MANAGING THE DEMAND AND SUPPLY OF LIQUIDITY IN ISLAMIC BANKING

(Case of Indonesia)

Rifki Ismal
PhD Student in Islamic Banking and Finance
School of Government and International Affairs
Durham University (United Kingdom)

Abstract

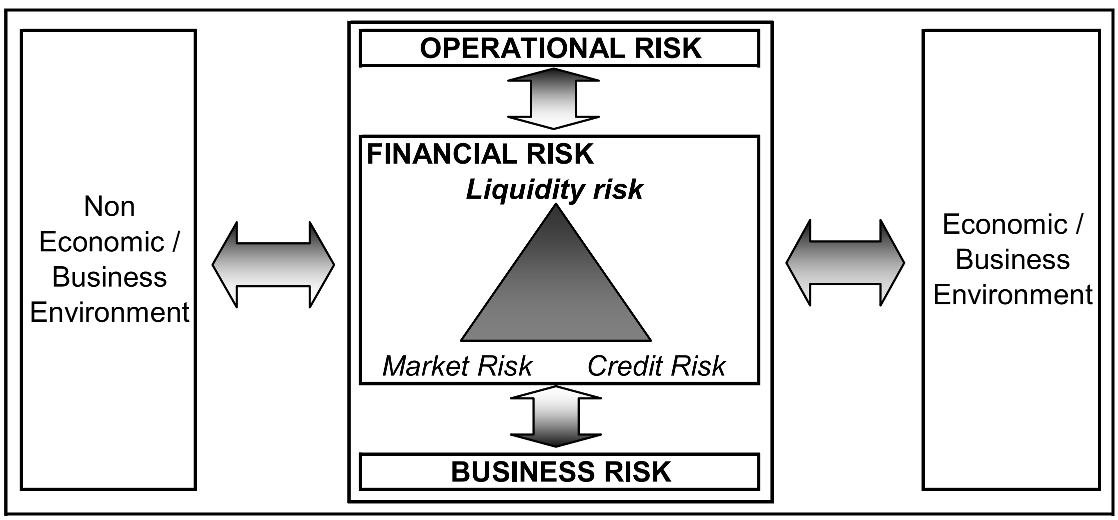
This paper attempts to assess the demand and supply of liquidity in Islamic banks. Firstly, it starts by identifying the sources of short-term demand and supply of liquidity. Secondly it assesses the historical performance of the bank to manage liquidity. Thirdly this paper predicts the short-term future performance and investigates the resiliency of the industry against any liquidity pressure. ARIMA models are used for such purposes particularly to produce the estimated numbers. The paper finds that the industry has historically managed the liquidity very well. Nevertheless, the resiliency against liquidity pressures is not strong enough because it does not perform well when the irregular demand of liquidity or liquidity run occurs. As such, this paper suggests to Islamic banks to strengthen their liquid instruments, improve the liquidity management, business operations and further educate the Islamic banking principles to the public.

Keywords – ARIMA, Wadiah, Mudarabah, Cash reserve
Paper type – Research paper

1. BACKGROUND

As financial institution, banks should manage the demand and supply of liquidity in an appropriate manner in order to safely run its business, maintain good relations with stakeholders and avoid liquidity risk problem. Liquidity risk commonly happens because of failures in management of funds or unfavorable economic conditions which lead to unpredictable liquidity withdrawals by depositors. Indeed, maintaining a robust liquidity management is very challenging and difficult in a competitive and open economic system with strong external influences and sensitive market players (see figure 1). In fact, the failures of banks[1] in the current global financial environment occurred due to insufficient liquidity management system solving adverse circumstances (Goldman, 2007).

Figure 1. Interconnections among Risks and Affecting Environment



Source: Combination of Arani (2006), Moreno (2006), Sach (2007) and Zhu (2001), with modifications.

Theoretically, liquidity risk arises when depositors collectively decide to withdraw more funds than the bank has immediately on hand (Hubbard, 2002, p. 323). Simply stated, liquidity risk management is the risk of being unable to raise funds without incurring unusually high costs (Moreno, 2006:74). Hence, liquidity risk applies symmetrically to borrowers in their relationship with banks[2] and to banks in their relationship to depositors[3] (Greenbaum and Thakor, 1995, p. 137).

Practically, the banks regularly find the liquidity imbalances between asset and liability side that needs to be equalized because by nature banks issue liquid liabilities but invest in illiquid assets (Zhu, 2001, p. 1). Hence, the ability of the bank to assess and manage the demand and supply of liquidity is very imperative to maintain the continuity of banking operations.

Figure 2 lists factors that may possibly lead to liquidity problems. Internal banking factors are those coming from the routine operation of the bank and some efforts may be applied to improve them. Meanwhile, the external banking factors are those coming from macroeconomics factors or depositors' behaviors which are difficult to be controlled by banks.

Figure 2. Internal and External Banking Factors Leading to Liquidity Problems

Internal Factors	External Factors
High off-balance sheet exposure	Very sensitive financial market and depositors
Rely heavily on short-term corporate deposit	External and internal sudden economic shocks
A gap in asset liability maturity date	Low economic performances
Rapid asset expansion exceeding liability side	Decreasing trust to banking sector
Short-term deposit concentration	Non economic factors (political unrest, etc).
Less allocation in liquid government instruments	Sudden cash needed for project financing
No incentive offered in long term deposit	Government's need for external obligation purpose

Source: Adapted and modified from Mirakhor and Iqbal (2007), Antonio (1999), Alsayed (2007) and Tariq and Ali (2005)

This paper attempts to assess demand and supply of liquidity in the Indonesian Islamic banking industry. Firstly, it starts by identifying the sources of short-term demand and supply of liquidity. Secondly, it examines the historical performance of the bank in managing demand and supply of liquidity. Thirdly, it predicts the short-term future performance of liquidity management and investigating the resiliency of the industry against liquidity pressure. By using Autoregressive Integrated Moving Average (ARIMA) to model the historical Islamic banking data from December 2000 to August 2009, the estimated numbers are produced to be able to assess the future performance and the resiliency of the industry. Finally, some findings are generated and suggestions are given to maintain the future performance of the industry.

