



# Liquidity Risk Management – A Study of Islamic Financial Institutions in Nigeria

Tijjani Ridwanlah Adewale<sup>a</sup>, Nissar Ahmed Yattoo<sup>b</sup>

<sup>a</sup>*Ethad Associates*

<sup>b</sup>*Dept. of Islamic Economics, Banking and Finance Islamic Online University*

---

## Abstract

This paper investigates short run and long run impact of specific determinant factors on liquidity risk of Islamic Financial Institutions in Nigeria. The study employs econometric methods such as unit root tests, Auto Regressive Distributed Lag (ARDL) model and error correction model to deeply investigate the issue. The empirical findings reveal the existence of the cointegration as well as short run and long run causality relationship between the determinant factors and liquidity risk. It was also found that about 83% of the past period liquidity risk deviation are from long-run equilibrium with the determinant factors, which restore back in the current period. The research findings support short-long run economic theory and recommend development of regulatory framework as well as establishment of special purpose institutions that would manage short-long run liquidity risk of IFIs.

*Keywords:* Framework, IFIs, short run, long run, ARDL model, Error correction model, liquidity risk, determinant factors.

© IIUM Press

---

## 1. Introduction

The global Islamic financial services industry, has been recording considerable growth over the last few decades. At present, the overall global value of the industrial assets stands at USD1.88 trillion (Islamic Financial Services Industry Report, 2016). However, the blossoming of global Islamic Financial Industry, no doubt poses a number of challenges. One of these is a lack of Short-Term Financial Instruments and Institutions, which may possibly lead to liquidity problems. Therefore, there are series of research being carried out to study the impact of specific determinant factors on liquidity risk of IFIs, with the aim to establish the extent of liquidity risk associated with IFIs operations. However, attention of past research was only on the instantaneous impact of the determinant factors on the IFIs' liquidity risk without considering time in which the liquidity risk would respond to change in determinant factors. Stated differently, no past study investigates the impact of determinant factors on liquidity risk of IFIs on the basis of short-long run analysis.

Thus, the objective of this paper is to identify the short run and long run determinant factors associated with liquidity risk, as well as to examine and assess the extent of the impact of a short-long run of determinant factors on the liquidity of IFIs in Nigeria. The paper is organized as follows: section two reviews both conceptual framework and previous empirical research. Research methodology is presented in section three while empirical analysis and result are presented in section four. Section five presents the summary and discussion of the paper findings.

## 2. Literature Review

### 2.1 Conceptual framework

The conceptual framework on liquidity risk concluded that the core business of IFIs and its conventional counterparts is maturity transformation of assets and liabilities. This naturally exposes financial institutions to liquidity risk. In the literature, liquidity risk is classified in two types namely, funding liquidity and market

liquidity risk. Funding liquidity risk “is the risk that an IFIs would not be able to efficiently meet both its expected and unexpected current/future cash flows and collateral needs without affecting either daily operations or the financial condition of the IFIs” (IFSB Standard 12, 2012). It generally means incapability to settle obligations with immediacy (Drehmann & Nikolaou, 2010; Castagna & Fede, 2013). Market liquidity risk, on the other hand, is “the risk of loss arising from an inability to convert assets into cash for some expected value in order to meet obligations” (Banks, 2014). For instance, investment account holder’s funds, particularly in Islamic banks, are tied up in illiquid long-term assets, such as *ijarah* assets, or *mudharabah/musharakah* profit-sharing arrangements (Ariffin et al., 2009; Salem, 2013). This makes it very hard for Islamic financial assets to liquidate a position in a timely manner at reasonable prices and hence expose to liquidity risk.

