Depositors’ withdrawal behavior in Islamic banking: case of Indonesia

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Abstract
Purpose – Islamic banks need to manage depositors’ deposit withdrawals in a well manner in order to be able to optimize depositors’ funds in their portfolio financing. Taking into account the Indonesian Islamic banking industry as a study case, this paper attempts to analyze the depositors’ withdrawal behavior. Moreover, it also analyzes the responses of Islamic banks to mitigate such deposit withdrawals.

Design/methodology/approach – First, the paper accommodates the flow of funds of the Indonesian Islamic banking operations. Second, it formulates a liability side model of the competitive Islamic banking industry referring to some ideas from the conventional models. Then, the paper uses linear probability model (LPM) to identify depositors’ withdrawal behavior and to analyze the responses of Islamic banks to mitigate deposit withdrawals.

Findings – It is found that depositors withdraw their money if: Islamic banks do not generate incomes from their financing; interest rate goes up; and total deposits tend to decrease. As such, Islamic banks have to anticipate this withdrawal behavior by doing two actions: reserving some liquidity and adjusting return sharing ratio to depositors. The output of this paper should benefit the policy markers and Islamic banks to understand depositors’ behavior in withdrawing money and determine appropriate policies to manage it.

Originality/value – The best of author’s knowledge, this is the first paper trying to analyze the depositors’ withdrawal behavior with LPM model taking into account the Indonesian Islamic banking industry.

Keywords Banks, Islam, Banking, Consumer behaviour, Indonesia

Paper type Research paper

Introduction
The same as other financial institution, Islamic banks need to manage and optimize their funds in the form Islamic financing contracts to generate profit. In their operations, anticipating deposit withdrawals is among actions that have to be done properly. It is because deposit withdrawals might potentially interrupt the business and investment process that requires a long-term placement of funds. Deposits, on the other hand, tend to be available to be withdrawn (terminated) anytime if depositors want and the bank agrees. Knowing the withdrawal behavior of depositors is one important way to have a robust management of liquidity on the liability side.

However, the Indonesian Islamic banking industry has been growing promisingly since the early 1990s. The awareness of people to deal with Islamic banks and the strong support from the government, central bank and Indonesian Moslem scholars (MUI) have fostered the development of the industry. Some facts prove premises such as the growing number of Islamic banks and the good performance of Islamic banking indicators. Until the end of April 2010, there are nine Islamic commercial banks (BUS) followed by 25 Islamic banking windows/units (UUS) and 144 Islamic rural banks (BPRS).
The performance of Islamic banking indicators such as financing to deposit ratio (FDR), non-performing financing (NPF), total assets, deposits and financings have all revealed the sound financial intermediary function. The FDR has been lying on 106.41 per cent on an average from December 2000 to April 2010. The NPF stands between 2 and 5 per cent. Total assets, financings and deposits grow annually for more than 50-60 per cent on an average. Later, the total assets have reached Rp70.14 trillion with the total financings of Rp51.65 trillion, utilizing the total deposits of Rp54.04 trillion.

Taking into account the problem of deposits withdrawal and considering the prospect of the Indonesian Islamic banking industry, this paper takes such industry as a study case to analyze depositors’ withdrawal behavior. Specifically, it identifies such behavior from the output of econometric model of the liability side. In the following sections, the paper first discusses the flow of funds in the Indonesian Islamic banking operations to give an initial idea of the whole pictures of liquidity management process in the industry.

Second, from the whole pictures of liquidity management process, it concentrates on liquidity management on the liability side, particularly the depositors’ withdrawal issue. Hence, it formulates a liability side model of the competitive Islamic banking industry and uses econometric model namely, linear probability model (LPM) with binary (dummy) variable to identify depositors’ behavior in terminating their deposits. Finally, the model explains depositors’ withdrawal behavior and anticipative actions that can be occupied by Islamic banks to manage such withdrawals.

**Flow of funds in islamic banking**

The Indonesian Islamic banking has unique flow of funds from depositors as the owners of funds to entrepreneurs as the users of funds (Figure 1). First of all, depositors put their money in Islamic deposits (Wadiah demand deposit, Mudarabah saving deposits and Mudarabah time deposits), numbered in arrow number 1. Before extending funds to finance the real sectors, Islamic banks take some liquidity for liquidity reserves (LR) (cash reserves and reserves requirement) (arrow number 2). These reserves function as a standby liquidity if depositors take their funds in a normal pattern. Then, the rests of liquidity go to the real sectors as bank financings (arrow number 3), particularly for both operational and non-operational financings.

