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EFFICIENCY MEASUREMENT OF ISLAMIC AND CONVENTIONAL BANKS IN SAUDI ARABIA: AN EMPIRICAL AND COMPARATIVE ANALYSIS¹

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Abstract

Saudi Arabia, beside Malaysia and many other Muslim countries, is one of those countries where Islamic and conventional banking operate in parallel. Over the last decade, the country's banking industry is growing at rapid pace that accounts for the largest share in GCC. The present study measures and compares the performance of Saudi conventional and Islamic banking industry and identifies the areas where the strategic measures are required to improve the banking performance. It applies non-parametric Data Envelopment Analysis (DEA) for the data from 2008-2016 of Saudi banking industry and provides comprehensive empirical results at individual bank vis-a-vis industry levels. The empirical results demonstrate a mix trend among the banks in achieving technical, pure technical and scale efficiency. It is observed that with the common pledge to expanding market share and performance, both conventional and Islamic banks have been successful in improving their levels of efficiency. At individual bank level, Al-Rajhi is the only bank that has achieved the highest score in terms of technical, pure technical and scale efficiency, while in the conventional banking group, both Saudi Hollandi and National Commercial banks are found on the top position. Despite the growth of incomes and deposits of entire banking industry in Saudi Arabia, this study particularly recommends for the Islamic banks to redirect their short term and long-term marketing strategies and to focus on improving their management skills at the branch level.

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1.0 Introduction

Saudi Arabia is one of those forefront countries where Islamic and conventional banks operate side by side under a single regulatory authority, Saudi Arabian Monetary Authority (SAMA). Its banking industry is ranked the second largest among the GCC in terms of assets value, while its Islamic banking industry is leading the region and Al Rajhi bank is on the top of Islamic bank ranking². In recent decades, many new banking products and services have been created and many new banking and financial institutions are established with the collaboration of local and international institutions. Today, in addition to commercial banks, Saudi financial industry is consisted of insurance companies, mutual funds, pension funds, finance companies, real estate investment trust and social welfare financial institutions called Waqf.

Saudi Arabia's banking is a subsector of its larger financial system which mainly coordinates with insurance companies, financial companies, investment managers, and other institutions aiming to support various economic activities. Banks' functions are widely varied depending upon its scope and nature i.e., commercial banks offer deposits, loan services and money transfer; investment banks specialize in capital market investments; Saudi Arabian Monetary Authority (SAMA) issues currency and frames monetary policies and electronic payment systems, such as SARIE, SPAN, and the Clearing House. Saudi Banking industry remains robust despite the liquidity crunch which resulted in the increasing cost of funding in the first two quarters of 2016. However, the Ministry of Finance and SAMA managed to resolve that temporary liquidity crisis.

Saudi banking sector is consisted of 12 local and 14 licensed

² GCC-banks-outlook-stable-in-2018-Moodys, accessed on July 20, 2018, <http://saudigazette.com.sa>; Islamic Finance Outlook, S&P Global Ratings, (2018), accessed on July 20, 2018, <https://www.spratings.com/>

branches of international banks. Only 3 local banks, out of 12, collectively account for the 45 percent while the largest seven banks have combined share of 85 percent of total banking industry. The public ownership (including quasi government) pattern is fairly high in the banking industry and the government is among the main shareholders of the ownership in the largest three banks while the fourth largest bank belongs to a family which holds several other businesses too. The industry has considerably a good network of banking branches equipped with modern technology and sophisticated banking system.

In broader classification, one can find three banking models in the Saudi Arabian banking industry:

- Islamic or *Shari'ah* Compliant Banks: Islamic banking and financial principles are applied in all the banking schemes and all the operations are observed by *Shari'ah* scholars.
- Bank with Mixed Operations: These banks are commercial banks in their nature however they provide Islamic banking services through dedicated Islamic Branches or Windows within any branch of the bank.
- Commercial Banks: Conventional banks that follow the international banking system. This type of banks exists only in the past. In Saudi Arabia, any commercial bank must provide Islamic and *Shari'ah* based products and services. This compels conventional banks to launch an Islamic section and therefore it goes under mixed operations banks division.

As compared to conventional banking, the Islamic banking industry of Saudi Arabia is relatively smaller, and there are only four Islamic banks: Al-Bilad, Al-Inma, Al-Jazira Bank, and Al-Rajhi. Though none of these banks use the term Islamic, all banks have their own independent *Shari'ah* Supervisory Board (SSB) and are offering banking and investment services according to Islamic teachings. The trend in Saudi banking sector to offer Islamic banking is getting momentum along-with the increasing local and regional demand and appreciation at international level. The Al-Rajhi bank, established during the second half of 1950s, is the oldest and largest bank in terms of assets. The second oldest bank is Al-Jazira, established in 1975/6 while Al-Bilad and Al-Inma banks enter into operations in

2004 and 2007, respectively.

