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PRICE EFFICIENCY AND RETURNS TO SCALE OF BANKING SECTOR IN GULF COOPERATIVE COUNCIL COUNTRIES: EMPIRICAL EVIDENCE FROM ISLAMIC AND CONVENTIONAL BANKS

Abstract. *This paper investigates the price efficiency consist of cost, revenue and profit efficiency and returns to scale on 74 banks (47 conventional and 27 Islamic banks) in Gulf Cooperative Council (GCC) countries over the periods 2007 to 2011. The Data Envelopment Analysis (DEA) method that applied the intermediation approach adopted in this study to measure the level of efficiencies. We find that, revenue efficiency seems to play the main factor leading to the lower or higher profit efficiency levels only on Islamic banks. This study also shows that they are statistically significant difference on cost, revenue and profit efficiency between Islamic and conventional banks in GCC countries. Furthermore, Islamic and conventional banks tend to operate at constant return to scale (CRS) or decrease return to scale (DRS), while the small banks tend to operate at CRS or increase return to scale (IRS).*

Keywords: *Price efficiency, returns to scale, cost efficiency, revenue efficiency, profit efficiency, gulf cooperative council*

JEL Classification: G21

1. INTRODUCTION

Islamic bank is an intermediary and trustee of money of other people but the difference is how it shares profit and loss with its depositors. The introduction of the element of mutuality in Islamic banking makes its depositors as customers with some ownership of right in it (Dar and Presley, 2000).Meanwhile the conventional banking

follows conventional interest-based principle, the Islamic banking is based on interest free principle and principle of Profit-and-Loss (PLS) sharing in performing their businesses as intermediaries. Meanwhile, the conventional banking theories assume that banks earn profits by purchasing transactions deposits from the depositors at a low interest rate, then reselling those funds at a higher interest rate to borrowers.

Nevertheless, the conventional banks enjoy several advantages over Islamic banks because they have a good experience and long history, practice and accept the interest from the loan that represent major source of the banks' revenue. In addition, conventional banks also enjoy a huge capital, do not share loss with clients, have much more developed technologies, ask for guaranteed collaterals in most transaction and spread very widely through the large numbers of the banks' branches. Furthermore, the conventional bank could also enter Islamic banking market that gives a more advantage to be a competitive rival to Islamic banking. For example, the Western financial market players such as Citibank, ABN AMRO, HSBC and others established their own Islamic windows or subsidiaries to attract petrodollars' deposits from the Middle East and Muslims clientele in local markets. Most of the previous studies had investigated the efficiency of the both Islamic and conventional banks and the results are mixed and inconclusive. Some of the researchers suggest the conventional banks are more efficient than Islamic, while others discovered on the other way (Yudistira, 2004 and Sairi 2010). Consequently, it is interesting to examine efficiency level form the both banking sectors.

Berger and Humphrey (1997) suggest studies focused on the efficiency of financial institutions have become an important part of banking literature science the early 1990s. A study by Berger *et al*. (1993) suggests that if banks are efficient, they could expect improved profitability, better prices and better service quality for consumers and that greater amounts of funds would be intermediated.

In fact, the general concept of price efficiency covers three components; namely, cost, revenue and profit efficiency (Adongo *et al*., 2005 and Bader *et al*., 2008). Evidence on bank efficiency could be produced by discovering these three types of efficiency concept. However, few studies have examined the comprehensive efficiency that consists of these three components. Most previous studies have mainly focused on the efficiency of cost, profit or both (Sairi 2010; Bader *et al*., 2008; Ariff and Can, 2008; Maudos *et al*., 2002).

Studies on bank efficiency which ignore the revenue side have been criticised (Bader *et al*., 2008). It is mainly because most of the studies have only revealed the levels of cost efficiency which are higher than the profit efficiency, but they have not identified the causes. The main problem that contributes to the lower profit efficiency comes from revenue inefficiency. Ariff and Can (2008) found that the inefficient revenue affected the difference between cost and profit efficiency, but they did not investigate further on the revenue efficiency and on the reasons for such an occurrence. A study which investigated on the causes of inefficiency was done by Maudos *et al*.

(2002) and Rogers (1998) who found that revenue inefficiency was caused either by mispricing of outputs or giving wrong choice of output.

Therefore, instead of focusing the Islamic and conventional banks on profit efficiency alone, it is better to compare it with cost efficiency as well in order to identify the existence of revenue efficiency. To the best of our knowledge, this is the first empirical study that has examined the comprehensive efficiencies concept including the revenue efficiency on Islamic and conventional banking sector in GCC countries. By employing a non-parametric Data Envelopment Analysis (DEA) method, we analyze the cost, revenue and profit efficiencies of the GCC Islamic and conventional banks over the period of 2007 to 2011. The preferred non-parametric Data Envelopment Analysis (DEA) methodology has allowed us to distinguish between three different types of price efficiency, which are cost, revenue and profit efficiencies. This information could be useful to several parties and may have several implications for regulators, bankers, investors and academicians.

The paper is set out as follows: the next section provides the related literature. Section 3 discusses on the methods employed in the study and variables employed. We present the empirical findings in section 4. The article concludes and provides discussions on the policy implications in section 5.

2. LITERATURE REVIEW

There are some documented studies that compare the performance of Islamic banks with their conventional counterparts. Nevertheless, the previous studies mostly concentrate on the technical, pure technical and scale efficiency (Hassan and Hussein, 2003 and Yudistira, 2004). Despite the significant importance of this area, documented studies that address on cost, revenue and profit efficiency are very few (Yudistira, 2004 and Hassan, 2005). Sufian *et al*. (2008) shows that pure technical inefficiency (PTIE) outweighs scale inefficiency (SIE) in the Islamic bank. Although the Islamic banks have been operating at a relatively optimal scale of operations, they were managerially inefficient to exploit their resources to the fullest.

