An Essay on Returns to Scale of Banks in UAE

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ABSTRACT

Over the last decade, Islamic banking has experienced global growth rates of 10-15 percent per annum, and has been moving into an increasing number of conventional financial systems at such a rapid pace that Islamic financial institutions are present today in over 51 countries. This study aims to show the significance of the banking industry in the economic sector and to understand the concepts of returns to scale and its applications in the banking industry. The efficiency and productivity of different banks in UAE is measured using this method of returns to scale for the last three years.

Keywords: Islamic Banking, Returns to Scale, Technical Efficiency, Data Envelopment Analysis

INTRODUCTION

The United Arab Emirates (U.A.E.) is an alliance of seven emirates specifically Abu Dhabi, Dubai, Sharjah, Umm Al Qaiwain, Ras Al Khaimah, Fujairah and Ajman. This nation is generally an oil and gas trading country and it is additionally one of the primary parts of the Gulf Cooperation Council (GCC). The nation intends to develop as the budgetary and administration segment pioneer in the Middle East and be a center point for worldwide Islamic account.

Like the vast majority of the creating nations, the saving money part makes up the center of the budgetary framework in UAE and it works under the principles and regulations of the UAE Central Bank. Under the Federal Law 10, the Central bank of UAE was made and from that point on it assumed control over the obligations of the Currency Board. The Bank's obligations incorporate prompting the legislature on monetary issues, issuing money and keeping up the gold stores.

With collected holdings equal to 142% of GDP in 2008, the UAE managing an account segment was thought to be the second biggest in GCC nations after Bahrain (Al-Hassan, et al., 2010). By 2010, the aggregate quantities of authorized banks working in UAE were 52, of which 24 were nationalized banks and 28 were remote banks. The managing an account division in UAE is still described by a dominating proprietorship by government and household shareholders. Nonetheless, it is still the minimum concentrated among all GCC keeping money areas with the three biggest banks (Emirates NBD bank, National bank of Abu Dhabi and Abu Dhabi Commercial bank) representing just 32% of the aggregate managing an account holdings (Al-Hassan, et al., 2010). The UAE saving money division performed amazingly well amid the 2003-08 oil blast, yet it is likewise amid the blast that the dangers began to develop on banks' asset reports. Thriving monetary action and plentiful liquidity coming about because of higher oil costs pushed inordinate credit development, swelling and possession cost expanded particularly in the land segment. Amid the same time, banks expanded their introduction to land and development part and also value markets which prompted a development of vulnerabilities on their monetary records that took a toll later when the worldwide emergency occurred in 2008.

Leena and Luna International, Oyama, Japan.
(株) リナアンドルナインターナショナル, 小山市、日本.
ISSN: 2186-845X ISSN: 2186-8441 Print
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LITERATURE REVIEW

Two most important approaches used for estimating efficiency which have been stated in previous researches are the non-parametric and the parametric approach. A generalization which can be made is that the parametric approach specifies a functional form for the cost, revenue, profit, or production relationship within inputs, outputs and others (for instance, environmental factors), and allows for any random error. The most renowned technique utilized in the parametric approach is Stochastic Frontier Approach (SFA). On the other hand, the DEA (Data Envelopment Analysis) is the most renowned technique used in the nonparametric. The efficiency (relative) of each bank is computed using various inputs and various outputs by using the DEA analysis.

First, a completely widespread study undertaken by Humphrey and Berger (1997) surveyed more than 120 studies which utilized frontier methods to estimate the efficiency and performance of different financial institutions in more than 21 countries. Majority of the researches are performed between the years 1990 and 1998 in the U.S. banking industry. It was emphasized to study the efficiency of banks in regions other than the US since very few studies were done outside the US. Berger and Humphrey pointed out variations and spread in estimates of efficiency between non-parametric and parametric methods. Research as well as critical analysis of observed financial institution efficiency estimates so that the implications of efficiency results can be addressed in the fields of research, government policy and managerial performance was done by them.

Mohd Zaini Abd Karim (2001) investigated whether there were significant differences in bank efficiency across selected ASEAN countries (Indonesia, Malaysia, Philippines, and Thailand). The study indicated that the major proportion of a total variability is associated with inefficiency of input used. It also markedly points out the fact that inefficiency tends to reduce with bank size and increase with government ownership.

