Does issuing Islamic bonds through banks increase banking efficiency?

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ABSTRACT

This study investigates the impact of issuing sukuk (Islamic bonds) on the issuing banks’ efficiency, in selected GCC countries by applying stochastic frontier approach with translog cost function. The empirical application covers 13 Islamic banks and conventional banks providing Islamic windows, from Saudi Arabia, UAE, and Qatar, using quarterly data from Q3 2009 to Q2 2019. The results show that issuing Islamic bonds (sukuk) increases bank efficiency, through increasing financial leverage and liquidity. The results of the cost frontier analysis suggest that higher input prices bring more funds that increase bank efficiency. The results of output variables indicate that higher output leads to higher total cost. However, the higher order terms of output variables have a negative relationship with cost, suggesting that doubling bank output could diminish total cost.

1. Introduction

With increasing global demand for Islamic financial instruments, the value and number of sukuk products has grown significantly for more than three decades. Global sukuk issuance peaked in 2019 at about USD 162 billion, albeit this was followed by an abnormal 40% decline to USD 100 billion in 2020, attributable to investment attrition due to COVID-19 lockdowns (S&P Global, 2020). According S&P Financial Service, in 2016 the corporate and infrastructure sukuk issuance in Saudi Arabia, UAE, and Qatar represented 24%, while Indonesia and Malaysia represented 26% and 41%, respectively. The relative decline of sukuk issuance in GCC countries since 2015 is attributed to a slump in oil prices during this period (Islamic Finance Outlook S&P Global, 2017). GCC national economies are dominated by oil and gas export revenue, thus sukuk returns in the region are highly susceptible to oil price fluctuations (Naifar and Hammoudah, 2016). Moreover, sukuk returns’ dynamics are less sensitive to general financial uncertainty and economic policy than conventional bonds, which is mainly attributable to combining assets with Islamic bonds (Naifar et al., 2017). Nevertheless, the value of sukuk issued in foreign currencies in the GCC reached over USD 9 billion in June 2019 (S&P Global, 2020).

Few studies have investigated the empirical relation between sukuk issuance and bank efficiency, and most existing research in this area was based on sukuk market issues related to bank profitability and performance (Said, 2011; Mimouni et al., 2019). Another strand of literature has examined banking industry efficiency using several methods, such as cost and profit efficiencies, through stochastic frontier approach (SFA) and data envelopment analysis (DEA) (Beccalli et al., 2006; Berger and Humphrey, 1997; Berger and Mester, 2000; Fiorentino et al., 2006). Against this backdrop, this paper explores the impact of issuing sukuk on bank efficiency, which could increase the liquidity rate and bank efficiency level.

To give a brief illustration of sukuk-related bank efficiency, the bank plays the role of issuer in issuing sukuk procedures, thus the liquidity rate is likely to be increased, in particular during the issuing period, which in turn increases the efficacy level of this bank. The sample of the study includes the selected GCC countries of Saudi Arabia, UAE, and Qatar. We apply the SFA with translog cost function to identify the impact of issuing sukuk on bank efficiency (Lensink et al., 2008). We seek to contribute to the literature from an empirical perspective in the following aspects. First, we adopt parametric approach to evaluate the efficiency level of each bank (as an issuer), with and without the impact of issuing sukuk. Specifically, we use SFA with translog cost function to control and investigate the extent of the impact of the external variable (sukuk) on bank efficiency, which is comprised directly in the cost translog equation to be estimated in one-step regression. The use of this model is more suitable for the data of our study, since the utilized data is quarterly (from 2009 to 2019).

The remainder of this paper is organized as follows. Section 2 provides an extensive survey of Islamic bonds and bank efficiency literature to situate this study in context, and sukuk issuance and sukuk market impacts on banking performance related studies. Section 3 describes the
methodology of translog cost function based on the SFA model, presents the utilized variables and the data. Section 4 discusses the resultant data and the robustness check for results, and Section 5 concludes the paper.

2. Literature review

There is limited literature providing empirical evidence to investigate the relation between issuing sukuk and the level of bank efficiency, but there are two discernible strands of existing studies, as explored below.

2.1. Bank efficiency studies in developed, developing, and emerging markets countries

Berger and Humphrey (1997) reviewed a number of studies that investigated efficiency in US banks and reported that the average 188 distributions of US banks differed in time periods, input output selections, size ranking, and efficiency methods. They used 78 observations to estimate efficiency by applying nonparametric method including DEA, and 110 observations to examine efficiency by employing parametric methods, including SFA. They found that the nonparametric methods reflected lower levels of efficiency estimation than parametric methods. Also, they indicated that different techniques affect the efficiency rankings of individual financial institutions. Berger and Mester (2000) estimated the efficiency of approximately 6000 US commercial banks over the period 1990–1995, empirically applying the multiple efficiency concepts of cost, standard profit, and alternative profit efficiencies in sequence. The results reflect that each measurement of efficiency concepts contributes with some informational value, and larger banks are better able to achieve profits than smaller banks.

Beccalli et al. (2006) investigated the efficiency in EU banks by applying DEA and SFA to estimate cost efficiency, employing the inter-mediation approach to define inputs and outputs. In general, the results show that the efficiency scores of DEA appear to be inconsistent, while the scores of SFA are more consistent. In Germany, Fiorentino et al. (2006) examined the cost efficiency of the national banking industry over the period 1993–2004. They analyzed the consistency of SFA and DEA, and found that the major efficiency scores acquired with the former are higher. Moreover, they concluded that the use of SFA to benchmark the efficiency of the banking system seems to provide more clear and efficient information due to random error and other (non-random) effects.

