

Bank Efficiency and Oil Price Volatility: A View from the GCC Countries

Ammar Jreisat ^{1*}, Somar Al-Mohamad ²

¹ Department of Economics and Finance, College of Business Administration, University of Bahrain, Zallaq, Kingdom of Bahrain.

² College of Business Administration, American University of the Middle East, Eqaila 54200, Kuwait.

Abstract

The study investigates the banks' efficiency in the Gulf Cooperation Council (GCC) countries' members (GCC). The efficiency of the banking sector is a cornerstone in the financial development of a country. It has also become a prominent label in both economic and financial lexicons due to the lucid importance of the financial intermediation function it provides. The banking industry is considered the backbone of the financial system in oil exporting countries of the GCC region. In general, the advancement and stability of the banking sector are inextricably related to the total economic output as measured by the GDP and to the stability of the financial system in particular. This study aims to evaluate how efficient banking is in the six countries of the GCC bloc, and to assess the effect of the oil price shock in 2014 on the bank's efficiency in these countries. This study employs the 2-stage Data Envelopment Analysis (DEA) methodology for this aim. This model assigns efficiency scores for GCC banks over a period of time from 2008 to 2016 in the first stage. The second stage of the model regresses the aforementioned efficiency scores against a variety of financial and macroeconomic variables to depict the main determinants of bank efficiency and to assess the banking sector's resilience to global shocks as well as to macroeconomic conditions. The empirical outcomes of this study indicate that the global financial crisis (GFC) in 2008 and the oil price shock in 2014 had a significant negative impact on the efficiency scores of the GCC banks. The findings also show that domestic macroeconomic indicators have a greater impact on bank efficiency than institutional or bank-specific variables.

JEL Classifications: E6, E44, Q4, G21

Keywords:

Oil Price Volatility;
Bank Efficiency;
Financial Development;
Global Energy Trends;
Macroeconomics Factors.

Article History:

Received: 23 September 2021
Revised: 29 January 2022
Accepted: 12 February 2022
Available online: 18 April 2022

1- Introduction

The Gulf Cooperation Council (GCC) was formed in 1981 and comprises six member countries: Bahrain, Kuwait, Saudi Arabia, Qatar, Oman, and the United Arab Emirates, with the intention of advancing coordination and cooperation among member states in various aspects of economic and financial affairs. Oil exports and banking services alike have played a crucial role as the main economic growth engines and fiscal stance stabilizers of the GCC members. The GCC countries represent the backbone of the world energy market as Kuwait, Saudi Arabia, and UAE are listed among the world's top 10 oil exporters (with \$133.6, \$49.3, and \$38.2 billion in value, respectively), in addition to their share of almost 65.4% of crude oil reserves in the world [1]. Figure 1 shows the location of the six countries that comprise the GCC bloc.

* **CONTACT:** abarham@uob.edu.bh

DOI: <http://dx.doi.org/10.28991/ESJ-2022-06-03-07>

© 2022 by the authors. Licensee ESJ, Italy. This is an open access article under the terms and conditions of the Creative Commons Attribution (CC-BY) license (<https://creativecommons.org/licenses/by/4.0/>).



Figure 1. GCC Countries' Map, and Location

The financial industry in GCC countries is largely dominated by the banking sector, which has been marked by its paramount contribution to the GDP outputs of member countries. In 2018, the percentage of total assets controlled by GCC banks to their national GDPs ranged from 56% in Oman (lowest among GCC), to 136% in Bahrain (the highest among GCC) [2]. The banking industry also plays a vital role in cushioning the budget deficit and allocating funds for different sized business enterprises. The repercussions of the GFC had reverberated beyond its main epicenters, and despite the relative segmentation of the banking sector in GCC countries from their developed counterparts. Nevertheless, banks in the majority of GCC countries experienced a significant oscillation in their profit as they were deprived of foreign deposit flows from the rest of the world [3]. Consequently, policymakers in the region have adopted new protection regulations aimed at enhancing the resilience of the regional banking industry to future political, financial, and economic crises. Figure 2 depicts the proportion of each GCC country in this study.

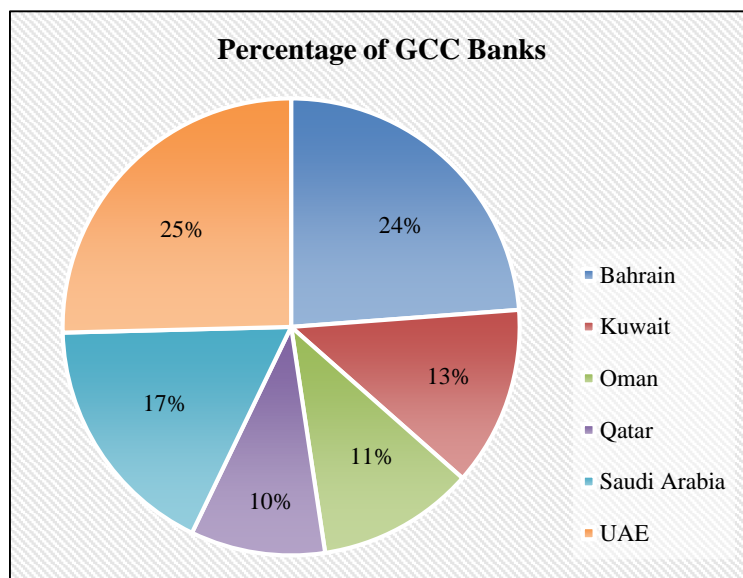


Figure 2. Number of banks per each GCC country in this study

Unfavorable oil price shocks, on the other hand, are also considered to have been an underlying source of financial and macroeconomic volatility in the GCC region. The recent oil price shock in the mid-2014 has caused a profound effect on the fiscal position of the GCC countries analogously. Consequently, the monetary and financial authorities in GCC countries have abruptly decreased their domestic expenditures and reduced subsidiaries to small and medium

enterprises. The main imperative repercussions of the oil price shock were substantially reflected in the decline in banks' performance in the aforementioned countries, such a deterioration in their financial positions in general and low levels of liquidity in particular due to the spike in non-performing loans and the drought of loan provisions on banks' balance sheets [2]. The banking sector in GCC countries gained substantial importance since the inception of the privatization and partial deregulation of financial system during the end of 1990s due to their paramount role in liquidity transformation among borrowers and savers, in addition to their inextricable contribution to the national economic growth rates and fiscal stability. Therefore, the resilience of banking research on bank efficiency in the GCC region has come to the fore over recent years. Figures 3 and 4 demonstrate the crude oil prices and the price changes, respectively, between 2008 and 2016.

