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Bank efficiency in Saudi Arabia: examining the impact of the global financial crisis

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Abstract:

Aim: The global financial crisis in 2008 has obstructed almost every bank around the world. This study examines the impact of global financial crisis on bank efficiency in Saudi Arabia.

Design / Research methods: This study examines the impact of global financial crisis in bank efficiency applying the data envelopment analysis (DEA) during 2006-2014. Eleven commercial banks were examined from Saudi banking sector which covers almost half of total banks of Saudi Arabia. Scale efficiency, technical efficiency and productivity of banks have been examined for assessing the impact of financial crisis overtime.

Conclusions / findings: Results reveal that banks in Saudi Arabia are inefficient in terms of technical and scale efficiency. The results also reveal these banks are not immune to the global financial crisis. Though only one bank has kept their unit efficient positions during the study period, the impact of global crisis on bank efficiency is found visible among other banks. The robustness of this study is also tested.

Originality / value of the article: The importance of this study is twofold. First, examining bank efficiency with special attention to financial crisis. Second, Saudi Arabia needs sustainable growth to be ensured. Hence, examination of impact of financial crisis on bank efficiency of Saudi Arabia will surely help the policy makers for future planning.

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Implications of the research: The findings of this study will assist the policy makers in Saudi Arabia for taking corrective measure in advance in case of such future financial crisis. Moreover, the results will be used by the managers of the respective banks for decision making and problem solving.

Keywords: slack based model, data envelopment analysis, efficiency, Saudi Arabia

JEL: C23; G21; L2

1. Introduction

Bank is the critical part of a financial system which plays an important role to economic development. If banking industry cannot execute well, the economy cannot perform as well. Thus, examining bank efficiency ensures economic growth by providing relevant and comparative performance index. There are a number of tools available for examining bank efficiency. Some studies have examined bank efficiency using financial ratios only. They only showed the relative numerical evaluation. The unique criticism of using these ratio analysis is that it provides biased results because of variable selection. Some studies have also used regression analysis. The criticism of using regression analysis is that it examines the central representativeness of a sample. Thus, examination of a lowest performer comparing to the highest performer is impossible in regression method. In recent days, a vast area of literature has used non-parametric frontier approaches for examining bank efficiency. The prime benefit of using frontier method is that it helps all other banks to compare from the unit (the highest) performer. The frontier approach is mostly two types- DEA (Charnes, Cooper 1959; Emrouznejad et al. 2008) and stochastic frontier approach (SFA) (Wanke, Barros et al. 2016). This study applies the most used DEA technique for examining bank efficiency in Saudi Arabia (Wanke, Azad et al. 2016).

The banking sector of Saudi Arabia is one of the fastest growing markets in the world. Many banks in Saudi Arabia have been conducting their activities as a competitor with each other. The growing interest of academics on this banking sector reflects the importance of studying bank efficiency (Emrouznejad, Anouze, 2009). The main objectives of this study are to identify bank efficiency among the

selected Saudi banks using DEA and to measure the impact of global crisis on banking sectors in Saudi Arabia. This study takes 11 banks' data out of 24 banks in Saudi Arabia representing almost half of the total banking sector. Data was collected from the bankscope[1] database. This study includes one output[2] and three inputs[3].Here most of the banks are conventional banks. Net interest margin is used as output. For calculation of efficiency, traditional DEA has applied.

The findings of this study make contributions in twofold: contributions to the management decision makings, and examine efficiency levels before and after financial crisis. The results also reveal that Saudi banks are not immune to the global financial crisis (GFC). Though only one bank has kept its unit efficient positions, the impact of global crisis was visible among the efficiency scores for other banks. This study assists to the decision makers for setting financial strategies, managerial plans and also helps to increase bank efficiency positions on banking fields.

This study consists of another five sections. Section two shows the banking sectors overview and Section three presents a brief literature review. Next Section explains methodology. In methodology chapter, the evolution of DEA and its application in banking sector is described. Afterward, Section five critically examines the results and analysis of this study. Finally, Section six discusses conclusion.

