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EFFECTS OF CREDIT, LIQUIDITY, AND OPERATIONAL RISKS ON EFFICIENCY OF ISLAMIC BANKS IN AFRICA

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Abstract: Islamic banks in Africa are characterized with some technical inefficiencies. The low efficiency of Islamic banks in the region has been linked to high exposure to different risk variables. However, adequate attention has not been given to such risk variables in past studies on Islamic bank efficiency. This study therefore assessed the effects of credit, liquidity and operational risks on efficiency of Islamic banks in Africa. Twenty (20) Islamic banks were selected across Africa for a period of eight (8) years from 2012 to 2019. Data were collected from annual reports of the banks and analysed via Data Envelopment Analysis (DEA) and Ordinary Least Square (OLS) regression. The study found that the banks were not efficient as the average overall technical efficiency (OTE) was 0.748. The inefficiencies could be traced to both managerial inefficiencies (PTE, 0.827) and poor selection of operating scale (SE, 0.902). The study also found that non-performing financing ratio (p = 0.002), deposit-asset ratio (p = 0.019), and operating expenses to earnings ratio (p = 0.000), have a negative and significant relationship with OTE at 5% level of significance. The study concluded that Islamic banks in Africa are not technically efficient and that exposure to credit, liquidity and operational risks had impaired their technical efficiencies. The study recommends employment of staff with requisite skills and knowledge of Islamic banking and finance to enhance their efficiency. Timely identification of potential risks and adequate risk management are also necessary to forestall high risk exposure which jeopardize technical efficiency.

Keywords: Africa, Credit, Liquidity, Operational, Risk, Technical Efficiency, Scale Efficiency

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1. Introduction

Islamic financial market in the continent of Africa, according to Bank Negara Malaysia [BNM] (2017), is dominated by Islamic banks. This however occupy less than 10% of conventional commercial banking market in the region (Ali, 2016). In fact, their market share was just about 1.74% in 2017 and 0.85% in 2018. Regarding asset base of Islamic banks in the region, the banks' assets were valued as $27.1 billion in 2017 and $13.2 billion in 2018 (IFSB, 2018, IFSB, 2019). Thus, the market share of Islamic banks is relatively small when compared with conventional banks. The small market share of the banks in Africa put them in serious competition with conventional banks, and survival depends on their level of efficiency. This is because high efficiency enables firms to withstand competition in the long run (Jimoh, et al., 2021). It is therefore important for Islamic banks to be efficient for improved performance and favourable competition in the market.

Islamic banks in Africa are characterized with high level of inefficiencies (Ahmad & Abdulrahman 2012). The low efficiency level of Islamic banks in the region has been linked to high exposure to different kinds of risk. According to Li (2016), Islamic banks have higher level of credit, liquidity and operational risks when compared to their conventional counterparts across all regions.

In relation to credit risk, receivables for instance, take higher portion of Islamic banks' assets and Islamic banks can only hold them till maturity as discounting is not allowed in Shariah. The issue becomes more compounded when the counterparty defaults, as banks are prohibited from charging any accrued interest or imposing any penalties on the defaulters. Mejia et al. (2014) observed that high operational risk in the complex structure of Islamic banking products and services, results from documentation requirements, storage and management of real assets which mostly are commodities. In other words, Islamic banks are exposed to internal process, system, people and external factors that can hinder the banks performance and efficiency.

On the liquidity risk, there is likely to be maturity mismatch since many of the banks operates on short-term deposits of retail customers. Aside that, Islamic banks usually face difficulty in managing liquidity risks effectively, because of the Shariah's restrictions or prohibitions on the usage of derivatives for hedging.

Exposure to these risk factors tends to have negative impact on efficiency of the banks except they are effectively managed. Unfortunately, past studies on the determinants of efficiency of Islamic banking in Africa, have not given the required attention to the risk variables (Mohamad & Abd wahab, 2016; Alam, 2012). It has also been observed that any efficiency estimation that does not consider risks impact will result in biased ranking of banks in terms of efficiency (Delis, et al., 2016). This study filled this gap by including credit, liquidity and operational risks in determining the efficiency of Islamic banks. The study was therefore conducted with the objective of assessing the effects of credit, liquidity and operational risks on efficiency of Islamic banks in Africa. The following hypotheses were formulated and tested in the study:

Ho1: Credit risk has no significant effect on efficiency of Islamic banks in Africa

Ho2: Liquidity risk has no significant effect on efficiency of Islamic banks in Africa

Ho3: Operational risk does not have any significant effect on Islamic banks in Africa

The remainder of this paper is structured as follows. Past empirical studies as well as theory upon which the study was hinged were discussed under review of literature in section two. This is followed by the methodology adopted for the study. Section four details the results and discussion while conclusion and recommendation was presented as the section of the paper.