2. SHORT TERM DEMAND FOR LIQUIDITY

There are three main sources of fund in Indonesian Islamic banking industry namely: (1) Wadiah demand deposit; (2) Mudarabah saving deposit and; (3) Mudarabah time deposit. With demand deposits, Islamic banks obtain an explicit or implicit authorization to use it for whatever purpose permitted by sharia, but do not guarantee return or profit to investors (Obaidullah, 2005, p. 49). Meanwhile, with Mudarabah saving deposits and Mudarabah time deposits, Islamic banks can actively use them and share risks with the investors without any voting rights (Grais and Pellegrini, 2006, p. 1). Hence, in relation to liquidity risk management, these three deposits require adequate liquidity reserves to be maintained by the banks.

The short-term demand for liquidity may come from Wadiah demand deposits. This is the most unpredictable deposit accounts since depositors may take out their money anytime without prior notice to the banks. In this sense, an Islamic bank has to accurately predict how much the potential regular liquidity withdrawals are. Historically, based on data from December 2000 into Aug 2009, the average depositors' withdrawals are 8.89% per month. The next short-term demand for liquidity may come from Mudarabah saving deposit. This deposit is less predictable because there is also no requirement for depositors to inform the bank if they want to take some cash. Data points out the average of 5.39% withdrawals per month of this deposit.

Finally, the last demand for short-term liquidity may appear from the short-term maturity of Mudarabah time deposit. Nonetheless, dissimilar with the previous two, Mudarabah time deposit is the most predictable account. Islamic bank may exactly know the demand for short-term liquidity from the tenor and maturity date of such deposit. In this case, some of the depositors place funds in a 1-month tenor (19.53% of total deposits) with automatic roll over (ARO) (Ismal, 2009, p. 7). Moreover, data recognizes only 11.84% termination of this tenor of time deposits, the rest of them are always rolled over.

The identification of the sources of short-term demand for liquidity is the basis to compute both historical and future demand for liquidity in the following sections. The former will explain the performance of Islamic banks in managing liquidity whilst the later, with ARIMA models, will identify any potential liquidity pressure as a result of greater demand for liquidity from depositors than the available liquidity held by the banks.

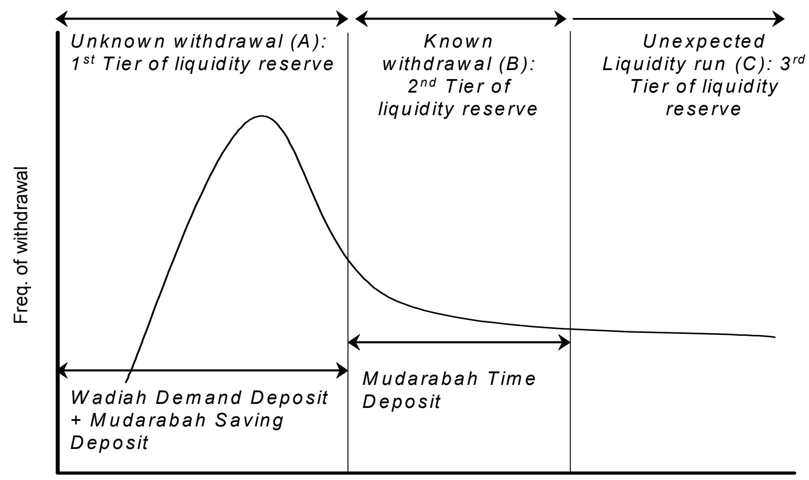
3. SHORT TERM SUPPLIERS OF LIQUIDITY

Following the three sources of short-term demands for liquidity, there are sets of short-term suppliers of liquidity to fulfill any regular or irregular demand for liquidity. For simplicity, such suppliers are grouped into the 1st, 2nd and 3rd tier liquid instruments based on its function (see figure 3). First of all, any unpredictable liquidity withdrawals from Wadiah demand deposit and Mudarabah saving deposit is served by the 1st tier liquid instruments which are (a) Cash reserves; (b) Placement of funds in Bank Indonesia (BI) and; (c) Borrowing from Islamic money market (PUAS).

Then, combining the liquid instruments in the 1st tier with the other three instruments creates the 2nd tier liquid instruments prepared to tackle any demand for liquidity from the termination of 1-month Mudarabah time deposit. Those three liquid instruments are: (i)

Withdrawing the inter bank placement and (ii) Repurchasing Bank Indonesia Sharia Certificate or SBIS (formerly named as BI Wadiah Certificate or SWBI) to BI and (iii) Withdrawing the equity participation. Finally, in the case of liquidity run, the 1st and the 2nd tiers above are coupled with the 3rd tier containing (a) Central bank's intra day emergency funds (FLI/FPJP) (b) Deposit Guarantee Institution (LPS) and (c) Bank's capital. All of it is figured in area A, B and C of figure 3.

Figure 3. Short Term Liquid Instruments



Source: taken from Arani (2006), Promoting Islamic Financial Stability Through Risk Management Techniques in IFS. Presentation in The 2nd SEACEN-IRTI Course on Regulation and Supervision of Islamic Banks, Jogjakarta

3. 1. Suppliers of Liquidity for Withdrawals in Wadiah Demand Deposits and Mudarabah Saving Deposits

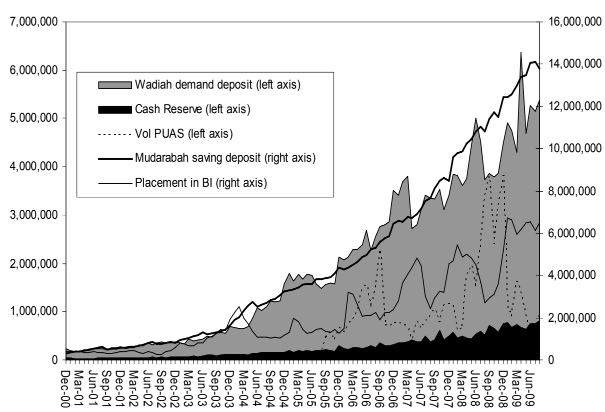
The first instrument used by Islamic banks to serve regular and short-term liquidity withdrawals from both Wadiah demand deposits and Mudarabah saving deposits are cash reserves. Islamic banks reserved 1.98% of their total deposits in this instrument (average data from December 2000 to August 2009). If the demand exceeds stock of cash reserves, banks will use the second instrument namely placement of funds in BI which consists of reserve requirement and excess reserves. Islamic banks allocate 19.13% of total deposits into these two liquid instruments.

If demand for liquidity still goes beyond cash reserves and placement of funds in BI, borrowing funds from PUAS by using the IMA instrument is the next alternative. This is the tradable instrument and the quickest way of getting instant liquidity although it needs a strong cooperation among Islamic banks. Further, its amount is counted 2.57% of total deposits. As displayed in figure 4, the 1st tier liquid instruments have settled down any withdrawal from both accounts.

