0511
Emirates	0.290406	0.059234	4.902655	0.0000

Left censored obs	0	Right censored obs	12
Uncensored obs	38	Total obs	50

Table 5.11: Tobit Censored Regression Result, 2007

Dependent Variable: EFFICIENCY SCORE
Included observations: 50
Left censoring (value) series: 0
Right censoring (value) series: 1

	Coefficient	Std. Error	t-Statistic	Prob.
Total Assets	4.23E-10	2.82E-09	0.149914	0.8808
Return On Equity	0.021486	0.004082	5.262931	0.0000
Islamic Banks	0.252252	0.075044	3.361373	0.0008
Bahrain	0.572649	0.102463	5.588832	0.0000
Kuwait	0.208479	0.095269	2.188334	0.0286
Oman	0.460794	0.103692	4.443869	0.0000
Qatar	0.296503	0.114887	2.580815	0.0099
Emirates	0.307392	0.077761	3.953035	0.0001

Left censored obs	0	Right censored obs	12
Uncensored obs	38	Total obs	50

First, we analyzed the influence of the difference in the total assets (TA [bank's size]) on the efficiency score. We tested the null hypothesis H_0: $\beta_1 = 0$ in each year against the alternative hypothesis H_A: $\beta_1 \neq 0$. We rejected the null hypothesis, and the results of the t-test for the relationship between the TA and technical efficiency score showed that there was a significant positive relationship between them at a 5% level for the years 2000 and 2002. However, the results for the other years noted that there was a positive sign on the coefficient of the total asset variable, but it was not statistically significant.

Second, we estimated the relationship between profitability, which we defined as the return on equity (ROE), and the technical efficiency score by testing the null hypothesis H_0: $\beta_2 = 0$ against the alternative hypothesis H_A: $\beta_2 \neq 0$ during the period of study. The results of the t-test suggested that ROE was positively related to bank efficiency and that the coefficient had a positive statistical relation to the efficiency score at the 1% level for all the years in the period of study except 2000, which was significant at the 5% level.

Third, the dummy variable IB (Islamic Bank) was introduced to investigate whether efficiency differences existed between Islamic banks and traditional banks. We used a t-test to test the null hypothesis H_0: $\beta_3 = 0$ against the alternative hypothesis H_A: $\beta_3 \neq 0$ in each year. There did appear to be a strong relationship between Islamic banks and high technical efficiency scores, so we deemed Islamic banks more efficient than their traditional counterparts. This result was statistically significant at the 1% level for the years 2000, 2001, 2002, 2003, 2004, 2006 and 2007; and at the 5% level for year 2005.

Finally, in order to determine the influence of the different countries in the GCC, we tested the coefficients β_4, β_5, β_6, β_7 and β_8 of dummy variables BH, KU, OM, QT, and UAE each year by the null hypothesis $H_0 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8$ against the alternative hypothesis H_A that at least one pair is unequal. Based on the results of the F-test (Table 5.12 shows the F-statistic value with a degree of freedom [5,42]), we rejected the null hypothesis for 2001, 2002, 2006 and 2007 at the 5% significant level; and at the 10% significant level for 2000. However, we failed to reject the null for years 2003, 2004, and 2005.

Table 5.12: Yearly F-Statistic Value to Test the Influence Of the Different Countries in the GCC, 2000-2007

Year	F-Statistic Value	Degree of Freedom
2000	2.049992	(5, 42)
2001	3.181158	(5, 42)
2002	2.59788	(5, 42)
2003	1.784751	(5, 42)
2004	1.582238	(5, 42)
2005	1.562783	(5, 42)
2006	3.772429	(5, 42)
2007	2.657743	(5, 42)

The estimated results of the panel data (using random effect) for eight years are given in table 5.13, where Tobit regression was used as well. We followed the same analytic steps as before. First, we analyzed the influence of the difference in TA on the efficiency score. Second, we estimated the relationship between ROE and the technical

efficiency score. Third, we introduced the dummy variable IB to investigate whether there were efficiency differences between Islamic banks and traditional banks. Finally, we investigated the influence of the different countries in the GCC. For the first three estimations, we calculated the t-statistic and then tested the individual null hypothesis H_0: $\beta_i = 0$ against the alternative hypothesis H_A: $\beta_i \neq 0$ for i = 1, 2, 3 at.