According to Wahyudi et al. (2015), determinant factors of liquidity risk are grouped into direct and indirect sources. Direct sources come from the disruption in the pattern of cash-flow as a result of market risk, operational risk, or business risk, etc., while indirect source originates from the higher rate of delinquency, massive deposit withdrawal, asset-liabilities mismatch. The former relates to internal behaviors of an institution itself, whereas the latter is external to the industry (Banks, 2014). Institutional level variables such as financial ratios e.g. Liquidity gap, financing deposit ratio etc. and macroeconomics variables such as inflation rate, interest rate etc. are endogenous and exogenous determinant factors of liquidity risk respectively. Therefore, liquidity risk is a consequential risk; it is a dependent variable, which cannot exist in and on its own. It appears when there is a total distortion in the cash flow due to operational risk, credit and market risk (Salem, 2013) that sometimes rooted from the macroeconomics variables as well as when financial ratios go beyond threshold level.

## 2.2 Empirical Research Evidences

Table 1 summarizes empirical studies related to the impact of specific determinant factors on liquidity risk of IFIs.

Table 1: Summary of past empirical research

Names	Sample Population	Methods	Findings
Akhtar, Ali & Sadaqat, (2011)	Twelve conventional and Islamic banks in Pakistan	multivariate regression models.	Return on assets and capital adequacy positively significant relation with liquidity risk. Size of bank and net working capital are positively insignificant
Ariffin, (2012)	Malaysia banks. 2006 to 2008	descriptive statistics	Return on assets and return on equity have insignificant correlation with the banks' liquidity risk.
Anam, Hassan, Huda, Uddin & Hossain., (2012)		Descriptive statistics and regression analysis	In the Islamic banks model, Net working capital and return on equity have an inverse relationship with the liquidity risk whereas sizes of the bank, capital adequate ratio, and return on assets have positively influenced the liquidity risk. Size of the bank is most influencing while return on equity is the least in determining liquidity risk.
Muhammad, Muhammad & Samsudin, (2013)	dynamic panel data estimation for 17 Islamic banks from 1994 to 2009 in Malaysia.	applied GMM estimation	Macroeconomic variables such as Gross domestic product and money supply have negative correlation and Inflation has positive correlation with liquidity. Other variables such as total financing and total assets have a negative relationship with

Jedidia and Hamza, (2015)	60 Islamic banks liquidity in the Middle East & North Africa Region and southern Asian countries (2004-2012).	data dynamic panel data estimation & GMM estimator	liquidity. The research found consistency between the theory of “too big to fail” and the size of the bank.  Only Return on assets positive and significant relationship with bank liquidity risk. Capital adequacy and investment ratio have negative significant relationships with liquidity risk. More so, the bank size and gross domestic products have no significant relationship with liquidity risk.
Rahman & Banna, (2015)	banks’ annual report of medium size Islamic and conventional banks in Bangladesh from 2007 to 2011.	Correlation matrix and Linear regression model	The size of the bank, net-working capital and return on assets have positive but insignificant correlation in case of an Islamic banks. Return on assets are positively correlated with conventional banks’ liquidity risk, but network capital is negatively related.

Based on the foregoing reviewed of previous empirical research on liquidity risk, it is safe to say that these findings do not reflect the impact of determinant factors on liquidity risk of IFIs on the bases of short-long run analysis. In economics sense, it is very rare to find the instantaneous dependence of a variable to another variable without allowance of time (Gujatai & Porter, 2009; Studenmund, 2016). The responsiveness of liquidity risk to its determinant factors is of this nature. According to Gujatai & Porter, (2009), psychological, technological and institutional reasons immensely contribute to the responsiveness of one variable to another variable. In this regard, this study fills existing literature the gap.

### 3. Methodology

#### 3.1 Hypotheses and Data Sources

Based upon the previous research and literature gap, following research hypotheses are developed:

*H0: there is no short-long run cause and effect relationship between liquidity risk and determinant factors. Examined variables FDR, LG, WCR, INFR and MRR*

*H1: there is short-long run cause and effect relationship between liquidity risk and determinant factors. Examined variables FDR, LG, WCR, INFR and MRR*

The above hypotheses are to be tested against monthly analytical balance sheet of Non-interest bank collected from the Central Bank of Nigeria (CBN) statistics database together with the data on macroeconomics variables for the fifty-five months starting from January 2012 to July 2016. More so, the study chooses five independent variables; three from core institutional variables namely, Financing Deposit Ratio (FDR), Liquidity Gap (LG) and Working Capital Ratio (WCR). The rest are from the macroeconomics variables; Inflation (INFR) and Interest rate (MRR).