3. 2. Supplier of Liquidity for Withdrawals in Mudarabah Time Deposit

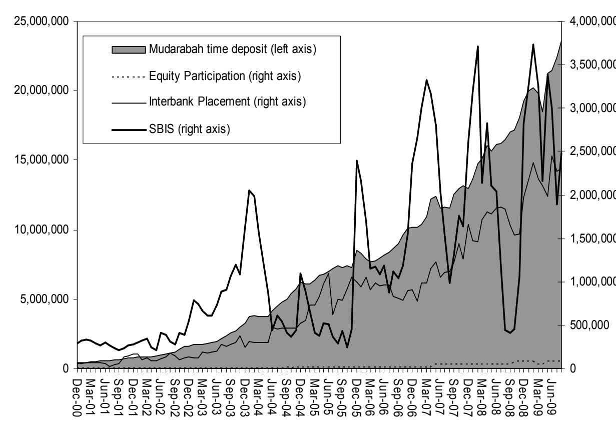
If liquidity demand is added with the withdrawals from Mudarabah time deposits, the 2nd tier liquidity reserves are available to provide extra liquidity. Besides instruments in the 1st tier, withdrawing the inter bank placement supplies additional liquidity. This is actually a short-term allocation of Islamic bank's funds into other banks readily to be taken when needed. Its amount is recorded 5.80% on average of total deposits. If it is still not enough, alternatively, Islamic banks may repurchase their funds in SBIS to BI. SBIS is actually functioning as Islamic monetary instrument to absorb short–term excess liquidity in the industry. Thus SBIS gives direct return to banks. Nonetheless, for banks, SBIS functions as a liquid instrument to fill out liquidity needs by repurchasing it to BI. In proportion to total deposits, SBIS only dominates 12.98%.

Figure 4. The 1st Tier Liquid Instruments



Source : Bank Indonesia (www.bi.go.id/statistics)

Figure 5. The 2nd Tier Liquid Instruments



Source : Bank Indonesia (www.bi.go.id/statistics)

Finally, a small portion of another supplier of liquidity namely equity participation can be executed to strengthen the role of the 2nd tier of liquid instruments when needed. This instrument records 0.10% of total deposits. As such, the 2nd tier liquid instruments offer liquidity equivalent to 42.57% of total deposits (see figure 5).

3. 3. Suppliers of Liquidity in Liquidity Distress

When the needs for short-term liquidity still surpass liquidity prepared above, Islamic banks can use the last option which is the 3rd tier liquid instruments. First of all is using

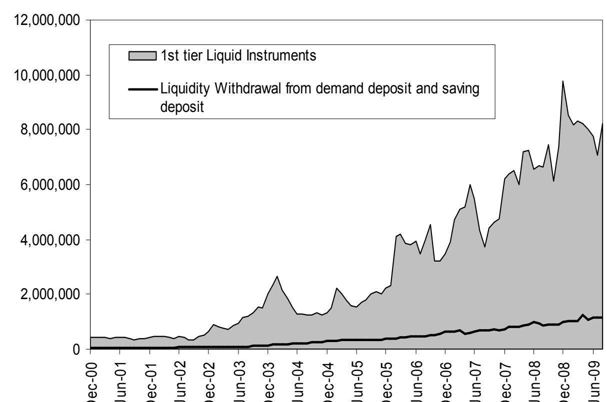
FLI/FPJP. Although it requires some specific pre-requisite from the monetary authority, this is the instant way to gain the on the spot liquidity. Secondly, Islamic banks can also use their capital as long as it does not violate the capital adequacy ratio (CAR) requirement. Finally, contacting government institution (LPS) may guarantee depositors' funds in the banks.

So far, fortunately, Islamic banks rarely use the 3rd tier liquid instruments because they can balance a growing trend of deposits and high demand of financing from the real sector. Moreover, the market share is around 2% of the total banking industry and its interactions, operations, etc are not as complicated as the conventional counterparty. Islamic depositors on the other hand also show strong motivation and religious intention to deal with the banks and seem far away from rushing the banks for some unrealistic and non Islamic reasons (speculation, etc).

4. HISTORICAL PERFORMANCE OF THE SHORT TERM LIQUIDITY MANAGEMENT

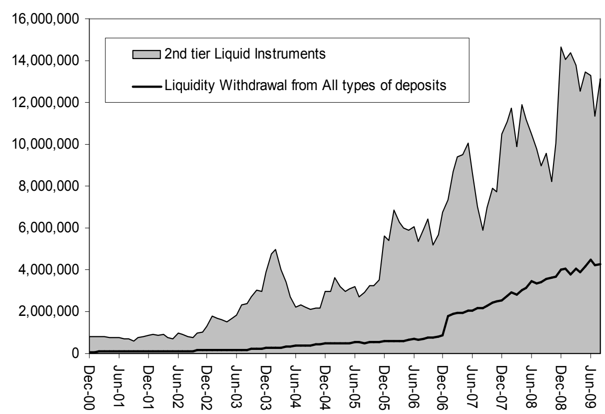
The historical performance of the 1st and 2nd tier to provide the requested liquidity to depositors has been quite successful. The total amount of short-term liquid instruments stands above the demand for liquidity. Figures 6 and 7 below prove this point.

Figure 6. The 1st Tier and Liquidity Demanded



Source : Bank Indonesia (www.bi.go.id/statistics)

Figure 7. The 2nd Tier and Liquid Demanded



Source : Bank Indonesia (www.bi.go.id/statistics)

Nonetheless, this performance may not possibly apply if:

a) Severe economic pressures hit the country followed by very tight monetary policy like the one occurred in 1997/1998. When interest rate is high, some of Islamic banking depositors tend to switch their deposits to the conventional banks for a higher interest rate return.

b) Islamic banks are proven to be un-Islamic and do not have either proper banking facilities or services. Up to now, Indonesian Sharia Scholars (Majelis Ulama Indonesia/MUI) has strictly guided the operation of Islamic banking to prevent it from non compliant activities. Further, there is a mutual cooperation between Islamic windows and their parent banks to arrange office channeling[4] to reach more depositors.

c) Islamic banks do not implement short-term financing orientation. Due to the characteristics of the deposits and depositors (short-term, continuous and positive expectation of profit), Islamic banks play safe by advancing most of the funds in the short-term, safe, liquid and pre-determined financing instruments.

The next part of this paper will investigate the future trend of short-term liquidity demand. Technically, every liquid instrument and deposit will be modeled and forecasted with ARIMA model. At the end, the future performance of short-term liquidity management will be checked and analyzed particularly for the next two years.