2. Overview of banking sector in Saudi Arabia

Saudi banking sector is one of the world largest and fastest banking markets in the world where 24 commercial banks, of which 12 domestic banks & 11 foreign banks are operated currently. Many banks in Saudi Arabia have been facing healthy competition. In 2008, global financial crisis was created a negative impact in Saudi Arabia banking sectors as a result, many banks failing their efficiency position. But

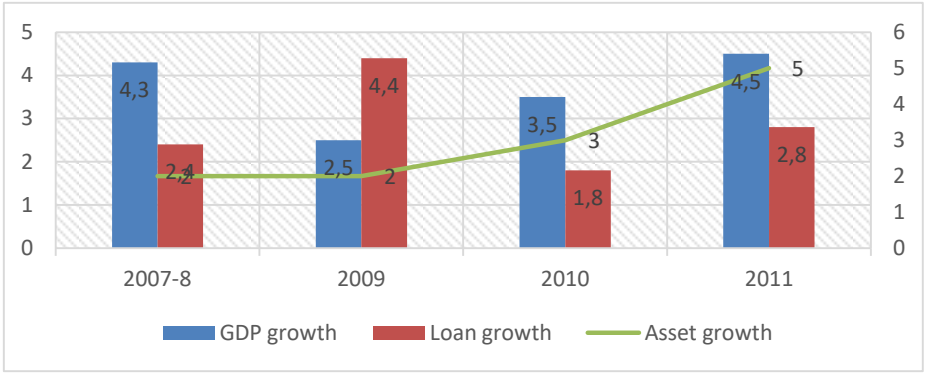
[1] Bank-scope is a comprehensive, global database of banks' financial statements, ratings and intelligence. Its coverage of banks is unique. Bank scope has information on 32,000 banks and is the definitive tool for bank research and analysis

[2] Net interest margin

[3] Loans, equity and total assets

Saudi banking industry registered impressive positive growth in these periods. Because of their strong financial policies and government reserves, Saudi banking sector could recover its position. Earlier study reveals that Saudi banking sector's growth rate reached 13.6 percent where loan growth rate expanding to 12.2 percent during 2007-10. Saudi banks' performance and GDP growth continued ups and downs and their real GDP growth during 2007-10 (2.7%), 2009 (.6%), 2010 (3.8%), 2014 (3.6%) but Saudi Arabia is most benefited of its high oil prices which protects global economic distress. The overall banking and economic growth in Saudi Arabia is shown below.

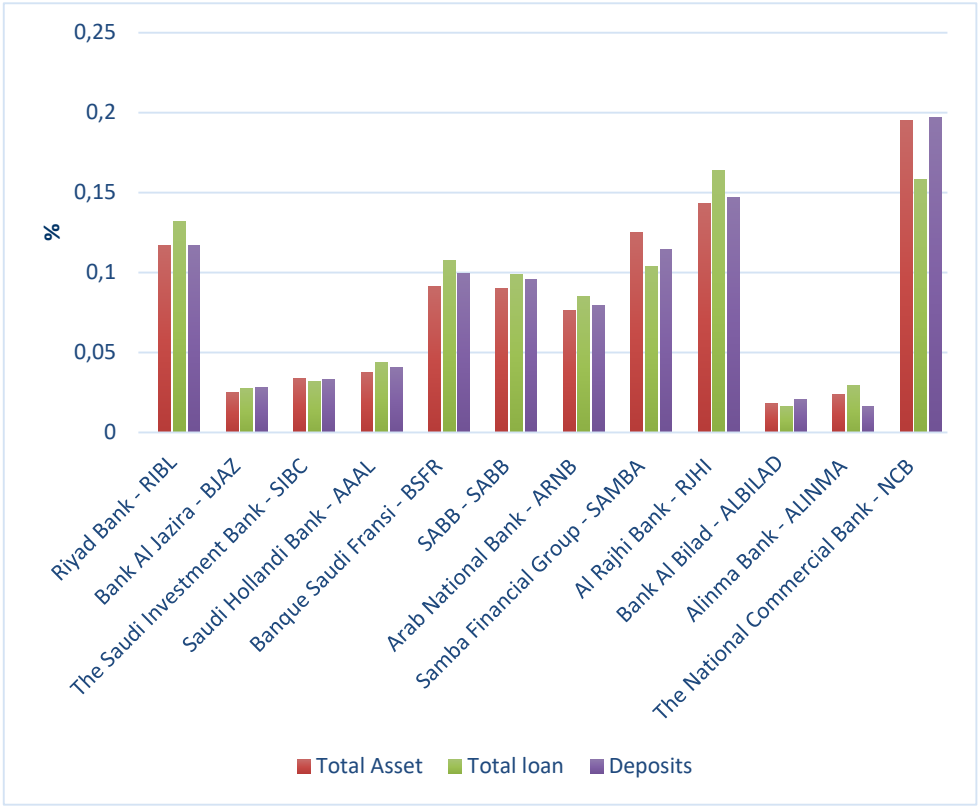
Figure 1: Saudi Arabia banking sectors and economic growth



Source: Ministry of economics and finance, Saudi Arabia

Figure **1** shows that Saudi Arabia banking industry and economic condition had ups and downs during the study period. In this sector, GDP growth was different during the study period 2007 to 2011. Banking loan ratio was fluctuating for GFC where ratio was 2.4 to 4.4 to 1.8 to 2.8 noticed that in 2010 the banking industry sectors were very weak position for GFC where loan ratio was only 1.8, that is less than the ratio of previous year but they were improving their condition.

