

# The Mediating Effects of Profitability on the Liquidity Risk and Cost Efficiency of Islamic Banks in Selected Countries

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## Abstract

*This paper investigates liquidity risk, cost efficiency and profitability relationships in Islamic banking. It also assesses the mediating effects of profitability (ROE and PBTZ) on the two variables. The study uses panel data techniques and mediation to assess 28 Islamic banks from ten countries over 2005 to 2015 periods. The result shows that profitability and liquidity risk significantly affect the cost efficiency of Islamic banks. Profitability mediates the relationship between the banks' cost efficiency and liquidity risk. The mediating effect suggests that Islamic banks can achieve both cost efficiency and profit maximization through good management of liquidity. However, future research should explore the dynamics of other factors affecting the interactive nature between liquidity risk, cost structure and bank profit performance.*

**Key words:** Profitability, Liquidity Risk, Cost Efficiency

**JEL Classification:** G01, G21, G24, G28, G32

## 1. Introduction

An area which prompted the building of risks in financial institutions was their eagerness to increase risks in order to gain higher profits. The core principles of Western capitalism of profit maximization was witnessed in the US subprime mortgage crisis where

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subprime borrowers were given mortgages despite of their weak credit assessments. To compensate for the higher risks, the borrowers were charged higher lending rates. The borrowers faced tight liquidity and acute repayment problems when interest rates spiked sharply during recession in the US economy. The crisis created reservations on work dynamics of banks. Miah and Shareem, (2015) also submit that this unparalleled global financial crisis challenged the hegemony of conventional banking system that is based on interest. The authors also raised concern that the banking practice is prone to financial crisis. In contrast, the good performance of Islamic banks diverted customers' attention to Islamic banking. (Hasan and Dridi, 2011; Beck, Demirguc-Kunt, and Merrouche 2013). Through the spread of interest rates between lenders and borrowers, the conventional banks generate profit. Islamic banks, on the other hand, do not deal with interest. Rather, profit is generated through the profit and loss sharing mechanism that guarantees fair dealings to both depositors and users of funds.

From a business perspective, profitability and stability of banks are contingent on risk management of the banks (Ahmed, 2011). Profitability is a basic objective of any business enterprise. While pursuing the profit objectives, banks tend to face tight liquidity while controlling their cost structure. Although operating in a different business philosophy where the ultimate aim is to achieve maqasid al shariah or the overall socio-economic well-beings of the ummah, Islamic banks act in a similar manner on targeting high profitability, through efficient management of their operating expenses and risks exposures while observing Shariah obligations. An efficient bank is expected to intermediate more funds, leading to greater profit, but may expose themselves to higher risks (Bader et al, 2008). However, it is rather scant to find empirical research in this area of Islamic banking. This scarcity provides a compelling motivation for us to empirically testing the mediating effect of profitability on cost efficiency and liquidity risk of banks operating Islamic banking in Malaysia, Bahrain, Indonesia, Iran Pakistan, Saudi Arabia, Turkey, Sudan, Kuwait and United Arab Emirate UAE).

### **1.1 Risk Management**

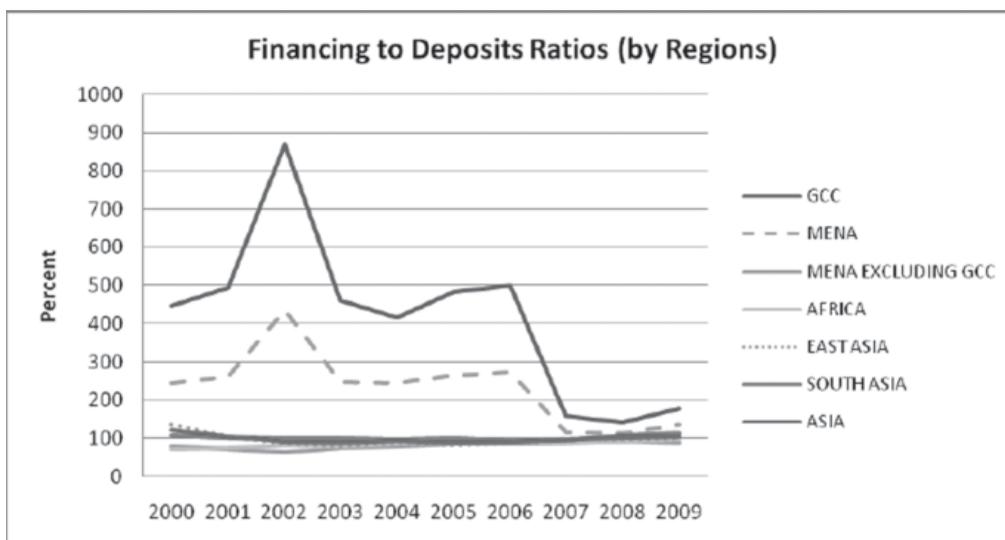
Bank evolution revolves around risk taking and how the risks are managed. The management of risks determines the return from a transaction. For Islamic banks, risk management does not only involve risk transfer (Sulaiman, Muhammad, and Samsudin, 2013) but risk sharing. Risk is shared between Islamic banks and their customers since as suppliers of funds, Islamic banks become capital provider rather than creditors and the customers assume the role of investors.

The risk and return distribution of financial transactions in Islamic banks is usually symmetrical. A risk sharing financial system according to Askari, et al (2012) is based on equity finance (as against debt) and the return is shared based on pre-agreed determined ratio between the parties involved. In risk sharing arrangement, the real segment (asset or equity backed) and financial segment are seen and closely connected with each other and grow together. This makes it insusceptible considerably to the financial crunches that plaque the conventional banking system. On the contrary, Islamic banks are free from the sources of the crises including interest, too much debt creation, influence and speculation.