5. FUTURE PERFORMANCE OF THE SHORT TERM LIQUIDITY MANAGEMENT

5. 1. Autoregressive Integrated Moving Average (ARIMA)

In order to assess the future performance of liquidity management and analyze the resiliency of the industry, the estimated numbers are generated with ARIMA model. ARIMA was firstly developed by Box and Jenkins in 1976. Unlike structural model which composes of some independent variables, ARIMA employs autoregressive (AR) and moving average (MA) plus integration order term. AR(p) is describing dependent variable (Y_t) based on its past (lag) value (of order p) or the same as dynamic model. AR is also commonly said as the one uses lag value of the residual of the regression.

On other hand, MA(q) is explaining dependent variable (Y_t) based on past value of the error terms (ε_t) which are the moving average of past error terms of order q added into mean value of Y_t. MA is also commonly said as the one occupies lag value of forecast error to improve current forecast. The general equation of ARIMA is:

$$Y_t = \beta_0 + \theta_1 Y_{t-1} + \theta_2 Y_{t-2} + ... + \theta_p Y_{t-p} + \varepsilon_t + \Phi_1 \varepsilon_{t-1} + \Phi_2 \varepsilon_{t-2} + ... + \Phi_q \varepsilon_{t-q} \quad (1)$$

The process of modeling with ARIMA approach follows four steps (Firdaus, 2006, p.19): (i) Identification of variables (ii) Estimation of model (iii) Model evaluation (iv) Model forecasting. In *identification*, a series is investigated whether it has seasonal pattern or not; stationary or non stationary and; pattern of auto correlation function (ACF) and partial auto correlation function (PACF) such that:

$$Z_t = \mu + \theta_1 Z_{t-1} + \theta_2 Z_{t-2} + ... + \theta_p Z_{t-p} + \varepsilon_t - \Phi_1 \varepsilon_{t-1} - \Phi_2 \varepsilon_{t-2} - .... - \Phi_q \varepsilon_{t-q} \qquad (2)$$

From (2) Zt is said to be stationary, if the following conditions are met: (a) Constant mean for all investigation period or $E(Z_t) = \mu$ for all t; (b) Constant variance or $Var(Z_t) = E[(Z_t - \mu)^2] = \sigma^2_x$ for all t and; (c) Constant covariance or $Cov(Z_t, Z_{t-k}) = E[(Z_t - \mu)(Z_{t-k} - \mu)] = \gamma_k$ for all t.

Next, *estimation* step will find out the most robust estimated model combining AR and MA or both of them. Model *evaluation* will conduct some diagnostic test to check the accuracy of the estimated model and the actual one such as residual test, coefficient of variables, etc. Finally, *forecasting* will produce future data of every model under two assumptions (a) Linear forecasting and; (b) Selected model with the most efficient variables.

ARIMA process in the subsequent section involves nine variables and are grouped into two: (i) Liquidity demanders: Wadiah demand deposit (WD), Mudarabah saving deposit (MS) and 1-month Mudarabah time deposit (MT1); (ii) Liquidity suppliers: cash reserves (CR), placement of funds in BI (PB), inter bank placement (IP), BI Sharia Certificate (SB), equity participation (EP) and, borrowing funds from Islamic money market (PS). Lastly, the group of liquidity suppliers will be regrouped as the 1st tier and the 2nd liquid instruments to serve liquidity demand from Wadiah demand deposits and Mudarabah saving deposits (the 1st tier) and Mudarabah time deposit (the 2nd tier).

A. Identification of Variables

First of all, statistical summaries of variables of liquidity demanders and suppliers are given by tables 1 and 2, respectively. From standard deviation value, all of variables have indication of upward trend as previously illustrated in figures 4 and 5. In fact, this is one of causes of the non stationary. Thus, every variable needs to be tested for stationarity.

In this case, unit root tests were carried out to check stationarity of every variable which can be explained by taking a simple AR (1) process:

$$Y_t = a_0 + a_1 Y_{t-1} + \varepsilon_t \qquad (3)$$

where Y_{t-1} is lag of an independent variable which might contain a constant and trend; a is a constant and; ε is assumed to be white noise (Enders, 1995: 70). If $|a_1| \geq 1$, if Y_t is a non stationary series, it has a trend, does not have constant mean and; has time variant of variance. Therefore, the stationary can be evaluated by testing whether absolute value of a_1 is strictly less than one.

Table 1. Statistical Summary (million Rp)

Variable	Mean	Median	Std Deviation
Cash Reserve (CR)	256,042	183,344	222,778
Placement of Funds in BI (PB)	2,190,674	1,454,641	1,835,653
Inter Bank Placement (IP)	795,092	734,125	678,324
Equity Participation (EP)	16,920	5,660	24,353
Islamic Money Market (PS)	578,256	84,000	847,278
BI Sharia Certificate (SB)	1,207,924	882,000	993,585

Table 2. Statistical Summary (million Rp)

Variable	Mean	Median	Std Deviation
Wadiah Demand Deposit (WD)	1,692,825	1,403,000	141,947
Mudarabah Saving Deposit (MS)	4,705,904	3,545,000	4,154,258
Mudarabah Time Deposit (MT1)	8,783,393	7,259,519	7,822,117

Two widely used tests are Augmented Dickey-Fuller (ADF) (1979) and Phillips and Perron (PP) (1988). ADF re-estimates (3) by subtracting Y_{t-1} such that (Lutkepohl and Kratzig, 2004, p. 54):

$$\Delta Y_t = \alpha Y_{t-1} + \sum_{j=1}^{p-1} a_j^* \Delta Y_{t-j} + \varepsilon_t \qquad (4)$$

The process is integrated when a(1) = 1- a(1) -…- a_p = 0 where α = -a(1) and $a_j^* = -(a_{j+1}+\ldots+a_p)$. Null and alternative hypothesis are H_0: α = 0 and H_1: α < 0; with $t_\alpha < \alpha/(se(\alpha))$. The basic idea of ADF is to correct high order serial correlation by adding lagged difference terms in the right hand side of the equation.

Meanwhile, Phillips and Perron (PP) use nonparametric statistical methods to take care of the serial correlation in the error terms without adding lagged difference terms (Gujarati, 2004, p. 818). Tables 3 and 4 provide the results for the ADF and PP tests (105 frequencies of data) which include intercept and use 12 lags based on Schwarz info criterion.

