SFA Application on Islamic Economics and Finance Research

Aam Slamet Rusydiana[1], Lina Nugraha Rani[2*], Rosadiro Cahyono[3]

Sharia Economic Applied Research & Training (SMART) Indonesia. Email: aamsmart@gmail.com
[2] Faculty of Economic and Business Airlangga University, Indonesia. *Email: linanugraha@feb.unair.ac.id
[3] STIE Pancasetia Banjarmasin, Indonesia. Email: rosadirocahyono@gmail.com

Abstract

This study aims to determine the map of SFA research on Islamic economics and finance (IEF). SFA or Stochastic Frontier Approach is one method for parametric efficiency measurement. The data analyzed were in the form of publication of the SFA application research on IEF, totaling 109 articles. Map of the development of SFA field research is obtained through the export process into the .txt file format. The export data is then processed and analyzed using the VOSviewer application program to determine the SFA development's bibliometric map in Islamic finance application research. The results showed that the number of publications on the study results on the SFA application in IEF from 2009-2019 had increased significantly and was the most published in the International Journal of Islamic and Middle Eastern Finance and Management. Network visualization shows that the map of the development of the SFA application research is divided into 4 clusters. Cluster 1 consists of 7 topics, cluster 2 consists of 4 topics, cluster 3 consists of 3 topics, and cluster 4 consists of 2 topics. Application in the Islamic banking industry with a cost efficiency approach is the most widely used. Meanwhile, the sfpanel model is the most frequently used in the SFA model.

Keywords: *SFA, Bibliometric, Islamic economics, Islamic finance, efficiency*

I. INTRODUCTION

The Islamic financial sector has a very important role in the world economy. Where today, the Islamic financial sector is one of the attractions for world finance. Since the beginning of the emergence of Islamic banks, namely Mit Ghamr Local Saving Bank in 1963 and Islamic Development Bank (IDB) in 1973, the world's Islamic finance industry has developed and continues to increase until now. According to the Global Islamic Financial Report (2018), the development of Islamic banking and finance worldwide in the 2013-2017 period has increased, where the highest increase occurred in 2014.

Khan and Bhatti (2008) indicate that Islamic banking and financial institutions have gained a growing base in the Middle East and Southeast Asia. According to the 2012 Global Islamic Finance Forum Report, more than 600 Islamic financial institutions (IFIs) operate in 75 countries. This sector has experienced tremendous growth, with total assets worldwide reaching around the US $ 1.3 trillion in 2011. It is projected to exceed the US $. 6.5 trillion in 2020 (Zeineb & Mensi, 2018).

In recent decades, its spectacular growth in Islamic finance is due to several factors, mainly due to the increase in oil prices and the proportion of Muslims in the population. According to several studies, Islamic banks also appear to be complementary rather than substitutes for conventional banks. In this context, major reforms have been implemented to provide a lot of competition in maintaining financial stability and resilience (Louati & Boujelbene, 2015).

Islamic banking, which is dominated by Islamic banking, has researched how Islamic banking's performance has been widely conducted. One of them is measuring the efficiency of Islamic banking in measuring its performance. Rumiasih and Enayatullah (2018) stated that amidst the competitive conditions and problems in national banks in this era of industrial transformation 4.0, each bank would race to improve its operational performance to reach the most efficient point of its business. Also, Islamic finance develops the same intermediary function but differs in interest rates. Likewise, other Islamic financial institutions do not receive income in the form of interest (Bakour & Galalli, 2014).

In measuring efficiency that is often carried out by previous studies, namely the Stochastic Frontier Analysis (SFA) method. SFA is a parametric efficiency measurement that is often used in addition to DEA as a non-parametric efficiency measurement. This study aims to determine the map of research development related to applying the Stochastic Frontier Analysis (SFA) method in Islamic economic and financial research using the VOSviewer software. This analysis is called bibliometric analysis. Besides, before the bibliometric analysis was carried out, these SFA-related publications were analyzed based on text mining, namely Meta-Analysis. Matters presented in the meta-analysis are related to the year of publication, country case studies, study sector classification, input-output combinations, and the estimated model of each published paper regarding applying the SFA method.

II. THEORETICAL BASIS

Stochastic Frontier Analysis (SFA)

Overall, five general efficiency differentiation procedures have been used in measuring bank efficiency. Distribution Free Approach (DFA), Tick Frontier Approach (TFA), and Stochastic Frontier Analysis (SFA) which are under the parametric procedure. Meanwhile, Free Disposal Hull (FDH) and Data Envelopment Analysis (DEA) are under the non-parametric methodology. These approaches have different functions mainly based on the presence of random errors, dispersion of random errors and inefficiencies, and hypotheses imposed on the efficiency limit provisions (Abdul-Wahad & Razali, 2017).

Meanwhile, DEA uses a linear program, whereas SFA uses a regression procedure and requires assumptions on the statistical distribution of random errors and inefficiency terms. The SFA also requires assumptions on the appropriate functional associations regarding the production of inputs and outputs. Due to these assumptions, SFA's use can take an unsuitable functional form (Abdul-Wahad & Razali, 2017). The SFA models address technical efficiency and reveal that observed deviations from the production function can arise from two sources: negative productive inefficiency and firm-specific special effects. Several different functional forms such as Cobb-Douglas (linear log of output and input), quadratic (at input), normalized quantization, translog function are used in literature to model production functions (Miah and Uddin, 2017).

Bibliometric Mapping

Bibliometric mapping is an important research topic in the bibliometric field (Borner et al., 2003). Two distinguishable bibliometric aspects are the construction of the bibliometric map and the graphical representation of the map. In the bibliometric literature, the greatest concern is in the construction of the bibliometric map. Research related to the effects of differences in similarity measures (Klavans and Boyack 2006) tested with different mapping techniques (Van Eck and Waltman 2007). The graphic representation of the bibliometric map has received less attention. Although some researchers seriously study graphical representations (Chen 2006), most articles published in the bibliometric literature rely on simple graphical representations provided by computer programs such as SPSS and Pajek. For thumbnails containing no more than 100 items, a simple graphical representation usually yields satisfactory results. However, there appears to be a trend toward larger maps (e.g., Klavans and Boyack 2006), and for such maps, simple graphical representations are not adequate. A large bibliometric map's graphical representation can be further improved by using a zoom function, special labeling algorithms, and density metaphors. Such functionality is not included in the computer programs commonly used by bibliometric researchers. In this paper, we introduce a new computer program for bibliometric mapping. This program pays special attention to the graphical representation of bibliometric maps.

This section discusses the use of VOS, which is to build a bibliometric map. VOS's purpose is to place items in such a low dimension that the distance between the two items accurately reflects the items' uniformity or association. For each pair of items i and j, VOS requires a similarity input s_{ij} ($s_{ij} \geq 0$). VOS treats the equation s_{ij} as a measure on a ratio scale. The equation sij is usually calculated using the association's strength defined in Equation 1 (e.g., Van Eck & Waltman, 2007). VOS determines the location of items in the map by minimizing

$$V(x_i, \ldots, x_n) = \sum_{i<j} s_{ij} \|x_i - x_j\|^2 \qquad (1)$$

to:

$$\frac{2}{n\,(n-1)} \sum_{i<j} \|x_i - x_j\| = 1 \qquad (2)$$

Therefore, VOS's idea is to minimize the weighted sum of the squares of the distance between all pairs of items. The equation between those items weights the square of the distance between pairs of items. To avoid worthless solutions, where all items have the same location, limits are imposed so that the average distance between two items must be equal to one.

Two computer programs have implemented the VOS mapping technique. Both are available free of charge. A simple open-source program is available at www.neesjanvaneck.nl/vos/, and a more advanced program called VOSviewer (Van Eck & Waltman, 2010) is available at www.vosviewer.com. Both programs use the variant of the SMACOF algorithm mentioned above to minimize Equation 1 to Equation 2.

Meta-Analysis

The meta-analysis method is a statistical systemization tool that combines several studies that discuss a series of related research topics. It is also an attempt to reduce statistical power in a study with a small sample size. And allows for more accurate data analysis (Khlif & Chalmers, 2015). So this method is suitable for use with samples in the form of collections of literature with related themes. Meanwhile, according to Khlif and Souissi (2010), meta-analysis summarizes and clarifies findings inconsistent with various studies. Thus, the meta-analysis will provide an opportunity to combine and evaluate all the different influences on their research findings.

According to Hunter and Schmidt (1990), the meta-analysis method has potential drawbacks when only examining completed studies or studies. Some studies have not been published, or authors have not completed a draft paper. This is likely to have less effect on research than in published and completed research. As a result, there may be bias because research is only conducted with one type: completed and published in print or online media (Hay, 2013).