Table 1.1: Branches and ATMs of Saudi Banks in 2018

No	Saudi Banks	Establishment	Branches	ATMs
Islamic Banks				
1	Al-Rajhi Bank	1950s	539	4,475
2	Bank Al-Jazira	2007*	80	621
3	Al-Bilad Bank	2004	114	896
4	Al-Inma Bank	2008	76	1340
Conventional Banks				
5	Riyadh Bank-RIBL	1957	337	2,667
6	Saudi Investment Bank	1976	48	500
7	Banque Saudi Fransi	1977	86	550
8	Saudi British Bank	1978	82	966
9	Arab National Bank	1979	151	1266
10	Samba Financial Group-Samba	1980	72	540
11	The National Commercial Bank	1997	374	3477
12	Alawwal Bank	2008	65	560

Source: SAMA, 2018

*The bank established as conventional bank in 1976 and converted to an Islamic bank in 2007.

A total of 12 Saudi commercial banks have a total of 2,024 branches and 17,858 Automated Teller Machines (ATMs) across the country as of 2018. Although Riyadh Bank is the earliest established bank, the largest bank in Saudi Arabia is Al-Rajhi Bank which is also a full-fledge Islamic bank. Undoubtedly, these banks are functioning as one of the most important intermediaries in the economy as they

manage surplus and deficit of funds of economic agents. Their functions in collecting the small deposits from a large number of the depositors and providing these collected funds to the households, business firms and governments to carry out the desired economic activities is also widely regarded as the 'lifeblood' of the economic activities. The success of allocation of funds or the process of financial intermediation depends on the operational efficiency of banks; ability of bank to utilize its resources in the optimal level that eventually enables the bank to provide the funds at the lowest possible costs. The bank's operational efficiency helps to make overall banking services more efficient and generate more profits for the banks and all the stakeholders.

Although the banking sector of Saudi Arabia is among the largest and fastest growing sectors, its contribution to the GDP is quite insignificant. This has been partly because of the economic slowdowns that mostly caused by dramatic decrease in oil prices over the last few years. It also creates some difficulties in resource mobilization i.e., lower deposits which may lead to inefficiency in banks' performance. In view of this problem, the principal goal of this study is to measure and compare the performance in terms of operational efficiency of Saudi conventional and Islamic banks by using the input and output indicators. As the efficiency of bank is linked with the performance of financial industry, it determines the position of each bank in the prevailing competitive environment of banking industry.

The study will provide a comprehensive and robust set of results of Saudi banking industry at individual bank levels as well as at industry levels in terms of efficiency in every aspect considered. The results of this study will be significant to the stakeholders of banking industry, as it analyzes largest set of available data ranging from 2008-2016 covering all the four Islamic banks and eight conventional banks of Saudi Arabia, to formulate appropriate policy implications and recommendations to improve the banking operations for the growth of real sector.

2.0 Literature Review

There are a number of studies conducted in measuring the banks' performance where various types of efficiency are used i.e., profit efficiency, cost efficiency and output efficiency. In efficiency analysis studies, two most frequently used methods are technical efficiency, which maximize output with a given level of input and allocative efficiency, which minimize input for achieving a given level of output (Fare *et al.*³).

In Saudi Arabia, the banks' efficiency study is found in early 1990s. Such a study conducted by Al-Faraj, Alidi and Bu-Bshait⁴ who focused on the relative efficiency of a single bank's branches located in the eastern province of Saudi Arabia. The authors consider some input factors such as, employees, education, experience, location, salaries, expenditure on decoration etc. and some output factors like net profit, balance of current account, balance of saving account, loans, mortgages, number of accounts etc. By employing DEA method with one-year data, the authors have identified 12 out of 15 branches (bank's name is not mentioned) which are efficient based on the selected input and output indicators.

Al-Faraj, Bu-Bshait and Al-Muhammad⁵ evaluate Saudi commercial banks by considering technical efficiency and relate the results with world average efficiency scores. By adopting DEA method, the authors find that Saudi commercial banks have higher average efficiency score than the world. In another study, Al-Jarrah⁶ examines a few banks in Jordan, Egypt, Saudi Arabia and Bahrain from 1992-2000. The author divides cost efficiency method into allocative efficiency and technical efficiency in variable and constant

³ R. Fare, S. Grosskopf, and C. A. K. Lovell. *The Measurement of Efficiency of Production*. (Boston, Kluwer Academic Publishers, 1985).

⁴ T. Al-Faraj, A. Alidi & K. Bu-Bshait. "Evaluation of bank branches by means of data Envelopment Analysis". *International Journal of Operations & Production Management*, 13, (1993), 45–52.

⁵ T. Al-Faraj, K. Bu-Bshait & W. Al-Muhammad. "Evaluating the efficiency of Saudi commercial banks using data Envelopment analysis". *International Journal of Financial Services Management*, 1(4), (2006), 466 477.

⁶ I. M. Jarrah, "The Use of DEA in measuring efficiency in Arabian banking. *Banks and Bank Systems*", 2(4), (2007), 21-30.

return to scale where the result shows that cost efficiency scores are varied across the banks under study.

A number of factors that affect banks' efficiency are banks' geographic location and their relative size. Considering these factors, the Saudi banks are found more efficient in terms of both cost efficiency and allocative efficiency as compared to Jordanian and Egyptian banks.