#### 3.2 Model Specification

This study adopts Autoregressive Distributive Lag (ARDL) model to find the relationship between liquidity risk and determinant factors. The ARDL cointegration approach was developed by Pesaran and Shin in 1999 and a further extension was made by Pesaran et al., in 2001. There are three distinctive features of ARDL model from other bound tests techniques. Firstly, unlike other traditional co-integration methods, which require the same order of integration of the data, this model can be applied to a different order of integrations such I(0), I(1) and fractionally integration order with the exclusion of I(2) order of integration. Secondly, it

can also be adopted for small and finite sample size data efficiently. Thirdly, the estimates derived from ARDL approach are unbiased and efficient estimates since the problem of serial correlation and endogeneity is totally eliminated (Harris and Sollis, (2003); as cited in Jenkins & Katircioglu, (n.d.)). Furthermore, like highlighted empirical research evidence in the literature section, the model specification for liquidity risk usually follows linear model as follows:

$$LQR_t = \alpha_0 + \beta_2(LGR)_{t-1} + \beta_3(INFR)_{t-1} + \beta_4(FDR)_{t-1} + \beta_5(MRR)_{t-1} + \beta_6(WCR)_{t-1} + v_t \quad (1)$$

Where:

LQR represents independent variable of liquidity risk  
 $\alpha$  denotes intercept coefficient,  
 $\beta$  values represent the parameters of the explanatory variables  
 $v_t$  represents the value of the error term.

Other variables such as financing to Liquidity gap (LG), Deposit ratio (FDR), Working Capital Ratio (WCR) and Inflation (INFR), Interest Rate (MRR) represents specific bank independent variables of determinant factors and specific macroeconomics variables respectively.

Equation (1) above is re-parameterized to obtain a conditional version of ARDL model specification in order to drive short run and long run relationship between the liquidity risk and its determinant factors as follow:

$$\begin{aligned} \Delta(LQR)_t = & \alpha_0 + \sum_{i=1}^p \phi_i \Delta(LQR)_{t-i} + \sum_{i=0}^p \theta_i \Delta(LGR)_{t-i} + \sum_{i=0}^p \lambda_i \Delta(INFR)_{t-i} + \\ & + \sum_{i=0}^p \rho_i \Delta(FDR)_{t-i} + \sum_{i=0}^p \varphi_i \Delta(MRR)_{t-i} + \sum_{i=0}^p \tau_i \Delta(WCR)_{T-1} + \beta_1(LQR)_{t-1} + \beta_2(LGR)_{t-1} + \\ & \beta_3(INFR)_{t-1} + \beta_4(FDR)_{t-1} + \beta_5(MRR)_{t-1} + \beta_6(WCR)_{t-1} + v_t \end{aligned} \quad (2)$$

Where:

$\Delta$  represents first-difference operator  
 $p$  represents the optimal lag length.

Equation (2) is an ARDL order of  $(p_1, p_2, \dots, p_n)$  and shows the explanation of IFIs liquidity risk with its previous value and value of its determinant factors.