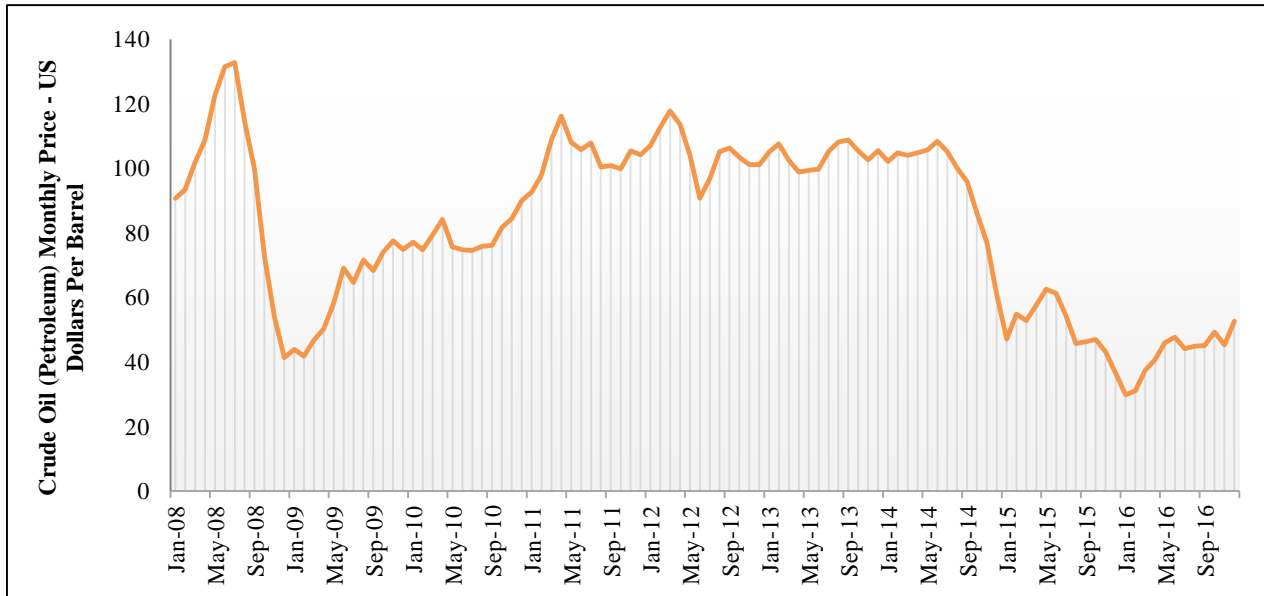


Figure 3. Crude oil price

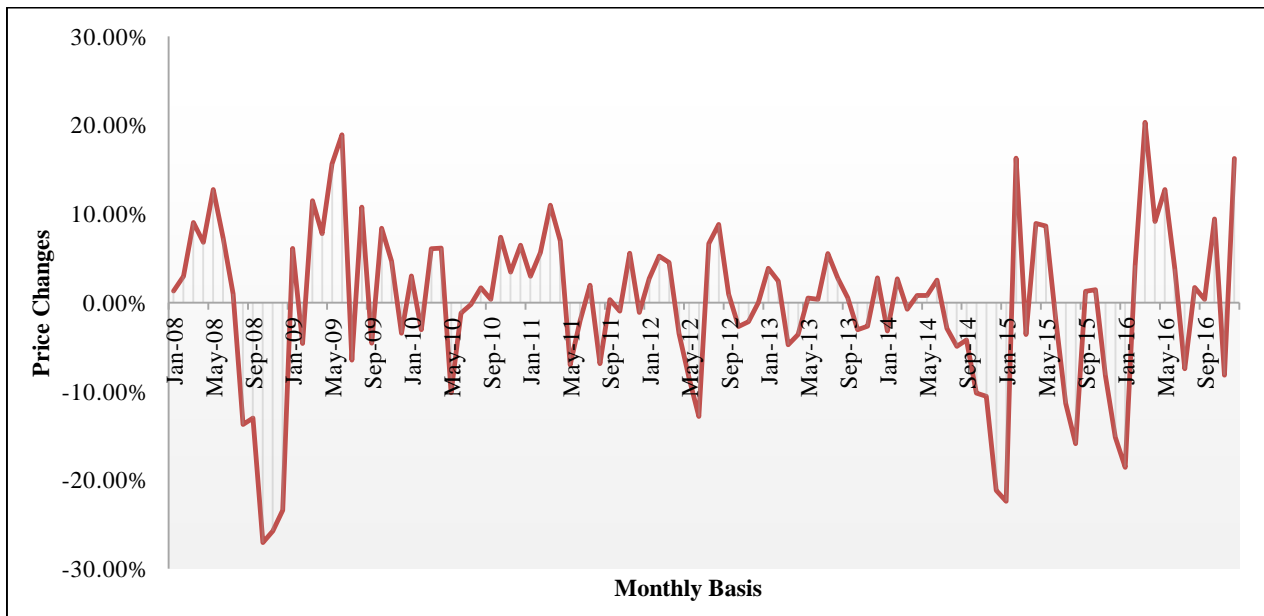


Figure 4. Crude oil price Changes

As can be seen in Figure 3, the crude oil price has significantly dropped in 2008 and 2014. These declines have led to noticeable vulnerability of the monetary and fiscal conditions in the GCC member countries due to their heavy reliance on oil exports. With respect to previous empirical work that has either prognosticated the effect of financial crises on banks' efficiency in the GCC region or have assessed the impact of regional instabilities on banks' performance in this bloc. However, and to the best of our knowledge, there is a dearth of research into the effect of immense shock in oil prices in 2014 on efficiency levels of banks in the GCC region. This paper also revisits the impact of the GFC in 2008 on banks' efficiencies in GCC countries in order to investigate if the crisis impact has led to long-run, or short-lived, systematic regime changes in efficiency scores of banks in the aforementioned region. Research in this paper aims at filling this