Previous Researches

The following is a summary of previous research related to measuring efficiency in Islamic economic and financial research using the Stochastic Frontier Analysis (SFA) method. Zuhroh et al. (2015) Measuring efficiency is carried out using the Stochastic Frontier Analysis (SFA) method by comparing Islamic and conventional banks' efficiency in Indonesia. The result is that the overall efficiency of Islamic banking is lower than conventional banking. However, the technical efficiency of Islamic banking is higher than conventional banking.

Miah dan Uddin (2017) measures Islamic and conventional banking's efficiency and stability in GCC member countries. Efficiency measurements were carried out using Stochastic Frontier Analysis (SFA) and stability using ordinary least square (OLS) regression techniques. In terms of cost-efficiency, conventional banking is more efficient than Islamic banking in the GCC. Besides, in terms of stability, Islamic banks in the short term are more efficient than conventional banks, while there is no significant difference between the two in the long term.

Alqahtani et al. (2017) measured efficiency using the DEA and SFA methods in Islamic and conventional banking in the Gulf Cooperative Council (GCC). In this study, efficiency measurements were carried out in the period before, during, and after the global financial crisis (GFC), namely 1999-2012. Whereas from the research results, it is known that between Islamic and conventional banking, there is no significant difference in cost efficiency.

Also, there is an efficiency measurement using the SFA method in zakat institutions conducted by Budiantoro et al. (2018). His research was conducted to measure technical efficiency and identify the factors that cause inefficiency in the National Zakat Agency (BAZNAS) in managing zakat funds on receipt and distribution and zakat. Overall, the technical efficiency regarding the receipt of BAZNAS zakat funds was found to be 94.98%, which means that there are still 5.02% that can still be optimized. Meanwhile, the technical efficiency regarding the distribution of BAZNAS zakat funds was 70.99%, leaving 29.01% that could still be optimized.

Alshammaari et al. (2019) conducted measurements using the SFA method in the insurance and Takaful industries. His research discusses the impact of oil prices and financial markets on the insurance and Takaful sectors' cost efficiency in the GCC countries in 2009-2016. The results show that the relationship between oil prices and efficiency changes from positive to negative as prices increase, whereas the relationship between financial markets and efficiency is negative.

III. METHODOLOGY

This study uses data in the form of research journals and other research publications during the 2009-2019 period that have been published regarding the application of the Stochastic Frontier Analysis (SFA) method in Islamic economic and financial research. These journals can be obtained or accessed online from published journals. The methodology used in this research is a qualitative method approach with descriptive statistical literature studies of 109 publications related to the application of the SFA method. The qualitative research method is a research method based on the philosophy of postpositivism used to examine a natural object (as opposed to an experiment) where the researcher is the key instrument. Data collection techniques are carried out by triangulation (combined), data analysis is inductive/qualitative, and qualitative research results emphasize meaning rather than generalization (Sugiyono: 2008).

This study uses international publication data related to applying the SFA method in Islamic economic and financial research sourced from the Scopus database (www.scopus.com). The data was collected through searches for Scopus publications with the keyword SFA on Islamic economic with the categories article title, abstract, keywords in the period 2003 - 2019. From the search results, there were 65 published articles. The trend of the development of waqf publications was analyzed using the VOSViewer software.

The computer program that we are introducing is called VOSviewer. VOSviewer is a program we developed to build and view bibliometric maps. This program is freely available to the bibliometric research community (see www.vosviewer.com). VOSviewer, for example, can be

used to create author maps or journals based on co-citation data or to build keyword maps based on shared incident data. The program offers a viewer that allows the bibliometric map to be examined in detail. VOSviewer can display maps in a variety of ways, each emphasizing a different aspect of the map. It has functions for zooming, scrolling, and searching, which facilitate detailed inspection of the map. VOSviewer's viewability is particularly useful for maps containing at least a large number of items (e.g., at least 100 items). Most computer programs used for bibliometric mapping do not nicely display such maps.

This study used a purposive non-probability sampling method. Purposive samples are samples that have the aim of understanding certain information. This sample can be grouped into sample decisions (judgment), which select sample members who fit certain criteria based on records or research objectives to be achieved. The quota sample, namely the sample, is selected based on a specific quota or category, which describes the dimensions dimension (proportion) of the population (Wijaya: 2013). The criteria referred to in this study are 109 publications related to the application of the SFA method on the rise of Islamic economics and finance from 2003-2019.

IV. RESULT AND DISCUSSION

In this study, the authors reviewed 109 studies on applying the Stochastic Frontier Analysis (SFA) method in Islamic economic and financial research, which have been published in international and national journals, conferences, working papers, and other publications. This study will review the analytical methods used, topics, efficiency objectives, case studies, year published, and the highest number of citations used using descriptive analysis. Besides, this study will also add a bibliometric method to explain literature studies using the SFA method.

This study reviewed 109 studies with publications from 2003 to 2019. During that period, research on the three-year SFA with the most publications occurred from 2015 to 2018. In 2018, 12 papers were published using the SFA method, while in 2018, 12 papers were published using the SFA method. 2017 and 2015 had the same number of 10 papers, and in 2016 there were 11 papers published using the SFA method. From 2003 to 2019, there was an increase as well as a decrease. In 2003 there were only 3 papers, and in 2018 there were 12. This shows that the development of the SFA analysis model to see a company's efficiency has increased. The following is a table of the year of publication and the number of papers each year.

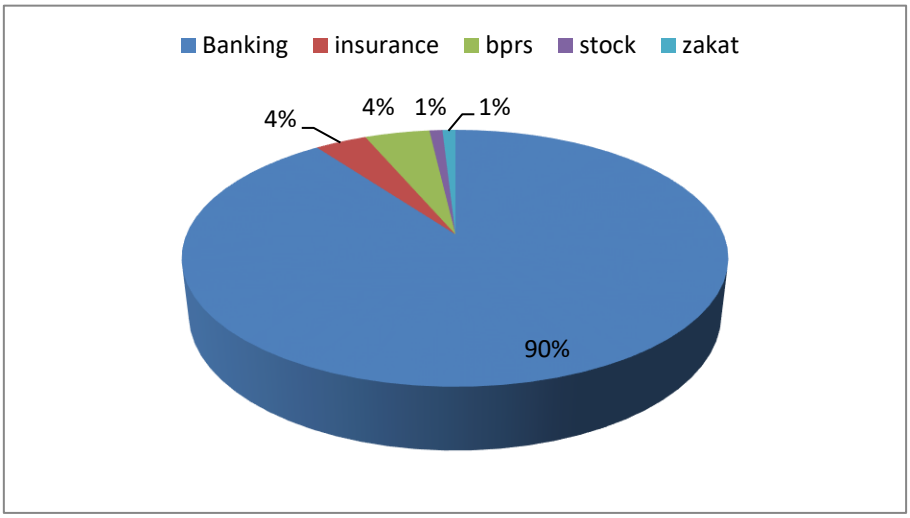
Table 1: Classification of Publication Based on the Year of Publication

No.	Year of Publication	Number of Articles
1	2019	9
2	2018	12
3	2017	10
4	2016	11
5	2015	10
6	2014	8

7	2013	6
8	2012	5
9	2011	9
10	2010	8
11	2009	4
12	2008	4
13	2007	1
14	2006	3
15	2005	4
16	2004	2
17	2003	3
	Total	109

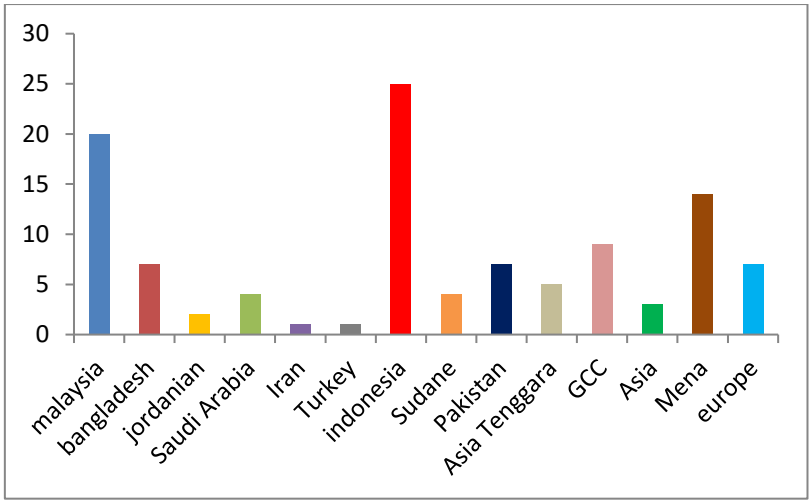
We also classify the papers reviewed based on the study's focus or topics on the Islamic finance sector. The studies carried out various cover sectors such as Islamic banking, waqf, insurance, zakat, Islamic microfinance institutions, etc. The following shows the number of sectors that focus on researchers, and their distribution can be seen in Figure 1.

