FACTORS INFLUENCING EFFICIENCY OF ISLAMIC BANKS IN GCC REGION: EVIDENCE FROM ARAB SPRING PERIOD

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Abstract

The main purpose of this research is to estimate efficiency and its factors of Islamic banks in GCC countries during the period 2005-2014. In this study, efficiency is measured using data envelopment analysis (DEA), which is divided into technical efficiency (TE), pure technical efficiency (PTE), and scale efficiency (SE). The statistical methods to find the determinants are generalized least squares (GLS), generalized method of moments (GMM) and Tobit regressions. The DEA measures show that the highest efficiency found to be in Islamic banks in Kuwait. The statistical results demonstrate that size of banks is highly important to efficiency as larger Islamic banks could reduce their costs (based on economies of scale approach) and they could provide more services (more outputs) than smaller banks. Focusing on capitalisation, the results suggest that better capitalised banks have better efficiency. The lending services increase the efficiency significantly, which encourage Islamic banks in GCC region to focus more in providing loans. Furthermore, achieving profits is significantly and positively support the efficiency of Islamic banks. In contrast, foreign and local ownerships decreased efficiencies significantly. Additionally, banks in lower rates of economic growth operated more efficiently. Finally, the global financial crisis and Arab spring impacted the efficiency of Islamic banks in GCC countries dangerously. The strength point is that the efficiency of Islamic banks in GCC countries has not been affected by inflation (based on insignificant correlation between efficiency scores and inflation). These results actually help bankers and policy maker to evaluate the financial performance in banking sector. Moreover, identifying the positive and negative determinants allow banks to apply strategies to enhance efficiency.

Keywords: Islamic Banks; Efficiency; Data Development Analysis; Gulf Corporation Council, Arab Spring

1. INTRODUCTION

The Arab Spring consist of protests, demonstrations and riots against political regimes in Arabic world. Historically, the Arab or Democracy Spring started on 17 December 2010 in Tunisia (the Tunisian Revolution). After that, the demonstrations have spread in the Middle Eastern and North African countries. Based on that, the whole Arabic economies have been destroyed through instable political issues in the region. One of the main advantage of the Arab Spring is that the existence of political reforms in some countries but in some countries, the political crisis is still continue until now such as Iraq, Syria and Libya. Many studies have concentrated on how Arab Spring can affect economies such as Malik and Awadallah (2013). This study investigates whether Arab Spring impact the efficiency of Islamic banks in the Gulf Corporation Council (GCC) countries (Bahrian, Kuwait, Qatar, Saudi Arabia and United Arab Emirates). The main reason behind focusing on the GCC is because this region is considered to be one of the main world economy influential based on the ownership from the GCC countries of huge reserve of oil. In particular, this research focuses on efficiency of Islamic banks as there are limited studies that considered efficiency in Islamic banks compared to studies on efficiency in conventional banks. Depending on the International Monetary Fund and

World Bank databases, Islamic financial sector plays strong and essential roles in Islamic and countries and non-Islamic countries e.g. United Kingdom (International Monetary Fund, 2017; World Bank, 2017). The rapid spread and the significant importance for economies of Islamic banking in Muslim countries are key factors to focus on Islamic banks. As a result, enhancing efficiencies of Islamic banks allow more stable economies. In particular, the banking of GCC region has fallen after the Arab Spring period. Therefore, this study attempts to fill the gap in the literature through finding empirically the influence of Arab Spring on efficiency of Islamic banks. Moreover, the main determinants of efficiency in Islamic banks in GCC area can be found statistically in this study. Consequently, finding the significant factors that affect efficiency in banking could allow more profitability and effective activities through focusing on positive and significant factors. Additionally, avoiding the negative and significant factors could enhance banking performance.

The importance of this study also can be specified as the most recent studies have focused only on efficiency on conventional banks and they neglected the importance of Islamic banking to economy. Examples of studies that focused purely on efficiency of Islamic banks can be Rosman et al. (2014) and El-Moussawi and Obeid (2011). Many recent studies test the determinants of efficiency in conventional banks using DEA such as Haque and Brown (2017) and Triki et al. (2017).

The main objective of efficiency in banking sector is to compare inputs and outputs of banks. Efficient banks minimise their inputs (e.g. reducing costs) and generating from their inputs the maximum production. Identifying the efficiency of banks could be figured based on the estimation of efficiency measures like the data envelopment analysis (DEA) and stochastic frontier analysis. Variety studies have estimated the efficiency using DEA (Rosman, 2014) and SFA (Hassan, 2006) for Islamic banks. This study provides suggestions on how to improve efficiency after finding DEA measures and the determinants of efficiency. The investigation of the determinants of efficiency leads banks to know the strength (positive indicators) and weakness (negative indicators) points. This study contributes to the field of efficiency through some new concepts as (1) this study includes updated period 2005-2014, (2) the consideration of the effects of Arab Spring on efficiency of Islamic banks in GCC countries is a unique add to the knowledge, (3) comparing between the two significant statistical approaches as generalised least square (GLS), general method of moments and Tobit regressions have not been used in the literature of efficiency review of efficiency in Islamic banks. Research on efficiency however, helps banker, policy makers and researchers in terms of identifying the factors behind inefficiency.

