Cost Efficiency, Technological Progress and Productivity Growth of Banks in GCC Countries

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ABSTRACT

The structure of banking systems in GCC countries; namely, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates, has substantially changed over the past decade, mainly as a result of regional economic integration and banking deregulation. The new banking environment has given banks an incentive to focus on cost and productive efficiency. This study uses a non-parametric frontier approach to compare and contrast the efficiency performance, efficiency and technological change, and productivity growth of banks in GCC countries. The results indicate that banks in Oman, on average, have been the most efficient among GCC countries followed narrowly by banks from Bahrain and to a lesser extent by banks from Kuwait. In contrast, the findings point to a low efficient banking environment in UAE and Qatar, with Saudi Arabia being the least efficient. Additionally, the efficiency measures of banks in Oman and Kuwait has been descending from 1999 to 2004, while at the same time the efficiency scores of banks in Bahrain have been rising. Furthermore, banks from Oman and Bahrain are dominating the common efficient frontier since a larger percentage of banks from these countries lie on the frontier. Examination of return to scale measures provides evidence to indicate that there is very limited opportunity for banks to improve their scale efficiency, given that only a handful of banks are operating at increasing returns to scale. The result of the Malmquist productivity index reveals that banks on average have experienced a decline in productivity due to technological regress and to a lesser extent caused by a decline in overall technological efficiency.

JEL Classification: F3, G2

Keywords: Banking cost efficiency; Malmquist productivity; GCC countries

I.   INTRODUCTION

The recent globalization of financial markets and institutions has created an international and competitive banking environment. Banking industries all over the world struggle with the reality that the market has become global and hence competition has grown intensely. To meet competition and demand of internationalization, the banking firm must launch strategies to operate more efficiently in order to stay competitive. Globalization on the other hand necessitates that the banking regulatory agencies respect international competition and to respond positively to these challenges by relaxing the rigid and inflexible domestically regulated banking system. Consequently, governments are required to promote a deregulated banking environment consistent with the international competitive environment. The survivals of banks in this deregulated, free and open, and yet competitive market depends on their performance and efficiency. It follows that information regarding banking efficiency and performance would assist firms and policy makers in developing policies and plans to improve performance and remain competitive.

Based on the above, it is no surprise that the efficiency performance of banks has been extensively studied during the last two decades in different theoretical and applied directions to constitute a voluminous literature. However, most of the existing literature pertains to developed economies, although a few recent studies have focused on the efficiency performance of developing and emerging economies undergoing structural transition towards financial liberalization[1].

The Gulf Cooperative Council (GCC), comprising Bahrain, Kuwait, Qatar, Oman, Saudi Arabia and United Arab Emirates (UAE), was born in 1981 out of the need among the six Arab states for a unified economic integration and toward establishing a single market and currency. In the past 25 years, GCC countries have gradually achieved steps toward their economic unification. It is expected that the last step in economic integration will take place in the year 2010 by implementing monetary union among member states. A well-implemented economic integration will further enhance economic ties among the GCC countries and requires an efficient financial system to flow funds to more productive capacity. Therefore, the comparative study of banking performance and efficiency of the GCC countries provides valuable information for bank managers and regulatory agencies to structure and implement managerial and regulatory strategies to prepare their institutions for regional as well as for global competition. It is surprising, however, that only a handful of studies have concentrated on assessing the efficiency of the banking industry in GCC countries[2]. This paper makes an attempt to contribute to the existing literature by empirically examining the efficiency performance of commercial banks operating in GCC countries. Specifically, we compute, compare and contrast several efficiency indices, efficiency change and technological change, and productivity growth of banks in GCC countries. The paper, furthermore, draws a number of practical implications on the basis of findings for managers and policy makers.

The rest of the paper is organized as follows. Section II provides a review of the literature in the area of banking efficiency in GCC countries. Section III briefly outlines the recent reforms and economics conditions of the GCC countries. Section IV presents the methodology and data. Section V describes empirical results, and section VI concludes the paper with a number of policy implications.

II.   REVIEW OF LITERATURE

An extensive body of literature exists on cost and productive efficiency in banking using single-country or multi-country samples. However, there are a limited number of studies in which attempts have been made to measure and evaluate the efficiency performance of banking firms operating in the GCC countries.

For instance, Darrat et al. (2003) estimate a number of efficiency indices for banks operating in Kuwait over a period between 1994 and 1997, using the Data Envelopment Analysis (DEA) approach. Their study provides evidence to indicate that the overall efficiency of banks in Kuwait is on average 68% and that the cause of this inefficiency is a combination of allocative and overall technical inefficiency. Darrat et al. further investigate the productivity progress of these banks and document that banks in Kuwait have enjoyed about 28% productivity growth over the period under study. They also show that this productivity growth is generally caused by technological progress whereas the role of increase in technical efficiency, as part of this progress, is not significant. In addition, the findings of these authors reveal that small banks are more efficient than their larger counterparts and that profitability, measured by several financial ratios, is positively correlated with efficiency indices.

Limam (2004), alternatively, uses a stochastic frontier model to examine the technical efficiency of banks in Kuwait from 1994 to 1999.   He finds that, over this period, the average efficiency index of all banks is 0.91, with the most efficient bank being 99.7% technically efficient and least efficient bank being 86.3% efficient. Limam reports that most banks in his sample are scale efficient; therefore, increasing bank size through mergers and acquisition does not substantially enhance technical efficiency of the merged banks. Additionally, Limam provides evidence to suggest that there is a positive association between efficiency and profitability for larger banks.

In another paper Limam (2001) examines the comparative efficiency of 52 banks operating in GCC during 1999 by employing the DEA approach. He reports that banks in Bahrain and Saudi Arabia are more efficient than banks operating in other GCC countries. He relates the superior performance of banks in Bahrain and Saudi Arabia to the favorable operating environment in these countries. Limam reports that while size, equity capital and age of the bank are positively correlated with technical efficiency, there is no association between profitability and technical efficiency of banks in GCC countries.

Islam (2003) compares the performance of domestic and foreign banks in GCC countries by using time-series financial ratio analysis. He documents that banks operating in Bahrain, Oman and the United Arab Emirates in particular have enhanced their financial performance in the past several years. He further reports that most commercial banks in GCC countries are financially healthy based on financial ratio analysis.

The most recent study by Grigorian and Manole (2005) examines the technical efficiency of four out of six GCC countries; namely, Bahrain, Kuwait, Qatar, and UAE relative to their Singapore counterparts. The results of this study show that banks in Bahrain, on average, are more technically efficient compared to other GCC countries, but they still lag behind their Singaporean counterparts. Grigorian and Manole also report that inefficiencies are largely caused by pure technical inefficiency and to a lesser extent by scale inefficiency.