Figure 2: Individual performance of banks in Saudi Arabia (SAR-Billion)



Source: Authors' calculation based on Annual Report SAMA 2012 in Saudi Arabia

Figure 2 shows that shows that total asset ratio was 97.47 percent of total bank assets, total loans conducting was 99.80 percent of total amount and they gains 98.94 deposits holders of banking industry sectors where average banking performance was good during the study periods. Literature also reveals that banks in Saudi Arabia have strong capitalization according to international standards, and they maintains the average Basal capital law or ratio like as 16% in 2008 (15.9% in September 2009). It is remarkable that all Saudi banks follow Tier 1 capital ratio under BASLE criteria. In addition, the performance and quality of Saudi Banks are very strong by their asset conditions where non- performing loans amount were 1.4 % of total loans at end-2008, while 153% was provisions coverage .NPL remained

below 3% at September 2009. Banks maintained their highly liquid capacity where liquid assets representing an average ratio of 34% of total customers deposits in 2008. The healthy situation prevailing at end-September 2009 has continued unabated, with a liquidity ratio at over 30%.

3. Literature review

This study drew the sample banks from Saudi Arabia over the period 2006-2014. The empirical results from static and dynamic panel regression indicate that there is a positive relation between economic growth and institutional quality of institutions in Saudi Arabia has a positive effect of banking concentration on economic growth (Al-Khathlan, Malik 2010). Almumani (2013) found that Saudi banks are more efficient than others banks in this region and he also said that commercial banks are developing their new technology and providing more services. A research by Srairi (2013) examined the efficiency of Islamic banking sector in Saudi Arabia. The results from data envelopment analysis (DEA) indicate that Saudi Arabia Islamic banks have showed a higher mean technical efficiency relative to Asian Islamic banks. Moreover, they showed that Islamic banks from this region are dominating the efficiency frontier. Another study also said that Saudi Arabia banks were in an efficient position by their management of financial resources (Al-Khathlan, Malik 2010).The findings suggest that capital variables (equity to assets and equity to liabilities), net profit revenue on average assets, and loan to total assets have positive influences on Islamic bank profitability. On the other hand, loan loss provision and cost to total income have a negative impact on Islamic bank profitability (Sufian, Mohamad Noor 2009). The findings suggest that domestic banks had better performance relative to the foreign banks during the crisis. This study also found that the liquidity ratio has a negative effect on profitability but size was found to be insignificant determinant of profitability. Moreover, net interest revenue had a positive effect, and GDP is also found to be positively affecting the profitability of domestic banks (Mongid 2016). He examined whether the profitability of Islamic banks is affected by the same factors that affect the conventional banks, using data of 6 Islamic Banks from Saudi Arabia during the

period of 1994 to 2012. The findings suggests that capital variables (equity to assets and equity to liabilities), net profit revenue on average assets, and loan to total assets have positive influences on Islamic bank profitability.

On the other hand, loan loss provision and cost to total income have a negative impact on Islamic bank profitability (Sufian, Mohamad Noor 2009). They have investigated the relationship between cost efficiency and competition in the banking industry of 10 MENA countries (i.e. Lebanon, Bahrain, Algeria, Egypt, Israel, Jordan, Morocco, Oman, Saudi Arabia and UAE) over the period 1997-2011. Level of competition was measured through the structural indicator popularly known as H-statistics. And the bank efficiency is estimated through Data Envelopment Analysis (DEA) and the Bootstrap Data Envelopment Analysis (BDEA). This study found that efficiency granger-causes the competition. This cause is found to be negative, implying that progress in terms of cost efficiency lowers the competition. The empirical findings also showed that average cost efficiency in the MENA banking region was relatively high (77.6%). This implies that MENA banks need to improve only by 22.4, to reach the cost efficiency frontier (Rahman, Rosman 2013).

4. Methodology and data

Nowadays, many studies on efficiency use many methods for their research tasks. Data envelopment analysis (DEA) is one of them. It is a data oriented approach for evaluating performance of decision making units (DMU) with multiple inputs and outputs. DEA is founded by Farrell (1957) and is developed by Charnes, Cooper, and Rhodes (1978). DEA proves an uncovering relationship that's hidden from others methodologies. This means one is the efficiency score particularly according to DEA methods where applied a mathematical programing model to observational data that provides a new way of empirical estimation of relations like as production function or efficient function possibility surfaces. DEA is a statistical approach that compares each DMU with the best DMU. DEA usually use for both production and cost data and utilizing the selection variables with unit cost and outputs. Farrell (1957) established the beginning of measuring efficiency through his study "the measurement of productive efficiency". In his study, a firm consists of

technical efficiency and allocative efficiency where technical efficiency measures outputs from a certain amount of inputs of a firm. And allocative efficiency measures the ability to utilize inputs by best possible mixture. Technical efficiency can be separated into part of scale efficiency and pure technical efficiency where technical efficiency helps the management implement effective plans–converting inputs into outputs.