The following sections of this study can be presented as section 2 that includes the literature review of efficiency in Islamic banks. Section 3 consist the data description and methods. Section 4 indicates the measures of Islamic banks in GCC and their determinants. Finally, section 5 concludes the results of this study.

2. LITERATURE REVIEW AND HYPOTHESES

Most studies on efficiency in Islamic banks have used the DEA in their research such as Rosman et al. (2014), Hassan (2006), Hassan and Hussein (2003), Sufian (2007), Belanes et al. (2015), Mokhtar et al. (2007). Fewer numbers of studies have investigated the determinants of the efficiency. Based on the determinants of the recent studies, we can conclude the hypotheses that could affect efficiency significantly depending of the importance of the variables. These hypotheses can be divided into two parts as internal (bank-specific) and external (macroeconomic) variables. The internal hypotheses can be tested in this paper are size, capital ratio, loan intensity, return on assets (ROA), age of banks, z-score, foreign ownership, domestic ownership, public ownership and listing in stock market. According to external variables, gross domestic production (GDP), inflation, market capitalisation, global financial crisis, corruption control and Arab Spring can be examined in this study. As a result, these internal and external hypotheses allow finding the determinants of efficiency for Islamic banks in GCC region. The following section discusses the recent studies on efficiency in banking sector in details.

Rosman et al. (2014) measured the efficiency of 79 Islamic banks in the Middle East and Asia employing DEA through the period 2007-2010. The DEA measures illustrate that Asian Islamic banks have higher efficiency measures than Middle Eastern Islamic banks. The results of DEA explain that the Islamic banks were able to sustain their operations throughout the financial crisis period as there is a slight drop in TE, PTE and SE after 2009 in Asian banks and after 2008 in the Middle East. The profits and capitalisation enhanced efficiency in Middle East but total assets led to poorer efficiency. According to Asian banks, profits, size of bank, capital ratio and loan loss provisions supported efficiency positively. The gap of this study is that there is no analysis of effect of loans (one of main banking operations) on efficiency.

Belanes's et al. (2015) study focused on 30 Islamic banks in GCC using DEA over the period 2005-2011. Most banks remained efficient but some banks witnessed a slight decline in technical, pure technical and scale efficiency measures. However, the most inefficient year was 2009 for TE, PTE and SE. The most efficient Islamic banks were in UAE due to the booming financial sector, while Bahraini Islamic banks attained the minimum efficiency indicators. No determinants of efficiency were estimated in this study, only efficiency measuring was included.

Alharthi (2016) used DEA (TE, PTE and SE) to measure the efficiency of Islamic, conventional and socially responsible banks for the period 2005-2012. Concentrating on the determinants of Islamic banks, the main findings confirm that Islamic banks in MENA and the UK needs to focus on size of bank, profitability (ROA) and loans to improve their efficiency due to a significant and positive impact on efficiency. The stock market development supports the efficiency of Islamic banks effectively. Finally, the advantage of Islamic banks can be seen as Islamic banks in this study performed efficiently through the global financial crisis period (2007-2009).

Focusing on commercial banks, Stewart et al. (2016) analysed the efficiency of commercial Vietnamese banks utilising DEA during the period 1999-2009. The main outcomes of this study proposed that financial performance is strongly important to efficiency. In addition, larger banks found to be more effective than smaller banks. It is unexpected result that more branches led to inefficiency. The reason behind this can be explained as establishing branches is costly compared to profits (there is not enough profit to operate more branches). Finally, the more experienced banks could minimise their inputs and maximise their outputs efficiently compared to modern banks in Vietnam.

Mamatzakis et al. (2015) also considered the determinants of efficiency in commercial banks. This study concentrated on Japanese commercial banks employing DEA (TE) for the period 2000-2012. The summary of this study is that the relationship between capital ratio (equity to total assets) and technical efficiency is significant and positive. Furthermore, the interest profit enhanced the efficiency significantly. In addition, higher Nikkei (Japanese stock market) index led to have better technical efficiency scores. Finally, the industrial sector in Japan supported the banking sector due to a positive and significant correlation between technical efficiency and industrial production. This provides incentives to companies to produce more as industrial and banking sectors are very important to each other for better economy.

Chen and Wang (2015) found the determinants of efficiency (DEA) for Chinese commercial banks through the period 1994-2010. This study encourages banks in China to have more total assets due to a positive association between size of bank and DEA's measures. This study also suggests that more equity led to better efficiency. The state ownership has affected the efficiency inversely as the government has not got enough experience of managing banks. However, based on country-specific factors, it is remarkable that more economic growth (GDP) results to better performance in banking sector.

The most recent research is the study of Alhassan and Tetteh (2017). This article tested the bank-specific (internal) variables that influencing the efficiency for 26 Ghanaian banks from 2003 to 2011. The most important results of this study could be concluded as the reasons behind the efficient performance are size of banks, profitability and bank assets concentration (for 5 largest banks in Ghana). On the other side, the debts, loan loss provisions and loan intensity are the causes of inefficiency.

To sum up, the main gap for the recent studies can be shown as there is no study has examined the impact of Arab Spring on efficiency in banking sector. Thus, this study fills this gap through finding statistically the correlation between efficiency and Arab Spring.