Our study differs from the existing literature on banking efficiency of the GCC countries on several fronts. First, we use most current inputs/outputs/input prices data sets of banks operating in GCC counties to reflect the most recent changes in the face of increasing domestic and international banking deregulation and competition. Second, we define and employ a set of inputs and outputs that is more consistent with the standard definitions of inputs and outputs in the banking literature. This, of course, enables us to compare the efficiency indices across different countries in order to obtain a better sense of the efficiency differentials. Finally, contrary to previous studies, our sample contains the entire banks that operate in all six GCC countries.

III.   RECENT DEVELOPMENTS IN THE BANKING ENVIRONMENT OF GCC COUNTRIES

This section presents a brief description of economic conditions and recent financial developments in each of the banking sectors of the GCC countries, including financial liberalization efforts. Islam (2003) provides a comprehensive examination of the structure of regulations, regulatory reforms, and supervision in each of four GCC countries, including Bahrain, Kuwait, Oman and Saudi Arabia.

A.   Bahrain

Bahrain is the smallest country among all GCC countries with a GDP of only $11 billion. In the year 2004, the financial sector in this country represented the largest component of GDP, accounting for more than 30% of output. Over the past decades, the Bahrain Monetary Authority (BMA) provided incentives for major international financial institutions to operate in the country as off-shore Banking Unit (OBUs), and the country established itself as a regional banking hub. According to Molyneux and Iqbal (2005), around one third of the OBUs are from the Arab region, one third from Western Europe, 20 percent are American, and the rest are from Asia. Many Islamic banks were also established as off-shore banks, a policy that caused Bahrain to hold the largest concentration of Islamic banks in the region. In contrast to the size of the OBU financial sector, however, the domestic banking sector in Bahrain is among the smallest in the region. At the end of 2004, there were 24 commercial banks in Bahrain, mostly foreign banks, with five banks owning over 70 percent of local assets (Economist Intelligence Unit (EIU) Country profile, 2006).

B.   Kuwait

Kuwait's economy is small, open and mostly dependent on oil with the petroleum industry accounting for nearly half of the country's GDP. Kuwait has eight largely privately owned commercial banks, including two Islamic banks. The Kuwaiti banking sector displays the highest level of concentration among GCC countries. In 2002, all international rating organizations improved their ratings of most Kuwaiti banks, including the National Bank of Kuwait, which became the highest rated bank in all emerging markets. The Central Bank of Kuwait (CBK) took on an effective regulatory role in 1984 after a debt crisis engulfed commercial banks, following the collapse of the informal stock market, the Souq al Manakh, and also in the early 1990s following the

Iraqi occupation of Kuwait. In January 2004, foreign banks were permitted to set up operations in Kuwait provided they received approval from the CBK. The new banking regulation, however, allows foreign banks to operate only one bank and requires that half of their workforce be made up of Kuwaiti nationals within a period of three years.

C.   Oman

The Omani economy is a free market economy with low taxation, no capital control and liberal investment laws. Like Saudi Arabia, Oman is heavily dependent on the oil sector, which accounts for 30 percent of GDP. The Omani banking system is the smallest in the GCC region. There are 15 commercial banks, 6 of which are local banks and 9 are foreign banks. The Omani banking sector is highly concentrated with the top 4 banks holding around 80 percent of the total banking sector assets at the end of 2004. Following rising concerns over non-performing loans in the late 1990s, the Central Bank of Oman (CBO) imposed stringent provisioning requirements on the banking sector. Deregulation measures were also undertaken with the removal of ceilings on deposits in Omani Riyals (OR) and the liberalization of interest rates in January 1999 (Molyneux and Iqbal, 2005). In recent years, The CBO has encouraged consolidation and mergers as a means of strengthening the local banking sector by providing incentives in the form of tax breaks for five years and cheap deposits. Capital requirements were also increased from OR 30mn to OR 50mn for local commercial banks. With the domestic consumer market relatively well served, local banks are seeking to expand within the region[3].

D.   Qatar

Qatari nationals, on average, stand as the wealthiest in the Gulf region, with a GDP per capita around US$ 40,000, compared to US$ 24,000 for United Arab Emirates (UAE), US$ 20,000 for Kuwait and US$ 15,000 for Bahrain, while GDP per capita for Saudi Arabia and Oman hovered around US$ 10,000 in 2004 (EIU Country profile, 2006). The Qatari economy is heavily dependent on oil and gas. While this sector contributed to more than 60 percent to GDP in 2004, the finance sector accounted for less than 7 percent of GDP. Fifteen commercial banks operate in Qatar, eight of which are foreign and the remaining domestic banks account for about 80 percent of banking assets. Qatar National Bank, which is partly government owned, holds nearly 50 percent of total deposits and is involved in funding most government programs. Like most other GCC countries, all Qatari banks have to prepare their accounts in line with international standards, and have to comply with a 10 percent capital adequacy ratio. Deregulation measures were first undertaken in 1995. In 2001, the Qatari Central Bank (QCB) removed all interest rate ceilings and introduced the Qatar Monetary Rate, in an effort to stimulate greater competition and to promote financial liberalization in the banking system.

E.   Saudi Arabia

The Saudi Arabian economy is dominated by the oil sector, which accounts for around 35 percent of GDP. The population of Saudi Arabia is about six times the UAE, but the

kingdom has less than 20 percent the number of banks in the UAE, even though its banking sector is the largest among GCC countries. There are 11 Saudi commercial banks in the country, four of which are wholly Saudi owned, and the remaining are joint ventures with foreign banks[4]. No new foreign bank was allowed to enter the Saudi banking system since 1975, but a new era of openness was ushered recently. Foreign banks in Saudi Arabia are allowed to hold up to 10 percent of the shares of a domestic company, as long as the investment does not exceed 10 percent of the bank's own equity capital. In recent years, consumer lending has been rapidly expanding, but borrowing limits were tightened as a significant portion of credit has financed stock market investments (EIU Country Profile, 2006).

F.   United Arab Emirates (UAE)

The establishment of the UAE Central Bank in 1980 came in response to a chaotic financial environment in terms of bank proliferation, credit expansion, and real estate speculation following the oil boom. A remarkably large number of banks operate in disproportion with the capacity of the total market, with five leading banks controlling around two thirds of total assets[5]. In the absence of a recognized credit bureau, retail lending is based on the individual's or family's reputation, which raises serious concerns about the asset quality of the loan portfolio of banks in the event of an economic downturn. However, major lending projects involve some level of government backing. This makes the risk of default relatively low and rating agencies have recently issued rating upgrades for UAE banks. Furthermore, Islamic banking is taking on a prominent role in UAE. Banks are embracing Islamic banking through either an Islamic window or through a fully-fledged Islamic financial institution. Despite tight competition in the industry, the banking sector in UAE is strong, liquid and profitable.