A group of developing countries were explored by Chen (2009), who determined the main efficiency factors of 71 commercial banks in 10 Sub-Saharan African middle-income countries over the period 2000–2007 by employing SFA to evaluate the differences between cost efficiency levels and cost efficiency frontier. The results indicated that foreign banks were more efficient than local banks, and a steady macroeconomic situation and high level of financial structures promote bank efficiency. Similarly, Wezel (2010) showed that cost efficiency of international banks is better than that of domestic banks in Central America, based on testing 86 banks’ efficiency in six regional countries over the period 2002–2007, applying the DEA and SFA approaches.

Beck et al. (2013) investigated the cost efficiency and stability of Islamic and conventional banks, highlighting the impact of the global financial crisis in 2008, using cost-income ratio as indicator for cost efficiency. They found that asset quality is affected negatively by Islamic banks; however, during the global financial crisis Islamic banks performed better than conventional banks in terms of capitalization.

Belanès et al. (2015) examined the impact of subprime crisis on the efficiency level of Islamic banks in the GCC countries by applying DEA method over the period 2005–2011. They concluded that the efficiency level of most Islamic banks remained efficient, whereas some of them decreased slightly in their efficiency level when the subprime crisis occurred.

Miah and Uddin (2017) examined stability and bank efficiency in Islamic and conventional banks in the GCC, from 2005 to 2014 utilizing SFA, and found that Islamic banks are less efficient in managing costs than conventional banks. Furthermore, highly capitalized banks are more stable, but cost inefficient. In addition, Rizvi (2017) concluded that larger Islamic banks are more efficient than smaller ones after reaching a precise threshold size, indicating that bank size has a significant role in banks’ performance and stability.

Nguyen (2018) investigated the diversification effect on the cost and profit efficiency of Southeast Asian commercial banks in six countries by applying SFA, and found that asset-diversified banks have lower cost efficiency. In contrast, funding-diversified banks have higher profit efficiency.

Shamshur and Weill (2019) studied bank efficiency and cost of credit in firm-level and bank-level data for nine European countries, to examine banks’ ability to operate at lower costs of credit. They concluded that large banks’ efficiency is significantly linked with lower credit cost, indicating that an increase in bank efficiency can foster access to credit.

Anvar (2019) examined cost efficiency of commercial banks in Indonesia over the period 2002–2010, by applying SFA, and showed that macro-level variables and bank-level variables, including the size of banks, profitability, capital adequacy, loans to deposit, and credit risk management, have impacts on cost efficiency.

2.2. Sukuk and banking performance

The Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) in Financial Reporting for Sukuk-holders defines the originator as a financial institution or other institution that issues Islamic bonds (sukuk) in compliance with Shariah rules, either directly, or indirectly via a Special Purpose Vehicle (SPV), which is also referred as Special Purpose Entity (SPE), formed as a legal entity for managing the virtual sukuk entity to accomplish specific financial objectives. Sukuk are issued on 14 contracts that can be classified into four types: asset-based (e.g., Ijara); debt-based (e.g., Murabaha, Salam, and Istisna); equity-based, including Musharaka, Muzara'a (sharecropping), Muqasa (irrigation), and Mugharas (agricultural partnership); and agency-based (e.g., Wakala) (Arundina et al., 2015; Naifar, 2016). Several studies have examined Islamic bond structures and provided empirical foundations to estimate the determinants of sukuk ratings using a number of approaches, from rating agencies and previous studies on bond ratings (Arundina et al., 2015; Elhaj et al., 2015). In addition, Hanef (2009) stated that Islamic bonds have changed from an asset-backed to an asset-based structure, as the condition of having tangible assets tends to be asset-light.

In its role as an issuer or SPV, the bank is a legal party created exclusively for many purposes, including transactions, transferring assets to individual investors, protecting investors from the risks of the originator, holding assets, and making payments to sukuk holders. Generally, reputable commercial or financial institutions such as bank take the issuer role or SPV (Wilson, 2008). Furthermore, due to the risk and uncertainty associated with investment decisions, the involvement of a reputable bank is essential in the process of issuing sukuk (Brooks et al., 2009). In the case when the bank assumes the issuer role, the liquidity rate is likely to be increased, in particular during the issuing period, which in turn increases the bank’s efficiency.

Zulkhibri (2015) delivered a critical perspective of theoretical and empirical research on sukuk addressing three dimensions: theory and nature, functioning issues and structures comprised in sukuk, and sukuk role in economic development. The study concluded that literature on sukuk is generally qualitative rather than quantitative, which was attributed to lack of historical, reliable, and consistent related data.

Mimoani et al. (2019) investigated the impact of the sukuk market on bank profitability, measured by the net interest margin and return on assets of 216 banks in 13 countries over the period 2003–2014, by applying the system Generalized Method of Moments (GMM) estimator. They found that bank profitability is adversely affected by sukuk market development.
Said (2011) examined the impact of issuing Islamic bonds on 14 Islamic banks’ performance during the global financial crisis period (2007–2009) through two stages. In the first stage, some financial ratios were used to measure bank strength, including liquidity, deployment, overall efficiency, and profitability. In the second stage, to measure bank performance sensitivity to using sukuk in their operations, regression analysis was applied. The results indicated that using sukuk did not affect the performance of Islamic banks.

