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Efficiency of Banks in the Gulf Cooperation Council Region: A DEA and Malmquist Approach

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Exposed to the free-competition nature of the WTO regulations and the prospect of monetary union in 2010, the banks in the Gulf Cooperation Council, GCC, face competition both regionally and internationally. Cost efficiency and efficiency gain over time are thus of paramount importance to bankers as these are factors that could strengthen banks position as an independent entity. Using data envelopment analysis, this study, for the first time, investigates the efficiency of the performance of the banking sector in the Gulf Cooperation Council, over the period of 1998-2004. In addition, using the Malmquist productivity index, the components of efficiency gain/loss of the banks during the period in question is also measured. The results show that although the banks under examination do not exhibit large inefficiencies, the little technical and scale efficiency gains over time could be a matter of concern for decision and policy makers.

Field of Research: Banks; Gulf Cooperation Council; Cost Efficiency; DEA; Malmquist.

1. Introduction

The banking sectors in the GCC countries enjoy some common features. First, they are constrained by limited domestic markets. The entire population of the GCC countries counts for less than 35 million, two third of which live in Saudi Arabia alone. This leaves the population of other countries to range from as low as a mere ca. 600,000 in Bahrain to around 4 million in the UAE.

The second common feature of the GCC countries is the high dependency of the governments' revenue on the proceedings of the petroleum sector. In 2002, the UAE had the lowest dependency of just below 55%, while the figures for Saudi Arabia and Oman is just below and above 75%, respectively. In average, about 70% of the government's revenue in the GCC, as a whole, is coming from the petroleum sector. However, in the past two decades there have been signs of reducing this dependency through diversification of investments.

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The third feature is the limitation in investment opportunities. The main investment opportunity in the GCC countries is offered by the real estate, trade, and financial sectors. The fact that the expatriate population in these countries, which form a relatively large proportion of the population, are restricted in making investments in many of the popular areas of business (while not having easy access to the credit market) make the situation even worse.

The next, and probably the most important common factor, as far as this study is concerned, is the protectionist policies of the governments towards their banking systems. Government regulations protecting domestic banks, along with various obstacles to free entry of the foreign banks, have made the GCC countries a heaven for domestic banks. Even in the countries such as the UAE and Bahrain, where the foreign banks have a longer history of presence than in other GCC countries (although the UAE has not yet issued any license for a foreign branch for the past 20 years), the foreign banks do not represent a material share of the local market even when outnumbering the local ones. In the UAE, for instance, foreign banks hold only 27% of the total deposits in the banking system despite outnumbering the local banks by 26 to 21.

The protectionist mechanism in the GCC countries not only bars free entry but also provides the local banks with instruments to compete with the existing and established foreign banks. The GCC governments have provided their local banks with implicit guarantees for bank deposits, freeing them to extend their lending capacity well above that of the foreign competitors. The foreign banks are imposed 20% income tax, whereas the local ones enjoy a tax-free income.

The existing banking system in the GCC countries, however, has experienced intentions to, or starts of, changes, which, once completed, would confront the banks – specially the local ones – with serious challenges. To start with, all the GCC member countries are signatories of the WTO agreement, which should result in further liberalization of their economies, in general, and the financial sector in particular. Indeed, most of these six countries have already revised, or are in the process of revising, their “company and investment laws” to allow for higher level of foreign ownership of banks and foreign investors in the local stock markets. While the UAE and Bahrain, for instance, have long had foreign presence, Kuwait started the process in 2004.

Further, the GCC countries are envisioning a monetary union by the year 2010. This not only assumes the removal of all barriers towards the flow of capital between the member countries, It may also lead, through mergers and acquisition, to a wave of consolidation between the banks, as the GCC countries are also characterized by well over-the-average number of banks in each of the member countries, relative to their population.

With these scenarios, the efficiency and/or over-the-time efficiency gain of each bank in the system would play a major role in their survival as an independent

entity, for the less efficient firms have traditionally been the prime target of well-functioning competitors. On a cross-country basis, on the other hand, the possibility of a monetary union between the member countries would suggest homogenous banking system in each and every GCC countries. Without this homogeneity cross-country mergers and acquisitions are possibilities that could not be ignored. Once again the efficiency of banks and their over-the-time efficiency gain play major role in provoking a take-over initiation.

This study is to examine the cost efficiency of the banks in all six member countries of the GCC over the period of 1998 – 2004. We measure the efficiency of each bank and the average efficiency of the banks in each country in each year of the operation within the time period in question. We then compare the overall average efficiency of the banking system for each country and test whether there have been significant efficiency differences between them. Finally, we investigate the efficiency gain/loss of each bank during the mentioned period to shed some lights on overall performance of the banking industry in the GCC countries. The study is important, not only for the bankers whose banks' future existence depend on their present productivity, but also for decision makers at macro level as these decisions could make the efficient management of these most important financial intermediaries impossible.

