

Efficiencies in Islamic banking: a bibliometric and theoretical review

by Bayu Fianto

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Efficiencies in Islamic banking: a bibliometric and theoretical review

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Syed Alamdar Ali Shah,
Raditya Sukmana* and Bayu Arie Fianto

Department of Islamic Economics,
Faculty of Economics and Business,
Universitas Airlangga,
Surabaya, Indonesia
Email: alamdar2000pk@yahoo.com
Email: raditya-s@feb.unair.ac.id
Email: bayu.fianto@feb.unair.ac.id

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*Corresponding author

Abstract: This study takes an intensive review of literature on Islamic bank efficiencies highlighting regional efficiency trends, contributing factors and integrated framework. Bibliometric and content analysis have been used to analyse 99 articles published between 2002 and 2019 taken from ISI Web of Science and Scopus contributed by leading authors, journals and regulatory bodies. This study makes various contributions with respect to effects of choice of variables, changes in choice of variables, difference in applicability of laws of return in various global locations, size of the organisations, efficiencies during crisis, Shariah compliance cost, framework for analysing efficiency of an Islamic bank and supervisory effects. The conceptual framework identifies outcomes of value creation, performance improvement and minimisation of failures.

Keywords: DEA; Islamic banking; efficiency trends; financial crisis.

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Biographical notes: Syed Alamdar Ali Shah is a PhD candidate in Islamic Economics at Universitas Airlangga Indonesia. He has professional banking experience of over 14 years along with academic experience of more than five years.

Raditya Sukmana is currently the Head of Department of Islamic Economics Universitas Airlangga Indonesia. He secured his Master's from Georgia State University USA, and PhD from International Islamic University Malaysia.

Bayu Arie Fianto is currently an academic and research staff as the Vice Dean Universitas Airlangga Indonesia. He secured his Master's from International Islamic University Malaysia and PhD from Lincoln University, New Zealand.

1 Introduction

Over the period of last 20 years, operations of Islamic banking have been expanded the world over with Bahrain and Malaysia emerging as hubs. According to Dusuki and Abdullah (2007) Islamic banking is the demand of new customers rather than of Muslim community alone. Iqbal and Molyneux (2005) argue that banks exist in any economy because of four reasons namely:

- 1 intermediation services
- 2 creation of a wide range of assets and liabilities
- 3 offering financial services
- 4 creation of incentives’.

However, existence of Islamic banks is primarily based on involvement of business risks.

Assets of global Islamic banking industry are expected to cross over 3 trillion USD till 2021. This expansion along with structural and regulatory transformations has enlarged the footprint and impact of Islamic banking industry manifold. Many countries have successfully removed underlying distortions in the growth of Islamic banks and have moved ahead in restructuring and reorganising. Since primary role of Islamic banking is to secure and channelise funds on Shariah basis, the efficiency was not their top priority in the beginning. The concept of financial analysis was mostly neglected and in a very few cases analysts and researchers used a few conventional financial ratios.

The growth of Islamic banking is not uniform across regions. Some countries and regions have taken lead over the others (Johnes et al., 2014). There also exist many variants depending upon financial, economic, social and most importantly on Shariah basis. In this process reduced sources of Shariah compliant funding also encourages Islamic banks to develop alternatives based on geographical needs. As the financial side of world economies has encountered many obstacles including the financial crisis 2007–2008, economies also grew simultaneously from social, financial, technological and technical point of view which also helped in the expansion of Islamic financial sector. This expansion in growth has been analysed by many researchers in various dimensions. For instance, Nejad et al. (2018) analyse success factors of a bank in the context of employee motivation and found welfare facilities as the most important factor that creates motivation in employees leading to success. Derbali and Jamel (2018) analyse insurance in Tunisia and found size, age and growth as the major success factors be it takaful or conventional insurance. Sharif et al. (2018) analyse currency stability in the post financial crisis 2008 scenario and observe that the impact on currencies is more profound than most of the sectors of the economy. Singh et al. (2019) analyse the impact of selected managerial factors such as, supplier relationship, people management and top management support, etc., on business performance.

In the light of above developments, it has become necessary to review performance of Islamic banks across the countries and regions. Developments in the realm of Islamic banking suggest that such reviews can be made from various perspectives (Hassan and Aliyu, 2018). However, we take a concise approach to review efficiency analysis over the

last two decades based on input output analysis only. Our objective is not to restate findings of previous Islamic research but also to enlighten and synthesise the paths and conclusions to develop conceptual framework of efficiency analysis. Keeping in view this background we set our research objective as under:

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1.1 Objective of the research

The objective of this research is to take an intensive review of research literature on efficiency of Islamic banks and present landmarks achieved in terms of theoretical contributions, institutional developments, efficiencies and synergies achieved, and competitiveness developed to compete conventional banks in various regions around the globe. In doing so not all published work has been taken into account rather a criterion has been developed to include high impact research only. The focus is to provide an intrinsic review of literature to student, policy makers and researchers to enhance their understandings of contemporary dynamics of Islamic bank efficiencies for future research.

This objective shall be addressed by answering the following research questions:

- 1 What are the drivers and theoretical underpinnings of efficiency analysis in Islamic banks?
- 2 What are the global clusters in the researches of efficiency analysis?
- 3 What are the available future research directions?

Reviews of Islamic bank efficiencies are required because of growing complexity with the increase in business (Chapra, 2017). Recently, various concerns raised by scholars (Chapra (2017), Hassan and Aliyu (2018) and global policy makers such as World Bank and Islamic Development Bank Group (2017); Shabsigh et al. (2017) about global trends towards debt financing and system performance after paradigm shift to debt-based finance also encourages initiation of efficiency analysis taking a global perspective over the period of expansion in Islamic banking.

Productivity and performance analysis considering input-output relationship has been the subject of various recent studies (Gidwani and Dangayach, 2017; Abdelalim et al., 2019; Granadillo et al., 2019). A major research stream that has emerged over the period of time for efficiency analysis of financial institutions is the use of DEA (Berger and Humphrey, 1997; Chen, 2002; Saljoughian et al., 2019). Efficiency of Islamic banks using DEA has been assessed in various studies, however, ones taking global perspective are almost negligible (Sufian and Kamarudin, 2015; Wanke et al., 2016; Hassan and Aliyu, 2018). Having said that analysing the efficiency of expanding Islamic banking is important because it is now accepted by Muslims and non-Muslims worldwide (Kumru and Sarntisart, 2016).

This research addresses our objectives firstly by comparing global efficiencies of Islamic and conventional banks; secondly by taking a holistic view of regional efficiency trends and finally by identifying the factors that contribute to growth of Islamic banks over the period of time. This will be achieved by analysing literature on the basis of

- 1 theoretical foundations of Islamic bank efficiencies
- 2 how efficiency is analysed
- 3 and the impact of various versions of efficiency analysis.

This focus will provide guidance for students, policy makers, researchers, monetary control authorities and academicians to comprehend Islamic banking efficiency dynamics and will resultantly guide on subsequent studies.

2 Methodology

We have utilised co-citation along with content analysis following the recommendations of recent bibliometric studies (Apriliyanti and Alon, 2017; Alon et al., 2018). Bibliometric analysis is a recent mechanism that utilises statistical tools to determine qualitative and quantitative developments in a research topic (Apriliyanti and Alon, 2017; Randhawa and Ahuja (2017). In other words it is an advanced form of meta-analysis that Fetscherin and Heinrich (2015) use to identify objectively linked research manuscripts published in reputed journals with analysis unit being citations (Alon et al., 2018; Zamore et al., 2018). Instead of simple publication counting it takes into account impact of the research, authors, journals and research topic development (Fetscherin and Heinrich, 2015). We have primarily utilised ISI Web of Science (SOS) and Scopus because these are leading bibliometric data bases (Falagas et al., 2008). These data bases are although different however, Falagas et al. (2008) stated that these are correlated. This is supplemented with research reports from various monetary authorities and leading authors since in the early ages Islamic banking was not a popular phenomenon.

A recent literature review by Hassan and Aliyu (2018) addresses the literature from 1987 to 2017 taking a holistic review of entire work done in the area of Islamic banking. Their focus is to identify overall research directions not addressing any specific research area. Their work provides theoretical developments and contributions from performance of Islamic banks. However, their work do not take focused account of any specific area. Addressing this gap of combining actual performance with theories we have conducted a thorough review of literature of the 99 carefully selected research papers, published since 2003 covering data from 1990 to 2016, on variables used, results derived, theories, country/region of the study and finally the conclusions drawn. Having established the criteria this research does not fully cover all types of efficiencies and trends on account of lack of literature, for instance social and psychological impact of Shariah compliance, although a little effort has been made in this regard.

Next section takes a tabular review of literature followed by a combined graphical analysis of regional efficiency trends and factors contributing to various efficiencies over the period of time. An overall analysis integrating various themes emerging from literature, graphical analysis and factorial analysis followed by conclusion concludes this research paper.

Table 1 Literature review

| Sr | Authors | Period | Efficiency variables | Country(ies) | Efficiency model | Conclusion |
|----|---------------------------|-----------|---|---|--|--|
| 1 | Hussein (2003) | 1990-2000 | SFA: Input prices cost of capital, cost of funds, cost of labour, investment in murabaha, investment in other modes of finance, off balance sheet transactions. TOBIT regression: Total assets, total deposits, government banks, private banks, Islamic finance/total assets, musharaka/total assets, bank finance through other modes of finance, tradeoff between musharaka and murabaha finance, non-financial activities, musharaka/off balance sheet items, murabaha/off balance sheet, deposit mix. | Sudan | Stochastic Frontier analysis, TOBIT regression | Joint ownership banks operate more efficiently than government owned banks. Bank size and equity size, capital adequacy ratio negatively affect cost efficiency. Shariah compliant products and personnel expenses have positive impact on cost efficiency of Islamic banks. |
| 2 | Hassan (2003) | 1994-2001 | DEA: Inputs: labour, fixed capital, customer and short-term funds, input prices, staff expenses; output: short-term financing, non-endline on fixed assets, customer and short-term funds, total interest expenses, customer and short-term funds, Output: total loans, other earning assets, off balance sheet items Regression: Efficiencies, size of the bank, market power, profitability. | Sudan, Iran, Sudan | Data envelopment analysis, Malmquist productivity index, correlation analysis, regression analysis | Islamic banks are less efficient than their conventional counterparts. Efficiency scores are highly correlated with profitability measures showing effect of efficiency on profitability. Islamic banks have better allocative efficiency than technical efficiency due to highly supportive regulatory environment. Scale inefficiency is higher than pure technical efficiency which shows that Islamic banks are suffering more from product diversification and market penetration rather than staff abilities. Productivity variation in Islamic banks is due to technological variations and not due to staff abilities. |
| 3 | Yudistira (2004) | 1997-2000 | DEA: Inputs: staff costs, fixed assets, total deposits Outputs: Total loans, other income, liquid assets Regression: Capital to total assets, net income to total assets, market share, geographical location, listed and no listed banks | Bahrain, Kuwait, Qatar, United Arab Emirates, Indonesia, Malaysia, Algeria, Gambia, Sudan, Egypt, Jordan, Yemen | Data envelopment analysis, OLS | Conventional banks have better efficiencies than Islamic banks. Islamic banks have performed better during crisis than their conventional counterparts. Islamic banks have fewer economies to scale than conventional banks. Islamic banks in middle east are less efficient than banks in any part of the world. Support from the regulator has better influence than market share on efficiencies of the banks. |
| 4 | Shams and Molyneux (2004) | 1995-2000 | SFA: Price of inputs: Price of deposit, price of labour Outputs: total loans, other income Price of outputs: price of loans, price of other income Logit regression: Total cost, profits, price of deposits, loans, other income, price of loans, total equity, total provisions, equity, return on assets, provisions, total assets, fixed assets, total assets/CI | Qatar, UAE, Saudi Arabia, Kuwait, Bahrain, Oman | Stochastic Frontier analysis, logit regression | Cost inefficiency between the region is between 8% to 10% and profit inefficiency is between 30% to 32%. The risk and quality have negative impact on efficiency levels of banks. |

Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Countries | Efficiency model | Conclusion |
|----|-----------------------|-----------|---|---|---|---|
| 5 | Hassan (2005) | 1994–2001 | DEA: Inputs: Labour, fixed capital, customer and short-term funds Input prices: Price of labour, price of capital, price of funds Outputs: Total loans, other earning assets, off balance sheet items Regression: Efficiencies, bank size, profitability, loan ratio | Algeria, Bahamas, Bahrain, Bangladesh, Bunei, Egypt, Gambia, Indonesia, Iran, Jordan, Kuwait, Lebanon, Malaysia, Mauritania, Qatar, Saudi Arabia, Sudan, Tunisia, United Arab Emirates, UK, Yemen | Data envelopment analysis, regression analysis, correlation | Islamic banking industry is less efficient than conventional banking. All efficiency scores are highly related with ROA and ROE which means profitability can be increased with efficiency scores. Cost efficiency in Islamic banks is lower than profit and revenue efficiency which means Islamic banks mostly focus on revenues at whatever costs. The allocative efficiency is also higher than technical efficiency which means Islamic banks have to look for new avenues to generate revenues and control costs. Scale efficiency is also higher than pure technical efficiency which means that Islamic banks need to focus output related activities as well. Larger bank size and profitability are positively related with efficiency which shows banks need to increase their scale through diversification. Also major source of efficiency in Islamic banks is adoption of new technologies rather than improving managerial qualities. |
| 6 | Hassan (2006) | 1995–2001 | DEA: Inputs: Labour, fixed capital, customers and short-term funding funds Price of inputs: Total expenditure on employees/customer and short-term funding, total expenditure on premises and fixed assets/customer and short-term funds, total non-interest expenses on deposits and non-deposit funds/customer and short-term funding Outputs: Total loans, other earning assets and off balance sheet items. | Global | Data envelopment analysis | Islamic banks were less efficient than their conventional counterparts. The efficiency of Islamic banks is related to return on assets and return on equity. The main cause of inefficiency of Islamic banks was allocative inefficiency. Islamic banks are more efficient in countries where the whole banking system is Islamic. Technological advancement increases productivity of Islamic Banks. Islamic banks need to introduce more products to survive in competition with Islamic banks. |
| 7 | Makhtar et al. (2006) | 1997–2003 | DEA: Inputs: Total deposits, personnel expenses, other operating or overhead expenses Outputs: Total earning assets Input prices: Return paid to depositors/total deposits, personnel expenses/total assets, other overhead expenses/total assets | Malaysia | Data envelopment analysis | Average efficiency of Islamic banks is increasing but is still less than efficiency of conventional banks. Efficiency increases with the increase in size and age of the bank. |
| 8 | Omar et al. (2006) | 2002–2004 | DEA: Inputs: Total deposits, personnel expenses, capital expenditure, input prices, price of deposits, price of labour, price of capital expenditure Output: loans and advances, capital market investments, and money market investments | Malaysia | Malmquist productivity index, data envelopment analysis | Total fit or productivity increases with technical efficiency. Islamic banks are less efficient than conventional banks. Islamic bank efficiency increases are solely coming from increases in scale efficiency. |

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Table 1 Literature review (continued)

| Authors | Period | Efficiency variables | Countries | Efficiency model | Conclusion |
|----------------------------------|-----------|---|--|---|---|
| 9 Brown and Skully (2006) | 2005 | DEA: Inputs: Personnel expenses, non-interest expenses Outputs: Loan deposits, other earning assets Ratio analysis: assets, ROA, ROE, cost to income ratio, Islamic operations/total assets, equity investments/total assets, income from Islamic transactions/total assets, deposit and short-term funding/total assets, other non-interest bearing assets/total assets, equity/total assets, total funding, customer loans, total deposits, other earning assets, personnel expenses, non-interest expenses 29 | Bahrain, Egypt, Iran, Jordan, Malaysia, Kuwait, Pakistan, Qatar, Russia, Sudan and United Arab Emirates 17 41 | Data Envelopment Analysis, Financial Ratio Analysis | There exists no obvious relationship between profitability, Islamic financing and efficiency. Islamic bank investments are short-term in nature but are more or ethical importance than financial investments. Islamic banks efficiency should be examined taking in view their social efficiency as well. As ethical performance takes time to grow therefore short-term poor results of Islamic banks should not be of concern. |
| 10 Bader et al. (2007) | 1990–2005 | DEA: Inputs: Labour, fixed assets, total income Outputs: total loans, other earning assets, off balance sheet items, price of inputs and outputs, price of labour, price of fixed assets, price of funds, price of loans, price of other earning assets, price of off balance sheet items 1 3 | Algeria, Egypt, Gambia, Senegal, Sudan, and Tunisia, Bangladesh, Brunei, Indonesia, Malaysia and Pakistan, Bahrain, Iran, Jordan, Kuwait, Lebanon, Qatar, Saudi Arabia, Turkey, UAE, Yemen 11 | Data Envelopment Analysis, Mann-Whitney test, Kruskal-Wallis test | Revenue efficiency is higher in all banks than their cost efficiency. New Islamic banks are more efficient than old Islamic banks. |
| 11 Mokhtar et al. (2007) | 1997–2003 | DEA: Inputs: Total deposits, total overhead expenses Outputs: total earning assets, personnel and other expenses/total assets, return paid to depositors/total deposits | Malaysia | Data envelopment analysis | Efficiency of Islamic banks is increasing, while efficiency of conventional banks is stable. Full-fledged Islamic banks are more efficient than window Islamic banks. 12 |
| 12 Surfan (2007) | 2001–2005 | DEA: Inputs: Total loans, total deposits Outputs: Investments, investments, loan loss provisions | Malaysia | Two model data envelopment analysis to account for sensitivity of efficiency scores, spearman and Pearson correlation | Foreign banks have higher efficiency than local banks, scale inefficiency is higher than technical efficiency. Technical efficiency is more affected by taking excessive risks. Scale efficiency has more effects on technical efficiency than pure technical efficiency. Islamic banks need to optimise their size because they are operating at decreasing returns to scale. 4 1 |
| 13 Safian and Abdul Majid (2007) | 2001–2005 | DEA: Inputs: Total deposits, total assets, labour Outputs: Total loans, investments GMM: Natural log of deposits, loan/total assets, natural log of total assets, loan loss provision/total loans, net return income/total assets, equity/total assets, return on assets, natural log of gross domestic product, dummy of foreign banks. Dummy of Islamic banks. | Malaysia | Two stage: Data envelopment analysis, multivariate TOBIT regression analysis | Scale inefficiency in Islamic banks is higher than technical inefficiency. Banks are realising economies of scale. Foreign banks are more technical efficiency and consequently are more cost efficient. 5 1 |

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Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Country(ies) | Efficiency model | Conclusion |
|----|--------------------------|-----------|---|--|---|---|
| 14 | Hassan et al. (2009) | 1990-2005 | DEA: Inputs: La bour, fixed assets, total funds, price of inputs; price of labour, price of fixed assets, price of funds Outputs: Total loans, other earning assets, off balance sheet items | Africa, Asia, Middle East | Data envelopment analysis, t-test, stochastic Frontier analysis | Profit efficiency is higher and stable than cost efficiency over the years, but the difference between Islamic banks and conventional banks is not significant. Islamic banks in middle east have higher cost efficiency than banks in other parts. Large size conventional banks have higher efficiencies than small banks |
| 15 | Mohhtar et al. (2008) | 1997-2003 | DEA: Inputs: Total overhead expenses Outputs: Total earning assets Input prices: personnel and other expenses; total assets, return paid to depositors; total deposits | Malaysia | Data envelopment analysis | Efficiency of Islamic banks is increasing while efficiency of conventional banks is stable. Full-fledged Islamic banks are more efficient than window Islamic banks. Efficiency of Islamic banks was lower than conventional banks. |
| 16 | Kamaruddin et al. (2008) | 1998-2004 | DEA: Inputs: Personnel expenses, total deposits, fixed assets, input prices price of labour, price of deposit, price of capital Outputs: earning assets, other assets, other income | Malaysia | Data envelopment analysis | Efficiency of Islamic banks remains almost stagnant during the period. Cost efficiency of domestic banks was higher than foreign banks. Though domestic banks have better efficiencies but foreign banks are catching them up. |
| 17 | Sufian and Haron (2008) | 2001-2005 | DEA: Inputs: Total deposits, labour, total loans Outputs: Investments | Malaysia | Malmquist productivity index, multivariate regression analysis | The productivity increase in Islamic banks is due to increase in technical efficiency but mainly from scale efficiency, without any support from technological advancement. Foreign Islamic banks are suffering from productivity regress due to technological and technical efficiency as well. Zakat paying Islamic banks are more efficient than non-zakat paying banks. Profitability and bank size has positive impact on bank productivity. |
| 18 | Sufian et al. (2008) | 2001-2006 | DEA: Inputs: Total loans, income, investments Outputs: Deposits, assets | Bahrain, Bangladesh, Egypt, Gambia, Indonesia, Iran, Kuwait, Malaysia, Pakistan, Saudi Arabia, Turkey, United Arab Emirates, Qatar, South Africa, Sudan, Yemen | Data envelopment analysis | Banks in MENA region have better technical efficiency than Islamic banks in Asia. Also Islamic banks in countries with both Islamic and conventional banking systems display better efficiencies than countries solely with Islamic banking systems. |

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Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Country(ies) | Efficiency model | Conclusion |
|----|------------------------|-----------|---|--|--|---|
| 19 | Bader et al. (2008) | 1990–2005 | DEA: Inputs: Total costs, revenues, profits Outputs: Labour, fixed capital, total funds, total loans, other earning assets, off-balance sheet assets, total personal expenses by the total funds, depreciation expenses, the fixed assets, interest expenses on deposits and non-deposits funds plus other operating expenses by the total funds, Interest income/ total loans, other operating income/other earning assets, net commission revenue plus net earning income divided by off-balance sheet items | Egypt, Bahrain, Tunisia, Jordan, Kuwait, Lebanon, Qatar, Saudi Arabia, Turkey, UAE, and Yemen. | Data envelopment analysis | Cost and technical efficiency of all banks is better than revenue efficiency. No significant difference between efficiencies of Islamic and conventional banks. The behavior of Islamic and conventional banks is similar towards efficiency. |
| 20 | Sufian and Noor (2009) | 2004–2006 | DEA: Inputs: Deposits, capital, financing Outputs: Investments, income. | Asian countries and MENA region | Data envelopment analysis, correlation analysis, TOBIT regression analysis | Technical inefficiency in Islamic banks is higher than the scale inefficiency. Islamic banks in MENA region are more technically efficient than banks in Asia. Banks with low market share and low non-performing loans have more technically efficiency. Banks with more technical efficiency have more profitability. Favourable economic conditions contribute to efficiency of the banks. |
| 21 | Johnes et al. (2009) | 2004–2007 | DEA: Inputs: Deposits and short-term funding, fixed assets Outputs: General and administration expenses, equity Ratios: Cost to income ratio, non-interest expense to average assets, net interest margin, other operating income to average assets, return on average assets, return on average assets. | GCC countries | Data envelopment analysis, financial ratio analysis, Mahquist productivity index, correlation analysis | Islamic banks have less cost efficiency but more revenue efficiency. The results of Islamic and conventional banks are significantly different. Technical efficiency of conventional banks is higher than Islamic banks. In order to be more technically efficient Islamic banks need to be more shariah compliant. Difference between shariah rules also leads to difference between efficiencies of Islamic banks in different regions. Banks which are cost efficient tend to have better financial performance ratios. Although banks have improved on technical efficiency but their overall efficiency has decreased. |
| 22 | Hamilton et al. (2010) | 1993–2006 | DEA: Inputs: Total cost, net profit Input prices: Price of funds, price of labour, price of physical capital Outputs: Loans, investments, other earning assets, price of loans, price of investments, price of other earning assets. | Jordan | Stochastic Frontier analysis, data envelopment analysis | Profit and cost efficiency of Islamic banks is lower than the similar efficiencies of their conventional counterparts. Alternate profit efficiency which includes market power is higher in Islamic banks. |

Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Countries | Efficiency model | Conclusion |
|----|-------------------------|-----------|--|--|---|---|
| 23 | Stairi (2010) | 1999–2007 | DEA: Inputs: Labour cost, fixed capital, total cost Outputs: Total profit, Input and output prices; personnel expenses/total assets, interest expenses/total deposits, other administration and operating expenses/fixed assets, net total loans, other earning assets, per capital GDP, M2 money supply/GDP; total deposit of banking sector, average annual rate of inflation, density of population, assets of three largest banks/total assets of the country; total loans of banking sector/total deposits, total equity of banking sector/total assets, natural log of total assets, equity/total assets, net profits/average total assets, loans/total assets, cost/income | Bahrain, Kuwait, Oman, Qatar, Saudi Arab, UAE | Stochastic Frontier analysis, data envelopment analysis, maximum like libhood model | Banks need to put more control on personnel cost than on financial cost for improving technical efficiency. Countries with higher per capital income have lower cost efficiency. Countries with higher capital to asset, loan to deposit and population density have higher cost efficiency. Banks have significantly higher profit efficiency than cost efficiency. Higher demand of Islamic banking is leading to creation of monopoly of Islamic banks. The rise in bank efficiency is not systematic. Conventional banks have better cost and profit efficiency than Islamic banks. Highly capitalised and profitable banks are less efficient. |
| 24 | Jreisat and Paul (2010) | 1996–2007 | DEA: Inputs: Labour, deposits, loans Outputs: Other investment | Jordan | Data envelopment analysis | Small size banks are more efficient than medium and large banks, domestic banks have better technical efficiency than foreign banks. The efficiency of Islamic banking sector is increasing overall. |
| 25 | Akhtar (2010) | 2000–2006 | DEA: Input: Interest expense, non-interest expense Output: Interest income, non-interest income. | Saudi Arabia | Data envelopment analysis, Malmquist productivity index | The productivity of Islamic banks is increasing due to adoption of new technology and not due to efficiency. Technical and pure technical efficiencies are decreasing. |
| 26 | Noor et al. (2010) | 2001–2006 | DEA: Inputs: Total deposits, assets Output: Total loans, income, investments | Bangladesh, Indonesia, Malaysia, Pakistan | Data envelopment analysis | Pure technical inefficiency in Islamic banks is higher than scale inefficiency. Banks in Indonesia are more efficient. |
| 27 | Ahmad et al. (2010) | 2003–2009 | DEA: Inputs: Total deposits, labour costs, Output: total assets, total loans, income, other earning assets | Bahrain, Bangladesh, Brunei, Egypt, Gambia, Indonesia, Iran, Iraq, Jordan, Kuwait, Malaysia, Mauritania, Pakistan, Palestine, Saudi Arabia, Singapore, Syria, Thailand, Turkey, UAE, UK, Qatar, Yemen, South Africa, Sudan | Data envelopment analysis | Islamic banks have higher pure technical efficiency than scale efficiency. In low income countries Islamic banks operate under increasing returns to scale. Banks that operate under increasing return to scale should endeavour to reduce their scale inefficiency. |
| 28 | Shahid et al. (2010) | 2005–2009 | DEA: Inputs: Deposit, Capital, Outputs: investments, loans and advances, price of capital, price of deposits | Pakistan | Data envelopment analysis, t-test | Technical efficiencies of conventional banks are higher than Islamic banks while cost and scale efficiencies are lower. |

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Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Country(ies) | Efficiency model | Conclusion |
|----|--------------------------|-----------|--|----------------------|--|---|
| 29 | Onour and Abdalla (2010) | 2007-2008 | DEA: Inputs: Salaries and wages, deposits Outputs: Loans, net income | Sudan | Data envelopment analysis, Malmquist index | Bank ownership, and size have no relationship with efficiency of Islamic banks. Banks with improved technical efficiency also exhibit also depict productivity improvement. |
| 30 | Ahmad and Noor (2011) | 1992-2009 | DEA: Inputs: Total loans, total deposits, labour cost Output: Income, other earning asset, total assets. For Tobit multivariate analysis and fixed effect model: Operating expenses/total assets, equity/total assets, total loans and assets, loans/total assets, loans/deposit, and non-performing loans/total loans, while the loans/GDP, inflation, market capitalisation, and seven dummy to test various event (Asian financial crisis, global financial crisis, Middle east and North Africa, Asia, low medium and high income countries) fail under economic condition. | 25-Islamic countries | Data envelopment analysis, TOBIT model, fixed effect model, ordinary least square method | Islamic banks have greater technical efficiency. Banks in Asia with greater technical efficiency derive more profitable results. |
| 31 | Noor and Ahmad (2011) | 1992-2009 | DEA: Inputs: Total deposits, labour cost, total assets Outputs: Total loans, income, other earning assets Tobit and fixed effect model: total loans divided by total assets (LOANS/TA), log of total assets (LNTA), non-performing loans divided by total loans (NPL/TL), log of total deposits (LNDEPO), operating expenses divided by total assets (OE/TA) and book value of stockholders' equity as a fraction of total assets (EQUITY/TOTAL ASSET). Logarithm of GDP, inflation, market capitalisation (MARKET), AIC, GFC, MENA, Asian countries, and countries income level (LOW, MEDIUM and HIGH). | Global analysis | Data envelopment analysis, fixed effect model, TOBIT regression model | Islamic banks have better pure technical efficiency than scale efficiency. Pure technical inefficiency have lead to technical inefficiency. Technical efficiency is related with operating expenses, asset size, equity, non-performing loans, average fixed costs and GDP. |
| 32 | Mariam et al. (2011) | 1996-2002 | Labour expenses plus physical capital expenses and financial expenses, loan, other earning assets, price of labour, price of financial capital, price of physical capital, loan quality, equity assets, Islamic bank dummy, merged bank dummy, financial crisis, Foreign bank with IB dummy, foreign bank w/without IB dummy, Domestic bank with IB dummy, publicly owned bank dummy. | Malaysia | Stochastic Frontier analysis, generalised Malmquist index | Islamic banks have lower cost efficiency than conventional banks. Asian crisis 1998 had negative affects on Malaysia banking industry. Banks with higher technical efficiency have higher productivity change as well. Technological advancement brings initial cost efficiency which then grows to cost efficiency with increase in productivity and technical efficiency. Merged banks did not have did not have any impact on their productivity. After mergers banks need to relaunch their products to reap benefits of mergers. |

Table 1

Efficiencies in Islamic banking

Literature review (continued)

| Sr. | Authors | Period | Efficiency variables | Countries | Efficiency model | Conclusion |
|-----|---------------------------|-----------|---|---|--|--|
| 33 | Kablan and Yousfi (2011a) | 2001–2008 | DEA: Inputs: Labour, physical capital, deposits Outputs: Net loans, net liquid assets, total earning assets Price of inputs: Personnel expenses/total assets, other expenses/total assets, income | Algeria, Lebanon, Tunisia, Malaysia, Turkey, Yemen, Bahrain, Egypt, Jordan, Saudi Arab, UAE, Kuwait, Qatar, Iran, Pakistan, Sudan | Data efficiency analysis, stochastic frontier analysis, Hausman test, correlation analysis | Size of the bank has negative impact on efficiency of the bank because of operating at wrong scale. Banks in Asia are the most efficient. Profitability and market power have positive impact on efficiency. It is more costly for Islamic banks to operate in country with Islamic government and Islamic systems. |
| 34 | Kablan and Yousfi (2011b) | 2001–2008 | DEA: Inputs: Labour, physical capital, deposits Input prices: Personnel expenses/total assets, other expenses/total assets Outputs: Income, net loans, net liquid assets, total earning assets TOBIT: regression: log of total assets, return on assets, bank deposit/total assets, deposits/urban population, GDP per capita, risk rating, dummy of Middle East bank, dummy of UK banks, dummy of Islamic Banking system, dummy of subprime crisis. | Iran, Jordan, Kuwait, United Arab Emirates, Qatar, Bahrain, Lebanon, Saudi Arabia, Yemen, Pakistan, Malaysia, Turkey, Brunei, Sudan, Egypt, Tunisia, UK | Data efficiency analysis, stochastic frontier analysis, TOBIT regression model | Profitability and market power have negative impact on efficiency of Islamic banks. GDP has positive impact on efficiency while urban population has negative impact on efficiency of Islamic banks. Efficiency of Islamic banks in countries where solely Islamic banks exist is below average. Islamic banks depict higher efficiency in competitive systems. Islamic banks in countries which have better Islamic regulatory frameworks show better efficiency. |
| 35 | Hadad et al. (2011) | 2003–2007 | DEA: Inputs: Total consumer deposits and commercial borrowing, total employee expenses, total non-employee expenses Outputs: Total provisions, total commercial loans, other earning assets, net total off balance sheet income | Indonesia | Malmquist Index, semi-oriented radial measure-data envelopment analysis, truncated regression analysis | Major cause of productivity improvement is technological advancement. Risk Management efficiency also affects technical efficiency of financial institutions. Banks efficiency is highly related with stock market efficiency and log of total assets. The productivity of Indonesian banking sector is highly dispersed and volatile. |
| 36 | Tahir et al. (2011) | 2003–2008 | DEA: Inputs: Total deposits, overhead expenses Output: Total loans, other earning assets | Africa, Far East and Central Asia, Europe, Middle East | Data envelopment analysis | Islamic banks suffer higher from pure technical efficiency than scale efficiency. Banks in middle east are more efficient than banks in any other part of the world. Larger banks exhibit better results are constant returns to scale. But most of the Islamic banks are operating at diminishing returns to scale. Size of the Islamic banks is mostly big in middle east. The number of Islamic banks over increasing returns to scale has declined, which shows the efficiency of Islamic banks decreases with increase in size. |
| 37 | Moussawi and Obeid (2011) | 2005–2008 | DEA: Input: Total fixed assets, interest expense, personnel expenses, other operating expenses Outputs: Total earning assets, net commission revenue, total deposits Regression: Growth rate, inflation rate, equity to asset ratio, size of the bank, doubtful loans to asset ratio, return on assets. | GCC region | Data envelopment analysis, regression analysis | Productive efficiency of Islamic banks has increased but the results are dispersed. Inflation is the major factor in determining efficiency of Islamic banks. The relationship between economic growth and efficiency appears negative. |

Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Country(ies) | Efficiency model | Conclusion |
|----|----------------------------|-----------|--|--|---|---|
| 38 | Moutafá (2011) | 2009 | DEA: Inputs: Assets, equity, net income Outputs: Return on assets, return on equity | Saudi Arab, Iran, Kuwait, Malaysia, Bahrain, Qatar, Turkey, Egypt, Bangladesh, Syria, Sudan, Brunei, Jordan, Pakistan, Indonesia, UK, Yemen, Singapore, Palestine, | Data envelopment analysis, sensitivity analysis | Efficiency does not have any significant relationship with profitability in Islamic banks, however, efficiency does contribute to long term performance. Changing the variables in the model changes the efficiency between 0.8 to 1. |
| 39 | Noor and Ahmad (2012a) | 1992–2009 | DEA: Inputs: Total deposits, labour cost, total assets Output: Total loans, income, other earning assets | | | |
| | | | TOBIT and fixed effect model: Total loans divided by total assets | | | |
| | | | (LOANSTLA), log of total assets (LNTA), non-performing loans divided by total loans (NPL/TLL), log of total deposits (LNDEPO), operating expenses divided by total assets (OETA) and book value of stockholders' equity as a fraction of total assets (EQUITY/TOTAL ASSET) | | | |
| | | | Logarithm of GDP, inflation, market capitalisation level (LOW, MEDIUM and HIGH) | | | |
| | | | DEA: Inputs: Deposit, labour, fixed capital | | | |
| | | | Outputs: Loan and advances, income, other earning assets | | | |
| 40 | Noor and Ahmad (2012b) | 1997–2009 | TOBIT: Return on equity, operating expenses/total assets, equity/total assets, natural log of total assets, loans/total assets, natural log of total deposits, natural log of GDP, inflation, market capitalisation, dummy for crisis, dummy for region. | | | |
| 41 | Al-Khasawneh et al. (2012) | 2003–2006 | DEA: Inputs: Personnel expenses, fixed assets, loanable funds net loans and investment securities, total interest income/net loans, other operating income/other earning assets, as personnel expenses/total assets, non-interest expenses/total assets, total interest expense/loanable funds | Tunisia, Algeria, Egypt, Sudan | Data envelopment analysis | Conventional banks have increasing cost efficiencies while Islamic banks have decreasing. Revenue efficiency in Islamic banks is higher than conventional banks. Islamic banks are more successful in countries with competitive conventional systems than solely with Islamic systems. |

Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Country(ies) | Efficiency model | Conclusion |
|----|-------------------------------------|-----------|--|------------------------------|--|---|
| 42 | Ahmad and Rahim Abdul Rahman (2012) | 2003–2007 | DEA: Inputs: Total personnel expenses, net book value of property plant and equipment Outputs: Total deposits, loans and advances, total income | Malaysia | Data envelopment analysis, t-test and Mann-Whitney U-test | Most of the Islamic banks have scale inefficiency. There are two factors to pure technical efficiency managerial efficiency and technological advancement but Islamic banks suffering primarily from managerial inefficiency. |
| 43 | Abu-Elkheil et al. (2012) | 2005–2008 | DEA: Inputs: Deposits and short-term funding, total expenses, total staff cost Outputs: Total loans, total revenues | GCC, Turkey, Malaysia and UK | Data envelopment analysis, financial ratio analysis, correlation analysis, regression analysis | Islamic banks are technically inefficient. Islamic banks in Muslim countries are more efficient than Islamic banks in non-Muslim countries. An Islamic bank should be a medium sized bank because it helps to achieve efficiencies. |
| 44 | Yahya et al. (2012) | 2006–2008 | DEA: Inputs: Deposits (this includes, current, savings and term deposits plus short-term borrowings), fixed assets Output: other earning assets among these assets are loans and advances to banks, securities, derivatives, investment in property, and insurance assets), and overheads, loan amount (this is inclusive of residential mortgage loans, consumer or retail loans, commercial loans less non-performing loans), interest revenue, and net income. | Malaysia | Data envelopment analysis, t-test | The efficiency of Islamic banks was below conventional banks earlier but became at par lately. |
| 45 | Said (2012) | 2006–2009 | DEA: Inputs: Labour cost, fixed assets, total deposit Output: Total loans, liquid assets, and other income | USA | Data envelopment analysis | There are significant changes in the efficiency of Islamic banks during and after the crisis. |
| 46 | Sufian et al. (2012) | 2006–2010 | DEA: Inputs: Deposits, labour, input prices: interest, expenses/deposits, personnel expenses/total assets Output: Loans, income, output prices income on loans and other loans/loans, other operating income/income Generalised regression: revenue efficiency, log of total assets, less reserve/gross loans, equity/total assets, bank deposit/total deposit, total loans/total asset, on-interest income/total asset, log of GDP, inflation, dummy of domestic Islamic banks; observation for banks; observation for year | Malaysia | Data envelopment method, multivariate regression analysis using generalised least square comprising fixed effect and random effect model, Mann Whitney (Wilcoxon) test, t-test | Revenue efficiency of domestic Islamic banks remains lower than foreign Islamic banks. Capitalisation has positive effects on revenue efficiency, whereas market share, inflation and liquidity have negative effects. |
| 47 | Alkhar (2013) | 2000–2009 | DEA: Inputs: Deposit, labour, capital Output: Interest income, loan and advances, capital TOBIT: Efficiencies, real GDP from oil sector, oil prices, market capitalisation of banking industry, return on equity. | Saudi Arabia | Data envelopment analysis and TOBIT regression analysis | Banks in Saudi Arab remained least affected by financial crisis but remained inefficient. Banks are mostly affected allocative inefficiency which means they are unable to find optimum mix of their inputs and outputs. Banks with large market share are better able to achieve efficiency. They are significant relationship with profitability with efficiency means banks can have profitable operations despite inefficiencies. |

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Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Countries | Empirical model | Conclusion |
|----|---------------------------|-----------|--|---|---|---|
| 48 | Kablan and Yousofi (2013) | 2001–2008 | SE-ADAE: Inputs: Labour, physical capital, deposits Input prices: Personnel expenses/total expenses, total expenses/total assets, income for deposits/total assets, output: net loans, net liquid assets, total earning assets Regression and correlation: Cost efficiency, natural log of total cost, natural log of loans, natural log of securities, natural log of loans, natural log of personnel expenses, size, return on assets, return on equity, risk taking market power, per capital GDP, population density, risk taking, dummy middle east, dummy UK, dummy of Islamic banking system, dummy of subprime crisis. DEA: Inputs: Staff expenses, fixed assets, total deposits Output: Total loans, other revenues, liquid assets Regression: Asset quality, management quality, liquidity, return on assets, return on equity, bank size, market share, gross domestic product, population density, Herfindahl-Hirschmann index, equity ratio. DEA: Inputs: Labour cost, fixed capital, total deposits Output: Total loans, liquid assets, other income Financial ratios: Credit risk (ratio of total debt to total asset), liquidity risk (equity/total asset), operational risk (EBIT/net total assets) Correlation analysis: The correlation between financial ratio analysis and efficiency analysis | Iran, Jordan, Kuwait, United Arab Emirates, Qatar, Bahrain, Lebanon, Saudi Arabia, Yemen, Pakistan, Malaysia, Brunei, Sudan, Egypt, Tunisia, UK | Stochastic Frontier analysis, data envelopment analysis, regression analysis | Islamic banks in Asia are more efficient than all other regions. It is less costly for Islamic banks to operate in countries with Islamic government legislation. However, this does not guarantee cost efficiency. Profitability and market power have positive impact on efficiency of Islamic banks. |
| 49 | Fitri et al. (2013) | 2005–2009 | DEA: Inputs: Staff expenses, fixed assets, total deposits Output: Total loans, other revenues, liquid assets Regression: Asset quality, management quality, liquidity, return on assets, return on equity, bank size, market share, gross domestic product, population density, Herfindahl-Hirschmann index, equity ratio. DEA: Inputs: Labour cost, fixed capital, total deposits Output: Total loans, liquid assets, other income Financial ratios: Credit risk (ratio of total debt to total asset), liquidity risk (equity/total asset), operational risk (EBIT/net total assets) Correlation analysis: The correlation between financial ratio analysis and efficiency analysis | GCC Countries | Data envelopment analysis, regression analysis | GDP, population density and experienced management positively effects efficiency of Islamic banks. |
| 50 | Said (2013) | 2006–2009 | DEA: Inputs: Labour cost, fixed capital, total deposits Output: Total loans, liquid assets, other income Financial ratios: Credit risk (ratio of total debt to total asset), liquidity risk (equity/total asset), operational risk (EBIT/net total assets) Correlation analysis: The correlation between financial ratio analysis and efficiency analysis | MENA region | Three stage analysis: data envelopment analysis, correlation analysis, financial ratio analysis | Credit and operational risks are negatively related with efficiency while relationship of liquidity risk with efficiency is not significant in Islamic banks. |
| 51 | Sufian et al. (2013) | 2006–2010 | DEA: Inputs: Deposits, number of employees, physical capital, input prices: price of deposit, price of labour Output: Loans, investment Price of output: Price of loans, price of investment | Malaysia | Data envelopment analysis, Mann-Whitney and Wilcoxon test, Kruskal-Wallis tests | Domestic Islamic banks have lower revenue efficiency but better cost and profit efficiency than multinational Islamic and other banks. Foreign banks in Malaysia benefit from their global advantage. |
| 52 | Shahwan and Hassan (2013) | 2009 | Profitability efficiency: Inputs: Total deposits, total expenses, leverage Output: Return on assets, return on equity Marketability efficiency: Inputs: ROA, ROE Output: EPS, P/E ratio Social efficiency: Inputs: Audit Committee proportion of local executives, institutional ownership, government ownership Output: EPS, P/E ratio, the voluntary social disclosure score. | UAE | Data envelopment analysis | The banks have high profitability and social efficiency but are far below in marketability efficiency. Banks with high profit efficiency have high social efficiency and vice versa. |

Table 1

Efficiencies in Islamic banking

Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Countries | Efficiency model | Conclusion |
|----|-----------------------------|-----------|---|---|--|---|
| 53 | Findaus and Hosen (2013) | 2010-2012 | DEA: Inputs: Total deposits, total assets, labour cost Outputs: Financing, operational income TOBIT - Efficiencies, assets, the number of the branch of the banks, ROA, ROE, CAR, NPF | Indonesia | Data envelopment analysis, TOBIT regression model | There is a huge dispersion in the efficiency score of Islamic banks, which means that Islamic banking in Indonesia is not competent enough. Non-performing loans and capital adequacy ratios have negative impacts on the efficiency of the banks. |
| 54 | Johnes et al. (2014) | 2004-2009 | DEA: 1st stage variables: Inputs: Deposits and short-term funding, fixed assets, general fund and administrative expenses, equity Outputs: Total loans, other earning assets 2nd stage variables: Inputs: assets, loan loss/assets, net loans/assets, normalised Herfindahl index, market capitalisation, growth in real GDP, inflation, GDP per capita Islamic banks need to improve on their portfolio and product management, whereas conventional banks need to improve on their performance management. | 18 Countries with 60% or more Muslim Population | 2-stage data envelopment analysis (DEA) and meta-frontier analysis (MFA) | Results suggest that managers of Islamic banks are efficient but Islamic banks are inefficient. |
| 55 | Sufian and Kamarudin (2014) | 2004-2011 | DEA: Inputs: Deposit, labour, capital Outputs: Loan, investment | Bangladesh | Slack-based data envelopment analysis | Islamic banks are not operating according to their scale of investment which is causing scale inefficiency. |
| 56 | Sufian et al. (2014) | 2006-2010 | DEA: Inputs: Deposits, labour, Input prices: price of deposits, price of labour Output: Loan, income Output prices: price of loan, price of investment | Malaysia | Data envelopment analysis and Mann-Whitney (Wilcoxon test), T-test | The revenue of domestic Islamic banks is lower than foreign Islamic banks. Large Islamic banks are operating at decreasing or constant returns to scale while small Islamic banks are operating at increasing or constant returns to scale. Banks on increasing returns to scale are always target of being taken over. |
| 57 | Rosman et al. (2014) | 2007-2010 | DEA: Inputs: loans, other earning assets, deposits and short-term funding Outputs: fixed assets, personnel expenses TOBIT model: Return on assets, total assets, equity/total assets, loan loss provisions/net interest expenses | Middle Eastern and Asian countries | Data envelopment analysis, TOBIT model | Islamic Banks are more technically efficient whereas Islamic Banks in Asia are even more technically efficient. Also Islamic banks have grown beyond productive scale therefore need to adjust their scale to improve their efficiency. |
| 58 | Kamarudin et al. (2014) | 2007-2011 | DEA: Inputs: Deposits, labour cost, loans Output: Income, price of deposits, price of labour, price of loans, price of income | GCC countries | Data envelopment analysis, Mann-Whitney and Wilcoxon test, Kruskal-Wallis tests | Conventional banks have significantly higher efficiencies than Islamic banks. Revenue efficiencies effects profit efficiencies in Islamic banks but not in conventional banks. |
| 59 | Shawtari et al. (2015) | 1996-2011 | DEA: Discretionary accrual proxy for earnings quality, Overall Efficiency using DEA, Capital ratio, Size of the bank, Loan to Deposits, GDP, Auditor, Islamic or Non-Islamic Banks (Panel Data) | Yemen | Two stage approach using Breusch-Pagan Lagrange multiplier (LM) pooled OLS and random effects. | Islamic like conventional banks use and manipulate loan loss provisions to smooth their profitability which is a non-shariah compliant practice. |

Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Countries | Efficiency model | Conclusion |
|----|---------------------------|-----------|--|---|---|---|
| 60 | Shawtari et al. (2015) | 1996–2011 | DEVA: Deposits, capital, labour, interest income, non-interest income, total loans, financing income, non-interest income, total financing, total loans to borrowers, total financing in case of Islamic banks. Panel regression: Dummy Islamic, natural log of GDP, natural log of inflation index, natural log of market concentration, natural log of total assets, natural log of capital structure, natural log of return on assets, natural log of loan loss provisions/total loans, natural log of non-interest income/non-finance income, natural log of total loans or finances. | Yemen | Three stage data envelopment window analysis (modified DEA analysis), panel data technique with unbalanced data for regression. | Islamic banks are better than conventional banks in terms of efficiency. The profitability of Islamic banks is negatively related to their efficiency. The size of bank only matters in case of Islamic banks for enhancement of efficiencies. |
| 61 | Gheeraert and Weil (2015) | 2000–2005 | DEA: Inputs: Total credit to GDP, Islamic credit to GDP, conventional credit to GDP, total deposits to GDP, Islamic deposits to GDP. Output: conventional deposits to GDP, inflation, latitude, log (Y/L), log (K/L) | Algeria, Argentina, Bahrain, Bangladesh, Belize, Benin, Bolivia, Botswana, Brazil, Burkina Faso, Cameroon, Chad, Chile, Colombia, Congo, Dem. Rep., Costa Rica, Cote d'Ivoire, Cyprus, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, Gabon, Ghana, Guatemala, Guyana, Honduras, India, Indonesia, Iran, Israel, Jordan, Kenya, Kuwait, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Nepal, Niger, Pakistan, Papua New Guinea, Paraguay, Peru, Philippines, Rwanda, Saudi Arabia, Senegal, Singapore, South Africa, South Korea, Sri Lanka, Sudan, Swaziland, Syria, Thailand, Togo, Trinidad and Tobago, Tunisia, Uganda, Uruguay, Venezuela, and Zambia. | Stochastic Frontier analysis, data envelopment analysis | Development of Islamic banks favors overall efficiency of the economy, however the relationship is nonlinear. Development of Islamic banking favors overall economic efficiency unless it remains under controlled parameters. Excessive growth in Islamic banking has negative effects on overall economic efficiency. The general relationship of conventional banking development with economic efficiency only starts after some certain level of development is reached with conventional banking. |