Ahmad et al. (2012) investigated the relationship between macro-economics factors and sukuk issuance in Malaysia by applying vector autoregressive models, variance decomposition, and impulse response functions. They concluded that sukuk issuance Granger-causes gross domestic product (GDP). Moreover, Islamic banks have a competitive advantage since they target a global market segment, thus policy makers should design new policies to reform the functional characteristics of Islamic capital market.

Godlewski et al. (2013) studied the reaction of stock market investors towards announcements of sukuk and conventional bond issues by applying an event study method in Malaysian listed companies. The findings indicated that the stock market reacted neutrally to the announcement of conventional bonds, however a negative reaction was associated with the announcement of Islamic bonds, due to the excess demand for sukuk (which are favored by lower-quality debtor companies). Mohamed et al. (2015) also studied the Malaysian sukuk market, exploring firms’ motivation to issue sukuk or conventional bonds by examining firm-specific determinants of target debt ratio. The data of the study consisted of 120 conventional bonds and 80 sukuk issuers over the period 2000–2012. Through applying GMM estimators, the findings indicated that firms with higher growth prefer issuing sukuk, because they bring better advantages to corporate issuers, even when they could increase funds by conventional bonds.

Mahomed et al. (2018) investigated the wealth effects of debt-based sukuk issuances in Indonesia relative to the global financial crisis (from June 2007 to 2010) in three eras: pre-crisis, during the crisis period, and post-crisis, when the risk level is high and investors tend to increase the liquidity rate through utilizing multiple breakpoint analysis. Mahomed et al. found that the market reaction was positively related with debt-based sukuk issuance during the crisis period.

Naifar and Hammoudeh (2016) examined the causal relationship of GCC sukuk returns with global financial distress and several uncertainty variables, including financial and commodity market and economic policy uncertainty indicators, through applying a quantile regression analysis. The results presented that the GCC sukuk returns are affected adversely and causality by global financial distress, economic policy, and oil price uncertainties. On the other hand, the conventional bond market and gold market uncertainties have no impact on GCC sukuk returns.

Nagano (2016) investigated the difference between sukuk, conventional debt, and equity issuers in Malaysia, Indonesia, Saudi Arabia, and UAE over the period 2001–2013 by applying Probit regressions to determine issuers choice. The findings revealed that after satisfying market accessibility, firms tend to take sukuk issuance when they have a lower degree of financial constraints. Finally, firms prefer to issue sukuk when both the issuer and external investors have expectations to increase firm earnings during the post-issuance period.

Ibrahim (2015) pointed out that the acceptance of Islamic bonds outside the Muslim world as demonstrated by its issuance in non-OIC countries, such as the UK, Senegal, Hong Kong, South Africa, and Luxembourg. In addition, the study indicated that the development of sukuk has attracted increasing attention, and the list of research on the sukuk market has kept expanding.

Given the mixed findings of the previous empirical studies, this paper is a step forward to explore whether issuing sukuk affects the efficiency level of some selected banks from the GCC countries, which have taken the role as issuers in the process of sukuk issuance.

3. Methodology and data

This section briefly describes the econometric methodology employed in analyzing the cost efficiency of the studied banks, and utilized data. The translog cost function based on the SFA provides an appropriate method for summarizing the relationship between the cost efficiency of banks and issuing sukuk.

The parametric approach with SFA method or the econometric frontier method offer functional models of cost, profit, or production relation between the inputs and outputs of an institution, and other macro-level related factors, which allows for random errors (Berger and Humphrey, 1997). Cost function, under the producer’s aim, utilizes a minimum amount of inputs (costs) to produce a certain amount of outputs per unit in specific time period. By assuming that production function provides maximum output by using specific level of inputs, an economic firm maximizes profit under cost minimization condition, as a result of the given function:

\[ C = f(Q, X_p, t) \]  

Where \( C \) is total cost, \( Q \) is the amount of output and \( X_p \) represents input prices. Various types of cost functions are utilized to measure efficiency, the most popular of which is translog function, which is basically based on second-order approximation in logarithm of an arbitrary cost function (Coelli et al., 2005). Berger et al. (1993) indicated that the translog function does not fit as a rational global estimation, as it obliges large and small banks to depend on a symmetric U-shaped curve (referred to as ‘ray average cost curve’), and to reject other opportunities (e.g., when an average cost curve reduces up to some output points, and remains constant after that). Consequently, to avoid ambiguous results, the sample of this study focuses only on GCC banks that took part in issuing sukuk during the studied period.

The description of inputs and outputs differs among studies of bank efficiency. For instance, Berger and Humphrey (1997) suggest that the deposit can be an input or output, as it has characteristics of both. Sherman and Gold (1985) specify inputs as labor (consisting of full-time equivalent personal per branch), rent paid for each branch, and total cost of supplies used. In addition to this, intermediation approach is widely employed; for instance, capital and labor were utilized by Drake and Hall (2003) as inputs, therefore they used the level of fixed assets as a proxy for capital input, and general and administrative or personal expenses for the labor input. Delis and Papanikolaou (2009) utilized intermediation method by employing the two inputs of operating expenses and total deposits, and they measured bank outputs with two approaches: the production approach, where output is evaluated by several operations or documents procedure within a given time period; and the intermediation approach, where output is evaluated from values of stock variables perspective such as deposits and loans which are showed in a bank account. The SFA translog cost function can be obtained by maximum likelihood (ML) estimation, given by taking the logarithms of outputs and inputs variables in both sides of the function shown below:

\[
\ln Y_{it} = \beta_0 + \sum_{n=1}^{N} \beta_n \ln x_{n, it} + \frac{1}{2} \sum_{m=1}^{N} \sum_{n=1}^{N} \beta_{nm} \ln x_{n, it} \ln x_{m, it} + v_{it} + u_{it}
\]  

