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Price Efficiency of Islamic and Conventional Banks: Evidence from Panel Data

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ABSTRACT

Literature on the price efficiency of Islamic and conventional banks have focused mostly on cost efficiency while attention on profit and revenue efficiency has been lukewarm. This study examines how Islamic and conventional banks differ in terms of cost, profit and revenue efficiency. Using a sample of 18 countries with 70 Islamic and 374 conventional banks spanning from year 2009 to 2017 across the Middle East, South Asia and Southeast Asia regions, the empirical results derived from using the least squares dummy variable indicate that there is no significant difference between both types of banks. Further robustness checks utilizing random effects model also reveal similar findings. Among the sample countries, Islamic and conventional banks from Singapore, Malaysia and Qatar were found to be relatively higher in average profit efficiency compared to banks from other sampled countries, while Islamic and conventional banks from Indonesia, Iraq and Jordan were found to be relatively inefficient in generating profit. This study also found that banks from some countries did relatively better in terms of revenue efficiency compared to cost efficiency and vice versa. This indicates there is a need to look not just into the topic of costs but also how well banks fare in generating revenue.

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INTRODUCTION

Earlier literature on the efficiency of banks focused on examining cost efficiency but little effort has been made to understand profit and revenue efficiency. As it is important for banks to minimize cost, a deeper understanding on the cost efficiency of banks in terms of profit and revenue efficiency must not be forgotten as minimizing cost is just one mechanism to improve overall profitability of banks. In layman terms, maximum profitability is derived from the ability of banks to maximize revenue and minimize cost. For example, if Firm A is able to minimize cost from $50 to $40 while revenue remains unchanged, the profit of Firm A will increases by $10. However, if Firm A can improve revenue from $100 to $110 while cost remains unchanged, the profit of Firm A will also increases by $10. Hence, this demonstrates that minimizing cost is just a part of the puzzle to improve profitability of banks, and that profit and revenue efficiency must not be overlooked. This is consistent with arguments from Silva, Guerra, Tabak and Miranda (2016) that the contribution of revenue to overall efficiency of banks must not be overlooked.

A deeper understanding on profit efficiency is important for both Islamic and conventional banks as the main objective of both banks is to maximize profit (Hassan and Aliyu, 2018). Due to the importance of profit, cost, and revenue efficiency and the lack of literature that sought to examine them, this study fills the gap by examining profit, cost, and revenue efficiency of Islamic and conventional banks using updated data. This follows the efforts of Kamarudin, Bany, Junaina and Mohamad (2014) that examined all three efficiency using Data Envelopment Analysis (DEA) from Gulf Cooperative Council (GCC) countries from year 2007 to 2011. This study examines all three efficiency using data from post-Global Financial Crisis (GFC) from year 2009 to 2017. Post-GFC, financial institutions across the world have set up new regulations such as liquidity coverage ratio and net stable funding ratios (DeYoung et al., 2018). As banking is a highly regulated industry, these new regulations can change the daily operation of banks which in turn influence the efficiency of bank differently compared to pre-GFC.

This study utilizes data from 70 Islamic and 374 Conventional banks from countries with dual-banking systems in the Middle East, South Asia and Southeast Asian regions. DEA is used to generate efficiency scores of banks. Further, to examine whether efficiency of both types of banks are significantly different from one another, this study utilises the Least Square Dummy Variable (LSDV) and Random Effect Model (REM) instead of T-test, Mann-Whitney, Kruskall-Wallis tests used in previous studies. LSDV allows control of country-specific heterogeneity which cannot be accomplished by more traditional methods such as T-test, Mann-Whitney, and Kruskall-Wallis. As LSDV and REM allow control on heterogeneity of country-specific effects, samples from multiple countries can be utilised instead of focusing on one particular country. Present literature and theories have not arrived at any conclusion on whether Islamic banks' performance will be better or worse than their their conventional counterpartss. Batir et al. (2017) found Islamic banks to have a higher efficiency score than their their conventional counterpartss while Kamarudin et al. (2014), Beck Kunt and Merrouche (2013) and Majid et al. (2017) found conventional banks to be more efficient than Islamic banks. Beck et al. (2013) acknowledged that Islamic banks have the advantage over their their conventional counterpartss in reducing agency problems with their client with the use of equity-like products but Islamic banks also suffer from being more complex and relatively inexperienced compared to their their conventional counterpartss. This study seeks to contribute to present literature by providing a discussion on and examining dimensions that have been lacking such as profit and revenue efficiency and the use of LSDV to look into the significant different in performance of Islamic and conventional banks.