Mostafa⁷ applies DEA to examine the efficiency of top performing 85 Arab banks, and demonstrates that only 8 banks' CCR score and 4 banks' BCC score are on the efficiency frontier. Besides, two banks from Saudi Arabia i.e., Al-Rajhi Bank and National Commercial Bank are found to be on the ranking of eight and ten position, respectively. However, this result slightly contradicts with Emrouznejad and Anouze⁸ who conducted the similar study and confirmed that these two banks Al-Rajhi Bank and National Commercial Bank have achieved better ranking of six and seven, respectively among the top ten Arab banks.

Muharrami⁹ applies DEA to measure three types of efficiency i.e., technical, pure technical, and scale efficiency of banks in Gulf Cooperation Council (GCC). The author adopts an input orientation approach for the period 1993–2002 and finds that that only few small banks achieve highest technical efficiency scores, but the relatively bigger banks have the advantages of utilizing best available technology whereas the medium size banks are found to be more efficient than others in selecting optimal levels of outputs. The author also shows that Islamic banks are relatively more successful in terms of adopting best technology and deciding optimal output.

Moreover, some banks are exhibited as best performer in achieving the technical efficiency from Bahrain, Qatar, Oman, UAE,

⁷ M. M. Mostafa, "Modeling the efficiency of top Arab banks: A DEA–neural network approach". *Expert Systems with Applications*, 36 (2007), 309-320.

⁸ A. Emrouznejad & A. L. Anouze, "A note on the modeling the efficiency of top Arab banks", *Expert Systems with Applications*, 36(3),(2009), 5741-5744.

⁹ S. Al-Muharrami, "An examination of technical, pure technical and scale efficiencies in GCC banking", *American J. Finance and Accounting*, 1(2), (2008) 152-166.

Kuwait and Saudi Arabia which ranked from first to sixth, respectively. AlKhathlan and Malik¹⁰ considers DEA approach like Charnes–Cooper–Rhodes (CCR)¹¹ and Banker–Charnes–Cooper (BCC) in 1978 for examining relative efficiency of Saudi Banks based on the data from 2003 to 2008. In terms of relative scale, majority of Saudi banks are found to be efficient in financial resource management. More specifically, the study considers Al-Rajhi Bank and Banque-Saudi Fransi as the role models for other Saudi banks as their scores were on the efficient frontier in both CCR and BCR models, whereas National Commercial Bank are observed to be the least efficient. Similarly, Srairi¹² investigates the performance of 71 commercial banks over the period 1999 to 2007 in GCC region and uses SFA model with the consideration of country-specific environment variables. By measuring cost and profit efficiency of the banks under study, the author finds that the conventional banks are relatively more efficient than the Islamic banks in achieving these efficiencies. Overall, both conventional and Islamic banks in the GCC region are more competent and effective in making profits rather than controlling costs. Almazari and Almumani¹³ evaluate the performance of Saudi National Banks from the period 2006-2010 by applying regression analysis.

They determine a number of factors affecting banks' profitability such as, operational efficiency, asset management, and total assets and bank size. In other study, Almumani¹⁴ examines the relative efficiency of Saudi banks by applying DEA models i.e., CCR

¹⁰ AlKhathlan & Malik, "Are Saudi Banks Efficient? Evidence Using Data Envelopment Analysis (DEA)" *International Journal of Economics and Finance*, 2(2), (2010), 53-58.

¹¹ A. Charnes, W. W. Cooper and E. Rhodes, "Measuring the efficiency of decision-making units", *European Journal of Operational Research*, 2(6), (1978), 429-444.

¹² S. Srairi, "Cost and profit efficiency of conventional and Islamic banks in GCC Countries", *Journal of productivity analysis*, 34, (2010), 45-62.

¹³ A. A. Almazari & M. A. Almumani, "Measuring Profitability Efficiency of the Saudi National Banks", *International Journal of Business and Social Science*, 3(14), (2012), 176-185.

¹⁴ M. A. Almumani, "The Relative Efficiency of Saudi Banks: Data Envelopment Analysis Models", *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 3(3), (2013), 152-161.

and BCR from 2007-2011. The determinants used for measuring relative efficiency are bank size and capitalization. The results show that the Saudi banks are efficient in terms of financial resource management while the relatively smaller banks achieve higher scores as compared to the medium and larger size banks.

Sillah, Khokhar and Khan¹⁵ investigate the technical efficiency of 12 banks in Saudi Arabia. By adopting stochastic frontier model with the sample of 12 years, the authors find mixed results, for instance, the Banque Saudi Fransi is found to be more efficient under the category of Saudi-foreign owned bank despite its own fluctuating performance. This bank remains the top performer in achieving best efficiency scores in case of deposit and investment and becomes a good performer in income efficiency. The study also reveals that Bank Al-Rajhi and SAMBA are the best income performers among others.