Figure 3-a. Technical and allocative efficiencies: case of two inputs, normalized by single output

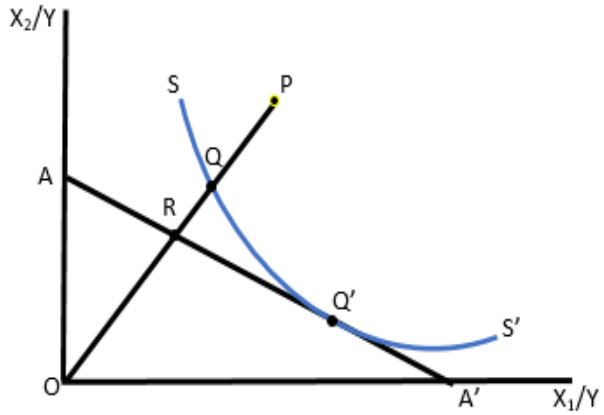
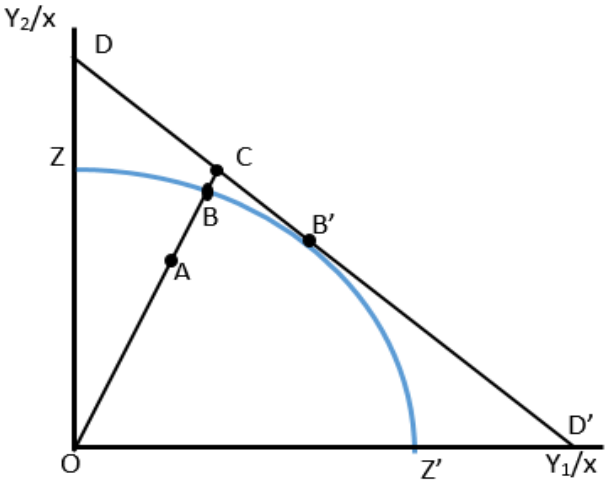


Figure 3-b. Technical and allocative efficiencies: case of two outputs,



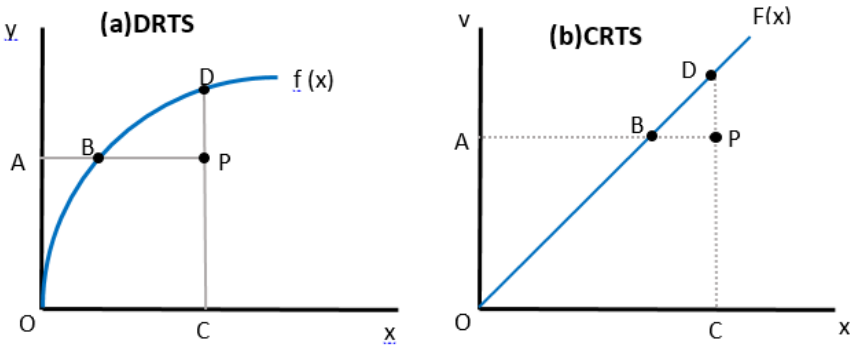
normalized by single input"

If a firm represents only two inputs (X1 and X2) and one output (Y) under the constant returns to scale (CRS) assumption according to figure 3 (both a and b). The SS˙ curve represents that the firm is fully efficient by technical efficiency. But a firm is operating at the TE point P that we assume an inefficient firm. TE can be measured by TE = OQ/OP =1-QP. And point p measure the allocative efficiency which means: AE = OR/OQ (according to figure 3a). At the point Q indicates the technical efficiency where production cost of a firm decrease by RQ and the firm overall efficiency is measured by: OE=OR/OP. Overall efficiency of a firm means: TE × AE = OQ OP × OR OQ ≡ OR OP = OE.

Output-Oriented Measures

Figure 4(a) indicates the decreasing return to scale by f(x) and at the point p represent the inefficient position of a firm. Prof. Farrel input-oriented measured by TE that's equal to AB/AP ratio and output-oriented measurement point is CP/CD. And output-oriented measures will provide technical efficiency of equivalent measure where CRS exist (Färe, Lovell 1978) Figure 4(b) shows that CRS is censured where AB/AP=CP/CD for any inefficient point P. One can consider only output-oriented measures by considering the case where production involves two outputs (y1 and y2) and one input (x1).