2.1 Internal variables

1. Size of bank: Many researchers considered size of banks as main factor. Most of studies conclude that larger sized banks are performing more efficiently than smaller sized banks. Noor and Ahmed (2012) test the determinants of DEA in 25 Countries 1992-2009 and they confirm that the relationship between DEA and size is positive (consistent to Alharthi's, 2016 finding). As a result, the first hypothesis can be formulated as:

H1: There is a significant association between efficiency and bank size.

2. Capital ratio: Rosman et al. (2014) have analysed the efficiency of Islamic banks using DEA for 12 Middle Eastern countries through the period 2007-2010. The capital ratio indicates the higher capitalisation leads to better efficiencies (similar to Noor and Ahmed, 2012). Based on this, the second hypothesis is:

H2: There is a significant association between efficiency and capitalisation.

3. Loan intensity: Numerous number of studies focus on the impact of lending upon efficiency in Islamic banks. For example, Alharthi (2016) has examined the determinants of efficiency in for 26 Islamic banks spreading in MENA region and the United Kingdom. The results of this study suggest that providing more loans enhance efficiency during the period 2005-2012. By the contrary, Noor and Ahmed (2012) encourage Islamic banks to reduce their loans due to a negative and significant correlation between efficiency and loans. In this, we can propose the third hypothesis:

H3: There is a significant association between efficiency and loan intensity.

4. Return on assets (ROA): This profitability ratio has been considered in most studies as a positive indicator for efficiency. El-Moussawi and Obeid (2011) for example argue that higher profitable banks could maximise their outputs effectively for Islamic banks in GCC countries for the period 2005-2008. This outcome is linked to the finding of Hassn (2006), Rosman et al. (2014), Sufian (2007) and Alharthi (2016).

H4: There is a significant association between efficiency and ROA.

5. Age of bank: Mokhtar et al. (2007) claims that more experienced Islamic banks with higher age are performing much better than recent established Islamic banks in Malaysia over the period 1997-2003 (same result of Alharthi, 2016). The age of bank hypothesis then is:

H5: There is a significant association between efficiency and Age.

6. Z-score: Higher z-score in banking provides banks the ability to be more stable and further from failure. The z-score has not been used in recent researches on Islamic banks but z-score extensively has been investigated as a determinant of conventional efficiency. Examples, Mamatzakis et al. (2015) research upon Japanese commercial banks for the period 2000-2012 and Chortareas et al. (2012) study that focused on European commercial banks over the period 2000-2008. Both studies found that the correlation between efficiency and z-score is significant and negative. In both cases, banks could decrease their banking services due to instable relationship between efficiency and z-score. The sixth hypothesis can be examined in this study as:

H6: There is a significant association between efficiency and z-score.

7. Foreign ownership: Alharthi (2016) found insignificant association between foreign ownership and DEA measures. However, in this paper, we can expect that the foreign ownership would

significantly increase the efficiency of Islamic banks in GCC countries. This expectation can be occurred because international banks have high capitals, more services based on their experiences and they can diversify the banking investment risks through having banks nationally and globally.

H7: There is a significant association between efficiency and foreign ownership.

8. Domestic ownership: Sufian (2007) investigated the determinants of Islamic banks in Malaysia for the period 2001-2005. The conclusion of this study proposes that there is a negative correlation between domestic ownership and efficiency. This finding highly discourages Islamic banks to open more branches.

H8: There is a significant association between efficiency and domestic ownership.

9. Public ownership: Alharthi (2016) could not find any evidence of impact from public ownership upon efficiency in Islamic banks. We expect however a significant sign as government could have great capitalisation.

H9: There is a significant association between efficiency and public ownership.

10. Listing: Yudistira (2004) estimated the efficiency of 18 Islamic banks during the period 1997-2000. The unlisted banks in this study have better efficiency scores based on a negative correlation between efficiency and listing factor. The listing hypothesis will be tested in this paper as:

H10: There is a significant association between efficiency and listing.

2.2 External variables

11. Gross domestic production (GDP): The natural case suggests that banks operating efficiently in countries with greater rates of economy growth. But, El-Moussawi and Obeid (2010) approved the opposite point of view as Islamic banks in countries with lower GDP development acting more efficiently than banks in developed economies. We can however, examine the effect of the GDP in this paper through the eleventh hypothesis:

H11: There is a significant association between efficiency and GDP.

12. Inflation: El-Moussawi and Obeid (2010) found that the inflation of GCC countries has a positive (similar to Alharthi, 2016). On other words, Islamic banks provide better quality of services in countries with higher interest rates. Based on this, the impact of inflation upon efficiency could be tested as:

H12: There is a significant association between efficiency and inflation.

13. Market capitalisation: Alharthi (2016) concludes that Islamic banks in MENA and UK are more efficient when stock market indices grow. This encourages Islamic banks to operate when stock market increase. The hypothesis of market capitalisation is:

H13: There is a significant association between efficiency and market capitalisation.

14. Global financial crisis (GFC): Noor and Ahmed (2012) confirm that Islamic banks in their study have been affected badly from the global financial crisis. This result is contrast with Alharthi's (2016) result who notes that Islamic banks in MENA and UK have been influenced positively from the global financial crisis. This approves that the economy have grown in MENA and UK through the period of the GFC (2007-2009), which is against the predictions. The hypothesis however for the GFC in this research can be conducted as:

H14: There is a significant association between efficiency and GFC.