Yudistira (2004) suggests that the largest degrees of SIE come from large size Islamic bank. It is interesting to note that all but one of the large size Islamic banks in 1997 to 1998 exhibited decrease return to scale (DRS), whilst in 1999 to 2000 most large size banks show constant return to scale (CRS). The level of TIE in 1998 is more attributable to PTIE rather than SIE. Drake (2001) finds that the big four UK banks suffer from DRS over the period 1984-1995. However, X-efficiencies are exhibited by these banks and are similar to US banking studies, which suggest that very large banks are likely to minimize their costs better than smaller counterparts. Evidently, the result shows that these banks have higher technical efficiency than scale efficiency.

There are many studies had conducted the price efficiency on cost and profit efficiency in the conventional banks rather than Islamic banks and discovered that the

different levels between cost and profit efficiency are caused by the inefficiency from the revenue side (such as: Rogers, 1998 and Maudos *et al*., 2002).

Revenue is defined as how effectively a bank sells its outputs. Maximum revenue is obtained as a result of producing the output bundle efficiently (Rogers, 1998 and Adongo *et al*., 2005). Another way to improve the revenue efficiency proposed by several studies is for banks to produce higher quality services and charge higher prices and struggle to avoid any improper choice of inputs and outputs quantities and mispricing of outputs (Adongo *et al*., 2005, and Rogers, 1998). The revenue inefficiency could be well identified via the profit function because this function combines both the cost and revenue efficiency to evaluate the profit efficiency (Akhevein *et al*., 1997). The revenue efficiency would totally affect the efficiency of the profit even though the cost efficiency is high. In essence, the revenue efficiency would be the major factor that influences the efficiency on the profit efficiency. Berger and Humphrey (1997) and Bader *et al*. (2008) stated that there have been limited studies done on revenue efficiency of banks.

The above literature reveals the following research gaps. First, the majority of these studies have mainly concentrated on the technical, pure technical and scale efficiency in conventional banking sectors of the western and developed countries. Second, empirical evidence on the developing countries, particularly the Islamic banking sector, is scarce. In the light of these knowledge gaps, the present paper seeks to provide new empirical evidence on the price efficiency consist of cost, revenue, and profit efficiency in the GCC Islamic and conventional banking sector.

3. DATA AND METHODOLOGY

The present study gathers data from all GCC Islamic and conventional banks from 2007 to 2011. The primary source for financial data is obtained from the BankScope database produced by the Bureau van Dijk which provides the banks' balance sheets and income statements. The data were collected from 74 banks (47 conventional and 27 Islamic banks) in the GCC countries

3.1 Inputs, Outputs, Approaches and the Choice of Variables

The definition and measurement of bank's inputs and outputs in the banking function remains arguable among researchers. To determine what constitutes inputs and outputs of banks, one should first decide on the nature of banking technology (bank's approaches). There are two main approaches that are widely used in the banking theory literature; namely, production and intermediation approaches. The first approach is the production approach which assumes that financial institutions serve as producers of services for account holders; that is, they should perform transactions on

deposit accounts and process documents such as loans. The second approach is the intermediation approach which is a preferred approach among researchers to apply in the first stage of DEA analysis. This approach views that banks basically act as financial intermediaries whose primary role is to obtain funds from savers in exchange for their liabilities, and the banks in turn will provide loans to others for profit making. The present study views the banks as intermediary and it will apply intermediation approach as well.

Under this approach, the bank's outputs are found on the asset side of the balance sheet and deposits are seen as inputs. Thus, the results of the efficiency scores will be affected and may vary depending on the selection of variables for each of the banks efficiency. Thus, the DEA method requires bank inputs and outputs whose choice is always an arbitrary issue (Ariff and Can, 2008 and Berger and Humphrey, 1997).

According to Cooper *et al*. (2002), there is a rule required to be complied with in order to select the number of inputs and outputs. A rough rule of thumb which could provide guidance is as follows:

$$n \geq \max \{m \times s, 3(m+s)\}$$

where:

n	is a number of DMUs
m	is a number of inputs
s	is a number of outputs

Because this study uses the intermediation approach, two inputs, two input prices, two outputs and two output prices variables were chosen. The overall selection of the variable of banks' input and output was based on Ariff and Can (2008) and other major studies on the efficiency of the banks (Sufian *et al*., 2012a; 2012; Bader *et al*., 2008 and Hassan, 2005). The two input vector variables consist of x1: deposits and x2: labour. The input prices consist of w1: price of deposit, w2 and price of labour

The two output vector variables are y1: loans and y2: income. Meanwhile, two output prices consist of r1: price of loans and r2: price of income. The summary of data used to construct the efficiency frontiers are presented in Table 1.