The remaining of this study is organized as following. The next section looks at some of the existing works on the issue. This will be followed by discussing the methodologies used in this study. We will see how data envelopment analysis can be used to measure the relative efficiency of the banks and how we can apply the Malmquist Index technique to break down the efficiency changes in various components and how it could be used to measure the efficiency changes of the banks over time. To measure the efficiency of the banks, we need the input and output data. Section four discusses the variables we use in this study. We then proceed to introduce the results. The study comes to its end with a summary and some concluding remarks.

2. Literature

The literature focusing on the efficiency of the financial sectors of various countries, in general, and the bankers, in particular, is vast. To mention only a few, Berg, Forsund, and Jansen (1992), Fukuyama (1995), and Zaire (1995) use data envelopment analysis, DEA, to assess the effects of deregulation of financial sectors in Norway, Japan, and Turkey, respectively. Barr, Seiford, and Siems (1994) use DEA to forecast bank failure in the USA. On a comparative basis, Berg, Forsund, Hjalmarsson, and Suominen (1993) focus on the comparative efficiency of banks in three Nordic countries of Norway, Sweden, and Finland; Fecher and Pestieau (1993) use parametric approach of stochastic frontier analysis, SFA, to compare the efficiency of the banking sector in 11 OECD countries; Ruthenberg and Elias (1996) analysis the efficiency issue in the banking sector of 15 developed countries.

More recently, and closer to the region under this study, Rao (2005) looks at 35 banks operating in the UAE between 1998 and 2000, and concludes that these banks suffer substantial cost, X- (managerial), and scope inefficiency. Finally, Saif and Yaseen (2005) looks at Scope and Scale efficiency of banks operating in the Middle East and North Africa (MENA). Four out of 11 MENA countries covered in the study were from the GCC region (Oman, Qatar, Saudi Arabia and UAE). Overall, the 100 sampled banks (both foreign and domestic) exhibit, the study concludes, "reasonable degree of efficiency" among the banks in question.

The contribution of the current study to the literature is that: 1. it, for the first time, isolates the banking system in the GCC countries in one study, and 2. it investigates the pattern of efficiency change on individual country, as well as on cross-country bases. The latter helps the banks, and the policy makers, to be aware of the effects of their decision on the prospect of future survival in an ever-growing competitive environment.

3. Methodology

3.1. Data Envelopment Analysis (DEA)

A production process, in its simplest form, consists of applying one or a number of inputs to produce one or a number of outputs. However, producers of identical goods may have different policies with regard to the quantity, quality, and source of their inputs for producing one unit of each output. Thus, there is an interest among economists to identify the best possible combination of inputs for producing a given output. This gives them the opportunity to identify a production process that gives the highest level of output holding the input fixed, or the lowest amount of input for a given quantity of production. The best production process is often labeled as the most efficient one. Data Envelopment Analyses is one of the techniques to measure the efficiency of the production units in question.
DEA is a non-parametric technique for measuring the relative efficiency of each decision making unit, DMU – in our case banks. Utilizing a specific optimizing procedure, DEA evaluates individual DMU's performance to form an efficient production frontier. The observed DMUs are systematically evaluated to ascertain "best practice" units and the efficiency of all DMUs is determined relative to these "best" units. A DMU achieves an efficiency score of 1 if it is efficient relative to other units, or less than 1 if it is relatively inefficient compared to the efficient ones. In other words, the score attributed to each DMU indicates the degree of efficiency of that DMU relative to the best practice frontier (efficient units).

DEA can be applied assuming either constant or variable returns to scale, depending on the scale of operation dominating the industry in question. In this study, we assume variable returns to scale due to the relatively young age of many of the banks in the GCC countries, which would prevent them reaching the

target (constant) returns to scale operation possibility. To measuring efficiency of each DMU, the variable returns to scale model of BCC (Banker, Charles, and Cooper, 1984) distinguishes between technical and scale efficiencies by estimating pure technical efficiency at the given scale of operation, and identifying whether increasing, decreasing, or constant returns to scale possibilities are present for further exploration.