2. Literature Review

In Islamic banking context, Rhanoui and Belkhoutout (2019) define the term risk to include all future uncertainties that are capable of influencing the achievement of strategic, operational, financial and other objectives of the bank. Specifically, Islamic banks also deal with other issues relating to non-compliance with shariah provisions which are capable of affecting their operations and the achievement of their objectives. These issues present other risks that are specific to Islamic banks (Rhanoui & Belkhoutout, 2019). This means risk in Islamic banking can be classified in to two. These are risks that affect banks generally regardless of banking model such as liquidity, credit, operational risk; and risks that are specific to Islamic banking like shariah compliance risk. Majorly, Islamic banks face credit, liquidity, operational, legal (including shariah-compliance), and fiduciary risks in their day to day banking activities.

2.1 Credit risk

According to Helmy (2012), credit risk is the probability that a bank trading partner (borrower or partner) will fail in meeting his financial obligations as agreed with the bank. Credit risk comes in different forms in islamic banking depending the types of contract (financing). Credit risk occurs in Istisna' when a customer fails to make payment due for the manufactured goods as agreed. In the profit sharing contract of murabahah and musharakah, it arises when the entrepreneur refuses or fails to remit the bank' share of profit (Al-Wesabi & Ahmad, 2013).

2.2 Liquidity risk

Liquidity risk arises when a bank faces difficulties in obtaining sufficient funds to meet its obligations either by increasing its liabilities or by quickly converting its assets to cash at a reasonable cost (Shen et al., 2009). This risk is the most crucial of all bank risks because without adequate liquidity, bank business cannot go smoothly and there is high risk of bankruptcy and eventual failure of such bank (Khan & Ahmad, 2001). In Islamic banks, liquidity risk results from unavailability of many money market instruments due to shariah prohibition of interest which makes obtaining adequate liquidity through market difficult.

2.3 Operational risk

According to Basel Committee on Banking Supervision (2006), operational risk is the probability of incurring loss which results from inadequate or failed internal processes, people and systems or other happenings from

external environment. This risk may be particularly significant in Islamic banks as sufficiently qualified staff may not be available to carry out operation in a manner that will be shariah-compliant to achieve the business objectives of the bank.

In their financing and investing activities, Islamic banks make different risky decisions. The risks inherent in the activities must be well managed for efficient operation of the banks, if only for better competition (Swartz, 2013). In other words, risk management is paramount in any responsible banking operation and it goes a long way in enhancing profitability, efficiency as well as the competitiveness of the banks. Risk management is vital for efficiency and maintaining good risk management helps in achieving efficiency in banking operations. In the same vein, Nadeem and Khalil (2014) observed that when a bank put in place good structure for risk management, its financial performance becomes stronger and that most cases of insolvency cannot be disconnected from bad management of risk.

2.4 Concept of Efficiency

According to Kumar and Gulati (2010), efficiency has to do with allocation of resources to alternative uses in manner that a given level of output is achieved with minimum resource input. It is a measure of organization's ability to get maximum result in terms of output from a given input or use minimum input to produce a given level of output. The most efficient technique of making a product or discharging a service is that which utilizes the minimum (least) resources (Ogunyinka & Ajibefun, 2003).

Efficiency is therefore a measure of association between inputs and outputs as well as the degree of success achieved in the transformation of the inputs into outputs (Low, 2000). The degree of success measured by efficiency means that the firm is successful in the process of resources utilization which might not necessarily transform to market performance. That is why, Bartuševičienė and Šakalytė (2013) state that efficiency is just about operational excellence in resources allocation or utilization and has nothing to do with excellent market achievement.

The concept of efficiency is better understood when the term is decomposed into its various types; technical, pure technical, scale, allocative (price), cost (economic), revenue and profit efficiencies. These efficiency concepts are discussed in the following order:

2.5 Technical Efficiency

Zieba (2011) defines technical efficiency as managerial ability which is demonstrated in deriving maximum amount of output from the resources available to a firm, using the existing production technology. Also, Watkins et al. (2014) state that technical efficiency measures the ability of a decision making unit (like bank) to employ a set of input in the production of maximum feasible output (output-oreinted) or obtain a given level of output by utilizing the minimum amounts of inputs (input-oriented).