Then, the result of business operations generates operational and non-operational incomes and returns the principal of financing[1] as highlighted by arrow numbers.
4 and 5 and grey arrow number 6. Next, the principal comes back to depositors (arrow numbers 7 and 8) while the operational and non-operational incomes follow some treatments. First, retained earnings are deducted from the operational incomes (arrow number 7a) before they are ready to be shared with depositors (arrow number 7b).

At this stage, revenues sharing from operational financings are divided based on an agreed revenue sharing ratio between bank and depositors (arrow number 7c). For an Islamic bank, its revenues sharing part (arrow number 7d) is then deducted by costs (arrow number 7e) in order to become bank’s profit from operational financings (arrow number 7f). Meanwhile, unlike operational financings, non-operational incomes are not shared and directly become bank’s profit after compensating costs (grey arrow numbers 6a and b).

Actually, the paper does not consider the whole process of liquidity management in Figure 1, but it concentrates its analysis on the liability side to investigate withdrawal behavior of depositors. The examples of it are behavior in depositing money, responding to the bank’s return sharing and, operational incomes. It also formulates the LR model to examine how Islamic banks manage the demand for liquidity from depositors as reflected in how much total LR they hold. Temporarily, it does not capture the asset side (representing bank’s financing decision and entrepreneurs’ performance), the role of banking regulators and, the Islamic money market to manage liquidity of the banking industry because the focus of the paper is mainly on depositors’ withdrawal behavior which lies on the liability side.

Model of liability side in the competitive banking sector

Conventional banking model of the liability side

There are various models of banking behavior in economic literatures. Among all, there are four alternative references, which suit with the purpose of this research. Those are models of: Song and Thakor (2007), Takemura and Kozu (2009), Totzek (2009) and Freixas and Rochet (1999).

Song and Thakor (2007) illustrated an economy with three agent types: borrowers, banks and depositors and three-date time frame: t = 0, 1 and 2. A bank’s fragility because of withdrawal risk was monotonically increasing in the probability of unanticipated liquidity withdrawal at t = 1. In this case, the bank’s bad projects did not generate return and depositors got nothing while the good projects needed to be shut down and depositors received only first time return. Failures occurred at t = 2, if the projects failed and the loan defaulted (Song and Thakor, 2007, pp. 2134-8).

Next, Takemura and Kozu (2009) investigated relationship among individual depositor behavior whether they would withdraw all of their deposits and factors behind them such as the degree of trust in information sources, frequency of communication, individual transaction with banks and individual attributes. They made a model by binary logistic regression analysis with p as the probability of depositor’s deposit withdrawal and the explanatory variables were:

• the degree of trust in information sources;
• frequency of communication;
• individual transaction with banks; and
• individual attributes (Takemura and Kozu, 2009, p. 30).
Then, Totzek (2009) modeled commercial banks as a third type of economic agent to implement the feature of early deposit withdrawal in New Keynesian Model and to investigate the resulting implications for the real sectors. He found that:

- the extended withdrawal could lead to temporary stagnation;
- an impulse shock in the deposit withdrawal risk has persistent real effects;
- the resulting destabilizing effects decrease in the degree of loan rate rigidity;
- the central bank could help stabilizing the system by decreasing the cost of refinancing; and
- the shock in withdrawal rate causes the marginal cost of both firms and banks to increase (Totzek, 2009, p. 3).

However, this paper takes some ideas of those three alternative references and does not choose one of them individually. It is because, Song and Thakor (2007) limit their analyses to certain time periods (for depositors, bank and entrepreneurs). This paper needs a model without time period constraints assuming that banks manage liquidity on the liability sides in accordance with their profit maximization motive. Nevertheless, they raise the issue of the probability of unanticipated liquidity withdrawal which is relevant to be considered in this paper.

Meanwhile, the purpose of this paper is very close with Takemura and Kozu (2009). Nonetheless, they focus on the roles of information and communication which are the external activities of a bank (relation with third parties). This paper is more on the internal activities of a bank, the impact of interest rate, etc. But, Takemura and Kozu’s idea to use a binary model with the probability of deposit withdrawal as the dependent variable and one of the independent variables is individual transaction with banks is similar with the idea of this paper. Finally, Totzek (2009) model is also relevant to this paper but it includes the intervention of central bank to mitigate deposit withdrawals which is excluded in this paper. However, their model considers banks as an economic agent in a competitive behavior is occupied in the model of this paper.