15. Corruption control: There is no test for the corruption control in the literature review, which can be a contribution for this research. However, we expect that tighter control of corruption lead to more efficiency of Islamic banks in GCC countries overt the period 2005-2014. The hypothesis of corruption control is:

H15: There is a significant association between efficiency and corruption control.

16. Arab Spring: The expected sign for the Arab Spring is negative upon efficiency of Islamic banks in GCC countries as the whole economy of Arabic world have been impacted negatively through the period of Arab Spring. There no evidence that Arab Spring has been tested as an efficiency influential indicator in the recent studies. Thus, we can see the impacts of Arab Spring through the following hypothesis:

H16: There is a significant association between efficiency and Arab Spring.

3. METHODOLOGY AND DATA DESCRIPTION

The data in this study was extracted from two main sources: Bankscope and World Bank databases. The study investigates the efficiency in its determinants for 18 Islamic banks in GCC countries through the period 2005-2014. The DEA is divided into three measures as (1) technical efficiency (TE), (2) pure technical efficiency (PTE) and scale efficiency (SE). The DEA score are calculated through Frontier Analyst software. The DEA can be derived from comparing inputs (as fixed assets, deposits and equity) and outputs (as net income, securities and loans). Table 1 below shows the data description of inputs and outputs. The statistical models to find the determinants of efficiency in this research are generalised least square (GLS), general method of moments and Tobit regressions (which can be run through STATA 14 software).

Table 1. Descriptive statistics of the inputs and outputs

Variables	*Obs.*	*Mean (Million US$)*	*Std. Dev.*	*Min*	*Max*
Inputs					
Fixed assets	148	144.89	231.20	0.01	1283.73
Deposits	148	7803.24	11851.84	0	68856.59
Equity	148	1712.35	2116.73	90.60	11172.32
Outputs					
Net income	148	239.80	468.18	-559.40	2102.60
Securities	148	1302.90	2051.66	25	11346.53
Loans	148	6377.22	9501.73	2.10	54917.34

3.1. DEA measures

3.1.1. Technical Efficiency

The objective of technical efficiency is to obtain the efficiency through comparing the current production and the potential production. The TE scores show how well management of banks' strategies (decisions) can use inputs to achieve outputs (size of operations). So, the technical efficiency considers practical (operational) work. The efficiency situation can be maximum when the production index hits the frontier, and it gives the proportional reduction in input usage (Green, 1993). The technical efficiency can be determined as how to use inputs efficiently. Farrell (1957) defined technical efficiency as comparing the performance of a bank with its counterparts facing the same regulations, environment and technology based on production function.

Another formula is: *TE = PTE x SE,* (Banker et al., 1984)

3.1.2. Pure Technical Efficiency

Pure technical efficiency is representing the efficiency measure of management practice (performance) of transforming inputs to outputs. Greater PTE indicates that bank practically operates more efficiently. All banks strive to score the highest efficiency measure (1). The PTE has been calculated as technical efficiency divided by scale efficiency as extracted from the equation above. In fact, PTE was defined by Rosman et al. (2014) as a measurement of technical efficiency devoid of the scale efficiency effects. Additionally, PTE includes the costs of inputs and outputs compared to TE (does not consider costs of inputs and outputs) If there is any difference between TE and PTE measures of a particular bank at any year, it means that there is scale inefficiency in the same year. Gaganis and Pasiouras (2009) applied the PTE method to the Greek banking industry. In particular, they conduct a comparison between the efficiency of foreign and domestic banks. Domestic banks achieved higher PTE scores than foreign banks in Greece. However, the equation to calculate pure technical efficiency is *PTE= TE / SE* (Banker et al., 1984). In fact, pure technical efficiency (PTE) is technical efficiency under a variable-to-scale method (VRS). Another name for PTE is the BCC model from Banker, et al. (1984).

3.1.3. Scale Efficiency

The main determinant of scale efficiency is the ability to generate large size of outputs using fewer amounts of inputs. In other words higher size of banking operations (by comparing TE with PTE) means better scale efficiency which allows banks from achieving economies of scale. This study utilises scale efficiency following Garza-García (2012) studying the Mexican banking industry. Garza-García (2012) uses calculated *SE = CRS / VRS.* In the other words, *SE = TE / PTE* (Banker et al., 1984). In conclusion, any difference between technical efficiency and pure technical efficiency forces banks to have scale inefficiency.

The above information lead us to Estimate the DEA indicators based on Charnes et al. (1978) approach who provided a mathematical model for DEA as:

$$Max\ h_0 = \frac{\sum r\ ur\ yr\ j0}{\sum i\ vi\ xij0}$$

$$\text{subject to } \frac{\sum r\ ur\ yr\ j}{\sum i\ vi\ xij} \leq 1,\ j = 1,\Lambda,n \text{ (for all j)}$$

Where,

y_r - represents output data for decision making unit (DMU);

x_i - represents input data for decision making unit (DMU).