The implication of the above definition of technical efficiency is that the utilization of available resources to produce maximum output depends on the skills, expertise and capability and as a matter of fact, willingness of the management. In the words of Shanmugam and Venkataramani (2006), technical efficiency represents both the ability and willingness of a firm to produce the maximum possible output from a given amount of input, under the existing technological and environmental conditions. In measuring

economic profitability of a firm, technical efficiency is a key element because it shows the ability of the firm to achieve maximal output from the little resources at the firm's disposal (Giroh, 2012).

The technical efficiency is a measure of the process which an organization follows in converting its input to output as compared to its maximum potential of doing the same as assumed by the production possibility frontier (Barros & Mascarenhas, 2005). In this context, a technically efficient firm is that firm that operates on the production frontier while any firm operating below the frontier is technically inefficient. Inefficiency could be corrected either by putting more efforts to increase output with same input (reduction of wastage) or by using less inputs to produce the same amount of output (Rukwe & Zubair, 2019). Production frontier analysis of technical efficiency indicates that the closer a production unit (firm) moves to the frontier, the better in terms of technical efficiency (Rahman et al., 2005).

2.6 Pure Technical Efficiency

A further decomposition of technical efficiency is what brings about pure technical and scale efficiencies. According to Kumar and Gulati (2008), pure technical efficiency is obtained by measuring technical efficiency with no consideration for the scale efficiency. Pure technical efficiency shows the extent to which the inputs of a firm can be proportionally reduced with no effect on its status on the variable return to scale (VRS) frontier. This implies that pure technical efficiency is normally estimated under variable return to scale (VRS) assumption.

The resultant efficiency measure is pure technical which shows the level of managerial performance in organizing the available inputs to achieve the maximum output in the production process (Kumar & Gulati, 2008). In a nutshell, pure technical efficiency is a measure of managerial performance. If a firm is pure technically inefficient, it means there is managerial underperformance in the resources utilization of the firm.

2.7 Scale Efficiency

Scale efficiency is defined as the kind of relationship which exists between the level of output and average cost. It thus relates to the firm's size of operation (Abel & Bara, 2017). Scale efficiency, according to Kumar and Gulati (2008), measures the ability of management in selecting the optimum size of resources for the firm's operation. That is, the selection of production scale required for the expected level of production. Such selection requires some managerial skills because inappropriate size of operation may lead to technical inefficiency (Iqbal & Awan, 2015).

It is important to discuss the three possibilities under which an organization operates for better appreciation of the concept of scale efficiency. These are constant returns to scale (CRS), increasing returns to scale (IRS) and decreasing returns to scale (DRS). For the CRS, change in output results from proportional change (increase or decrease) in inputs and any firm operating on CRS is assumed to be scale efficient.

When a firm is found to be operating at the IRS, such that the output increases more than the input, it means that the firm is not efficient in terms of scale of operation. There is need increase its size as the firm is operating below the optimal size. Lastly, a firm which operates at a DRS will have a change (increase) in its output be far less than the increase in input. The

implication is that the firm operating above the optimal size, also implying scale inefficiency.

Summarily, a firm is only scale efficient when it operates at the constant return to scale. Operating at either increasing returns to scale or decreasing returns to scale means that the firm is characterized with scale inefficiency (Abel & Bara, 2017).

2.8 Empirical Review

Empirical findings are scanty on the effect of risk on efficiency of Islamic banks. Mokhtar, et al. (2007) evaluated the technical efficiency of banks with the framework of DEA. The study considered loan loss provision, and found that credit risk does not exert any significant influence on efficiency. In another study, El-Moussawi and Obied (2011) reported negative effect of credit risk effect on efficiency. Similar result was reported by Alam (2012) which examined the relationship between credit risk and cost inefficiency of some Islamic banks across the globe. Credit risk was captured with Loan loss provision to total and result shows that banks that have high provision for loan losses tends to be inefficient. Also, Rozzani and Abdulrahman (2013) investigated credit risk as one of the factors affecting Islamic banking efficiency. The study found that reduction in credit risk, probably through better management tends to increase efficiency of Islamic banks. In all of the above reviewed studies, credit risk was the only risk measure that was put into consideration.

However, Said (2013) conducted a correlation analysis of the relationship between risk and efficiency of selected Islamic banks. Credit and liquidity and operational risks were assessed in relation to bank efficiency. The study found that both credit and liquidity risks are negatively correlated with efficiency while operational risk has no significant relationship with efficiency. Mohamad and Abd wahab (2016) assessed the relationship between risk and efficiency of Islamic banks in Malaysia. Correlation analysis was conducted and the result indicates a negative relationship with credit risk. As correlation analysis measures just the relationship between variables, little or no inference could be taken regarding the effect or impact of risk on efficiency.