This research finds the banking behavior models in a competitive banking sector developed by Freixas and Rochet (1999) as the most appropriate ones. Freixas and Rochet models not only incorporated ideas of the previous models above but also matched the requirement and purpose of this paper. In particular, one of the focuses of their model was on bank’s liquidity on the liability side. They stated four assumptions in the models implying the competitive banking deposits:

1. banks are risk neutral;
2. banks are price taker;
3. profit maximization motive in balancing liquidity on asset and liability; and
4. full information.

Initially, the model formulated bank’s profit as the output of total revenues from asset side minus total expenditures (costs) from liability side as in the following:

$$\pi = r_L L + r M - r_D D - C(D, L)$$

where $\pi$ is bank’s profit; $r_L$ is interest on loans; $L$ is total outstanding loans; $r$ is money market rate; $r_D$ is interest on deposits; $D$ is total deposits and $C$ is total costs representing
the bank’s technology in managing both deposits and loans. In particular, M is the bank’s net money market position and formulated as:

\[ M = (1 - \alpha)D - L \]  

(2)

while \( \alpha \) is compulsory reserves required by the central bank. Therefore, \( \pi \) can be rewritten as:

\[ \pi(D, L) = (r_L - r)L + [r(1 - \alpha) - r_D]D - C(D, L) \]  

(3)

and maximum profit are the first order condition of equation (3) such that:

\[ \frac{\partial \pi}{\partial D} = [r(1 - \alpha) - r_D] - \frac{\partial C}{\partial D}(D, L) \]  

(4)

It means, maximum profit is the condition where the volume of deposits are adjusted in such a way that \([r(1 - \alpha) - r_D]D\) equal marginal costs. An increase in \( r_D \) will decrease the deposits. If there are N different banks \((n = 1, \ldots, N)\) with their typical deposits \((D^n)\) and loans \((L^n)\), and total amount of securities (T-Bills) \((B)\) held, the functions of household saving and demand for investment from corporations are formulated in equations (5)-(7) (Freixas and Rochet, 1999, p. 55):

\[ S(r_D) = B + \sum_{n=1}^{N} D^n(r_L, r_D, r) \text{ (the saving of household)} \]  

(5)

\[ I(r_L) = \sum_{n=1}^{N} L^n(r_L, r_D, r) \text{ (the demand for investment from companies)} \]  

(6)

\[ \sum_{n=1}^{N} L^n(r_L, r_D, r) = (1 - \alpha)\sum_{n=1}^{N} D^n(r_L, r_D, r) \text{ (the inter bank market)} \]  

(7)

Equation (7) assumes that the aggregate position in the inter bank market is zero and \( r \) is a controlled variable set by the central bank. Finally, by modifying equation (4) with the assumption of constant marginal costs of intermediation \((C_D = \gamma_D)\) such that \( r_D = r(1 - \alpha) - \gamma_D \) and adding them together into equations (5)-(7), the equilibrium equations with the bank’s maximum profit and optimum liquidity which fulfill the depositors’ expected utility, are:

\[ S[r(1 - \alpha) - \gamma_D] = \frac{I(r + \gamma_L)}{1 - \alpha} = B \]  

(8)

\[ I(r + \gamma_L) = \sum_{n=1}^{N} L^n(r_L, r_D, r) = (1 - \alpha)\sum_{n=1}^{N} D^n(r_L, r_D, r) \]  

(9)

Equation (8) explains that liquidity on the liability side of the bank is determined by a reserves coefficient \((\alpha)\); or by open market operation \((B)\) on the equilibrium levels of \( r_L \) and \( r_D \) (Freixas and Rochet, 1999, p. 56). Subsequently, equation (9) explains that total investment of banks is driven by a set of interest \((r_L, r_D, r)\) in addition to the cost of managing loans, total deposits and LR required by the central bank.
Islamic banking model of the liability side

Referring to Freixas and Rochet’s model of bank behavior, the adjusted model is derived for Islamic banks to investigate the flow of liquidity on the liability side. But, before constructing it, some of the Sharia principles must be inserted to the chosen model to make it Sharia compliance. The principles are written below:

- **Sharia** prohibits any deposit dealing with interest (riba), gambling (maysir) and fraud (gharar). Thus, Islamic modes of deposit take the form of Wadiah or Mudarabah.
- **Sharia** jurisprudence adopts a risk-return sharing concept for any profit and loss of financing. Thus, interest on loans ($r_L$) in the conventional model is modified into return from financing ($r_f$). Interest rate from deposits ($r_D$) in the conventional model is also turned into profit/revenue sharing ratio ($r_b$).
- Since any return in the form of interest is prohibited, **Sharia** does not allow any remuneration for unutilized funds such as reserves requirement stipulated by the central bank.