Ferhi and Chkoundali¹⁶ also measure the efficiency of 209 Islamic and conventional banks from 1999 to 2010 by adopting stochastic frontier analysis (SFA) and the DEA. The result from DEA indicates that Islamic banks enjoy slightly higher (65.2%) constant returns to scale than that of conventional banks (64.9%) whereas the conventional banks have the higher (64.9%) scores in terms of variable returns to scale as compared to Islamic banks (61.7%). Moreover, Islamic banks in Bahrain, Egypt, Qatar and Turkey are found most efficient. On the other hand, the outcome from SFA indicates that Islamic banks are slightly less efficient than conventional banks under study. The study also confirms that Islamic banks in the Arab region i.e., Saudi Arabia, Qatar, and Jordan, some from East-Asia like Malaysia, Singapore along with the Russian Federation, the United Kingdom, the Cayman Islands have the highest cost efficiency scores. In addition, the study reveals that the efficiency scores of Islamic banks are slightly declined during

¹⁵ B. M. Sillah, I. Khokhar, & M. N. Khan, "The performance of Saudi Banking industry 2000-2011: have the banks distinguished themselves from one another?", *International Journal of Financial Research*, 5(2), (2014), 1-12.

¹⁶ A. Ferhi & R. Chkoundali, "Comparing Effectiveness between Islamic and Conventional Bank during the Current Crises". *Intel Prop Rights*, 3 (2015), 139.

European crisis (2007-2010) and Subprime crisis (2007-2008).

Bukhari and Nizar¹⁷ measured the efficiency of Islamic banks and conventional banks in the GCC countries from 2006 to 2012. A total of 28 conventional banks and 20 Islamic banks, and a total of six variables i.e., two output variables (total loans and investments), and four input variables (total deposit, equity, fixed assets and general expenses) are considered for the comparative analysis. In the case of constant return to scale, there is no difference in efficiency scores of the two bank types whereas the conventional banks are observed to be more efficient than Islamic banks in terms of variable return to scale in 2009 and 2010. The study also reveals the comparisons of efficiency scores within country, and this indicates that the two bank types are observed in almost similar scores in some countries including Kuwait, Saudi Arabia, and Qatar. However, the conventional banks are noticed to be more efficient than Islamic banks in Bahrain and UAE.

In evaluating the technical efficiency of Islamic banks in MENA region, Bahrini¹⁸ applies advanced bootstrap Data Envelope Analysis (DEA) method and shows that Islamic banks in GCC region are more consistent as compared to Islamic banks located in MENA region during the two sample periods i.e., global financial crisis time (2007–2008) and early of post-crisis (2009–2010).

Miah and Uddin¹⁹ measured the business orientation, stability, and efficiency of 28 Islamic and 48 conventional banks in Gulf Cooperative Council (GCC) countries based on the data from 2005 to 2014. They adopt various methods i.e., accounting ratios analysis, Stochastic Frontier Analysis (SFA), and ordinary least square regression technique. The study's outcome confirms that

¹⁷ B. M. S. Sillah & N. Harrathi, "Bank Efficiency Analysis: Islamic Banks versus Conventional Banks in the Gulf Cooperation Council Countries 2006-2012", *International Journal of Financial Research*, 6(4), (2015), 143-150.

¹⁸ Bahrini, R. (2017), "Efficiency Analysis of Islamic Banks in the Middle East and North Africa Region: A Bootstrap DEA Approach", *International Journal of Financial Studies*, Vol. 5 No. 7, pp. 1-13.

¹⁹ M. D. Miah, H. Uddin, "Efficiency and stability: A comparative study between Islamic and conventional banks in GCC countries", *Future Business Journal*, 3, (2017), 172–185

conventional banks are more cost efficient and Islamic banks are more stable in short-term, but there is no such variation among these two in achieving the long-term stability. In addition, the study confirms that relatively larger banks operate under diseconomies of scale as they have less intermediation ratio, and although highly capitalized banks are observed to be more stable, they are cost inefficient, and in most cases, failed to exploit the leverage effect.

In a most recent study²⁰, the authors investigate the efficiency of Saudi Islamic banks with a set of data from 2008 to 2016. By applying DEA, the authors show that Al-Rajhi is the most efficient bank followed by Al-Jazira bank, Al-Inma bank and Al-Bilad bank in achieving technical and pure technical efficiency. Besides, Al-Bilad bank is found to be performed sound in term of scale efficiency.

3.0 Methodology

This study includes a total of 12 local banks in Saudi Arabia to compare the performance of four *Shari'ah* compliant banks i.e., Al-Rajhi, Al-Jazira, Al-Bilad and Al-Inma, and eight conventional banks i.e., The National Commercial Bank, Saudi British Bank, Samba Financial Group, Saudi Investment Bank, Banque Saudi Fransi, Alawwal Bank, Arab National Bank, and Riyadh Bank. All these banks are regulated under a single regulatory authority, Saudi Arabian Monetary Authority (SAMA). Although there are 14 licensed foreign banking branches of international banks in Saudi Arabia, this study confined to only 12 local banks to observe the actual banking performances based on domestic resources. This study conducts performance analysis by considering period from 2008 to 2016 due to the lack of data of some Islamic banks.

3.1 Non-parametric Approach: Data Envelopment Analysis (DEA)

First it was introduced by Charnes *et al.*²¹ in 1978, Data

²⁰ M. Hassan, M. N. Khan, F. M. Amin and I. Khokhar, "Measuring the Performance of Islamic Banks in Saudi Arabia", *International Journal of Economics and Management*, 12(1), (2018), 99-115.