Hassine and Limani (2014) measured liquidity and credit risk on efficiency of Islamic banks in the Middle East and North Africa (MENA) region. Data were collected from Annual reports of the 21 selected banks and IMF and analysed with DEA and regression techniques. It was found that loan to asset ratio and equity to asset ratio have positive and significant effect on efficiency while loan loss provision to total liability has negative effect on efficiency. That is, liquidity risk had positive and significant effect on efficiency but the effect of credit risk was negative.

Based on review of empirical literature, the effect of different risks facing Islamic banks has not been properly considered in previous studies. Most of the studies considered the risks differently as only few studies examined the combined effect of the variables as determinants of efficiency in Islamic banks. Some of the studies however included some credit risk measures in correlational studies (Mohamad & Abdwahab, 2016; Said, 2013; and Alam, 2012). Omission of such important variables like operational will only make the result of model estimation to be unreliable (Delis et al., 2016). It is therefore clear from review of literature that Islamic bank efficiency is

affected by many factors including risks. Combining the credit, liquidity and operational risks would enhance the validity of result regarding efficiency of Islamic banks in Africa.

2.9 Bad Management Theory

The theoretical relationship between poor management practices including risk management and efficiency was embedded in the bad management hypothesis (Berger & DeYoung, 1997). According to the theory, managerial failure due to lack of good skills, competence and monitoring capability, in the day-to-day operations of the firm, will most likely affect efficiency level of the firm in negative manner. This is because lower cost efficiency level is generally associated with any firm whose management lacks competence and good managerial traits. The lower efficiency level results from higher operating cost as a manifestation of poor administration and cost control.

In the context of Islamic bank, high non-performing financing is likely to result in low efficiency. The high non-performing financing may be due to the bad management practices in the area of proposal and collaterals appraisals, as well as monitoring of the customer for timely repayment in accordance with the agreed terms and conditions of the contracts (Podpiera & Weil, 2008).

The theory may also be used to explain the ability of the management in the area of credit, liquidity and operational risks, and the effect of such on bank performance in terms of efficiency. The implication is that any inefficiencies in managerial activities can increase the bank's operating cost leading reduced efficiency. The theory has been validated by many studies such Louzis, et al. (2010), Ahmad and Bashir (2013), and Chaibi (2016), have recently applied the theory in research works.

Since bad management theory signals the possible existence of some links between risk management and efficiency. High exposure to various risks like credit, liquidity and operational tends to have effect on efficiency of Islamic banks and thus the adoption of bad management theory in this study.

3. Methodology

This study selected twenty (20) Islamic banks whose annual reports were publicly available were selected from Africa for a period of eight (8) years from 2012 to 2019 (See Appendix 1). The sample was selected on basis of data availability. The data were extracted from published annual reports of the banks which were downloaded from the official website of the selected banks. For the uniformity of dataset, end of the year exchange rate, deflated at individual country's inflation rate was used to translate the data to US dollar as suggested by Sufian and Noor (2009). Data Envelopment Analysis (DEA) was used to estimate the efficiency levels of the banks while the second stage analysis was conducted via regression analysis.

3.1 Data Envelopment Analysis (DEA) Model

Following Charnes, Cooper and Rhodes (1978) popularly known as CCR model, the DEA model was specified as follows:

$$\text{Max } a_r = \frac{\sum_{j=1}^{l} u_j \; y_{jr}}{\sum_{j=1}^{k} v_i \, x_{ir}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

Subject to the following constraints:

$$\sum_{i=1}^{k} v_i \; x_{ir} = 1 \, , \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$$

$$\sum_{j=1}^{l} u_j \; y_{jr} - \sum_{i=1}^{k} v_i \; x_{ir} \le 0 \, , \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3$$

uj, vi ≥ 0, ……..4

j = 1, 2,…….l, i = 1,2,……k and r =1,2,……s.

Where i is the input that ranges from 1 to k; j is the output which also ranges from 1 to l; r is a bank whose efficiency is to be analysed and ranges from 1 to s. yjr is the value of output (j) from bank (r); uj is the weight (u) attached to output j. xir is the value of input i to bank r; vi is the weight attached to input i. l= number of output, k= number of output, s= number of banks. Efficiency score (ar) for bank r shall be obtained by providing a linear programing solution to the CRR model, where $0 \leq ar \leq 1$.

However, PTE and SE estimations follow Banker, Charnes and Cooper (1984), BCC model with addition of one more constraint as:

uj, vi =1…….5

Based on the above, the scale efficiency is the ratio of overall technical efficiency to pure technical efficiency scores which is computed as $SE = a_r^{CCR}/a_r^{BCC}$.