According to the TA, we rejected the null hypothesis, and the results of the t-test for the relationship between the technical efficiency scores showed that the coefficient on the size variable was positive and statistically significant at the 5% level. Therefore, on average the larger banks attained a higher level of technical efficiency. This positive relationship between TA (bank size) and the technical efficiency score was found in several previous studies. Yildirim (2002) reported that the size of a bank was positively related to the technical and scale inefficiencies. Jemric and Vujcic (2002) found that large banks appeared to be locally efficient while smaller banks were globally efficient. Altunbas, Liu, Molyneux, and Seth (2000) and Mester (1996) also found this positive relationship. The association of size and efficiency score could happen for different reasons. For instance, Cole and Gunther (1995) reported that larger banks can be assumed to possess more flexibility in financial markets and be better able to diversify credit risk.

With respect to the ROE, the results of the t-test suggested that the ROE was positively related to bank efficiency, and the coefficient had a positive statistically significant relation to the efficiency score at a 1% level. This result is consistent with the findings of Casu and Molyneux (2003) and Yildirim (2002). However, Limam (2001)

estimated the technical efficiency of GCC banks for the year 1999 and found that there was a weak link between technical efficiency and profitability.

In terms of the IB dummy variable, we rejected the null hypothesis, and the result of the t-test for the relationship between the IB and the technical efficiency score showed that there was a significant positive relationship at the 1% level. Hussein (2004) and Al-Jarrah and Molyneux (2003) found the same results.

To determine whether the efficiency scores could be explained by country-specific factors, we tested the null hypothesis $H_0 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8$ against the alternative hypothesis H_A that at least one pair is unequal. The result of the F-test (F-Value = 6.366, with df: (5,392)) led us to reject the null hypothesis at the 1% significant level and showed that there was a different influence of the GCC countries on the efficiency score.

Table 5.13: Tobit Censored Regression Result, 2000-2007
Dependent Variable: EFFICIENCY SCORE
Included observations: 400
Left censoring (value) series: 0
Right censoring (value) series: 1

	Coefficient	Std. Error	t-Statistic	Prob.
Total Assets	4.61E-09	2.23E-09	2.063747	0.0390
Return On Equity	0.021023	0.001845	11.39360	0.0000
Islamic Banks	0.296705	0.034977	8.482924	0.0000
Bahrain	0.440720	0.046894	9.398284	0.0000
Kuwait	0.187492	0.041217	4.548903	0.0000
Oman	0.392282	0.047693	8.225080	0.0000
Qatar	0.368003	0.051490	7.147082	0.0000
Emirates	0.321112	0.032843	9.777224	0.0000

Left censored obs	0	Right censored obs	96
Uncensored obs	304	Total obs	400

5.4 Conclusion:

We evaluated the technical efficiency of banking sectors in the six GCC countries employing the two-stage method. In the first stage, we estimated the efficiency score of 50 GCC banks by using the DEA approach to investigate whether the technical efficiency of the GCC banking system improved between 2000 and 2007. The results showed an improvement in the average efficiency scores for the GCC banking sector. We also found that the banking sector in Qatar, Bahrain, and the UAE were more efficient than their counterparts in Kuwait, Saudi Arabia, and Oman. In the second stage, we used the Tobit regression model to regress the efficiency level obtained from the stage one on factors that could influence the efficiency score. The results suggested that higher efficiency levels were associated with large and high-profitability banks. In addition, there was a positive relationship between Islamic banks and high technical efficiency scores. Finally, we tested the influence of the various countries on the efficiency score and found that there was indeed a difference.

6 Chapter Six: Summary and Conclusion

6.1 Conclusion and Policy Recommendations:

The debate on differences in measuring and analyzing the efficiency of the banking industry is still open and has been the subject of many applied works. The techniques used in estimating the frontier are based on parametric methods (when some hypotheses are introduced on the frontier functional form, based on their properties) and non-parametric methods (when observational criteria based on programming techniques are used to construct the frontier). We demonstrated that the parametric method is an econometric model which involves specifying a functional form and error term. The relevant literature has emphasized three main approaches: stochastic frontier approach (SFA), thick frontier approach (TFA), and the distribution free approach (DFA). On the other hand, the nonparametric method is a mathematical model which does not recognize the error term and which usually measures technical efficiency. The literature emphasizes two main approaches: data envelopment analysis (DEA) and Free Disposal Hull (FDH). In this dissertation, we used nonparametric DEA to estimate bank efficiency in Gulf Cooperation Countries (GCC) countries with the assumption of a variable return to scale. The reason for choosing DEA is because the parametric SFA requires a large sample size to make reliable estimates (Havrylchyk 2006). On the other hand, DEA works well with a small sample size and does not require knowledge of any functional form of

the frontier. This fact has been helpful in our analysis due to the small number of GCC banks with available data.