Table 3. Stationary Test of Liquidity Suppliers

Variable Name	Augmented Dickey-Fuller		Phillip and Perron	
	Level	1st Difference	Level	1st Difference
CR	2.8039*	-16.9189***	0.7722	-21.6681***
PB	-1.0213	-7.2559***	-0.2546	-6.8677***
IP	0.5743	-12.8870***	1.8091	-14.6011***
EP	-0.4352	-9.4668***	0.5506	-11.4327***
PS	-1.5714	-12.2915***	-2.7211*	-12.0391***
SB	-2.4629	-9.2767***	-2.6883*	-9.6712***

Note: ***,**,* refers to stastical significance of 1%, 5% and 10%

Table 4. Stationary Test of Liquidity Demanders

Variable Name	Augmented Dickey-Fuller		Phillip and Perron	
	Level	1st Difference	Level	1st Difference
WD	0.0282	-15.2957***	0.3817	-22.1848***
MS	5.6345	-3.5843***	5.1519	-10.9070
MT1	3.4664**	-14.5310***	4.1683	-14.8723***

Note: ***,**,* refers to stastical significance of 1%, 5% and 10%

Tables 3 and 4 reveal that all variables of liquidity suppliers and demanders are stationary (1% statistical significance) in 1st difference (integrated in order 1). Therefore, the estimated ARIMA models will integrate all variables with order *p* for AR, order q for MA or *(p,d,q)*. The next identification process is checking the pattern of AR and MA through correlogram test for behavior patterns of ACF and PACF. There are at least three patterns commonly found in ARIMA model, (i) Correlogram test which produces zero value in all periods of auto correlation function (ACF = 0) namely the white noise ACF function; (ii) Correlogram test which shows cut off ACF pattern (usually) between the first period of auto correlation function and the second or third one and; (iii) Correlogram test with decreasing pattern of ACF from the beginning of the period until end of the period namely dying down pattern.

In modeling ARIMA, when ACF shows a dying down pattern and PACF indicates a cut off pattern, pure auto regressive (AR) model should be employed with formula of:

$$Z_t = \delta + \theta_1 Z_{t-1} + \theta_2 Z_{t-2} + ... + \varepsilon_t \quad (5)$$

where Z_t and Z_{t-q} as the current and prior value of stationary series; δ and θ as value of parameters (coefficient and constant values) and; ε_t as residual with expected value of zero.

However, when ACF shows a cut off pattern while PACF is dying down, pure moving average (MA) model should be employed with formula of:

$$Z_t = \mu + \varepsilon_t - \Phi_1\varepsilon_{t-1} - \Phi_2\varepsilon_{t-2} - .... - \Phi_q\varepsilon_{t-q} \quad (6)$$

where Z_t is the current value of stationary series; ε_t and ε_{t-q} are a white noise residual and historical residual and; Φ_1 and μ are value of a constant and coefficient of variables. Finally, when both ACF and PACF depict a dying down pattern, combination of AR and MA is used with the formula written in equation (2). In fact, computation on ACF and PACF finds dying down patterns of all variables (see table 5), then combination of AR and MA is confirmed.