gap in literature by employing the 2-stage DEA methodology introduced by Coelli et al. (2005) [4]. This research technique assigns efficiency scores to GCC banks in first stage, and then investigates the impact of multiple impulses in macroeconomic and financial variables on the efficiency score in the second stage. To sum up, we believe that, beyond measuring the banks efficiency in GCC region, this paper will add value to policy makers, researchers, and investors alike as it will shed the light on the main causes of potential instability of banking performance in GCC region.

The rest of this study is designed as follows: section two presents the previous literature, section three will define the dataset used in this paper, section four will identify and describe the methodology, section five for results and analysis, section six for results implications and recommendations, section seven for limitations and future research, and finally section eight for concluding remarks.

2- Literature Review

A main strand in literature measured banking efficiency and performance has evolved in the last couple of decades. The empirical work in this field has utilized both of economic and accounting approaches to examine the banking sector efficiency, where the former is mainly based on the notion of; distance from optimal frontier (optimal frontier equals banks with highest profit divided by the ones of lowest cost among the studied sample), the latter however utilized the fundamental analysis pertinent to financial ratios including return on assets ratio (ROA). For instance, Bonin et al. (2005 a, b) [5, 6] are among others who investigated the bank efficiency across different countries. In the last few years, a considerable interest in more advanced research methodology has emerged among researchers. The non-parametric methods of DEA developed by Coelli et al. (2005) for bank efficiency was utilized as it generates piece-wise scheme of decision-making units (DMU) with the best performance [4], this model is considered as an advanced technique compared to other methods [7]. This methodology was assiduously employed by a significant proportion of recent literature such as Drake et al. (2006) [8], Banker et al. (2010) [9], Jreisat and Paul (2010) [10], Paradi et al. (2011) [11], Kao and Liu (2014) [12], Tsolas and Charles (2015) [13], Wanke et al. (2018) [14], and Jreisat (2020) [15]. Obied and El Mussawi (2009) [16] utilized the aforementioned DEA approach investigate the level of efficiency of the GCC Islamic banks. They found that the internal and external factors alike exhibit a significant impact on GCC Islamic banks' efficiency levels. Kaffash and Marra (2017) supported the assertion on the advancement of the DEA methodology for the efficiency of the financial services industry generally, and banking segment particularly [17]. More recently, Kaffash et al. (2020) in their chronological study, analyzed and revisited a group of 50 research works that attempted to assess the impact of several controlling variables such as the percentage of non-performing loans, competition, acquisition, type of bank ownership, and deregulation and liberalization on banks efficiency. Based on their conclusion, these factors have a significant impact of bank efficiency, the volatility in oil prices also affected efficiency of banks, in particular, is neglected by the vast majority of researchers. More practically, the research affirmed on the advancement of the 2-step DEA model in measuring the contribution of different controlling variables in determining banks efficiency [18].

The interaction among the oil price volatility and macroeconomic performance has long attracted attention among the research society. The effect of sharp fluctuations in oil price on different aspects of macro and microeconomic variables has come to the fore since the end of the 20th century. In retrospect, Hamilton (1988), Gisser and Goodwin (1986), Mork (1989), Mork et al. (1994), Kahn and Hampton (1990) Hooker (1996, and 1999), Jones and Kaul (1996), Huntington (1998), Cunado and De Gracia (2005), Chen and Chen (2007), Cologni and Manera (2008), Berument et al. (2010), have investigated the connection among the oil price changes and fluctuations and different macroeconomic and microeconomic variables such as economic output, inflation, exchange rates, stock markets, bond markets, and other traditional and alternative investment instruments [19-31]. Nevertheless, and as asserted by Kaffash et al. (2020), negligible attention is given to discussing the possible interactions and connectedness among the oil price oscillations and bank efficiency [18]. One of the very few attempts, Hesse and Poghosyan (2009) reported a positive link among oil price changes and bank profitability [32]. Khokhar et al. (2020), measured the GCC banks efficiency at both country and industry levels, including commercial and Islamic banks, and concluded that the efficiency levels of Islamic and commercial banks almost equal, however banks in Bahrain and Saudi Arabia exhibited a higher efficiency score as to compared banks in other GCC counties [33].

The most recent work by Kaffash et al. (2020) and Khokhar et al. (2020) has mainly focused on the comparison among the efficiency levels among Islamic and commercial banks [18, 33]. However, they did not profoundly measure the effect of the oil shock in 2014, nor they have investigated the role of macroeconomic variables in determining the banking sector efficiency in the GCC countries. Thus, this paper aims at filling in this gap by assessing the repercussions of the aforementioned events on banks efficiency in GCC region, as well as investigating the main determinants of the potential changes in the efficiency scores.

3- Data

This study utilizes a dataset covers 63 banks in six GCC countries* over the time period from 2008 to 2016†. As mentioned in the first sections of this study, the DEA technique enables identifying the quality of bank practices based

* Including 16 banks in UAE, 15 in Bahrain, 11 in Saudi Arabia, 8 in Kuwait, 6 in Qatar, and 7 in Oman.