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Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Country(ies) | Efficiency model | Conclusion |
|----|---------------------------|-----------|---|---|--|--|
| 62 | Sulami and Adewale (2015) | 2002–2011 | Inputs: Total deposits, capital, total loans Outputs: Income, investments, | Malaysia | Data envelopment analysis, Malmquist productivity index | The efficiency of windows Islamic banks is better than the efficiency of full-fledged Islamic banks. Banks with longer years of operations are more efficient than other banks. The productivity improvement in Islamic banks is mainly due to technical efficiency improvement. |
| 63 | Zuhroh et al. (2015) | 2004–2010 | Inputs: Third party funds, labour, assets Input prices: Price of funds, price of labour, price of assets, loans (credit) Bifilar: Cost efficiency, assets, equity/assets, a set quality, liquidity, non-performing loans, competition. | Indonesia | Stochastic Frontier analysis, ordinary least square with maximum likelihood method, bifilar regression | Islamic banks have lower cost efficiency than conventional banks which is because of allocative efficiency. Technical efficiency of Islamic banks is higher than conventional banks. Islamic banking suffers from lack of supervision and regulations. |
| 64 | Alhbas et al. (2015) | 2005–2009 | Inputs: Employees, fixed assets, deposits, capital Outputs: Loans and advances, investments, other income | Pakistan | Data envelopment analysis, Malmquist productivity index | The productivity of Islamic banks is higher than conventional banks. The major source of productivity decline is technological change index. Which means that Islamic banks should focus on adopting new technologies. |
| 65 | Belanès et al. (2015) | 2005–2011 | Inputs: Total salary expenses, fixed assets and total deposits Outputs: Total loans, other revenues and liquid assets | Saudi Arabia, UAE, Qatar, Kuwait, Bahrain, Kuwait | Data envelopment analysis | Results indicate negative impact of global crisis on Islamic banks. Efficiency of Islamic banks significantly decreased after the crisis. With the decrease in efficiency many conventional banks lost their business but Islamic banks gained but to Shari'a factor. |
| 66 | Bahmi (2015) | 2006–2011 | DEA, MME: Inputs: Labour cost, fixed assets, total deposits Outputs: Total loans, investment portfolio, no operating income Regression: Capital adequacy, bank size, management quality, business diversification, credit risk, return on equity, loan to deposit ratio, cash to total asset ratio. | MENA Region | Data envelopment analysis, bootstrap second stage regression analysis | Efficiency of Islamic banks have grown during the period. Technological progress is positively related to efficiency. Sluggish adoption to new technology also slows down productivity improvement. The growth of bank efficiency is mainly due to bank specific variables although economic factors also leave their impact. Banks in MENA region have put their focus more on scale efficiency than technical efficiency. Global financial crisis also impacted efficiency of GCC Islamic banks. |

Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Country(ies) | Efficiency model | Conclusion |
|----|----------------------------|-----------|--|---|---|--|
| 67 | Sufian and Kamardin (2015) | 2006–2011 | DEA: Inputs: Deposit, labour, physical capital, input prices; price of deposit, price of labour, price of physical capital Output: Loans, investments. Regression: namely, size, asset quality, capitalisation, market share, liquidity and management quality. | Indonesia, Malaysia and Brunei | Data envelopment analysis test. Muro-Whitney (Wilcoxon). Kruskal-Wallis tests, OLS regression, generalised least square | There exists significant difference between local and foreign Islamic banks. Domestic banks have better revenue efficiency and foreign banks have better cost efficiency. Bank size, asset quality, capitalisation, liquidity, management quality, gross domestic product and inflation. |
| 68 | Ab-Rahim and Chung (2016) | 2000–2011 | DEA: Inputs: Personnel expenses, book value of premises and fixed assets, deposits and short-term funding Outputs: Total loans and other earning Regression: ROA, ROE, net income margin, marketshare, market concentration, technical efficiency, scale efficiency, expenses, loan, size, HHI, size | Malaysia | Data envelopment analysis, concentration ratios, Herfindahl-Hirschman index (HHI), regression | Inefficiencies in Islamic banks are higher but these should not be dealt with mergers and acquisitions like in the case of conventional banks. |
| 69 | Abbas et al. (2016) | 2004–2009 | DEA efficiency model: Inputs: Employees, fixed assets, deposits Outputs: Loans and advances, investments DEA effectiveness model: Inputs: Loans and advances, investments Output: Mark-up interest income, other income TOBIT: Efficiency, effectiveness, performance, years of operation, owner's equity/assets, loans and advances/assets, non-performing loans/assets, log (deposits), profit (before tax)/assets, non-markup income/assets, other operating expenses/assets, square of the sum of the market shares of each bank in national market, dummy of minimum capital requirements by regulatory authority | Pakistan | Data envelopment analysis, TOBIT regression analysis | Reason for inefficiency of Islamic banks is their early age and small size. Islamic banks have increased their competitiveness with the increase in experience and size. Islamic banks are suffering from loan loss provisions, GDP growth rate and minimum capital requirements have positive effect on efficiency of Islamic banks whereas market concentration and inflation have negative effects. |
| 70 | Wanke et al. (2016) | 2010–2014 | DEA: Inputs: Assets, deposits, equity, outputs: operational results, personal expenses, banking products, number of employees | Middle East, including Iran; South and South East Asia; Africa and Europe | Two stage and technique for order preference by similarity to the ideal solution (TOPSIS) method with neural network analysis | The efficiency of Islamic banks recently subjected to War remains low. Major factors of inefficiency in Islamic banks relate to cost structure and country of origin of the bank. Cultural traditions also leave positive impact on efficiency of Islamic banks. Islamic banks do not learn from their experiences due to low competition. European and Gulf-based Islamic banks are required to focus on their learning curves. |

Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Country(ies) | Efficiency model | Conclusion |
|----|---------------------------|-----------|---|---|--|--|
| 71 | Aghamien et al. (2016) | 2007–2011 | DEA Inputs: Total assets, deposit Outputs: Total loans, income | Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, UAE | Data envelopment analysis | Technical inefficiency in Islamic banks is mainly due to pure technical inefficiency. Scale inefficiency is quite low in Islamic banks. Large Islamic banks are operating at decreasing or constant returns to scale while small Islamic banks are operating at increasing or constant returns to scale. |
| 72 | Majeed and Zamb (2016) | 2007–2014 | DEA: Inputs: Deposits, fixed assets, capital, Outputs: investments, advances, assets | Pakistan | Data envelopment analysis | Conventional banks have higher technical efficiency than Islamic banks. Islamic branches of conventional banks are less efficient than Islamic banks and also enjoy better scale efficiency. EPS and ROE have the most influence on efficiency of DMU's |
| 73 | Mirdamadian et al. (2016) | 2012 | DEA: Inputs: total assets, systematic risk, non-systematic risk, return on equity, Outputs: yearly efficiency, sales growth, current ratio and earning per share | Iran | Data envelopment analysis | |
| 74 | Tan et al. (2016) | 2016 | | Malaysia | Extended DEA gaps model | Service quality of an organisation is very much based internal strengths and is also affected from internal weaknesses. |
| 75 | Alqabani et al. (2017) | 1999–2012 | DEA: Inputs: Islam Year, Islamic or conventional bank, state foreign or listed bank Outputs: Capital adequacy ratio, non-performing-loans, cost to income ratio, return on assets, other earning assets, total assets, natural log of fixed capital/labour expenses, natural log of total assets, inflation, GDP, Natural log of annual oil prices | GCC countries | Non-parametric data envelopment method, parametric stochastic frontier analysis with regression analysis | In the long run there is no significant difference between the cost efficiencies of Islamic and conventional banks. Conventional banks have better profit efficiency. Only Islamic banks in Bahrain have better cost and profit efficiency due to better management. During global financial crisis Islamic banks remained more cost efficient. Profit efficiency gap of Islamic and conventional banks eroded down during financial crisis period. When financial crisis remained within financial sector Islamic banks remained less affected however, when crisis spread into economy Islamic banks started to receive effects. This shows Islamic banks are more related to real sector of the economy. Domestic banks were more efficient than Islamic banks. |

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Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Country(ies) | Efficiency model | Conclusion |
|----|------------------------|-----------|--|---|---|--|
| 76 | Doumpos et al. (2017) | 2000–2011 | BOFSI: Equity/total assets, loan loss provision/gross loans ratio, cost/income, profits/total assets, liquid assets/deposits and short-term funding ratio. DEA: Inputs deposit, equity overhead Output: Other assets, loans other earning assets. SFA: Interest expenses/deposits, overheads/total assets, loans other earning assets | Algeria, Bahrain, Bangladesh, Brunei, Egypt, Indonesia, Iraq, Jordan, Kuwait, Lebanon Malaysia, Mauritania Pakistan, Qatar, Saudi Arabia, Senegal, Syria, Tunisia, Turkey, UAE, Yemen | BOFSI, data development analysis, stochastic Frontier analysis | Islamic banks have performed better in MENA region, however, conventional banks have performed better in Asia and Gulf region. Overall performance and efficiencies of Islamic banks are very similar to those of conventional banks. |
| 77 | Daly and Frikha (2017) | 2005–2009 | DEA: Inputs: Market share, income diversity, total assets Outputs: Equity/total assets, net loans/total assets, govt. variables, efficiency | Bahrain | Data development analysis, multiple regression, DWH test, Fisher-test, financial ratios | Income diversity, bank size, solvability indicators, and loans to assets ratio has positive impact on the performance of Islamic banks' (ROE). Whereas market share, solvability indicators and net loans to total assets (N/LTA) have significant effects on the ROE for conventional banks. |
| 78 | Miah and Uddin (2017) | 2005–2014 | DEA: Inputs: Operating costs, cost of deposits Outputs: loan Output. Regression: Efficiencies, bank's size, earning assets, and equity buffer. Islamic bank dummy | Saudi Arab, UAE, Kuwait, Qatar, Bahrain, Oman | Data development analysis, stochastic Frontier analysis, ordinary least square analysis | Conventional banks are more cost efficient than Islamic banks, Islamic banks in Qatar and Saudi Arabia Banks are developing but banks in Bahrain and Kuwait have matured up and thus have cut throat competition with their competitors however, their size is smaller. Conventional banks are oversized whereas Islamic banks undersized which is leading to diseconomies of scale. Capital adequacy ratio in the GCC region is double the Basel requirement which is also a cause of inefficiency. Islamic banks are diverse in terms of cost efficiency whereas conventional banks are homogeneous, short-term efficiency of Islamic banks is higher than conventional banks. |
| 79 | Batir et al. (2017) | 2005–2013 | DEA: Inputs: labour, capital, funds Outputs: Total loans, off balance sheet items, price of labour, price of physical capital, price of funds TOBIT: Technical efficiency, cost efficiency, allocative efficiency, profitability, capital adequacy, expense, deposit, loans, loan quality (NPL), size, GDP growth, inflation. | Turkey | Data development analysis and TOBIT method | Technical Efficiency is higher than Allocative efficiency for all banks. Efficiencies of Islamic banks are higher than efficiencies of conventional banks in all respects. External variables such as GDP and inflation effect both types of banks negatively. |
| 80 | Bahrini (2017) | 2007–2012 | DEA: Inputs: Labour, fixed assets, deposits Outputs: Total loans, other earning assets | MENA region and GCC region | Boot strap data development analysis | Pure technical inefficiency causes technical inefficiency. It has no concern with scale efficiency. Efficiency of GCC region Islamic banks remained better than the efficiency of Non-GCC region Islamic banks during the period of crisis. |

Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Country/(ies) | Efficiency model | Conclusion |
|----|----------------------------|-----------|--|---------------|---|---|
| 81 | Ali Shah and Masood (2017) | 2007–2015 | Admin cost, deposit account, capital employed, commission on premium, net return margin, total loans and advances, net spread earned, total financing, gross premium, net investment income | Pakistan | Data envelopment analysis | The technical efficiency of insurance sector is better than banking sector. Scale efficiency of conventional financial institutions is better than Islamic. |
| 82 | Azad et al. (2017b) | 2009–2013 | Production approach: Inputs: Interest expense, salary expenses, operating expenses Outputs: Interest income, net income Profitability approach: Inputs: Total capital, salary expense, interest expense Outputs: Total deposits, total loans Intermediation approach: Inputs: Total capital, total deposit, salary expense Outputs: Total loans | Malaysia | Two stage data envelopment analysis | Foreign banks have higher efficiencies than domestic banks. However, domestic Islamic banks are more efficient than domestic conventional banks. Islamic bank nature, foreign ownership and GDP are major determinants of bank efficiency. Efficiency scores vary according to approach and variables selection. To estimate efficiency during business cycles profitability approach should be used. Intermediation approach should be applied on long term data as it is more closer to going concern concept. Production approach gives holistic idea of bank efficiency, hence it should be applied to gauge the efficiency of the bank to serve the economy. The improvement in bank efficiency is not the phenomenon of technology and training alone, rather it also depends upon business strategy, bank's operational approach, and time of existence as well. |
| 83 | Azad et al. (2017a) | 2010–2015 | DEA Input: Deposit, equity, interest expense, non-interest expense. Undesirable carry over output: Non-earning assets Desired output: Liquid assets, net income Undesirable outcome: Loan loss provision Intermediary: Earning assets, loans | Malaysia | Three step NDEA model, robust regression, CAMEL | Local conventional and Islamic Banks are performing better than their foreign counterparts in terms of efficiency. Separate efficiency for each stage of operation of the bank i.e., production, intermediation and profitability should be computed. Banks inputs and outputs are related to each other i.e., by increasing inputs a proportionate output cannot be expected. Banks have different efficiencies in different stages of operation. |

Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Countries(s) | Efficiency model | Conclusion |
|----|-------------------------|-----------|--|---|---|--|
| 84 | Shawstani et al. (2018) | 1996–2011 | DEWA: Inputs: Deposits, capital, labour Input prices: loan/finance, interest/finance income, non-interest/finance income Pooled OLS: Natural log of pure technical efficiency, natural log of scale efficiency, natural log of pure technical efficiency, natural log of scale efficiency, natural log of market concentration, natural log of total assets of the bank, natural log of capital/total assets, natural log of return on assets, natural log of finance provision/total finance, natural log of total non-interest income, natural log of total loans and finances for conventional and Islamic banks, natural log of liquid assets/liabilities. | Yemen | Three stage data envelopment window analysis (modified DEA analysis), pooled ordinary least square. | Islamic banks are far better than their conventional counterparts on the basis of technical and scale efficiencies. However, pure technical efficiency of conventional banks remain higher which implied Islamic banks need to invest more on human resource/training. |
| 85 | Mezti (2018) | 2004–2012 | DEA: Inputs: Staff cost, physical capital, total deposits Outputs: Income paid to depositors, administrative expenses, total debt income Regression: Size of the board of directors, number of independent directors, concentration of capital, size of shariah board, existence of a central shariah board, size of the bank, debt financing intensity, return on assets, quality management, risk of failure, financial crisis, economic growth. | Saudi Arabia, Bahrain, Bangladesh, Indonesia, Jordan, Kuwait, Malaysia, Palestine, Qatar, Sudan, Syria, Tunisia, UAE, Yemen | Data envelopment regression analysis | Islamic banks are showing improvement in cost efficiency. Malaysian and GCC Banks are realising scale efficiencies. MENA and South East Asian Banks have almost similar scale efficiencies. Board of directors and Shariah Board have significant roles in improving efficiencies. Size, financial stability, debt financing and cost control contribute significantly towards efficiency improvement. |
| 86 | Zeineb and Mensi (2018) | 2004–2013 | DEA: Inputs: Z-score, CEO duality, board size, structure Outputs: Total assets, deposit, debt ratio, credit growth, GDP. | GCC region | Data envelopment stochastic Frontier analysis, Z-score, sensitivity analysis | Banks with higher risk appear more efficient due to their governance structure. Economic conditions of a country play important role between efficiency and risk relationship. |
| 87 | Hadhek et al. (2018) | 2005–2014 | DEA: Inputs: Profit, number of employees, funds, net fixed assets, prices of inputs, personnel expenses/total assets, profit expenses/total deposits, operating expenses/fixed assets Outputs: Net loans, investment bond, bond, certificate of deposit. TOBIT: GDP/total population, average rate of inflation, population density, log of total assets, equity/total assets, net profit/average total assets, total loans/total assets, costs/income | Saudi Arab, Iran, Malaysia, Pakistan, Thailand, Egypt, Qatar, Jordan, Dubai, Tunisia, Kuwait, Sharjah, Dubai, Oman, Abu Dhabi | Two stage stochastic Frontier analysis, data envelopment analysis, TOBIT regression | There exists negative relationship between bank size and profit efficiency. Inflation and demand density negatively effects profit efficiency whereas GDP effects positively. Equity ratio and operating costs negatively affect profit efficiency whereas Credit risk does not have any significant relationship. |

Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Country(ies) | Model | Conclusion |
|----|---------------------------|-----------|--|--|--|---|
| 88 | Mahdi and Abbas (2018) | 2005-2016 | DEA analysis: Inputs: Labour cost, fixed capital for production, financial capital Outputs: Total loans, other earning assets, personal expenses, fixed assets, total deposits. GMM: Loan loss provisions, bank cost efficiency, loan growth rate, net interest/return margin, preprovision income, capital, loan to asset ratio, inflation, GDP | Bahrain, Iraq, Algeria, Egypt, Jordan, Kuwait, Qatar, Saudi Arabia, Palestine, Tunisia, Turkey, UAE, Yemen, Pakistan | Data envelopment analysis, stochastic frontier analysis, generalised method of movements | Risk taking in Islamic bank is the cause of risk underestimation, over estimation of technical efficiency and future profits. |
| 89 | Bahrini and Quinae (2018) | 2006-2012 | Inputs: Staff costs, fixed assets, total deposits Outputs: Total loans, investment portfolio | Bahrain, UAE, Kuwait, Qatar, Saudi Arabia | Boot strap data envelopment analysis | Islamic banks have better technical efficiency than scale efficiency. Pure technical inefficiency causes were not affected by financial crisis, be it during or after. Efficiency of Islamic banks was effected by financial crisis when it spread from financial to real sector. |
| 90 | Sakti and Mohamad (2018) | 2008-2012 | DEA: Total deposit, personnel expenses, fixed assets, loans, non-interest income Regression: Size of the bank, fee income, non-deposit funding, loan deposit ratio, loss reserve, loan loss provision, non-performing loans, Z-score, return on assets, equity to asset ratio. | Indonesia | Data envelopment analysis, t-score, Z-score, | Islamic banks in Indonesia rely on non-deposit funding. Islamic banks have better assets quality. Islamic banks have better stability, overall efficiency, technical efficiency and scale efficiency. |
| 91 | Hassana et al. (2018) | 2008-2016 | DEA: Inputs deposits Outputs: Assets, capital, investments, advances, income | Saudi Arabia | Data Envelopment Analysis | With the increase in scale of business the efficiency of Saudi Islamic banks have started to decline. |
| 92 | Mohitashami et al. (2018) | 2009-2013 | DEA: Inputs physical assets, number of employees, deposit values, operational costs Outputs: Received commission, loan payments, investment amount, net revenue. | Iran | Two stage double frontier data envelopment analysis, Malmquist productivity index. | None of the bank has shown improvement in efficiency or productivity. |
| 93 | Najid et al. (2018) | 2018 | DEA: Input: Salaries, employee benefits Outputs: Branch profitability | Iran | DEA | Employee benefits lead to improved productivity of the bank branches. |

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Table 1 Literature review (continued)

| Sr | Authors | Period | Efficiency variables | Countries | Efficiency model | Conclusion |
|----|---------------------------|-----------|--|---|---|---|
| 94 | Chatfin and Hassan (2019) | 2002–2014 | DEA: Inputs: Personnel expenses, book value of fixed assets, interest expenses, Outputs: total loans, other earning assets, and deposits. | Algeria, Bahrain, Egypt, Iran, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates, and Yemen | Stochastic Frontier analysis | Conventional banks are more efficient than Islamic banks in terms of technological, managerial and allocative efficiency. Banks in MENA region need to introduce more products and introduce more technology to improve their efficiency. The technological efficiency is higher in larger banks. Foreign bank status has no impact on efficiency. Online banking is important driver of cost efficiency. Before financial crisis conventional banks outperformed Islamic window banks and Islamic banks. After financial crisis Islamic banks have better. |
| 95 | Hafez and Halim (2019) | 2003–2008 | DEA: Inputs: Total deposits, assets Outputs: Total loans income | Egypt | DEA | Cost efficiency of Islamic banks is lower than conventional banks; revenue efficiency is similar. |
| 96 | Jahnes et al. (2019) | 2006–2012 | Four financial ratios analysed: cost to income ratio, non-interest expense to average assets ratio, net interest margin, other operating income to average assets, return on average assets, return on average equity. | GCC Countries | Financial ratio analysis and extended data envelopment analysis, i.e., Malmquist productivity index with standard two component composition | Variations in technical efficiency and technology are more pronounced in Islamic banks. The blend of Islamic and conventional banks improves the ability of banking system to absorb external shocks; besides the distinction of Islamic and conventional, the distinction within Islamic banks in terms of product lines and specialisation. Islamic banks can improve their cost efficiency by adopting latest information technology speculations. |
| 97 | Wanke et al. (2019) | 2006–2014 | Inputs: Loans Outputs: Total assets and equity | MENA | Dynamic DEA | The results reveal that bank type, origin, and ownership impact efficiency levels differently in terms of profit sheet, balance sheet, and financial health indicators, although the impact of culture and regulatory barriers seem to prevail at the country level. |
| 98 | Samad (2019) | 2008–2012 | DEA: Inputs: Labour, capital, deposits, and expenses; Outputs: Loans, investments in securities, and advances | Bangladesh | DEA with TOBIT Analysis, SFA, CAMEL and CAMEL plus Model | Efficiency of Islamic banks is positively related to capital adequacy ratio and number of branches and negatively related to poor loan quality, higher liquidity claim and bank size. |
| 99 | Sajjoughia et al. (2019) | 2012–2013 | Choice of input out variables depends upon various factors. No single input out combination is applicable on all banks in operation | Fortune 500 List | DEA | DEA is a useful technique to identify inefficient units. Each inefficient bank can set its own benchmark input output variables and can accordingly improve their performance. |

3 Conceptual framework of Islamic bank efficiency

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The proposed conceptual framework for efficiency analysis of Islamic banks identifies three essential domains that must be followed. First domain is the research motivation i.e., the purpose of ascertaining the efficiency. Various motivations for Islamic bank efficiencies have been identified in research motivation box of Figure 17. Having decided research motivation second domain is the choice of input-output variables. The choice of inputs and outputs must coincide with research motivation. Various choices for inputs and outputs used by researchers around the globe have been mentioned in choice of input-output variables box of Figure 17. Third and final domain is structure and competency level of existing Islamic banking arrangements. Various choices in this regard have been mentioned in efficiencies in global regions box of Figure 17.

4 Analysis of results

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An account of various efficiency trends has been depicted in Figures 1 to 16. Figures 1 and 2 depict technical efficiency trends and comparison between Islamic and conventional banks all around the regions whereas technical efficiency of MENA region has received pronounced effects of financial crisis. The figures suggest that conventional banks of Asia have performed slightly better than others during the period of crisis. Figure 1 also reveals an interesting finding that Islamic banks of Asia pacific region have outperformed their conventional and Islamic counterparts in terms of improving their technical efficiencies as they are now the leading region. Figures 3 and 4 depict pure efficiency trends and comparison between Islamic and conventional banks. This analysis shows an interesting finding that Islamic banks received least effect of financial crisis. An important finding which complements our findings from the analysis of Figures 1 and 2 is the fact that Asia pacific region has shown significant progress in terms of pure technical efficiency.

Figure 1 Technical efficiency trend Islamic banking (see online version for colours)

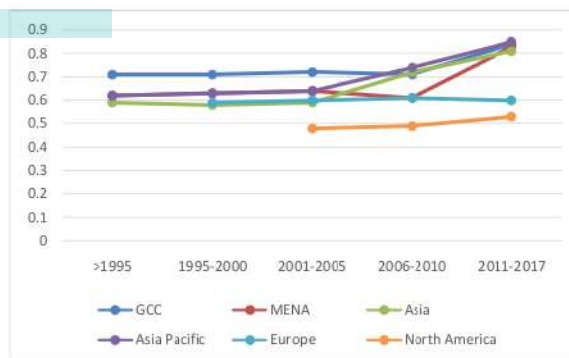


Figure 2 Technical efficiency trend conventional banking (see online version for colours)

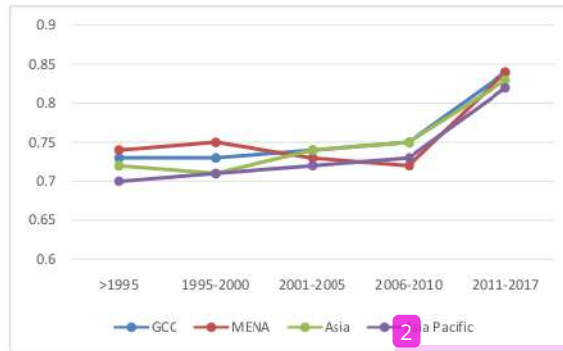


Figure 3 Pure technical efficiency trend Islamic banking (see online version for colours)

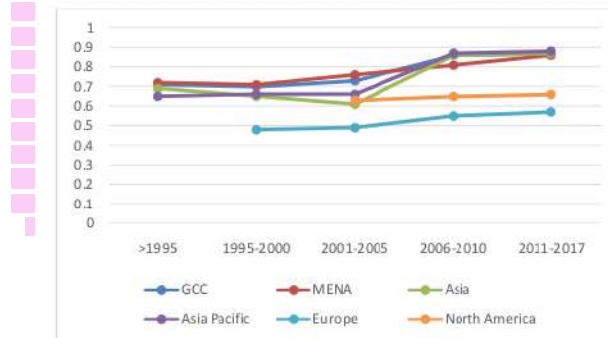


Figure 4 Pure technical efficiency conventional banking (see online version for colours)