After considering Sharia principles, the Islamic banking model takes into account the special characteristics of the Indonesian Islamic banking industry, which are:

1. There are two types of financing (as mentioned before):
   - operational financing (F) which is comprised of mostly Murabahah (61 per cent) and Mudarabah (30 per cent); and
   - non-operational financing (L) which is dominated by Ijarah (2 per cent).
2. Because of the domination of Murabahah and Ijarah, Islamic banks have a pre-determined short-term cash inflow ($r_f$ and $r_l$) with a minimum probability of bearing loss. These financings are funded by saving and time deposits (79 per cent of the total deposits (D)) which are mostly of short-term tenor[2].
3. There are LR which are taken from total deposits (discussed in Figure 1).
4. Placement of funds in Islamic money market and Bank Indonesia Sharia Certificate (both in M) is not the ultimate target of Islamic banks and hence is excluded from the model.
5. Islamic banks adopt revenue sharing schemes ($r_b$) rather than profit loss sharing (PLS) in the deposit contracts as explained before in Figure 1.

As such, the Indonesian Islamic banking behavior in the competitive banking sector is formulated as:

$$\pi = [(r_f F + r_M)(1 - r_b) - C(D, F)] + [r_l L - C(L)]$$

with the first $[\cdot]$ as operational profit and the second $[\cdot]$ as non-operational profit while, M is formulated as:

$$M = (1 - \alpha)D - (F + L)$$

Therefore, $\pi$ can be rewritten as:

$$\pi = [r_f F(1 - r_b) - (1 - r_b)F + r(1 - \alpha - r_b(1 - \alpha))D - L(1 - r_b)] - C(D, F) + [r_l L - C(L)]$$

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and the maximum profit is the first-order condition of equation (12) as written below:

\[ \frac{\partial \pi}{\partial F} = r_f (1 - r_b) - (1 - r_b) - \frac{\partial C}{\partial F} (D, F) \] (13)

\[ \frac{\partial \pi}{\partial D} = r[(1 - \alpha) - r_b(1 - \alpha)] - \frac{\partial C}{\partial D} (D, F) \] (14)

\[ \frac{\partial \pi}{\partial L} = r_l - (1 - r_b) - \frac{\partial C}{\partial L} (L) \] (15)

Equations (13)-(15) explain that maximum profit occurs if Islamic banks can make:

- operational return (after return sharing) equals to the marginal cost of financing;
- the Islamic money market return plus operational return (after return sharing) equal to the marginal cost of deposit; and
- non-operational return plus return sharing equal to the marginal cost of financing losses.

Assuming that there are \( N \) different Islamic banks \((n = 1, \ldots, N)\) with typical deposit \((D^n)\), financing schemes \((F^n\) and \(L^n)\) and without any government security\[3\] being held, the functions of household saving and demand for investment from corporations are written as:

\[ S(r_f) = \sum_{n=1}^{N} D^n(r_f, r_b, r) \] (saving of household) (16)

\[ I(r_b, r_l) = \sum_{n=1}^{N} F^n(r_f, r_b, r) + \sum_{n=1}^{N} L^n(r_l, r) \] (demand for investment from companies) (17)

\[ \sum_{n=1}^{N} F^n(r_f, r_b, r) + \sum_{n=1}^{N} L^n(r_l, r) = (1 - \alpha) \sum_{n=1}^{N} D^n(r_f, r_b, r) \] (18)

(Inter bank money market)