## 1.2 Challenges of Islamic Banks on Liquidity Risk

In spite of the huge investment and growth in Islamic financial assets, Ali (2013) reports a low and declining liquidity position of Islamic banks operating in most regions.

**Figure 1: Financing to Deposits Ratio (by Region)**



Source: Ali (2013)

Figure 1 displays the liquidity growth of Islamic banks which peaked in 2002 for GCC and MENA regions and thereafter started declining till around 2007 shortly before the global financial crisis. The liquidity was relatively stable during the crisis although at low level for most of the banks in the regions except for the GCC region which experienced once again a gradual increase from 2009.

The low liquidity position of Islamic banks poses a major challenge in liquidity

management. Inappropriate liquidity instruments (non-Shari'ah compliant), difficulty in debt transfer except on face value and insufficient tools for supervisory authorities to support liquidity requirements of Islamic financial institutions are some of the difficulties relating to liquidity management in Islamic banks.

Moreover, the global growth of Islamic banks can only be sustained with a robust risk management practice. However, this is not yet effective even in countries with more years of experience. The critical issue on liquidity management in Islamic banks arises because of the banks' orientation towards short-term borrowing as against long-term financing (Ismal, 2010). This represents a liquidity gap or a funding mismatch.

Liquidity is the readiness of a bank to provide funding for increases in current liabilities. It is also ability of the banks to meet obligations when it is due without suffering undesirable losses. (Basel Committee, 2008). A bank is said to be illiquid if it cannot settle obligation on time (Nikolaou, 2009).

Paradoxically, Islamic banks are tagged profit efficient but cost inefficient. The explanation usually given for this abnormality is that the banks incurred higher cost due to the initial set up expenses of mostly news banks. What then is relationship between profitability, liquidity risk and cost efficiency of the banks?

If the management of Islamic banks is not efficient, it will be difficult to monitor their funding cost relative to financing rate charged to customers. This means that the balance sheet structure will affect the cost efficiency of Islamic banks. Where the banks rely on short term funding which is relatively costlier, the financing rate charged by the bank will be high.

The main objective of this study is to identify the mediating effects profitability on the liquidity and cost efficiency of the banks.

The following specific objectives are then identified to be achieved from this research:

- i. To study the connection between the liquidity risk and cost efficiency of Islamic banks.
- ii. To assess the influence of profitability (ROE and PBTZ) on the liquidity risk of Islamic banks
- iii. To explore whether Profitability (ROE and PBTZ) mediates on the relationship between liquidity risk and cost efficiency of Islamic banks in selected countries.

The rest of the paper is organized as follows. Next section reviews previous studies on liquidity risk, efficiency and performance. Section three discusses the research methodology adopted. Analysis of result is discussed in section four while section five summarizes and concludes the study.

## **2. Literature Review**

### **2.1 Risk, Efficiency and Performance**

Studies have been conducted on risk as a factor of efficiency. Alam (2012) used loan loss reserves to total assets as a proxy for risk while cost efficiency is measured by net loans and operating expenses to total assets ratios whilst short-term assets are divided by short-term assets in his investigation of the influence of efficiency on risk in Islamic and conventional banking systems. He found that conventional banks have higher cost efficiency score whereas Islamic banks recorded greater profit efficiency. He posits that both banking systems biased towards generating higher profits through expanding customer base. In contrast, Islamic banks were found to hold higher liquid but risky assets. The limitation of this study is that it did not measure technical, scale and operational efficiency. A series of papers have examined Islamic banks efficiencies in a number of countries (Brown et al, 2004; Hassan et al, 2004; 2006; Hassan, 2006)

According to Abdul Majid et al. (2010) study, Sudan Islamic banks exhibit relatively stronger return to scale and higher inputs than their interest- based institutions. The authors highlight the issue of low outputs relative to higher inputs as an important challenge for Islamic banks to resolve in the future. In the previous study, stochastic frontier method was used by Srairi (2010) to examine the cost efficiency and profit efficiency of 71 commercial banks in GCC countries over 1999 -2007 study period. The result shows that GCC banks are more profits than costs efficient. He reports a positive association between cost efficiency, profit efficiency with the banks' market capitalization, loan activity and productivity but an inverse relationship with process costs. He concludes that in terms of in cost and profit efficiency, conventional banks in GCC are more efficient than Islamic banks.

Also, Yahya et al. (2012) used DEA to measure efficiency and study the difference in the efficiency position of Islamic banks and conventional banks using. The study which involved only two banks and for a period of just three years finds no significance difference in the efficiency of Islamic banks and conventional banks.

Similarly, Siraj and Pillai (2012) examine the growth of performance parameters of Islamic banks and conventional banks with respect to operating profit ratio (OPR),

net profit ratio (NPR), return on asset (ROA), ROE, operating expense and income, deposits and total equity. They discover that Islamic banks performance is better and they are more equity based than conventional banks. Although the conventional banks recorded improved revenue, this could not translate to better profitability due to higher provisions on credit losses and impairment losses.

Wiyono and Raymayuni (2012) introduce the effect of Shari'ah conformity proxies by Islamic income and profit sharing ratio as moderating variables to the relationship between bank risk (credit and liquidity) and profitability of Islamic banking in Indonesia. The result shows that the Islamic income and profit sharing ratio only moderate on profit margin but not on ROA and ROE.

However, study on conventional investment banks for the G7 countries (US, UK Japan, Germany, France and Canada) and Switzerland before the last financial crisis was carried out by Radic, Fiordelisi, and Girardone (2012). The study states that in order to assess profit efficiency accurately, it is important to consider the capital exposure and liquidity as factors of bank risk-taking. They argue that environmental factors also influence the level of efficiency of banks involved in investment. It is also their position that the core functions of investment banks expose them to different risks. This confirms the fact that because Islamic banks also function more or less as investment banks, they are exposed to a wide array of risks.