LITERATURE REVIEW

Islamic bank and conventional banks share a common goal, which is to maximise profitability (Hassan and Aliyu, 2018). However, although both share a common goal, Islamic financial institutions operate and provide different financial products to their clients. Hassan et al. (2019) mentioned that Shariah compliant firms have to comply to qualitative and quantitative screening by Shariah board. Besides, part of Islamic banks' financial products are equity-like products such as *Mudaraba* and *Musharakah* (Beck et al., 2013; Ajmi et al., 2020). However, not all Islamic financial products are equity-like, and a lot of Islamic financial products resemble

those of their conventional counterparts. Regardless, the presence of equity-like or commonly known as Profit and Loss Sharing (PLS) products in Islamic banks sets Islamic banks apart from conventional banks.

Due to the presence of PLS in Islamic banks, agency problems faced by Islamic banks may be lower than their conventional counterparts. For example, under *Mudaraba*, Islamic banks are not loaning an amount and charging clients at predetermined rate. Instead, Islamic banks come to a partnership agreement with their clients where profit from the client's activities will be shared with the Islamic bank at an agreed rate. Unlike normal conventional loans, *Mudaraba* allows Islamic banks to participate in the investment decisions of their clients. This allows Islamic bank to have more control over their clients which lowers agency problems between them and this potentially reduces the chances of client default by intervening in client investment decisions (Beck et al., 2013). This can ultimately reduce costs related to loan loss, and therefore, increase overall efficiency of bank. However, Beck et al. (2013) did point out that Islamic banks can suffer from relatively high complexity in managing such products as well as a relative lack of experience compared to their conventional counterparts which potentially make Islamic banks less efficient than their conventional counterparts.

Along with several earlier theories, empirical studies from various paper have shown inconclusive results on whether Islamic banks are more efficient than their conventional counterparts or vice versa. Bitaret al. (2017) study on the profitability of Islamic and conventional banks covering 124 countries between year 2006 to 2012 found that Islamic banks are likely to be more capitalized, more liquid and profitable than their conventional counterparts. Bader et al. (2008) study on cost, revenue and profit efficiency of Islamic and conventional banks in 21 countries from year 1990 to 2005 found that the efficiency of Islamic banks are not statistically different compared to their conventional counterparts.

Alqahtani et al. (2017) studied cost and profit efficiency of Islamic and conventional banks in Gulf Cooperation Council (GCC) countries from year 1999 to 2012 found cost efficiency to have no significant difference while profit efficiency of Islamic bank was found to be significantly lower than conventional banks. Kamarudin et al. (2014) study on all three efficiencies in GCC countries from year 2007 to 2011 found that conventional banks have better efficiency in all three measures. Majid et al. (2017) study on cost efficiency of Islamic and conventional banks in Malaysia from year 1996 to 2010 found that Islamic banks have higher cost efficiency. Miah and Uddin (2017) studied cost efficiency and stability of Islamic and conventional banks in GCC during 2005 to 2014 found that Islamic banks have significantly lower cost efficiency than conventional banks, but Islamic banks have more stability than conventional banks. Overall, results from the cited literature have been mixed and inconclusive.