David A. Grigorian and Vlad Manole (2002), used both cross-country and cross-regional settings, and applied the DEA approach, while trying to calculate the correct measure of commercial bank efficiency in a multiple input/output framework for transition economies, and to identify the effects of policy framework on the performance of commercial banks. The results of the study illuminated the fact that banks with a larger market share and a larger controlling foreign ownership are more likely to be efficient than those with a smaller market which was owed to their significantly better risk management and operational techniques.

ECONOMIES OF SCALE

Economies of scale measure the relationship between the level of yield and the expense of delivering an unit of yield. The movement is said to have (increasing) economies of scale when the normal expense of creating a unit of yield falls as yield increments. It could be nearby implying that normal expenses may drop for a few levels of creation yield and afterward later settle or increment. It can likewise be worldwide implying that normal expenses keep on dropping as yield increments.

Measuring of yields and inputs is hypothetically direct in the assembling and farming industry. Be that as it may, the proper estimation of yield is less clear while measuring the scale economies for administration firms. An example of such a circumstance is the health awareness industry. The test of evaluating the yield is additionally risky in the managing an account segment because of many-sided quality in measuring yield and perceiving yields from inputs. The best measure of bank yield is a point on which there is no true general accord. In different scholarly writings, bank yield has been measured from numerous points of view like advances, stores, holdings and credits in addition to stores.

The use of average bank cost per dollar of bank assets eliminates the complex problem of defining a bank's output. A decline in the average cost ratio as bank size increases implies that economies of scale exist. An assumption that is implicit while using the average cost per dollar of assets is that banks' "true" output is a constant fraction of assets, irrelevant to the bank's size. However, if a bank's output mix varies as it expands or it can use different technologies thus allowing the bank to produce more services per dollar of bank assets without resulting in a decline in total cost, then the implicit assumption that all banks' output is a constant fraction of assets gives the wrong results.

Our analysis focusses on estimating economies of scale individually for each CB specialty lending group because the mix of services provided by a CB specialty lender probably does not change in a systematic way as CBs grow in size.

CCR MODEL

Once the data is given, we measure the value of efficiency of each DMU once and hence need *n* optimizations, one for each DMU_j to be measured. Let the DMU_j to be measured on any trial be assigned as DMU_o where *o* ranges over 1, 2,..., *n*.

We now find the solution of the following fractional programming problem to get values for the input "weights" (v_i) $\{i = 1,...,m)$ and the output "weights" (u_r) $\{r = 1,...,s)$ which are variables.

$$(FP_o) \qquad \max_{v,u} \ \theta = \frac{u_1 y_{1o} + u_2 y_{2o} + \cdots + u_s y_{so}}{v_1 x_{1o} + v_2 x_{2o} + \cdots + v_m x_{mo}} \qquad (2.3)$$

$$\text{subject to} \qquad \frac{u_1 y_{1j} + \cdots + u_s y_{sj}}{v_1 x_{1j} + \cdots + v_m x_{mj}} \leq 1 \quad (j = 1, \ldots, n) \qquad (2.4)$$

$$v_1, v_2, \ldots, v_m \geq 0 \qquad (2.5)$$

$$u_1, u_2, \ldots, u_s \geq 0. \qquad (2.6)$$

The constraints imply that the fraction of "virtual output" by "virtual input" should not be more than 1 for each DMU. The main aim is to get weights (v_i) and (u_r) that maximize the ratio of DMU_o, the DMU which is being measured. Due to the constraints, the optimal objective value θ^* is maximum 1. The constraint for non-negativity (2.5) is insufficient for the fractional terms in (2.4) to obtain a positive value. We explain this in managerial language by primarily assuming that all outputs and inputs have some non -zero value and this is reflected in the weights U_r and V_i which are being designated some positive value.