Equally, examining cost efficiencies of conventional and Islamic banks and banks in Malaysia was the objective of Ismail, AbdurRahim and Kadri (2013). They also use DEA and Tobit Regression Analysis (TRA) to define factors prompting the efficiency of conventional and Islamic banks. The findings show that technical efficiency (TE) is the core cause of cost efficiency for conventional banks whereas allocative efficiency (AE) is the main cause of cost efficiency of Islamic banks. The study suggests that in terms of IT and electronic utilization, conventional banks are more efficient. Islamic banks on the other hand show better efficiency in allocation and utilization of other resources. Scale efficiency is the key source of technical efficiency for both conventional banks and Islamic banks. Tobit regression also reveals that capitalization and bank size are positively and significantly associated to efficiency. It also says that loan quality is negatively and significantly associated with efficiency.

The authors recommend future studies to use different input / output specifications on a larger sample or for a longer period as the study was for a period of 2006- 2009. They further suggest that comparison of conventional banks and Islamic banks should also be done across country borders.

Also, Eljelly and Elobeed (2013) describe the common performance traits of banks operating under a full Islamic banking system in Sudan. They use nine large and active banks to analyze financial ratios.. The result states that coverage, liquidity risk, efficiency (utilization), capital adequacy, profitability, and control are factors that most explain variation of the financial ratios.

Beck et al. (2013) further ratifies that Islamic banks are well capitalized, have higher intermediation ratio, asset quality is developed but suffer less cost efficiency. They also contend that due to their better capitalization and higher asset quality, the Islamic banks during the recent crisis had a better stock performance. This is contrary to Miah and Sharmeen (2015) findings that Islamic banks are less efficient than conventional banks.

Equally, Al-Tamimi et al. (2015) examine the connection between financial risk and performance of GCC Islamic banks. They use two alternative parameters to measure performance – Return on Asset (ROA) and Return on Equity (ROE). Four types of risks were also included in the study – credit, liquidity, operational and capital risks. They report that a regression analysis indicates a significant negative relationship between bank's performance, capital risk and operational risk in Islamic banks in GCC region. They posit that capital risk and operational risk are most important risks. Positive relationship between risk and performance of the banks was not confirmed.

Lately, Daly and Frikha (2015) confirm previous studies that customers' deposits growth and size of Islamic banks are critical factors in performance measurement. They argue that government intervention has a negative effect on the conventional banks' performance.

Also, Paleckova (2015) suggests that portfolio riskiness and liquidity risk had positive effect on cost efficiency in Czech Republic banks.

### **2.1.1 Relationship between Risk and Efficiency**

Many studies have been conducted on the correlation between risk and efficiency. However, there is no clear theoretical picture of the connection and empirical evidence is also not conclusive (Deelchand and Padgett, 2009). Following recurrent global financial crises, there are growing interest among researchers and regulators to understand the relationship between risk, capital and efficiency of financial institutions worldwide. Knowledge about risk, capital and efficiency of banks is still very limited and fixed. For instance, Laeven and Majnoni (2002), submits that studies on efficiency should include risk by making reference to provision for loan loss. This is also in

line with the position of Drake and Hall (2003) that with exclusion of risks, there is possibility of overstatement of potential economies of scale.

Also, examining the impact of risk and efficiency on the activities of Islamic banks, Sutrisno (2016) concludes that inclusion of risk factors has mixed effect on Islamic banks efficiency. When risk factors are excluded, the potential economies of scale may be overestimated and technical efficiency is also delicate if risk factors are not included.

Furthermore, Deelchand and Padgett (2009) established an adverse connection between capital efficiency and risk when all deposits are indemnified with a level premium rate that is, when there is no 'market discipline'. The authors findings tend to confirm the 'too big to fail' in which big banks rely on public for bailout during financial complications because they are aware of their prominence in the financial system. This is different from Altunbas et al (2007) findings whose empirical outcomes indicate positive connection between capital risk and liquidity which confirms regulators' inclination for capital to curtail activities that involves taking risk

Similarly, Said (2013a) examines the correlation between efficiency and risks of Islamic banks in MENA countries. He uses three stages of analyses:

- i. Measures efficiency with Data Envelopment Analysis (DEA).
- ii. Analyses risks by using financial ratios.
- iii. Uses Pearson Correlation coefficients to study the correlation between liquidity risk, operation risk, credit risk and efficiency.

The result of the study shows that both operational risk and credit risk are negatively related to efficiency. Incidentally, the result shows there is no significant correlation between liquidity risk and efficiency. The author, nonetheless submits that in conventional bank there is positive correlation between efficiency and risks, but in Islamic banks, the relationship is negative. In another study, Said (2013b) measures the technical efficiency of Islamic banks in MENA and concludes that Islamic banks are not technically efficient. He submits that pure technical and scale efficiencies show problems of allocation of resources between inputs and output mix for MENA compared with GCC. This again highlights the characteristic differences between efficiency and risk relations between the two forms of banking system (Alam, 2012).

Thus, most of the propositions between risk and efficiency are non-conclusive and yield inconsistent results. It is only an empirical analysis that can resolve the differing estimates.