Figure 4: Technical efficiency measures and returns to scale: Case of single input-single output



Here, AB represent the distance of TE. Where output-oriented TE ratio is TE=OA/OB. By price information we can draw the ISO revenue line and define the allocative efficiency to be AE = 0B/0C[4] according to the figure 3b. The Banker, Chames and Cooper model (BBC) allows a flexible construct for the DMUs and presents with piecewise linear function. Similar to CCR model, the BCC model reduces multiple input-output using a virtual input and a virtual output; as shown in equation below.

$$Maximize\ \theta_{BCC} = \frac{\sum_{r=1}^{s} u_r Y_{r0} - \widetilde{u_0}}{\sum_{i=1}^{m} v_i X_{i0}}$$

$$Subject\ to: \frac{\sum_{r=1}^{s} u_r Y_{rj} - \widetilde{u_0}}{\sum_{i=1}^{m} v_i X_{ij}} \leq 1; j = 1, \dots, n$$

$$\theta_{BCC} = efficiency\ estimation\ under\ BCC\ model$$

$X_{ij} \geq 0$; i^{th} input to unit j

$v_i \geq 0$; Corresponding weight to i^{th} input

$Y_{rj} \geq 0$; r^{th} output to unit j

$u_r \geq 0$; corresponding weight to r^{th} input

$\widetilde{u_0}: unrestricted$

The new variable $\widetilde{u_0}$is included in order to estimate economics of scale. Where,

$\widetilde{u_0} = 0$, means θ_{BCC} is equivalent to the CCR model

$\widetilde{u_0} > 0$, means the DMU is operating under IRS

$\widetilde{u_0} < 0$, means the DMU is operating under DRSs

[4] Efficiency: Efficiency means the getting maximum output with minimum input. And we also say that efficiency is the ratio of output with input of any system.
Resources process to output to efficiency target.
Technical Efficiency: reflects the ability of a firm to obtain maximal output from a given set of inputs. TE=OQ/OP which is equal to one. It will be take value between 0 and 1.
Allocative Efficiency: reflects the ability of a firm to use the input in optimal proportions given their respective prices.
Economic efficiency =OR/OP and overall economic efficiency = TE+AE
Scale efficiency means the properly uses of input ratio by which gets optimal proportions a firm
VRS: when more relation occurred.
CRS: 1 to 1 relation

5. Results and Analysis

The results obtained from the DEA and Malmquist DEA calculations are presented in Table 1.

Table 1. Table of efficiency of banks in Saudi Arabia (2006 to 2014)

	2006	2007	2008	2009	2010	2011	2012	2013	2014
Al Rajhi Bank	1	1	1	1	1	1	1	1	0.872
Arab National Bank	1	0.83	0.882	0.756	0.857	0.693	0.765	0.745	1
Bank AlBilad	1	1	1	1	1	1	1	1	1
Bank AlJazira JSC	1	1	1	1	0.676	0.672	1	1	0.798
Banque Saudi Fransi JSC	0.671	0.639	0.668	0.623	0.646	0.612	0.63	1	0.77
National Commercial Bank	0.666	0.663	0.812	0.932	1	1	0.957	0.678	1
Riyad Bank	0.749	0.753	0.481	0.471	0.455	0.534	0.628	0.719	0.871
Samba Financial Group	0.862	0.82	0.767	0.761	0.721	0.629	0.664	0.752	0.808
Saudi British Bank JSC	0.941	1	1	0.963	1	0.752	0.721	0.765	0.869
Saudi Hollandi Bank	1	1	1	1	1	0.652	0.748	0.661	0.846
Saudi Investment Bank	0.854	0.703	0.732	0.572	0.694	0.68	0.668	0.952	0.656
Mean value	0.895	0.867	0.862	0.84	0.837	0.769	0.815	0.856	0.874

Source: Authors' own elaboration.

Table 1 compares the efficiency of banking industry in Saudi Arabia between the years 2006 and 2014. The period was divided into two parts of banking performance one is 2006 to 2009 and another is 2009 to 2014. It can be clearly seen that the efficiency of banking industry is gradually increasing and decreasing among banks in Saudi Arabia like as Al Rahim Bank Public Joint Stock Company, Arab National Bank, Public Joint Stock Company, Bank AlBilad, Bank AlJazira JSC, Saudi Hollandi Bank were efficient in 2006 where banks efficient ratio is 1. But others banks like as Banque Saudi Fransi JSC (0.671), National Commercial Bank (.666), Riyad Bank (0.749), Samba Financial Group (0.862), Saudi British Bank JSC (0.941) and Saudi Investment Bank (0.854) showed weak performance in this period. Which means inefficient score of the banking sectors in Saudi Arabia. After three years, the graph shows that Al Rajhi Bank Public Joint Stock Company, Bank AlBilad, Bank AlJazira JSCand Saudi Hollandi Bank were in an efficient position for their strong bank assets, liquidity.