Extensive empirical studies of banking efficiency have been conducted with U.S. and European commercial banks. However, few studies have been carried out to investigate banking efficiency in developing countries, especially in GCC countries. Since more empirical work is needed on banking efficiency in GCC countries, the primary objective of this study was to evaluate the technical efficiency of the banking system in the GCC countries to fill the gap of literature in this area.

In this study, we employed the two-stage method in order to analyze the technical efficiency of the Gulf Cooperation Council (GCC) banking sector. In the first stage, we estimated the efficiency level of 50 GCC banks by using the nonparametric DEA approach to investigate whether the technical efficiency of the GCC banking system improved between 2000 and 2007, and to compare the efficiency scores of the financial sectors of GCC countries.

In the second stage, we regressed the efficiency level obtained from the first stage on factors that could influence the efficiency of banks by using a Tobit regression model for each year during the period of study. (In this scenario, total assets indicate the size

of each bank, and the return on equity indicates the profit. We considered an Islamic bank as a dummy variable and indicated the country through dummy variables.) In addition, we applied data as panel data for eight years and used the same Tobit regression model to estimate the coefficients of variables that could influence the efficiency score.

The finding of the first stage indicated that the banking sector in GCC countries grew significantly from 2000 to 2007. GCC countries' banks achieved a whopping 200% growth in average deposits for the period from 2000 to 2007. During those years, GCC banks focused extensively on improving their quality of investment, which resulted in a 147% increase in the investment averages in the sample, from $1.160 billion to $2.868 billion. In addition, the average amount of capital over the sample period reflected the same high growth path of 147%, with $548 million in 2007 compared to $221 million at the end of 2000.

This significant growth of the banking sector in GCC countries is mainly the result of a relatively low interest rate environment, high oil prices, and a flourishing economy. The high economic performance in GCC countries is because of the strong global oil demand (especially from China), an improvement in privatization activities, the growth of assets of central banks, and the strength of the GCC corporate sector.

The finding also indicated a progress in average efficiency scores for almost all samples during the period of study. The efficiency score average of the Qatar banking system appeared stable and had the highest overall score except for in the years 2006 and 2007. The average increased by 1.42% during the period of study. The country that improved its banking industry most was Bahrain, where the average of the efficiency score increased by 22.26% from 2000 to 2007. Furthermore, the average efficiency scores in Kuwait, Oman, and the UAE were close to each other, improving by 19.14%, 16.5%, and 13.12%, respectively, within the eight years. The only country that recorded a decrease in its average efficiency score was Saudi Arabia. It showed progress in the years 2001, 2002, and 2003, but the average declined after that, especially in 2007, which caused the efficiency score average to decrease by 17.42 during the complete period of study. Overall, the results showed an improvement in average efficiency scores for almost all GCC countries.

It is worth mentioning that we found the most efficient banks to be in Qatar, followed by banks in the UAE and Bahrain. The least efficient banks were in Oman, followed by Saudi Arabia and Kuwait. Given the relatively well-developed nature of the banking industry in Qatar, the UAE and Bahrain, this finding does not come as a surprise. It can be partly attributed to increased foreign participation, which has led to an increasingly competitive atmosphere. In this regard, we conclude that degree of competition has a positive influence on technical efficiency; these results suggest that

the banks operating under more competitive conditions are under more pressure to control their performance. Consequently, the GCC governments need to focus their attention on increasing competitiveness in the banking sector in order to raise the efficiency level of the domestic banks to prepare them for the serious challenges they will face in the near future because they are being considered for liberalization.