**2.1.2 Liquidity Risk and Performance**

There are also studies relating liquidity risk to financial performance of banks. For instance, Sohaimi (2013) analyses the liquidity risk and disclosure and draw the relationship between financial performance and liquidity risk. He uses deposits, cash-liquidity gap and non-performing loans (NPL) as independent variables and the effect on banks’ capital and reserves. He observes that liquidity risk has significant impact on banks’ capital and reserves. He regards NPL as the exacerbating factor of liquidity risk. He also submits that there is a negative relationship with deposit, cash and liquidity gap. This is similar to the findings of Arif and Anees (2012) who also included liquidity gap as the second factor exacerbating liquidity risk. Both studies agree with Alshatti (2014) who says that liquid assets and capital ratios have negative impact on profitability. He however states that investment and quick ratios have positive impact on profitability. Similarly, Njeri (2014) and Jacob (2014) reveal that liquidity is the most critical factor that influence financial activities of microfinance, savings and credit cooperative societies in Kenya.

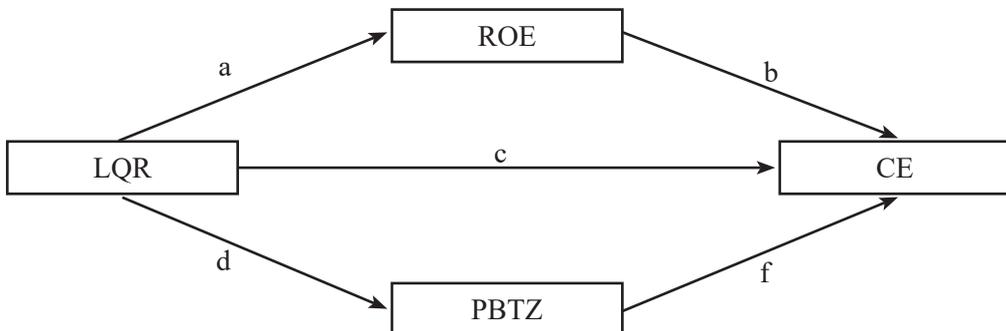
However, Al-Tamimi et al. (2015) insist on negative correlation between the activities of Islamic banks in GCC with respect to operational risks and capital. They contend that the two most important risks are capital and operational risks. Saeed (2015) also supports the argument that liquidity risk has insignificant relationship to conventional bank performance in Malaysia.

Again, an empirical study of this nature is expected to provide more evidence on the relationship between risk, particularly liquidity risk and financial performance in Islamic banks.

**3. Methodology**

**3.2 Conceptual Framework**

In order to establish the connection between the dependent and independent variables, the following framework was conceptualized.



LQR= Liquidity Risk, ROE=Return on Equity, PBTZ=Profit before Tax and Zakat and CE= Cost Efficiency

In the framework, paths ab and df indicate the respective mediation of ROE and PBTZ between LQR and CE. These are the indirect effect. The direct effect is the path e.

### 3.3 Model Specification

$$CE_{it} = \beta_0 + \beta_1 LQR_{it} + \beta_2 ROE_{it} + \beta_3 PBTZ_{it} + \varepsilon_{it} \dots \dots \dots$$

Where:

$LQR_{it}$  = Liquidity for bank  $i$ , year  $t$

$CE_{it}$  = Cost efficiency for bank  $i$ , year  $t$

$\beta_0$  = intercept

$\beta_1 - \beta_3$  = Coefficients of parameters

$\varepsilon_{it}$  = Error term of bank  $i$

### 3.4 Research Design.

A research design can be regarded as a plan to collect, measure and analyze data of a research study (Sekaran and Bougie, 2013). Research design helps researcher to find solution to the problems of the study. It also ensures the accuracy, generalization and application of the research result (Bhatti and Sundram, 2015). It involves identifying the purpose of study, type of investigation, unit of analysis and time horizon.

This study adopted a hypothesis testing approach. Hypothesis testing refers to a process whereby the researcher explains the relationship between variables and test statistical hypothesis.

#### 3.4.1 Panel Data

The study used panel data. A panel data means data that contains a cross section and time series. Panel data provides more explanatory data, more efficacy, more degrees of freedom and less collinearity among variables. The study of cross section in panel data enables a better understanding of dynamic forces of change. There is always problem of heterogeneity when using panel data. Thus, individual-specific variables estimation provided in panel data technique is able to resolve the problem of heterogeneity. Panel data also enrich empirical analysis by providing a better way of detecting and measuring effects than time series and cross-sectional analysis.

In addition, Baltagi (2008) also highlighted other advantages of panel data analysis over cross-sectional and time series data analyses. This include the fact that panel data can identify and measure effects that may not be easily detected in cross-sectional and

time series data. Panel data also allows for construction and testing of models that are complicated. Also with panel data which gathers information on micro units, including individuals, firms and household, it is more accurate to measure many variables. This eliminates biases that may result in aggregation of firms and individuals.

The panel data model is normally estimated with either the fixed effect model (FE) or the random effect model (RE) also known as the error components model.

### **3.4.2 Mediating Variable**

A mediating variable is regarded as information transporter or carrier in a series of causal relationship (Little, et al. 2007)

There is a lengthy history of mediation (Kenny, 2014). It was made very popular by Baron and Kenny (1986). A mediator stipulates how an effect occurs. They describe a mediator variable in the following:

‘The generative mechanism through which the focal independent variable is able to influence the dependent variable of interest. Mediation is best done in the case of a strong relation between the predictor and criterion variable.’ (Baron and Kenny, 1986; pp 1173,1178).

A moderator on the other hands explains the relationship between a predicting variable and criterion variable. While mediator talks about how and why of a relationship, moderator stipulates when such relationship occurs (Baron and Kenny, 1986). According to Kenny (2014), mediation becomes more interesting due its ability to provide explanation on the effects of causal variable on outcome. Moderator and mediator are both essential in process analysis. However, mediator seems to be more dominant than moderator.