And, by modifying equations (13)-(15) with the assumption of constant marginal costs of intermediation \((C_F = \gamma_F, C_D = \gamma_D \text{ and } C_L = \gamma_L)\) such that:

\[ r_f = 1 + \frac{\gamma_F}{(1 - r_b)}; \quad r_b = 1 - \frac{\gamma_D}{r(1 - \alpha)}; \quad \text{and} \quad r_l = \gamma_L + (1 - r_b) \] (19)

and adding them together into equation (16) in conjunction with equations (17) and (18), the equilibrium equations are formulated as:

\[ S\left(1 + \frac{\gamma_F}{(1 - r_b)}\right) = \sum_{n=1}^{N} D^n(r_f, r_b, r) = \frac{\sum_{n=1}^{N} F^n(r_f, r_b, r) + \sum_{n=1}^{N} L^n(r_l, r)}{(1 - \alpha)} = \frac{I(r_b, r_l)}{(1 - \alpha)} \] (20)
Model (20) explains that a balanced liquidity on the liability side is a function of cost of financing, revenue sharing ratio, PLS, return from operational financing, LR, total deposits, PLS return from money market and return from non operational financing.

**Econometric analysis**

Based on that Islamic model of liability side, an econometric method namely, ordinary least square (OLS) with a LPM is employed to explain factors that trigger depositors’ deposit withdrawals. Some lag independent variables are also included in the model (distributed lag model) to allow the possibility of the influence of previous periods to the current period of the target variable.

OLS is chosen because it is simple but powerful enough to explain relationship between dependent and independent variables. Moreover, the main focus of the econometric analysis is to find the short-run relationship among related variables due to limitation in the number of relevant variables and short period of historical data.

However, unlike common variables regressed with OLS method which are quantitative variables, this paper uses a qualitative variable (binary variable) representing the probability of depositors’ deposit withdrawals (Wooldridge, 2002, p. 211). In this case, such a binary variable is represented by value one or zero. Particularly, it values one for withdrawals in total Islamic banks deposits in a certain period (month) and value zero for no deposit withdrawal occurred in the other periods (months). The LPM takes the general formula of (Wooldridge, 2002, p. 233):

\[ P(y = 1|x) = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k \quad \text{or} \quad P(y = 1|x) = \beta_k \Delta x_k \quad \text{and}, \quad (21) \]

\[ \beta_k = E(x_k | \delta = 1, 0) \quad \text{(22)} \]

With regard to OLS method, it requires the fulfillment of six classical assumptions called classical error term plus one additional classical assumption called classical normal error term. Those seven assumptions are (Studenmund, 2005, p. 85):

1. The regression model is linear in the coefficient, correctly specified and has an additive error term.
2. The error term has a zero population mean.
3. All explanatory variables are uncorrelated with the error term.
4. Observations of the error term are uncorrelated with each other (no serial correlation).
5. The error term has a constant variance (no heteroskedasticity).
6. No explanatory variable is a perfect linear function of any other explanatory variable(s) (no perfect multicollinearity).
7. The error term is normally distributed.

Further, to have a robust model, the output of regression should comply with the Gauss-Markov requirement of best (minimum variance), linear, unbiased estimator (BLUE) (Gujarati, 2004, pp. 79-81). The following sub-sections are the process of econometrics analysis which are:
• defining the variables and model specification;
• constructing the models including testing them to fulfill the requirement of classical normal error term; and
• interpreting the result of the models.

**Definition of variables and model specification**

All time series data in the models are using Bank Indonesia monthly data report of Islamic banking industry, from December 2000 into December 2009. There are seven variables involved in the model namely:

(a) DFR = total incomes from operational financings.
(b) PF = total Islamic bank financings.
(c) SD = total Islamic deposits.
(d) SBI = rate of Bank Indonesia certificate.
(e) RS = return sharing paid by banks to depositors.
(f) BL = business (financing) losses.
(g) LR = liquidity reserves.
(h) WTR = total deposit withdrawals (binary variable).

For depositors, DFR is an indicator of the banking performance in managing robust portfolio financing. Assuming Islamic banks invest a significant amount of funds in their financing (PF), the high performance of DFR is seen in a high payment of RS. Depositors will respond it with an increasing placement of deposits (SD) and vice versa. Nonetheless, Islamic banks have to anticipate deposit withdrawals (WTR) because of (for example) a raising trend of SBI rate or under performance of financing (BL). One of their anticipations is by having LR. The statistical summary of every variable is listed in Table I.