Figure 1: Classification of Publications by Study Focus Sector



Based on Figure 1, most of the 109 papers reviewed discussed the banking sector, namely as much as 90%. The banking sector is the sector most researched by researchers to determine its efficiency. This is since the banking sector is a fairly transparent one in data. Meanwhile, there are still very few other sectors. In the share and zakat sector, the yield is 1%. This shows that the two sectors are still less attractive to researchers to assess efficiency based on the SFA method. The BPRS sector and the insurance sector are still more attractive than stocks or zakat, which shows a value of 4% of the total number of papers reviewed.

Figure 2: Distribution of papers based on country case studies



Also, we explain the distribution of reviewed papers based on studies conducted in certain countries. Studies conducted in various countries and comparative analyzes between countries are also included in the literature we reviewed. Based on Figure 2, a case study in the country with the most SFA research during the 2003-2019 period was Indonesia with 25 papers, then underneath there was Malaysia with 20 papers. Developing countries get the greatest attention from researchers, namely Malaysia and Indonesia. However, there are only 5 special case studies in Southeast Asia.

Meanwhile, the European countries are less attractive to researchers. This is evidenced by the number of papers that discuss efficiency with case studies in European countries, only 7 papers. In contrast, the Middle East and North Africa (MENA) countries received high attention, namely 14 papers that discussed the efficiency of using the SFA method.

Approach to the selection of input-output combinations. The choice of input-output combination is a complex issue since each DMU may have "n" numbers of inputs and outputs. From the literature, we have identified the following approaches for variable selection and determination of efficiency objectives: the cost approach, the profit approach, the two approaches, and other approaches. The following lists the input-output combination approaches and the number of studies.

Table 2: Classification of Publications Based on the Input-Output Combination Approach

Approach	No.of Papers
Cost Efficiency	58
Cost and Profit efficiency	17
Profit Efficiency	21
Other	13
Total	109

The cost-efficiency approach shows that it is the main approach used in the literature. As many as 58 papers describe efficiency with the aim of cost-efficiency. Cost efficiency is of the greatest interest to researchers to discuss the efficiency of several Islamic financial sectors. The profit efficiency approach is quite attractive to researchers, namely several 21 papers that discuss the efficiency profit using the SFA method. Among the 109 papers, 17 papers

discussed not only cost efficiency but also profit efficiency. Meanwhile, the other approach is not for cost efficiency or profit efficiency as much as 13 papers.

The Stochastic Frontier Approach (SFA) is a parametric method that uses an econometric method based on the Cobb Douglas production function. This method will estimate the function of the factors that determine production efficiency, external factors, macroeconomic variables, etc. (Kismawadi, Nuruddin, & Yusuf, 2017). This method is based on the data divided into two, namely sfcross and sfpanel. Sfcross is the SFA method used for cross-section data, and sfpanel is the SFA method used for panel data. The spfpanel is divided into three methods, namely fixed effect, true fixed effect, and true rundom effect. SFA explains that the error distribution in the efficiency model is divided into 3 types, namely the distribution following the exponential (exp) model, truncated normal (normal), and half normal (hnormal). Based on this division, the following lists the classification of 109 papers reviewed based on the type of method used.

Table 3: Classification based on the type of model estimated

Model Estimation		**No.Of Papers**
Sfcross		2
Sfpanel	fixed effect	22
	maximum likelihood, half normal	6
	maximum-likelihood truncated normal	7
	the true fixed effect, half normal	3
	true random error, exponential	15
	true random error, half normal	26
	true random error truncated normal	13
Other	OLS	2
	pooled least square	3
	meta-frontier analysis (MFA)	4
	SFA (efisiensi)	6
Total		109

Based on Table 3, the estimation model most interested by researchers to estimate efficiency is the panel data estimation model. This suggests that researchers mostly use several units to estimate the efficiency. The panel data SFA estimation model that researchers often use is the type of panel data estimation with the assumption that the error is Rundom and its distribution is truncated normal or often called "sppanel true random error distribution truncated normal." The number of papers using this model was 26 papers. The estimation model, which is also widely used by researchers, is the panel data model with the type of fixed effect totaling 22 papers. In the estimation model, the cross-section data was less attractive to researchers because of the 109 papers. Only 2 papers used SFA, the type of cross-section data. Also, to estimate the efficiency in the Islamic financial sector, researchers use other methods besides the SFA method, namely the OLS method, pooled least square (PLS), and meta-frontier analysis (MFA).

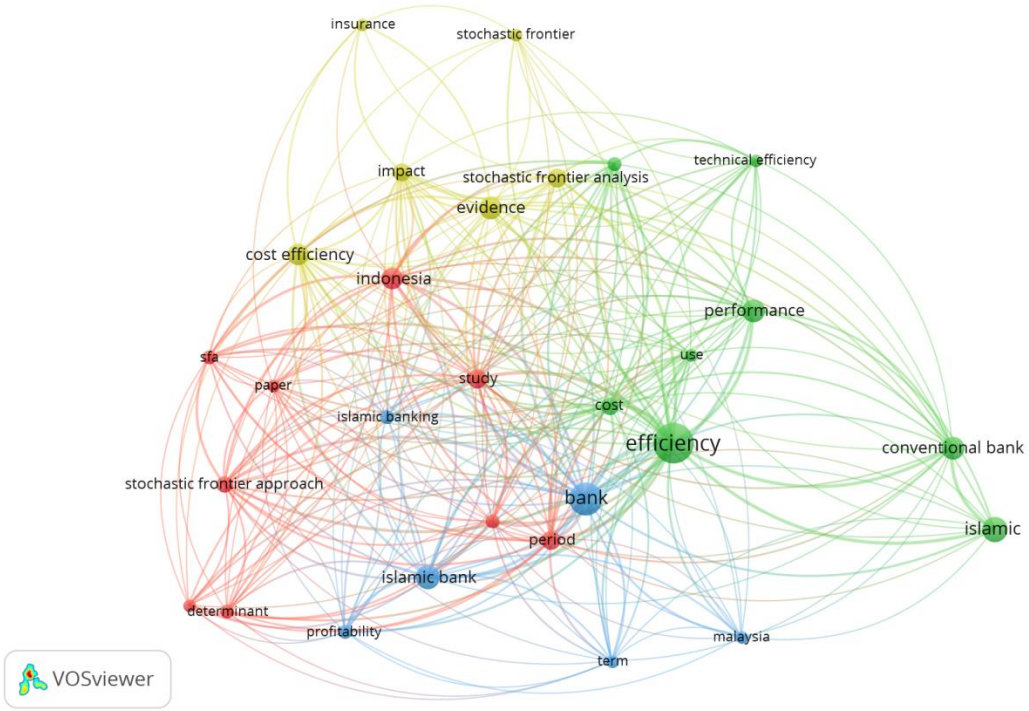
Bibliometric Map Research using the SFA method

From the search results through the Scopus database obtained as many as 65 documents on developing the results of research papers using the SFA method, then the documents were exported to .txt format, inputted, and analyzed by VOSViewer, the following results were obtained.

Co-word Map Network Visualization

The results of the co-word map network visualization of research development using the stochastic frontier approach (SFA) method are divided into 29 topics, as in Figure 3 below. The 29 topics are divided into 4 clusters marked in yellow, green, and blue. Cluster 1 marked in red consists of determinant, Indonesia, inefficiency, paper, period, profit efficiency, SFA, stochastic frontier approach, and study. In this cluster, the most frequently used topic in Indonesia is marked by the red cluster's largest circle. This is also comparable to the previous discussion that Indonesia is the largest case study that discusses the SFA method. Cluster 2, which is marked in green, consists of 8 items, including conventional bank, cost, efficiency, Islamic, level, performance, technical efficiency, and use. In this cluster, the word most used by the author is efficiency, which is indicated by the largest green circle in the cluster. This shows that most of the 109 papers with the SFA method discuss efficiency, and the use of the SFA method is appropriate to show the value of efficiency.