† Data is obtained from Bank-scope database that offers detailed information on pre-calculated financial ratios, balance sheet, and income statements. The oil price and country data pieces are collected from the World Bank Database.

on an efficient non-parametric frontier scheme. This paradigm necessitates the identification of the main input and output variables which indicate for technical efficiencies of banks under investigation. For this regard, this study follows Fried et al. (1993), and Kirkwood and Nahm (2006) who considers *net interest expense and the non-interest expense* as a proxies of input variables, whereas the *net interest income and non-interest income* are used to indicate for the output variables [34, 35]. Hence, the banks' input and output variables can be conceptualized as the core sources of banks' expenses and revenues, respectively. Following the exploration of efficiency scores, they are regressed against the following bank-specific variables; liquidity (LIQ), equity to total assets (EQT), loan loss reserves (LLR), and bank size (SIZE), The ration of equity to total asset and provisions for loan loss indicate for the bank's size of capital (capitalization), and for degree of credit risk, respectively. The oil price in this study is defined as the ratio of quarterly and three month crude oil price averages of U.K. Brent (EUCRBREN), West Texas Intermediate (USCRWTS), Dubai (PGCRDUBAI) in USD/barrel to U.S. GDP deflator. Oil price volatility is determined based on annual representation of the monthly oil price standard deviation following Ferderer, (1996):

$$\text{Oilpvolt} = \left[\frac{\sum_{i=1}^n (\text{olip}_i - \overline{\text{olip}_t})^2}{n-1} \right]^{\frac{1}{2}} \quad (1)$$

where, olip_t denotes monthly oil price average in year t, while n refers to months in year t [36].

This study also employs data indicates for the values for country-specific variables including inflation (INF), oil price volatility (OPV), and the gross domestic product growth (GDPG) for all six countries but differed for each year. Both INF and GDPG indicate consumer price index and annual economic growth, respectively. In Table 1, the high inputs-outputs correlations and low correlation within inputs (outputs) signify low redundancy and negligible multicollinearity. Next, table 2 tabulates the variances of inputs and outputs in this study. The net interest expense minimum and maximum values were USD 0.1 million and USD 5233 million, respectively, with USD 238 million as the average value and USD 370 million standard deviation. Heterogeneity was reflected in high standard deviation and variation among the variables, which are ascribed to long data period across six countries and value-sensitive DEA.

Table 1. Correlation coefficients between inputs and outputs

	Outputs		Inputs	
	Interest income	Non-interest income	Net interest expense	Non-interest expense
Interest income	1.000			
Non-interest income	0.875	1.000		
Net interest expense	0.864	0.636	1.000	
Non-interest expense	0.891	0.957	0.653	1.000

Table 2. Summary statistics of inputs and outputs (in Million USD)

Variable	Mean	St. Dev.	Min	Max
Inputs				
Net interest expense	238.9459	370.052	0.1	5233.352
Non-interest expense	284.945	341.535	0.8	1976.951
Outputs				
Interest income	789.753	995.335	0.1	10169.34
Non-interest income	242.36	303.266	-134.4445	1357.363

4- Research Methodology

The methodology of this study comprises two stages. In first stage, the study utilizes the DEA to generate the efficiency scores. Empirically, the DEA scores for efficiency can be generated from the variable returns to scale (VRS), or by the constant returns to scale (CSR). This study adopts the VSR specifications since it is considered as least restrictive as the CSR which is considered as parsimonious indicator of efficiency scores for banks with less than optimal operation scale [37]. The utilization of the VSR in this study is believed to satisfy and maintain the goodness of fit of the empirical model since banks in the GCC region are not deemed to have similar degree of optimal operational scale. In Stage 2, the estimated efficiency outcomes were modeled against vector (x) that includes set of explanatory variables, which could influence the efficiency scores. The Ordinary Least Square technique is employed to omit the bounded feature of dependent variable, and to impose a linear conditional mean model for Efficiency (Ef):

$$E(Ef/x) = x\beta \quad (2)$$

As Ef is strictly bounded from above and below, the impact of explanatory variable cannot be assumed as constant. The linearity conditions might not assure that the predicted TE values will range at (0-1) without severe constraint x to fitted parameters outside the unit interval. Hence, empirical economists have prescribed logistic correlation to address this issue as it ascertains $0 < E(\frac{Ef}{x}) < 1$:

$$E(Ef/x) = \frac{e^{x\beta}}{1+e^{x\beta}} \tag{3}$$

For stage 2, Papke and Wooldridge (1996) method is utilized to depict the impact of other factors on technical efficiency levels [38]. Papke and Wooldridge (1996) introduced an estimation method that omits manipulation of dependent variable at extreme value of 0 or 1 for fractional dependent variables, afterwards a straightforward projection can be derived based on the independent variables [38]. Lastly, the estimated dependent variable values should fall from 0 to 1. The following Bernoulli log-likelihood function was used to do so:

$$l_{it}(\beta) = Ef_{it} \log[G(x_{it}\beta)] + (1 - Ef_{it}) \log[1 - G(x_{it}\beta)] \tag{4}$$

where $0 < G < 1$ is logit function, y_i denotes efficiency, and vector X signifies independent variable. Estimates for parameter B were gained by the log-likelihood maximizing for the sample (banks) throughout 2008-2016. The maximization problem is expressed as follows:

$$\max_{\beta} \sum_{t=1}^9 \sum_{i=1}^{64} l(\beta) \tag{5}$$

An estimated variance-covariance matrix appears as follows: $\hat{V} = \hat{A}^{-1} \hat{B} \hat{A}^{-1}$ where A and B are given by $\hat{A} = (N \times T)^{-1} \sum_{i=1}^N \sum_{t=1}^T \hat{g}_{it}^2 x'_{it} x_{it} [\hat{G}_{it}(1 - \hat{G}_{it})]^{-1}$ and $\hat{B} = (N \times T)^{-1} \sum_{i=1}^N \sum_{t=1}^T \hat{u}_{it}^2 \hat{g}_{it}^2 x'_{it} x_{it} [\hat{G}_{it}(1 - \hat{G}_{it})]^{-2}$, respectively, where $\hat{G}_{it} = G(x_{it}\hat{\beta})$, $\hat{g}_{it} = g(x_{it}\hat{\beta})$, $g(x\beta) = \frac{\partial G(x\beta)}{\partial x\beta}$ and $= Ef_{it} - \hat{G}_{it}$.