IV.   METHODOLOGY AND DATA

A.   Methodology

In this study, we use a non-parametric frontier approach to calculate efficiency indices for GCC banks. We first compute the overall efficiency (OE) index for each bank as the ratio of the minimum potential total cost to the actual total cost incurred by each bank in the sample. The OE is then decomposed into several efficiency indices to better pinpoint the sources of overall inefficiency. These efficiency indices are allocative efficiency (AE), overall technical efficiency (OTE), pure technical efficiency (PTE) and scale efficiency (SE). Let bank k be an observation in a sample of K banks, the OE of this bank can be written as:

$$OE_k = OTE_k \times AE_k \qquad (1)$$

The (OTE) of bank k assesses the efficiency of this bank relative to a frontier that is characterized by constant returns to scale (CRS). The OTE can be further decomposed into two efficiency indices to determine the sources of overall technical inefficiency. The first one is PTE which determines the bank's efficiency relative to a

frontier that exhibits constant as well as variable returns to scale. The other index, SE, measures whether or not the bank operates at constant returns to scale (optimal scale) or at increasing or deceasing returns to scale (sub-optimal scale). Formally, the technical efficiency of bank k can be written as:

$$OTE_i = PTE_k \times SE_k$$

where

$$SE_i = \frac{OTE_k}{PTE_k}$$

The following linear programming problem (LP) for bank k (k=1,……., K) is solved in order to calculate overall technical efficiency for this bank.

$$\min \ \lambda_k$$
$$y_k \le zY$$
$$\lambda_k x_k \ge zX \qquad\qquad\qquad (LP1)$$
$$z \ge 0$$
$$k = 1,......., \ K$$

where:
K is number of firms in the sample.
y_k is a vector of outputs produced by firm k of dimension (1, m)
x_k is a vector of inputs utilized by firm k of dimension (1, n)
Y is a matrix of observed outputs of dimension (m, N)
X is a matrix of observed inputs of dimension (n, N)
Z is an intensity vector

In order to compute the PTE for bank k (denoted by θ_k for firm k), we solve LP1 for bank k with $\sum_{k=1}^{K} z_k = 1$ as an additional constraint. After computing the OTE and PTE for bank k, the scale efficiency index for this bank is calculated as:

$$SE_k = \frac{OTE_k}{PTE_k} = \frac{\lambda_k}{\theta_k}$$

$SE_k = 1$ implies that bank k is scale efficient and operates at CRS. If $0 < SE_k < 1$ the bank k is scale inefficient.

To examine the overall efficiency (OE) for bank k, we first solve the following linear program to calculate the potential minimum total cost for this bank:

$$C_i^* = \min \quad p \times x$$
$$y_i \leq zY$$
$$x_i \geq zX \qquad \qquad \qquad (\text{LP2})$$
$$z \geq 0$$

Where all variables are as defined earlier and C^* is the minimum potential total cost and p is a vector of input prices. In the second step, we compute the overall efficiency as the ratio of the calculated minimum cost to the observed total cost incurred,

$$OE_k = \frac{C_k^*}{C_k}$$

Finally, the allocative efficiency, which is a measure of efficiency that discloses the degree of "optimal input mix" utilization given cost minimization, is calculated as:

$$AE_k = \frac{OE_k}{OTE_k}$$

It follows that:

$$OE_k = PTE_k \times SE_k \times AE_k$$

To investigate the inter-temporal productivity growth of the banks between 1999 and 2004, we estimate the Malmquist index. This index decomposes productivity growth index of bank k into two measures, technological change and change in technical efficiency. Following Färe and Grosskopf (1990) and Berg et al. (1992), the Malmquist index of productivity growth for bank k is written as:

$$M_k = \Delta OTE_k \times \Delta T_k \qquad \qquad (3)$$

where M_k is the Malmquist measure of productive growth of bank k between 1999 and 2004, ΔOTE_k is the overall technical efficiency gain (loss) of bank k between 1999 and 2004, ΔT_k = the technological progress (regress) of bank k over the period.

Note that $M_k > 1$ ($M_k < 1$) specifies productivity growth (productivity decline) between 1999 and 2004. In addition, the first term on the right hand side of Equation (3) represents the change in overall technical efficiency between two years. The second term, ΔT, stands for technological change during this period. If $\Delta OTE_k > 1$ ($\Delta OTE_k < 1$), the relative OTE of bank k has increased (declined) between the two years and if $\Delta T_k > 1$ ($\Delta T_k < 1$) then bank k exhibits technological progress (technological regress) between 1999 and 2004.

B.   Data

The geographic coverage of this study is the six Gulf countries that are member of the Gulf Cooperative Council (GCC), namely Bahrain, Kuwait, Oman, Qatar, Saudi

Arabia, and United Arab Emirates. The period under study is 1999-2004. The major source of data is the BankScope database provided by Fitch-IBCA (International Bank Credit Analysis Ltd). In the case of missing information, we referred to the original financial information provided by the banks' annual financial report. We excluded foreign banks, special financial institutions and finance companies from our sample to avoid comparison problems among different types of financial institutions that could be characterized by different objective functions of technologies. Our panel data included 270 observations consisting of 6 banks from Bahrain, Kuwait and Qatar, 14 banks from UAE, 5 banks from Oman, and 8 banks from Saudi Arabia operating between 1999 and 2004[6]. After deleting 10 observations with missing values, there remains a total of 260 observations.

The issue of definition and measurement of bank inputs and outputs is still not settled in the banking literature. The major argument evolves around the treatment of deposits as an input or output. *Intermediation* and *Asset* approaches argue that deposits are inputs used in production process to produce outputs. On the other hand, *Value added* and *User Cost* approaches treat deposits as output by arguing that deposits create value to the bank and impose opportunity costs to the depositors. In this study, we follow Berger and Humphrey (1997) and employ the intermediation approach. We assume that banks use deposits along with labor and fixed assets to produce earning assets such as loans, securities, and other earning assets. Therefore, bank outputs are defined as: net loans (Y1), securities (Y2), and "other earning assets" (Y3). The three inputs are: borrowed funds (X1), labor (X2) and fixed assets (X3). The price of inputs are computed as follows: price of borrowed funds (P1) as the ratio of interest expense to borrowed funds, price of labor (P2) as the ratio of employee salary and benefits to total assets[7], and price of fixed assets (P3) as the ratio of the expenditure on premises and fixed assets to the book value of fixed assets. Total cost is the sum of interest expense, labor cost, and cost of premises and fixed assets.