Figure 3: Visualization of the research development map network using the SFA method based on words

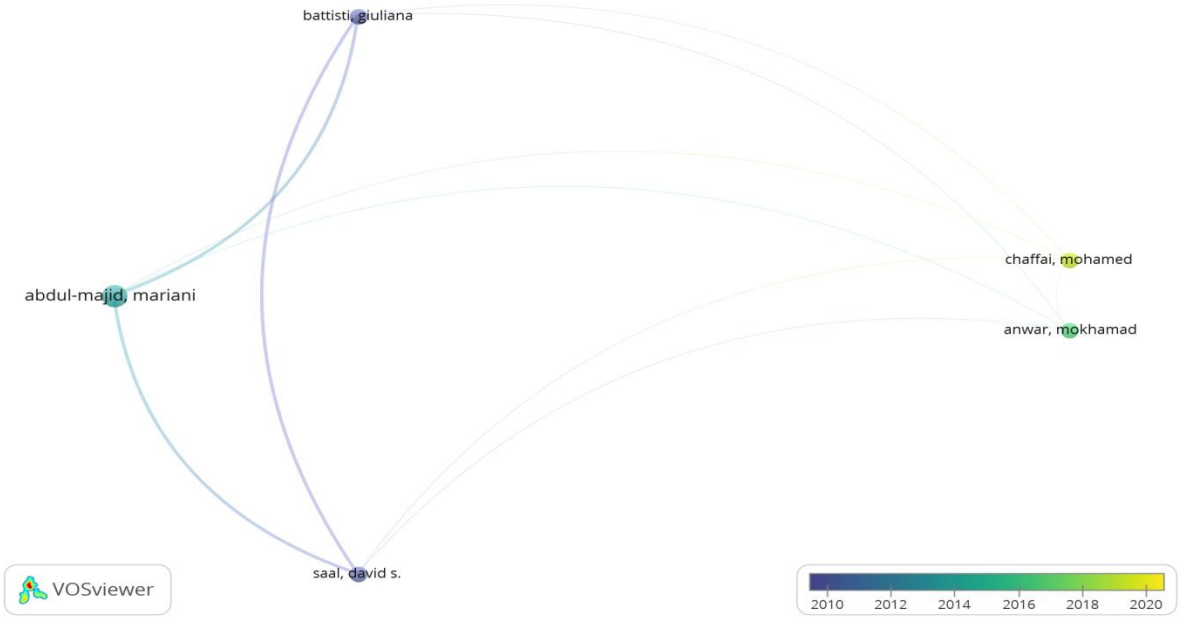


Cluster 3, marked in blue, consists of 6 items, including banks, Islamic banks, Islamic banking, Malaysia, profitability, and terms. In this cluster, the author's most words are banks marked by the largest blue circle in the cluster. This shows that the 109 papers using the SFA method mostly discuss efficiency in banking. This is following the previous discussion regarding the classification of papers based on the topics researched and most concerning banking. The last cluster, namely cluster 4, marked in yellow, consists of 6 items, including cost efficiency, evidence, impact, insurance, stochastic frontier, and stochastic frontier analysis. In this cluster, the two most used words are cost efficiency and evidence. This suggests that most of the papers reviewed discussed efficiency intending to reduce costs and case studies in specific countries.

Co-Author Map Overlay Visualization

The visualization of the co-word map network of research developments using the stochastic frontier approach (SFA) method can be seen in Figure 4. Figure 4 shows that the authors who write the most articles about efficiency using the SFA method include Mariani Abdul-Majid, Giuliana. Battisti, David S. Saad, Mohamed Chaffai, and Mokhamad Anwar.

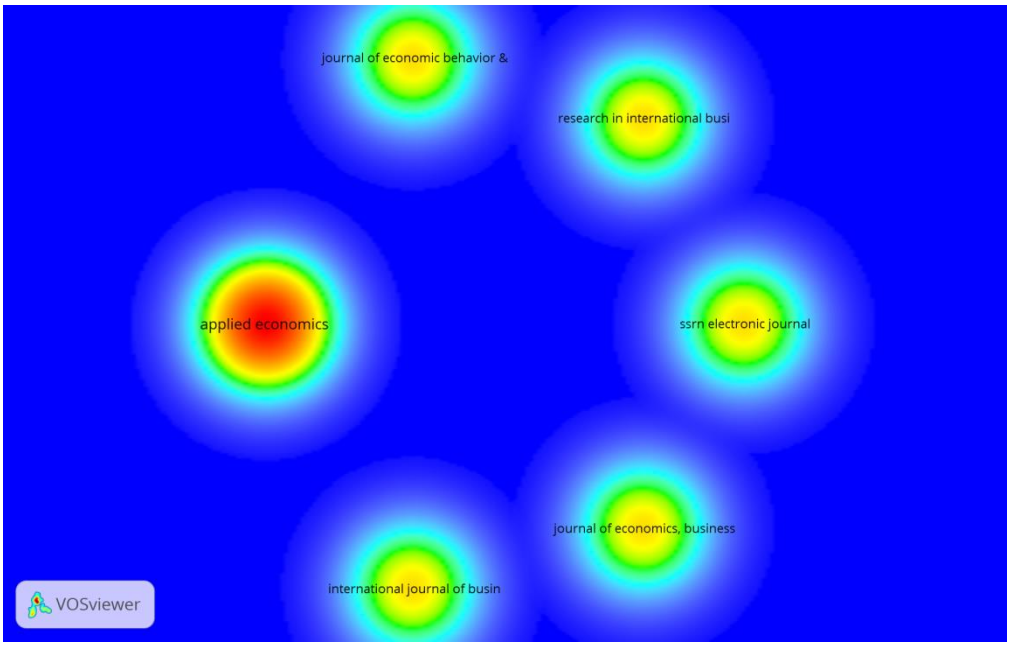
Figure 4: Visualization of the map overlay research development using the SFA method based on authors



Visualization of the Density Map of Co-Sources

The cluster density view is the item (label) marked the same as the visible item. Each item dot has a color depending on the density of the item at that time. It identifies that the color of the map points depends on the number of items associated with other items. This section is very useful for obtaining an overview of the bibliometric map's general structure by paying attention to which parts of the items are considered important to be analyzed. Through this worksheet, we can interpret the keywords that are most used in a publication. Visualization of co-source density maps of research developments using the SFA method can be seen in Figure 5.

Figure 5: Visualization of the density map of research developments using the SFA method based on the source

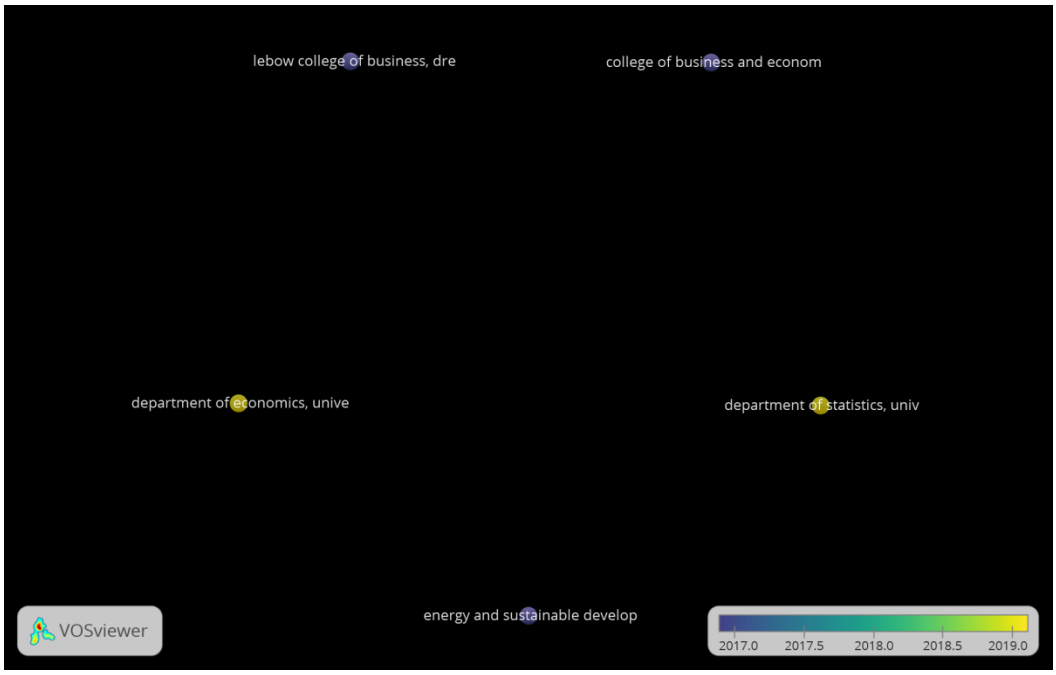


Based on the results in Figure 5, the visualization of the co-word map network of research developments using the stochastic frontier approach (SFA) is divided into 6 sources, including applied economics, the Journal of economics, behavior & organization, Research of international business and finance. SSCN electronic journal, journal of economics, business and accountancy ventures, and International journal of business and management. Of the 6 sources, the journal with the highest number of published papers using the SFA method is applied economics. This is indicated by an increasingly reddish color, as shown in Figure 5.