5- Results and Discussion

Table 3 demonstrates the initial results of the output-based Variable Returns to Scale (VRS) for stage 1 of the DEA model. The second column in the table reports the levels of banks' efficiency, the efficiency score values range between 72 to 78% for efficiency levels with a lowest score of 72% in 2008, and this depicts the effect GFC of 2008 on banking industry in the GCC region. The results also illustrate that the efficiency scores have tenuously increased after 2008. The delay and interruption in the recovery of GCC banking sector might be explained by the Dubai's Sovereign Debt Crisis that has been instigated by credit default of state-owned Dubai World in 2009, as a results of high leveraged investments of state-owned enterprises, and reverberated to the GCC neighbor counties during 2010 and 2011 [39].

In 2014, the immense shock in oil prices where the price per oil barrel had abruptly decreased from higher than \$100 in the mid of 2014 to less than \$50 by end of the same year. The political and social unrest that have blanketed the Middle East region (the main neighborhood countries of the GCC region) and intensified in 2014 and in 2015 have also affected the investment environment in the region. These outcomes are in line with the results of Kaffash et al. (2020) who stated that during the GFC period, the banking sector efficiency in the region has been subject to high volatility and sharp decrease in values [18]. The results also support the findings of Bader et al. (2016) and Srairi (2010) who attributed the decrease in banks efficiency of GCC banks to the sharp decline in Islamic Banks' operations and business activities [40, 41]. In a similar study, Khokhar et al. (2020) reported that the low level of efficiency among Islamic banking sector in many GCC countries could be due to a lack of prudence decisions and excess customization of their products where the majority of their contracts are tailored to fit the needs of specific business needs [33]. In a nutshell, the outcomes of efficiency scores of GCC banks in table 3 reveals that despite the financial difficulties faced by the GCC banking sectors in the wake of crises, the efficiency scores have maintained a minimum level of 70%, and this indicates that GCC banks has displayed a relative resilience to the regional and international shocks such as Dubai sovereign debt crisis, the GFC, and oil price shock in 2014.

Table 3. Summary of banking average efficiency for 2008-2016

Year	Banks in GCC Countries
2008	0.72
2009	0.76
2010	0.74
2011	0.75
2012	0.74
2013	0.78
2014	0.75
2015	0.77
2016	0.74
Mean	0.70

Figure 5 demonstrates GCC banks' average efficiency scores from 2008 to 2016. It can be noticed that in 2008 the score has reached its lowest level of 72%, whereas in 2013 it has jumped to its highest level of 78%. Table 4 displays the Stage 2 results of the DEA. The bank efficiency scores in table 3 are modeled against a vector of explanatory variables including bank specific-variables; liquidity (LIQ), equity to total assets (EQT), loan loss reserves (LLR), and bank size (SIZE), country-specific variables; inflation (INF), and the gross domestic product growth (GDPG), and oil price volatility (OPV).

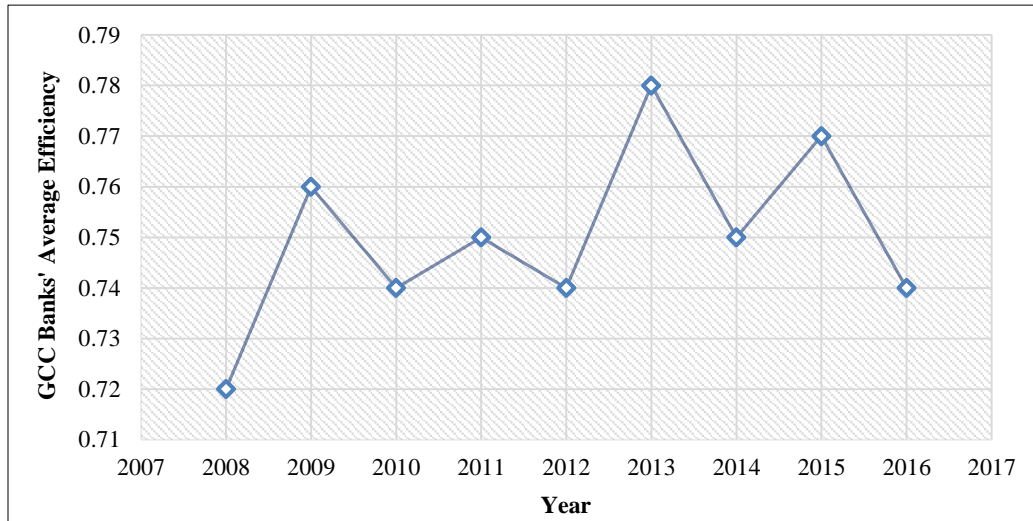


Figure 5. Yearly GCC Banking average efficiency, 2008-2016.

Table 4. Stage 2 Regression Results

Variables	Coefficient
Constant	1.1492***
	-0.0335
LIQ	0.009
	-0.00024
EQT	0.000375
	-0.00025
Constant	-0.0000665**
	-0.000165
LNP	-0.005222***
	-0.000568
OILV	-0.005484***
	-0.001145
GDP	0.000739**
	-0.000611
Size	0.002781
	-0.00258
No of observation	567
Log pseudo-likelihood	-214.8974134

***, **, and * are 1%, 5%, and 10% significance levels, respectively; Asymptotic standard errors in parentheses.

The estimated coefficient of GDP is positively significant at a 5% level. This indicates a positive link between economic output as measured by GDP and bank efficiency. This outcome is somewhat plausible and expected since the increase in GDP is determined by the aggregate output and production volume of the private and public sectors to a large extent, and this, in turn, is highly dependent on the availability of loans and credit lines provided by banks. Hence, the banking sector in general experiences higher profitability during the expansionary eras of the business cycle. This result is also substantiated by the outcomes of Maudos et al. (2002), Grigorian and Manole (2004), Tanna (2009), and Johnes et al. (2014), who conclude that higher economic output has a positive effect on banking efficiency [42-45]. On the other hand, the coefficient of inflation, which represents the second macroeconomic indicator in this study, has a significant negative impact on bank efficiency. This result seems to contradict the findings of Obied and El Mussawi