Table 1 provides means of the outputs, inputs and input prices for all GCC banks as well as individual GCC countries[8]. The difference in the average size of banks measured by total assets is evident from Table 1. Saudi banks are the largest among GCC countries followed by Bahrain and Kuwait. The average size of banks in other GCC countries; namely UAE, Oman and Qatar, are below the mean of the overall sample, with Oman banks being the smallest. Although the mix of earning assets in the asset portfolio of the GCC countries differs, there has been a clear pattern of increase in loans and decrease in securities and in other earning assets. For example, in 1999, the ratio of loans, securities and other earning assets to total earning assets were 46.78, 32.10, and 21.11 percent respectively. In the year 2004, loans as a percentage of total earning assets increased to 54.16 percent and at the same time the percentage of securities and other earning assets declined to 28.44 and 17.40 percent respectively. Table 1 also provides information on the cost of inputs. As the figures show, the price of fund (P1, defined as the interest paid on borrowed funds) had a declining trend for the period under study; the highest interest, however, was consistently paid by banks in Oman, Bahrain, and Kuwait. Although the price of labor (P2, defined as wages per unit of total asset) does not follow a clear pattern for the period of the study, banks in Oman, Saudi Arabia and UAE, on average, paid higher salary per dollar of asset. In terms of the price of fixed assets (P3), again there does not exist a clear pattern; however, Bahrain, Oman and Qatar show the highest expenditure on premises and fixed assets

per unit of fixed assets. Overall, banks in Oman seem to have the highest operating costs compared to other GCC countries[9].

Table 1
Mean of the outputs, inputs, and price of inputs, 1999-2004

	1999	2000	2001	2002	2003	2004
All GCC Banks (No. of observations = 260)						
Y1	2409.29	2556.13	2633.31	2995.42	3393.07	3868.88
Y2	1652.86	1784.26	1839.59	2011.19	2066.06	2031.55
Y3	1087.09	1193.33	1138.89	1131.35	1086.73	1243.26
X1	4687.29	4986.55	4994.39	5417.88	5734.68	6107.54
X2	47.74	50.22	51.12	53.90	53.67	57.76
X3	84.70	83.58	77.67	77.91	75.88	71.26
P1	0.0473	0.0520	0.0399	0.0204	0.0152	0.0
P2	0.0096	0.0096	0.0097	0.0095	0.0095	0.0088
P3	0.7015	0.6906	0.8368	0.8970	0.9709	0.8600
TA	5501.82	5933.94	5940.31	6494.14	6905.63	7448.88
Bahrain Banks (No. of observations = 35):						
Y1	3132.05	3493.83	3427.93	2995.42	3953.38	3050.66
Y2	1892.59	2113.28	2271.04	2011.19	2737.25	3041.34
Y3	2256.21	2055.01	2022.90	1131.34	2092.64	1960.16
X1	6616.03	6804.05	6765.30	5417.88	7623.71	6598.05
X2	63.68	70.73	70.93	53.90	49.74	55.17
X3	93.15	92.57	86.48	77.90	98.82	49.83
P1	0.0462	0.0569	0.0434	0.0204	0.0155	0.0187
P2	0.0082	0.0083	0.0084	0.0095	0.0081	0.0081
P3	0.7938	0.9285	1.5983	0.8970	2.2974	1.3448
TA	7777.77	8135.45	8202.86	8826.40	9290.78	8346.18
Kuwait Banks (No. of observations = 36):						
Y1	2056.25	2299.25	2657.23	3323.94	3883.25	4309.79
Y2	2424.95	2184.36	2228.10	2505.38	2475.44	2336.19
Y3	882.43	1057.57	1329.75	1590.06	1801.26	1508.47
X1	4690.94	4829.79	5373.39	6324.30	6753.42	6781.75
X2	36.03	36.52	37.44	40.94	42.81	46.72
X3	75.78	74.45	62.48	64.74	62.57	64.28
P1	0.0559	0.0577	0.0400	0.0258	0.0204	0.0226
P2	0.0065	0.0063	0.0059	0.0054	0.0049	0.0053
P3	0.4769	0.4559	0.5255	0.4426	0.6236	0.6035
TA	5576.77	5780.99	8208.86	7616.34	8366.03	8458.45
Oman Banks (No. of observations = 30):						
Y1	1125.33	1199.48	1436.55	1466.64	1443.26	1542.42
Y2	166.24	129.38	180.41	137.14	243.16	229.03
Y3	155.48	137.64	177.50	210.04	204.60	338.57
X1	1272.23	1216.38	1556.37	1629.63	1634.46	1691.60
X2	17.21	19.55	22.93	27.00	29.28	31.52
X3	18.36	14.82	19.24	19.45	18.41	18.35
P1	0.0532	0.0575	0.0460	0.0268	0.0215	0.0189
P2	0.0119	0.0135	0.0049	0.0138	0.0144	0.0143
P3	0.9931	1.0229	0.9286	1.1633	1.2808	1.2483
TA	1528.07	1788.59	1885.95	1968.02	2009.73	2236.72

Table 1 (continued)

	1999	2000	2001	2002	2003	2004
Qatar (No. of observations = 29):						
Y1	1245.82	1589.09	1436.72	1604.51	1587.29	1921.35
Y2	351.04	475.13	180.40	450.42	486.28	610.29
Y3	361.30	745.39	177.50	472.31	409.84	516.92
X1	1658.26	2390.19	1556.37	2282.89	2084.55	2589.60
X2	13.61	19.46	22.93	17.09	16.50	19.31
X3	11.92	16.43	19.24	16.08	19.81	45.28
P1	0.0609	0.0643	0.0460	0.0211	0.0142	0.0114
P2	0.0107	0.0081	0.0126	0.0085	0.0094	0.0064
P3	1.0906	0.7863	1.1275	1.5032	1.0704	1.0658
TA	2056.33	2961.70	2379.48	2634.53	2606.44	3201.54
Saudi Arabia Banks (No. of observations = 47)						
Y1	4721.04	4884.65	5107.31	5753.64	6817.16	8683.54
Y2	4642.04	5251.22	5473.23	5817.67	5949.25	6217.09
Y3	1584.52	1765.88	1669.70	1412.11	1357.61	2161.63
X1	10443.52	11278.18	11379.17	11952.91	13038.65	15193.04
X2	116.71	118.88	126.96	131.57	142.32	160.99
X3	247.43	242.21	232.39	220.75	209.09	212.69
P1	0.0409	0.0433	0.0321	0.0157	0.0115	0.0113
P2	0.0100	0.0096	0.0102	0.0098	0.0096	0.0095
P3	0.4624	0.4574	0.4565	0.5661	0.5801	0.5808
TA	11925.17	12927.22	13159.06	13953.83	15142.16	17730.41
UAE Banks (No. of observations = 83):						
Y1	1667.85	1625.52	1716.04	2051.03	2456.50	3230.33
Y2	318.72	362.20	494.85	612.25	712.06	700.45
Y3	917.46	1033.22	1004.58	914.43	799.76	1048.76
X1	2498.62	2582.44	2731.85	3037.05	3343.49	4185.47
X2	25.28	25.62	27.68	29.29	34.00	37.66
X3	32.68	31.95	35.10	38.33	40.20	41.22
P1	0.0414	0.0479	0.0375	0.0173	0.0103	0.0151
P2	0.0102	0.0105	0.0107	0.0104	0.0103	0.0092
P3	0.6779	0.6833	0.5736	0.5638	0.6212	0.7144
TA	3052.47	3177.22	3362.88	3745.87	4141.90	5236.76