We also found from the first stage that the movement trend of the mean of technical efficiency was quite different over the period of study. However, in each year of the study all the sample banks appeared to be performing reasonably well, with the annual mean of technical efficiency scores for the GCC banking sector ranging between 0.628 in 2005 and 0.763 in 2003. As it shown, the technical efficiency improved slightly in the first year from 0.63 to 0.69 (2000-2001), and then reached the highest level of the sample period in 2002 and 2003 (0.76). In 2004, the efficiency score mean moved to the opposite direction by 4%, reaching 0.72, and it continued to fall in 2005 until it reached the lowest efficiency score mean (0.62) during the period of study. The mean of the efficiency score increased, however, in 2006, reaching 0.68. In the final year (2007) of the sample period, the efficiency score improved to 0.72, which led to a cumulative 8.4% rise in the mean of the GCC banking sector during the sample period.

In addition to estimating the DEA efficiency scores in stage one; we constructed an econometric regression model in stage two. This regression is based on the efficiency

scores as a dependent variable for determining the relationship between efficiency and some of the determinants. Due to the limited nature of our efficiency measure, which ranged from 0 to 1, we estimated our models using Tobit-regression onto a vector of explanatory variables in order to explain the variation in the efficiency scores obtained from stage one.

In this process, we first analyzed the influence of the difference in total assets (TA [bank's size]) on the efficiency score. The results showed that there was a positive and statistically significant relationship between TA and technical efficiency for the years 2000, 2002 and for panel data regression. This result is consistent with several previous studies. Yildirim (2002) reported that the size of a bank was positively related to technical and scale inefficiencies. Jemric and Vujcic (2002) found that large banks appeared to be locally efficient while smaller banks were globally efficient. Altunbas, Liu, Molyneux and Seth (2000) and Mester (1996) also found this positive relationship. The association of size and efficiency score could occur for various reasons. For example, Cole and Gunther (1995) reported that larger banks can be assumed to possess more flexibility in financial markets and be better able to diversify credit risk. This result suggested that there would be an improvement in the efficiency level when banks increase in size; consequently, merging of banks in GCC countries is positively related to increasing efficiency level. Hence we suggest that the GCC policy makers need

to encourage merging in small banks in order to increase banking sector power as well as improving the banking industry in the GCC countries.

Second, we estimated the relationship between profitability, which we defined as the return on equity (ROE), and the technical efficiency score. The results of the t-test suggested that ROE was positively related to bank efficiency and that the coefficient had a positive relation to the efficiency score at the 1% level for almost all years and for regression of panel data. This result is consistent with the findings of Casu and Molyneux (2003) and Yildirim (2002). However, Limam (2001) estimated the technical efficiency of GCC banks for the year 1999 and found that there was a weak link between technical efficiency and profitability.

Third, the dummy variable IB (Islamic Bank) was introduced to investigate whether efficiency differences existed between Islamic banks and traditional banks. The result showed a strong relationship between Islamic banks and high technical efficiency scores, so we deemed Islamic banks to be more efficient than their traditional counterparts. Hussein (2004) and Al-Jarrah and Molyneux (2003) reported the same results. It would be useful if the governments of GCC nations promote increasing efficiency in the banking industry by adopting policies that encourage the traditional banks in the region to transfer their system to the Islamic system or, alternatively, establish Islamic branches for these traditional banks, as well as allowing more licenses for new Islamic banks. The efficiency of Islamic banks is resulted of several factors,

among them, the fact that Islamic banks are, on the average, more profitable than conventional banks. Presumably, this difference is due to risk. Islamic banks voluntarily hold more cash relative to deposits than conventional banks due to the risk of withdrawal of deposits (Olson and Zoubi 2008). Also, Islamic banks are less affected by world financial crises (for instance, that of 2008) due to the nature of the Islamic banking system.

Islamic banking has grown very fast in recent years, not only in Islamic countries but also throughout the world, namely, Europe and the United States. Since the inception of Islamic baking about three decades ago, the number of Islamic financial institutions worldwide has risen from one in 1975 to over 300 today in more than 75 countries. The Islamic financial system is being studied in a number of developed countries, such as the United States, where in 2008 the Treasury Department announced that it would teach Islamic finance to US banking regulatory agencies, Congress, and other parts of the executive branch.

6.2 Direction of Future Research

Further research is needed on the following topics:

First, as for all empirical work, the results of this study can be checked for their robustness using different methods, such as parametric methods, stochastic frontier approach (SFA), thick frontier approach (TFA), and the distribution-free approach (DFA). The results of such a method can then be compared to the findings of this study which

used the data envelopment analysis (DEA) approach. It also would be useful to use the bootstrap technique[24] that was proposed by Xue and Harker (1999).