Substituting the above fractional program (FP_o) by the consequent linear program (LP_o),

$$(LP_o) \qquad \max_{\mu,\nu} \ \theta = \mu_1 y_{1o} + \cdots + \mu_s y_{so} \qquad (2.7)$$

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ISSN: 2186-845X ISSN: 2186-8441 Print
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$$\text{subject to} \quad \nu_1 x_{1o} + \cdots + \nu_m x_{mo} = 1 \quad (2.8)$$

$$\mu_1 y_{1j} + \cdots + \mu_s y_{sj} \leq \nu_1 x_{1j} + \cdots + \nu_m x_{mj} \quad (2.9)$$

$$(j = 1, \ldots, n)$$

$$\nu_1, \nu_2, \ldots, \nu_m \geq 0 \quad (2.10)$$

$$\mu_1, \mu_2, \ldots, \mu_s \geq 0. \quad (2.11)$$

Theorem 1: The fractional program (FP_o) is equivalent to (LP_o)

Proof

Under the non - zero assumption that $\boldsymbol{v}$ and X > 0, the denominator of the constraint of *(FP_o)* is non-negative for each *j,* and hence we get (2.3) by multiplying each side of (2.4) by the denominator. Consequently, it is noted that a fractional number is constant when multiplying both numerator and denominator by the same nonzero number. After multiplication, the denominator of (2.3) is set equal to 1, moved to a constraint, which is done in (2.8), and maximized the numerator, leading to *{LP_o)*. Assume an optimal solution of *{LP_o)* to be $\{\boldsymbol{v} = \boldsymbol{v}^*, \boldsymbol{\mu} = \boldsymbol{\mu}^*\}$ and the optimal objective value to be θ^*. The solution $\{\boldsymbol{v} = \boldsymbol{v}^*, \boldsymbol{\mu} = \boldsymbol{\mu}^*\}$ is also the best solution for *(FP_o)*, due to the above transformation being reversible under the assumptions above. Due to this *(FP_o)* and *(LP_o)* have equal optimal objective value θ^*.

It should be noted that the measures of efficiency presented are "units invariant" — i.e., independent of measurement units utilized in the sense that multiplication of each input by a constant $\delta_i > 0$, $i = 1, \ldots, m$, and each output by a constant $P_r > 0$, $r = 1, \ldots, s$, keeps the obtained solution unchanged. Stated in precise form we have:

Theorem 2 (Units Invariance Theorem): The optimal values of max $\theta = \theta^*$ in (2.3) and (2.7) are independent of the units in which the inputs and outputs are measured provided these units are the same for every DMU.

Which hence implies that while one person can calculate outputs in yards and inputs in gallons of gasoline and quarts of oil while another measures these same outputs and inputs in meters and cubic metres, they will nonetheless get the same efficiency value from (2.3) or (2.7) when measuring the same collection of vehicles, say.

It can be noted that *(LP_o)* may be solved by the simplex method of linear programming. The optimal solution can be easily obtained by dealing with the dual side of *(LP_o)*.

Let us assume we have an optimal solution of *(LP_o)* which is represented by *{θ^*, v^*, u^*)* where v^* and u^* are values with constraints given in (2.10) and (2.11). It can be identified whether *CCR-efficiency* has been achieved as follows:

Definition 1 (CCR-Efficiency)

1. DMU_o is CCR-efficient *if $\theta^* = 1$ and there exists at least one optimal {v^*,u^*), with $V^* > 0$ and u^** > 0.

2. Otherwise, DMU_o is CCR-inefficient

Thus, CCR-inefficiency implies that either (i) $\theta^* < 1$ *or* (ii) $\theta^* = 1$ and atleast a single element of *{v^*,u^*)* is 0 for each optimal solution of *(LP_o)*.

It can be observed in the case where DMU_o has $\theta^* < 1$ (CCR-inefficient) that there must be at least one constraint (or DMU) in (2.9) due to which the weight *{v^*,u^*)* leads to equality between the both sides since, else, θ^* could be enlarged. Let the set of such $j \in \{1, \ldots, n\}$ be

$$E_o' = \{ j : \sum_{r=1}^{s} u_r^* y_{rj} = \sum_{i=1}^{m} v_i^* x_{ij} \}. \qquad (2.12)$$

The set E_o of E_o', comprised of CCR-efficient DMUs, is named the *reference set* or the *peer group* to the DMUo. It is the presence of this collection of efficient DMUs that leads the DMU_o to be inefficient. The set spanned by E_o is aptly named the *efficient frontier* of DMU_o.

Optimal Weights Explanation

The *{v*, u*)* got as the optimal solution for (LP_o) results in the set of optimal weights for the DMU_o. The ratio scale is calculated by:

$$\theta^* = \frac{\sum_{r=1}^{s} u_r^* y_{ro}}{\sum_{i=1}^{m} v_i^* x_{io}}. \qquad (2.13)$$

From (2.8), the denominator is 1 and therefore

$$\theta^* = \sum_{r=1}^{s} u_r^* y_{ro}. \qquad (2.14)$$

As stated previously, *{v*, u*)* are the sets of the most accurate weights for the DMU_o for maximizing the ratio scale, v^* is the optimal weight for the input item *i* and its magnitude signifies how high the item is calculated, relatively speaking. Similarly, u^* does the same function for the output item r.