Where \( \beta_n , \beta_{ns}, \) and \( \beta_{nt} \) are unknown parameters of input-output and sukuk variables (to be estimated in the later section 4); \( v_{it} \) indicates noise impacts, assumed to be distributed separately from every \( u_{it} \) with zero mean and variance \( (0, \sigma^2_n) \); and \( u_{it} > 0 \), linked with inefficiency measures, assumed to be distributed with one side of \( u_{it} \) (see: Coelli et al., 2005). The dependent variable is cost efficiency, measured as the total cost divided by the quantity of labor. As far as the influence of sukuk (as an environmental variable) on cost efficiency is concerned, where this
Influence might decrease or increase cost efficiency, we initially considered the cost efficiency model, using input-output variables typically used in cost efficiency literature (see: Beccalli et al., 2006; Fior-entino et al., 2006; Lensink et al., 2008; Srairi, 2010). Input variables comprise total expenses, price of labor, and price of fund; while output variables are total loans and other earning assets.

In this paper we apply cost efficiency, because it shows us the actual best practice of banks regarding the cost to produce the optimal output under some specific conditions (Berger and Mester, 2000). Cost efficiency estimates the decreased level in costs that could be obtained with increased bank efficiency. Measuring inefficiencies is calculated in comparison with an efficient cost frontier. Therefore, the technical efficiency of every individual firm (bank) can be acquired by dividing the observation of translog cost function by the optimal stochastic functions, as shown below:

\[ TEE_i = \frac{\ln Y}{\text{Optimal } \ln Y} = \text{Exp} \left(-u_i\right) \]  

Battese and Coelli’s (1995) SFA model is used in this paper to estimate efficiency scores and to control and investigate how far the environmental variable (sukuk) can affect bank efficiency. This variable includes input-output variables comprised directly in the cost translog equation to be estimated only in one-step regression, which can be represented from Eqs. (2) and (3) as:

\[ \ln Y_{it} = \beta_0 + \sum_{n=1}^{N} \beta_n \ln x_{ai} + \sum_{n=1}^{N} \gamma_n z_{ai} + v_i - u_i \]  

Where \( Y_{it} \) is the input variable, which is total cost divided by price of labor (tc/pl); \( x_{ai} \) and \( z_{ai} \) are the input-output variables, comprising the price of fund divided by price of labor (pf/pl), loans, and other earning assets (OEA); \( z_{ai} \) is an exogenous element of the environmental variable, which is a sukuk; and \( \gamma_n \) is the parameter of sukuk, which measures the impact on efficiency scores for each bank (Coelli et al., 2005; Lensink et al., 2008; Srairi, 2010).

The estimation of \( v_i \) and \( u_i \) is assumed to be uncorrelated with independent variables. Assuming the translog functional form, we specify the cost function as:

\[ \ln \left( \frac{tc}{pl} \right) = \beta_0 + \beta_1 \ln(\text{loans}) + \beta_2 \ln(\text{OEA}) + \beta_3 \ln \left( \frac{pf}{pl} \right) + \frac{1}{2} \left( \ln \left( \frac{pf}{pl} \right) \right)^2 + \beta_4 \ln \left( \frac{pf}{pl} \right) \ln(\text{loans}) + \beta_5 \ln(\text{OEA}) + \beta_6 \ln(\text{loans}) \ln(\text{OEA}) + \beta_{10} \text{ Sukuk} + v_i - u_i \]  

Table 1 explains the symbols of variables.

In our model, we consider the bank as an intermediary that receives funds from savers and distributes those funds to investors at minimum costs. The cost function with translog form is modelled according to the method of Lensink et al. (2008). In this paper, by applying translog function paper we examine the hypothesis that issuing Islamic bonds through banks increases banks’ efficiency; if the estimated coefficient of Sukuk variable presents a significant negative impact on cost, we reject the null hypothesis test, indicating that issuing sukuk increase banks’ efficiency as an issuer.

We analyze the cost efficiency of 13 banks issuing sukuk in Saudi Arabia, UAE, and Qatar, comprising both dedicated Islamic banks and conventional banks provide Islamic window, which are conventional banks offering Islamic service windows (Jibal and Levin, 2009). We use quarterly data from Q3 of 2009 to Q2 of 2019. We obtained the data of the 13 banks from the BankFocus database produced by Bureau van Dijk and Moody’s Analytics. Furthermore, all of the annual financial information that is used in this research paper is presented under the International Accounting Standard (IAS) in the US dollars. The sukuk data was obtained from Islamic Finance foundation, which is an initiative for the development of the Islamic Finance and Sukuk industry—Issued Sukuk Profiles.

We employ a dummy variable to examine the impact of issuing sukuk on bank efficiency. Table 2 shows the list of studied banks from the selected GCC countries that issued sukuk during the period of this report. It can be observed that the sukuk types issued through banks differ from profit-loss sharing (PLS) contracts (e.g., Murabahah and Musharakah), to mark-up or sales instruments creating debt (debt-based) contracts (e.g., Murabahah), to assets based (e.g., Ijarah), and agency-based (e.g., Wakala). Table 3 summarizes the statistics of the applied variables that obtained from Table 1, showing that there are no outliers in each used variable, as the natural logarithm was calculated to apply translog cost efficiency model.

4. Results and discussion

After describing the methodology, model specification, and data sources, this section of the study conducts the results and discussion in a dual structure: the efficiency results, and robustness check using SFA with time-invariant inefficiency model.