However, Arab National Bank lost its position gradually form 1 to 0.83 from 0.882 to 0.756 because of a failure in their operational tools as decreasing loans (66811 million), gross loans (68268.4) ,net interest rate and interest margin (2.996), ROAA (2.044), ROAE (17.434),interbank ratio, net loans total assets (60.574), total deposits (72.716) etc. Unfortunately, Saudi Investment Bank, Riyad Bank and Samba Financial Group reduced their efficient ratio gradually because of their poor environment as loans, assets, and interest. Another cause was the global financial crisis in this region in 2008. For this cause banks were negative affected of their core function. And for this causes Saudi British Bank JSC lost their efficient position because this bank was 94% efficient ratio and next year the banks was increasing their ratio and achieved the efficient position in the banking sectors but after 2008 the bank lost their efficient level again. This study shows that overall banking performance and efficiency level were gradually weakened like as from 0.895 to 0.867 to 0.862 to 0.84 during the financial crisis period.

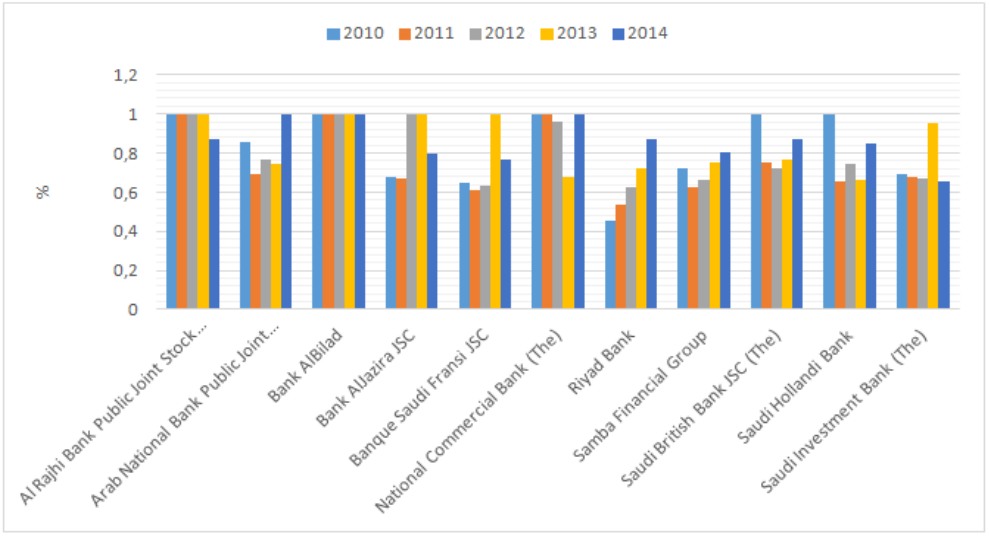
After the financial crisis, banks of Saudi Arabia were improving gradually. And their financial operation sectors were expanded. This means their efficiency score were increasing in most of banks in this region like as Arab National Bank Public Joint Stock Company 0.756(2009), 1(2014); National Commercial Bank 0.932(2009), 1(2014); Riyad Bank 0.471(2009), 0.871(2014); Samba Financial Group 0.76(2009), 0.808(2014); and Saudi British Bank JSC 0.963(2009), 0.869(2014). And many banks were moved to the efficient position because of their positive environment for banking operation by expanding their loans, gross loans, ROAA, ROAE, net loans, total assets and total deposits, etc. On the other hand, many banks diminished were declined from their efficient position. Many banks could not keep their efficient position for individuals, government laws and environmental conditions like as Saudi Investment Bank, Banque Saudi Fransi JSC, Bank AlJazira JSC, Al Rajhi Bank Public Joint Stock Company. Inefficient ratios were 29%, 23%, 21% and 13%. Bank AlBilad was in an efficient position, though their bank asset and loans ratio observed ups and downs, this bank kept their efficient scores from 2006 to 2014 as a result their managerial and operational quality.