Thus, long run relationship is derived from the equation (2) above on the following ARDL model:

$$\begin{aligned} (LQR)_t = & \alpha_0 + \sum_{i=1}^p \phi_i (LQR)_{t-i} + \sum_{i=0}^p \theta_i (LGR)_{t-i} + \sum_{i=0}^p \lambda_i (INFR)_{t-i} + \sum_{i=0}^p \rho_i (FDR)_{t-i} \\ & + \sum_{i=0}^p \varphi_i (MRR)_{t-i} + \sum_{i=0}^p \tau_i \Delta(WCR)_{T-1} + v_t \end{aligned} \quad (3)$$

And lastly, short run dynamic coefficient is established by constructing an error correction model (ECM) of the following form:

$$\begin{aligned} \Delta(LQR)_t = & \alpha_0 + \sum_{i=1}^p \phi_i \Delta(LQR)_{t-i} + \sum_{i=0}^p \theta_i \Delta(LGR)_{t-i} + \sum_{i=0}^p \lambda_i \Delta(INFR)_{t-i} + \sum_{i=0}^p \rho_i \Delta(FDR)_{t-i} \\ & + \sum_{i=0}^p \varphi_i \Delta(MRR)_{t-i} + \sum_{i=0}^p \tau_i \Delta(WCR)_{T-1} + \psi ECT_{t-1} + v_t \end{aligned} \quad (4)$$

Where:

$\Delta$ : represents difference operator

$\psi$ : represents a speed of adjustment parameter and its coefficient value ranging from -1 and 0.

ECT: represents lagged error correction term derived from verified long run equilibrium relationship, which must be negative and significant simultaneously to show the existence of causality in the long run otherwise no causality is feasible. More so, a statistical significant of ECT $t-1$  implies long causality from all the independent variables to the dependent variable.

The above model specification is carried out using EVIEW software as follows: The paper employed two categories of Unit root tests namely, DF-GLS and Zivot-Andrew, to standardize the data stationarity processes. The lags order (past values) are chosen based on Akaike information criteria as it was the best that returns minimum values in order to determine the optimal structure for ARDL model specification. Thereafter, the co-integration test was carried out and, F statistic was used to establish existence of cointegration or otherwise. To do so, hypotheses are specified as follows: null hypothesis is that there is no cointegration in the variable and is denoted as:

$H_0: \phi_1 = \theta_2 = \lambda_3 = \rho_4 = \varphi_5 = \tau_6 = 0$  against the alternative hypothesis that there is cointegration in the variables denoted as  $\neg$

$H_1: \phi_1 \neq \theta_2 \neq \lambda_3 \neq \rho_4 \neq \varphi_5 \neq \tau_6 \neq 0$

The F statistic has upper and lower critical value for I(0) series and I(1).series The decision rule here is that if the calculated F-statistic is higher than the upper bound critical value, the evidence goes against the null hypothesis that is no co-integration. If the calculated F-statistic is in-between the bound, the test is inconclusive. Then if the cointegration is found, short run and long run relationship were carried out using equation 3 and 4. Lastly, CUSUM and CUSUMQ were carried out to check the stability of research model and various diagnostic tests such as serial autocorrelation, heteroscedasticity, model specification errors and normality tests to check robustness of the model.

## 4. Empirical Analysis and Results

### 4.1 Unit Root Test

The hypothesis test is:

$H_0$ : Unit root (there is stationary) (Null)

$H_1$ : Unit root (there is no stationary) (Alternative)

The decision rule is to reject the null hypothesis ( $H_0$ ) if the computed test statistic is more than critical value at a 5% level in absolute terms together with the significant p-value. Contrarily if test statistic has a lower value than the critical value, the null hypothesis cannot be rejected. The data is non-stationary. Table-2 shows the result of the tests. The absolute critical values are lower and higher than computed test statistic at all the significant levels at level and first difference respectively in the both tests with the exception of MRR at level. Based on this result null hypothesis of all variables cannot be rejected except for MRR rather alternative hypothesis is rejected at level. However, null hypothesis is rejected and alternative hypothesis is accepted at first difference under DF-GLS Unit Root Test. In the Zivot Andrews Unit Root Test.