4.1. The efficiency results

To ensure the validity of the study’s empirical efficiency results, they were derived from translog estimated Eq. (5) through four models: these are Ordinary Least Squares (OLS) (also applied as an initial step for robustness check), Half-Normal, Exponential, and Normal-Gamma models. The first column of each model shown in Table 4 includes the translog cost function components in order to estimate bank efficiency; the second column of each model comprises the translog cost function
components and Sukuk variable to estimate bank efficiency after taking into account issuing Sukuk for each bank; both equations are associated with bank-level variables. As presented in Table 4, the four models give very similar results for the estimated coefficients of each variable.

Table 4 reports cost efficiency estimations for two models, with and without the sukuk variable. The results for the cost frontier are reasonably good; most coefficients are significant for input prices and output, excepting a few variables. Both variables that represent the price of fund over price of labor show a positive relationship, however the former is not significant while the latter (the higher order terms of price of fund over price of labor) is significant at 1%, which indicates a higher input price brings more funds, and thus generating over 20% higher total costs. This result is in line with the findings of Lensink et al. (2008), suggesting that banks should seek to control personnel expenses more than interest expenses (Srairi, 2010). Similarly, for the output variables, loans, OEA, and the interacted variables (loans with OEA) have a positive relationship with total cost in all model estimates, indicating that increasing outputs loans and OEA variables could increase total costs by more than 200% and 60%, respectively. Furthermore, the loans variable is statistically significant at 1% in OLS and SFA estimates, while OEA shows significant results in some estimated models at 10%, and the interacted variables between both of them also present significant results at 1% and 5%. This finding indicates that higher output leads to higher total cost (Lensink et al., 2008).

On the other hand, the higher order terms of output variables, and the interaction of price of funds over price of labor interacted with OEA, present a negative relationship with cost, often significant, at 1%, 5%, and 10%. Such results signify that increasing bank output by double could diminish total cost, by about 25%, which would be supported by a “too big to fail” state (Beccalli et al., 2015). Larger banks are generally more likely to be efficient than smaller ones, as they can apply certain techniques that small banks cannot due to economies of scale and scope. Altunbas and Molyneux (1996) and Girardone et al. (2004) demonstrated that larger size provides more flexible strategies in production and input output process, leading to improved cost minimization and ability to diversify assets and reduce risk, rendering management more efficient.

In addition, banks with higher liquidity can double their output by minimizing their costs, and several banks in GCC countries have various degrees of public ownership, which props up liquidity in banks issuing sukuk (Badunenko and Kumbhakar, 2017; Nguyen et al., 2016). The coefficient of the sukuk variable is significant, with a negative effect on cost, which means that issuing sukuk for the selected Islamic and conventional banks reduces total costs and increases efficiency with around 6%. This result indicates that issuing sukuk increases financial leverage and liquidity, through utilizing different Islamic financing contracts, as displayed in Figure 1.

Figure 1 shows the average of estimated efficiency scores of 13 banks that issued sukuk through stochastic cost frontier models (Half-Normal, Exponential, and Normal-Gamma), obtained by applying Eq. (3). It can be seen that there is a difference between cost efficiency levels when we include sukuk as an environmental variable in the equation. The estimate cost efficiency scores with a sukuk variable are higher than without a sukuk variable in most of the studied period, in all presented frontier models, with the exception of 2015, indicating that issuing sukuk helps to diminish total cost and increases bank efficiency. In 2015 the efficiency level decreased dramatically, which is largely attributable to the downturn in oil prices that affected the financial sector in the GCC region (Islamic Finance Outlook S&P Global, 2017).

4.2. Robustness check using balanced panel data

To ensure that the input and output variables of cost efficiency models are estimated accurately, and to examine the robustness of the estimated SFA model, several models were conducted on balanced panel data as a part of the data sample for 11 banks from the fourth quarter of 2009 to the first quarter of 2019. Those models are random-effects, SFA half-normal, and dynamic panel-data estimates (Arellano, 2003). Table 5 presents a statistical summary for the balanced panel data.

1 In the robustness check sample we have reduced the number from 13 to 11 banks, to obtain balanced panel data.
2 Panel data models are estimated using only random effects, rather than fixed effects, because of the explanatory variables that contain the dummy variable (sukuk). The fixed effect model is calculated by computing dummy variables of N groups in the model, which could pose a statistical dilemma (Greene, 2002).
### Table 4. Efficiency (stochastic cost frontier) models estimate.