The application of mediation is not limited to areas of psychology as in Baron and Kenny (1986), Zhao, X., Lynch, J., & Chen, Q. (2010) and Wu (2011). Mediating variables have also been used by Ramada and Chen (2012), Wahba and Khaled (2015) and Ramli and Gilbert (2016) relating to finance performances. Ramadan and Chen (2012) used debt level as a mediator in explaining the relationship between a firm’s capital structure and its financial performance. The study used three methods of pooled Ordinary Least Squares (OLS), Fixed Effects (FE) and Random Effect (RE). It concludes that the mediating role of debt level is partial and very small.

Similarly, Wahba and Khaled (2015) used panel data regression to test financial performance as a mediation in the relationship between ownership structure and social responsibility. The study conducted on a sample of firms listed in the Egyptian social responsibility index for the period 2007 to 2010 conclude that financial performance and not social responsibility helps institutional investors in making investement decisions.

More recently, Ramli and Gilbert (2016) using Partial Least Squares- Structural Equation Modeling (PLS-SEM) investigated the mediating effects of firm leverage in Malaysia. The question was to find out the mediating role of firm's leverage in the relationship between the capital structure of the firm and micro-economic variables. The study concluded that there is partial mediation on the choice of capital structure of a firm.

The present study used profitability measured by return on equity (ROE) and profit before tax and zakat (PBTZ) as mediating variables between liquidity risk and cost efficiency.

### 3.5 Variable Measurement

Table 3.1 shows the measurement of the variables used for the study. The source of the data is from IBIS database.

**Table 3.1: Variable Measurement**

Variables	Measurement	Source
COST EFFICIENCY	Deployment Ratio= Total Investment/ Total Customers' Funds	Financial Statement
LIQUIDITY RISK	Total Investments / Total Assets	Financial Statement
ROE	Profit /Total Shareholders' equity	Financial Statement
PROFIT	Log of profit before tax and Zakat	Financial Statement

### 3.6 Population and Sampling

Sekaran and Bougie (2013) define population as the entire group of people, events, or things of interest to the researcher. It is the total number of people, events or things a researcher is interested to make conclusions.

The population of the study included all the Islamic banks in the selected countries. For this purpose, the countries selected was based on up to date data on Islamic banks. The selected ten countries contribute 90% of the global Islamic bank assets. The countries include Bahrain, Indonesia, Iran, Kuwait, Malaysia, Pakistan, Saudi Arabia, Sudan, Turkey and United Arab Emirate (UAE).

### 3.7 Sources of Data

Secondary data source was used for this study. Data was collected from Islamic Banks and Financial Institution Information (IBIS) data base of Islamic Research and Training Institute (IRTI). The database has a comprehensive financial reports of Islamic banks. This makes comparison among banks in the selected countries possible. A total of 28 banks from ten member countries were used for the study. The data source was supplemented with information from the respective individual banks websites.

### 3.8 Method of Data Analysis

The study employs STATA14 to analyze the influence of the independent variables on liquidity while liquidity itself was measured using liquid asset over total asset.

Efficiency as the dependent variable was measured using deployment ratio calculated from the data sources. The mediating effects of ROE and PBTZ on liquidity risk and efficiency of Islamic banks were tested using three approaches of BK (Baron and Kenny), Sobel-Goodman and Bootstrapping.

## 4 Analysis of Result

### 4.1 Descriptive Statistics

In table 4.1, deployment ratio (DR) used as proxy for cost efficiency, measures the ratio of total investment to total customers' fund. It indicates that on average 110 percent of customers' funds are invested. This implies that Islamic banks in addition to using customers' deposit, they also access other funds like equity for investment. Liquidity risk (LQ), shows that on average, 74 percent of total assets of the sampled Islamic banks are invested. The Return on Equity (ROE) measured as Profit before Tax and Zakat (PBTZ) over total share equity of 0.112 also suggests that on average, investors gain 11percent from their investment in Islamic banks. Profit before Tax and Zakat (PBTZ) shows average natural logarithm of 5.14 and standard deviation of 1.13 which suggests that the profit is widely dispersed around the mean.

**Table 4.1: Descriptive statistics**

Variables	Observation	Mean	Standard Deviation	Min.	Max.
LQ	308	0.737	0.159	0	0.997
DR	308	1.103	0.629	0	6.471
ROE	308	0.112	0.333	-5	0.745
PBTZ	308	5.139	1.128	-2	7.707

Note: DR= Deployment Ratio, ROE=Return on Equity, PBTZ= Profit before Tax and Zakat

### 4.2 Panel Analysis

Prior to conducting panel data regression, two test were carried out to confirm the suitable model to employ. The first test carried out was Breusch and Pagan Lagrangian multiplier test for random effects. This was to confirm which of Ordinary Least Square (OLS) and Random Effect Model (REM) is suitable. The result shows probability value of 0.000. This suggests that OLS is not suitable for the analysis. Rather, the preferred model is REM. The second test conducted was Hausman test in order to ascertain whether Fixed Effect Model (FEM) or REM is the appropriate model. The result also gave a probability value of 0.3968. This indicates that REM is the appropriate model.

Furthermore, the study used vce (robust) option (vce stands for variance co-variance estimator) to correct the issue of heteroscedasticity and autocorrelation. By using vce (robust), one can do without model-based variance estimates in favor of the more model-agnostic “robust” variances. Robust variances provide correct calculations of the sample-to-sample variability of the parameter estimates even when the model is not properly specified. The vce option allows stata to change the way standard error is calculated. The vce (robust) option in stata calculates Huber-White robust estimates of the standard errors. The use of this option is supported by Huber, 1967; White, 1980; Froot, 1989; Roger, 1993; Williams, 2000 and Wooldridge, 2002.

The panel analysis result in table 4.2 shows consistently that liquidity risk (LQ) positively and significantly affect cost efficiency at 1% confidence level for the all the four models of OLS, RE, FE and vce option. PBTZ is negatively significant in the three models of OLS, RE and FE at 1% but at 10% for vce. However, ROE shows no consistent effect on cost efficiency.