²¹ A. Charnes, W. W. Cooper & E. Rhodes, "Measuring the efficiency of decision-making units", *European Journal of Operational Research*, 2(6), (1978), 429-444.

Envelopment Analysis (DEA) is a non-parametric method and approach to regression analysis that analyze the relative productive efficiency and management or decision-making unit (DMU) having the same multiple inputs and outputs. DEA develops a function whose form is determined by the most efficient producers. This method differed from the Ordinary Least Squares (OLS) or regression that bases comparison relative to an average producer. As, regression analysis relies on central tendencies only, that does not provide a comprehensive and robust observation of the managerial performance of productivity at the maximum or optimal levels, therefore we use the DEA approach that relies on external observations. DEA identifies a frontier which is characterized as an extreme point method that assumes that if a firm can produce a certain level of output utilizing specific input level, another firm of equal scale should be capable of doing the same. The most efficient producers can form a composite producer, allowing the computation of an efficient solution for every level of input or output. Moreover, the regression approach assumes a single estimated regression equation applies to each observation vector or managerial performance of productivity (MPP) or decision-making unit (DMU), DEA analysis each vector (MPP or DMU) separately. DEA can handle multiple input and multiple output models and it doesn't require an assumption of functional form relating inputs to outputs²².

It follows linear programming procedure under the assumption of variable return to scale in order to measure efficiency of any institution. In this institution or decision-making unit (DMU), the higher efficiency of production is usually measured by the maximum level of output with given level of input. The DEA follows two methods: an output orientation method which provides maximization output with a given level of input and an input orientation method which provide a given level of output with minimum amount of input. One of the advantages of using a non-parametric method like DEA is that it does not require to satisfying any explicit optimization objective regardless of the size and nature of the institution. Considering the fact, this study adopts comparative analysis of the

²² S. Berg, *Water Utility Benchmarking: Measurement, Methodology, and Performance Incentives*, (International Water Association, 2010).

input-oriented efficiency method.

Technical Efficiency means ability of a firm to obtain maximal output from a given set of inputs. Pure Technical Efficiency is a performance-based measuring approach that examine the managerial performance of an organization while Scale Efficiency provides the insight to the management to choose the optimum quantity of the resources to be allocated to the bank size or to choose the scale of production that attains the expected production level.

The constant return to scale (CRS) and variable return to scale (VRS) are the two principal assumptions of DEA in order to measure the scale effects. In most cases, the scale efficiency scores based on VRS model ranged between 0 and 1 model which is higher than CRS due to the nature of close-fitting of data points. Besides, the obtained score from VRS model assists decision makers to determine whether the institution is under the operation of increasing or decreasing or constant return to scale. On the other hand, CRS is mostly applicable to a case where both slope of efficiency and ratio of inputs to outputs are similar²³.

In order to obtain the most precise and accurate results, it is recommended to follow a single-year analysis approach rather than multi-year efficiency analysis for any institution or individual decision-making unit (DMU)²⁴. For this reason, this study estimates the efficiency of individual bank separately on yearly basis. This approach is also helpful to get the best result in most volatile banking industry over the years.

Above discussion paves the way to understand the following equations. Let's assume there are "n" number of decision-making units (DMU) to be evaluated under following model specification.

$$\max z = \sum_{i=1}^n u_i y_i \quad (1)$$

²³ W. Cooper, L. M. Seiford & K. Tone, *Data Envelopment Analysis*, (Boston, MA: Kluwer Academic Publishers, 2000).

²⁴ I. Isik & M. Hassan, "Technical, scale and allocative efficiencies of Turkish banking industry", *Journal of Banking and Finance*, 26(4), (2002), 719-766.

Subject to

$$\sum_{j=1}^m v_j x_j = 1 \quad (2)$$

$$\sum_{i=1}^n u_i y_i - \sum_{j=1}^m v_j x_j - \leq 0 \quad (3)$$

$$u_i, v_j \geq 0$$

Where,

z = Efficiency of DMU under consideration

u_i = n output coefficients of DMU under consideration

y_i = n output weighting coefficients for DMU under consideration

v_j = m input coefficients for DMU under consideration

x_j = m input weighting coefficients for DMU under consideration

In equation (1) provides the efficiency score for DMU I , equation (2) transforms the weighted inputs of DMU i equal to 1, and equation (3) confirm that the weighted outputs cannot be more than the weighted inputs for all DMU's (capping efficiency to 1).