Table 1: Summary Statistics of the Variables Input and Output in the DEA Model (million USD)

Variable	Mean	Minimum	Maximum	Std. Deviation
Deposit (x1)	11,740.227	0.044	69,172.564	13,213.378
Labour (x2)	121.856	0.900	661.387	124.103
Loan (y1)	9,795.650	6.875	54,017.420	10,190.788
Income (y2)	694.820	0.100	3,178.320	711.964
Price of deposit (w1)	0.078	0.001	5.773	0.387
Price of labour (w2)	0.012	0.001	0.120	0.014
Price of loan (r1)	0.101	0.010	6.393	0.377
Price of income (r2)	0.362	0.000	14.333	1.518

Notes: x1: Deposits (deposits and short term funding), x2: Labour (personnel expenses), y1: Loans (total of short-term and long-term loans), y2: income (gross interest and dividend income), w1: Price of deposits (total interest expenses/ deposits), w2: Price of labour (personnel expenses/ total assets), r1: Price of loans (interest income on loans / loans), r2: Price of income (other operating income/ income)

3.2 Method of measurement

There are six reasons why this study adopts DEA method. Firstly, each DMU is assigned a single efficiency score that allows ranking amongst the DMUs in the sample. Secondly, DEA highlights the areas of improvement for each single DMU such as either the input has been excessively used, or output has been under produced by the DMU (so they could improve on efficiency). Thirdly, there is a possibility of making inferences on the DMU's general profile. DEA allows the comparison between the production performances of each DMU to a set of efficient DMUs (called reference set). Thus, the owner of the DMUs may be interested to know which DMU frequently appears in this set. A DMU that appears more than others in this set is called the global leader. Apparently, DMU owner may obtain a huge benefit from this information especially in positioning its entity in the market. Fourthly, several studies suggest that DEA does not require a preconceived structure or specific functional form to be imposed on the data in identifying and determining the efficient frontier, error and inefficiency structures of the DMUs. Fifthly, DEA does not need for standardisation and this allows the researchers to choose any kind of input and output of managerial interest (arbitrary), regardless of the different measurement units (Ariff and Can, 2008 and Berger and Humphrey, 1997). Finally, DEA is suitable with small sample sizes.

3.3 Data Envelopment Analysis (DEA)

Based on the idea of Farrell (1957) who originally developed the non-parametric efficiency method, Charnes *et al*. (1978) introduce the term DEA to measure the efficiency of each DMU, obtained as a maximum of the ratio of weighted outputs to weighted inputs (hereafter referred to as the CCR model). The more the output produced from given inputs, the more efficient is the production. The CCR model presupposes that there is no significant relationship between the scale of operations and efficiency by assuming constant return to scale (CRS) and it delivers the overall technical efficiency (OTE). The CRS assumption is only justifiable when all DMUs are operating at an optimal scale. However, firms or DMUs in practice may face either economies or diseconomies of scale. Thus, if one makes the CRS assumption when not all DMUs are operating at the optimal scale, the computed measures of OTE will be contaminated with scale inefficiency (SIE).

To obtain robust results, the present study estimates efficiency under the assumption of variable returns to scale (VRS). The VRS model was first proposed by Banker *et al*. (1984) and extends the CCR model. The BCC model which derives efficiency estimates under the VRS assumption relaxes the CRS assumption made in the earlier study. The VRS assumption provides the measurement of pure technical efficiency (PTE). The PTE measures the efficiency of DMUs without being contaminated by scale (SIE). Therefore, efficiency results derived from the VRS assumption provide more reliable information on the efficiency of the DMUs (Coelli *et al*. 1998). The OTE scores obtained from the CRS DEA can be divided into two components, one due to scale efficiency (SE) and another is due to PTE. If there is a difference between the two OTE scores of a DMU (CRS OTE and VRS OTE), then, it indicates that the DMU has SIE and it could be measured from the difference between the PTE and OTE score (Coelli *et al*. 1998).

Although the SE measure will provide information concerning the degree of inefficiency resulting from the failure to operate with CRS, it cannot provide the information as to whether a DMU is operating in an area of increasing returns to scale (IRS) or decreasing returns to scale (DRS). This may be determined by running an addition DEA problem with non-increasing returns to scale (NIRS) imposed.

Therefore, the nature of the scale inefficiencies, due to either IRS or DRS could be determined by the difference between the NIRS OTE and VRS OTE score if the VRS OTE @ PTE $\neq$ NIRS OTE, then DMU is operating at IRS) and if the VRS OTE @ PTE = NIRS OTE, then DMU is operating at DRS

For the purpose of this study, we adopt the DEA Excel Solver developed by Zhu (2009) under the VRS model to solve the price efficiency which are consists of cost, revenue and profit efficiency problem. The price efficiency model is given in equation. As can be seen, the price efficiency scores are bounded within the 0 and 1 range.

Revenue Efficiency (Eq. 1)	**Cost Efficiency (Eq. 2)**	**Profit Efficiency (Eq. 3)**
$max \sum_{r=1}^{s} q_r^o \tilde{y}_{ro}$ $subject\ to$ $\sum_{j=1}^{n} \lambda_j x_{ij} \le \tilde{x}_{io} \quad i = 1,2,...,m;$ $\sum_{j=1}^{n} \lambda_j y_{rj} \ge \tilde{y}_{ro} \quad r = 1,2,...,s;$ $\lambda_j \tilde{y}_{ro} \ge 0$ $\sum_{j=1}^{n} \lambda_j = 1$	$min \sum_{i=1}^{m} p_i^o \tilde{x}_{io}$ $subject\ to$ $\sum_{j=1}^{n} \lambda_j x_{ij} \le \tilde{x}_{io} \quad i = 1,2,...,m;$ $\sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{ro} \quad r = 1,2,...,s;$ $\lambda_j, \tilde{x}_{io} \ge 0$ $\sum_{j=1}^{n} \lambda_j = 1$	$max \sum_{r=1}^{s} q_r^o \tilde{y}_{ro} - \sum_{i=1}^{m} p_i^o \tilde{x}_{io}$ $subject\ to$ $\sum_{j=1}^{n} \lambda_j x_{ij} \le \tilde{x}_{io} \quad i = 1,2,...,m;$ $\sum_{j=1}^{n} \lambda_j y_{rj} \ge \tilde{y}_{ro} \quad r = 1,2,...,s;$ $\tilde{x}_{io} \le x_{io}, \tilde{y}_{ro} \ge y_{ro}$ $\lambda_j \ge 0$ $\sum_{j=1}^{n} \lambda_{j=1}$