DATA AND METHODOLOGY

Data Collection

Bank data from 18 countries in the Middle East, South Asia and Southeast Asia covering year 2009 to 2017 is collected from Fitch Solutions. All financial data collected is denominated in U.S. Dollar (USD). Only countries with dual-banking systems are used. Sampled countries include Malaysia, Singapore, Brunei, Indonesia, Pakistan, Bangladesh, Maldives, Egypt, Jordan, Lebanon, Saudi Arabia, Bahrain, United Arab Emirates (UAE), Kuwait, Iraq, Iran, Oman and Qatar. Data for macroeconomic variables used as controlled variables such as Growth Domestic Product (GDP) and inflation is collected from the World Bank. Ownership of banks which also acts as a controlled variable is determined sourced from Fitch Solutions. To be sure of the ownership of banks, other sources of information such as the websites of various central banks and Bloomberg is also used.

METHODOLOGY

To obtain the efficiency score of Islamic and conventional banks, DEA method is used. It has been used in empirical studies such as Batir et al. (2017), Kamarudin et al. (2014), Bader et al. (2008), Sufian et al. (2012) and Hassan and Aliyu (2018). According to Hassan and Aliyu (2018), most empirical studies on efficiency published in year 2004 to 2016 used DEA. Similar to literature such as that of Sufian et al. (2012), Kamarudin et al. (2014) and Majid et al. (2017) that used both Islamic and conventional banks as sample, the intermediation approach is adopted.

As banks can have multiple inputs and outputs to generate income, the calculation of efficiency score using DEA also incorporate multiple inputs and outputs as variables. The following equation shows the measurement of efficiency using multiple inputs and outputs:

$$\text{Efficiency} = \frac{Weighted\ sum\ of\ Outputs}{Weighted\ sum\ of\ Inputs} \quad (1)$$

This study follows Kamarudin et al. (2014) in the used of DEA frontier and formulas of revenue, cost, and profit efficiency developed by Zhu (2009). Each bank efficiency is measured relative to the best performing banks in the sample. These efficiency scores will be ranging between 0 and 1 where 1 the most efficient while 0 is least efficient. Variable Returns to Scale (VRS) assumptions created by Banker et al. (1984) are preferred over the classic Constant Return to Scale (CRS) assumptions because VRS can accommodate economies and diseconomies of scale while CRS assumes banks are constantly operating at optimal scale (Kamarudin et al., 2014). Accordingly, the variables used are presented in Table 1. The output of banks consists of loans and investments whilst the input of banks consists of deposit, labour, and physical capital. Output prices consist of price of loans, and price of investment, while input prices consist of price of deposits, price of labour and price and physical capital. However, there are certain differences between Islamic and conventional banks that much be addressed. In Islamic banks, '*Loans are identified as financial activities, interest incomes as financing revenue, and interest expenses as financing expenses'* (Kamarudin et al., 2014).

Table 1A in the appendix presents the summary statistic of these variables. In order to test the significant differences between Islamic and conventional banks' efficiency, the efficiency score generated from DEA frontier is used and regressed using the LSDV model. LSDV is a fixed effect method that unlike the conventional fixed effect method allows the inclusion of variables that persist over time such as country-specific and ownership variables. LSDV is preferred over the use of average, T-test, Mann-Whitney, and Kruskall-Wallis used in previous studies such as Kamarudin et al. (2014) because it allows better control over country-specific, bank-specific, time-specific and macroeconomic variables that T-test, Mann-Whitney, and Kruskall-Wallis cannot. As a robustness check for empirical results from LSDV, random effect model is used similar to the one used by Ariefianto et al. (2020) which employed both fixed and random effect models on intermediation cost of banks. Referring to Majid and Saal (2010), efficiency of Islamic and conventional bank can vary drastically between countries, hence, controlling such heterogeneity can provide a better examination on whether Islamic banks' efficiency are significantly different from their conventional counterparts. Random effect model allows the presence of unobserved heterogeneity and similar to fixed effect, random effect model '*assume each unit have their own intercept*' (Law, 2018).