Y1 = Output, net loans; Y2 = Output, securities; Y3 = Output, other earning assets; X1 = Input, borrowed funds; X2 = Input, labor; X3 = Input, book value of fixed assets; P1 = Price of borrowed funds, ratio of annual interest expense to borrowed funds; P2 = Wages and salary, the ratio of salary and fringe benefits to total assets; P3 = Price of fixed assets, ratio of annual expenses of premises and fixed assets to the book value of the premises and fixed assets; and TA = Total assets. The numbers in parentheses represents the total number of banks in the pooled sample. All variables are in $ millions.

V.   EMPIRICAL RESULTS

We constructed the GCC countries' common efficient frontier by pooling the data for banks in all six countries in the sample. This allows us to compare the efficiency of banks from each country relative to the same efficient frontier. Table 2 presents the summary statistics of efficiency indices relative to a pooled sample frontier for each

year. This table also displays the mean of efficiency indices for all countries during the entire sample period. The mean of overall efficiency scores for all banks in GCC countries is 77.59 percent, indicating that GCC banks on average could have saved 22.41 percent of their actual total costs had they been operating on the common efficient frontier[10]. The overall inefficiency of GCC banks is due to both allocative (input-mix sub-optimization) and technical (over-utilization of inputs) inefficiencies. The average allocative efficiency of the banks in the sample is 86.12 percent, indicating that the banks on average could have saved 13.88 percent in costs if they have used the most appropriate input-mix (optimal input-mix). At the same time, the technical efficiency of the average bank in the sample is 88.13 percent, suggesting that banks on average used 11.87 percent more output than the most efficient bank(s) in the sample.

It is also interesting to note that there is a decline in the overall efficiency score of banks in GCC countries from 1999 to 2004. This decline in the overall efficiency is caused by the decrease in allocative rather than technical efficiency (and its component of pure technical rather than scale efficiency). The examination of the standard deviation of efficiency indices reveals that the variation of efficiency indices, although different over time and across the sampled countries, is relatively stable over the period under study.

To better understand the comparative cost and efficiency advantages of banks in different GCC countries, Table 3 displays the results of country specific efficiency indices per year and their mean values over the period of 1999-2004[11]. The mean values of efficiency measures for the six GCC countries show that banks in Oman, on average, have been the most efficient among GCC countries followed narrowly by banks in Bahrain and Kuwait, with Saudi Arabia being the least efficient. However, the efficiency scores of banks in Oman and Kuwait have been descending from 1999 to 2004, while at the same time the efficiency measures of banks in Bahrain have been ascending such that efficiency of banks in Bahrain surpasses Kuwaiti banks after year 2000[12]. The decline in the overall efficiency score of banks in Oman and Kuwait during the 1999-2004 period is a result of the decline in both allocative and overall technical (and its components, PTE and SE) efficiencies. At the same time, improvement in the overall efficiency score of Bahrain is due to improvement in overall technical (and its components PTE and SE) rather than allocative efficiency.

The trend of the efficiency indices for the other three GCC countries for the period of 1999-2004, namely Qatar, Saudi Arabia and UAE, has been mixed. For the period under study, there has been some improvement in the overall efficiency of UAE banks, but a substantial deterioration in the overall efficiency of banks in Qatar and Saudi Arabia is noticeable. The low and declining overall efficiency of banks in Qatar and Saudi Arabia is a consequence of a sharp decline in the allocative efficiency of the banks in these two countries. The increase in the overall efficiency of UAE banks is due to increases in both allocative and technical efficiency. Although not given in the table, the variation of efficiency indices as measured by the standard deviation of efficiency scores are relatively more stable in Oman and Bahrain than in any other GCC countries, with the most volatile being Saudi Arabia. It appears that, in terms of banking efficiency, the GCC countries can be dichotomized as either high efficient banking environment consisting of Oman and Bahrain and to a lesser extent Kuwait, and low efficient banking environment consisting of UAE, Qatar and Saudi Arabia.

Table 2
Summary statistics of the efficiency measures of all banks in GCC countries relative to
the pooled sample common efficient frontier, 1999-2004.

	1999	2000	2001	2002	2003	2004	Mean
Mean:							
OE	0.7755	0.8445	0.8232	0.7852	0.7116	0.7151	0.7759
AE	0.9079	0.9348	0.9145	0.8852	0.8205	0.7045	0.8612
OTE	0.8540	0.9033	0.8984	0.8823	0.8576	0.8923	0.8813
PTE	0.9169	0.9433	0.9407	0.9368	0.9071	0.9237	0.9281
NTE	0.9152	0.9302	0.9279	0.9177	0.9013	0.9153	0.9179
SE	0.9301	0.9575	0.9547	0.9422	0.9452	0.9663	0.9493
Stand Dev:							
OE	0.1575	0.1027	0.1222	0.1467	0.1856	0.1673	
AE	0.1073	0.0467	0.0646	0.0869	0.1228	0.1178	
OTE	0.1333	0.0983	0.1022	0.1079	0.1349	0.1132	
PTE	0.0959	0.0822	0.0809	0.0926	0.1183	0.1049	
NTE	0.0969	0.0873	0.0912	0.1061	0.1196	0.1063	
SE	0.0916	0.0584	0.0636	0.0689	0.0739	0.0546	
Min:							
OE	0.4600	0.6400	0.5900	0.5100	0.3800	0.4100	
AE	0.4600	0.8369	0.7473	0.6707	0.5672	0.5769	
OTE	0.5900	0.7100	0.7000	0.6600	0.6100	0.6700	
PTE	0.6900	0.7100	0.7100	0.6900	0.6200	0.6800	
NTE	0.6900	0.7100	0.7100	0.6900	0.6000	0.6700	
SE	0.5900	0.7100	0.7000	0.7396	0.6700	0.7400	
Max:							
OE	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
AE	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
OTE	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
PTE	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
NTE	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
SE	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	