Source: Zhu (2009)

where

s is output observation

m is input observation

r is s^{th} output

i is m^{th} input

q_r^o is unit price of the output r of DMU0 (DMU0 represents one of the *n* DMUs)

p_i^o is unit price of the input i of DMU0

$\tilde{y}_{ro}$ is r^{th} output that maximise revenue for DMU0

$\tilde{x}_{io}$ is i^{th} input that minimise cost for DMU0

y_{ro} is r^{th} output for DMU0

x_{io} is i^{th} input for DMU0

n is DMU observation

j is n^{th} DMU

λ_j is non-negative scalars

y_{rj} is s^{th} output for n^{th} DMU

x_{ij} is m^{th} input for n^{th} DMU

By calculating these three price efficiencies concepts (cost, revenue and profit), we could observe the GCC Islamic and conventional banks on these efficiency levels and more robust results could be obtained.

4. EMPIRICAL RESULTS

Before proceeding with the discussion of DEA results, this study first tested the rule of thumb on the selection of inputs and outputs variables suggested by Cooper *et al*. (2002). Since the total number of DMUs (74 banks) in this study is more than the numbers of inputs and outputs variables (2 inputs x 2 outputs @ 3 [2 inputs + 2 outputs]), the selection of variables are valid since it complies with the rule of thumb and allows the efficiencies of DMUs to be measured.

Next, by calculating all three efficiencies concepts (revenue, cost and profit), we could observe the Islamic and conventional banks to these efficiencies levels and further obtain more robust results. Table 2 illustrates all efficiencies concepts which are cost, revenue and profit efficiency for GCC Islamic and conventional banks.

Table 2: Summary on Cost, Revenue, and Profit Efficiencies for Islamic and Conventional Bank in GCC countries during year 2007-2011

No.	Islamic Bank	CE	RE	PE	No.	Conventional Bank	CE	RE	PE
1	ABC Islamic Bank (E.C.)	0.058	0.426	0.609	1	Abu Dhabi Commercial Bank	0.999	1.000	1.000
2	Abu Dhabi Islamic Bank	1.000	1.000	1.000	2	Ahli Bank QSC	0.610	0.861	0.761
3	Ajman Bank	0.273	0.300	0.276	3	Ahli United Bank BSC	0.571	0.661	0.334
4	Al Rajhi Banking & Investment Corp	1.000	0.978	1.000	4	Ahli United Bank KSC	0.589	0.638	0.407
5	Albaraka Banking Group B.S.C.	0.955	0.539	0.858	5	Al Ahli Bank of Kuwait (KSC)	0.627	0.772	0.550
6	Albaraka Islamic Bank BSC	0.105	0.096	0.045	6	Al Khalij Commercial Bank	0.576	0.471	0.320
7	Alinma Bank	0.322	0.488	0.478	7	Arab Banking Corporation BSC	0.680	0.551	0.271
8	Al-Salam Bank-Bahrain B.S.C.	0.008	0.300	0.270	8	Arab National Bank	0.634	0.671	0.586
9	Arcapita Bank B.S.C.	0.007	0.079	0.051	9	Awal Bank	0.494	0.633	0.622
10	Bahrain Islamic Bank B.S.C.	0.012	0.164	0.100	10	Bank Al-Jazira	0.527	0.525	0.415
11	Bank AlBilad	0.017	0.305	0.266	11	Bank Dhofar SAOG	0.829	0.826	0.780
12	Bank Alkhair BSC	0.038	0.008	0.004	12	Bank Muscat SAOG	0.672	0.747	0.652
13	Boubyan Bank KSC	0.007	0.350	0.472	13	Bank of Bahrain and Kuwait B.S.C.(BBK)	0.605	0.601	0.369
14	Dubai Islamic Bank plc	0.599	0.627	0.450	14	Bank of Sharjah	0.732	0.792	0.717
15	Elaf Bank	0.378	1.000	1.000	15	Bank Sohar SAOG	0.779	0.877	0.800
16	Emirates Islamic Bank PJSC	0.002	0.306	0.161	16	Barwa Bank	1.000	1.000	1.000
17	Investors Bank BSC	0.811	1.000	1.000	17	Burgan Bank SAK	0.542	0.688	0.445