3.2 Regression Model

The second stage of the analysis involved estimation of Ordinary least square (OLS). McDonald (2009) argued that since the efficiency score obtained from the first stage of analysis is not a figure generated through a censored process; but rather a figure bounded between zero and one, the result of Tobit or logistic regression would not be reliable, and for such estimation, ordinary least squared method (OLS) is more appropriate The relationship between technical efficiency and risk variables is thus expressed as follows:

$OTEit = \beta 0 + \beta 1NPFr\ it + \beta 2DPAr\ it + \beta 3OER\ it + \beta 4BAZit + \beta 5Bagit + \mu it$

Where:

OTE = Overall Technical Efficiency

NPFr = Non-Performing Financing ratio

DPAr = Deposit to Asset ratio

OER = Operating Expenses ratio

BAZ= Bank Size

Bag = Bank Age

μit = error term

A priori expectation

$\beta 1 < 0, \beta 2 < 0, \beta 3 < 0, \beta 4 > 0, \beta 5 > 0,$

This means that the higher the coefficient of each of the risk variables, the lower the technical efficiency of the banks. Other variables are expected to have positive relationship with technical efficiency of the banks.

3.3 Variable Measurements

Input Variables: three input variables- labour, fixed asset and total deposit are used in this study. Labour is measured as the amount of staff (personnel) cost, book value of property, plant and equipment is taken as fixed asset while amount of customer deposit, deposit from banks and other financial institutions are used to represent total deposit as the last input variable.

Output Variables: total financing (loan), other earning assets and other income are taken as outputs for efficiency measurement in this study. Total

financing is the amount of all murabaha, ijarah, mudarabah, musharakah and other related financing contracts. Other earning assets include the amount if investment in companies' securities, properties and real estate. Other income is also treated as an output variable.

Credit risk: credit risk is measured as the ratio of non-performing financing to total financing. Financing is used in Islamic banking in place of loan in conventional banking system.

Liquidity Risk: Total customer deposit as a percentage of total asset is used to represent liquidity risk in this study.

Operational Risk: operating expenses to gross earnings is used as indicator of operational risk.

Bank Size: Bank size is measured as the natural log of total asset.

Bank Age: Bank age means the number of years that the bank has been in existence or since it began operation.

Table 1: Operationalization of the study variables

S/N	Variable	Proxy	Measurement
1	Credit Risk	Non-Performing Financing ratio (NPFr)	Non-performing Financing as a percentage of Total financing
2	Liquidity risk	Deposit to Asset ratio (DPAr)	Total deposit as percentage of Total asset
3	Operational risk	Operating Expenses ratio (OER)	Operating expenses as a percentage of Gross earnings
4	Bank Size	Log of Assets (LAsset)	Logarithmic transformation of total asset.
5	Bank Age	Years of Operation (Age)	Number of Years since establishment or commencement of Islamic Banking operation

compilation (2022)

3.4 Results

Data Envelopment Analysis (DEA)

Table 2 provides a description of efficiency for the selected Islamic Banks in Africa over a period of eight years from 2012 to 2019.

Table 2: Descriptive Analysis of Efficiency Estimates

Estimator	Obs	Mean	Std. Dev.	Min.	Max.
OTE	80	0.748	0.184	0.260	1
PTE	80	0.827	0.172	0.330	1
SE	80	0.902	0.110	0.580	1

Source: Author's computation (2022)

From Table 2, it could be observed that the selected Islamic banks in Africa recorded efficiency average efficiency scores of less than 1 during the period under review. The banks scored 0.748, 0.827, and 0.902 as means of OTE,

PTE and SE, respectively. This means that Islamic banks in Africa are inefficient in terms of overall, pure technical and scale efficiencies. The implication is that the banks could not create more financing at lower cost to their customers.

The standard deviations of OTE (0.184), PTE (0.172) and SE (0.110) estimators for the selected Islamic banks represent the spread of efficiency scores around their mean scores. It means that on the overall, the bank efficiency score could vary from the average by about 18%. The maximum value of 1 indicates that the banks, at some point inconsistently lied on the efficiency frontier.

Table 3: Averages of Efficiency Scores for Islamic banks in Africa

YEAR	OTE	PTE	SE
2012	0.748	0.826	0.903
2013	0.749	0.825	0.904
2014	0.750	0.826	0.905
2015	0.746	0.825	0.902
2016	0.744	0.825	0.900
2017	0.746	0.826	0.900
2018	0.749	0.829	0.901
2019	0.751	0.833	0.899
Mean	**0.748**	**0.827**	**0.902**

Author's computation (2022)

Table 3 reported the average efficiency scores of selected Islamic banks in Africa from 2012 to 2019. The overall efficiency of the banks averaged 0.748 indicating that the banks are not technically efficient for the periods of under consideration. According to Table 3, the observed inefficiencies could be traced to both managerial inefficiencies (pure technical) and poor selection of operating scale (scale inefficiency) with 0.827 and 0.902 as mean scores for PTE and SE respectively. The OTE and PTE recorded highest scores in 2019 meaning that the banks' efficiencies improve over time due to improved managerial skills and competence. It could however be observed from Table 2 that SE (0.902) is higher than PTE (0.827) which means that the inefficiencies result majorly from managerial underperformance.