Visualization of Map Co-Organizations Overlay

The visualization overlay map results of research development co-organizations using the SFA method are divided into 5 clusters as in Figure 6, and each consists of one organization. Cluster 1 consists of the college of business and economics, Qatar University. Cluster 2 consists of the department of economics, University of Isfahan, Iran. Cluster 3 consists of the department of statistics, the University of Isfahan, Iran. Cluster 4 consists of Energy and Sustainable Development, Montpellier Business School, Montpellier, France, and Cluster 5 consist of Lebow College of Business, Drexel University, Philadelphia, US. Visualization of the co-source map overlay of research developments using the SFA method can be seen in Figure 6.

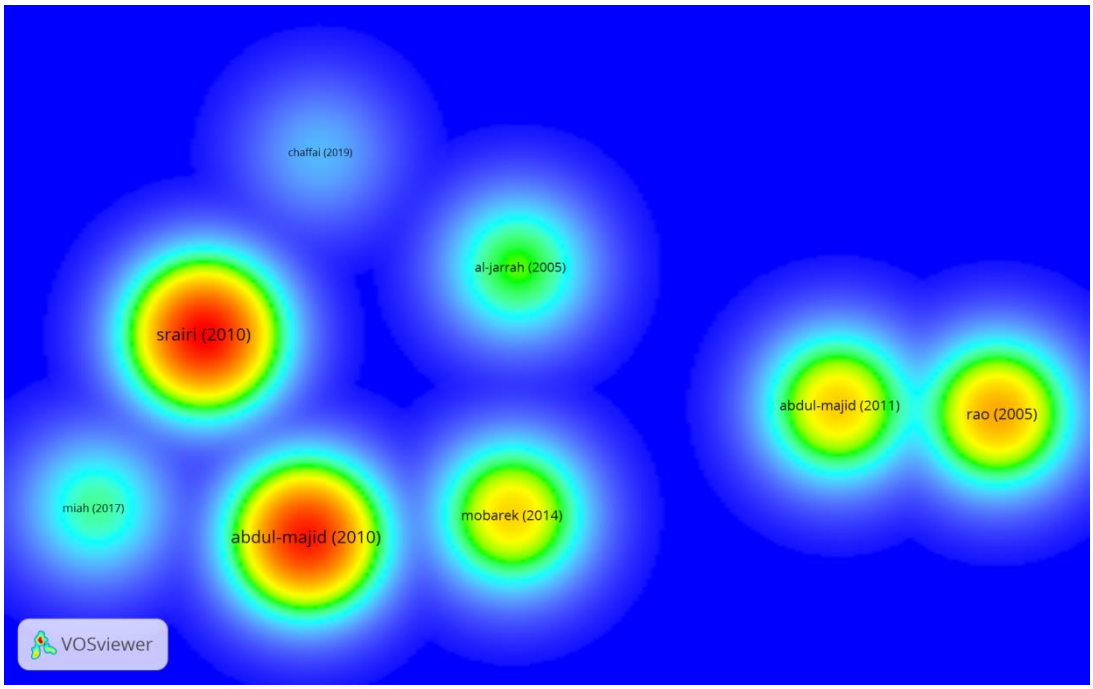
Figure 6: Visualization of the map overlay of research development using the SFA method based on the organization



Citation network map visualization

The results of the visualization of the research development co-citation map network using the SFA method are divided into 3 clusters, as shown in Figure 6. Cluster 1 consists of Abdul-Majid (2010), Miah (2017), Mubarek (2014), and Srairi (2010). There are two citation clusters, most of which are used by other researchers, namely citation Srairi (2010) and Abdul-majid (2010). This is indicated by the color of the core in the two citations is more reddish than the circle in the other citation, and the color shows the number is more than the others. Cluster 2 consists of Abdul-Majid (2011) and Rao (2005). Meanwhile, cluster 3 consists of al-jarrah (2005) and chaffai (2019). Visualization of the co-source map network of research developments using the SFA method can be seen in Figure 7.

Figure 7: Visualization of the research development map network using the SFA method based on the number of citation



V. CONCLUSIONS

The focus of this research is to try to find out to what extent the portrait of the development of the use of the Stochastic Frontier Approach (SFA) method in Islamic economics and finance in the world, especially those included in the Scopus journal publication with the criteria of Q1 or the best journal categories. The results show an increasing trend in the number of published articles on Islamic economics and finance, especially in the journal Scopus Q1 during the 2003-2019 period or the last 16 years.

Discussion of research using the SFA method is dominated by discussing issues related to banking, both Islamic banking or conventional banking, from 2003 to 2019. Comparing the efficiency approach is still more dominant than the cost efficiency approach compared to the profit efficiency approach. Also, the SFA panel data method's use is more dominant than the SFA cross-section method, and the most superior is the true rundom effect model with a half-normal error distribution. This is the potential to increase research with the SFA method using different types of models and perspectives.

In this research, the journal with the most published articles on Islamic economics and finance in the Scopus index journal Q1 has applied economics. Writers who write a lot about SFA, among others, write the most articles on efficiency using the SFA method, including Mariani Abdul-Majid, Giuliana Battisti, and David S. Saad, Mohamed Chaffai, and Mokhamad Anwar. Meanwhile, most authors write journals and are widely used as citations, namely Abdul-Majid (2010) and Srairi (2010). The author's institution that does a lot of research using the SFA method consists of 5 institutions, including the Qatar University college of business and economics, the department of economics at the University of Isfahan Iran, the department of

statistics, the University of Isfahan Iran, energy and sustainable development, the Montpellier business school, Montpellier, France, dan Lebow collage of business, Drexel University, Philadelphia, US.

REFERENCES

Ab-Hamid, M. F., Abdul-Rahman, A., Abdul-Majid, M., & Janor, H. (2017). Bank market risk and efficiency of commercial banks in Malaysia. *Jurnal Pengurusan*, *51*, 249–259. https://doi.org/10.17576/pengurusan-2017-51-21

Ab-Hamid, M. F., Asid, R., Sulaiman, N. F. C., Sulaiman, W. F. W., & Bahri, E. N. A. (2018). The effect of earnings management on Bank Efficiency. *Asian Journal of Accounting and Governance*, *10*, 73–82. https://doi.org/10.17576/AJAG-2018-10-07

Abdul-Majid, M., Falahaty, M., & Jusoh, M. (2017). Performance of Islamic and conventional banks: A meta-frontier approach. *Research in International Business and Finance*, *42*, 1327–1335. https://doi.org/10.1016/j.ribaf.2017.07.069

Abdul-Majid, M., & Hassan, M. K. (2011). The impact of foreign-owned islamic banks and islamic bank subsidiaries on the efficiency and productivity change of Malaysian banks. *Journal of King Abdulaziz University, Islamic Economics*, *24*(2), 149–176. https://doi.org/10.4197/Islec.24-2.5

Abdul-Majid, M., Saal, D. S., & Battisti, G. (2008). The Impact of Islamic Banking on the cost efficiency and Productivity Change of Malaysian Commercial Banks. *Applied Economics*, *43*(16), 1–41. https://doi.org/10.1080/00036840902984381

Abdul-Majid, M., Saal, D. S., & Battisti, G. (2010). Efficiency in Islamic and conventional banking: An international comparison. *Journal of Productivity Analysis*, *34*, 25–43. https://doi.org/10.1007/s11123-009-0165-3

Abdul-Majid, M., Saal, D. S., & Battisti, G. (2011). The impact of islamic banking on the cost efficiency and productivity change of Malaysian commercial banks. *Applied Economics*, *43*(16), 2033–2054. https://doi.org/10.1080/00036840902984381

Abdul-Wahab, A, H., Razali, H. Efficiency of Qatari banking Industry : an empirical Investigation. *International Journal of Marketing, 35(2).*

Abdullah, N., & Saaid, A. (2003). Measurement and sources of technical inefficiency : some evidence from the Sudanese Islamic bank. *Analisis*, *10*(1), 89–106. https://doi.org/10.13140/2.1.3025.6001

Abid, I., Goaied, M., & Ben Ammar, M. (2018). Conventional and Islamic Banks' Performance in the Gulf Cooperation Council Countries; Efficiency and Determinants. *Journal of Quantitative Economics*, *17*(3), 623–665. https://doi.org/10.1007/s40953-018-0139-2

Agustina, D., Sholihin, M., & Fithria, A. (2019). The Efficiency of Indonesian Islamic Rural Banks: A Stochastic Frontier Analysis. *International Journal of Islamic Economics and Finance (IJIEF)*, *1*(2), 229–248. https://doi.org/10.18196/ijief.1212

Al-Farisi, A. S., & Hendrawan, R. (2010). Measuring Efficiency as Intermediation Approach Between Conventional and Sharia Banks in Indonesia. *Jurnal Keuangan Dan Perbankan*, *14*(3), 501–508.