Figure 5 shows the efficiency scores for the sample banks from 2006 to 2009. In those years the global financial crisis is included. Global Financial crisis brought about less efficient position than other periods in the banking industry in Saudi Arabia. But, many banks were in an inefficient position before global financial crisis in 2008. As Banque Saudi Fransi JSC, National Commercial Bank, Riyad Bank,Samba Financial Group, Saudi Investment Bank were inefficient from 2006 to 2007 where their loans, gross loans, total earnings assets, total customer deposits, total equity and liabilities were increasing but their net interest margin and net loans were decreasing at this period as a result they become gradually inefficient.

However, global financial crisis widely affected the Saudi Arabia banking sectors. Because many banks are foreign banks in Saudi Arabia so it is a worldwide problem have a negative impact on banking sector efficiency gradually where duration was much longer from 2007 to 2009. Like as Arab National Bank Public Joint Stock Company is from 1 (2006) and 0.756 (2009). Banque Saudi Fransi JSC from 0.671 (2006) and 0.623 (2009). Riyad Bank from 0.749 (2006) and 0.471 (2009). Saudi Investment Bank from 0.854 (2006) and 0.572 (2009).

Finally, many banks were inefficient during the financial crisis period in Saudi Arabia. In this period, many banks lost their efficient score because of a failure in their loans, gross loans, total earning assets and interest margin, etc. As a result, most of the banks were gradually losing efficiency according to the table 1 (0.895 to 0.867 to 0.862 to 0.84) from 2006 to 2009.

Figure 5. VRS efficiency levels after GFC in Saudi Arabia banking sector

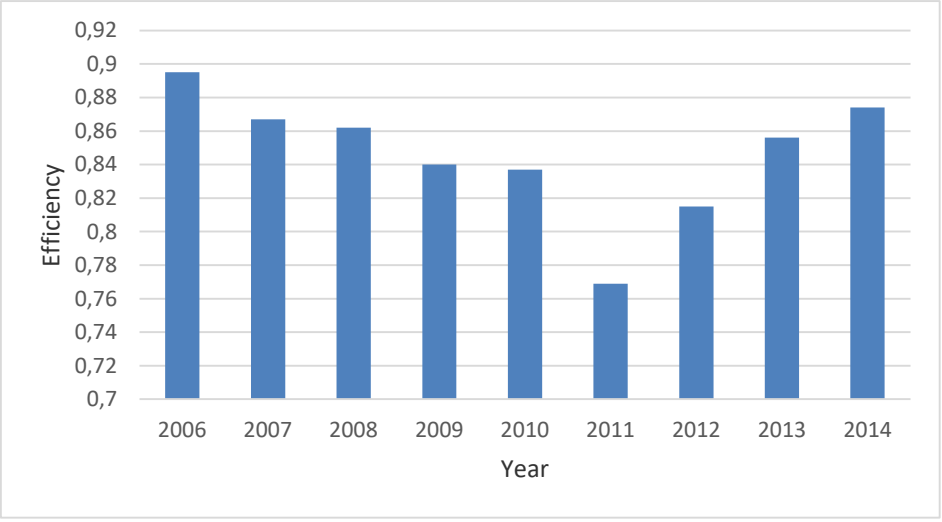


Source: Authors' own elaboration.

Figure 5 shows that banking efficiency level after GFC from 2010 to 2014. Figure 5 shows banks efficiency levels after global financial crisis in Saudi Arabia banking industry during the coverage period from 2010 to 2014. Though, financial crisis is a vital problem all over the world and it is a long term process for recovering that's why it is impossible to achieve an efficient position for any financial institutions rapidly. However, most of banks in this region tried to move from their bad position as possible as fast. That shows above VRS mean in table 1 where overall banks performance is better than GFC period. Like as Arab National Bank Public Joint Stock Company (0.857-0.693-0.765-0.745-1), Banque Saudi Fransi JSC (0.646-0.612-0.63-1-0.77) here after GFC banks became into an efficient position, but they lost their position because of changing net interest margin (2.33-2.422). Riyad Bank (0.455 to 0.534 to 0.628 to 0.719 and 0.871), Samba Financial Group (0.721 to 0.629 to 0.664 to 0.752 to 0.808); but many banks could not achieve an efficient level such banks are increasing their efficient scores. Finally, note that, only one bank kept their efficient position and market position from 2006 to 2014. Bank AlBilad is a private bank. This bank kept its efficient position in the global and local market from 2006 to 2014. That is loans, gross loans total earning assets, total equity and total customer deposits were decreasing ~~a~~ in the period of

global financial crisis but this banks kept their efficiency position because of their strong managerial policies. At this time, largely increased recurring earning power, ROAE, ROAA, net interest margin and equity of the Bank AlBilad; that is why it kept their efficiency level because in this bank loans, gross loans and total earning assets, total equity, and total customer deposits were expanding after GFC from 2006 to 2014. Figure 6 shows that Saudi Arabia banks were inefficient during period from 2006 to 2014. Where inefficient score was 0.895 in 2006 and 0.874 in 2014.