18	Islamic Development Bank	0.814	0.974	0.931	18	Commercial Bank International P.S.C.	0.812	0.723	0.614
19	Kuwait Finance House	0.821	0.799	0.713	19	Commercial Bank of Dubai P.S.C.	0.737	0.795	0.725
20	Kuwait International Bank	0.019	0.354	0.398	20	Commercial Bank of Kuwait SAK (The)	0.584	0.874	0.751
21	Noor Islamic Bank	0.148	0.469	0.227	21	Commercial Bank of Qatar (The) QSC	0.742	0.761	0.679
22	Qatar International Islamic Bank	0.016	0.230	0.160	22	Doha Bank	0.588	0.640	0.426
23	Qatar Islamic Bank SAQ	0.143	0.439	0.348	23	Emirates Bank International PJSC	1.000	1.000	1.000
24	Seera Investment Bank BSC	0.356	0.916	0.900	24	First Gulf Bank	0.856	0.965	0.903
25	Shamil Bank of Bahrain B.S.C.	0.022	0.127	0.043	25	Gulf Bank KSC (The)	0.641	0.890	0.838
26	Sharjah Islamic Bank	0.407	0.600	0.480	26	Gulf International Bank BSC	0.763	0.843	0.729
27	Venture Capital Bank	0.744	0.696	0.891	27	International Bank of Qatar Q.S.C.	0.561	0.682	0.495
					28	International Banking Corporation BSC	0.810	1.000	1.000
					29	Invest Bank P.S.C.	0.858	0.921	0.901
					30	Mashreqbank	0.721	0.638	0.357
					31	National Bank of Abu Dhabi	0.907	0.991	0.986
					32	National Bank of Bahrain	0.438	0.464	0.284
					33	National Bank of Dubai	0.576	0.725	0.530
					34	National Bank of Fujairah	0.784	0.725	0.592
					35	National Bank of Kuwait S.A.K.	0.804	0.801	0.830
					36	National Bank of Oman (SAOG)	0.711	0.731	0.634
					37	National Bank of Ras Al-Khaimah	0.927	0.770	0.837
					38	National Bank of Umm Al-Qaiwain	0.821	0.836	0.836

					39	National Commercial Bank (The)	0.906	0.838	0.906
					40	Oman Arab Bank SAOG	0.847	0.809	0.770
					41	Oman International Bank	0.729	0.665	0.600
					42	Qatar National Bank	0.830	0.977	0.855
					43	Riyad Bank	0.679	0.778	0.675
					44	Saudi British Bank (The)	0.652	0.697	0.583
					45	Saudi Hollandi Bank	0.583	0.645	0.462
					46	Union National Bank	0.698	0.831	0.656
					47	United Arab Bank PJSC	0.860	0.875	0.885
	MEAN FORM ALL BANKS	**0.384**	**0.527**	**0.522**		**MEAN FROM ALL BANKS**	**0.719**	**0.766**	**0.657**

4.1 Efficiency of GCC Islamic Banks

Table 2 shows the mean of cost, revenue, and profit efficiency for the GCC Islamic banks of 38.4%, 52.7% and 52.2% respectively. In other words, the GCC Islamic banks have been inefficient in producing outputs by using the same input (revenue inefficiency) and by not fully using the inputs efficiently to produce the same outputs (cost inefficiency). Banks are said to have slacked if they fail to fully minimize the cost and maximize the revenue (profit inefficiency). The results indicate that levels of cost inefficiency, revenue inefficiency, and profit inefficiency are shown as 61.6%, 47.3% and 47.8% respectively.

For the cost efficiency, the results indicate that on average Islamic banks have utilized only 38.4% of the resources or inputs to produce the same level of outputs. In other words, on average, Islamic banks have wasted 61.6%, of its inputs, or it could have saved 61.6%, of its inputs to produce the same level of outputs. For revenue efficiency, the average Islamic bank could only generate 52.7% of revenues, less than what it was initially expected to generate. Hence, revenue is lost by 47.3% , indicating that the average Islamic bank loses an opportunity to receive 47.3% more revenues given the same amount of resources, or it could have produced 47.3% of its outputs given the same level of inputs. It is also worth noting that on average, Islamic banks have been more revenue efficient in producing their outputs compared to their ability to generate costs and profits.

Noticeably, the highest level of inefficiency is on the cost side, followed by the profits side. Similarly, the average Islamic bank could have earned 52.2% of what was available, and lost the opportunity to make 47.8% more profits from the same level of inputs. Consequently, the profit efficiency is higher than cost efficiency due to higher revenue efficiency levels. Therefore, the higher revenue efficiency seems to have contributed to the higher profit efficiency or lower profit inefficiency levels compared to the cost efficiency levels.

4.2 Efficiency of GCC conventional Banks

The empirical findings presented in Table 2 seem suggest that the GCC conventional banks have exhibited mean cost, revenue, and profit efficiency (inefficiency) of 71.9% (28.1%), 76.6% (23.4%), and 65.7% (34.3%) respectively. Furthermore, it is interesting to note that on average GCC conventional banks have been found to be more efficient compared to their Islamic bank peers. For revenue

efficiency, the average conventional bank could generate 76.7% of revenues than it was expected to generate. Hence, the average conventional bank lost an opportunity to receive 23.4%% more revenue, given the same amount of resources.

As for the cost efficiency, the results seem to suggest that the average conventional bank have utilized only 71.9% of the resources or inputs in order to produce the same level of output. In other words, on average, conventional banks have wasted 28.1% of its inputs, or it could have saved 28.1% of its inputs to produce the same level of outputs. Therefore, there was substantial room for significant cost savings for the conventional banks if they employ their inputs efficiently. Obviously, the inefficiency is on the cost side, which is followed by the profits side. Similarly, the average conventional bank could have earned 65.7% of what was available, and lost the opportunity to make 34.3% more profits when utilizing the same level of inputs.

In conclusion, the empirical findings from this study seem to suggest that the conventional banks have exhibited a higher efficiency levels for all three efficiency measures [eg: cost efficiency (71.9% vs. 38.4%), revenue efficiency (76.6% vs. 52.7%), and profit efficiency (65.7% vs. 52.2%)]. In essence, revenue efficiency seems to play the main factor leading to the lower or higher profit efficiency levels. Besides, results for the conventional banks shows that the level of profit efficiency is lower than cost efficiency due to the higher revenue efficiency or lower inefficiency level from the revenue side. Meanwhile, the level of profit efficiency is higher than cost efficiency due to the higher revenue efficiency level from the revenue side for the Islamic banks.