DEA could be applied after deciding on the orientation of the study, which identifies whether the decision-makers have more say in determining the level and/or the type or inputs, or the level of output. The results of an input-oriented DEA indicate the degree of inefficiency in the application of inputs, holding the output fixed. The output-oriented DEA, on the other hand, indicates the relative efficiencies of the production process of each decision making unit. The orientation of the study depends on the aim of the study and/or the nature of the industry in question. In the current study, we are seeking the cost efficiency of the banks, which moves us towards an input-oriented analysis.
The input-oriented BBC model is structured as:

Minimize: $Z_0 = \theta - \varepsilon \cdot \beta \cdot S^+ - \varepsilon \cdot \beta \cdot S^-$ (1)

Subject to:

$$\begin{aligned} & Y\lambda - S^+ = Y_0 \\ & \theta\ X_0 - X\lambda - S^- = 0 \\ & \beta \cdot \lambda \geq 1 \\ & \lambda, S^+, S^- \geq 0 \end{aligned} \quad (2)$$

Here λ is a $N \times 1$ vector of constants, *Y* and *X* are the output and input vectors, respectively, *S* is the slack variables, β is a $(1 \times N)$ row of 1s, and θ is a scalar the value of which will be the efficiency score of the i[th] DMU. The constraint of $\beta \cdot \lambda \geq 1$ allows for variable return to scale of operation.

It should be mentioned that DEA does not account for statistical noise in data. To overcome this problem in efficiency measurements, the more commonly used alternative is the stochastic frontier analysis, SFA, which, in turn, suffers other problems. The first problem, as far as this study is concerned, is that to evaluate the banks' performance, SFA could take into account only one input. This would require normalization of all inputs in one input, which might harm the generalization of the results, specially with regard to making reference to inefficient use of inputs. The second shortcoming is that SFA requires a pre-determined functional form of production relationship. This is particularly problematic when dealing with cross-country DMUs, as the assumption of similar production function form is difficult to justify. For these reasons, the DEA is preferred in this study despite its shortcoming in distinguishing efficiency and noise.

3.2. Malmquist Productivity Index

The current study also seeks to breakdown efficiencies in various components and measure efficiency changes of each component over time. This comparison is barred with the fact that technical progress over time may prevent a valid and meaningful comparison. Fortunately, the Malmquist Productivity Indices (MPI) can address this problem. The Malmquist total factor productivity (TFP) index measures the total factor productivity change between two data points by calculating the ratio of the distances of each point relative to a common technology. The input-oriented Malmquist compares the input requirements for producing output level y_t using period ***t*** technology, with the input that would have been required if the production technology was the same as that in a later period, ***s***. Thus, x_t is essentially being compared with what would have been required under technology ***s***. If we let the two periods be ***s*** > ***t*** and define the vectors of inputs and outputs in each period by **x** and **y** respectively, then the MPI for DMU i is given by:

$$MPI = \underbrace{\left(\frac{d_i^t(y_t, x_t)}{\underbrace{d_i^s(y_s, x_s)}_{Efficiency\ Change}} \right)}_{} \underbrace{\left(\frac{d_i^s(y_t, x_t)}{d_i^t(y_t, x_t)} \times \frac{d_i^s(y_s, x_s)}{d_i^t(y_s, x_s)} \right)^{\frac{1}{2}}}_{Technical\ Change} \quad (3)$$

The first expression measures the change in $i's$ position relative to the frontier in each period; other things equal, it measures how $i's$ relative efficiency has changed between the periods. In Malmquist literature this is called the "catching up effect". The second expression contains a geometric average of two alternative measures of shifts in the technology frontier between period ***t*** and period ***s***. In the first, the shift is measured in relation to year ***t*** observations while in the second the shift is measured in relation to year ***s*** observations. This shift can also be interpreted as measuring innovation or change in technology over time.

The decomposition can be extended by decomposing the technical efficiency change into scale efficiency and pure technical efficiency components.

Scale Efficiency of each period = $\frac{CRS}{VRS}$ efficiency;

Scale Efficiency Change = scale efficiency in period ***t*** / scale efficiency in period ***s***. This shows how much the scale of operation has changed over the two periods. Further decomposition could be made with regard to the pure efficiency change, which is defined as the change in the efficiency of the unit in question over the two periods with the assumption of no technical and scale change during the period in question. In the other words, pure efficiency change could be interpreted as the change in the performance of that part of, say, a bank's activity that is directly controllable by its managers, while technical change might be an exogenous factor to manager's decision-making process.

4. Data

The multi-product nature of the banking firm has long been recognized and tested. But what constitutes an appropriate measure of input and output is still a matter of debate. According to the intermediation approach, deposits are treated as an input variable, for banks collect funds and transform them into loans. The Intermediation approach views banks as mediators between the supply and the demand of funds, and as such they take deposits and other purchased funds and transforms them into loans and other assets. The production approach, on the other hand, treats deposits as one of the output produced by banks by using capital and labor. At present, there is no agreement on the explicit definition and measurement of inputs and outputs of the industry. Data availability has also been a factor in the choice of input-output variables used. For the definition of inputs and outputs, we adopt a variation of the production approach used by Ferrier and Lovell (1990) and Cebenoyan and Register (1989) and conform more to a recent study by Ozkan-Gunay, and Tektas (2006) about the Turkish banking industry. We use three input variables: Personnel expenses, Administrative expenses, and interest expenses and five output variables: Total loans, total securities, total deposits, interest income and non-interest income (fees and commissions).