Then, the model has three equations with three dependent variables namely WTR in the first equation, RS in the second equation and, LR in the third equation. The independent variables, on the other hand, are selected and tested referring to equation (20). The complete equations are:

\[
\Delta(WTR_t) = c - \beta_1 \Delta(DFR_t) + \beta_2 \Delta(SBI_t) - \beta_3 \Delta(SD_t) + e \quad (23)
\]

\[
\Delta(LR_t) = c + \beta_1 \Delta(BL_{t-2}) + \beta_2 \Delta(SD_t) + \beta_3(WTR_{t-1}) + e \quad (24)
\]

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomes from operational financings (DFR)</td>
<td>1,513,119</td>
<td>866,512</td>
<td>1,596,907</td>
</tr>
<tr>
<td>Islamic bank financings (PF)</td>
<td>16,365,341</td>
<td>14,270,381</td>
<td>13,666,364</td>
</tr>
<tr>
<td>Islamic deposits (SD)</td>
<td>15,150,818</td>
<td>12,189,905</td>
<td>13,181,813</td>
</tr>
<tr>
<td>LR</td>
<td>1,079,935</td>
<td>843,294</td>
<td>939,454</td>
</tr>
<tr>
<td>Rate of Bank Indonesia Certificate (SBI)</td>
<td>10.59</td>
<td>9.28</td>
<td>3.33</td>
</tr>
<tr>
<td>Return sharing paid by banks to depositors (RS)</td>
<td>5,011,372</td>
<td>1,762,620</td>
<td>5,336,819</td>
</tr>
<tr>
<td>Business (financing) losses (BL)</td>
<td>329,951</td>
<td>156,552</td>
<td>340,748</td>
</tr>
</tbody>
</table>

**Table I.**

**Statistical summary**

(million Rp)

**Note:** The variables in percentage per year
\[ \Delta(RS_t) = c + \beta_1 \log(PF_t) + \beta_2 WTR_{t-1} + e \]  \hspace{1cm} (25)

Equation (23) tries to explain the probability of deposit withdrawals based on the influences of:
- total amount of incomes from operational financing (DFR);
- rate of Bank Indonesia certificate (SBI); and
- total deposits in Islamic banks (SD).

Equations (24) and (25) are the reactions/responses of Islamic banks to mitigate deposit withdrawals. Particularly, equation (24) explains the existence of LR variable to fulfill the demand for deposit withdrawals which is influenced by:
- Islamic banks’ business (financing) losses;
- total deposits in Islamic banks; and
- probability occurrence of deposit withdrawals.

Finally, equation (25) explains the role of return sharing variable to prevent deposit withdrawals which is determined by:
- total Islamic banks’ financing; and
- probability occurrence of deposit withdrawals.

**Construction of the models**

**Stationary test.** Before modeling, a unit root test is conducted to check the stationarity of the variable. The basic idea of stationarity can be explained by taking a simple Autoregressive (AR) (1) process:
\[ Y_t = a_0 + a_1 Y_{t-1} + \epsilon_t \]  \hspace{1cm} (26)

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

Two widely used tests in this stage are augmented Dickey-Fuller (ADF) and Phillips and Perron (PP). ADF re-estimates equation (26) by subtracting \( Y_{t-1} \) (Lutkepohl and Kratzig, 2004, p. 54):
\[ \Delta Y_t = \alpha Y_{t-1} + \sum_{j=1}^{b-1} a_j \Delta Y_{t-j} + \epsilon_t \]  \hspace{1cm} (27)

The process is integrated when \( a(1) = 1 - a(1) - \cdots - a_p = 0 \) where \( \alpha = -a(1) \) and \( a_j = - (a_{j+1} + \cdots + a_p) \). Null and alternative hypothesis are \( H_0: \alpha = 0 \) and \( H_1: \alpha < 0 \); 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, 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). The result of stationary test is shown in Table II.

Table II reveals that LR and RS (dependent variables) are not stationary in level but integrated in order 1 (first difference). The same as those two variables, DFR, SD, SBI
and BL (independent variables) are also stationary (1 per cent statistical significance) in order 1 (first difference). However, PF is found stationary in level (10 per cent statistical significance) if it is formatted in log. In fact, PF is more stationary in order 1 (first difference) but to maintain the information on PF, log of PF is more preferable than its first difference. WTR is not tested as it is a binary variable.

Later, based on the result of stationary test, the equation (23) integrates all variables in order 1. Equation (24) also occupies all variables in order 1 except WTR and finally, equation (25) uses log PF besides WTR. After testing the stationary of variables, the next sub-section identifies the indication of correlation and causality among variables in the model.