Table 1 Variables for Efficiency Scores

Variable	**Variable Name**	**Proxy**
Outputs	Loans	Net loans
	Investments	Total securities
Inputs	Deposit	Total deposits
	Labour	Personnel expenses
	Physical Capital	Fixed assets
Output Prices	Price of Loans	Interest income/loans
	Price of Investment	Other operating income/securities
Input Prices	Price of Deposits	Total interest expenses/deposits
	Price of Labour	Personnel expenses/total assets
	Price of Physical Capital	Other operating expenses/fixed assets

Control variables used in this stage of the study includes country-specific, ownership, bank-specific, and macroeconomic variables. 18 countries' dummy variables are created to represent the market the bank is operating in. As Sufian et al. (2012) pointed out that heterogeneity of bank ownership can influence the performance of banks, state-owned, domestic, and foreign banks dummy variables are created. To avoid perfect multicollinearity, one variable from country-specific and ownership dummy variables are each removed from the examination. Bank-specific variables used as control variables consist of bank size, loan, capital adequacy, management quality, and loan quality. Controlled macroeconomic variables consist of economic growth and inflation. Table 2 shows proxies used as controlled bank-specific and macroeconomic variables.

Table 2 Proxies for Controlled Bank-Specific and Macroeconomic Variables

Variables	Description
Bank-Specific	
Bank Size	Logarithm of Total Asset (LnTA)
Loan	Total Loans/Total Asset (TL/TA)
Capital Adequacy	Total Equity/Total Asset (TE/TA)
Loan Quality	Non-Performing Loan/Total Loan (NPL/TL)
Management Quality	Non-Interest Expense/Total Asset (NIE/TA)
Macroeconomic	
Economic Growth	Change in Gross Domestic Product (ΔGDP)
Inflation	Change in Consumer Price Index (ΔCPI)

The following represents the formula used to determine the significant differences in the efficiency of Islamic and Conventional banks:

$$y_{it} = \alpha + \beta_1(Bank\ Type_i) + \beta_2(Country_i) + \beta_3(Ownership_i) + \beta_4(Bank_{it}) + \beta_5(Macroeconomic_{it}) + \beta_6(Time_t) + u_{it} \quad (2)$$

where *y* represents bank efficiency, *Bank Type* represents bank type (Islamic and conventional banks) dummy, *Country* represents country-specific dummy, *Ownership* represents ownership (state-owned, domestic and foreign banks), *Bank* represents bank-specific variables, *Macroeconomic* represents macroeconomic variables, *Time* represents time-specific variables, *u* represents unobserved independent variables and error term, *i* represents individual bank, and *t* represents time.

RESULT AND DISCUSSION

Table 3 shows the descriptive statistic of efficiency score generated from the use of DEA frontier developed by Zhu (2009). Table 3 shows that on average, the profit, cost, and revenue efficiency of Islamic banks is higher than conventional banks. Besides, both Islamic and conventional banks have better revenue efficiency score compared to cost efficiency score. This indicates that both banks do relatively well in selling their outputs while they do relatively poor in controlling inputs to generate same collection of outputs. However, average efficiency score shown in Table 3 indicates profit, cost, and revenue are relatively inefficient as the average score is below the mid-score of 0.5. Therefore, both banks should not just aim to minimize cost, but also improve in generating revenue and ultimately, profit.

Table 3 Descriptive Statistic of Efficiency Score

Islamic Bank	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
Profit Efficiency	451	0.4170	0.3539	0.0005	1.0000
Cost Efficiency	451	0.4292	0.3006	0.0163	1.0000
Revenue Efficiency	451	0.4671	0.3186	0.0005	1.0000
Conventional Bank					
Profit Efficiency	2584	0.3617	0.3617	0.0000	1.0000
Cost Efficiency	2584	0.4215	0.2482	0.0000	1.0000
Revenue Efficiency	2584	0.4296	0.2540	0.0001	1.0000

Table 4 shows the descriptive statistic of efficiency score based on country and bank type. Descriptive statistic in Table 4 shows the efficiency score can vary across different countries. While Islamic and conventional banks in Singapore achieve high profit, cost, and revenue efficiency, Islamic and conventional banks from countries such as Indonesia, Bangladesh, Iran, Iraq, and Jordan have relatively poor efficiency. These varied results further indicate the need to control heterogeneity of country-specific effects in understanding the significant differences in Islamic and conventional bank's efficiency score. Islamic banks from sampled countries such as Egypt, Indonesia, Iran, Iraq, Jordan, Kuwait and Oman and conventional banks from sampled countries such as Maldives, Pakistan, Bahrain, Egypt, and Lebanon's revenue efficiency are lower than cost efficiency, and this indicates the inefficiency of banks from such countries are resulting from their revenue stream instead of cost management.