OE = Overall efficiency; AE = Allocative efficiency; OTE = Overall technical efficiency; PTE = Pure
Technical efficiency; NTE = Non Technical Efficiency; and SE = Scale efficiency

Table 3
Mean efficiency measures of banks in GCC countries relative to the pooled sample
common efficient frontiers, 1999-2004 (not deflated)

	1999	2000	2001	2002	2003	2004	Mean
Bahrain Banks (No. of observations = 35):							
OE	0.8317	0.9217	0.9350	0.9050	0.8400	0.8420	0.8792
AE	0.9355	0.9681	0.9630	0.9589	0.8866	0.8778	0.9317
OTE	0.8883	0.9517	0.9700	0.9433	0.9433	0.9540	0.9418
PTE	0.9533	0.9717	0.9850	0.9783	0.9600	0.9660	0.9691
NTE	0.9533	0.9650	0.9833	0.9750	0.9600	0.9660	0.9671
SE	0.9317	0.9796	0.9849	0.9644	0.9818	0.9879	0.9716
Kuwait Banks (No. of observations = 36):							
OE	0.9283	0.9167	0.9350	0.8967	0.8433	0.7783	0.8831
AE	0.9462	0.9479	0.9459	0.9339	0.8731	0.8134	0.9101
OTE	0.9800	0.9667	0.9883	0.9600	0.9683	0.9583	0.9703
PTE	0.9917	0.9750	1.0000	0.9767	0.9967	0.9833	0.9872
NTE	0.9917	0.9733	1.0000	0.9750	0.9967	0.9833	0.9767
SE	0.9882	0.9912	0.9883	0.9832	0.9717	0.9748	0.9829
Oman Banks (No. of observations = 30):							
OE	0.9460	0.9160	0.8820	0.8980	0.8780	0.8540	0.8957
AE	0.9611	0.9249	0.8872	0.8997	0.9267	0.8854	0.9142
OTE	0.9840	0.9900	0.9940	0.9980	0.9440	0.9620	0.9787
PTE	0.9900	1.0000	1.0000	1.0000	0.9800	0.9720	0.9903
NTE	0.9900	0.9900	0.9940	0.9980	0.9800	0.9620	0.9857
SE	0.9937	0.9900	0.9940	0.9980	0.9635	0.9893	0.9881
Qatar (No. of observations = 29):							
OE	0.8950	0.8000	0.7880	0.7820	0.6250	0.6333	0.7539
AE	0.9701	0.9430	0.9124	0.9258	0.7789	0.7323	0.8771
OTE	0.9200	0.8533	0.8640	0.8400	0.7900	0.8550	0.8537
PTE	0.9500	0.8933	0.9120	0.8920	0.8267	0.8650	0.8898
NTE	0.9425	0.8533	0.8640	0.8400	0.7912	0.8617	0.8539
SE	0.9668	0.9524	0.9469	0.9454	0.9597	0.9881	0.9599
Saudi Arabia Banks (No. of observations = 47):							
OE	0.6300	0.7013	0.6663	0.5938	0.5213	0.5129	0.6043
AE	0.9393	0.9135	0.8695	0.7867	0.7462	0.7066	0.8269
OTE	0.6688	0.7675	0.7663	0.7575	0.6975	0.7271	0.7308
PTE	0.8300	0.8588	0.8500	0.8400	0.8338	0.8214	0.8390
NTE	0.8300	0.8575	0.8475	0.8363	0.8338	0.8214	0.8378
SE	0.8171	0.9027	0.9088	0.9091	0.8489	0.8974	0.8807
UAE Banks (No. of observations = 83):							
OE	0.6662	0.8464	0.8086	0.7564	0.6864	0.7293	0.7489
AE	0.8184	0.9287	0.9163	0.8694	0.7918	0.7947	0.8532
OTE	0.8238	0.9129	0.8829	0.8679	0.8629	0.9157	0.8777
PTE	0.8808	0.9564	0.9371	0.9507	0.8964	0.9421	0.9273
NTE	0.8777	0.9336	0.9186	0.9143	0.8929	0.9214	0.9098
SE	0.9363	0.9545	0.9424	0.9130	0.9609	0.9717	0.9465

OE = Overall efficiency; AE = Allocative efficiency; OTE = Overall technical efficiency; PTE = Pure Technical efficiency; NTE = Non Technical Efficiency; and SE = Scale efficiency

Table 4
Number of banks in GCC countries with efficiency score of equal one, 1999-2004.

	1999	2000	2001	2002	2003	2004	Total
Bahrain Banks (No. of observations = 35):							
OE	1	3	2	2	3	2	13
AE	1	1	2	2	3	2	11
OTE	2	2	2	3	4	2	15
PTE	3	3	4	4	4	3	21
NTE	3	3	4	4	4	3	21
SE	2	2	3	3	4	3	17
Kuwait Banks (No. of observations = 36):							
OE	2	0	1	1	0	0	4
AE	2	0	1	1	0	0	4
OTE	4	4	4	2	4	4	22
PTE	5	4	6	3	5	5	28
NTE	5	4	6	3	5	5	28
SE	4	4	4	3	5	4	24
Oman Banks (No. of observations = 30):							
OE	1	1	1	1	2	1	7
AE	1	1	1	1	2	1	7
OTE	4	2	4	4	2	3	19
PTE	4	5	5	5	3	3	25
NTE	4	2	4	4	3	3	20
SE	4	2	4	4	2	3	19
Qatar (No. of observations = 29):							
OE	2	0	1	1	1	0	5
AE	2	1	1	1	1	0	6
OTE	2	1	2	2	2	2	11
PTE	2	1	2	2	3	2	12
NTE	2	1	2	2	2	2	11
SE	2	1	2	3	3	2	13
Saudi Arabia Banks (No. of observations = 47):							
OE	0	0	0	0	0	0	0
AE	4	0	0	0	0	0	4
OTE	0	0	0	0	0	0	0
PTE	2	2	1	1	1	2	9
NTE	2	2	1	1	1	2	9
SE	0	1	0	0	0	1	2
UAE Banks (No. of observations = 83):							
OE	0	2	1	1	0	0	4
AE	0	2	1	1	1	0	5
OTE	2	4	2	1	3	6	18
PTE	2	9	7	8	5	7	38
NTE	2	6	5	6	5	6	30
SE	2	4	2	1	4	7	20

OE = Overall efficiency; AE = Allocative efficiency; OTE = Overall technical efficiency; PTE = Pure Technical efficiency; NTE = Non Technical Efficiency; and SE = Scale efficiency

        To explore which GCC country dominates the common efficient frontier, we sort the number of banks with efficiency indices equal to unity and display the result in Table 4. As can be observed, the figures in this table confirm the findings presented in Table 3 that the Bahraini and Omani banks demonstrate a clear dominance in efficiency performance. For example, out of 35 banks operating in Bahrain between 1999 and 2004, the number of banks with dominant overall, allocative and technical efficiency was 13, 11 and 15, representing 37.14, 31.43, and 42.86 percent of total banks respectively. Over the same period, the corresponding numbers for Omani banks were 7, 7 and 19, representing 23.33, 23.33, and 63.33 percent of the sample respectively. Please note that while the percentage of Omani banks falling on the efficient frontier is less than the Bahraini banks, the efficiency scores of the remaining Omani banks are so high that the overall average is higher for Omani than for Bahraini banks.