| Variables | OLS | Half-Normal | Exponential | Normal-Gamma |
|-----------|-----|-------------|-------------|--------------|
| Constant | -12.1*** (2.29) | -12.3*** (2.290) | -13.7*** (2.33) | -13.8*** (2.32) | -14.67*** (2.41) | -14.76*** (2.32) | -14.67*** (2.41) | -12.20*** (1.84) | -12.40*** (1.87) |
| ln (loans) | 2.82*** (0.475) | 2.76*** (0.475) | 3.12*** (0.484) | 3.02*** (0.483) | 3.42*** (0.50) | 3.33*** (0.49) | 2.82*** (0.44) | 2.75*** (0.47) |
| ln (OEA) | 0.68* (0.42) | 0.75* (0.42) | 0.63 (0.42) | 0.70* (0.41) | 0.495 (0.40) | 0.555 (0.40) | 0.685* (0.384) | 0.746* (0.415) |
| ln (pf/pt) | 0.42 (0.441) | 0.55 (0.445) | 0.54 (0.441) | 0.66 (0.443) | 0.631 (0.430) | 0.730* (0.431) | 0.419 (0.399) | 0.553 (0.41) |
| 1/2 (ln (pf/pt))^2 | 0.25*** (0.058) | 0.23*** (0.058) | 0.23*** (0.057) | 0.22*** (0.058) | 0.215*** (0.056) | 0.205*** (0.056) | 0.247*** (0.062) | 0.233*** (0.063) |
| 1/2 (ln (loans))^2 | -0.35*** (0.087) | -0.35*** (0.087) | -0.39*** (0.087) | -0.38*** (0.087) | -0.453*** (0.086) | -0.44*** (0.085) | -0.352** (0.077) | -0.348*** (0.089) |
| 1/2 (ln (OEA))^2 | -0.061 (0.046) | -0.067 (0.045) | -0.074* (0.045) | -0.079* (0.045) | -0.110** (0.043) | -0.115** (0.043) | -0.061 (0.049) | -0.067 (0.053) |
| ln (pf/pt) ln (loans) | 0.072* (0.041) | 0.073* (0.040) | 0.061 (0.040) | 0.063* (0.039) | 0.044 (0.038) | 0.045 (0.038) | 0.072 (0.053) | 0.073 (0.054) |
| ln (pf/pt) ln (OEA) | -0.25*** (0.041) | -0.26*** (0.041) | -0.25*** (0.039) | -0.26*** (0.040) | -0.23*** (0.036) | -0.24*** (0.037) | -0.252*** (0.054) | -0.261*** (0.057) |
| In (loans) ln (OEA) | 0.13*** (0.062) | 0.13*** (0.062) | 0.141*** (0.061) | 0.143*** (0.061) | 0.181*** (0.057) | 0.182*** (0.058) | 0.126*** (0.056) | 0.128*** (0.064) |
| Sukuk | -0.066*** (0.032) | -0.061*** (0.031) | -0.053*** (0.028) | -0.053*** (0.028) | -0.066 (0.054) |
| R-squared | 0.927 | 0.927 | 0.926 | 0.926 | 0.232 | 0.231 | 0.232 | 0.231 |
| Adjusted R-squared | 0.926 | 0.926 | 0.232 | 0.231 | 0.80*** (0.103) | 0.77*** (0.103) | 0.264*** (0.0004) | 0.261*** (0.0004) |
| Lambda | 0.80*** (0.103) | 0.77*** (0.103) | 0.264*** (0.0004) | 0.261*** (0.0004) | 9.673*** (1.31) | 9.88*** (1.34) | 10.95*** (0.83) | 15.40*** (1.16) |
| Sigma | 0.190*** (0.0084) | 0.190*** (0.0082) | 0.210*** (0.006) | 0.22*** (0.007) | 1.00*** (0.20) | 0.99*** (0.21) | 0.190*** (0.0084) | 0.190*** (0.0082) |
| Sigma-v | 0.190*** (0.0084) | 0.190*** (0.0082) | 0.210*** (0.006) | 0.22*** (0.007) | 1.00*** (0.20) | 0.99*** (0.21) | 0.190*** (0.0084) | 0.190*** (0.0082) |
| P | 28.77 | 30.62 | 52.77 | 54.52 | 48.01 | 45.98 |
| Obs. | 502 | 502 | 502 | 502 | 502 | 502 | 502 | 502 |
| Number of Banks | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |

Note: Standard error presented in parentheses.
Figure 1. The Average of Cost Efficiency in 13 Banks with and Without Sukuk Issuance. Note: efficiency 1, efficiency 3, efficiency 5 = the average rank of cost efficiency without issuing sukuk; efficiency 2, efficiency 4, and efficiency 6 = the average rank of cost efficiency with issuing sukuk.
Table 5. Summary statistics.

| Variable | Mean | Std. Dev. | Min. | Max. |
|----------|------|-----------|------|------|
| ln(loans) | 8.92 | 0.923 | 6.93 | 11.34 |
| ln(OEA)  | 4.62 | 0.520 | 3.48 | 6.073 |
| ln(pf / pl) | 4.62 | 0.520 | 3.48 | 6.073 |
| ln(loans) ln(OEA) | 45.55 | 6.04 | 31.43 | 62.59 |
| ln(pf / pl) ln(loans) | 41.22 | 5.82 | 27.66 | 59.22 |
| ln(pf / pl) ln(OEA) | -0.98 | 2.84*** | 2.76*** | 5.6*** |
| ln(loans) ln(OEA) | 88.39 | 14.81 | 54.61 | 120.27 |
| Sukuk     | 0.133 | 0.341 | 0.00 | 1.00 |

Note: Standard error are presented in parentheses; dynamic panel-data estimate (generalised method of moment GMM-type with one lag).

Table 6 displays the results of random-effects, half-normal, and dynamic panel-data models, showing that most estimated coefficients of input and output variables are significant. Furthermore, the relationship between those independent variables and the total cost variable are consistent with our estimated SFA cost models (as presented in Table 4).

Our findings again support the view that sukuk, as an external variable, has significant negative effects on total cost, demonstrating that issuing sukuk reduces the total cost and increases bank efficiency. This result indicates that issuing sukuk increases financial leverage and liquidity, whether the banks are financed by asset-based, debt-based, equity-based, or agency-based parties, through utilizing different Islamic financing contracts.