Table 4 Descriptive Statistic of Efficiency Score Based on Country

	Islamic Banks' Mean			Conventional Banks' Mean		
	Profit Efficiency	Cost Efficiency	Revenue Efficiency	Profit Efficiency	Cost Efficiency	Revenue Efficiency
Brunei	0.2009	0.0874	0.2419	0.1205	0.1318	0.1615
Indonesia	0.1618	0.2662	0.2395	0.2779	0.3686	0.3735
Malaysia	0.6371	0.6723	0.7277	0.5120	0.5674	0.5306
Singapore	0.9899	0.9959	0.9810	0.7329	0.7227	0.7557
Bangladesh	0.1330	0.2533	0.2638	0.2033	0.3010	0.3388
Maldives	0.3871	0.3671	0.4176	0.1407	0.2011	0.1691
Pakistan	0.3375	0.2708	0.4310	0.3123	0.4254	0.3796
Bahrain	0.5048	0.4449	0.5360	0.4935	0.4951	0.4739
Egypt	0.8932	0.8530	0.2695	0.3582	0.4274	0.4048
Iran	0.1449	0.4936	0.4381	0.1611	0.3779	0.3689
Iraq	0.1342	0.1195	0.1383	0.2770	0.2093	0.2271
Jordan	0.1467	0.1997	0.0519	0.2837	0.2809	0.3862
Kuwait	0.3286	0.3745	0.3320	0.5137	0.5118	0.5877
Lebanon	0.1851	0.1765	0.2221	0.2948	0.3912	0.3524
Oman	0.2643	0.3496	0.3133	0.3232	0.3890	0.4214
Qatar	0.7159	0.6592	0.7075	0.6641	0.6198	0.6974
Saudi Arabia	0.4570	0.2270	0.5042	0.7763	0.6247	0.7557
UAE	0.3775	0.4495	0.4607	0.5336	0.5453	0.5642

Table 5 shows the results of panel regression to determine whether Islamic banks' efficiency are significant compared to their conventional counterparts. The results in Table 5 show that profit, cost, and revenue efficiency of Islamic and conventional bank are not significantly different. However, conventional banks' dummy variable shows negative coefficient when regressed with efficiency, indicating that while conventional banks have weaker efficiency than Islamic banks, it is not significant. This is consistent with the results of Alqahtani et al. (2017) which found Islamic banks in Turkey to have insignificant difference in cost efficiency compared to their conventional counterparts. Besides, this result is also consistent with the findings of Beck et al. (2013) that Islamic and conventional banks are quite similar to each other despite theories suggesting that Islamic banks' business model are highly differentiated from their conventional counterparts. This result also indicates that although Islamic bank may have differences in terms of agency problem, complexity, and experience, these differences are insufficient to significantly make Islamic banks' efficiency to be different from conventional banks.

F-statistic are used to measure the joint effect of country-specific variables. F-statistic on Table 4 indicates the presence of country-specific effect is significant to profit, cost, and revenue efficiency. While F-statistic shows joint effect to be significant, results on individual country effects varied. Indonesia, Maldives, Pakistan, Egypt, Kuwait, Oman and UAE show no significant country-specific effect. Brunei, Iran and Jordan show significant negative effect while Malaysia, Singapore, Qatar and Saudi Arabia show significant positive effect on profit efficiency of banks. Bangladesh, Iran and Iraq show significant negative effect while Lebanon and Saudi Arabia show significant positive effect on cost efficiency of banks. Brunei, Iran and Iraq show significant negative effect while Malaysia, Singapore, Qatar and Saudi Arabia show significant positive effect on revenue efficiency of banks. Overall, Singapore's banks were found to be the best performer amongst sampled countries as they are shown to have the highest positive coefficient on profit efficiency and highest average efficiency of both types of banks in Table 4. These results in respect of Singaporean banks is unsurprising as Singapore is a developed country that also serves as one of the largest financial centres in the world (Long Finance, 2020). Besides, developed countries have many advantages over other less-developed countries due to the greater availability of an educated labour force and having developed better management technology (Pelletier, 2018).