Al-Jarrah, I. M., Al-Abdulqader, K. S., & Hammoudeh, S. (2017). Cost-efficiency and financial and geographical characteristics of banking sectors in the MENA countries. *Applied Economics*, *49*(35), 3523–3537. https://doi.org/10.1080/00036846.2016.1262524

Al-Jarrah, I., & Molyneux, P. (2006). Cost efficiency, scale elasticity and scale economies in Arab banking. *Banks and Bank Systems*, *1*(3), 60–89.

Al-Jarrah, I., & Molyneux, P. (2007). Efficiency in Arabian Banking. *Islamic Perspectives on Wealth Creation*, *3*(3), 97–116. https://doi.org/10.3366/edinburgh/9780748621002.003.0007

Alam, N. (2012). Efficiency and Risk-Taking in Dual Banking System: Evidence from Emerging Markets. *International Review of Business Research Papers*, *8*(4), 94–111.

Ali, A., Hui, L., & Ali, A. (2016). Efficiency and performance of Islamic Banking in Pakistan – A Stochastic Frontier Analysis. *International Journal of Economics, Finance and Management*, *5*(2), 42–48.

Ali, S. A. S., & Mahran, H. A. (2011). Efficiency of Sudanese Banks : A Stochastic Frontier Approach (1996-2004). *Gezira Journal Of Economic and Social Sciences*, *2*(1).

Alqahtani, F., Mayes, D. G., & Brown, K. (2017). Islamic bank efficiency compared to conventional banks during the global crisis in the GCC region. *Journal of International Financial Markets, Institutions and Money*, *51*, 58–74. https://doi.org/10.1016/j.intfin.2017.08.010

Alshammari, A. A., Alhabshi, S. M., & Saiti, B. (2019). The impact of oil prices and the financial market on cost efficiency in the insurance and Takaful sectors: Evidence from a stochastic frontier analysis. *Economic Systems*, *43*(3–4), 1–18. https://doi.org/10.1016/j.ecosys.2019.100716

Alshammari, A. A., Syed Jaafar Alhabshi, S. M. bin, & Saiti, B. (2019). The impact of competition on cost efficiency of insurance and takaful sectors: Evidence from GCC markets based on the Stochastic Frontier Analysis. *Research in International Business and Finance*, *47*, 410–427. https://doi.org/10.1016/j.ribaf.2018.09.003

Anwar, M. (2019). Cost efficiency performance of Indonesian banks over the recovery period: A stochastic frontier analysis. *The Social Science Journal*, *56*(3), 377–389. https://doi.org/10.1016/j.soscij.2018.08.002

Ara, S. (2016). Profit and Cost Efficiencies of Conventional Banking (CB) and Islamic Banking (IB) Using Stochastic Frontier Approach : A Comparative Study. *Journal of Islamic Economics Banking and Finance*, *12*(1), 63–89. https://doi.org/10.12816/0028312

Ascarya, Achsani, N. A., Yumanita, D., & Rokhimah, G. S. (2009). POSITIONING ANALYSIS OF ISLAMIC BANK vis-à- vis CONVENTIONAL BANK IN INDONESIA USING PARAMETRIC SFA AND DFA METHODS. *Islamic Finance & Business Review*, *4*(2), 785–

807. https://doi.org/10.30993/tifbr.v4i2.36

Azizul, B., & Anton, A. K. (2013). Evaluating advance efficiency of Bangladeshi online banks using stochastic frontier analysis. *African Journal of Business Management*, *7*(32), 3177–3185. https://doi.org/10.5897/ajbm11.1906

Bakour, A., & Gallali, M. I. (2014). Competition and Efficiency: Comparative Analysis between Islamic and Conventional Banks of MENA Region. *International Journal of Business and Commerce*, *5*(3), 20–40.

Baten, M. A., & Kamil, A. A. (2010). Measuring online bank profit efficiency: A stochastic frontier model. *The 6th IMT-GT Conference on Mathematics, Statistics and Its Applications (ICMSA2010)*, *42*(3), 49–60. https://doi.org/10.4102/sajbm.v42i3.499

Bilal, M., & Abbas, S. (2015). Comparison of Islamic banking and conventional banking: an empirical review. *International Journal of Management & Organizational Studies*, *4*(1), 39–43.

Börner, K., Chen, C., & Boyack, K. W. (2003). Visualizing knowledge domains. *Annual review of information science and technology*, *37*(1), 179-255.

Budiantoro, R. A., Luthfi, F., & Herianingrum, S. (2018). Measuring the Efficiency of BAZNAS in Managing Zakat Funds with Stochastic Frontier Approach Analysis ,. *Internasional Journal of Zakat*, *3*(1), 89–107. https://doi.org/10.3329/agric.v15i2.35465

Bushara, M. O. A., Aziz, Y. A. M., & Hussain, A. I. M. (2018). Cost efficiency of Yemen Islamic banks : An inefficiency effects approach (2002 - 2014). *Gezira Journal Od Agricultural Science*, *16*(2).

Chaffai, M., & Coccorese, P. (2019). How far away is the MENA banking system? Efficiency comparisons with international banks. *North American Journal of Economics and Finance*, *49*, 378–395. https://doi.org/10.1016/j.najef.2019.04.013

Chaffai, M., & Hassan, M. K. (2019). Technology Gap and Managerial Efficiency: A Comparison between Islamic and Conventional Banks in MENA. *Journal of Productivity Analysis*, *51*(1), 39–53. https://doi.org/10.1007/s11123-019-00544-x

Chen, C. (2006). CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. *Journal of the American Society for information Science and Technology*, *57*(3), 359-377.

Doumpos, M., Hasan, I., & Pasiouras, F. (2017). Bank overall financial strength: Islamic versus conventional banks. *Economic Modelling*, *64*, 513–523. https://doi.org/10.1016/j.econmod.2017.03.026

Effendi, Y. (2016). Measuring Efficiency of the Indonesian Islamic Banks. *Kajian Ekonomi Keuangan*, *20*(2), 134–148. https://doi.org/10.31685/kek.v20i2.185

Eisazadeh, S., & Shaeri, Z. (2012). An Analysis of Bank Efficiency in the Middle East and North Africa. *The International Journal of Banking and Finance*, *9*(4), 28–47.

Elrhman, A., Saaid, E., & Ph, D. (2008). Allocative and Technical Inefficiency in Sudanese Islamic Banks Using Cost Functions|. *Gezira Journal of Tafakkur*, *8*(2), 1–23.

Fenn, P., Vencappa, D., Diacon, S., Klumpes, P., & O'Brien, C. (2008). Market structure and the efficiency of European insurance companies: A stochastic frontier analysis. *Journal of Banking and Finance*, *32*, 86–100. https://doi.org/10.1016/j.jbankfin.2007.09.005

Ferhi, A., & Chkoudali, R. (2015). Islamic and conventional banks : Efficiency and stability during the current crises. *Journal of Research in Economics and International Finance*, *4*(2), 27–33. https://doi.org/303/jrief.2015.100

Ghannouci, W., Fiordelisi, F., Molyneux, P., & Radic, N. (2012). Do Islamic and Convenstional Banks Have The Same Technology? In *Centre For EMEA Banking, Finance, & Economics* (Vol. 34). https://doi.org/10.20955/r.85.67

Ghosh, S. (2018). Bad luck, Bad policy or Bad banking? Understanding the financial management behavior of MENA banks. *Journal of Multinational Financial Management*, *47–48*, 110–128. https://doi.org/10.1016/j.mulfin.2018.10.001

Ghroubi, M., & Abaoub, E. (2016). A Meta-Frontier Function for the Estimation of Islamic and Conventional Banks' Cost and Revenue Efficiency: The Case of Malaysia from 2006 to 2012. *International Journal of Business and Management*, *11*(5), 254–270. https://doi.org/10.5539/ijbm.v11n5p254

González, L. O., Razia, A., Búa, M. V., & Sestayo, R. L. (2019). Market structure, performance, and efficiency: Evidence from the MENA banking sector. *International Review of Economics and Finance*, *64*(August 2017), 84–101. https://doi.org/10.1016/j.iref.2019.05.013

Gumilar, I. S. P., & Komariah, S. (2011). Pengukuran Efisiensi Kinerja dengan Metode Stochastic Frontier Approach Pada Perbankan Syariah. *Jurnal Bisnis Dan Manajemen*, *7*(2), 93–122.