Table 4: Distance from Efficiency Frontier

YEAR	OTE	PTE	SE
2012	0.252	0.174	0.097
2013	0.251	0.175	0.096
2014	0.250	0.174	0.095
2015	0.254	0.175	0.098
2016	0.256	0.175	0.100

2017	0.254	0.174	0.100
2018	0.251	0.171	0.099
2019	0.249	0.167	0.101
Mean	**0.252**	**0.173**	**0.098**

Source:Author's computation (2022)

From Table 4, the average inefficiency scores of the selected Islamic banks are 0.252, 0.173 and 0.098 measuring how far the banks are from the efficiency frontier. By these mean scores, an average Islamic bank from Africa requires an increase of about 25.2% in financing capacity in the area of intermediation for it to achieve full efficiency and locate itself on the efficiency frontier. The overall efficiency can be achieved by improving its pure technical and scale efficiencies by 17.3% and 9.8%, respectively.

Preliminary Analysis

Multicolinearity Test

Table 5: Results of Correlation Analysis

	(1)	(2)	(3)	(4)	(5)
Variable	NPFr	DPAr	OER	LAsset	Age
NPFr	1.00				
DPAr	0.49	1.00			
OER	0.19	0.37	1.00		
LAsset	0.42	0.21	0.15	1.00	
Age	-0.67	-0.09	-0.16	0.42	1.00

Source: Author's Computation (2022).

Table 5 presents the correlational matrix of the relationship between each pair of independent variables. According to Gujarati (2004), the relationship between two independent variables becomes a problem when the correlation co-efficient is greater than 0.8. It however obvious, from Table 5 that, none of the coefficient is even close to 0.8. Thus, the variables could be employed in the regression model without any problem of multicollinearity.

Table 6: Results of Unit Root Test

	LLC		HT		Fisher-PP	
Variable	Statistic	p-value	statistic	p-value	Statistic	p-value
NPFr	-5.39	0.011	-3.99	0.000	6.66	0.000
DPAr	-4.72	0.000	-9.15	0.000	3.79	0.000
OER	-3.83	0.000	0.33	0.990	3.65	0.000

Age	5.99	0.000	8.17	0.000	4.39	0.000
LAsset	8.46	0.000	5.09	0.000	9.88	0.000

Source: Author's Computation (2022).

The unit root test results are presented in Table 6, with the unit root test statistics of each procedure and their respective p-values. All tests have null hypothesis of 'presence of unit root', which means that the significance of the test statistic will imply rejection of such null hypothesis in favour of no presence of unit root. Result of the tests suggested that the variables are stationary and consequently model estimates using pooled OLS, fixed effects or random effects methods are reliable

Regression Analysis

Table 7: Risk and Efficiency of Islamic banks

	OLS			Fixed Effects			Random Effects		
Variable	Coef	T	p-val	Coef	T	p-val	Coef	Z	p-val
NPFr	-0.53	-2.93	0.014	-1.63	-3.04	0.007	-0.37	-3.28	0.002
DPAr	-0.19	-0.87	0.309	-0.12	-2.88	0.021	-0.13	-2.49	0.019
OER	-0.72	-3.59	0.000	-0.22	-1.20	0.195	-0.23	-4.55	0.000
Age	0.31	2.43	0.791	0.52	2.99	0.013	0.26	3.01	0.009
LAsset	0.25	2.37	0.015	0.21	1.09	0.205	0.43	2.55	0.020
LDep	0.82	5.66	0.000	0.29	0.45	0.843	0.59	5.19	0.000
Constant	44.56	0.95	0.283	89.37	5.22	0.000	63.53	1.24	0.199
R-squared	0.528	-	-	0.596	-	-	0.766	-	-
F-statistic	5.17	-	0.000	2.77	-	0.011	-	-	-
Wald Chi-squared	-	-	-	-	-	-	40.68	-	0.000
F-test of Homogeneity				11.27		0.000			
Hausman test				7.32		0.520			
Autocorrelation test				3.19		0.437			
Average VIF				2.41		-			

Source: Author's Computation (2022)

From Table 7, the F-test of homogeneity shows a statistic value of 11.27 and p-value of 0.000 indicating the significance of the test's result. The hypothesis underlying the F-test of homogeneity is that there is no heterogeneity among panel members. The significance of test statistic means the presence of heterogeneity among the panel observations, leading to the rejection of the null hypothesis of homogeneity. In other words, the panel members are heterogeneous in nature. This means that the pooled ordinary Least Squared (OLS) method that assumes homogeneity among panel members is not appropriate for the model estimation. Hence, heterogeneous panel method of fixed or random effects method is preferred.