Based on the formula above we can conclude the technical efficiency as follows:

$$TE = \frac{Aggregate\ Output\ Measure}{Aggregate\ Input\ Measure} \quad (1)$$

The following study on efficiency which conducted by Banker et al. (1984) approved the following equation for pure technical and scale efficiencies:

$$PTE = Technical\ Efficiency\ /\ Scale\ efficiency \quad (2)$$

$$\text{subject to} \quad SE = Technical\ Efficiency\ /\ Pure\ Technical\ Efficiency \quad (3)$$

This means that any difference between technical and pure technical efficiencies leads to scale inefficiency. In fact, technical efficiency can be used as a formula of pure technical efficiency multiplied by scale efficiency.

3.2 GLS, GMM and Tobit models

The GLS, GMM and Tobit regressions can be run to find the determinants of efficiency of Islamic banks in GCC region through STATA 14 software. There are many reasons behind choosing these regressions. The GLS and GMM models help to control for: (1) time-invariant fixed effects through taking first-differences of all variables; (2) the autoregressive process in the data for each efficiency indicator; and (3) the potential presence of endogeneity of the explanatory variables. According to Tobit model, this regression is ideal to be used when dependent variables (DEA in this study) are varied between 0-1. It provides highly accurate and significant results in the recent studies on efficiency (such as Garza-García, 2012 on Mexican commercial banks). Using three models can confirm a robust evidence of determination. The determinants of efficiency could be internal and external factors. The internal hypotheses in this study are size of bank, capital ratio, loan intensity, return on assets (ROA), age of bank, z-score, foreign ownership, domestic ownership, public ownership and listing in stock market. On the other side the external hypotheses are gross domestic production (GDP), inflation, market capitalisation, global financial crisis, corruption control and Arab Spring. Table 2 below describes the internal and external variables in details.

Table 2. Independent variables definitions and summary statistics

Variables	*Definition*	*Obs*	*Mean*	*S.D.*
Bank-specific variables				
Size	Log (total assets)	148	8.345	1.515
Capital ratio	Capital/total assets	148	0.273	0.219
Loan intensity	Loans/total assets	148	0.484	0.241
ROA	Return on assets = net income/total assets	148	0.033	0.192
Age	Log (years since establishment)	148	2.877	0.618
Z-score	Log(Z-score), where Z-score = (ROA + capital ratio) / S.D. (ROA)	148	2.411	0.940
Foreign ownership	Dummy = 1 if a bank owned by foreign, else zero	148	0.264	0.442
Domestic ownership	Dummy = 1 if a bank owned by local, else zero	148	0.514	0.502
Public ownership	Dummy = 1 if a bank owned by government, else zero	148	0.223	0.418
Listing	Dummy = 1 if a bank is listed, o if a banks is unlisted	148	0.696	0.462
Country-specific variables				
GDP	Log (GDP)	148	25.465	1.241
Inflation	Inflation rates	148	0.159	0.281
Market capitalisation	Market capitalisation to GDP	148	0.680	0.374
Global Financial Crisis	Dummy = 1 for the period 2007-2009, otherwise zero	148	0.311	0.464
Corruption control	%, higher percentage indicates tighter control	148	73.240	11.022
Arab Spring	Dummy = 1 for the period 2011-2014, otherwise zero	148	0.453	0.499

The statistical models (GLS, GMM and Tobit) in this research can be presented in the following model:

$$Eff_{it} = \alpha + \beta_1 SIZE_{it} + \beta_2 EQTA_{it} + \beta_3 LOANSTA_{it} + \beta_4 ROA_{it} + \beta_5 LAGE_t + \beta_6 LOGZ_{it} + \beta_7 FORE_i + \beta_8 DOM_i + \beta_9 PUB_i + \beta_{10} LISTING_i + \beta_{11} GDP_t + \beta_{12} INFLATION_t + \beta_{13} MCAP_t + \beta_{14} GFC_t + \beta_{15} CCONTROL_t + \beta_{16} ASPRING_t + \varepsilon_{it} \quad (4)$$

$i = 1\ldots. n;\ t = 1\ldots.n$

Where,

Eff_{it}, - efficiency scores derived from DEA approach (TE, PTE and SE);

α - is the constant;

SIZE - is the size of bank;

EQTA - is the capital ratio;

LOANSTA - is a bank's loan intensity;

ROA - is the return on assets ratio;

LAGE - is age of bank;

LOGZ - denotes z-score;

FORE - is foreign ownership dummy;

DOM - is domestic ownership dummy;

PUB - is public ownership dummy;

LISTING - is listing in financial market dummy;

GDP - represents gross domestic production;

INFLATION - describes the percentage of inflation rates;

MCAP - is the ratio of market capitalisation over GDP;

GFC - is the global financial crisis dummy (the period of 2007-2009);

Control (Corruption control) - is the percentage of controlling corruption;

ASPRING - represents Arab Spring dummy (the period of 2011-2014);

β - denotes the regression coefficient;

ε_{it} - is the error term.

Before running GLS, GMM and Tobit regressions, the multicollinearity test needs to be done through the correlation matrix in Table 3. As a result, Table 3 indicates that the dataset has no multicollinearity. In this case, we can run the statistical models safely without any errors as all values of correlation matrix are under 70%.