State-owned bank dummy variable only shows to have significant negative influence on revenue efficiency, while foreign bank dummy variable shows insignificant influence on all efficiency. Bank size and management quality variables are shown to have significant positive influence on all efficiency of banks. Loan intensity variable shows to only have significant negative influence on profit efficiency of banks. Capital adequacy and loan quality variables show to have insignificant influence on all efficiency. Economic growth variable show to have significant negative influence on cost efficiency while inflation variable shows no significant influence on all efficiency. Time effect is also found to be significant to all efficiency. As a robustness test, random effect model is used as it can accommodate unobserved heterogeneity. The results of the robustness test is present in table 2A. Table 2A shows consistent results where Islamic and conventional banks' efficiency were found to be insignificantly different and that of conventional bank dummy variable

shows negative coefficient to all efficiency. In conclusion, price efficiency of both types of banks during the period of 2009 to 2017 was found to be insignificantly different. The use of LSDV and REM is ideal as F-statistic has shown that country-specific heterogeneity is present in the data. Regardless of the insignificant differences, it shows that despite modern Islamic banks lacking in terms of experience and potentially being more complex, modern Islamic banks are able to achieve a similar degree of efficiency to that of their conventional counterparts which have been established for decades.

Table 5 Regression using LSDV

Dependent Variable	Profit Efficiency		Cost Efficiency		Revenue Efficiency	
	Coefficient	Robust Standard Error	Coefficient	Robust Standard Error	Coefficient	Robust Standard Error
Conventional Banks	-0.0621	0.0384	-0.0206	0.0603	-0.0422	0.0317
Controlled Country Intercept						
Brunei	-0.2210**	0.0568	0.0269	0.0699	-0.2070**	0.0392
Indonesia	-0.0039	0.0662	-0.1120	0.0645	0.0379	0.0467
Malaysia	0.1340*	0.0665	0.0200	0.1270	0.1450**	0.0495
Singapore	0.2170**	0.0732	0.0064	0.0708	0.2010**	0.0595
Bangladesh	-0.0815	0.0628	-0.324**	0.0655	0.0124	0.0440
Maldives	0.0027	0.1330	-0.0623	0.0650	0.0405	0.1360
Pakistan	-0.0027	0.0651	0.1020	0.0784	0.0463	0.0477
Egypt	-0.0163	0.0690	0.0468	0.0630	-0.0311	0.0452
Iran	-0.2830**	0.0728	-0.1950*	0.0776	-0.1320*	0.0590
Iraq	-0.2250	0.1150	-0.1550**	0.0582	-0.1950*	0.0805
Jordan	-0.1160*	0.0577	-0.0330	0.0835	-0.0690	0.0466
Kuwait	0.0189	0.0845	-0.0285	0.0644	0.0312	0.0676
Lebanon	-0.0911	0.0610	0.1700**	0.0617	-0.0496	0.0460
Oman	-0.0780	0.0636	0.0633	0.0646	-0.0502	0.0480
Qatar	0.1770*	0.0767	-0.0617	0.0703	0.1610**	0.0492
Saudi Arabia	0.1540*	0.0725	0.1750*	0.0700	0.0975*	0.0511
UAE	0.0218	0.0742	-0.0311	0.0330	0.0230	0.0500
Controlled Bank-specific Intercept						
State-Owned Bank	-0.0402	0.0307	-0.0410	0.0292	-0.0650**	0.0191
Foreign Bank	-0.0192	0.0213	-0.0381	0.0214	0.0024	0.0164
LnTA	0.0734**	0.0069	0.0725**	0.0069	0.0733**	0.0054
TL/TA	-0.1810**	0.0867	-0.0738	0.0782	-0.0299	0.0696
TE/TA	0.0593	0.0895	-0.0144	0.1050	0.0856	0.0728
NIE/TA	0.8410**	0.1280	0.5790**	0.1270	0.5830**	0.1020
NPL/TL	-1.5190	0.8410	-0.9390	0.7530	-0.7690	0.7210
Controlled Macroeconomic Intercept						
ΔGDP	0.0014	0.0021	-0.0036*	0.0014	-0.0026	0.0015
ΔCPI	-0.0001	0.0015	-0.0007	0.0012	0.0003	0.0010
Constant	-0.1110	0.0964	-0.0348	0.0988	-0.0789	0.0775
Time Effect	YES		YES		YES	
F-Statistic	12.3600**		11.8400**		16.6700**	
Multicollinearity (Mean VIF)	1.3100		1.3100		1.3100	
Observations	3,006		3,006		3,006	
R-squared	0.4050		0.3850		0.3990	