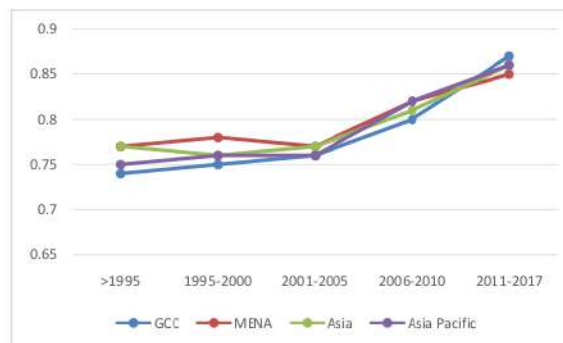


Figure 5 Allocative efficiency trend Islamic banking (see online version for colours)

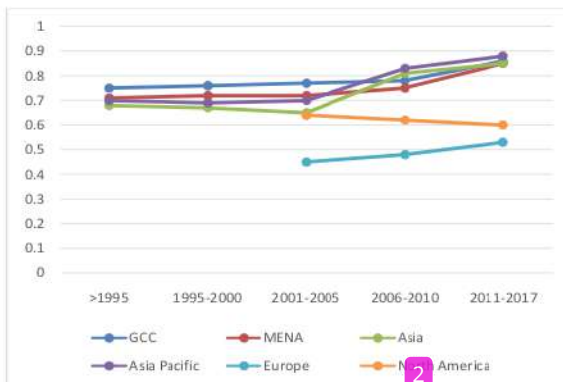


Figure 6 Allocative efficiency trend conventional banking (see online version for colours)

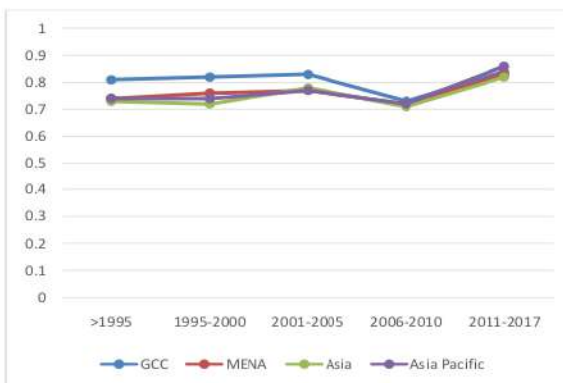


Figure 7 Scale efficiency trend Islamic banking (see online version for colours)

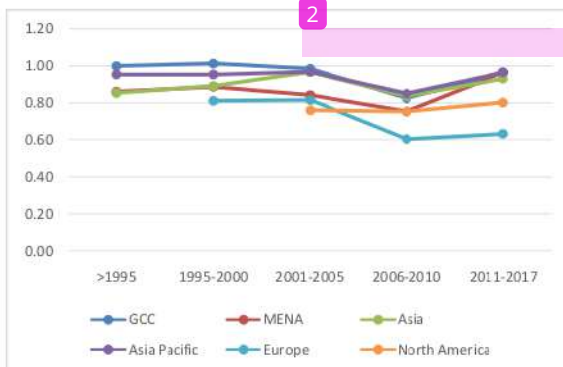


Figure 8 Scale efficiency trend conventional banking (see online version for colours)

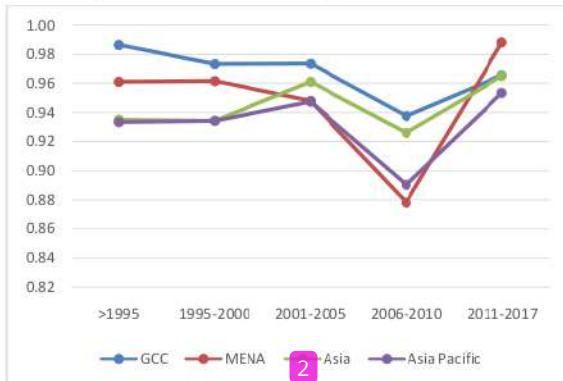


Figure 9 Cost efficiency trend Islamic banking (see online version for colours)

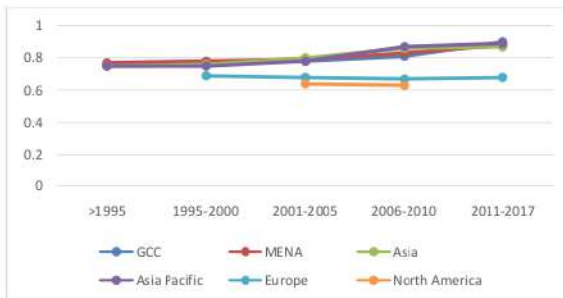


Figure 10 Cost efficiency trend conventional banking (see online version for colours)

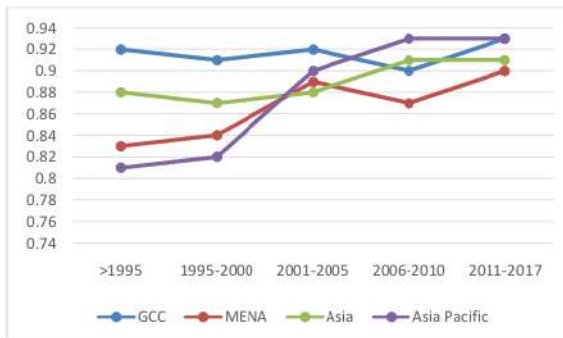


Figure 11 Revenue efficiency trend Islamic banking (see online version for colours)

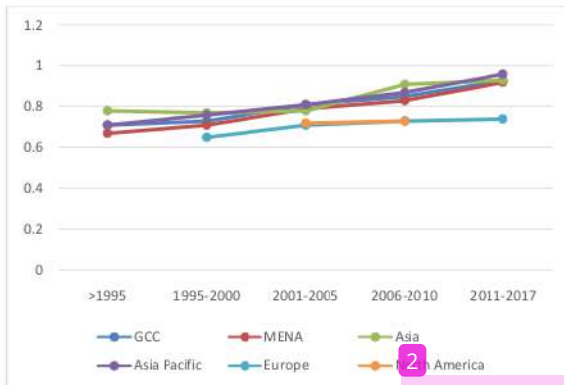


Figure 12 Revenue efficiency trend conventional banking (see online version for colours)

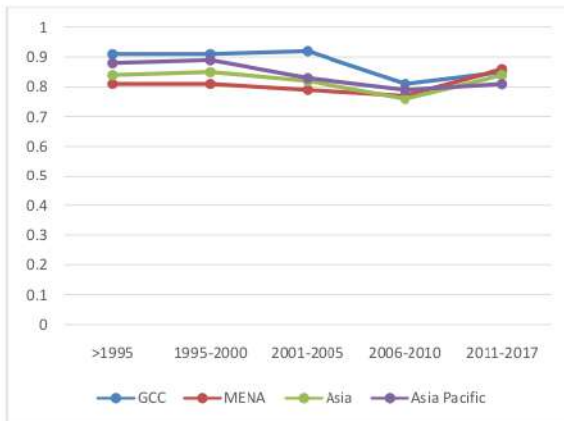


Figure 13 Profit efficiency trend Islamic banking (see online version for colours)

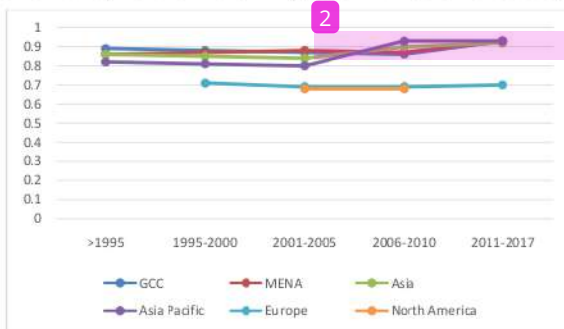


Figure 14 Profit efficiency trend conventional banking (see online version for colours)

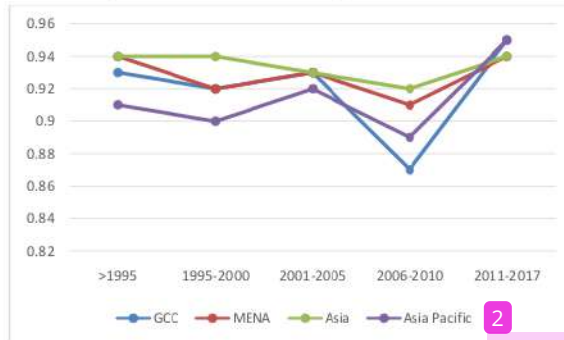


Figure 15 Revenue efficiency foreign and domestic Islamic banks (see online version for colours)

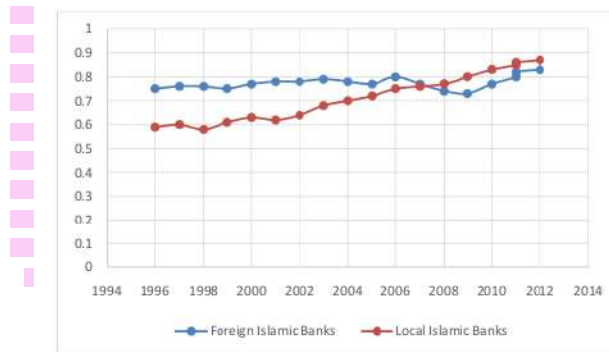


Figure 16 Revenue efficiency foreign and domestic Islamic banks (see online version for colours)

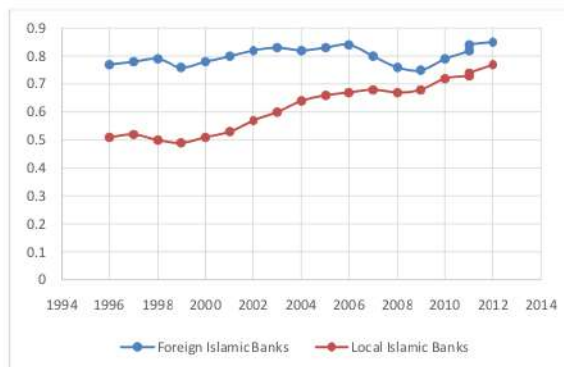
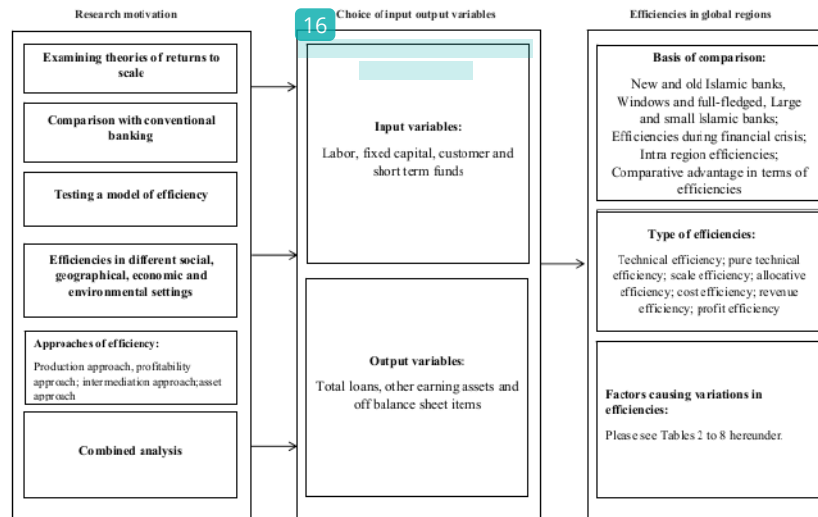


Figure 17 Conceptual framework of Islamic bank efficiency



Figures 5 and 6 depict allocative efficiency trends and comparisons between Islamic and conventional banks which has also received pronounced effects of financial crisis. Asia Pacific region here again depicts significant improvements in terms of allocative efficiency. Besides, these figures also reveal slow growth in the productivity of Islamic banks in Europe and American regions; hence these are the regions which need to be looked upon. Figures 7 and 8 reveal scale efficiency trends in Islamic and conventional banking. These figures depict the most pronounced effects of financial crisis on Islamic and conventional banks. These figures lead us to an interesting find that scale efficiency receives the most effect of financial crisis be it Islamic or conventional banks, therefore, this type of efficiency can also be used as a predictor of financial crisis. Having said that however, Islamic banks have performed better than their conventional counterparts in terms of scale efficiency as well, whereas scale efficiency behaviour of banks in GCC region, be it Islamic or conventional, was very much similar which shows the openness of GCC region towards western world.