Table 3. Correlation matrix for variables

	Size	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*	*(14)*
(1) EQTA	-0.616														
(2) LOANSTA	0.647	-0.612													
(3) ROA	-0.075	0.036	-0.147												
(4) Age	0.431	-0.462	0.444	-0.038											
(5) Z-score	0.417	-0.274	0.503	-0.086	0.415										
(6) FORE	-0.467	0.558	-0.505	0.137	-0.349	-0.452									
(7) DOM	0.204	-0.284	0.241	-0.080	0.042	0.085	-0.615								
(8) PUB	0.250	-0.250	0.246	-0.049	0.319	0.376	-0.320	-0.550							
(9) Listing	0.640	-0.501	0.495	-0.094	0.355	0.549	-0.338	0.209	0.107						
(10) GDP	0.693	-0.504	0.616	-0.074	0.322	0.463	-0.482	0.109	0.380	0.610					
(11) Inflation	0.217	0.066	0.091	-0.068	-0.016	0.073	-0.098	0.281	-0.233	0.090	0.194				
(12) MCAP	-0.334	0.248	-0.266	0.030	-0.077	-0.261	0.346	-0.010	-0.354	-0.291	-0.641	0.225			
(13) GFC	-0.090	0.064	-0.104	-0.008	-0.013	-0.033	0.062	0.011	-0.079	-0.032	-0.140	0.007	0.092		
(14) Control	0.273	-0.380	0.314	-0.049	0.313	0.255	-0.065	-0.363	0.504	0.273	0.314	-0.597	-0.279	-0.007	
Arab Spring	0.109	0.007	0.087	0.104	-0.104	-0.020	-0.020	-0.038	0.067	-0.019	0.147	-0.194	-0.182	-0.611	-0.008

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. DEA scores

Table 4 indicates that Islamic banks in Kuwait are the most efficient banks compared to the rest GCC countries over the period 2005-2014. The DEA mean scores are 0.967, 991 and 0.974 for TE, PTE and SE, respectively. In contrast, the highest waste of inputs occurred from Islamic banks in Saudi Arabia. The efficiency measures for Islamic banks (which considered to be the lowest) in Saudi Arabia are 0.846, 0.943 and 0.894 for TE, PTE and SE. Overall, the most efficient performance for Islamic banks in GCC countries is in 2012 (average DEA equals 0.966) while, 2008 reflects bad efficiency indicators (mean = 0.905). This result could be occurred due the global financial crisis (that happened during the

period 2007-2009). Therefore, this study attempts to test the effects of the global financial crisis upon Islamic banks in GCC countries.

Table 4. DEA scores by year and country

Type	*Bahrain*			*Kuwait*			*Qatar*			*Saudi Arabia*			*UAE*			AVG
DEA Measures	TE	PTE	SE	TE	PTE	SE	TE	PTE	SE	TE	PTE	SE	TE	PTE	SE	
2005	1	1	1	0.673	0.912	0.738	1	1	1	1	1	1	1	1	1	0.942
2006	1	1	1	1	1	1	1	1	1	0.659	0.773	0.853	0.942	0.987	0.952	0.944
2007	1	1	1	1	1	1	0.975	1	0.975	0.682	0.793	0.860	0.985	1.000	0.985	0.950
2008	0.842	1	0.946	1	1	1	0.907	1	0.985	0.674	1	0.674	0.869	1	0.869	0.905
2009	0.875	0.959	0.902	1	1	1	0.835	0.921	0.902	0.843	0.900	0.928	0.966	0.983	0.982	0.933
2010	0.993	1	0.993	1	1	1	0.988	1	0.988	0.986	0.997	0.989	0.943	0.994	0.949	0.988
2011	1	1	0.993	1	1	1	1	1	1	1	1	1.000	1	1	0.926	0.989
2012	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.996
2013	0.813	1	0.887	1	1	1	0.924	1	0.937	0.812	1	0.812	0.902	1	0.927	0.922
2014	0.838	0.932	0.899	1	1	1	0.930	0.953	0.956	0.805	0.970	0.826	0.920	0.956	0.920	0.927
Descriptive																
Mean	0.932	0.970	0.959	0.967	0.991	0.974	0.956	0.978	0.974	0.846	0.943	0.894	0.936	0.984	0.942	0.950
Std. Dev.	0.076	0.040	0.044	0.098	0.026	0.079	0.053	0.032	0.031	0.136	0.085	0.103	0.038	0.025	0.038	0.030
Min	0.813	0.892	0.887	0.673	0.912	0.738	0.835	0.920	0.902	0.659	0.773	0.674	0.869	0.921	0.869	0.905
Max	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

4.2 Discussion

Based on Table 5, we can conclude that the variables control efficiency of Islamic banks in GCC countries (over the period 2005-2014) are size of bank, lending, ROA (positive indicators), foreign ownership, domestic ownership, global financial crisis and Arab Spring (negative signs). These effects can be explained in details as follows:

Table 5. Results for the determinants of efficiency for Islamic banks in GCC region