Correlation and causality test. In order to assess the strength of the linear relationship between a dependent variable and independent variables and the direction of causality, the correlation coefficient test and granger causality test are used. The correlation coefficient formula is formatted as:

$$r_{1,2} = \frac{\sum [(X_{1i} - \bar{X}_1)(X_{2i} - \bar{X}_2)]}{\sqrt{\sum (X_{1i} - \bar{X}_1)^2 \sum (X_{2i} - \bar{X}_2)^2}}$$

(28)

with $r$ value ranges between $-1 \leq r \leq 1$. If two variables have a perfect positive linear correlation then $r = 1$, if they have a perfect negative linear correlation then $r = -1$ and, if there is no linear correlation then $r = 0$. Basically correlation coefficient detects the correlation of two variables without explaining the causality or direction of the correlation.

Table III shows that DFR, SBI and SD indicate a relatively high-correlation coefficient. DFR has an indication of strong negative correlation with SBI rate because incomes from operational financing are indeed influenced by the rate of SBI. When interest rate

<table>
<thead>
<tr>
<th>Variable name</th>
<th>ADF Level</th>
<th>ADF First difference</th>
<th>PP Level</th>
<th>PP First difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFR</td>
<td>3.0718</td>
<td>-10.6952**</td>
<td>-1.3961</td>
<td>-14.1540**</td>
</tr>
<tr>
<td>L(PF)</td>
<td>-2.7768*</td>
<td>-10.1171**</td>
<td>-2.5774</td>
<td>-10.3917**</td>
</tr>
<tr>
<td>SD</td>
<td>6.8046</td>
<td>-5.6610**</td>
<td>7.727</td>
<td>-6.1859**</td>
</tr>
<tr>
<td>LR</td>
<td>7.8714</td>
<td>1.1858</td>
<td>17.4706</td>
<td>-13.2525**</td>
</tr>
<tr>
<td>SBI</td>
<td>-1.6032</td>
<td>-4.5753**</td>
<td>-1.2837</td>
<td>-4.6116**</td>
</tr>
<tr>
<td>RS</td>
<td>2.6119</td>
<td>-12.2241**</td>
<td>2.6681</td>
<td>-12.1295**</td>
</tr>
<tr>
<td>BL</td>
<td>0.4752</td>
<td>-9.4924**</td>
<td>-0.1298</td>
<td>-14.2442**</td>
</tr>
</tbody>
</table>

Note: Significance at: *10 and **1 per cent
(SBI rate) goes up because of unfavorable economic/business condition, conventional banks will reduce their credits to the real sector.

Islamic banks, although do not rely on interest, get the impact of unfavorable economic condition through the lower incomes from operational financing. Meanwhile, the increase in total deposits in Islamic banks inflates total Islamic banks’ financing and incomes from operational financing accordingly. All of these variables determine the probability of deposit withdrawals as formulated in equation (23).

The next variable, LR, has a very strong and positive coefficient of correlation with SD and BL. It is because when SD raises, Islamic banks have to anticipate the unnoticed deposit withdrawals from depositors. Similarly, business (financing) losses have a tendency to trigger deposit withdrawals, hence, Islamic banks need to prepare a proper LR. Finally, RS shows a very strong and positive coefficient of correlation with PF because return sharing is paid higher if Islamic banks invest more funds to the real sectors. All of these variables are influenced by deposit withdrawals as formulated in equations (24) and (25).

After testing the coefficient of correlation, the granger causality test specifically investigates how the dependent variable \( Y_t \) can be explained by its past values \( (Y_{t-n}) \) and lags value of independent variables \( (X_{t-n}) \). Mathematically, the granger causality function is given as (Gujarati, 2004, p. 697):

\[
Y_t = \sum_{i=1}^{n} \alpha_i X_{t-i} + \sum_{j=1}^{n} \beta_j Y_{t-j} + u_{1t} \quad \text{and} \quad \tag{29}
\]

\[
X_t = \sum_{i=1}^{n} \lambda_i X_{t-i} + \sum_{j=1}^{n} \delta_j Y_{t-j} + u_{2t}
\]

\( Y_t \) is said to be granger caused by \( X_t \) if \( X_t \) and its lags explain \( Y_t \) and vice versa. Following the result of the coefficient of correlation, the granger causality test further identifies the direction of correlation as given in Table IV.