**Table 4.2: Regression Analysis Dependent Variable: Cost Efficiency**

VARIABLES	(1)	(2)	(4)	(5)
	OLS	RE	FE	Vce(robust)
LQ	1.766***	1.617***	1.553***	1.617***
	(0.213)	(0.229)	(0.247)	(0.368)
ROE	0.0919	0.164*	0.185**	0.164
	(0.0982)	(0.0904)	(0.0920)	(0.171)
PBTZ	-0.111***	-0.118***	-0.119***	-0.118*
	(0.0300)	(0.0332)	(0.0364)	(0.0617)
Constant	0.358*	0.496**	0.547***	0.496***
	(0.192)	(0.204)	(0.207)	(0.168)
B/ Pagan (LM) test		93.22 (0.0000)		
Hausman test(X <sup>2</sup> )		2.97 (0.3968)		
F-Stat	23.78 (0.0000)		4.83 (0.0000)	
Heteroscedasticity (X <sup>2</sup> -Stat)			(0.000)	
Observations	308	308	308	308
R-squared	0.190		0.135	
Number of Bank		28	28	28

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### 4.3 Mediating Result

Table 4.1 below shows the result of BK approach using ROE as mediator. It indicates that b coefficient with a p-value of 0.3276 is not significant. This suggests that ROE does not significantly mediate the relationship between liquidity risk (LQ) and cost efficiency (CE)

**Table 4.1: BK Approach with ROE as Mediator**

	Coefficient	Standard Error	T	P>/t/
'a coefficient'	-0.1305	0.0672	-1.9405	0.0532
'b coefficient'	-0.1804	0.1840	-0.9806	0.3276
Direct effect(c')	1.5212	0.2177	6.9860	0.0000
Total effect(c)	1.5447	0.2164	7.1381	0.000

Similarly, Table 4.20 below presents the Sobel test for ROE as a mediator. It also shows that with a p-value of 0.3621, ROE does not significantly mediate the relationship between liquidity risk (LQ) and cost efficiency (CE). The proportion of total effect that is mediated is only .003 or 0.3 percent

**Table 4.2 Sobel-Goodman Mediation Tests: ROE as Mediator**

	Coefficient	Standard Error	T	P>/t/
Sobel	-0.0051	0.0111	-0.4619	0.6441
Goodman-1 (Aroian)	-0.0051	0.0163	-0.3136	0.7538
Goodman-2	-0.0051	-	-	-
a coefficient	-0.0766	0.1199	0.6390	0.5228
b coefficient	0.0668	0.0999	0.6685	0.5038
Indirect effect	-0.0051	0.0111	-0.4619	0.6441
Direct effect	1.5595	0.2098	7.4319	1.1e-13
Total effect	1.5544	0.2095	7.4191	1.2e-13

Proportion of total effect that is mediated: -0.0033

Ratio of indirect to direct effect: -0.0033

Ratio of total to direct effect: 0.9967

Lastly, Table 4.3 presents the summary of bootstrapping approach using ROE as mediator. The Table indicates that the confidence intervals of the mediator (ROE) ranges between -0.0290 and 0.0188. This suggests that there is zero in the range. Thus, there is no mediation in the relationship using the three approaches.

**Table 4.3 Summary Bootstrapping Approach with ROE as Mediator**

	Lower	Upper
Total	-0.0290	0.0188
ROE	-0.0290	0.0188
Level of Confidence for Confidence Interval	95	
Number of Bootstrap Resamples	5000	

Next, result of the mediating effect of PBTZ on the relationship between LQ and CE using the three approaches is represented.

Table 4.4 shows the BK approach using PBTZ as mediator. With a p-value of 0.0005 for the b coefficient, it suggests that there is statistical significant effect when PBTZ is included in the relationship between LQ and CE. In compliance with BK approach, the direct effect c' is also significant with a p-value of 0.000. This signifies PBTZ is a mediator.

**Table 4.4: BK Approach with PBTZ as Mediator**

	Coefficient	Standard Error	T	P>/t/
'a coefficient'	1.7402	0.4068	4.2777	0.0000
'b coefficient'	-0.1050	0.0299	-3.5165	0.0005
Direct effect(c')	1.7274	0.2188	7.8967	0.0000
Total effect(c)	1.5447	0.2164	7.1381	0.000

Similarly, Table 4.5 presents the Sobel approach on the mediating effect of PBTZ. With a z-score of 2.888 and p- value of 0.00, it shows the statistical significance of indirect effect. Thus, it also established the mediating effect of PBTZ. The proportion of total effect that is mediated is put at 13 percent

**Table 4.5: Sobel-Goodman Mediation Tests: PBTZ as Mediator**

	Coefficient	Standard Error	T	P>/t/
Sobel	-0.2009	0.0698	-2.878	0.0040
Goodman-1 (Aroian)	-0.2009	0.0708	-2.838	0.0045
Goodman-2	-0.2009	0.0688	-2.92	0.0035
a coefficient	1.8424	0.3920	4.7000	2.6e-06
b coefficient	-0.1091	0.0301	-3.6398	0.0003
Indirect effect	-0.2009	0.0698	-2.8778	0.0040
Direct effect	1.7553	0.2127	8.2515	2.2e-16
Total effect	1.5544	0.2095	7.4191	1.2e-13

Proportion of total effect that is mediated:	-0.1293
Ratio of indirect to direct effect:	-0.1145
Ratio of total to direct effect:	0.8855

Finally, Table 4.6 also confirms the mediating effect of PBTZ using bootstrapping approach. It shows confidence intervals of -0.4757 and -0.0251 for lower and upper limits respectively. The intervals do not include zero and thus establish the mediating effect.