Regressions	*(GLS)*	*(GMM)*	*(Tobit)*	*(GLS)*	*(GMM)*	*(Tobit)*	*(GLS)*	*(GMM)*	*(Tobit)*
DEA	*TE*	*TE*	*TE*	*PTE*	*PTE*	*PTE*	*SE*	*SE*	*SE*
Internal Variables									
(H1) Size	0.0511**	0.0511**	0.120**	-0.00714	-0.00101	-0.0173	0.0511***	0.0488**	0.112**
	(2.91)	(2.73)	-2.71	(-0.44)	(-0.11)	(-0.30)	(3.40)	(3.04)	-3.26
(H2) Capital ratio	0.218	0.218	0.499	0.0375	0.0485	-0.172	0.205*	0.168	0.392
	(1.94)	(1.91)	-1.82	(0.39)	(0.90)	(-0.47)	(2.22)	(1.69)	-1.87
(H3) Loan intensity	0.191*	0.191*	0.465*	0.0661	0.0964*	0.314	0.138*	0.120	0.269
	(2.28)	(2.32)	-2.2	(0.97)	(1.97)	-1.14	(2.02)	(1.85)	-1.67
(H4) ROA	0.0816	0.0816*	0.334	0.00961	0.0283	0.201	0.0603	0.0599**	0.249
	(1.35)	(2.50)	-1.23	(0.23)	(1.50)	-0.49	(1.34)	(2.61)	-1.2
(H5) Age	-0.00891	-0.00891	-0.0777	0.0180	0.0105	0.0147	-0.0131	-0.0165	-0.0659
	(-0.40)	(-0.45)	(-1.31)	(0.66)	(1.13)	-0.18	(-0.62)	(-0.95)	(-1.47)
(H6) Z-score	-0.0221	-0.0221	-0.0752	-0.0158	-0.0202	-0.0553	-0.0104	-0.00702	-0.0409
	(-1.21)	(-1.30)	(-1.65)	(-0.92)	(-1.90)	(-0.90)	(-0.67)	(-0.55)	(-1.18)
(H7) Foreign ownership	-0.0753	-0.0753*	-0.218	-0.0293	-0.0346	-0.201	-0.0593	-0.0484	-0.156
	(-1.57)	(-2.03)	(-1.81)	(-0.66)	(-1.32)	(-1.28)	(-1.45)	(-1.92)	(-1.68)
(H8) Domestic ownership	-0.0606	-0.0606*	-0.104	-0.0557	-0.0248	-0.175	-0.0571	-0.0497*	-0.0733
	(-1.67)	(-2.13)	(-1.19)	(-1.45)	(-1.58)	(-1.38)	(-1.72)	(-2.05)	(-1.09)
(H9) Public ownership									
(H10) Listing	0.000309	0.000309	-0.0814	0.0122	0.00194	-0.192	0.0104	0.00416	-0.0644
	(0.01)	(0.01)	(-0.81)	(0.28)	(0.09)	(-1.21)	(0.30)	(0.14)	(-0.83)
External Variables									
(H11) GDP	-0.0567*	-0.0567	-0.098	0.00829	-0.00134	0.0125	-0.0649**	-0.0574*	-0.0966*
	(-2.19)	(-1.78)	(-1.59)	(0.34)	(-0.07)	-0.16	(-2.97)	(-2.35)	(-2.06)
(H12) Inflation	-0.0641	-0.0641	-0.223	-0.0181	-0.0308	-0.166	-0.00116	-0.0365	-0.147
	(-0.83)	(-0.95)	(-1.14)	(-0.34)	(-0.85)	(-0.65)	(-0.02)	(-0.76)	(-0.99)
(H13) Market capitalisation	-0.0345	-0.0345	-0.00353	-0.00326	-0.0107	-0.00748	-0.0350	-0.0309	-0.00728
	(-0.68)	(-0.79)	(-0.03)	(-0.09)	(-0.40)	(-0.05)	(-0.90)	(-1.03)	(-0.07)
(H14) Global financial crisis	-0.0715*	-0.0715*	-0.195*	-0.0295	-0.0331	-0.0981	-0.0368	-0.0415*	-0.130*
	(-2.28)	(-2.44)	(-2.45)	(-1.49)	(-1.69)	(-0.95)	(-1.63)	(-2.00)	(-2.14)
(H15) Corruption control	-0.0002	-0.0002	-0.0003	-0.0011	-0.0004	-0.0045	-0.00004	-0.0004	0.0003
	(-0.14)	(-0.15)	(-0.06)	(-0.75)	(-0.41)	(-0.72)	(-0.03)	(-0.30)	-0.09
(H16) Arab Spring	-0.0608	-0.0608*	-0.183*	-0.0176	-0.0264	-0.121	-0.0332	-0.0438*	-0.127
	(-1.83)	(-2.34)	(-2.13)	(-0.78)	(-1.87)	(-1.09)	(-1.35)	(-2.17)	(-1.95)
_cons	2.023***	2.023**	0.265***	0.897	1.060**	0.282***	2.202***	2.086***	0.201***
	(3.60)	(3.00)	-9.1	(1.62)	(2.62)	-6.09	(4.56)	(4.18)	-8.9
R^2	0.4908	0.1280	0.1666	0.0682	0.0759	0.1383	0.3001	0.1460	0.2178
Number of Banks	18	18	18	18	18	18	18	18	18
Obs	148	148	148	148	148	148	148	148	148