5. Conclusion

Previous studies have provided little empirical evidence investigating the relationship between banking efficiency and sukuk issuance. This study addressed the identified gap in the literature by employing SFA models with translog cost function to examine whether issuing sukuk affects the efficiency level of selected GCC commercial banks functioning as sukuk issuers. Using stochastic cost frontier models (Half-Normal, Exponential, and Normal-Gamma), the average efficiency scores of the 13 studied banks were estimated, to observe their performance with and without the sukuk variable. The findings support the hypothesis that issuing sukuk reduces costs and increases bank efficiency, thereby increasing financial leverage and liquidity, whether their financing is sourced from asset-based (e.g., Ijarah), debt-based (e.g., Murabahah), equity-based (e.g., Musharakah), or agency-based (e.g., Wakala) parties.

Ultimately, the results for the cost frontier have presented a positive and significant relationship for the higher order terms of price of fund over price of labor variable, supporting the conclusion that a higher input price brings more funds that thus increase bank efficiency (Lensenk et al., 2008). Furthermore, the output variables have positive and significant relations with total cost. This indicates that higher output leads to a higher total cost, but the higher order terms of output variables, and the interaction of price of funds over price of labor interacting with OEA, present a negative relationship with cost, suggesting that increasing bank's output by double could diminish total cost.

In terms of economies of scale and scope, some banks in the study sample are relatively small, such as Saudi Investment Bank and Arab National Bank, and they might therefore lack more flexible strategies in production and input output process, thus increasing their costs. On the other hand, several banks in the GCC countries have large proportions of state ownership, such as NCB among this study's sample, which buttresses liquidity in such banks in issuing sukuk (Badunenko and Kumbhakar, 2017). The sukuk variable coefficient has a negative effect on cost, suggesting that issuing sukuk reduces costs and increases efficiency for the selected Islamic and conventional banks.

Lastly, it is also important to note that the sample of this study to investigate the relation between bank efficiency and issuing sukuk was wholly from the GCC region; including other banks that issued Islamic bonds from different regions would have enhanced the quality of the findings established in this study. Comparative studies of GCC banks’
performance and other regions (e.g., Southeast Asia, where sukuk issuance is a major financial sector) would give a more general view of efficiency impacts. However, this study is designed by taking into account the realities of the region, with the aim of shedding some light on the particular field of studying GCC commercial banks.

Declarations

Author contribution statement

Maha Alandejani: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data will be made available on request.

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The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

References

AAOIFI Financial Accounting Standard No. 34, Financial Reporting for Sukuk-holders 2017. http://aaoifi.com/financial-reporting-for-sukuk-holders/?lang=en.

Ahmad, N., Daud, S.N.M., Kefeli, Z., 2012. Economic forces and the sukuk market. Procedia-Social and Behavioral Sciences 65, 127–133.

Altunbas, Y., Molyneux, P., 1996. Cost economies in EU banking systems. J. Econ. Bus. 48 (3), 217–230.

Anwar, M., 2019. Cost efficiency of Indonesian banks over the recovery period: a stochastic frontier analysis. Soc. Sci. J. 56 (3), 377–389.

Arellano, M., 2003. Panel Data Econometrics. OUP, Oxford.

Arundina, T., Omar, M.A., Kartiwi, M., 2015. The predictive accuracy of sukuk ratings: multinomial logistic and neural network inferences. Pac. Basin Finance J. 34, 273–292.

Badunenko, O., Kumbhakar, S.C., 2017. Economies of scale, technical change and persistent and time-varying cost efficiency in Indian banking: do ownership, regulation and heterogeneity matter? Eur. J. Oper. Res. 260 (2), 789–805.

Battese, G.E., Coelli, T.J., 1995. A model for technical inefficiency effects in a stochastic frontier production function for panel data. Empir. Econ. 20 (2), 325–332.

Beccalli, E., Casu, B., Giradonne, C., 2006. Efficiency and stock performance in European banking. J. Bus. Financ. Account. 33 (1–2), 245–262.

Beccalli, E., Anolli, M., Borello, G., 2015. Are European banks too big? Evidence on economies of scale. J. Bank. Finance 58, 232–246.

Beck, T., Demirgüç-Kunt, A., Merrouche, O., 2013. Islamic vs. conventional banking: business model, efficiency and stability. J. Bank. Finance 37 (2), 433–447.

Belanès, A., Fiti, Z., Regazzi, R., 2015. What can we learn about Islamic banks efficiency under the subprime crisis? Evidence from GCC Region. Pac. Basin Finance J. 33, 81–92.

Berger, A.N., Humphrey, D.B., 1997. Efficiency of financial institutions: international survey and directions for future research. Eur. J. Oper. Res. 98 (2), 175–212.

Berger, A.N., Mester, L.M., 2000. Inside the black box: what explains the differences in the efficiencies of financial institutions? In: Patrick, T., Zenios, S.A. (Eds.), Performance of Financial Institutions. Cambridge University Press, pp. 93–150.

Berger, A.N., Hunter, W.C., Timme, S.G., 1993. The efficiency of financial institutions: a review and preview of research past, present and future. J. Bank. Finance 17 (2–3), 221–249.

Brooks, R., Faff, R., Mulino, D., Scheelings, R., 2009. Deal or No deal, that is the question: the impact of increasing stakes and framing effects on decision-making under risk. Int. Rev. Finance 9 (1–2), 27–50.

Chen, C., 2009. Bank efficiency in Sub-Saharan African middle income countries (Working Paper No. WP/09/14). IMF. https://www.imf.org/external/pubs/ft/wp/2009/wp0914.pdf.

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.

Delis, M.D., Papanikolaou, N.I., 2009. Determinants of bank efficiency: evidence from a semi-parametric approach. Manage. Financ. 35 (3), 260–275.