Hadhek, Z., Frifita, M., & Lafi, M. (2018). The Determinants of Profit Efficiency of Islamic Banks Using Stochastic Frontier Analysis Approach. *International Journal of Economics and Financial Issues*, *8*(6), 20–29. https://doi.org/10.32479/ijefi.6996

Haghnejad, A., Samadi, S., Nasrollahi, K., Azarbayjani, K., & Kazemi, I. (2019). Market Power and Efficiency in the Iranian Banking Industry. *Emerging Markets Finance and Trade*, 1–18. https://doi.org/10.1080/1540496X.2019.1643716

Hamiltona, R., Qasrawib, W., & Al-Jarrahc, I. M. (2010). Cost and profit efficiency in the Jordanian banking sector 1993-2006: A parametric approach. *International Research Journal of Finance and Economics*, (56), 96–110.

Haque, M. R., & Sohel, M. N. I. (2019). Are Islamic banks less efficient than other banks? Evidence from Bangladesh. *Asian Economic and Financial Review*, *9*(10), 1136–1146. https://doi.org/10.18488/journal.aefr.2019.910.1136.1146

Hasan, Z. (2004). Measuring The Efficiency of Islamic Banks: Criteria, Methods and Social Priorities. *Review of Islamic Economics*, *8*(2), 5–30.

Hasan, Z. (2007). Evaluation of Islamic banking performance : On the current use of econometric models. *Munich Personal RePEc Archive*, (6461).

Hassan, M. H., & Hassan, M. (2018). Cost efficiency of banking sector of Bangladesh: evidence using the stochastic frontier analysis. *Asian Journal of Empirical Research*, *8*(6), 208–224. https://doi.org/10.18488/journal.1007/2018.8.6/1007.6.208.224

Hassan, M. K. (2005). The Cost, Profit and X-Efficiency of Islamic Banks. *12th ERF Conference Paper*, 1–34.

Hay, P. (2013). A systematic review of evidence for psychological treatments in eating disorders: 2005–2012. *International Journal of Eating Disorders*, *46*(5), 462-469.

HOSEN, M. N., & MUHARI, S. (2013). Efficiency of the Sharia Rural Bank in Indonesia Lead to Modified Camel. *International Journal of Academic Research in Economics and Management Sciences*, *2*(5), 34–53. https://doi.org/10.6007/ijarems/v2-i5/298

Hosen, M. N., & Rahmawati, R. (2016). Efficiency and Profitability on Indonesian Islamic Banking Industry. *Al-Iqtishad: Journal of Islamic Economics*, *8*(1), 33–48. https://doi.org/10.15408/aiq.v8i1.2507

Hosen Nadratuzzaman, M., & Rahmawati, R. (2014). Analisis Efisiensi, Profitabilitas dan Kesehatan Bank Umum Syariah di Indonesia Periode 2010- 2013. *Finance and Banking*, *16*(2), 207–227.

Hunter, J. E., & Schmidt, F. L. (1990). Dichotomization of continuous variables: The implications for meta-analysis. *Journal of applied psychology*, *75*(3), 334.

Hussein, K. A. (2003). Operational efficiency in Islamic banking: the Sudanese experience. *Islamic Research and Training Institute Islamic Development Bank*, 1–43.

Iimi, A. (2003). Efficiency in the Pakistani banking industry: Empirical evidence after the structural reform in the late 1990s. *Pakistan Development Review*, *42*(1), 41–57. https://doi.org/10.30541/v42i1pp.41-57

Iqbal, M., & Molyneux, P. (2005). Efficiency in Islamic Banking. In *Palgrave macmillan*. https://doi.org/10.1057/9780230503229

Irfan, M., Majeed, Y., & Zaman, K. (2014). The Performance and Efficiency of Islamic Banking in South Asian Countries. *Economia : Seria Management*, *17*(2), 223–237.

Izzeldin, M., Johnes, J., Ongena, S. R. G., Pappas, V., & Tsionas, E. G. (2019). Steady State and Efficiency Convergence Dynamics in Alternative Banking Systems: The Cases of Islamic and Community Banks. *SSRN Electronic Journal*, (September), 1–44. https://doi.org/10.2139/ssrn.3449215

Jarmiko, W. (2017). Efficiency and Ownership Structure: Evidence from Rural Banks In Indonesia. *International Journal of Econmics, Management and Accounting*, *25*(2), 355–380. https://doi.org/10.1017/CBO9781107415324.004

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*, 1–15. https://doi.org/10.1016/j.jebo.2013.07.016

Johnes, J., Izzeldin, M., Pappas, V., & Tsionas, M. (2015). *Measuring Convergence in Islamic and conventional banks - Evidence from Global Data*.

Kablan, S., & Yousfi, O. (2011a). Efficiency of islamic and conventional banks in countries with islamic banking Efficiency of Islamic and Conventional Banks in Countries with Islamic Banking. *Munich Personal RePEc Archive*, (32951).

Kablan, S., & Yousfi, O. (2011b). Performance of islamic banks across the world: an empirical analysis over the period 2001-2008. *Internal of Journal of Empirical Finance*, *4*(1), 27–46. Retrieved from https://mpra.ub.uni-muenchen.de/28695/1/MPRA_paper_28695.pdf

Kablan, S., & Yousfi, O. (2013). What drives efficiency of Islamic banks among regions? *Journal of Applied Business Research*, *29*(5), 1411–1420. https://doi.org/10.19030/jabr.v29i5.8071

Karimah, S., Novianti, T., & Effendi, J. (2016). Kajian Efisiensi Bank Umum Syariah di Indonesia. *Al-Muzara'ah*, *4*(1), 33–43. https://doi.org/10.29244/jam.4.1.33-43

Kasman, A., & Turgutlu, E. (2009). Cost efficiency and scale economies in the Turkish insurance industry. *Applied Economics*, *41*(24), 3151–3159. https://doi.org/10.1080/00036840701367663

Khalifaturofi'ah, S. O. (2018). Cost Efficiency, Total Assets, and Profitability: Evidence from Islamic Bank. *Jurnal Keuangan Dan Perbankan*, *22*(4), 769–778. https://doi.org/10.26905/jkdp.v22i4.2218

Khan, M. M., & Bhatti, M. I. (2008). Development in Islamic banking: a financial risk-allocation approach. *The Journal of Risk Finance*.

Khlif, H., & Chalmers, K. (2015). A review of meta-analytic research in accounting. *Journal of Accounting Literature*, *35*, 1-27.

Khlif, H., & Souissi, M. (2010). The determinants of corporate disclosure: a meta-analysis. *International Journal of Accounting & Information Management*.

Kismawadi, E. R., Nuruddin, A., & Yusuf, M. (2017). A Stochastic Frontier Approach (SFA) For Measuring Efficiency of Syariah Rural Bank (BPRS) in Aceh, Indonesia. *IOSR Journal of Humanities and Social Science*, *22*(5), 37–43. https://doi.org/10.9790/0837-2205073743

Klavans, R., & Boyack, K. W. (2006). Quantitative evaluation of large maps of science. *Scientometrics*, *68*(3), 475-499.

Louati, S., & Boujelbene, Y. (2015). Banks' stability-efficiency within dual banking system: a stochastic frontier analysis. *International Journal of Islamic and Middle Eastern Finance and Management*, *8*(4), 472–490. https://doi.org/10.1108/mf.2008.00934jaa.001

Marwansyah, S., & Utami, A. N. (2017). Analisis Hasil Investasi, Pendapatan Premi, Dan Beban Klaim Terhadap Laba Perusahaan Perasuransian Di Indonesia. *JURNAL AKUNTANSI, EKONOMI Dan MANAJEMEN BISNIS*, *5*(2), 213. https://doi.org/10.30871/jaemb.v5i2.533

Mghaieth, A., & El Mehdi, I. K. (2014). The determinants of cost/profit efficiency of Islamic banks before, during and after the crisis of 2007-2008 using SFA approach. In *Working*

Paper No. 2014-107.