*Note: t statistics in parentheses; * p < 0.05, ** p < 0.01, *** p < 0.001*

H1: Size of bank: the results in Table 5 report that total assets support efficiency positively especially for technical and scale efficiencies (insignificant impact on pure technical efficiency). This provides keys to Islamic banks in GCC countries to invest and operate more through their

total assets such as opening more branches. As a result, Islamic banks could increase their outputs (profits). The majority of recent studies confirm also that total assets enhance the efficiency of banks. The main reasons behind this is that larger banks could larger banks could reduce their costs (based on economies of scale approach) and they could provide more services (more outputs) than smaller banks. In addition, higher profits reduce the risks of bankruptcy compared lower earnings. Examples of study that approved the same results are Alhassan and Tetteh (2017), Alharthi (2016), Chen and Wang (2015), Rosman et al. (2014) and Noor and Ahmed (2012).

H3: Loan intensity: lending services found to be important to support efficiency as the association between DEA indicators and loan intensity is significant and positive (similar to Alharthi, 2016 and contrast with Noor and Ahmed, 2012). The loans could be provided based on deposits from clients. In this case, Islamic banks have to consider giving loans less than deposits to avoid credit risks. As know, Islamic banks do not deal with interest but the bank charge administrative fees on lending, these fees led to have better efficiency. Alhassan and Tetteh (2017) have completely different point of view as they approved that providing more loans result to inefficiency. This result indicates that the amount deposit at the period of the study (2003-2011) was relatively low, which restricted lending services.

H4: ROA: Islamic banks are listed under private sector and they activities based on business orientation. Therefore, profits are matter to achieve better efficiency and effectiveness. In addition, Islamic banks could not sustain without returns. Table 5 however approves this point of view through the positive a significant correlation between efficiency (TE and SE) and ROA. This outcome is consistent with many studies like Alharthi (2016), Rosman et al. (2014), El-Moussawi and Obeid (2011), Sufian (2007) and Hassn (2006). These studies strongly confirm the importance of earnings to efficiency in banking sector.

H7: Foreign ownership: the results in Table 5 discourage international banks to invest in Islamic banks in GCC countries as there is an evidence of negative foreign ownership sign on efficiency (TE). In this issue, international can conduct some research on different countries to find better investment areas in banking sector. Alharthi (2016) found insignificant correlation between foreign ownership and efficiency in Islamic banks.

H8: Domestic ownership: higher existence (level) of local Islamic banks decreased (worsen) efficiency (TE and SE) of Islamic banks in GCC countries significantly and negatively. This concludes also that local Islamic banks would lower their Islamic services due to avoiding inefficiency; this result is linked to Sufian (2007).

H11: GDP: Islamic banks in GCC countries could not exploit the development in economies of GCC region as the relationship between efficiency (TE and SE) is significant and negative. El-Moussawi and Obeid (2010) support this result. This finding contradict with Chen and Wang (2015) who approved that the efficiency of commercial banks in China has been influenced from economic growth (GDP) positively and significantly.

H15: GFC: The results confirm that the global financial crisis has affected efficiency of Islamic banks in GCC countries dangerously. Thus, Table 4 shows the worst DEA indicators in 2008 based on the effects of the GFC. Noor and Ahmed (2012) documents the same finding and Alharthi's (2016) results contrast with Noor and Ahmed (2012). Alharthi (2016) however claims that Islamic banks in MENA and UK have been impacted positively from the global financial crisis.

H16: Arab Spring: as expected, Arab Spring destroys Arabic world economy including MENA and GCC regions. This approves that Arab Spring made Islamic banks operating inefficiently. This is based on the significant correlation between efficiency (TE and SE) and Arab Spring variable.

5. CONCLUSION

The main aim of study is to estimate efficiency and its factors of Islamic banks in GCC countries through using DEA approach for the period 2005-2014. The Islamic banks in Kuwait scored the highest efficiency measures while, Islamic banks in Saudi Arabia found to be inefficient compared to the rest of GCC countries. In this study, GLS, GMM and Tobit models are the main statistical regressions to identify the determinants of efficiency. In banking system, banks strive to minimise their inputs and maximise their outputs. This research identified the variables that support this point of view. The Islamic banks in GCC countries can grow their total assets to increase their efficiency. Additionally, lending found to be strongly support maximising Islamic banks' profits. Furthermore, profits of banks highly determine technical and scale efficiencies. In contrast, foreign and local ownerships decreased efficiency of Islamic banks significantly. In an unexpected way, the economy growth that presented as GDP affected efficiency significantly reversely. The global financial crisis and Arab spring have influenced the efficiency of Islamic banks in GCC countries, as predicted.

The limitations of this study can be summarised as there is no consideration for some important factors such as quantitative easing, remittances and loan loss provisions. Moreover, this article focused on low number of Islamic banks in GCC region due to restricted availability of data in Bankscope.

More studies in the future can cover updated periods such as 2015 and 2016. Furthermore, more Islamic banks can be investigated by focusing more on other regions such as MENA and Asian areas. Many internal and external factors can be considered in further studies e.g. deposits, loan loss provisions and credit ratings. Finally, the most important observation, that further research can examine the impact of Arab Spring on banking sector on Arab world.

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