(2009) [16]. However, our outcomes are more compatible with the fact that the spike in inflation rates drives policy makers on the national level to adopt a more tightened (contractionary) monetary policy by increasing the interest rates on overnight lending among commercial banks, and this in turn decreases the amount of loanable funds available for businesses and individual customers. The results in table 4 also indicate that oil price volatility negatively influences the bank's efficiency in the GCC region. In general, oil price volatility is considered a main driver of economic instability [36]. Moreover, the GCC economies have always been known for their sensitivity to oil price oscillations in general and to oil shocks in particular, and this result is supported by the findings of Kaffash et al. (2020), who also reported a negative correlation between the banks' efficiency levels and oil price changes [18].

Apparently, from bank-specific variables, the degree of credit risk, as indicated by the loan loss reserves (LNP), exhibits a significantly negative effect on the bank's efficiency. In fact, banks with fewer loan loss reserves relative to total loans appeared to display better efficiency. The provisions for loan losses indicate the management's expectations about the level of loss that might be incurred. A higher LNP reflects the higher fraction of assets placed by banks for potential loan repayment defaults. As loan offerings are the key bank activity in the GCC nation, higher losses of loan directly affected bank efficiency in a negative manner, and this comes in line with Al-Muharrami (2007), and Obeid and El Moussawi (2011) [16, 46]. Lastly, the bank-specific factors of liquidity, bank size, and equity do not seem to have any significant impact on the degree of bank efficiency, and this contradicts the findings of Altunbas et al. (2000), Altunbas and Marqués (2008), Sufian (2009), and Kaffash et al. (2020) [18, 47-49].

5-1- Results Implications and Recommendations

Based on the findings of this study, a number of important implications can be drawn. From a policymaker's standpoint, the main outcomes demonstrate that the banking sector efficiency in the GCC region is sensitive to oil price shocks as well as domestic macroeconomic conditions. However, the bank-specific factors seemed to be less influential on efficiency scores. This suggests that the efficiency of the GCC banking sector is more affected by exogenous shocks than endogenous (bank-specific) variables, and this suggests that policymakers need to peruse and maintain prudent monetary and fiscal policies in order to stabilize the economic output and business cycle. Moreover, the regulatory authorities might need to introduce new policies, such as enhancing the banking laws, improving accounting standards, and institutional quality, in order to attract foreign and international investment that could ultimately enhance the economic diversification and mitigate the dependence on oil-related products. Furthermore, the results of this study reveal important suggestions for regional and international investors' trading strategies. The results of the second stage of the DEA test indicate that banks' efficiency scores exhibit dissimilar reactions and resilience to endogenous and exogenous factors, and this implies that institutional and individual investors have the potential for portfolio diversification within the banking sector in the GCC region, which could enhance the risk and return tradeoffs in their investment portfolios.

5-2- Limitations and Further Research

The empirical findings in this study provide insights into the bank's efficiency in the GCC region and provide evidence of the effect of domestic and international shocks on the efficiency scores. Nonetheless, there are a few limitations that could challenge the results obtained. These limitations are mainly attributed to the time period covered in this study. Since the global banking and financial systems have been drastically affected by the outbreak of the COVID-19 pandemic, an analysis using a longer time span could provide more up-to-date conclusions pertinent to the banking sector's performance and efficiency. In spite of the aforementioned limitations, This study provides a future direction for further research that should investigate the resilience of banking sector efficiency to the impact of the COVID-19 outbreak, as well as the severe oil price shock in 2020 that evolved in response to fears about the swift spread of COVID-19 and triggered a shock in global supply and demand.

6- Conclusion

This study aims to evaluate the efficiency of the banking sector in GCC countries. The banking sector in GCC countries is considered the backbone of the financial sector and one of the major economic growth engines in the GCC bloc, along with natural resources and oil exports. The study also investigates the impact of the global financial crisis in 2008 and the oil price shock in 2014 on the banks' efficiency scores. This study sheds light on the main macroeconomic, economic, and business-related variables that affect the efficient practices and operations of commercial banks in GCC countries. For this aim, the study utilized a set of variables that represent macroeconomic indicators such as DGP and inflation, in addition to bank-specific variables such as liquidity, bank size, capital, and default risk. The 2-stage DEA methodology is utilized. The main results in this paper indicate that the banking sector in the GCC is subject to a decrease in efficiency following the outbreak of international financial and energy shocks, as well as instability in domestic macroeconomic conditions. On the other hand, the sector exhibited relative resilience to changes and declines in internal, or bank-specific, factors such as liquidity, bank size, and capital. The overall results of this study suggest that the regulatory authorities in the region need to maintain macroeconomic stability and enhance financial transparency practices. Finally, the results show that investors from both inside and outside the region and the world can diversify

their investment portfolios by investing in the GCC bank sector. This is because the efficiency of the GCC bank sector isn't as affected by sectoral impulses as it is by external shocks.

7- Declarations

7-1- Author Contributions

Conceptualization, A.J., and S.A.; methodology, A.J.; software, A.J.; formal analysis, A.J.; resources, A.J.; data collection, A.J.; writing—original draft preparation, A.J., And S.A.; writing—review and editing, A.J., And S.A.; supervision, A.J., And S.A.; All authors have read and agreed to the published version of the manuscript.

7-2- Data Availability Statement

In the study, data were collected from the Bank scope database. Due to a rule enacted by Bank Scope, the data cited in this study are not publicly available. However, the corresponding author can provide the data upon request.