The result of the Hausman test shows a statistic value of 7.32 and p-value of 0.520 which is not statistically significant. Hausman test hypothesized that the difference between coefficient of the fixed and random effects results are not systematic. In that case, the result of random effects is preferred. The Hausman test's result reported in Table 7 indicates that

random effects model is more appropriate for the interpretation of regression results.

The R-squared presented for the random effects method is 0.766, which shows that about 77% of variations in technical efficiency of Islamic banks in Africa, is explained by the regression model. The Wald Chi-squared statistic value of 40.68 and its respective p-value of 0.000 suggest that model is in good fit. Similarly, Wooldridge test of autocorrelation has a statistic value of 3.19 with a p-value of 0.437. This means that the observations are free from problem of autocorrelation. The variance inflation factor (VIF) also has an average value of 2.41 which is far less than 10 suggested for the rule of thumb (Asteriou & Hall, 2016). This indicates that severe multicollinearity does not exist in the model. Having verified that models are in good fit and selected random effects as the most appropriate method of estimation, the effects of the explanatory variables on technical efficiency of Islamic banks in Africa are hereby reported.

On risk factors, the random effects model result shows that non-performing financing ratio (NPFr) has a negative effect on the technical efficiency (OTE) of the banks. The direction of this effect is indicated by the coefficient of -0.37 and the result is statistically significant at 5% level of significance given the p-value of 0.002. Deposit-asset ratio (DPAr) is also found to have a negative and significant relationship with OTE. According to Table 7, 1% increase in DPAr will result in about 0.13% decrease in OTE. The result is significant as the p-value of 0.019 is less than 5% level of significance. Similarly, operating expenses to earnings ratio (OER) has significantly negative effect on OTE of Islamic banks in Africa. The higher the ratio, the lower the overall technical efficiency of the banks, as indicated by the co-efficient of -0.23 and a p-value of 0.000.

However, positive relationships were also found for bank age (Age), and bank size (LAsset). The relationship between each of these variables and OTE is significant with a p-values (< 5%) of 0.046, 0.009, 0.020 and 0.000 respectively.

4. Discussion

From the first stage analysis result of DEA, it was found that the selected Islamic banks in Africa were not fully efficient technically. That is, overall technical efficiency scores of the banks were found to be less than 1 on average. The implication is that the banks have not been able to provide the maximum services of intermediation at the least possible costs. In other words, some resources are still underutilized making the banks to be distant from efficiency frontier of the hypothetical best practice bank with 100% efficiency. This finding is in line with Ahmad, Noor and Sufian (2010) who found lower efficiency for Islamic banks.

In analyzing the possible reasons (sources) for the banks' inability to maximize their output from the available resources and avoid wastage, the overall technical efficiency was decomposed to pure technical and scale efficiencies. In this study, the scale efficiency scores were found to be higher than pure technical efficiency for all the selected banks. Pure technical efficiency was found to be lower than scale efficiency for all the selected banks. This means that the inability of the banks to operate on the efficiency was due largely to pure technical inefficiency in the form of managerial underperformance. It therefore implies that managerial underperformance

in the resources utilization of the banks due to lack of adequate skills, expertise and capability and as a matter of fact, willingness of the management account mainly for technical inefficiencies of the banks. This finding followed the assumption of the bad management theory where it was argued that the failure of management for lack of good skills, competence and monitoring capability is capable of reducing efficiency level of the bank. This is because such a bank is likely to have lower efficiency level as higher operating cost will be incurred due to poor administration and bad cost control measures. Abdulsamad (2015) reported similar finding with result showing that scale efficiency is higher than pure technical efficiency. The finding of this work is also in tandem with Bahrini (2017) who reported that MENA Islamic banks are more scale efficient; meaning that inefficiency resulted majorly from pure technical inefficiency.