In the case of GCC banks, regardless of the adopted approach, the lack of consistency and quality places considerable constraints on the choice of the input-output variables. Several banks report costs on an aggregate basis, with no break-down between labor costs, depreciation, and other operating costs. It was therefore mandatory for us to disregard a number of banks whose data availability was not at a satisfactory level to our analysis. As a result, 47 banks of the six GCC countries take part in this study. A summary of the data on an annual country-by-country basis is given in Tables 1 to 6.

Table 1: Saudi Arabia Summary input – Output Data (million U.S. Dollars, Real 2000)

	Total Deposits	Total Loans	Total Securities	Total Interest Income	Non-Interest Income	Personnel Expenses	Admin. Expenditure	Int. Exp. / Ret. to dep.
1998	11940	6227	6553	884	71	103	66	354
1999	11947	5293	7176	843	84	113	78	387
2000	11440	4978	7053	850	93	114	77	448
2001	12029	5410	7500	799	105	120	71	331
2002	12222	5835	7398	641	117	125	87	175
2003	12697	6441	7255	590	157	136	110	140
2004	13092	7547	6742	611	171	131	87	138
Overall	12195 (7472)	5961 (3905)	7097 (4300)	746 (476)	114 (85)	120 (72)	82 (61)	282 (214)

Numbers in brackets are standard deviations

Table 2: Bahrain Summary input – Output Data (million U.S. Dollars, Real 2000)

	Total Deposits	Total Loans	Total Securities	Total Interest Income	Non-Interest Income	Personnel Expenses	Admin. Expenditure	Int. Exp. / Ret. to dep.
1998	5196	3231	3000	403	60	52	24	305
1999	5389	3121	3421	378	52	54	30	276
2000	4937	2839	3132	392	55	53	26	299
2001	4827	2785	3199	345	48	53	33	241
2002	5448	3159	3881	277	56	59	27	166
2003	4789	2867	3376	136	30	28	11	79
2004	2794	1580	2655	126	31	27	11	79
Overall	4769 (8161)	2798 (5200)	3238 (5135)	294 (533)	47 (96)	46 (930)	23 (48)	206 (385)

Numbers in brackets are standard deviations

Table 3: The U.A.E. Summary input – Output Data (million U.S. Dollars, Real 2000)

	Total Deposits	Total Loans	Total Securities	Total Interest Income	Non-Interest Income	Personnel Expenses	Admin. Expenditure	Int. Exp. / Ret. to dep.
1998	2715	1918	1406	208	81	28	15	118
1999	2439	1874	1230	190	66	26	14	105
2000	2485	1749	1350	203	74	25	13	123
2001	2832	1972	1531	193	67	28	15	105
2002	3030	2245	1509	143	48	28	16	55
2003	3793	3131	1654	162	57	37	20	55
2004	5102	4121	2209	227	87	45	26	84
Overall	3200 (3334)	2430 (2592)	1556 (1799)	189 (185)	69 (104)	31 (29)	17 (17)	92 (109)

Numbers in brackets are standard deviations

Table 4: Oman Summary input – Output Data (million U.S. Dollars, Real 2000)

	Total Deposits	Total Loans	Total Securities	Total Interest Income	Non-Interest Income	Personnel Expenses	Admin. Expenditure	Int. Exp. / Ret. to dep.
1998	974	1082	267	110	20	18	13	58
1999	1029	1070	311	111	18	17	11	59
2000	790	905	206	99	14	15	10	53
2001	975	1061	287	104	16	17	12	50
2002	993	1015	317	90	18	18	13	30
2003	1010	997	367	77	21	19	13	25
2004	985	996	358	72	19	19	12	22
Overall	965 (511)	1018 (642)	302 (182)	95 (58)	18 (12)	18 (9)	12 (6)	43 (34)

Numbers in brackets are standard deviations

Table 5: Qatar Summary input – Output Data (million U.S. Dollars, Real 2000)

	Total Deposits	Total Loans	Total Securities	Total Interest Income	Non-Interest Income	Personnel Expenses	Admin. Expenditure	Int. Exp. / Ret. to dep.
1998	2201	2116	586	212	26	19	8	124
1999	2210	1662	974	208	21	18	9	123
2000	1794	1196	951	184	17	15	8	119
2001	2133	1667	857	173	21	17	10	100
2002	2286	1737	960	139	21	17	11	55
2003	2204	1765	930	112	25	16	10	36
2004	2386	1882	990	109	29	17	13	36
Overall	2087 (2669)	1946 (2289)	1305 (943)	528 (193)	93 (19)	47 (16)	13 (9)	47 (119)