Furthermore, if we see each item $v_i^* x_{io}$ in the virtual input,

$$\sum_{i=1}^{m} v_i^* x_{io} \ (= 1), \qquad (2.15)$$

It can be seen that the relative significance of each item is by reference to the value of each $v_i^* x_{io}$. The same case holds true for $U_r^* Y_{ro}$ given U_r^* gives the measure of the relative contribution of Y_{ro} to the overall measure of θ^*. These figures not only show which items actually contribute to the evaluation of DMUo, but also signify to what extent they do so.

METHODOLOGY

The method used in this project is the non-parametric approach. The undirected disturbances in the banking sector are not significant when we compare it with another industry such as agriculture where climate and other factors (external) could have significant effect on production rates.

At present, we will allude to the information and meaning of data and yield variables. The obliged information is gotten from asset reports and salary articulations from large portions of the business banks, working in the UAE in the course of the most recent three years. The two real inputs used in this study are stores, working costs and the two yields are credits and working benefits. The picked inputs and yields for banks have accumulated much consideration in survey of writing because of the extraordinary nature of the bank's generation forms. There are for the most part two methodologies read about in the writing, the generation methodology and intermediation approach. In the generation methodology, banks are essentially taken as units delivering administrations for customers, for example, execution of transactions and handling of reports. Consequently, regularly, inputs are measured by physical units, and yields are computed by the number and sort of transactions or reports transformed over a given period. Under the other intermediation approach which is utilized, banks are seen as directing finances in the middle of contributors and borrowers. Along these lines, banks hold work, capital and loanable stores uses to exchange reserves

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ISSN: 2186-845X ISSN: 2186-8441 Print
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from those with overabundance of trusts to those with absence of trusts. In this way, aggregate expenses incorporate investment costs and working expenses (Topuz and Isik, 2004). This task takes after the second approach.

FINDINGS AND CALCULATIONS

Table 1. Input and outputs information for 2012

DMU	(I)x1	(I)x2	(O)y1	(O)y2
First Gulf Bank	3,24,81,523	3,88,210	3,08,05,139	11,40,961
Commercial Bank International	24,20,161	76,349	26,67,125	68,227
Emirates Bank International	2,16,47,090	5,76,984	2,36,70,907	6,50,787
Emirates NBD	4,80,03,855	10,20,640	5,48,25,775	6,69,517
Commercial Bank of Dubai	67,06,392	1,55,785	75,23,859	2,32,191
National Bank of Abu Dhabi	5,18,11,482	7,81,392	4,46,67,042	12,15,407
Union National Bank	1,68,66,542	2,14,209	1,48,84,741	4,43,627
National Bank of Umm AL Qaiwain	19,81,839	51,445	19,20,365	89,443
Emirates Investment Bank	2,18,688	7,311	5,879	7,167
Invest Bank	23,19,460	33,078	23,77,633	88,406
Bank of Sharjah	44,85,808	57,317	36,52,332	77,337
National Bank of Fujairah	33,86,905	76,223	35,35,718	83,258
United Arab Bank	27,48,239	63,601	30,11,075	1,11,576
Mashreq Bank	1,15,52,043	5,08,381	1,04,69,870	3,83,098
Abu Dhabi Commercial Bank	2,56,93,615	5,63,372	3,35,03,667	7,66,721