Dreze, L., Hall, J.B., M., 2003. Efficiency in Japanese banking: an empirical analysis. J. Bank. Finance 27 (5), 891–917.

Elkah, M.A.A., Muhamed, N.A., Ramli, N.M., 2015. The influence of corporate governance, financial ratios, and Sukuk structure on Sukuk rating. Procedia Econ. Finance 31, 62–74.

Islamic Finance Foundation, Manchester, United Kingdom. https://www.sukuk.com/whatiswho/islamicfinance-com-4403/.

Fiorentino, E., Karmann, A., Koetter, M., 2006. The Cost Efficiency of German Banks: A Comparison of SFA and DEA. SSRN.

Giradone, C., Molyneux, P., Gardener, E., 2004. Analysing the determinants of bank efficiency: the case of Italian banks. Appl. Econ. 36 (3), 215–227.

S&P Global, 2020. Global sukuk market: a window of opportunity is opening. S&P Global Ratings. https://www.spglobal.com/ratings/en/research/articles/200707-globalsukumarket-a-window-of-opportunity-is-opening-11561119.

Godlewski, C.J., Turk-Ariss, R., Weill, L., 2015. Are European banks too big? Evidence on conventional vs. sukuk: a stock market perspective. J. Comp. Econ. 41 (3), 745–761.

Greene, W.H., 2002. The Behavior of the Fixed Effects Estimator in Nonlinear Models. New York University.

Hameed, R., 2009. From “asset-backed” to “asset-light” structures: the intricate history of sukuk. ISRA Int. J. Islamic Finance 1 (1), 103–126.

Ibrahim, M.H., 2015. Issues in Islamic banking and finance: Islamic banks, Shari‘ah compliant investment and sukuk. Pac. Basin Finance J. 34, 185–191.

Iqbal, Z., Lewis, M., 2009. An Islamic Perspective on Governance. Edward Elgar Publishing.

Lensink, R., Meesten, A., Naaborg, I., 2008. Bank efficiency and foreign ownership: do good institutions matter? J. Bank. Finance 32 (5), 834–844.

Mohamed, Z., Ramailli, S., Arief, M., 2018. Sukuk announcement effects during financial crisis: the case for the Indonesia. J. Islamic Account. Bus. Res. 9 (4), 567–586.

Miah, M.D., Uddin, H., 2017. Efficiency and stability: a comparative study between Islamic and conventional banks in GCC countries. Future Bus. J. 3 (2), 172–185.

Mimouni, K., Smouli, H., Temimi, A., 2019. The impact of Sukuk on the performance of conventional and Islamic banks. Pac. Basin Finance J. 54, 42–54.

Mohamed, H.H., Masih, M., Bacha, O.L., 2015. Why do issuers issue Sukuk or conventional bond? Evidence from Malaysian listed firms using partial adjustment models. Pac. Basin Finance J. 34, 233–252.

Nagano, M., 2016. Who issues Sukuk and why? An analysis of the determinants of Islamic bond issuance. Rev. Finance Econ. 31, 45–55.

Naifar, N., 2016. Modeling dependence structure between stock market volatility and sukuk yields: a nonlinear study in the case of Saudi Arabia. Borsa Istanbul Rev. 16 (3), 157–166.

Naifar, N., Hammoudeh, S., 2016. Do global financial distress and uncertainties impact GCC and global sukuk return dynamics? Pac. Basin Finance J. 39, 57–69.

Naifar, N., Mroua, M., Bahoud, S., 2017. Do regional and global uncertainty factors affect differently the conventional bonds and sukuk? New evidence. Pac. Basin Finance J. 31, 65–74.

Nguyen, T.L.A., 2018. Diversification and bank efficiency in six ASEAN countries. Global Finance J. 37, 57–78.

Nguyen, M., Perera, S., Skully, M., 2016. Bank market power, ownership, regional presence and revenue diversification: evidence from Africa. Emerg. Mark. Rev. 27, 36–62.

S&P Global, 2017. Islamic Finance Outlook. S&P Global Ratings. https://www.spratings.com/documents/2018/0/Islamic-Finance-Outlook-2017/Sakkbe572-e826-4622-bd13-1aba17258f16.pdf.

Said, A., 2011. Does the use of sukuk (Islamic bonds) impact Islamic banks performances? A case study of relative performance during 2007–2009. Middle E. Finance Econ. 12. https://papers.ssrn.com/sol3/Delivery.cfm SRN_ID1906641 coder1e699849.pdf?abstractid=1906641&mirid=1.

Shambhu, A., Weill, L., 2019. Does bank efficiency influence the cost of credit? J. Bank. Finance 105, 62–73.

Sherman, H.D., Gold, F., 1985. Bank branch operating efficiency: evaluation with data envelopment analysis. J. Bank. Finance 9 (2), 297–315.

Srairi, S.A., 2010. Cost and profit efficiency of conventional and Islamic banks in GCC countries. J. Prod. Anal. 34 (1), 45–62.

Wessel, T., 2010. Bank Efficiency amid Foreign Entry: Evidence from the Central American Region (Working Paper No. WP/10–95). IMF. https://www.imf.org/external/pubs/ft/wp/2010/wp1095.pdf.

Wilson, R., 2008. Innovation in the structuring of Islamic sukuk securities. Humanomics 24 (3), 170–181.

Zulkhibri, M., 2015. A synthesis of theoretical and empirical research on sukuk. Borsa Istanbul Review 15 (4), 237–248.