Table 5. Correlogram of ACF and PACF

Period	EP		CR		PB		IP		SB		PS		WD		MS		MT1	
	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF	ACF	PACF
1	-0.015	-0.015	-0.474	-0.474	0.311	0.311	-0.244	-0.244	0.072	0.072	-0.135	-0.135	-0.397	-0.397	-0.053	-0.053	-0.353	-0.353
2	-0.281	-0.281	-0.231	-0.587	-0.04	-0.152	0.027	-0.034	0.006	0.001	-0.43	-0.456	0.031	-0.15	0.027	0.024	0.005	-0.136
3	-0.01	-0.021	0.57	0.232	-0.161	-0.112	-0.168	-0.18	-0.047	-0.048	0.289	0.184	-0.061	-0.129	0.398	0.402	0.14	0.109
4	-0.005	-0.092	-0.375	-0.019	-0.112	-0.03	-0.119	-0.224	-0.149	-0.143	0.228	0.14	-0.018	-0.113	0.065	0.131	-0.161	-0.08
5	-0.255	-0.292	-0.13	-0.161	-0.325	-0.345	0.052	-0.056	-0.19	-0.174	-0.155	0.116	-0.051	-0.142	0.084	0.087	0.199	0.146
6	-0.004	-0.064	0.408	-0.014	-0.3	-0.159	0.102	0.066	-0.206	-0.198	-0.191	-0.158	0.032	-0.079	0.273	0.149	0.116	0.253
7	0.258	0.108	-0.296	-0.026	-0.094	-0.037	-0.08	-0.109	-0.225	-0.251	-0.024	-0.253	0.028	-0.015	0.006	-0.035	0.037	0.264
8	-0.009	-0.046	-0.026	0.02	-0.012	-0.161	0.177	0.131	-0.038	-0.103	0.155	-0.032	-0.102	-0.141	0.211	0.162	-0.075	0
9	-0.008	0.078	0.324	0.138	-0.055	-0.17	-0.14	-0.026	-0.098	-0.236	-0.171	-0.189	-0.001	-0.15	0.178	0.065	0.168	0.174
10	-0.011	-0.074	-0.376	-0.158	-0.014	-0.147	0.139	0.126	0.01	-0.188	-0.172	-0.04	0.085	-0.009	-0.015	-0.035	-0.145	-0.076
11	-0.006	0.019	0.164	0.091	0.192	0.023	-0.118	-0.032	0.207	-0.015	0.124	-0.033	0.081	0.121	0.235	0.098	0.187	0.098
12	-0.007	0.086	0.209	0.152	0.402	0.266	0.053	0.055	0.279	0.099	0.1	0.085	0.015	0.134	0.12	0.009	-0.006	-0.067
13	-0.007	-0.005	-0.27	0.258	0.207	-0.011	-0.051	-0.014	0.233	0.115	-0.101	0.026	-0.157	-0.109	0.134	0.168	-0.014	0.012
14	-0.01	-0.009	0.098	0.038	0.074	0.072	0.031	0.006	0.023	-0.057	-0.078	-0.071	-0.031	-0.166	0.125	-0.023	0.093	-0.02
15	-0.007	-0.014	0.177	0.104	-0.036	0.012	0.103	0.146	-0.039	-0.048	0.07	-0.106	0.093	0.035	0.134	0.062	-0.127	-0.099
16	-0.004	-0.037	-0.238	0.123	-0.091	0.015	-0.043	-0.031	0.036	0.11	0.093	-0.079	0.041	0.125	0.038	-0.091	0.138	-0.007
17	0.223	0.308	0.062	0.071	-0.434	-0.273	-0.083	-0.059	-0.145	0.007	-0.081	-0.047	-0.028	0.024	0.144	-0.004	-0.063	-0.061
18	-0.007	-0.009	0.13	0.006	-0.241	0.101	0.112	0.089	-0.26	-0.127	-0.115	-0.101	0.07	0.077	0.092	0.024	-0.007	-0.115
19	-0.007	0.139	-0.158	0.069	0.002	0.052	-0.233	-0.162	-0.227	-0.173	0.079	-0.031	-0.049	0.087	-0.03	-0.156	-0.015	-0.114
20	-0.006	0.047	0.038	-0.043	0.097	-0.003	0.108	-0.082	-0.043	0.008	0.002	-0.125	-0.025	0.059	0.036	-0.111	0.104	0.077
21	-0.007	0.052	0.023	-0.145	-0.03	-0.054	-0.051	-0.05	-0.075	-0.095	-0.08	-0.031	0.001	-0.036	0.155	0.027	-0.061	0.033
22	-0.239	-0.127	0.07	0.204	0.123	0.082	0.075	0.014	0.092	0.018	-0.061	-0.139	0.008	-0.082	0.007	0.023	0.027	0.052
23	-0.002	0.021	-0.133	-0.1	0.11	-0.165	0.074	0.02	0.088	-0.1	0.076	-0.007	0.005	0.04	-0.03	-0.068	-0.067	-0.088
24	0.242	0.066	0.141	0.08	0.142	0.082	-0.103	-0.088	0.245	0.005	0.124	0.087	-0.133	-0.053	0.076	-0.085	-0.041	0.013
25	-0.008	0.012	-0.024	-0.103	0.026	-0.075	0.075	0.114	0.112	-0.079	-0.137	-0.088	0.173	0.115	-0.02	-0.068	0.168	0.107
26	-0.008	0.022	-0.085	0.006	0.097	0.056	0.038	0.1	0.081	-0.015	-0.032	-0.013	0.014	0.109	-0.001	-0.068	-0.087	0.082
27	-0.008	-0.072	0.099	-0.075	0.059	0.035	-0.107	-0.017	-0.117	-0.242	0.342	0.186	-0.069	-0.082	0.052	0.039	0.105	0.121
28	-0.003	-0.009	-0.033	-0.042	-0.025	0.051	0.085	0.039	0.031	-0.084	-0.087	-0.065	0.086	0.046	-0.013	0.003	-0.136	-0.029
29	-0.004	0.142	-0.06	-0.065	-0.155	0.134	-0.175	-0.077	-0.014	0.023	-0.16	0.013	-0.078	0.003	-0.007	-0.028	-0.093	-0.165
30	0.018	0.002	0.114	0.024	-0.131	0.037	0.085	-0.022	-0.046	0.133	0.113	-0.124	0.047	0.059	0.102	0.094	0.137	-0.006
31	-0.025	-0.034	-0.035	-0.014	-0.062	-0.004	0.071	0.09	-0.139	0.024	0.084	-0.024	-0.027	0.068	0.001	0.112	-0.039	-0.053
32	0.018	-0.014	-0.12	0.02	-0.102	-0.128	-0.012	-0.003	-0.134	-0.126	-0.065	-0.001	0.051	0.089	-0.068	-0.029	-0.004	-0.097
33	-0.004	-0.055	0.188	-0.068	-0.064	0.029	-0.053	-0.147	-0.07	-0.102	-0.011	0.19	-0.124	-0.076	0.059	0.006	0.008	-0.089
34	-0.004	0.032	-0.091	0.008	0.169	0.064	0.072	0.155	-0.071	-0.138	-0.069	-0.024	0.069	-0.019	0.02	0.031	-0.015	0.043
35	-0.004	-0.017	-0.05	0.048	0.115	-0.046	-0.079	-0.013	0.046	-0.073	0.045	-0.024	-0.059	-0.093	-0.053	-0.002	-0.013	0.135
36	-0.004	-0.143	0.107	-0.08	0.015	-0.018	-0.04	-0.22	0.234	0.03	0.027	-0.005	0.036	-0.076	-0.02	-0.036	0.029	0.003

B. Estimation of Models

Estimation of nine models has fitted the ARIMA regression requirements and every estimated model below is presented with values of coefficients, t-statistics (in bracket), r-squared and LM test.

$$\Delta CR_t = \mu + \theta_1 AR_{t-1} + \theta_2 AR_{t-3} + \theta_3 AR_{t-4} + \varepsilon_t - \Phi_1 MA_{t-2} - \Phi_2 MA_{t-3} - \Phi_3 MA_{t-5} - \Phi_4 MA_{t-9} \quad (7)$$

11243 -0.729 0.891 0.544 -0.656 -0.689 0.366 0.232

[2.949] [7.207] [11.079] [4.653] [-6.719] [-6.457] [2.849] [3.756]

R-squared 0.5612 AIC 24.019 LM test 0.8278

$$\Delta EP_t = \mu + \theta_1 AR_{t-7} + \varepsilon_t - \Phi_1 MA_{t-2} - \Phi_2 MA_{t-5} \quad (8)$$

1011.3 0.664 -0.216 -0.503

[1.549] [5.120] [-2.158] [-5.397]

R-squared 0.283 AIC 20.452 LM test 0.6317

$$\Delta PB_t = \mu + \theta_1 AR_{t-3} + \varepsilon_t - \Phi_1 MA_{t-1} - \Phi_2 MA_{t-5} - \Phi_3 MA_{t-6} \qquad (9)$$

57886 -0.257 0.248 -0.393 -0.374
[3.455] [-2.515] [2.599] [-4.072] [-3.767]
R-squared 0.242 AIC 28.643 LM test 0.111

$$\Delta IP_t = \mu + \theta_1 AR_{t-1} + \theta_2 AR_{t-3} + \theta_3 AR_{t-4} + \varepsilon_t - \Phi_1 MA_{t-1} - \Phi_2 MA_{t-3} - \Phi_3 MA_{t-4} \qquad (10)$$

24196 0.396 0.565 -0.706 -0.739 -0.682 0.916
[3.082] [4.921] [5.653] [-8259] [-20.917] [-14.435] [22.371]
R-squared 0.147 AIC 26.257 LM test 0.3361

$$\Delta PS_t = \mu + \theta_1 AR_{t-1} + \theta_2 AR_{t-2} + \varepsilon_t - \Phi_1 MA_{t-3} - \Phi_2 MA_{t-4} \qquad (11)$$