7-3- Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

7-5- Conflicts of Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

8- References

- [1] OPEC. (2019). OPEC Bulletin Report 2019, Organization of the Petroleum Exporting Countries. Available online: https://www.opec.org/opec_web/en/publications/5360.htm (accessed on January 2022).
- [2] El-chaarani, H., & El-abiad, Z. (2019). Analysis of capital structure and performance of banking sector in Middle East Countries. *International Journal of Economics and Financial Issues*, 9(2), 1–11. doi:10.32479/ijefi.7454.
- [3] Ferreiro, J., & Serrano, F. (2010). The impact of the current crisis on emerging market and developing countries. *An Assessment of the Global Impact of the Financial Crisis* (pp. 108–134). doi:10.1057/9780230306912_6.
- [4] Coelli, T. J., Rao, D. S. P., O'Donnell, C. J., & Battese, G. E. (2005). *An introduction to efficiency and productivity analysis*. Springer science & business media, Springer, Boston, United States. doi:10.1007/b136381.
- [5] Bonin, J. P., Hasan, I., & Wachtel, P. (2005). Bank performance, efficiency and ownership in transition countries. *Journal of Banking and Finance*, 29(1 SPEC. ISS.), 31–53. doi:10.1016/j.jbankfin.2004.06.015.
- [6] Bonin, J. P., Hasan, I., & Wachtel, P. (2005). Privatization matters: Bank efficiency in transition countries. *Journal of Banking & Finance*, 29(8-9), 2155–2178. doi: 10.1016/j.jbankfin.2005.03.012.
- [7] Emrouznejad, A., & Yang, G. liang. (2018). A survey and analysis of the first 40 years of scholarly literature in DEA: 1978–2016. *Socio-Economic Planning Sciences*, 61, 4–8. doi:10.1016/j.seps.2017.01.008.
- [8] Drake, L., Hall, M. J., & Simper, R. (2006). The impact of macroeconomic and regulatory factors on bank efficiency: A non-parametric analysis of Hong Kong's banking system. *Journal of Banking & Finance*, 30(5), 1443–1466. doi:10.1016/j.jbankfin.2005.03.022.
- [9] Banker, R. D., Chang, H., & Lee, S. Y. (2010). Differential impact of Korean banking system reforms on bank productivity. *Journal of Banking and Finance*, 34(7), 1450–1460. doi:10.1016/j.jbankfin.2010.02.023.
- [10] Jreisat, A., & Paul, S. (2010). Banking efficiency in the Middle East: A survey and new results for the Jordanian banks. *International Journal of Applied Business and Economic Research*, 8(2), 191–209.
- [11] Paradi, J. C., Rouatt, S., & Zhu, H. (2011). Two-stage evaluation of bank branch efficiency using data envelopment analysis. *Omega*, 39(1), 99–109. doi:10.1016/j.omega.2010.04.002.
- [12] Kao, C., & Liu, S. T. (2014). Multi-period efficiency measurement in data envelopment analysis: The case of Taiwanese commercial banks. *Omega (United Kingdom)*, 47, 90–98. doi:10.1016/j.omega.2013.09.001.
- [13] Tsolas, I. E., & Charles, V. (2015). Incorporating risk into bank efficiency: A satisficing DEA approach to assess the Greek banking crisis. *Expert Systems with Applications*, 42(7), 3491–3500. doi:10.1016/j.eswa.2014.12.033.