3.2 Input and Output Specifications

Banking institutions are involved in an intermediation process that mobilize the excessive resources to the production or manufacturing industry. The intermediation method is mostly appropriate for this study as the sample institutions or DMUs are banks which transform inputs i.e., deposits, assets and capital into output i.e., investment, advances and net income²⁵. Even though there are two commonly used approaches of measuring efficiency, i.e. the production

²⁵ C. Sealey & J. Lindley, "Inputs, outputs and a theory of production and cost at depository financial institutions", *Journal of Finance*, 32(4), (1977), 1251-1266; C. Favero & L. Papi, "Technical efficiency and scale efficiency in the Italian banking sector: a nonparametric approach", *Applied Economics*, 27(4), (1995),. 385-395; S. Kwan, "The X-efficiency of commercial banks in Hong Kong", *Working Paper Series No. 2002-14*, (Federal Reserve Bank of San Francisco, 2002), 1-30.

approach and the profit-oriented approach, the most appropriate approach is the intermediation approach for evaluating banks' efficiency. Adopting this approach, some other studies focus on these inputs and outputs variables to measure the banks' efficiency at different levels²⁶. As can be observed in table 3.1, this study uses deposits, assets and capital as inputs variable and investment, advances and income as outputs.

Table 3.1: Description of the Variables

Variables	Notation	Description
Deposits	X1	Deposits of customers
Assets	X2	Total assets include cash and balance with treasury and other banks, due from financial institutions, investment, financing and other related assets, operating fixed assets, deferred taxed
Capital	X3	Share capital is the summation of all funds that banks used to raise by issuing shares.
Investment	Y1	Investment
Advances	Y2	Financing and other related assets
Income	Y3	Total bank revenues and subtracting the costs of doing business such as depreciation, interest, taxes and other expenses.

4.0 Data Analysis and Discussion

The data require for this empirical analysis is gathered from the annual disclosure and financial statements of listed conventional and Islamic banks of Saudi Arabian banking industry in the period of 2007 – 2012. All the banks included in this study were established in

²⁶ B. M. S. Sillah & N. Harrathi, "Bank Efficiency Analysis: Islamic Banks versus Conventional Banks in the Gulf Cooperation Council Countries 2006-2012", (2015), op.cit.; [M. T. Majeed & A. Zanib](#), "Efficiency analysis of Islamic banks in Pakistan", *Humanomics*, 32(1), (2016), 19-32; Hassan, *et al*, "Measuring the Performance of Islamic Banks in Saudi Arabia", (2018), op. cit.

different times therefore they are different in their volume and size. Over the period 2007 to 2016, the average mean of total Assets, Deposits and Capital for the full-fledged Islamic banks are SAR 92,298, SAR71,561 and SAR15,844million, respectively. While, the conventional banking sector is relatively larger than the Islamic banking as its total Assets, Deposits and Capital are SAR 161,941, SAR 124,752 and SAR 24,870 million, respectively (table 4.1).

Table 4.1: Descriptive statistics of variables in SAR millions (Period 2007-2016)

Variables	Inputs			Outputs		
	Assets	Deposits	Capital	Loans	Income	Investment
Islamic Banks						
Mean	92,298	71,561	15,844	55,795	2,373	10,162
Standard Deviation	33,178	28,082	3,545	15,335	379	5,422
Conventional Banks						
Mean	161,941	124,752	24,870	88,672	3,260	40,286
Standard Deviation	34,588	22,382	7,141	20,531	589	7,103

Source: Authors' own compilation

Similarly, the output variables used in this study like loans, income and investment for the conventional banks are SAR88,672, SAR3,260 and SAR40,286 million that are 1.6, 1.4 and 4.0 times higher when compared with the Islamic banks. Perhaps, it is due to the large number of conventional banking branches. According to SAMA Annual report 2016, the total number of full-fledged Islamic banks branches is 809 while it is 1215 in conventional banking.

Table 4.2: Efficiency Estimates of Islamic and conventional Banks

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Mean	SD
Islamic Banks												
Technical Efficiency	0.98	0.88	0.96	0.96	0.83	1.00	0.95	0.95	0.91	0.92	0.93	0.05
Pure Technical Efficiency	1.00	0.98	0.97	0.97	1.00	1.00	1.00	1.00	0.97	0.97	0.99	0.02
Scale Efficiency	0.98	0.89	0.99	0.99	0.83	1.00	0.95	0.95	0.94	0.95	0.95	0.05
Conventional Banks												
Technical Efficiency	0.97	0.96	0.97	0.97	0.95	0.99	1.00	0.99	0.97	0.98	0.97	0.02
Pure Technical Efficiency	0.98	0.98	0.98	0.98	1.00	0.99	1.00	1.00	1.00	0.98	0.99	0.01
Scale Efficiency	0.99	0.97	0.99	0.99	0.95	1.00	1.00	0.99	0.98	1.00	0.99	0.02

Source: Authors' own compilation

Table 4.2 elaborates a mix trend in all the efficiencies among Islamic banks and conventional banking industry of Saudi Arabia over the period of study. In general, conventional banks can be considered more efficient than the Islamic banks as the score of these banks in technical efficiency of is 97 percent as compared to 93 percent for the Islamic banks. However, in the year 2007 and 2012, Islamic banks showed more technical efficiency than the conventional banks. In the rest of the years, conventional banks have more technical efficiency than the Islamic banks. Therefore, it entails that at the given input, conventional banks perform well and generate the maximum output.