Figure 6. Average efficiency score from VRS mean in Saudi Arabia banking sector annually



Source: Authors' own elaboration.

We now test the robustness of the derived results from DEA calculation from the two different independent sample groups (before and after financial crisis). Coakes and Steed (2003) demonstrated that with an even sample distribution, the Mann-Whitney test is the most relevant test.

In table 2, the parametric t-test results reveal that bank efficiency after economic crisis has scored higher with a value of 0.782 whereas local banks are marked with 0.467. In terms of bank efficiency, after crisis efficiency scored 0.782 which is higher than before crisis score. Similar result is observed in both the Mann-Whitney

test and Kruskall-Wallis test as shown in table 2. All results are significant at either the 1% or 5% level.

Table 2. Summary of robustness of test results

	Test groups					
	Parametric test		Non-parametric tests			
	t-test		Mann-Whitney test		Kruskall-Wallis test	
Test statistics	t(Prb>t)		z(Prb>z)		X^2(prb> $X^{2)}$	
	Mean	t	Mean rank	z	Mean rank	X^2
Bank Efficiency						
Before Crisis	0.467	-1.561***	43.21	-2.245**	53.17	6.001**
After Crisis	0.782		58.05		59.35	

Note: ** and *** indicate significance level at the 5% and 1% levels respectively.

6. Conclusions

This paper investigates efficiency of banks in Saudi Arabia with special consideration of global financial crisis in 2008. The findings reveal that majority of Saudi banks were found inefficient during the study period. The average efficiency in the year 2006 was 0.985 and 2014 was 0.874 (c.f. Table 1). This particular finding implies that these banks have been facing negative productivity during the crisis period. However, only one bank (Bank Al-Bilad) kept its efficiency score as unit efficient during the study period. The banks in Saudi Arabia got rid of global financial negative effects by providing sound management tools, credit and deposit facilities, foreign exchange services, strong trade securities, investment banking, expanding branches & ATMs service, and government finance etc. Thus, Bank Al-Bilad should be benchmarked with other Saudi banks since this bank was found to be efficient. This paper verified that the global financial crisis had significant impact on banking sector of Saudi Arabia.

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Wydajność banków w Arabii Saudyjskiej: ocena wpływu globalnego kryzysu finansowego

Streszczenie

Cel: Globalny kryzys finansowy z 2008 roku utrudnił funkcjonowanie niemal każdego banku na świecie. Niniejszy artykuł ma na celu ocenę wpływu globalnego kryzysu finansowego na wydajność banków w Arabii Saudyjskiej.

Metodyka badań: Artykuł określa wpływ globalnego kryzysu finansowego na wydajność banków poprzez zastosowanie metody obwiedni danych (ang. data envelopment analysis (DEA)) dla danych z lat 2006-2014. Przebadano 11 komercyjnych banków należących do saudyjskiego sektora bankowego, co stanowiło niemal połowę wszystkich banków w Arabii Saudyjskiej. Aby ocenić wpływ kryzysu finansowego w czasie, uwzględniono wydajność skali, wydajność techniczną oraz produktywność banków.

Wnioski: Na podstawie wyników można stwierdzić, że banki w Arabii Saudyjskiej są niewydajne pod względem wydajności technicznej oraz skali. Ponadto banki te są nieodporne na globalne kryzysy finansowe. Chociaż tylko jeden bank utrzymał swoją pozycję w ramach wydajności jednostkowej, wpływ globalnego kryzysu na wydajność banków jest widoczna w odniesieniu do pozostałych przeanalizowanych banków. Przetestowano także solidność przeprowadzonego badania.

Wartość artykułu: Niniejsze badanie ma podwójne znaczenie. Po pierwsze, przeanalizowano wydajność banków ze szczególnym uwzględnieniem kryzysu finansowego. Po drugie, w Arabii Saudyjskiej należy zapewnić zrównoważony wzrost. Z tego względu określenie wpływu kryzysu finansowego na wydajność banków w Arabii Saudyjskiej z pewnością wesprze decydentów politycznych w przyszłym planowaniu.

Implikacje badań: Wyniki badań zaprezentowane w artykule będą służyć politykom w Arabii Saudyjskiej podczas podejmowania zawczasu odpowiednich kroków w przypadku przyszłego kryzysu finansowego. Co więcej, wyniki będą wykorzystane przez kierowników banków w podejmowaniu decyzji oraz rozwiązywaniu problemów.

Słowa kluczowe: Slack based model, metoda obwiedni danych, Arabia Saudyjska
JEL: C23; G21; L2