4.3 Robustness Tests

After examining the results derived from the DEA method, the issue of interest now is whether the difference in the cost, revenue, and profit efficiency of the GCC Islamic and conventional banks is statistically significant. In what follows, we perform the non-parametric Mann-Whitney [Wilcoxon] test along with a series of other parametric (*t*-test) and non-parametric Kruskall-Wallis tests to obtain robust results.

Table 3 shows the robustness tests. The results from the parametric *t*-test and non-parametric Mann-Whitney (Wilcoxon) test suggest that the GCC Islamic banks have exhibited a lower mean cost efficiency level than conventional bank peers ($0.384 < 0.719$) and significantly different at 1%. Likewise, the GCC Islamic banks have also exhibited a lower mean profit efficiency level compared to conventional

banks (0.522 < 0.660) and significantly different at 1%. The results from the parametric *t*-test are further confirmed by the non-parametric Mann-Whitney (Wilcoxon) and Kruskall-Wallis tests. Similarly, the parametric *t*-test and non-parametric Mann-Whitney (Wilcoxon) and Kruskall-Wallis tests results indicate that the GCC Islamic banks have exhibited lower revenue efficiency level compared to the GCC conventional banks (0.527 < 0.766) and significant different at 1%.

Based on the results presented in Table 3, this study concludes that conventional bank is more efficient than Islamic bank in GCC countries since all tests shows those efficiencies (cost, revenue and profit efficiency) are significant at 1%

Table 3: Summary of Parametric and Non-Parametric Tests on GCC Islamic and Conventional Banks During the Year 2007-2011

	Test groups					
	Parametric test		Non-parametric test			
Individual tests	t-test		Mann-Whitney [Wilcoxon Rank-Sum] test		Kruskall-Wallis Equality of Populations test	
Hypothesis			MedianIslamic = MedianConventional			
Test statistics	*t(Prb>t)*		*z(Prb>z)*		*X² (Prb > X²)*	
	Mean	*t*	Mean Rank	*z*	Mean Rank	*X²*
Cost Efficiency						
Islamic banks	**0.384**	9.502***	119.182	–5.982***	119.182	35.779***
Conventional bank	**0.719**		184.766		184.766	
Revenue Efficiency						
Islamic banks	**0.527**	8.056***	124.245	–5.287***	124.245	27.951***
Conventional bank	**0.766**		182.164		182.164	
Profit Efficiency						
Islamic banks	**0.522**	3.673***	140.709	–3.036***	140.709	9.216***
Conventional bank	**0.660**		173.701		173.701	

***. Correlation is significant at the 0.01 level (2-tailed). **. Correlation is significant at the 0.05 level (2-tailed). *. Correlation is significant at the 0.01 level (2-tailed).

4.4 Composition on the Efficiency Frontier in Islamic and Conventional Bank

As stated before, bank could operate at CRS or VRS where CRS signifies that an increase in inputs results in a proportionate increase in outputs and VRS means a rise in inputs results in a disproportionate rise in outputs. Further, a bank operating at VRS could be either at DRS or IRS. Thus, DRS defines that an increase in inputs results in lesser output increases, while IRS means that an increase in inputs results in a higher increase in outputs.

Table 4 list the Islamic banks that lie on the efficiency frontier. During the period of study, Venture Capital Bank and Investors Bank seem to have dominated the efficiency frontier (CRS) compared with other Islamic banks. Meanwhile, there are six conventional banks that dominated the efficiency frontier namely, Abu Dhabi Commercial Bank, National Bank of Ras Al-Khaimah, Qatar National Bank, First Gulf Bank, Barwa Bank and National Bank of Umm Al-Qaiwain (Table 5).

In general, the results for the both Islamic and conventional banks indicate that while the large banks (the five largest) tend to operate at CRS or DRS, the small banks (the five smallest) tend to operate at CRS or IRS, the findings which are similar to the earlier studies by among others McAllister and McManus (1993), Drake (2001), Yudistira (2004). To review, Drake (2001) posit that further increase in size of bank would only result in a smaller increase of outputs for every proportionate increase in inputs of the large banks, resulting from the fact that the large banks have been operating at DRS during the periods. Based on the results, banks that are exposed with the higher DRS categorized under the large size of Islamic bank (large on total assets) are Al Rajhi Banking & Investment, Kuwait Finance House, Dubai Islamic Bank, Abu Dhabi Islamic Bank and Albaraka Banking Group. Meanwhile, there are only two conventional banks from the five largest conventional banks having the higher DRS namely National Commercial Bank and National Bank of Abu Dhabi

On the other hand, according to the McAllister and McManus (1993), small banks have generally exhibited IRS. The result is consistent with what has been discovered from this study, where the small Islamic banks have faced IRS in their operations during the period of the study. The smaller Islamic banks, which have been operating at IRS, could achieve significant cost savings and efficiency gains by increasing its scale of operations because proportionate increase in inputs in small banks would result in more than a proportionately increase in outputs. In another words, substantial gains could be attained from altering the scale via internal growth or through mergers and acquisitions in the sector. Therefore, the banks that experience IRS should either eliminate their SIE via internal expansion or will become a prime target for acquiring banks because it can create value from underperforming bank and eliminate redundancies and inefficiencies (Evanoff and Israelvich, 1991). Based on the results, Islamic banks that are exposed with the higher IRS categorized under the small

size of bank (small on total assets) are Elaf Bank and Investors Bank BSC. Meanwhile, there are two conventional banks form the five smallest conventional banks having the higher IRS United Arab Bank, Invest Bank and Oman Arab Bank. The small enterprise is relatively more technically efficient than the medium enterprise due to the efficient use of inputs. Therefore, the efficient usage of resources (input) for the small and large size of firm could contribute to the higher returns.