Table 2. Input and outputs information for 2011

DMU	(I)x1	(I)x2	(O)y1	(O)y2
First Gulf Bank	2,81,71,449	3,33,252	2,80,17,850	10,08,918
Commercial Bank International	22,96,473	75,285	24,20,622	17,633
Emirates Bank International	1,36,91,128	3,76,462	1,52,53,628	5,14,101
Emirates NBD	4,19,31,230	9,80,559	5,12,65,795	6,83,188
Commercial Bank of Dubai	69,18,183	1,55,253	76,16,142	2,23,822
National Bank of Abu Dhabi	4,13,33,212	6,97,992	4,28,72,148	10,39,636
Union National Bank	1,55,42,920	1,98,396	1,44,24,747	4,12,598
National Bank of Umm AL Qaiwain	19,30,183	53,022	19,15,352	87,129
Emirates Investment Bank	2,30,997	6,647	2,807	6,068
Invest Bank	20,52,675	30,104	22,56,579	86,386
Bank of Sharjah	40,67,559	52,463	34,92,672	71,741
National Bank of Fujairah	28,14,751	69,833	26,82,560	76,484
United Arab Bank	19,99,213	49,226	21,63,776	89,887
Mashreq Bank	1,09,38,475	5,25,992	95,99,882	2,40,351
Abu Dhabi Commercial Bank	2,50,02,384	5,77,366	3,44,99,559	8,96,386

Table 3. Input and outputs information for 2010

DMU	(I)x1	(I)x2	(O)y1	(O)y2
First Gulf Bank	2,68,83,184	3,05,349	2,53,61,484	9,64,974
Commercial Bank International	25,46,263	70,568	25,33,440	4,516
Emirates Bank International	80,21,873	2,10,816	1,01,48,039	4,70,618
Emirates NBD	4,43,18,625	8,56,833	5,07,68,048	6,42,538
Commercial Bank of Dubai	70,96,849	1,47,836	76,37,739	2,23,411
National Bank of Abu Dhabi	3,29,57,078	5,95,154	3,65,51,554	10,30,700
Union National Bank	1,45,25,903	1,94,657	1,38,93,527	3,69,585
National Bank of Umm AL Qaiwain	21,55,664	49,204	21,74,767	95,507
Emirates Investment Bank	1,53,915	4,074	3,473	5,540
Invest Bank	20,80,745	27,240	21,85,626	81,912
Bank of Sharjah	39,14,328	54,767	34,48,991	1,12,120
National Bank of Fujairah	23,57,090	56,560	23,73,181	46,521
United Arab Bank	11,59,420	44,357	15,36,829	83,855
Mashreq Bank	1,27,32,060	4,80,233	1,06,23,386	2,32,940
Abu Dhabi Commercial Bank	2,48,16,241	4,48,947	3,42,61,381	1,59,574

Ranking Efficiency in UAE Banks

Table 4. Ranking order for three year 2012, 2011 and 2010

In Rank Order		*Score in 2012*	*Score in 2011*	*Score in 2010*
Rank	*DMU*			
1	First Gulf Bank	1	1	1
1	National Bank of Umm	1	1	1
1	Invest Bank	1	1	1
1	United Arab Bank	1	1	1
1	Abu Dhabi Commercial	1	1	1
6	Commercial Bank of D	0.952449	0.9175719	0.917482
7	Union National Bank	0.9050621	0.9018246	0.88957
8	Emirates NBD	0.8920895	0.8860495	0.8530479
9	Emirates Bank Intern	0.8904435	0.8840471	0.8507602
10	Commercial Bank International	0.8757209	0.8486241	0.8328249
11	Bank of Sharjah	0.8326626	0.8304123	0.803758
12	Mashreq Bank	0.8228755	0.7638947	0.7397804
13	National Bank of Abu	0.8133415	0.7215434	0.7206734
14	National Bank of Fujairah	0.8077074	0.6360291	0.6130511
15	Emirates Investment	0.7261636	0.5819357	0.6112847

As per the data analysis above, banks with a score of 1 are most efficient banks and the ones which have a score below 1 are considered as less efficient.

Emirates Bank International was efficient in the year 2010 with an efficiency score of 1 but was not efficient in the years 2011 and 2012 with efficiency scores of 0.9175 and 0.89 respectively. It can easily be seen that the efficiency in this case is decreasing and therefore it shows decreasing returns to scale. In the case of National Bank of Umm Al Qaiwain, the bank had an efficiency of 0.83 in the year 2010 but it became efficient in the year 2011 and

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ISSN: 2186-845X ISSN: 2186-8441 Print
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2012 with efficiency scores of 1 in both years. Therefore, it shows increasing returns to scale based on its performance.

CONCLUSION

The sample of banks taken has shown potential to be productive banks with extremely good performances over the last three years. This study was limited to conventional banks only in the UAE which can be further extended to the whole of Middle East. This study shows that as an emerging economy UAE has performed much better than most other countries in the Middle East region due to their diversified economy with revenue from other sector such as tourism, trade, construction etc and not just relying on oil.

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