Numbers in brackets are standard deviations

Table 6: Kuwait Summary input – Output Data (million U.S. Dollars, Real 2000)

	Total Deposits	Total Loans	Total Securities	Total Interest Income	Non-Interest Income	Personnel Expenses	Admin. Expenditure	Int. Exp. / Ret. to dep.
1998	825	413	674	70	3	5	3	55
1999	917	355	810	67	7	6	4	52
2000	312	182	861	28	4	3	1	23
2001	372	208	349	30	5	3	2	21
2002	370	220	373	23	5	3	2	14
2003	399	222	383	21	7	3	2	12
2004	351	205	330	21	7	2	2	13
Overall	507 (1001)	258 (294)	540 (1119)	37 (65)	6 (7)	3 (5)	2 (3)	27 (53)

Numbers in brackets are standard deviations

5. Results

Before we start discussing the results, recall that Data Envelopment Analysis measures the relative efficiency of the units in question using the input and output data of the units in question. The units could be ranked according to the efficiency score. However, the results do not say much about the importance of each input or output in measuring the efficiency. That is, in an input oriented analysis, for instance, the role of each input in producing a particular efficiency score for the units in question is not obvious. The importance of each variable can be investigated simply by comparing the efficiencies of the units in question in the presence and absence of that particular variable. Banker et al. (1996, 1999) assure that the significant difference between the two sets is the significance of the variable in question. This method is used for the three inputs used in the current study. The result shows that all three inputs play significant role in determining the relative efficiencies of the banks in the GCC region.

5.1. Cost efficiency

Tables 7 to 13 summarize the results of efficiency measurement for each of the six GCC countries between 1998 and 2004. The first point to mention is the relatively high number of banks appearing on the best frontier. Although it could denote the efficiency of operation in these banks, it could also stem from the relatively high number of input and output that the study is based on.

In 1998, a total of 27 banks (57% of total) are reported to be efficient. Saudi Arabia with 6 out of 7 banks (86%) leads the number of efficient banks, while none of the Omani banks is efficient. The average efficiency of the GCC countries' banks is 0.930 (0.107), resulting in 7% cost inefficiency in the average operation of the GCC banking system. A total of 20 banks (43% of total) exhibit constant returns to scale production possibility, while 16 banks (34% of total) are experiencing increasing returns to scale. The most efficient country in numerical terms is Saudi Arabia, whose banking operation is significantly more efficient than Oman (at 99% level of significance) and Kuwait (at 90% level of significance).

Qatar leads the percentage of efficient banks in 1999, with 3 out of 4 banks (75%) recognized as best practice. Oman, once again, is the only country with no bank on the frontier. In numerical terms, the U.A.E. leads the efficiency score (0.975) which ranks it significantly higher than Oman (with 99% level of significance). The average GCC efficiency has dropped to 0.934 (0.095) compared to a year earlier. In 1999, the number of banks with constant returns to scale production technology also dropped to 16 (ca. 38%), while the number of banks with increasing returns to scale production possibility remained at the same rate of the previous year.

The major change in the year 2000 came in the form of dropping the number of banks that were exhibiting increasing return to scale from 16 in 1999 to 12 in 2000. The number of banks with constant returns to scale production possibility remained intact at 16 banks (38% of total). Again, leading the average efficiency score is the U.A.E., whose efficiency score is significantly higher than Oman and Kuwait, both at 95% level of significance. Saudi Arabia share this leading with the U.A.E., over Oman and Kuwait, at the same level of significance. The countries in the GCC show at best an average inefficiency of 3.8% (the U.A.E.) and at worst an average inefficiency of ca. 14%. On an individual bank basis, the worst efficiency score belongs to a Bahraini bank with just above 31% inefficiency.

The least efficient bank in 2001 is a Saudi bank with an efficiency level of 21.5%. On a country level, on the other hand, the U.A.E. leads the average efficiency score, again, with 97.8%. Statistical tests show that the U.A.E. is enjoying more efficiency than Oman at 95% level of significance. No other country has a significant supremacy over other GCC countries at this level of significance in 2001. The interesting feature in this year is the high number of banks enjoying

constant returns to scale production technology (23 banks, or 49% of the total). This comes at the cost of the banks that were previously experiencing increasing returns to scale technology. The number of banks with this characteristics dropped to 8 (17%) in 2001.

The average GCC efficiency for the year 2002 is 0.953, with Qatar leading the efficiency rank with an average of 1.000. All four Qatari banks appear on the frontier. The U.A.E. follows Qatar with an average of 0.996, as 14 banks active in the country marked as the best practice. A total of 24 banks (51% of total) enjoy constant returns to scale technology, while 19% of the banks are still on the increasing returns to scale mood.