Table 4: Islamic Banks on the Efficiency Frontier

Islamic Bank	Total Asset	Year					Count Bank
	(Mil USD)	2007	2008	2009	2010	2011	
Al Rajhi Banking & Investment Corp	58,884	DRS	DRS	DRS	DRS	DRS	0
Kuwait Finance House	48,312	DRS	DRS	DRS	DRS	DRS	0
Dubai Islamic Bank plc	24,667	DRS	DRS	DRS	DRS	DRS	0
Abu Dhabi Islamic Bank	20,241	DRS	DRS	DRS	DRS	DRS	0
Albaraka Banking Group B.S.C.	17,154	DRS	DRS	DRS	DRS	DRS	0
Qatar Islamic Bank SAQ	16,013	DRS	DRS	DRS	DRS	DRS	0
Islamic Development Bank	13,800	CRS	DRS	CRS	DRS	DRS	2
Alinma Bank	9,809	–	DRS	DRS	DRS	DRS	0
Bank AlBilad	7,394	DRS	DRS	DRS	DRS	DRS	0
Qatar International Islamic Bank	6,417	DRS	DRS	DRS	DRS	DRS	0
Emirates Islamic Bank PJSC	5,850	DRS	DRS	DRS	DRS	DRS	0
Boubyan Bank KSC	5,570	DRS	DRS	DRS	DRS	DRS	0
Noor Islamic Bank	4,954	–	DRS	DRS	DRS	–	0
Sharjah Islamic Bank	4,829	DRS	DRS	DRS	DRS	DRS	0
Kuwait International Bank	4,069	DRS	DRS	CRS	DRS	–	1
Arcapita Bank B.S.C.	3,718	DRS	DRS	DRS	DRS	DRS	0
Shamil Bank of Bahrain B.S.C.	2,762	DRS	DRS	DRS	–	–	0
Al-Salam Bank-Bahrain B.S.C.	2,280	–	DRS	DRS	DRS	DRS	0
Bahrain Islamic Bank B.S.C.	2,232	DRS	DRS	DRS	DRS	DRS	0
Albaraka Islamic Bank BSC	1,347	–	–	IRS	DRS	–	0
Ajman Bank	1,089	–	CRS	DRS	DRS	DRS	1
ABC Islamic Bank (E.C.)	1,035	CRS	IRS	CRS	DRS	DRS	2
Bank Alkhair BSC	727	DRS	DRS	DRS	DRS	–	0
Seera Investment Bank BSC	527	CRS	CRS	DRS	DRS	DRS	2

Venture Capital Bank BSC (c)-VCBank	199	CRS	CRS	CRS	CRS	DRS	4
Elaf Bank	161	CRS	IRS	IRS	DRS	–	1
Investors Bank BSC	43	IRS	IRS	CRS	CRS	CRS	3
Count Year		5	3	5	2	1	

CRS = constant returns to scale, DRS = decreasing returns to scale, IRS = increasing returns to scale. Count Bank (CRS) = number of times a bank has appeared on the efficiency frontier during the period of study. Count Year (CRS) = number of banks appearing on the efficiency frontier during the year

Table 5: Conventional Banks on the Efficiency Frontier

Commercial Bank	Total Asset (Mil USD)	Year					Count Bank
		2007	2008	2009	2010	2011	
Qatar National Bank	82,955	DRS	DRS	CRS	CRS	CRS	3
National Commercial Bank	80,319	DRS	DRS	DRS	DRS	DRS	0
National Bank of Abu Dhabi	69,617	DRS	DRS	DRS	DRS	DRS	0
Emirates Bank International PJSC	51,419	DRS	DRS	–	–	–	0
Abu Dhabi Commercial Bank	50,027	CRS	DRS	CRS	CRS	CRS	4
National Bank of Kuwait S.A.K.	48,912	DRS	DRS	DRS	DRS	DRS	0
Riyad Bank	48,237	DRS	DRS	DRS	DRS	DRS	0
First Gulf Bank	42,881	DRS	DRS	CRS	CRS	CRS	3
Saudi British Bank	36,975	DRS	DRS	DRS	DRS	IRS	0
Arab National Bank	31,353	DRS	DRS	DRS	DRS	DRS	0
Ahli United Bank BSC	28,330	DRS	DRS	DRS	DRS	IRS	0
National Bank of Dubai Public Joint Stock Company	27,547	DRS	DRS	–	–	–	0
Arab Banking Corporation BSC	25,015	DRS	DRS	DRS	DRS	DRS	0
Union National Bank	22,456	IRS	DRS	DRS	DRS	DRS	0
Mashreqbank	21,577	DRS	DRS	DRS	DRS	DRS	0
Commercial Bank of Qatar QSC	19,654	DRS	DRS	DRS	DRS	DRS	0
Bank Muscat SAOG	18,798	IRS	DRS	DRS	DRS	DRS	0
Gulf Bank KSC	17,178	DRS	DRS	IRS	IRS	IRS	0
Gulf International Bank BSC	16,789	DRS	CRS	IRS	IRS	IRS	1
Burgan Bank SAK	16,338	DRS	DRS	IRS	DRS	DRS	0
Saudi Hollandi Bank	15,346	DRS	DRS	IRS	DRS	IRS	0
Doha Bank	14,401	DRS	DRS	DRS	DRS	DRS	0