Table 4.3: The Average of Technical Efficiency of Saudi banks (2007-2016)

Bank Name	Technical Efficiency	Rank
Al Rajhi Bank	1	1
National Commercial Bank	1	1
Saudi Hollandi Bank	1	1
Samba Financial Group	0.999	2

Arab National Bank	0.99	3
Saudi British Bank	0.962	4
Riyad Bank	0.956	5
Alinma Bank	0.948	6
Banque Saudi Fransi	0.945	7
Saudi Investment Bank	0.935	8
Bank Al Jazira	0.921	9
Bank Albilad	0.865	10

Source: Authors' own compilation

Surprisingly, in terms of pure technical efficiency Islamic banks performed shoulder to shoulder with the conventional banks as we can see the mean of both banking is same. While in the scale efficiency, the results reveal that conventional banks are better in managing their branches in full capacity. As the score of pure technical efficiency and scale efficiency are same in conventional banking, it can be further stated that scale efficiency contributed to pure technical efficiency. While in case if Islamic banking, the management needs to make a harmonization between the technical and scale efficiency.

Table 4.4: The Average of Pure Technical Efficiency of Saudi banks (2007-2016)

Bank Name	Pure Technical Efficiency	Rank
Al Rajhi Bank	1	1
Bank Albilad	1	1
National Commercial Bank	1	1
Samba Financial Group	1	1
Saudi Hollandi Bank	1	1
Arab National Bank	0.995	2
Saudi Investment Bank	0.990	3
Riyad Bank	0.976	4
Saudi British Bank	0.975	5

Alinma Bank	0.969	6
Bank Al Jazira	0.968	7
Banque Saudi Fransi	0.958	8

Source: Authors' own compilation

The results also reveal that Islamic banks have the highest technical efficiency, score 1 out of 1, only in 2012, while conventional banks have scored highest in technical, pure technical and scale efficiency in year 2013. It is also observed that the Islamic banks achieved pure technical efficiencies during the year 2007, 2011, 2012, 2013 and 2014. On the other side, conventional banks achieved pure technical efficiencies during the year 2011, 2013, 2014 and 2015 (please refer to the tables 4.3 - 4.5).

Table 4.5: The Average of Scale Efficiency of Saudi banks (2007-2016)

Bank Name	Scale Efficiency	Rank
Al Rajhi Bank	1	1
National Commercial Bank	1	1
Saudi Hollandi Bank	1	1
Samba Financial Group	0.999	2
Arab National Bank	0.995	3
Saudi British Bank	0.987	4
Banque Saudi Fransi	0.986	5
Riyad Bank	0.980	6
Alinma Bank	0.976	7
Bank Al Jazira	0.951	8
Saudi Investment Bank	0.945	9
Bank Albilad	0.865	10

Source: Authors' own compilation

Now, from another perspective of measuring the scale efficiency, the banks may operate at constant return of scale (CRS) or variable return of scale (VRS). CRS denotes that output changes with the same proportion as input change. In contrast, VRS represents that

output may be change with increasing or decreasing trend disproportionately as input change. When the bank operates at VRS, then bank may have decreasing return of scale (DRS) or increasing return of scale (IRS). DRS intend that output increase less proportionate than the increase in input. IRS signifies that output increase with more proportionate than the input increase (table 4.6).

Table 4.6: Estimation of Efficiency Frontier

Type of Industry	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Islamic Banking	CRS	CRS	CRS	IRS	IRS	CRS	CRS	IRS	IRS	IRS
Conventional Banking	CRS	CRS	DRS	IRS	IRS	DRS	CRS	CRS	CRS	IRS

Source: Authors' own compilation

Note: IRS=Increasing Return to Scale; CRS=Constant Return to Scale; DRS=Decreasing Return to Scale.

From the table 4.6, it is obvious that since 2007 to 2016 in conventional banks exhibited mixed performance while the trend in the performance of Islamic banking is positive. An exceptional increase in the demand for Islamic banking services are observed in all over the Muslim world, especially in GCC region. Another implication is that this industry enjoyed the benefit of cost spreading and effective asset management strategies that leads to CRS. In addition, Islamic banks experienced IRS from 2014-2016 by minimizing the cost along with the automation of their banking operations. In the year 2010 and 2011, both banking sectors achieved increasing return to scale that show the management efficiency to achieve substantial gains from investments. Overall, Islamic banks and conventional banks are found to be equally performed in terms of constant return to scale during the studied period.

Table 4.7: Estimation of Efficiency Frontier

Bank Name	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Al Rajhi Bank	CRS	CRS	CRS	CRS	CRS	CRS	CRS	CRS	CRS	CRS

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Bank Name	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Alinma Bank	N.A*	CRS	CRS	CRS	CRS	CRS	CRS	IRS	IRS	IRS
Bank Al Jazira	IRS	IRS	IRS	IRS	IRS	CRS	CRS	CRS	CRS	CRS
Bank Albilad Arab	CRS	IRS	CRS	CRS	IRS	CRS	IRS	IRS	IRS	IRS
National Bank	CRS	DRS	IRS	IRS	CRS	CRS	CRS	CRS	DRS	CRS
Banque Saudi Fransi	IRS	DRS	IRS	IRS	DRS	CRS	CRS	DRS	IRS	IRS
National Commercial Bank	CRS	CRS	CRS	CRS	CRS	CRS	CRS	CRS	CRS	CRS
Riyad Bank	DRS	DRS	IRS	IRS	DRS	DRS	DRS	DRS	DRS	CRS
Samba Financial Group	CRS	CRS	CRS	CRS	CRS	CRS	CRS	CRS	CRS	IRS
Saudi British Bank	IRS	DRS	DRS	DRS	DRS	CRS	CRS	CRS	CRS	CRS
Saudi Hollandi Bank	CRS	CRS	CRS	CRS	CRS	CRS	IRS	CRS	CRS	CRS
Saudi Investment Bank	IRS	IRS	IRS	IRS	IRS	CRS	CRS	IRS	IRS	CRS