        Table 5 presents the results of the returns to scale of banks in the six GCC countries. Out of 260 observations, a total of 95 banks (36.54%) operate at constant returns to scale. Of the remaining 165 banks, 57 banks (21.92%) operate at increasing, and 108 banks (41.54%) operate at decreasing returns to scale. These figures show that the majority of banks in GCC countries (78%) operate either at optimal or above their optimal size. This finding implies that there exists a very limited opportunity for GCC banks to improve efficiency through expanding their size of operation. Hence, policies towards liberation of mergers and acquisitions among banks should be restrained in these countries at this point in time. However, the only exceptions are banks in Qatar and UAE where 38.71 and 33.73 percent of banks operate at increasing returns to scale, and where policies with the purpose of supporting bank mergers and acquisitions are reasonably justified.

        Table 6 includes the descriptive statistics of overall technical efficiency change (ΔOTE), technological change (ΔTC) and productivity change (Malmquist productivity index, M) for all GCC banks as well as for each of the GCC countries over the period of 1999-2004. The results show that between 1999 and 2004, GCC banks on average have experienced a decline in productivity. In general, the decline in the productivity index is caused by technological regress, despite an improvement in overall technical efficiency. Examination of the Malmquist productivity index of individual GCC countries reveals the same trend. Specifically, banks in all GCC countries have experienced deterioration in their productivity due to technological regress, in spite of the evident improvement in overall technological efficiency of banks in Bahrain, UAE and Saudi Arabia.

VI.   SUMMARY AND CONCLUSIONS

A linear programming technique is employed in this paper to investigate the comparative cost efficiency and productivity growth of banks operating in the six GCC countries during the period 1999-2004. The results indicate that there is still room for improvement in the efficiency of banks in GCC countries. Specifically, over the 6 year period, GCC banks displayed, on average, an overall efficiency score of 77.59%. This number implies that these bank could have saved 22.41% of their actual total costs had they been fully overall efficient. This 22.41% inefficiency is due to a combination of allocative inefficiency- inefficiency as a result of selection of sub-optimal input-mix- and overall technical inefficiency- inefficiency caused by excessive inputs utilization.

Table 5
Returns to scale of GCC banks relative to the pooled sample efficient frontier
1999-2004

	1999	2000	2001	2002	2003	2004	Total
Bahrain Banks (No. of observations = 35):							
IRS	0	3	1	1	0	0	5
CRS	2	2	3	3	4	3	17
DRS	4	1	2	2	2	2	13
Kuwait Banks (No. of observations = 36):							
IRS	0	1	0	1	0	0	2
CRS	4	4	4	3	5	4	24
DRS	2	1	2	2	1	2	10
Oman Banks (No. of observations = 30):							
IRS	0	3	1	1	0	2	7
CRS	4	2	4	4	2	3	19
DRS	1	0	0	0	3	0	4
Qatar Banks (No. of observations = 29):							
IRS	1	2	3	2	2	2	12
CRS	2	1	2	3	3	2	13
DRS	1	0	0	0	1	2	4
Saudi Arabia Banks (No. of observations = 47):							
IRS	0	1	1	1	0	0	3
CRS	0	1	0	0	0	1	2
DRS	8	6	7	7	8	6	42
UAE Banks (No. of observations = 83):							
IRS	3	6	6	7	2	4	28
CRS	2	4	2	1	4	7	20
DRS	8	4	6	6	8	3	35
Total	42	42	44	44	45	43	260

Table 6
Efficiency change, technological progress and productivity growth; 1999-2004

	Δ OTE	Δ TC	M
All Banks	1.0448	0.8433	0.8811
Bahrain	1.0739	0.8961	0.9623
Kuwait	0.9779	0.8095	0.7916
Oman	0.9776	0.8232	0.8047
Qatar	0.9293	0.7264	0.6751
Saudi Arabia	1.0872	0.8523	0.9266
UAE	1.1116	0.8826	0.9811

Δ OTE = Overall technical efficiency Change
Δ TC = Technological Change
M = Malmquist Index of Productivity Change

Concerning the comparative costs and efficiency advantages of banks in different GCC countries, the study finds that banks in Oman, on average, have been the most efficient among GCC countries, followed closely by banks in Bahrain and Kuwait. On the other extreme, the results point to a low efficient banking environment in UAE and Qatar, with Saudi Arabian banks being the least efficient. However, during the period of this study, the efficiency score of banks in Oman and Kuwait have had a declining trend, but at the same time banks in Bahrain have experienced an improvement in their efficiency scores. It seems that efforts undertaken by the Bahrain Monetary Agency to establish the country as a regional financial center are supported by a rising trend in banks' efficiency. The study also provides evidence to suggest that banks in Oman and Bahrain dominate the common efficient frontier.

Furthermore, examination of the scale efficiency indicates that only 22 percent of banks in GCC countries operate at increasing returns to scale. This finding demonstrates that there is very limited opportunity to improve scale efficiency through internal expansion in domestic markets. However, this conclusion is not inclusive of regional expansion by penetrating into new markets. Such growth opportunities are likely to be facilitated by the openness and financial liberalization requirements following accession to the World Trade Organization by all GCC countries. In the move toward financial sector integration, for example, countries like Saudi Arabia have recently lifted restrictions on other GCC banks to enter their market[13].

The findings of this study also show that between 1999 and 2004, all the six countries in GCC countries experienced a decline in the productivity of their banking system albeit with different degree. The decline in productivity of banking in Kuwait, Oman and Qatar was due to both technological regress and decline in overall technical efficiency. However, for the remaining countries of the GCC region (Bahrain, Saudi Arabia and UAE), the decline in productivity was the net results of technological regress and improvement in overall technical efficiency.