Second, this study has worked with data obtained for the period between 2000 and 2007. Therefore, the world financial crisis that started in the second half of 2008 was not included in the period of study. It is therefore useful to measure the efficiency level of two periods, before and after the financial crisis, for comparison. We recommend this kind of study because analyzing the impact of the changes in the efficiency level caused by the financial crisis of the GCC banking system is very important for researchers and

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[24] Xue and Harker (1999) proposed a bootstrap technique in order to eliminate the dependency problem that could appear of DEA measures. The following is the proposed bootstrap procedure for the regression analysis of DEA efficiency scores:

Step 1: Construct the sample probability distribution $\hat{F}$ by assigning a probability of 1/n at each DMU in the observed sample $(x_1, x_2, \ldots, x_n)$.

Step 2: Draw c (c is a constant) random samples of size n with replacement from the original sample $(x_1, x_2, \ldots, x_n)$:

$$S_k = (x_{k1}, x_{k2}, \ldots, x_{kn}), \qquad k = 1, 2, \ldots c$$

where $x_{ki} = (u_{ki}, v_{ki})$, i = 1, 2, ...n. S_k is a so-called bootstrap sample. The components of vector u_i are the inputs and outputs of DMU i used in the DEA model. The components of v_i are corresponding values of the variables associated with DMU i used in the regression model.

Step 3: for each bootstrap sample S_k, k = 1, 2, ...c, run the DEA model and recalculate the efficiency scores for all n DMUs:

$$\Theta_{ki} = \phi_i (u_k), \qquad i = 1, 2, \ldots n,$$

where ϕ_i represents the DEA model for DMU i.

Step 4: for each bootstrap sample S_k, k = 1, 2, ...c, evaluate the bootstrap replication $\hat{\beta}_j$, k = 1, 2, ...c, j = 0, 1, ..., m, by fitting the bootstrap model:

$$\Theta_{ki} = G (\beta_k , v_{ki}) + \varepsilon_{ki} , \; i = 1, 2, \ldots n, \; \beta_k = (\beta_{k0} , \beta_{k1} , \ldots, \beta_{kj} , \ldots, \beta_{km})$$

Step 5: estimate the standard error se $(\hat{\beta}_j)$ by the sample standard deviation of the c bootstrap replications of $\hat{\beta}_j$:

$$\hat{se}_c(\hat{\beta}_j) = \{ [\sum_{k=1}^{c} (\hat{\beta}_{kj} - \bar{\beta}_j)^2] / (c - 1) \}^{1/2} , \quad j = 1, 2, \ldots, m$$

where:

$$\bar{\beta}_j = [\sum_{k=1}^{c} \hat{\beta}_{kj}] / c , \quad j = 1, 2, \ldots, m$$

We call $\hat{se}_c (\hat{\beta}_j)$ the bootstrap estimator for the standard error of $\hat{\beta}_j$.

Now we use a t-test to test the following hypothesis:

$$H_0 : \beta_j = 0 , \quad \text{vs.} \quad H_0 : \beta \neq 0$$

Calculate the test statistic according to:

$$t = \hat{\beta}_j / \hat{se}_c(\hat{\beta}_j)$$

and compare t to the critical value $t_{\alpha/2}$ from the student t distribution with degrees of freedom equal to (n-m-1).

policy makers in order to avoid or reduce the effect of this kind of crisis on the banking sector in the future.

Third, another direction for future research would be to evaluate previous experiences of bank mergers. Such a study would examine the potential for improvement in technical efficiency resulting from such mergers.

Fourth, it would also be useful to evaluate the banks that transfer from traditional to Islamic banking. Such an evaluation would carried out by estimating the efficiency level of those banks for the periods before and after transference, and then comparing between these periods.

Fifth, the duration of the present study has not been sufficient to determine the dynamic relationship between technical efficiency score and factors that influence a bank's efficiency. A useful extension of this study would therefore be to expand the time period covered in order to obtain more accurate results. The number of banks involved might also be increased. It would be interesting to see results for a larger group of banks and longer time periods.

Sixth, yet another direction for future research would be to analyze the link between technical efficiency in the banking industry and economic growth. This would be by

estimating bank efficiency scores and then testing whether these scores have positive effects on GDP growth.

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