Source: Authors' own compilation

**Data for Alinma Bank in 2007 Bank is Not Available.*

Results in table 4.7 exhibits the facts that during the period of 2007 to 2016, the Islamic and conventional banks, again as seen in the previous results, operate at mixed of Return to Scale. Islamic banks operate at CRS during 2007 to 2009 followed by IRS during 2010 and 2011. Present results also signify the findings of our previous study on the efficiency of Islamic banking industry of Saudi Arabia²⁷. With the passage of time, the performance of Islamic banks

²⁷ M. Hassan, *et al*, "Measuring the Performance of Islamic Banks in Saudi Arabia", (2018), op. cit.

decreased and after the 2013 till the 2016, Islamic banks operated on the decreasing return to scale. On the other side, conventional banks operate at CRS during 2007, 2008, 2013 and 2014 and during 2010 and 2011 conventional bank operated at IRS followed by DRS during 2009, 2012, 2015 and 2016. In fact, when bank increases and exits operation at larger scale, the increase in input lead to increase in output with low proportionate that leads to DRS or diminishing marginal return to scale (DMRC).

Overall results reveal that conventional banks are more efficient in Saudi Arabia commemorating a mean efficiency score of 97%. In contrast to this, it is found that full-fledged Islamic banks are less efficient with mean efficiency score of 93%. This summarizes that conventional banks are highly efficient in minimizing cost by decreasing input for achieving a certain level of output. The findings of the present study are consistent with the results found by Saeed *et al.*²⁸, Srairi²⁹ and Hassan *et al.*³⁰.

5.0 Conclusion

Present study examined the performance of Saudi banking industry during the period 2007-2016 in the terms of technical, pure technical and scale efficiencies by applying the Data Envelopment Analysis (DEA) technique. The efficiency is measured and then compared for both types of banking institutions, i.e., Islamic and conventional. The empirical results demonstrate interesting insights about the Saudi Arabian banking industry. In overall, conventional banks exhibit high score in all the three test types of efficiencies than Islamic banks. While examining the respective efficiencies at bank individual levels, only one Islamic bank, name Al-Rajhi bank stands at first position along-with two conventional banks namely National Commercial, Saudi Hollandi bank, while the two Islamic banks namely Al-Jazira

²⁸ S. Al-Muharrami, "An examination of technical, pure technical and scale efficiencies in GCC banking", *American J. Finance and Accounting*, 1(2), (2013), 152-166.

²⁹ S. Srairi, "Cost and profit efficiency of conventional and Islamic banks in GCC Countries", *Journal of productivity analysis*, 34, (2010), 45-62

³⁰ M. Hassan, *et al*, "Measuring the Performance of Islamic Banks in Saudi Arabia" (2018), op. cit.

and Al-Bilad are on the ninth and tenth position, respectively. This lower performance of the Islamic banks, with the exception of Al-Rajhi bank, may be attributed to their relatively new emergence in the Saudi Arabian banking industry.

In the terms of deposits and financing, Islamic banks stand at better position than the conventional banks. Though the figures of deposits in conventional banks are improving too but Islamic banks are at much better position and have higher finance to deposit ratio. This relatively better performance can partially be credited to the religious back-ground of the Saudi people where whole population adheres to Islamic faith. In terms of pure technical efficiency, Islamic banks performed shoulder to shoulder with the conventional banks as can be seen from the average mean of both banking industries. Meanwhile, it is also revealed that conventional banks are better in managing their branches in terms of scale efficiency. As the score of pure technical efficiency and scale efficiency are same in conventional banking, it can be further stated that scale efficiency also contributed to achieve better pure technical efficiency. The marginal inefficiency in this measurement suggests that there is room for improvement for the Islamic banking management in the allocation of resources.

To conclude, all the banks, especially the larger banks, there is need to enhance their efficiency from current level to higher level by best allocation of resources, effective management techniques and optimal use of resources. There is also a room for all the banks involved in product development and innovation, to engage with the regulator, and enhance a dedicated legal framework, which is essential for the growth and development of Islamic banking in the kingdom of Saudi Arabia. In addition to this, a supportive environment for business and incentives to local banks be provided for the expansion of Islamic banking industry in order to strengthen the Kingdoms position in the global Islamic banking industry. Within the limitations of this study, it can be suggested that further studies can be conducted to address the relationship of production function to measure the efficiency of banks. Furthermore, cost and allocative efficiencies and risk exposure factors in the banking industry can be interesting topics for the further study of Saudi Banking industry.

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AL-SHAJARAH

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