3029 -0.170 -0.334 0.453 0.298
[0.070] [-1.715] [-3.308] [4.664] [3.060]
R-squared 0.308 AIC 28.563 LM test 0.8758

$$\Delta SB_t = \mu + \theta_1 AR_{t-6} + \varepsilon_t - \Phi_1 MA_{t-6} - \Phi_2 MA_{t-7} \qquad (12)$$

46693.44 -1.139 1.035 -0.082
[1.434] [-22.381] [15.832] [-1.835]
R-squared 0.234 AIC 28.854 LM test 0.1220

$$\Delta WD_t = \mu + \theta_1 AR_{t-1} + \theta_2 AR_{t-2} + \varepsilon_t - \Phi_1 MA_{t-2} - \Phi_1 MA_{t-3} - \Phi_1 MA_{t-5} \qquad (13)$$

42129.81 -0.521 -0.818 0.665 -0.497 -0.354
[3.736] [-5.568] [-4.518] [3.807] [-3.438] [-3.210]
R-squared 0.204 AIC 28.237 LM test 0.148

$$\Delta MS_t = \mu + \theta_1 AR_{t-3} + \varepsilon_t - \Phi_1 MA_{t-3} - \Phi_1 MA_{t-8} \qquad (14)$$

192047 0.929 -0.684 0.287
[1.162] [11.900] [7.347] [3.877]
R-squared 0.273 AIC 27.016 LM test 0.3177

$$\Delta MT1_t = \mu + \theta_1 AR_{t-1} + \theta_2 AR_{t-3} + \theta_2 AR_{t-4} + \varepsilon_t - \Phi_1 MA_{t-1} - \Phi_1 MA_{t-3} \qquad (15)$$

161711 -0.334 0.953 0.309 -0.060 -1.245
[1.186] [-3.445] [13.866] [2.665] [-3.049] [-50.980]
R-squared 0.3824 AIC 29.0983 LM test 0.1761

Every equation has found the robust past (lag) value(s) of dependent variable (Y_t) or AR(p) and the error terms (ε_t) or MA(q) that explain the dependent variable. Further, these models are occupied to produce estimated numbers which is the purpose of this subsection to assess the future performance of the demand and supply of liquidity and the resiliency of the industry.

C. Forecasting of the Models

The nine ARIMA models generate estimated values (in series) from September 2009 to December 2011. The decisions to choose this extended period are because of three reasons. First, the accuracy of the model is believed to be strong in the short-term rather than long-term. Second, more than three years ahead can lead to a bias forecast because of the dynamic progress of this industry. In the near future, new Islamic banks and Islamic banking units might join the industry, new banking regulations might come to strengthen and support the development of Islamic banks. Moreover, the issuance of sukuk might give another stimulus to this industry.

Third, the purpose of the paper is to give ideas to Islamic banks and regulators to manage demand and supply of liquidity through liquidity withdrawal scenarios. The first scenario is regular liquidity withdrawals which is the current management of liquidity. The second one is irregular liquidity withdrawals where the demand for liquidity rises above the former scenario. This scenario is possible when depositors want to hold more cash due to unstable economic conditions. Lastly is liquidity run when Islamic banks loose trust of depositors, bank rush and bank crisis like the one occurred in 1997/1998.

5. 2. Resiliency of Islamic Banking Industry

A. Resiliency of the 1st Tier Liquid Instruments

In order to examine the resiliency of the 1st tier liquid instruments, three scenarios of liquidity withdrawals from both Wadiah demand deposits and Mudarabah saving deposits are determined. The first scenario is regular liquidity withdrawals where the future demand for liquidity is computed based on the historical pattern of liquidity withdrawals. The average monthly liquidity withdrawals of Wadiah demand deposits and Mudarabah saving deposits are found to be 8.85% and 5.39% of each monthly balance. Based on this regular pattern and the output of ARIMA forecasting of liquidity demanders and suppliers, the resiliency of the 1st tier liquid instruments against regular liquidity withdrawals is drawn in thick line in figure 8.

The second scenario is the irregular liquidity withdrawal. It is assumed when liquidity withdrawals from both accounts increases up into a quarter (25%) of each monthly balance. As such, the resiliency of the 1st tier liquid instruments against irregular liquidity withdrawal is drawn in thin dotted line in figure 8. The last scenario is liquidity run with the assumption that 45% of each monthly balance is gone. Severe scenario of liquidity run (i.e more than 45%) is not considered because the 45% assumption should have given a strong signal to take emergency actions to avoid further worsening scenario. The resiliency of the 1st tier liquid instruments against liquidity run is drawn in thick dotted line in figure 8.

Figure 8. Resiliency of the 1st Tier

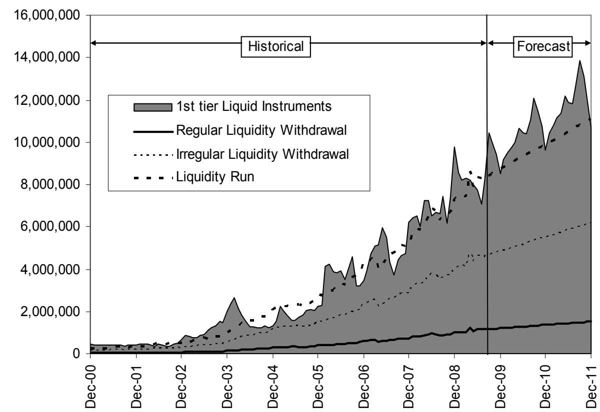
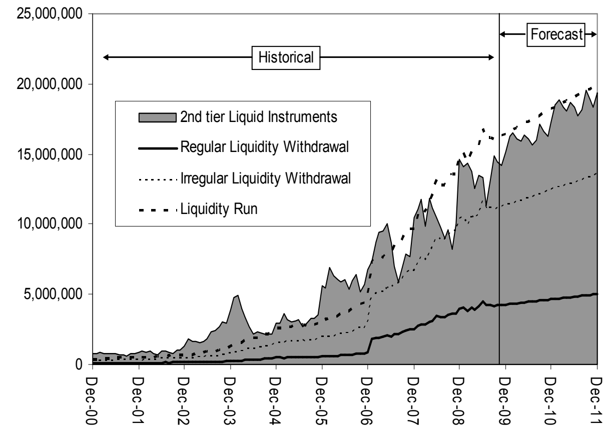


Figure 9. Resiliency of the 2nd Tier



B. Resiliency of the 2nd Tier Liquid Instruments

The existence of the 2nd tiers should strengthen the supply of liquidity to handle the additional demand for liquidity from 1-month Mudarabah time deposits besides the previous two accounts. The first scenario is regular liquidity withdrawal. Historical data shows that the average monthly liquidity terminations of 1-month Mudarabah time deposits are 11.84% of each monthly balance. This fact together with ARIMA's output test the ability of the 2nd tier to settle down such scenario. A thick line in figure 10 depicts the result of this scenario.