Moreover, in an attempt to standardize the process of stationary, Zivot Andrews Unit Root Test was considered in order to avoid the problem of unit root test without a break, which may report the spurious result. In the table-2, all the variables contain unit root except MRR and WCR at all level contrary to the above unit tests, which reported only MRR without unit roots. Furthermore, there is a significant break in the LQR as shown by Zivot Andrews unit root in table-3 in 2015 M1 and 2014 M5.

Table 2: Unit Root Test

Variable	DF-GLS Unit Root Test Statistics		Zivot Andrews Unit Root Test Statistic			
	Level	First Difference	Level	BREAK DATE	First Difference	BREAK DATE
	LQR	-1.891521	-6.592914	-3.096977	2015M1	-7.043389
FDR	-2.734202	-6.523543	-3.751613	2015M02	-6.878307	2015M08
LGR	-2.208821	-7.419464	-3.971899	2015M02	-8.123095	2015M08
INF	-0.533835	-6.665783	-1.790249	2015M10	-7.703291	2015M08
MRR	-4.024243		-5.687218	2015M06	-7.043389	2014M05
WCR	-2.597836	-6.592914	-6.101703	2014M10		

Source: Author's compilation and estimated values from Eviews

## 4.2 Co-integration Test

ARDL bounds testing approach investigates the cointegration relationship between the variables. This co-integration was estimated by using equation (2). Table-3 shows the result of Co-integration. The result records higher value of computed F- statistic value of 4.563998 over critical value at all significant levels. The null hypothesis is rejected. In our investigation, there is cointegration between liquidity risk and specific determinant factors. This rejects the hypotheses that there is no cause-effect between determinant factors and liquidity risk in the long run. So, the study accepts the alternative hypothesis i.e. the existence of cointegration. Co-integration means that causality exists between liquidity risk and determinant factors; however, no direction of the causal relationship is indicated. More specifically, ARDL bound test is a unidirectional test. It does not specify the direction of the causation. However, the theory has proved that the direction comes from determinant factors to liquidity risk; not vice versa.

Table 3: Co-integration Test

Test statistic	Value	lag	Significance level	Bound Critical values* (restricted intercept and no trend)	
F-statistic	<b>4.563998</b>	6		I(0)	I(1)
			2.5%	2.96	4.18
			5%	2.62	3.79
			10%	2.26	3.35

Source: Author's compilation and estimated values from Eviews

## 4.3 Long Run Model

Equation (3) establishes co-integration between liquidity risk and determinant factors. Table-4 shows the liquidity risk elasticity. In the long run, all the determinant factors have expected sign except FDR, which has a negative sign and significant at 5% level of significant 0.0159. LGR p-value 0.0508 is slightly high above the 5% level of significant but significant at 10% level. Furthermore, the long-run elasticity of determinant factors such as MRR, INFR, and WCR is statistically insignificant at all levels of significant and their coefficients values are 0.023941, 0.019621 and -0.02392 respectively. This means that despite the existence of a relationship between liquidity risk and determinant factors, in the long run, IFIs is so stable to the extent that all these specific determinant factors do not hurt them. This could be possibly accounted for due to many liquidity risks management frameworks put in place by the IFIs itself and the relevant regulatory agencies. This was confirmed by a study undertaken by Ariffin (2012) who confirmed the insignificance of ROA and ROE due to the introduction of liquidity framework by Bank Nagara Malaysia.

Table 4: Long Run Coefficients<sup>1</sup>

<i>DFDR</i>	<i>DLGR</i>	<i>DINF</i>	<i>DMRR</i>	<i>DWCR</i>
-0.47478*	0.408839**	0.019621	0.023941	-0.02392
(0.0159)	(0.0508)	(0.208)	(.9108)	(0.223)