Commercial Bank of Kuwait SAK	13,332	DRS	DRS	IRS	IRS	IRS	0
Al Ahli Bank of Kuwait (KSC)	11,055	DRS	DRS	IRS	IRS	IRS	0
Commercial Bank of Dubai P.S.C.	10,413	IRS	DRS	DRS	DRS	DRS	0
Bank Al-Jazira	10,373	DRS	DRS	DRS	DRS	DRS	0
Ahli United Bank KSC	8,747	DRS	DRS	IRS	IRS	–	0
Awal Bank	7,645	DRS	CRS	–	–	–	1
International Bank of Qatar Q.S.C.	7,469	IRS	DRS	IRS	IRS	–	0
Al Khalij Commercial Bank	7,418	–	IRS	IRS	DRS	IRS	0
National Bank of Ras Al-Khaimah (P.S.C.) -RAKBANK	6,672	CRS	DRS	CRS	CRS	CRS	4
National Bank of Bahrain	6,353	DRS	DRS	IRS	DRS	DRS	0
National Bank of Oman (SAOG)	5,797	IRS	DRS	IRS	IRS	IRS	0
Bank of Sharjah	5,700	IRS	DRS	DRS	DRS	CRS	1
Barwa Bank	5,251	–	–	CRS	CRS	CRS	3
Bank Dhofar SAOG	5,099	IRS	DRS	IRS	IRS	IRS	0
Ahli Bank QSC	4,872	IRS	DRS	IRS	IRS	IRS	0
National Bank of Fujairah	4,061	IRS	DRS	DRS	IRS	–	0
International Banking Corporation BSC	3,794	CRS	CRS	–	–	–	2
Bank Sohar SAOG	3,724	IRS	IRS	IRS	IRS	IRS	0
Oman International Bank	3,250	IRS	IRS	DRS	IRS	IRS	0
Commercial Bank International P.S.C.	3,246	IRS	DRS	IRS	IRS	–	0
National Bank of Umm Al-Qaiwain	3,188	IRS	DRS	CRS	CRS	CRS	3
United Arab Bank PJSC	2,950	IRS	IRS	IRS	IRS	IRS	0
Invest Bank P.S.C.	2,815	IRS	IRS	IRS	CRS		1
Oman Arab Bank SAOG	2,480	IRS	IRS	DRS	IRS	–	0
Bank of Bahrain and Kuwait B.S.C.(BBK)	1,659	DRS	DRS	DRS	DRS	DRS	0
Count Year		3	3	6	7	7	

CRS = constant returns to scale, DRS = decreasing returns to scale, IRS = increasing returns to scale. Count Bank (CRS) = number of times a bank has appeared on the efficiency frontier during the period of study. Count Year (CRS) = number of banks appearing on the efficiency frontier during the year

5. CONCLUSIONS

The study was carried out with the main purpose to examine the price efficiency consist of cost, revenue and profit efficiency and returns to scale of the Islamic and conventional banking sector in GCC countries over the period of 2007 to

2011. To date, the majority of researchers have focused more on cost and profit efficiency in banking sectors and only a few have looked on revenue efficiency. Furthermore, most of these studies are carried out on the conventional banking sectors, while empirical evidence on the Islamic banking sectors is relatively scarce. The non-parametric Data Envelopment Analysis (DEA) method is applied to distinguish between three different types of efficiency measures, namely cost, revenue, and profit. Additionally, we perform a series of parametric (*t*-test) and non-parametric (Mann-Whitney [Wilcoxon] and Kruskall-Wallis) tests to obtain the robust result.

We find that interesting results where revenue efficiency seems to play the main factor leading to the lower or higher profit efficiency levels. In essence, the higher revenue efficiency only affects the higher profit efficiency levels in Islamic banks. However, the profit efficiency on conventional banks will not be affect by the higher revenue efficiency levels since the result shows the level of profit efficiency is lower than cost efficiency due to the higher revenue efficiency.

The result of this study also shows that they are statistically significant difference on cost, revenue and profit efficiency between Islamic and conventional banks in GCC countries. The study discovers that the conventional banks have exhibited a higher efficiency levels for all three efficiency measures e.g. cost efficiency (71.9% vs. 38.4%), revenue efficiency (76.6% vs. 52.7%), and profit efficiency (65.7% vs. 52.2%) and all test reported significant at 1%.

Furthermore, the empirical findings seem to suggest large both Islamic and conventional banks (the five largest) tend to operate at CRS or DRS, while the small banks (the five smallest) tend to operate at CRS or IRS. Therefore, the banks that experience IRS should either eliminate their SIE via internal expansion or will become a prime target for acquiring banks because it can create value from underperforming bank and eliminate redundancies and inefficiencies (Evanoff and Israelvich, 1991). On the other hand, banks that operate at DRS (such as CIMB Islamic Berhad) are advised not to increase their size or be involved with mergers and acquisitions event because further increase in the size of the bank will only result in a smaller increase of outputs for every proportionate increase in inputs of the large banks.

The findings of this study are expected to contribute significantly to the existing knowledge on the operating performance of the GCC Islamic and conventional banking sector. Nevertheless, the study has also provided further insights to the bank's specific management as well as the policymakers with regard to

attaining optimal utilization of capacities, improvement in managerial expertise, efficient allocation of scarce resources, and the most productive scale of operation of Islamic and conventional banks operating in in GCC countries. This may also facilitate directions for sustainable competitiveness of the GCC Islamic and conventional banking sector operations in the future.

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