Mghaieth, A., & Khanchel, I. (2015). The Determinants of Cost/Profit Efficiency of Islamic Banks Before, During and After the Subprime Crisis Using SFA Approach. *International Journal of Accounting and Financial Reporting*, *5*(2), 74. https://doi.org/10.5296/ijafr.v5i2.7866

Miah, Md. Dulal, & Sharmeen, K. (2015). International Journal of Islamic and Middle Eastern Finance and Management. *Internasional Journal of Islamic and Middle Eastern Finance and Management*, *8*(2), 203–221. https://doi.org/10.1108/mf.2008.00934jaa.001

Miah, Mohammad Dulal, & Uddin, H. (2017). Efficiency and stability: A comparative study between islamic and conventional banks in GCC countries. *Future Business Journal*, *3*(2), 172–185. https://doi.org/10.1016/j.fbj.2017.11.001

Mobarek, A., & Kalonov, A. (2014). Comparative performance analysis between conventional and Islamic banks: Empirical evidence from OIC countries. *Applied Economics*, *46*(3), 253–270. https://doi.org/10.1080/00036846.2013.839863

Mohamad, S., Hassan, T., & Bader, M. (2008). Efficiency of conventional versus Islamic Banks: international evidence using the Stochastic Frontier Approach (SFA). *Journal of Islamic Economics, Banking and Finance*, *4*(2), 107–130.

Mokhtar, H. S. A., Abdullah, N., & Al-Habshi, S. M. (2006). Efficiency of Islamic Banking in Malaysia: a Stochastic Frontier Approach. *Journal of Economic Cooperation*, *27*(2), 37–70.

Muhari, S., & Hosen, M. N. (2014). Tingkat Efisiensi Bprs Di Indonesia: Perbandingan Metode Sfa Dengan Dea Dan Hubungannya Dengan Camel. *Jurnal Keuangan Dan Perbankan*, *18*(2), 307–328.

Othman, N., Maji, M. A., & Rahman, A. A. (2015). Equity-Based Financing and Islamic Banks Efficiency: Stochastic Frontier Analysis. *The 2nd International Conference on Management and Muamalah 2015 (2nd ICoMM)*, *2015*(2), 978–967.

Pellegrina, L. D. (2006). Capitalization Requirements , E ffi ciency and Governance. *SSRN Electronic Journal*, 1–32. https://doi.org/10.2139/ssrn.921070

Pellegrina, L. D. (2008). *Capital Adequacy Ratios, Efficiency and Governance: a Comparison Between Islamic and Western Banks*. Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Capital+Adequacy+Ratios+,+E+&#xfffd;+ciency+and+Governance+:+a+Comparison+Between+Islamic+and+Western+Banks#0%5Cnhttp://efmaefm.org/0EFMSYMPOSIUM/Nantes 2009/paper/Dalla Pellegrina.pdf

Pramuka, B. A. (2011). Assessing Profit Efficiency of Islamic Banks in Indonesia: an Intermediation Approach. *Journal of Economics, Business, and Accountancy | Ventura*, *14*(1), 79–88. https://doi.org/10.14414/jebav.v14i1.21

Rahman, M. M., & Islam, A. N. M. T. (2011). Stochastic Frontier Approach to Estimate Branch-wise Cost and Profit Efficiency of Islami Bank Bangladesh Limited (IBBL). *Journal of*

Islamic Economics, Banking and Finance, *7*(2), 45–70.

Rahmawati, R. (2015a). Strategi Peningkatan Efisiensi Biaya pada Bank Umum Syariah Berbasis Stochastic Frontier Approach dan Data Envelopment Analysis. *Buletin Ekonomi Moneter Dan Perbankan*, *17*(4), 457–480. https://doi.org/10.21098/bemp.v17i4.506

Rahmawati, R. (2015b). The Cost Efficiency Of Islamic Bank In Indonesia: A Stochastic Frontier Approach and Data Envelopment Analysis. *Bulletin of Monetary, Economics and Banking*, *17*(4), 461–484.

Rahmawati, R., & Hosen, M. N. (2012). Efficiency of Fund Management of Sharia Banking in Indonesia (Based On Parametric Approach). *International Journal of Academic Research in Economics and Management Sciences*, *1*(2), 144–158.

Rao, A. (2005). Cost frontier efficiency and risk-return analysis in an emerging market. *International Review of Financial Analysis*, *14*(3), 283–303. https://doi.org/10.1016/j.irfa.2004.10.006

Rozzani, N., & Rahman, R. A. (2013). Determinants of Bank Efficiency: Conventional versus Islamic. *International Journal of Business and Management*, *8*(14), 98–109. https://doi.org/10.5539/ijbm.v8n14p98

Rumiasih, N, A., Enayatullah, I, H. (2018). Analisis Efisiensi Bank Syariah Mandiri Tahun 2010-2018 Dengan Pendekatan Stochastic Frontier Approach (SFA). *Neraca Keuangan : Jurnal Ilmiah Akuntansi dan Keuangan,*

Saaid, A. E. E., Rosly, S. A., Ibrahim, M. H., & Abdullah, N. (2003). The X-Efficiency Of The Sudanese Islamic Banks. *IIUM Journal of Economics and Management*, *11*(2), 123–141.

Sadalia, I., Kautsar, H. M., Irawati, N., & Muda, I. (2018). Analysis of the efficiency performance of Sharia and conventional banks using stochastic frontier analysis. *Banks and Bank Systems*, *13*(2), 27–38. https://doi.org/10.21511/bbs.13(2).2018.03

Sadiq, R., Arshed, N., & Ahmad, H. K. (2017). Determinants of Cost Efficiency of Islamic Banks of Pakistan. *Journal of Muamalat and Islamic Finance Research*, *14*(2), 111–128. https://doi.org/10.12816/0045782

Safiullah, M., & Shamsuddin, A. (2019). Risk-adjusted efficiency and corporate governance: Evidence from Islamic and conventional banks. *Journal of Corporate Finance*, *55*(August), 105–140. https://doi.org/10.1016/j.jcorpfin.2018.08.009

Sajjad, F. D. (2014). Financial Sanctions and Iranian Banks Performance. *Journal of Money and Economy*, *8*(4), 99–136.

Samad, A. (2016). Technical efficiency of Islamic bank versus domestic banks: Evidence from Bangladesh. *The International Journal of Business and Finance Research*, *10*(2), 31–40.

Shaban, M., Duygun, M., Anwar, M., & Akbar, B. (2014). Diversification and banks' willingness to lend to small businesses: Evidence from Islamic and conventional banks in Indonesia. *Journal of Economic Behavior and Organization*, *103*, 539–555. https://doi.org/10.1016/j.jebo.2014.03.021

Sillah, B. M. S., Khokhar, I., & Khan, M. N. (2014). The Performance of Saudi Banking Industry 2000 -2011: Have the Banks Distinguished Themselves from One Another? *International Journal of Financial Research*, *5*(2), 121–132. https://doi.org/10.5430/ijfr.v5n2p121

Siwar, E., & Jawada, M. (2017). The Determinants Of Technical Efficiency: Case Of Islamic Banks. *Australian Journal Of Basic and Applied Sciences*, *11*(6), 12–24.

Srairi, S. A. (2010). Cost and profit efficiency of conventional and Islamic banks in GCC countries. *Journal of Productivity Analysis*, *34*(1), 45–62. https://doi.org/10.1007/s11123-009-0161-7

Tahir, I. M., & Haron, S. (2010). Cost and profit efficiency of Islamic banks: International evidence using the stochastic frontier approach. *Banks and Bank Systems*, *5*(4), 78–83.

Tai, L. (2014). Efficiency and Performance of Conventional and Islamic Banks in GCC Countries. *Middle East Journal of Business*, *9*(2), 60–71. https://doi.org/10.5742/mejb.2014.92387

Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *scientometrics*, *84*(2), 523-538.

Van Eck, N. J., & Waltman, L. (2007). Bibliometric mapping of the computational intelligence field. *International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems*, *15*(05), 625-645.

Van Eck, N. J., Waltman, L., Dekker, R., & van den Berg, J. (2010). A comparison of two techniques for bibliometric mapping: Multidimensional scaling and VOS. *Journal of the American Society for Information Science and Technology*, *61*(12), 2405-2416.

Wahyuni, S., & Pujiharto, P. (2016). Profit efficiency of shariah banks in Indonesia and the determining factors: Using Stochastic Frontier Analysis Method. *Journal of Economics, Business & Accountancy Ventura*, *19*(2), 271–282. https://doi.org/10.14414/jebav.v19i2.711

Wardhani, P. I., & Mongid, A. (2019). Strategies to increase production efficiency in Indonesian Sharia commercial banks using Stochastic Frontier Approach (SFA). *Journal of Economics, Business & Accountancy Ventura*, *21*(3), 379–389. https://doi.org/10.14414/jebav.v21i3.1597

Weill, L. (2012). How Quality of Institutions Shape the Expansion of Islamic Finance. In *Institut de Finance de Strasbourg*. https://doi.org/10.1287/opre.1080.0628

Zeineb, G., Mensi, S. (2018). Corporate governance, risk and efficiency: evidence from GCC Islamic banks. *Managerial Finance, 44(5),* 551-569.