Source: Author's compilation and estimated values from Eviews

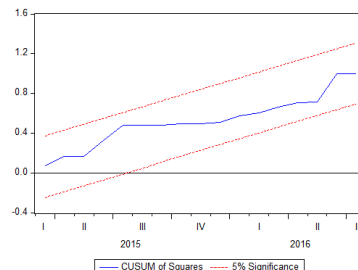
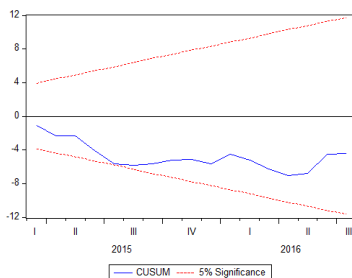
#### 4.4 Short-Run Model

Equation (4) was used to estimate short-run dynamics between liquidity and determinant factors, and table-6 presents the results of the ARDL (5,4,6,0,5,6) Model, which is selected on the basis of AIC. The results show that almost all the variables elasticity and their lag are statistically significant at all levels of significance with the exemption of the Working Capital Ratio, which is insignificant at its lag 3 and 4-period elasticity, but statistically significant at its other lag period elasticity. Thus, the overall result of short-run dynamic analysis supports the economics theory that in the short run the firm would not be able to vary its fixed cost. In this case, determinant factors can greatly cause more harm to the IFIs liquidity position in the short run.

More so, the error correction term is negative as expected and statistically significant at all level of significant. The ECT coefficient is -0.8306. This implies that the system is correcting about 83% of the previous period disequilibrium back monthly. The implication of this is that it would only take liquidity risk less two months to adjust and restore back to its long run equilibrium with the determinant factors. Furthermore, according to Banerjee et al. (1998) a highly significant ECT validates the stable long-run relationship between liquidity risk and determinant factors. Our model is not suffering<sup>2</sup> from diagnostics tests such as serial autocorrelation, Heteroskedasticity, model specification errors and passes the normality test as well as CUSUM and CUSUMQ stability test at 5% level of significance.

Table 5: Error Correction Model Result<sup>3</sup>

YR	DLQR	DLGR	DMRR	DINF	DFDR	DWCR
(0)	-0.0202 (0.8970)	0.1810 (0.0048)	-0.1875 (0.0007)	0.0085 (0.4759)	0.1101 (0.0078)	0.0170 (0.0001)
(-1)	0.1789 (0.2910)	0.2084 (0.0004)	-0.1735 (0.0053)		0.2158 (0.0016)	0.0048 (0.3669)
(-2)	0.1705 (0.3140)	0.1661 (0.0002)	0.17909 (0.0193)		0.2268 (0.0003)	0.0104 (0.0540)
(-3)	-0.1960 (0.1667)		-0.1777 (0.0142)		0.1851 (0.0002)	0.0075 (0.1130)
(-4)			-0.1333 (0.0270)		0.1810 (0.0000)	0.0048 (0.2324)
(-5)			0.1333 (0.0077)			0.0099 (0.0018)



<sup>1</sup> Note: p-values in parentheses, \* significant at 5% level and \*\* significant at 10% level.

<sup>2</sup> Jarque Bera =0.428285 [0.807233]; LM serial autocorrelation = 2 [0.1117]; LM Heteroskedasticity = (X2) 31 [0.1133]; White Heteroskedasticity = (X2) 31 [0.5111]; Ramsey RESET = 16 [0.504]

<sup>3</sup> Note: CointEq(-1) 0.8306(0.0000); Constant -007421(0.3129); Coefficients value and p-values in parentheses.

## 5. Summary and conclusions

This paper investigated the short run and long run dynamic between specific determinant factors on liquidity risk of IFIs in Nigeria by using monthly time series data from January 2012-July 2016 by employing unit root test, ARDL Model approach and error correcting model (ECM). In the short run, we found the all investigated variable highly significant both at all lag periods and all level of significant. This is the evidence of the causality between the determinant factor and liquidity risk in the short run.

The long run analysis demonstrates the significant existence of long run equilibrium causality between determinant factors and liquidity risk supported by error correction model (ECM) multiplier of 83%. That is, the speed of adjustment from the previous liquidity risk is 83% which means that disequilibrium from the immediate past month would only take less than two months to restore back into equilibrium. That is, IFIs would able to restore 83% of its past month's liquidity risk in the current month.