*Notes: * and ** denote significant at 5% and 1%. Robust standard error is used due to present of heteroscedasticity and autocorrelation. Modified Walt and Wooldridge test are used to test heteroscedasticity and autocorrelation. Variance Inflation Factor (VIF) is used to determine if there is a multicollinearity problem. As the mean VIF score is less than 10, there is no multicollinearity problem present in the models. Bank size is represented by logarithm of Total Asset (LnTA), Loan intensity is represented by Total Loans to Total Asset (TL/TA), Capital Adequacy is represented by Total Equity to Total Asset (TE/TA), Management Quality is represented by Non-Interest Expenses to Total Asset (NIE/TA), Loan Quality is represented by Non-Performing Loans to Total Asset (NPL/TA), Economic Growth is represented by change in Gross Domestic Product (ΔGDP) and inflation is represented by change in Consumer Price Index (ΔCPI).*

CONCLUSION

This article analyses the profit, cost, and revenue efficiency of Islamic and conventional banks using a large sample from 18 countries from Middle East, South Asia, and Southeast Asia from year 2009 to 2017. Using DEA frontier, Islamic banks were found to have higher average profit, cost, and revenue efficiency compared to conventional banks. A deeper dive into the efficiency score found that the average score from one country can be highly varied to another country. Hence, this indicates the need to control country-specific variables. Both types of banks in countries such as Singapore, Malaysia and Qatar were found to have relatively high average price efficiency scores while both types of banks from countries such as Indonesia, Bangladesh, Iran,

Iraq and Jordan have relatively weak price efficiency scores. Through analysing profit, cost, and revenue efficiency, this study found that the inefficiency of banks from some sampled countries such as Egypt and Iran mainly derive from revenue stream, while the inefficiency of banks from some sampled countries can derive mainly from cost management such as Bangladesh. This result shows that some banks have to prioritise on improving their revenue efficiency and research on price efficiency should not focus only on prioritising cost efficiency. Bankers and stakeholders should look beyond cost minimisation, but maximising revenue as well. Understanding cost and revenue efficiency provide stakeholders with information on whether the inefficiency arises mainly from cost management or generating revenue. This can help banks identify where they are relatively inefficient enabling them to draw up plans or a strategy to improve their efficiency.