Leading the efficiency ranking continued for Qatar in the next two years, with all four Qatari banks recognized as best practices in 2003 and 2004. Having said that, statistically, Qatar was more efficient than Oman (at 99% level of significance) and Kuwait (at 95% level of significance) in 2003, and only more significantly efficient than Oman (at 95% level of significance) in 2004. In fact, in 2003 all other countries showed more efficiency than Oman at a significant level, whereas in 2004, only Bahrain's supremacy over Oman could not be statistically established. In both years, 27 (over 57%) of the banks exhibited constant returns to scale, while 6 banks were still enjoying increasing returns to scale production technology.

Overall, the U.A.E. leads the other GCC countries with an average efficiency of 97.8%. This is statistically more efficient than Saudi Arabia (at 95% level of significance), Bahrain (at 99% level of significance), Oman (at 99% level of significance), and Kuwait (at 95% level of significance). The U.A.E. is followed by Qatar, who is more efficient than Oman at 99% level of significance, but only at 90% level of significance over Bahrain and Kuwait. Oman shows the highest inefficiency among the GCC countries with around 18% inefficiency.

5.2.Efficiency Gain Over Time

Table 14 summarizes the results of the Malmquist efficiency breakdown over the period in question.

As far as Saudi Arabia is concerned, none of the banks in 1999 had any technical or scale efficiency progress over the previous year, whereas in the year 2000, all Saudi banks had technical gain and all but two banks had scale efficiency improvement over those of 1999. The pattern was reversed in the year 2000, when 6 out of 7 banks experienced technical efficiency loss and 5 banks experienced scale efficiency loss. The same pattern of technical efficiency loss continued in 2002, while the majority of banks improved in scale efficiency gain. However, the progress was reversed in 2003, when the majority of banks lost the last year's technical progress but could partly compensate for their scale efficiency loss. The last year of study, 2004, was probably the best year for Saudi

Arabian banks, as the majority of banks (5 out of 7) gained both technical efficiency and scale efficiency over the previous year. Considering the efficiency and pure efficiency gain in this year, the Saudi banks could compensate a part of their previous years' shortcomings in total factor productivity changes. Overall, the Saudi's banks have loss efficiency in all categories over the period in question, although some of the individual banks show some signs of recovery.

The majority of the Bahraini banks experienced continuum technical efficiency gain between 1998 and 2002. This gave them an average 14% technical gain over this period. In 2002, however, all Bahraini banks stepped back and suffered substantial technical efficiency loss of over 50%. The average technical efficiency gain of 35% in 2003 was also cancelled out by the efficiency loss in 2004. These were enough to leave Bahrain with an average technical efficiency loss of 1.8% over the years of study. In scale efficiency front, Bahrain did not go through substantial efficiency gain/loss. The small efficiency gains of some of the years were offset by small scale efficiency loss of others, leaving Bahrain with almost intact average scale efficiency over the 7 years of study. The same is also true with regard to efficiency and pure efficiency changes. All these caused Bahrain to have an almost unchanged total productivity change between 1998 and 2004. Bahraini banking system could be thus characterized by stability in operation with potential worries in near future.

Although Oman is ranked as the least efficient country in the GCC in terms of cost efficiency, its efficiency gain over the years (with particular increase in 2003 and 2004) could be a major source of relief for the involved parties. The main source of overall improvement is the technical efficiency gain over the years. This reflects the fact that, with the exception of Kuwait, Oman has gained the most in the technical part, in which "learning by doing" could play a major role. The total factor productivity gain of Bahrain over the years under study is solely because of the technical gain the country experienced as the other factors of efficiency, pure efficiency, and scale efficiency remained, in average, intact. It is worth mentioning that the scale of operation of the banking system in Oman experienced efficiency gain ever other year, and lost the gained efficiency the very year after. This is a phenomenon that begs more attention by the authorities.

Kuwait experienced similar changes as Oman did. The technical productivity losses of 1999, 2001, and 2002 were compensated for by the efficiency gain of 2000, 2003, and 2004. In 2003 alone, the banking sector experienced a substantial 160% efficiency gain over the previous year. The technical gain of the last two years of study could be encouraging for the decision makers. Similar to the case in Oman, the 1.8% pure efficiency gain of Kuwait was offset by the same percentage average scale efficiency loss, leaving technical gain as the sole responsible for the banking system's total factor productivity gain. The average scale efficiency loss in Kuwait, despite the post-2001 high oil prices, is alarming.
Qatar also exhibits the same pattern of events as Kuwait, with even lower average technical progress. As far as the technical gain is concerned, the worst years of operation for the banking system were 2001 and 2002 when all 4 banks

lost substantial technical efficiency. The following 2 years, however, coupled with reasonable performances in 1999 and 2000, left the country with an average 14.7% technical efficiency gain over the period in question. Like the two previous cases of Oman and Kuwait, it is actually this technical efficiency gain that caused the total factor productivity of the banking system in Qatar to gain an average 7.7% gain over the 1998-2004 period.