With full implementation of economic integration and monetary unification among GCC countries by 2010, there will be more consolidation and penetration among banks in GCC member countries. Naturally, the more efficient banks are in a better position to expand their market shares and geographic presence through penetrating in the markets of the less efficient banks. In this regard, we believe that banks in Oman are in a better position to expand their operations in the banking market of less efficient countries such as Saudi Arabia, Qatar and UAE. Actually, there are obvious signs that such penetration is taking place in recent years. For example, Bank of Muscat from Oman plans to enter into project financing deals and has already obtained a license to open a branch in Saudi Arabia, in addition to branches in Kuwait and Qatar. However, banks in Oman should be aware that in order to keep their leading position among GCC countries, they have to reverse their recent trend of declining efficiency scores, otherwise their leading competitor, Bahraini banks whose efficiency has been increasing since 1998, may replace them.

ENDNOTES

1. For a comprehensive review of banking efficiency studies, please refer to Berger and Humphrey (1997) and Berger et al. (1993). Berger and Mester (2003) provide an updated review of the efficiency literature.

2. Most of the literature that studied GCC banks is either descriptive in nature or too simplistic. There are very few empirical studies which will be discussed in detail in the review of literature section.
3. For example, Bank Muscat plans to enter into project finance deals and it obtained a license to open a branch in Saudi Arabia, in addition to branches in Kuwait and Qatar.
4. Two mergers were concluded at the end of the past century; one was between United Saudi Commercial Bank and Saudi Cairo Bank in 1997 and the other merger was concluded between United Saudi Bank with Saudi American Bank (now Samba) in 1999.
5. There are 21 local banks in UAE, 25 foreign banks, two specialized banks and around 50 representative offices of other foreign banks.
6. The list of banks from each country is provided in the appendix.
7. The number of bank employees is not given in the BankScope data set. We were not able to find the number of employees from the banks' published financial statements. We assume that there is a high correlation between bank size and the number of employees in the bank.
8. Since our data is cross country panel data, we deflated the output variables by the corresponding GNP deflator of each country to bring output values to real terms, with 1999 set as the base year.
9. This observation is interesting since, as discussed in the results section, banks operating in Oman are on average found to be the most cost efficient among GCC countries.
10. The measure of overall efficiency obtained in this study for the GCC countries is lower than other studies for different countries. Berger and Mester (1997) report efficiency scores ranging between 88% and 92% for the US, and Altunbas et al. (2001) report a range of 76%-82% for Europe. Please note that any cross country efficiency comparison should be treated with extreme caution.
11. The efficiency measures of individual banks and their rankings are available upon request.
12. Similar results were obtained by Grigorian and Manole (2005).
13. Over the past two years, five GCC banks from Oman, Bahrain, Kuwait and UAE have been granted licenses to open branches in Saudi Arabia.

Appendix
Banks in GCC countries included in this study: 1999-2004

Bahrain:
Ahli United Bank (Bahrain) B.S.C.
Arab Banking Corporation BSC
Bahrain Saudi Bank (The) BSC
Bank of Bahrain and Kuwait B.S.C.
Gulf International Bank BSC
National Bank of Bahrain

Kuwait:
Alahli Bank of Kuwait (KSC)
Bank of Kuwait and The Middle East (The)
Burgan Bank SAK
Commercial bank of Kuwait SAK (The)
Gulf Bank KSC (The)
National Bank of Kuwait S.A.K.

Oman:
Bank Dhofar SAOG
Bank Muscat SAOG
National Bank of Oman
Oman Arab Bank
Oman International Bank

Qatar:
Ahli Bank QSC
Commercial Bank of Qatar (The) QSC
Doha Bank
International Bank of Qatar
Qatar International Development Bank
Qatar National Bank

Saudi Arabia:
Arab National bank
Bank Al-Jazira
Banque Saudi Fransi
National Commercial Bank (The)
Riyad Bank
Samba Financial Group
Saudi British Bank (The)
Saudi Hollandi Bank

UAE:
Abu Dhabi Commercial Bank
Arab Bank for Investment & Foreign Trade – ARBIFT
Bank of Sharjah
Commercial Bank International P.S.C.
Emirates Bank International PJSC
First Gulf Bank
Mashreqbank
National Bank of Abu Dhabi
National Bank of Dubai Public Joint Company
National Bank of Fujairah
National Bank of Umm Al-Qaiwain
RAKBANK – National Bank of Ras Al-Khaimah (P.S.C.) (The)
Union National Bank

United Arab Bank PJSC

REFERENCES

Altunbas, Y.M., E.P.M. Gardner, P. Molyneux, and B. Moore, 2001, "Efficiency in European Banking", *European Economic Review*, 45, 1931-1955.

Berger, A.N., and D.B. Humphrey, 1992, "Measurement and Efficiency Issues in Commercial Banking", *Output Measurement in the Service Sectors, Studies in Income and Wealth*, 56, edited by Zvi Grilichas, University of Chicago press, 245-279.

Berger, A.N., W.C. Hunter, and S.G. Timme, 1993, "The Efficiency of Financial Institutions: A Review and Preview of Research Past, Present, and Future", *Journal of Banking and Finance,* 17 (2-3), 221-250.

Berger, A.N., and D.B. Humphrey, 1997, "Efficiency of Financial Institutions: International Survey and Direction for Future Research", *European Journal of Operation Research*, 98, 175-212.

Berger, A.N., and L.J. Mester, 2003, "Explaining the Dramatic Changes in Performance of U.S. Banks: Technological Change, Deregulation, and Dynamics Changes in Competition", *Journal of Financial Intermediation,* 12, 57-95.

Darrat A.F., C. Topuz, and T. Yousef, 2003, "Assessing Bank Efficiency of Banks in an Emerging Market: The Kuwaiti Experience in the 1990s", *Studies in Economics and Financ*e, 21, 1-21.

Fare, R., and S. Grosskopf, 1990, "A Distance Function Approach to Measuring Price Efficiency", Journal of Public Economics,

Grigorian, D., and V. Manole, 2005, "A Cross-Country Nonparametric Analysis of Bahrain's Banking System", IMF Working Paper, WP/05/117.

Islam, M., 2003, "Development and Performance of Domestic and Foreign Banks in GCC countries", *Managerial Finance*, 29 (7), 17-42.

Limam, I., 2004, "Measuring Technical Efficiency of Kuwait Banks", API-Working Paper Series 0101, Arab Planning Institute - Kuwait, Information Center.

Limam, I., 2001, "A Comparative Study of GCC Banks Technical Efficiency", Working Paper 0119, Economic Research Forum , Cairo Egypt.

Molyneux, P. and M. Iqbal, 2005. *Banking and Financial Systems in the Arab World*, Palgrave Macmillan, New York, USA.