The overall research findings would assist IFIs' risk managers and policy makers in Nigeria in developing and establish policies, regulations, and institutions that would manage a short run and long run negative impact of determinant factors on liquidity risk of IFIs. In conclusion, as the research collected data from a single bank; Jaiz International Bank Plc, with considerable variables, this should be overcome in the future research by including more IFIs together with more variables as well as comparison between IFIs and conventional Financial Institutions in order to arrive at more interesting findings for the development of liquidity risk management framework in Nigeria.

## References

- Ahmed, O. S. (2003). Islamic Financial Instruments to Manage Short Term Excess Liquidity. Islamic Research and Training Institute Jeddah. Research paper 41.
- Akhtar, M. F., Ali, K., & Sadaqat, S. (2011). Liquidity risk management: a comparative study between conventional and Islamic banks of Pakistan. *Interdisciplinary Journal of Research in Business*, 1(1), 35-44.
- Akkizidis, I., & Khandelwal, S.K. (2008) Financial risk management for Islamic and finance. UK. Palgrave Macmillian. DOI:10.1057/9780230598751
- Anam, S., Hasan, S. B., Huda, H. A. E., Uddin, A., & Hossain, M. M. (2012). Liquidity risk management: a comparative study between conventional and Islamic banks of Bangladesh.
- Banks, E. (2014). *Liquidity risk: Managing funding and asset risk* (2nd ed.). UK. Palgrave, Macmillan.
- Castagna, A., & Fede F. (2013). *Measuring and managing liquidity risk*. The United Kingdom. John Wiley & Sons Ltd.
- Drehmann, M., & Nikolaou, K. (2010). Funding Liquidity Risk: definition and measurement. Working paper series, NO. 1024. European Central Bank.
- Gujatai, D.N., & Porter, D.C. (2009). *Basic Econometrics* (5th ed.). New York. McGraw-Hill Irwin Companies, Inc.
- IFN Country Analysis – Nigeria. (2016 April, 27). Nigeria: Promising Progress. Malaysia: REDmoney.
- IFSB Standard-12., Malaysia. (2012). *Guiding Principles on Liquidity Risk Management for Institutions (other than Insurance institutions) offering only Islamic Financial services Islamic*.
- Jedidia, K., and Hichem, H. (2010). Determinants of Liquidity Risk in Islamic Banks: A Panel Study. *Islamic Management and Business* 7(16), 137-146.
- Jenkins, P. H., & Katircioglu, S. T. (n.d). The bound test approach for cointegration and causality between financial development, international trade, and economic growth: The case of Cyprus.
- Khan, T., & Ahmed, H. (2001) Risk management: An analysis of issues in Islamic financial industry. Jeddah, Saudi Arabia. Islamic Research and Training Institute, Islamic Development Bank. Occasional paper (5).
- Mohd Ariffin, N. (2012). Liquidity risk management and financial performance in Malaysia: empirical evidence from Islamic banks. *Aceh International Journal of Social Sciences*, 1(2), 77-84.
- Nikolaou, K. (2009). *Liquidity Risk Concepts: Definitions and Interactions*. Working paper series No 1008. European Central Bank.
- Pesaran, M.H., & Pesaran, B. (1997). *Working with Microfit 4.0 Interactive Econometric Analysis*, Oxford.Oxford University Press.



- Salem, R. A. (2013). Risk management for Islamic Banks. U.K: Edinburgh University Press Ltd.
- Studenmund, A.H., & Johnson, B.K. (2016). Using econometrics: A practical guide (7th ed.). New York: Pearson education Limited.
- Wahyudi, I., Rosmanita, F., Prasetyo, M.D., & Putri, N.S. (2015). Risk management for Islamic banks: recent developments from Asia and Middle East. The United Kingdom. United Kingdom: John Wiley & Sons Ltd.