The interesting issue with the U.A.E. banking system is the harmony in their technical change over the years. That is, except for 2004, the banks in the U.A.E. either lost technical efficiency together (compared to the previous year) or gained efficiency together. This left the banking system with an average 3.5% annual gain in technical efficiency. The small but steady efficiency gain was experienced with regard to other factors, namely pure efficiency, scale efficiency, and total factor productivity. Whether this is enough to assist the Emirates' bank in their more fearsome future competition is to be seen.

Table 7: Annual Efficiency of Saudi Arabia (S)

Saudi (7 Banks)	Number of Efficient Banks	Minimum Efficiency Score	Maximum Efficiency Score	Average Efficiency	Significantly More efficient Than
1998	6	0.892	1.000	0.985 (0.041)	(O ***) ; (K **)
1999	4	0.795	1.000	0.946 (0.084)	(O ***)
2000	5	0.782	1.000	0.952 (0.087)	(O **); (K *)
2001	5	0.785	1.000	0.951 (0.087)	-
2002	3	0.762	1.000	0.928 (0.098)	(O *)
2003	5	0.796	1.000	0.962 (0.077)	(O **)
2004	6	0.808	1.000	0.973 (0.173)	(O **)

1. **Figures in the brackets are standard deviations;**
2. *** Significant at 90%; ** Significant at 95%; *** Significant at 99%.**

Table 8: Annual Efficiency of Bahrain (B)

Bahrain (7 Banks)	Number of Efficient Banks	Minimum Efficiency Score	Maximum Efficiency Score	Average Efficiency	Significantly More efficient Than
1998	5	0.675	1.000	0.914 (0.147)	(O **)
1999	5	0.683	1.000	0.928 (0.128)	(O **)
2000	4	0.689	1.000	0.896 (0.135)	-
2001	5	0.729	1.000	0.943 (0.106)	-
2002	5	0.724	1.000	0.938 (0.112)	-
2003	6	0.860	1.000	0.980 (0.053)	(O **)
2004	5	0.675	1.000	0.918 (0.141)	-

1. Figures in the brackets are standard deviations;
2.. * Significant at 90%; ** Significant at 95%; * Significant at 99%.**

Table 9: Annual Efficiency of the United Arab Emirates (U)

U.A.E. (16 Banks)	Number of Efficient Banks	Minimum Efficiency Score	Maximum Efficiency Score	Average Efficiency	Significantly More efficient Than
1998	10	0.826	1.000	0.967 (0.055)	(O ***)
1999	10	0.852	1.000	0.975 (0.049)	(O ***)
2000	9	0.865	1.000	0.962 (0.059)	(O **); (K **)
2001	13	0.826	1.000	0.978 (0.051)	(O **)
2002	14	0.963	1.000	0.996 (0.010)	(S **); (B *); (O **)
2003	13	0.841	1.000	0.980 (0.050)	(O ***)
2004	13	0.868	1.000	0.989 (0.033)	(O **)

1. Figures in the brackets are standard deviations;
2.. * Significant at 90%; ** Significant at 95%; * Significant at 99%.**

Table 10: Annual Efficiency of Oman (O)

Oman (5 Banks)	Number of Efficient Banks	Minimum Efficiency Score	Maximum Efficiency Score	Average Efficiency	Significantly More efficient Than
1998	0	0.654	0.863	0.755 (0.080)	-
1999	0	0.728	0.877	0.797 (0.054)	-
2000	1	0.824	1.000	0.877 (0.077)	-
2001	1	0.807	1.000	0.904 (0.077)	-
2002	0	0.649	0.950	0.811 (0.123)	-
2003	0	0.610	0.949	0.790 (0.133)	-
2004	1	0.597	1.000	0.810 (0.179)	-

1. Figures in the brackets are standard deviations;
2.. * Significant at 90%; ** Significant at 95%; * Significant at 99%.**

Table 11: Annual Efficiency of Qatar (Q)

Qatar (4 Banks)	Number of Efficient Banks	Minimum Efficiency Score	Maximum Efficiency Score	Average Efficiency	Significantly More efficient Than
1998	3	0.712	1.000	0.928 (0.144)	(O **)
1999	3	0.698	1.000	0.925 (0.1510	-
2000	3	0.724	1.000	0.931 (0.1380	-
2001	3	0.888	1.000	0.972 (0.056)	(O *)
2002	4	1.000	1.000	1.000 (0.000)	(S **); (B *); (O ***)
2003	4	1.000	1.000	1.000 (0.000)	(O ***); (K *)
2004	4	1.000	1.000	1.000 (0.000)	(O **)

1. Figures in the brackets are standard deviations;
2.. * Significant at 90%; ** Significant at 95%; * Significant at 99%.**