Table 4.6: Summary Bootstrapping Approach with PBTZ as Mediator

	Lower	Upper
Total	-0.4557	-0.0251
PBTZ	-0.4557	-0.0251
Level of Confidence for Confidence Interval	95	
Number of Bootstrap Resamples	5000	

The above results show that while ROE does not mediate the relationship between liquidity risks and cost efficiency, PBTZ does. This difference is attributable to dividend policy of the Islamic banks. It will also depend on proportion of equity holders and investment account holders. Thus, while profit will be important in determining the effect of liquidity risk on cost efficiency, ROE may not because it is affected by other factors.

## 5 Summary and Conclusion

This paper provides empirical evidence of the effect of liquidity risks on cost efficiency of Islamic banks. It also shows the mediating effect of profitability measured by PBTZ on the relationship between liquidity risk and cost efficiency. The implication of this is that Islamic banks can achieve both cost efficiency and profit maximization by managing liquidity risk adequately. Thus, after controlling for initial set up cost that makes Islamic banks less cost efficient, the banks can be competitive with conventional banks in terms of profitability and cost efficiency.

The study further confirms the consistency of the three methods of mediating variables. It shows that while ROE which does not significantly affect cost efficiency, it also fails to mediate between liquidity risk and cost efficiency. However, PBTZ mediates the relationship as it also affects cost efficiency significantly.

Future research should further explore other factors that affect and mediate or moderate the relationship between cost efficiency and risk management.

## **References**

- Abdul-Majid, M., Saal, D. S., & Guiliana, B. (2010). Efficiency in Islamic and conventional banking: An international comparison. *Journal of Productivity Analysis*, 34(1), 25- 43.
- Ahmed, H. (2011, June). Risk management assessment systems: an application to Islamic banks. *Islamic Economic Studies*, 9(1).
- Alam, N. (2012). Efficiency and risk-taking in dual banking system: Evidence from emerging markets. *International Review of Business Research Papers.*, 94-111.
- Ali, S. S. (2007). Financial distress and bank failure: Lesson from closure of Ihlas Finance in Turkey. *Islamic Economic Studies*.
- Ali, S. S. (2013). State of liquidity management in Islamic financial institutions. *Islamic Economic Studies*, 21(1), 63-98.
- Alshatti, A. S. (2014). The Effect of the liquidity management on profitability in the Jordanian commercial banks. *International Journal of Business and Management*, 10(1), 62-71.
- Al-Tamim, H., Miniaoui, H., & Elkelish, W. (2015). Financial risk and Islamic banks' performance in Gulf Cooperation Council Countries. *The International Journal of Business and Finance Research*, 9(5), 103.
- Altunbas, Y., Carbo, S., Gardener, E. P., & Molyneux, P. (2007). Examining the Relationships between Capital, Risk and Efficiency in. *European Financial Management*, 13(1), 49–70.
- Arif, A., & Anees, A. (2012). Liquidity risk and performance of banking system. *Journal of Financial Regulation and Compliance*, 182-195.
- Askari, H., Iqbal, Z., Krichene, N., & Mirakhor, A. (2012). Risk sharing in finance: the Islamic finance alternative.
- Bader, M. I., Mohamad, S., Ariff, M., & Hassan , T. (2008). Cost, revenue and profit efficiency of Islamic banks versus conventional banks: international evidence using data envelopment analysis. *Islamic Economic series*, 15(2).
- Baltagi, B. (2008). *Econometrics analysis of panel data* (Fourth ed.). John Wiley & Son.
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic and statistical considerations. *Journal of personality and social psychology*, 51, 1173-1182.
- Beck, T., Demircug-Kunt, A., & Merrouche, O. (2013). Islamic vs. conventional banking: business model, efficiency and stability. *Journal of Banking & Finance*, 37(2), 433-447.
- Bhatti, M. A., & Subdrum, V. P. (2015). *Business research quantitative and qualitative methods*. Kuala Lumpur: Pearson Malaysia Sdn Bhd.
- Brown, Kym, M.K. Hassan and Michael Skully, 'Operational efficiency and performance of Islamic banks,' as chapter 7 in M.K. Hassan and Mervyn Lewis (editors), *Handbook of Islamic Banking*, Published by Edward Elgar Publishing Company, U.K. and U.S.A., April 2007

COMCEC. (2015). Financial outlook of the OIC member. Standing Committee for Economic and Commercial Cooperation of the Organization of Islamic Cooperation (COMCEC).

Daly, S., & Frikha, M. (2015). Determinants of bank performance: comparative study between conventional and Islamic banking in Bahrain. *Journal of Knowledge Economy*, 1-18.

Deelchand, T., & Padgett, C. (2009). The relationship between risk, capital and efficiency: evidence from Japanese cooperative banks. *ICMA Centre Discussion Papers in Finance DP2009-12*.

Drake, L., & Hall, M. J. (2003). Efficiency in Japanese banking: An empirical analysis. *Journal of Banking & Finance* 27 (2003).

Eljelly, A. M., & Elobeed, A. A. (2013). Performance indicators of banks in a total Islamic banking system: the case of Sudan<sup>2</sup>.

Hasan, M., & Dridi, J. (2011). The effects of global crisis on Islamic and conventional banks: A comparative study. *Journal of International Commerce, Economics and Policy*, 2(02), 163-200.

Hassan, M. K. , A. Al-Sharkas and A. Samad, “ An Empirical Study of Relative Efficiency of the Banking Industry in Bahrain,” *Studies in Economics and Finance*, Volume 22, No. 2, 2004: 40-69

Hassan, M. K., and K.A. Hussein (2003), 'Static and dynamic efficiency in the Sudanese banking system', *Review of Islamic Economics*, 14, 5-48.