The second scenario is the irregular liquidity withdrawal. It is when the terminations of 1-month Mudarabah time deposit reach 25% of each monthly balance. This assumption and the supply of liquidity from the 2nd tier liquid instruments are illustrated in a thin dotted line in figure 9. Finally, the harshest condition occurs in the third scenario when liquidity run occur. It is if the terminations of 1-month Mudarabah time deposit occur 30% of each monthly balance and explained by thick dots line in figure 9.

6. FINDINGS AND SUGGESTIONS

The overall analysis of the demand and supply of liquidity in Indonesian Islamic banking industry leave some important findings:

a) Historically, the 1st and 2nd tier liquid instruments performs well to supply and match short-term demand for liquidity during regular and even irregular liquidity withdrawal conditions. This is clearly seen in the historical performance of the 1st and 2nd tier liquid instruments to serve monthly liquidity withdrawals from Wadiah demand deposit and Mudarabah saving deposits (1st tier) and 1-month Mudarabah time deposits (2nd tier).

b) However, in the future, the potential of liquidity mismatch may occur. In the irregular liquidity withdrawals, the 2nd tier faces liquidity mismatch in the last quarter of 2008 as seen in the grey line in figure 10.

Figure 10. Performance of the 2nd Tier

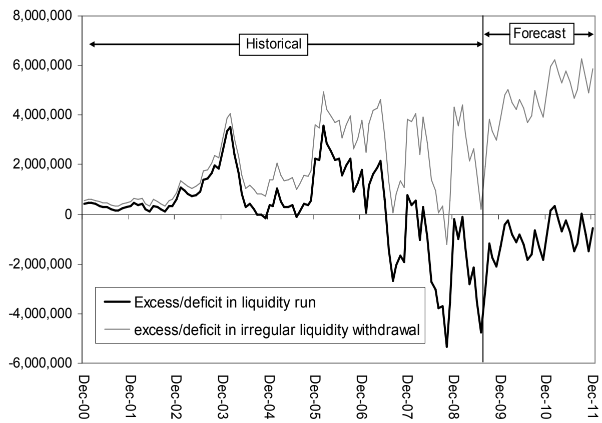
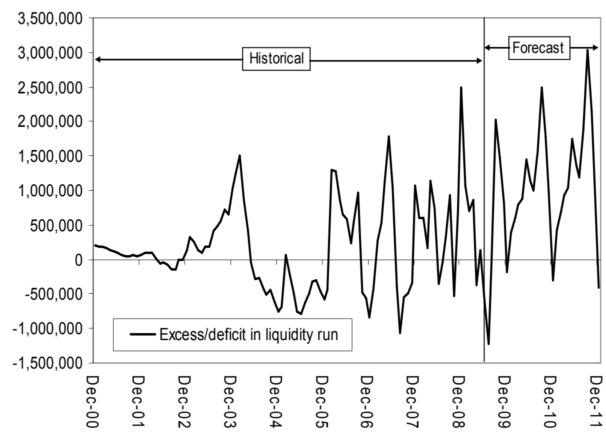


Figure 11. Performance of the 1st Tier



c) Unfortunately, both 1st and 2nd tier fail to mitigate liquidity run condition. The 1st tier liquid instruments cannot continuously serve the depositors demand for liquidity, for examples between May 2004 - February 2006; October 2006 - February 2007; and July – December 2007 (see figure 11). The 2nd tier, on the other hand, begins to loose its function from July 2007 to December 2011 (see figure 10).

d) Particularly, based on the liquidity run scenarios, the 1st tier fails to handle liquidity run when deposit withdrawals reach 45% of total deposits and the 2nd tier fails to survive in liquidity run when the withdrawals reach 30% of total deposit. It does not have to be 50% deposit withdrawals to end the function of these two tiers.

e) Fortunately, unfavorable liquidity problems have not hit the industry yet but the current global financial crisis, following some internal and external Islamic banking problems (lack of infrastructure, human resources and banking facilities, less competitiveness Islamic return, the existence of rational depositors) can make such irregular and liquidity run scenarios possible to exist.

f) The percentage assumption of liquidity run delivers the important message that the failure of Islamic banks to manage liquidity may begin from this percentage of liquidity withdrawals. Intensifying socialization and education to depositors and public; improving banking facilities, products and services; optimizing bank financing in order to be able gain and pay competitive return to depositors and stakeholders are amongst efforts that can be pursued by all market players and banking regulators to prevent liquidity run.

g) It is realized that there is still another tier, the 3rd tier, to finally solve the liquidity problem. Nonetheless, using this tier brings many negative consequences such as negative perception in the market and among depositors which may potentially impact the whole banking system, negative image of the quality of liquidity management of a needy Islamic bank, sanctions from banking regulators.

7. CLOSING REMARKS

The Islamic banking industry in Indonesia faces remarkable growth and performances. With respect to liquidity management, there are three sources of short-term demand for liquidity and the 1st, 2nd and 3rd tiers of short-term liquid instruments as suppliers of short-term liquidity. In fact, Islamic banks have shown a good short-term liquidity management under the assumptions of regular liquidity withdrawal, immature but growing industry, and high interest of the public. Even, during irregular demand for liquidity, the 1 and 2 tier liquid instruments are still able to mitigate it.

Nevertheless, when unfavorable conditions happen such as macroeconomic turbulence or unstable non economic factors (social and political unrests), leading to liquidity run, the performance of the industry is highly impacted. The paper finds that the industry is very fragile to suitably manage its liquidity. In the end, more efforts have to be taken in order to prepare a better liquidity management system to guard this industry for a more promising development.

Endnotes

1. For example, Barclays Bank, Westpac (Australian Bank) (1992), German BFG Bank (1993), (Greenbaum and Thakor, 1995:584) and Lehman Brothers, Merrill lynch (2008).
2. The banks decide not to renew their loan when borrowers want it.
3. The depositors decide not to extend their deposits in bank while banks need it.
4. Using parent bank's networks to reach depositors in all provinces.

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