- [14] Wanke, P., Barros, C. P., & Emrouznejad, A. (2018). A comparison between stochastic dea and fuzzy dea approaches: Revisiting efficiency in angolan banks. *RAIRO - Operations Research*, 52(1), 285–303. doi:10.1051/ro/2016065.
- [15] Jreisat, A. (2020). Credit risk, economic growth and profitability of banks. *International Journal of Economics and Business Research*, 20(2), 152–167. doi:10.1504/IJEER.2020.109150.
- [16] El Moussawi, C., & Obeid, H. (2011). Evaluating the productive efficiency of Islamic banking in GCC: A non-parametric approach. *International Management Review*, 7(1), 10–21.
- [17] Kaffash, S., & Marra, M. (2017). Data envelopment analysis in financial services: a citations network analysis of banks, insurance companies and money market funds. *Annals of Operations Research*, 253(1), 307–344. doi:10.1007/s10479-016-2294-1.
- [18] Kaffash, S., Aktas, E., & Tajik, M. (2020). The impact of oil price changes on efficiency of banks: An application in the Middle East oil exporting countries using SORM-DEA. *RAIRO - Operations Research*, 54(3), 719–748. doi:10.1051/ro/2019009.
- [19] Tatom, J. A. (1988). Are the macroeconomic effects of oil-price changes symmetric? *Carnegie-Rochester Confer. Series on Public Policy*, 28(C), 325–368. doi:10.1016/0167-2231(88)90030-9.
- [20] Gisser, M., & Goodwin, T. H. (1986). Crude Oil and the Macroeconomy: Tests of Some Popular Notions: Note. *Journal of Money, Credit and Banking*, 18(1), 95. doi:10.2307/1992323.
- [21] Mork, K. A. (1989). Oil and the Macroeconomy When Prices Go Up and Down: An Extension of Hamilton's Results. *Journal of Political Economy*, 97(3), 740–744. doi:10.1086/261625.
- [22] Mork, K. A., Olsen, O., & Mysen, H. T. (1994). Macroeconomic responses to oil price increases and decreases in seven OECD countries. *Energy Journal*, 15(4), 19–35. doi:10.5547/issn0195-6574-ej-vol15-no4-2.
- [23] Kahn, G. A., & Hampton, R. (1990). Possible monetary policy responses to the Iraqi oil shock. *Federal Reserve Bank of Kansas City Economic Review*, 2, 19–32.
- [24] Hooker, M. A. (1996). What happened to the oil price-macroeconomy relationship?. *Journal of monetary Economics*, 38(2), 195–213. doi: 10.1016/S0304-3932(96)01281-0.
- [25] Hooker, M. A. (1999). Oil and the Macroeconomy Revisited. *Finance and Economics Discussion Series*, 1999(43), 1–23. doi:10.17016/feds.1999.43
- [26] Jones, C. M., & Kaul, G. (1996). Oil and the stock markets. *Journal of Finance*, 51(2), 463–491. doi:10.1111/j.1540-6261.1996.tb02691.x.
- [27] Huntington, H. G. (1998). Crude oil prices and US economic performance: where does the asymmetry reside?. *The Energy Journal*, 19(4). doi:10.5547/ISSN0195-6574-EJ-Vol19-No4-5.
- [28] Cunado, J., & Perez de Gracia, F. (2005). Oil prices, economic activity and inflation: Evidence for some Asian countries. *Quarterly Review of Economics and Finance*, 45(1), 65–83. doi:10.1016/j.qref.2004.02.003.
- [29] Chen, S. S., & Chen, H. C. (2007). Oil prices and real exchange rates. *Energy Economics*, 29(3), 390–404. doi:10.1016/j.eneco.2006.08.003.
- [30] Cologni, A., & Manera, M. (2008). Oil prices, inflation and interest rates in a structural cointegrated VAR model for the G-7 countries. *Energy economics*, 30(3), 856–888. doi:10.1016/j.eneco.2006.11.001.
- [31] Berument, M. H., Ceylan, N. B., & Dogan, N. (2010). The impact of oil price shocks on the economic growth of selected MENA1 countries. *The Energy Journal*, 31(1). doi:10.5547/ISSN0195-6574-EJ-Vol31-No1-7.
- [32] Hesse, H., & Poghosyan, T. (2009). Oil Prices and Bank Profitability: Evidence from Major Oil-Exporting Countries in the Middle East and North Africa. *IMF Working Papers*, 09(220), 1–23. doi:10.5089/9781451873672.001
- [33] Khokhar, I., Hassan, M. U., Khan, M. N., & Amin, M. F. Bin. (2020). Investigating the efficiency of GCC banking sector: An empirical comparison of Islamic and conventional banks. *International Journal of Financial Research*, 11(1), 220–235. doi:10.5430/IJFR.V11N1P220.
- [34] Fried, H. O., Knox Lovell, C. A., & Eeckaut, P. Vanden. (1993). Evaluating the performance of US credit unions. *Journal of Banking and Finance*, 17(2–3), 251–265. doi:10.1016/0378-4266(93)90031-8.
- [35] Kirkwood, J., & Nahm, D. (2006). Australian banking efficiency and its relation to stock returns. *Economic Record*, 82(258), 253–267. doi:10.1111/j.1475-4932.2006.00338.x.
- [36] Ferderer, J. P. (1996). Oil price volatility and the macroeconomy. *Journal of Macroeconomics*, 18(1), 1–26. doi:10.1016/S0164-0704(96)80001-2.
- [37] Fethi, M. D., & Pasiouras, F. (2010). Assessing bank efficiency and performance with operational research and artificial intelligence techniques: A survey. *European Journal of Operational Research*, 204(2), 189–198. doi:10.1016/j.ejor.2009.08.003.

- [38] Papke, L. E., & Wooldridge, J. M. (1996). Econometric methods for fractional response variables with an application to 401 (k) plan participation rates. *Journal of applied econometrics*, 11(6), 619-632. doi:10.1002/(SICI)1099-1255(199611)11:6<619::AID-JAE418>3.0.CO;2-1.
- [39] Almohamad, S., Mishra, A. V., & Yu, X. (2018). Mena Stock Markets Integration: Pre and Post Global Financial Crisis. *Australian Economic Papers*, 57(2), 107–141. doi:10.1111/1467-8454.12106.
- [40] Srairi, S. A. (2010). Cost and profit efficiency of conventional and Islamic banks in GCC countries. *Journal of Productivity Analysis*, 34(1), 45–62. doi:10.1007/s11123-009-0161-7.
- [41] Bader, M. K. I., Mohamad, S., Ariff, M., & Shah, T. H. (2008). Cost, revenue, and profit efficiency of Islamic versus conventional banks: international evidence using data envelopment analysis. *Islamic economic studies*, 15(2).
- [42] Maudos, J., Pastor, J. M., Pérez, F., & Quesada, J. (2002). Cost and profit efficiency in European banks. *Journal of International Financial Markets, Institutions and Money*, 12(1), 33–58. doi:10.1016/S1042-4431(01)00051-8.
- [43] Girardone, C., Molyneux, P., & Gardener, E. P. M. (2004). Analyzing the determinants of bank efficiency: The case of Italian banks. *Applied Economics*, 36(3), 215–227. doi:10.1080/0003684042000175334.
- [44] Tanna, S. (2009). The impact of foreign direct investment on total factor productivity growth: International evidence from the banking industry. *Managerial Finance*, 35(3), 297–311. doi:10.1108/03074350910931799.
- [45] Johnes, J., Izzeldin, M., & Pappas, V. (2014). A comparison of performance of Islamic and conventional banks 2004-2009. *Journal of Economic Behavior and Organization*, 103, 93– 107. doi:10.1016/j.jebo.2013.07.016.
- [46] Al-Muharrami, S. (2007). The causes of productivity change in GCC banking industry. *International Journal of Productivity and Performance Management*, 56(8), 731–743. doi:10.1108/17410400710833029.
- [47] Altunbas, Y., Liu, M. H., Molyneux, P., & Seth, R. (2000). Efficiency and risk in Japanese banking. *Journal of Banking and Finance*, 24(10), 1605–1628. doi:10.1016/S0378-4266(99)00095-3.
- [48] Altunbaş, Y., & Marqués, D. (2008). Mergers and acquisitions and bank performance in Europe: The role of strategic similarities. *Journal of Economics and Business*, 60(3), 204–222. doi:10.1016/j.jeconbus.2007.02.003.
- [49] Sufian, F. (2009). Determinants of bank efficiency during unstable macroeconomic environment: Empirical evidence from Malaysia. *Research in International Business and Finance*, 23(1), 54–77. doi:10.1016/j.ribaf.2008.07.002.