Hassan, M. Kabir (2006), “The X-Efficiency of Islamic Banks,” *Islamic Economic Studies*, Volume 13, Number 2 (February): 49-77

Huber, P. J. (1967). The behavior of maximum likelihood estimates under nonstandard conditions. In *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability*. 1, pp. 221–233. Berkeley, CA: University of California Press.

Ismail, F., AbdurRahim, R., & Kadri, N. (2013). Efficiency performance of Malaysian Islamic banks. *Munic Personal RePEc Archive (MPRA)*.

Ismael, R. (2010). The management of liquidity in Islamic banks: the case of Indonesia. Durham theses, Durham University. Available at Durham E-Theses Online:. Retrieved 11 3, 2015, from <http://etheses.dur.ac.uk/550/>

Jacob, M. (2014). The effect of funding structure and liquidity on financial performance of savings and credit co-operative societies in Muranga's county, Kenya.

Kenny, D. A. (2014). Mediation. Retrieved 10 2016, from <http://davidakenny.net/cm/mediate.htm>

Laeven, L., & Majnoni, G. (2002). Loan loss provisioning and economic slowdowns: Too Much, Too Late? World Bank.

Little, T. D., Bovaird, J. A., & Preacher, K. J. (2007). Structural equation modeling of mediation and moderation with contextual factors. *Modeling contextual effects in longitudinal studies*, 1,

207-230.

Miah, M. D., & Sharmeen, K. (2015). Relationship between capital, risk and efficiency: a comparative study between Islamic and conventional banks of Bangladesh. *International Journal of Islamic and Middle Eastern Finance and Management.*, 8(2), 203-221.

Nikolaou, K. (2009). Liquidity (risk) concepts, definitions and interactions. *European Central Bank Working Paper Series No. 1008.*

Njeri, N. M. (2014). The effects of liquidity on financial performance of deposit taking microfinance institutions in Kenya. University of Kenya (Thesis).

PALEČKOVÁ, I. (2015). Estimation of banking efficiency determinants in the Czech Republic. *Journal of Applied Economic Sciences*, 10(2), 234-242.

Radic, N., Fiordelisi, F., & Girardone, C. (2012). Efficiency and risk-taking in pre-crisis investment banks. *Journal of Financial Services Research*, 41(1-2), 81-101.

Ramadan, A. H., & Chen, J. J. (2012). A mediating role of debt level on the relationship between determinants of capital structure and firm's financial performance: An application on the UK capital market. *International Research Journal of Applied Finance*, 3(1), 65-92.

Ramli, N. A., & Gilbert, N. (2016). Mediation effects of firm leverage in Malaysia: partial least squares- structural equation modeling (PLS-SEM). *International Journal of Economics and Financial Issues*, 6(1), 301-307.

Rogers, W. H. (1993). Regression standard errors in clustered samples. . *Stata Technical Bulletin*, 13, 19-23.

Saeed, M. H. (2015). Examining the relationship between operational risk, credit risk and liquidity risk with performance of Malaysian banks. UUM, OYA (Master in Banking Thesis).

Said, A. (2013a). Risks and efficiency in the Islamic banking systems: the case of selected Islamic banks in MENA region.

Said, A. (2013b). Evaluating the overall technical efficiency of Islamic banks operating in the MENA region during the financial crisis. *International Journal of Economics and Finance*, 3(2), 426-434.

Sekaran, U., & Bougie, R. (2013). *Research methods for business* (6th ed.). Chichester, West Sussex: John Wiley & Son Ltd.

Siraj, K. K., & Pillai, P. S. (2012). Comparative study on performance of Islamic banks and conventional banks in GCC region. *Journal of Applied Finance and Banking*, 2(3), 123.

Sohaimi, A. N. (2013, May 29). Liquidity risk and performance of banking system in Malaysia. Retrieved April 15, 2016, from [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2271427](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2271427).

Srairi, S. A. (2010). Cost and profit efficiency of conventional and Islamic banks in GCC countries. *Journal of Productivity Analysis*, 34(1), 45-62.

Sulaiman, A. A., Muhammad, M. T., & Samsudin, M. L. (2013). How Islamic banks of Malaysia

managing liquidity? an emphasis on confronting economic cycles. *International Journal of Business and Social Science*, 4(7).

Sutrisno. (2016). Risk, efficiency and performance of Islamic banking : empirical study of Islamic bank in Indonesia. *Asian Journal of Economic Modelling*, 4(1), 47-56.

Wahba, H., & Khaled, E. (2015). The mediating effect of financial performance on the relationship between social responsibility and ownership structure. *Future Business Journal*, 1–12.

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* , 48, 817–830.

Williams, R. L. (2000). A note on robust variance estimation for cluster-correlated data. *Biometrics*, 56, 645–646.

Wiyono, S. K., & Raymayuni, S. S. (2012). The effect of credit and liquidity risk to Islamic bank profitability with income and PLS ratio as moderating variable. *International Conference on Micro and Macro Economics Research (MME)*. Proceedings (p. 40). Global Science and Technology Forum.

Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.

World Bank. (2015). *World Bank Islamic Report*.

Wu, H.-S. (2011). How to model mediating and moderating effects. In *Workshop Series*. Center for Family and Demographic Research (CFDR).

Yahya, M. H., Junaina, M., & AbdulRazak, A. (2012). Comparative study on the level of efficiency between Islamic and conventional banking systems in Malaysia. *International Journal of Islamic and Middle Eastern Finance and Management*, 5(1), 48-62.

Zhao, X., Lynch, J., & Chen, Q. (2010). Reconsidering Baron and Kenny: Myths and truths about mediation analysis. *Journal of Consumer Research*, 37, 197–206.