Figures 9 and 10 depict cost efficiency trends and comparison between Islamic and conventional banks. This efficiency reveals more pronounced effects of financial crisis in GCC and MENA regions. These figures also depict Asia Pacific and Asian regions taking lead in terms of cost efficiency over the period of time. However, an interesting finding is the fact that Asia and Asia Pacific regions have shown improvement in cost efficiency in Islamic and conventional banking. Figures 11 and 12 reveal revenue efficiency trends and comparison between Islamic and conventional banking. An analysis of these figures reveal more pronounced effects of crisis on conventional banking as compared with Islamic banking. Here again, Asia Pacific region has shown more pronounced developments than all other regions. Figures 13 and 14 depict profit efficiency trends and comparison between Islamic and conventional banking. The effects of financial crisis in these figures are also more pronounced in the case of conventional banks. In terms of

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regions GCC has been the most affected and Asia being the least from crisis. An interesting finding in these figures is the fact that Islamic banks in Asia and Asia Pacific regions have shown improvement in profit efficiency even during the periods of crisis. Furthermore, profit efficiency across the regions in Islamic banks appears to converge towards a similar trend.

Though efficiency analysis of Islamic and conventional banks can be conducted from various perspectives for instance, new and old Islamic banks, windows and full-fledged, large and small Islamic banks, etc., however, due to lack of availability of diversified and in-depth literature we present a further analysis only from foreign and domestic Islamic banks in Figures 15 and 16. An analysis of Figures 15 and 16 shows that over the period of time domestic Islamic banks have able to improve their revenue efficiency above foreign Islamic banks but their cost efficiency has remained lower.

5 Conclusions

Research in Islamic banking using efficiency model started somewhere in the beginning of 21st century. Initial works are led by Hassan (2003) and Hussein (2003). According to Hassan and Aliyu (2018), the research in Islamic finance can be divided into two eras' i.e., before 1980s and after 1980s with after 1980s being the era of research where the researchers in Islamic banking started focusing on empirical work. Earlier studies in after 1980s era were mostly focused on bank efficiency analysis and its comparison with conventional banks. However, in recent studies, the scope of research has been extended to financial crisis, financial inclusion and working for social, economic, regulatory and Shariah factors that contribute to efficiencies.

A review of literature on Islamic banks can be made on several accounts such as Hassan and Aliyu (2018). However, we have made a more specific account of literature focusing input-output approach comparing it with conventional banking. An account of our findings has been given hereunder:

5.1 Returns to scale

An account of researches reveals that Islamic banks are not operating on optimum returns to scale. For instance, novice Islamic banks are operating on increasing returns to scale whereas old Islamic banks are operating on decreasing returns to scale. These bring problems of mergers and takeovers for novice banks and diseconomies of scale for larger commercial banks. Further window Islamic banks were close to optimum returns to scale as compared with full-fledged Islamic banks. Window Islamic banks when converted to full-fledged Islamic banks started to encounter similar returns to scale problems as other Islamic banks meaning thereby conventional banks supervision effects the operations of Islamic banks.

5.2 Choice of variables

Various studies have utilised different sets of variables for efficiencies. This appears logical because Islamic models followed in various parts of the world are not the same. Further, it has also been discovered that while calculating various efficiencies, change of variable(s) do not bring change in efficiency score more than an absolute value of '0.2',

i.e., even if in order to make comparisons, we change underperforming financial variables with better performing financial variables the efficiency scores will not improve more than an absolute value of '0.2' and vice versa. Therefore, in order to compare the results of Islamic banks across the boundaries an adjustment of 0.2 may be applied keeping in view the results and change in the nature of variables.

Over the period of time it has been established that the most effective input variables are labour, fixed capital and customer & short term funds; while total loans, other earning assets and off balance sheet items are effective outputs. Lastly, various regression models have been applied for determining factors that contribute to various efficiencies however, TOBIT regression analysis has been recommended as the most effective.

5.3 Application of law of variable proportions:

An analysis of efficiency trends under the ambit of laws of returns leads us to the conclusion that on overall basis, excluding the effects of financial crisis 2008, Islamic banking is in the first stage of law of variable proportion i.e., increasing returns to scale where Asia pacific region has taken the lead. This shows the novice status of Islamic banking which requires thorough supervision and support anywhere in the world. In order to reap the benefits of scale with expansion in Islamic banks, continuous protections from various factors are required. The factors include increasing operational costs, Shariah compliance cost, competition from conventional banks, protection from foreign banks, economic shocks and delays in learning curve due to inability of appropriate human resources.

5.4 Factors to efficiency

Tables 1 to 7 present detailed descriptions of factors that contribute to various efficiencies over the period of last 20 years grouped into periods of five years. An analysis of tables reveals that with the growth of Islamic banks the factors that affect various efficiencies have been increased. The factors that affect technical, pure technical, scale and allocative efficiencies are profitability, regulatory support, size, solely Islamic system, technology, Shariah board and board of directors. With respect to cost efficiency it has been observed that Shariah compliance cost has a critical role which deters Islamic banks to compete. Besides it has also been observed that over the period of time sole existence of Islamic system has been reversed. In the early years of Islamic banking, countries which had sole Islamic systems such as Iran and Sudan showed better efficiency than the countries with mixed systems. However, with the expansion of Islamic banking dual system of Islamic and conventional banking provided better resilience and stability. Also, the countries where Islamic banks competed with conventional banking, Islamic banks showed better results than the countries where Islamic banks had no conventional competitors. Lately, it has also been observed that banks with more Shariah compliant products tend to show better revenue efficiency than even their Islamic competitors. Furthermore, lack of product diversification also reduces allocative efficiency and eventually increases risks which also had negative relationship with various bank efficiencies. In terms of foreign and domestic banks, it has been observed that foreign banks are able to improve their cost efficiencies by introducing sophisticated technology but they suffer to compete in terms of revenue efficiency

because it requires competition in local markets where local banks hold better market share.

Table 2 Technical efficiency

| <i>Period</i> | <i>Factors</i> |
|---------------|--|
| > 1995 | Profitability, regulatory support, size, solely Islamic system |
| 1995–2000 | Profitability, regulatory support, size, solely Islamic system |
| 2001–2005 | Profit, size, competitive Islamic and conventional system, NPL, low market share, GDP, Sharia rules |
| 2006–2010 | Bank size has negative and profitability have no relationship with efficiency, technical efficiency is related with operating expenses, asset size, equity, non-performing loans, average fixed costs and GDP, risk management efficiency affects technical efficiency, credit and operational risk have negative affect on efficiency |
| 2011–2017 | Bank size and profits have negative relationship with efficiencies. BOD and Shariah board have significant impact on improving efficiencies. Higher appetite for risks contribute to technical and scale efficiencies. Latest technology improves cost, technical and scale efficiencies. |

Table 3 Pure technical efficiency

| <i>Period</i> | <i>Factors</i> |
|---------------|--|
| > 1995 | Profitability, regulatory support, size of the bank, new tech, solely Islamic system |
| 1995–2000 | Profitability, regulatory support, size, new tech, solely Islamic system |
| 2001–2005 | Profitability, size, competitive Islamic and conventional banking system, NPL, low market share, GDP, Shariah rules |
| 2006–2010 | Bank size has negative impact and profitability have no relationship with efficiency, managerial efficiency and technological advancement are factors to scale efficiency, credit and operational risk have negative affect on efficiency. |
| 2011–2017 | Bank size and profits have negative relationship with efficiencies. BOD and Sharia board have significant impact on improving efficiencies. Higher appetite for risks contribute to technical and scale efficiencies. Latest technology improves cost, technical and scale efficiencies. |

Table 4 Allocative efficiency

| <i>Period</i> | <i>Factors</i> |
|---------------|---|
| > 1995 | Profitability, regulatory support, size, new tech, solely Islamic system |
| 1995–2000 | Profitability, regulatory support, size, new tech, solely Islamic system |
| 2001–2005 | Profit, size, competitive ISLAMIC and conventional system, NPL, low share, GDP, Sharia rules |
| 2006–2010 | Bank size has negative impact and profitability have no relationship with efficiency, credit and operational risk have negative affect on efficiency. |
| 2011–2017 | Bank size and profits have negative relationship with efficiencies. BOD and Shariah board have significant impact on improving efficiencies. Higher appetite for risks contribute to technical and scale efficiencies. Latest technology improves cost, technical and scale efficiencies. |

Table 5 Scale efficiency

| <i>Period</i> | <i>Factors</i> |
|---------------|---|
| > 1995 | Profitability, regulatory support, size, new technology, solely Islamic system |
| 1995–2000 | Profitability, regulatory support, size, new tech, solely Islamic system |
| 2001–2005 | Profit, size, competitive Islamic and conventional system, NPL, low market share, GDP, Shariah rules |
| 2006–2010 | Bank size has negative impact and profitability have no relationship with efficiency, technological advancement are factors to scale efficiency. |
| 2011–2017 | Bank size and profits have negative relationship with efficiencies. BOD and Shariah board have significant impact on improving efficiencies. Higher appetite for risks contribute to technical and scale efficiencies. Latest technology improves cost, technical and scale efficiencies. |

Table 6 Cost efficiency

| <i>Period</i> | <i>Factors</i> |
|---------------|--|
| > 1995 | Joint ownership, Shariah compliance, staff expenses +ve, profit, regulatory support, solely Islamic system |
| 1995–2000 | Joint ownership, Shariah compliance, staff expenses +ve, profit, regulatory support, solely Islamic system |
| 2001–2005 | Profit, size, competitive Islam and conventional system, capital to asset ratio, loan to asset ratio, population density, NPL, low Mshare, GDP, Shariah rules, previous capital -ve, |
| 2006–2010 | Profitability, market share +ve, Shariah comp –ve. cost efficiency of banks in countries with Islamic legislation is better, credit and operational risk have negative affect on efficiency. |
| 2011–2017 | Bank size and profits have negative relationship with efficiencies. BOD and S. board have significant impact on improving efficiencies. Higher appetite for risks contribute to technical and scale efficiencies. Latest technology improves cost, technical and scale efficiencies. |

Table 7 Revenue efficiency

| <i>Period</i> | <i>Factors</i> |
|---------------|--|
| > 1995 | Joint ownership, Shariah comp, staff expensive +ve, profitability, regulatory support, solely Islamic system |
| 1995–2000 | Joint ownership, Shariah comp, staff expenses +ve, profitability, regulatory support, solely Islamic system |
| 2001–2005 | Profit, size, competitive Islam and conventional system, NPL, low market share, GDP, Shariah rules |
| 2006–2010 | Profitability and market share have positive effects on efficiency, credit and operational risk have negative affect on efficiency. |
| 2011–2017 | Bank size and profits have negative relationship with efficiencies. BOD and Shariah board have significant impact on improving efficiencies. Higher appetite for risks contribute to technical and scale efficiencies. Competitive system of banking increase efficiencies of the bank. Product development, product diversification improves revenue and profit efficiency. |

Table 8 Profit efficiency

| <i>Period</i> | <i>Factors</i> |
|---------------|--|
| > 1995 | Joint ownership, Shariah compliance, staff expenses +ve, regulatory support, solely Islamic system |
| 1995–2000 | Joint ownership, Shariah compliance, staff expenses +ve, regulatory support, solely Islamic system |
| 2001–2005 | Profit, size, competitive Islamic and conventional system, NPL, low Mshare, GDP, Shariah rules |
| 2006–2010 | Profitability and market share have positive effects on efficiency, credit and operational risk have negative affect on efficiency. Revenue Efficiencies effect profit efficiencies in Islamic banks only. |
| 2011–2017 | Bank size and profits have negative relationship with efficiencies. BOD and Shariah board have significant impact on improving efficiencies. Higher appetite for risks contribute to technical and scale efficiencies. Competitive system of banking increase efficiencies of the bank. Product development, product diversification improves revenue and profit efficiency. |

6 Limitation, implications and future research directions of the research study

Content and bibliometric analysis suffers from its own limitations (Apriliyanti and Alon, 2017). For instance, researches are available only from a particular source. To address this issue we have included papers from ISI database, Scopus and Google Scholar. Though Islamic banks have cost inefficiencies due to Shariah compliance, they have better managerial capacities as depicted by technical efficiencies and pure technical efficiencies. This is the indication of long term capabilities. It further requires that Islamic banks should continue evolving their capabilities regarding risk management, technological advancements, compliance and operational costs. There is a need to improve financial practices and modalities in order to address advanced requirements of the competitive financial world. Most of the Islamic banks and even researchers are focusing using conventional risk management mechanisms measures in Islamic settings. The results of our study show that there is a need to develop risk management models for Islamic banks keeping in view their domestic requirements. An important future research direction stemming from literature is based on the fact that Islamic banks started to receive effect of financial crisis after two years (Hassan and Aliyu, 2018). Rigorous studies are required to be conducted in this area that why Islamic banks were dragged into recession when all the economies were into recovery phase. This shows the lagged nature of Islamic banking system which needs to be worked on from academic, professional, policy making and research point of view!

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