Table 12: Annual Efficiency of Kuwait (K)

Kuwait (8 Banks)	Number of Efficient Banks	Minimum Efficiency Score	Maximum Efficiency Score	Average Efficiency	Significantly More efficient Than
1998	3	0.758	1.000	0.933 (0.087)	(O ***)
1999	4	0.842	1.000	0.940 (0.072)	(O ***)
2000	3	0.743	1.000	0.867 (0.118)	-
2001	4	0.795	1.000	0.940 (0.081)	-
2002	6	0.799	1.000	0.966 (0.072)	(O **)
2003	5	0.789	1.000	0.957 (0.078)	(O **)
2004	5	0.836	1.000	0.967 (0.060)	(O *)

1. Figures in the brackets are standard deviations;
2.. * Significant at 90%; ** Significant at 95%; * Significant at 99%.**

Table 13: Ranking of the GCC countries based on overall efficiency between 1998 and 2004

	Average Efficiency	Significantly More Efficient Than:
U.A.E.	**0.978 (0.047)**	**(S **); (K ***); (B ***); (O ***)**
Qatar	**0.965 (0.092)**	**(K *); (B *); (O ***)**
Saudi Arabia	**0.956 (0.077)**	**(O ***)**
Kuwait	**0.939 (0.085)**	**(O ***)**
Bahrain	**0.931 (0.116)**	**(O ***)**
Oman	**0.819 (0.111)**	**-**

1. Figures in the brackets are standard deviations;
2.. * Significant at 90%; ** Significant at 95%; * Significant at 99%.**

Table 14: Average Efficiency Change between 1998 and 2004

	Efficiency Change	Technical Change	Pure Efficiency Change	Scale Efficiency Change	Total Factor Productivity Change
U.A.E.	**1.011**	**1.035**	**1.001**	**1.011**	**1.047**
Qatar	**1.002**	**1.075**	**1.008**	**0.994**	**1.077**
Saudi Arabia	**0.982**	**0.980**	**0.990**	**0.992**	**0.963**
Kuwait	**0.999**	**1.147**	**1.017**	**0.982**	**1.145**
Bahrain	**0.986**	**0.982**	**0.991**	**0.995**	**0.968**
Oman	**0.999**	**1.125**	**0.996**	**1.003**	**1.123**

6. Summary and Concluding Remarks

Active in a relatively small region, the GCC banks have so far enjoyed favorable protectionist policy by the host authorities. These policies seem to be coming to an end as the individual countries of Saudi Arabia, Oman, Kuwait, Bahrain, Qatar, and the United Arab Emirates are all signatories of the WTO agreement, which obliges the member countries to join a free business environment. This, coupled with the prospect of a monetary union between the member countries, would, other factors being equal, mean higher efficiency requirement for the banks to enable them to continue to exist as an independent entity. For cost inefficiency has effectively been a significant cause of mergers and acquisitions.

This study is set up to investigate the relative efficiency issue among 47 GCC banks. To that end, the parametric approach of data envelopment analysis is used to measure the annual and aggregate efficiency of the banks on individual country basis. Further, Malmquist productivity index is used to breakdown the banks' total factor productivity into efficiency and pure efficiency, technical, and scale efficiency. The study has also benefited the Malmquist index's ability to measure the annual changes in the mentioned factors to investigate the banks' possible ability to gain efficiency on the mentioned grounds.

As far as the banks' relative efficiency is concerned, the results show that the GCC banks performance is not unsatisfactory. For each year under the study, the best practice frontier is formed by a good number of banks, while the others keep a fairly close distance with the efficient ones. On aggregate level, the U.A.E.

banks show significant efficiency supremacy over all other countries except Qatar. The latter is following the U.A.E. in numerical efficiency score. Other factors being held constant, this implies that the banks in the other GCC countries could be exposed to threat by U.A.E. and Qatari banks once free competition is allowed in GCC countries.

Perhaps more important is the pattern of growth among the banks in question. The Malmquist productivity indices show that the banks, by and large, have gained only little efficiency gain over the years of study. Scale efficiency gain, for instance, has been rare among the banks and this is particularly alarming considering the oil price boom since 2001. Bearing in mind that all the GCC countries, at different levels, are among oil producer countries, the substantial oil price increase should have, one may suspect, affected the scale of banks' operation in these countries. This could be of major concern for policy makers should the oil price experience a downward movement after reaching its pick some time in the future.

Except for the technical efficiency change for Kuwait, Oman, Qatar, and to some extent, the U.A.E., the efficiency gain on other factors does not seem satisfactory. While the countries, by and large, show capability in applying technical advances and learn from past experience, the cost efficiency improvement of these countries beg closer attention. This area is closely watched by experts in taking over inefficient firms.

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