On the determinants of Islamic bank efficiency, non-performing financing ratio was found to have negative effect on technical efficiency of the banks in the two regions. This implies that increase in credit risk exposure will reduce efficiency of the banks. This might be so since more efforts and costs will be directed towards credit administration to reduce the bad debt. It may also be implied that reduction in credit risk with efficient credit administration improves bank efficiency. Rozzani and AbdulRahman (2013) reported similar result of negative effect of credit risk on bank efficiency. In the case of liquidity risk, the effect of deposit-asset ratio, the portion of bank assets financed from customer's deposits is significant for Islamic banks in Africa. That is, liquidity risk is a major determinant of Islamic bank efficiency in the region. The effect of liquidity risk on efficiency was found to be negative. High liquidity risk implies banks' inability to meet customers demand for their deposits as and when due. This tends to affect performance and efficiency of the banks negatively. The finding Kassem and Sakr (2018) was inconsistent with this study's finding for African Islamic banks on liquidity risk. It was also not in line with Repkover (2015) which found positive and significant effect of liquidity risk on efficiency. Operational risk has significant effect on efficiency of Islamic banks as the ratio of operating expenses to gross earnings was found to be negative and significant. A high operating expenses in relation to earnings indicates inefficiency of management in the operation of the banks and vice-versa. This report is in consonance with the work of Fadun and Oye (2020) which found negative and significant effect of operational risk on bank performance.

The findings on the effect of the selected risk factors on efficiency of the banks supported the theoretical explanation of the bad management theory. The theory explains the risk management ability of the management on performance in terms of efficiency. Inefficiencies in the management reflecting bad managerial capability is capable of increasing the operating cost which reduces profitability and efficiency

Bank size has positive and significant effect on efficiency of Islamic banks in Africa. The result for bank size (LAssset) for Africa indicates that larger banks are more likely to be more efficient than smaller ones. Khalil and Khalil (2017) found result similar to the finding for Islamic banks Africa. Finally, bank age was found to have had positive and significant effect on efficiency of the selected Islamic banks. This implies that the experience

gathered over the years since its establishment or commencement of full-fledged Islamic banking operation matters for efficient financial intermediation. In other words, old banks are likely to be more technically efficient than the new ones. This finding supports that of Haryati, et al. (2019) which found that age contributes significantly to efficiency of banks.

5. Conclusion and Recommendations

This study assessed the technical efficiency if Islamic banks in selected Africa countries. Results on all the estimates of indicate none the selected banks was technically efficient. By decomposing into pure and scale efficiencies, the study found that the banks were still inefficient. However, the scale efficiency level was higher than pure technical efficiency level of the banks. This implies that the inefficiencies resulted majorly from poor managerial performance in the area skills, expertise and willingness of the management among other factors.

On the determinants of efficiency of the banks, the study revealed that that high credit risk exposure lead to higher cost of intermediation leading to lower efficiency. It was also revealed that higher cost is associated with higher liquidity risk and as non-interest institutions, there is restriction to how the risk can be managed using the market. Finally, high operating expenses in relation to earnings indicates inefficiency of management in the operation of the banks and vice-versa. It is thus concluded that high operational risk exposure reduces bank efficiency. Consequent upon these findings, the study concluded that Islamic banks in Africa are not technically efficient and that exposure to different types risk such as credit, liquidity and operational risks had impaired their technical efficiencies.

Based on the conclusion, the study recommends employment of staff with requisite skills and knowledge of Islamic banking and finance to enhance the managerial performance and boost their technical efficiency. Timely identification of potential credit risk and adequate risk management are also necessary to forestall high credit risk exposure which jeopardize technical efficiency in form of high cost of credit administration. Furthermore, the boards of Islamic banks in Africa should liaise with their respective board of Shariah scholars to adopt Shariah-compliant interbank financial instruments like Murabaha Interbank Financing (MIF) and Islamic Accepted Bills (IABs) and other Islamic negotiable instruments for proper management of their liquidity risk. This will ensure efficient management of high liquidity risk exposure that is capable of eroding their efficiencies. Finally, the banks should introduce and adopt more shariah-compliant products and services like spot murabaha financing and bay al-dayn set-off financing, with corresponding marketing efforts to boost their earnings and reduce their operational risk exposure due to high operating cost.

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APPENDIX 1(A-1)

S/N	Bank	Country	Region
1	JAIZ Bank PLC	Nigeria	Africa
2	Gulf African Bank	Kenya	Africa
3	Zitouna Bank	Tunisia	Africa
4	AlSalam Bank	Sudan	Africa
5	Amana Bank	Tanzania	Africa
6	Faisal Islamic Bank	Egypt	Africa
7	Agib Bank	Gambia	Africa
8	Salaam African Bank	Djibouti	Africa
9	Al Muamelat Assahiha Bank	Mauritania	Africa
10	Islamic Bank of Senegal	Senegal	Africa