Further examination using Least Square Dummy Variable and Random effect models found that the efficiencies of Islamic and conventional banks are insignificantly different. This is consistent with evidence from Beck et al. (2013) that the business model of Islamic banks is not too different from their conventional counterparts despite theories suggest Islamic banks to be differentiated from their conventional counterparts. Regardless, results from this analysis suggests Islamic bank are able to achieve the same level of efficiency as their conventional counterparts despite having disadvantages such as higher complexity in operation and their relative lack of experience. Results from this study also suggest that Islamic banking is a worthy competitor to their conventional counterparts in generating profitability. It is hoped that this article will stimulate academic interest in understanding not only cost efficiency but also revenue and profit efficiency as there are more works remaining unexamined. For example, Islamic banks are starting to expand to other nations, however, as each Islamic state has their own School of Thought and Shariah law, the efficiency of foreign Islamic banks that operate in widely differentiated Islamic host markets may have higher complexity than foreign banks working in host markets with similar conditions. This can provide guidance to Islamic banks in expanding their operations in foreign markets.

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APPENDIX

Table A1 Descriptive Statistic for Variables

Variables	Mean	Minimum	Maximum	Standard Deviation
Inputs				
Deposit	10822.2200	0.0400	420908.0000	29338.5000
Labour	110.6200	0.1000	2825.0000	241.0800
Physical Capital	130.3700	0.0100	4839.1000	329.8000
Outputs				
Loans	7773.6500	0.0600	323099.0000	22404.3900
Investments	2734.4600	0.0200	116035.0000	7859.3900
Input Prices				
Price of Deposits	0.0600	0.0000	20.6300	0.5700
Price of Labour	0.0100	0.0000	0.1600	0.0100
Price of Physical Capital	5.7700	0.0400	1291.8600	49.0200
Output Prices				
Price of Loans	0.1700	0.0000	38.6000	0.7700
Price of Investment	2.2300	0.0000	1135.0200	26.6300

Table A2 Robustness Check

Dependent Variable	Profit Efficiency		Cost Efficiency		Revenue Efficiency	
	Coef.	Rob.Std.Error	Coef.	Rob.Std.Error	Coef.	Rob.Std.Error
Conventional Bank	-0.0420	0.0397	-0.0160	0.0330	-0.0398	0.0354
Controlled Bank-Specific Intercept						
State-Owned Bank	-0.0560	0.0302	-0.0465	0.0275	-0.0719**	0.0200
Foreign Bank	-0.0308	0.0237	-0.0493*	0.0216	-0.0009	0.0182
LnTA	0.0607**	0.0075	0.0468**	0.0063	0.0647**	0.0062
TL/TA	-0.1970*	0.0781	-0.0900	0.0743	-0.0651	0.0702
TE/TA	0.1990	0.1530	-0.0146	0.1520	0.1600	0.1130
NIE/TA	0.6370**	0.1090	0.3480**	0.1150	0.4890**	0.1060
NPL/TA	-0.5320	0.7300	-0.1810	0.6610	-0.0122	0.7590
Controlled Macroeconomic Intercept						
Δ*GDP*	0.0015	0.0019	-0.0037**	0.0011	-0.0025	0.0014
Δ*CPI*	0.0003	0.0014	-0.0004	0.0010	0.0005	0.0009
Constant	-0.0138	0.0846	0.1210	0.0726	0.0151	0.0707
Country Effect	YES		YES		YES	
Time Effect	YES		YES		YES	
Multicollinearity (Mean VIF)	1.3100		1.3100		1.3100	
Observations	3,006		3,006		3,006	
R-Squared	0.3935		0.3641		0.3247	

*Notes: * and ** denote significant at 5% and 1%. Robust standard error is used due to present of heteroscedasticity and autocorrelation. Modified Walt and Wooldridge test are used to test heteroscedasticity and autocorrelation. Variance Inflation Factor (VIF) is used to determine if there is a multicollinearity problem. As the mean VIF score is less than 10, there is no multicollinearity problem present in the models. Bank size is represented by logarithm of Total Asset (LnTA), Loan intensity is represented by Total Loans to Total Asset (TL/TA), Capital Adequacy is represented by Total Equity to Total Asset (TE/TA), Management Quality is represented by Non-Interest Expenses to Total Asset (NIE/TA), Loan Quality is represented by Non-Performing Loans to Total Asset (NPL/TA), Economic Growth is represented by change in Gross Domestic Product (ΔGDP) and inflation is represented by change in Consumer Price Index (ΔCPI).*