The granger causality test in Table IV confirms that LR (equation 24) is indeed explained by both SD and BL and RS (equation 25) is also explained by PF. Unfortunately, this test is not appropriate to check the bilateral causality between binary (qualitative) variable and its counterpart. The robustness of equation (23) is checked referring to OLS methods in the following sub-section.

**Regression result.** The robust estimated LPM of liability side is shown in Tables V-VII subsequently. First, equation (23) informs that the probability of deposit withdrawals is significantly influenced by:

- marginal incomes from operational financing;
- marginal interest rate in SBI rate; and
- marginal deposits in total Islamic deposits.

<table>
<thead>
<tr>
<th>Null hypothesis</th>
<th>(F)-statistics</th>
<th>(p)-value</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>LR does not Granger cause SD</td>
<td>29.644</td>
<td>0.000</td>
<td>Not accepted</td>
</tr>
<tr>
<td>LR does not Granger cause BL</td>
<td>22.3675</td>
<td>0.000</td>
<td>Not accepted</td>
</tr>
<tr>
<td>RS does not Granger cause PF</td>
<td>10.1843</td>
<td>0.001</td>
<td>Not accepted</td>
</tr>
</tbody>
</table>

**Table IV.** Granger causality test
Depositors’ withdrawal behavior

For example, if the marginal incomes from operational financing go up Rp1 million per month, depositors might not withdraw their deposits for about Rp0.84 million, everything is held fixed. Similarly, if the marginal deposits in total Islamic deposits raise Rp1 million per month, depositors might not take their money for about Rp0.13 million, everything is held fixed. Finally, if marginal SBI rate increases 1 per cent, depositors are very likely to take liquidate their deposits for the amount of Rp0.14 million in a month, everything is held fixed.

Second, equation (24) suggests that marginal LR as Islamic banks’ anticipation to fulfill the demand for liquidity from depositors are determined by:

### Table V. Estimation of equation (23)

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Coefficient</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(DFR)</td>
<td>−0.8499</td>
<td>−2.1027</td>
</tr>
<tr>
<td>D(SBI)</td>
<td>0.1436</td>
<td>1.9028</td>
</tr>
<tr>
<td>D(SD)</td>
<td>−0.1351</td>
<td>−2.7675</td>
</tr>
</tbody>
</table>

Diagnostic analysis

<table>
<thead>
<tr>
<th>Value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R²</td>
<td>0.1207</td>
</tr>
<tr>
<td>Residual sum of square</td>
<td>11.3569</td>
</tr>
<tr>
<td>Akaike info criterion</td>
<td>0.6596</td>
</tr>
<tr>
<td>F-statistics</td>
<td>4.7608</td>
</tr>
</tbody>
</table>

### Table VI. Estimation of equation (24)

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Coefficient</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(WTR)</td>
<td>0.1274</td>
<td>2.4712</td>
</tr>
<tr>
<td>WTR(−1)</td>
<td>0.143</td>
<td>0.8913</td>
</tr>
</tbody>
</table>

Diagnostic analysis

<table>
<thead>
<tr>
<th>Value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R²</td>
<td>0.3485</td>
</tr>
<tr>
<td>Residual sum of square</td>
<td>5.57 × 10¹¹</td>
</tr>
<tr>
<td>Akaike info criterion</td>
<td>25.2949</td>
</tr>
<tr>
<td>F-statistics</td>
<td>18.1904</td>
</tr>
</tbody>
</table>

### Table VII. Estimation of equation (25)

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Coefficient</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>LPF</td>
<td>0.1274</td>
<td>2.4712</td>
</tr>
<tr>
<td>WTR(−1)</td>
<td>0.143</td>
<td>0.8913</td>
</tr>
</tbody>
</table>

Diagnostic analysis

<table>
<thead>
<tr>
<th>Value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R²</td>
<td>0.063</td>
</tr>
<tr>
<td>Residual sum of square</td>
<td>3.49 × 10¹³</td>
</tr>
<tr>
<td>Akaike info criterion</td>
<td>29.3944</td>
</tr>
<tr>
<td>F-statistics</td>
<td>3.5311</td>
</tr>
</tbody>
</table>
Precisely, if the marginal losses in business increased by Rp1 million in the last two periods, Islamic banks might increase their current marginal LR by Rp0.28 million, everything is held fixed. If the marginal deposits increase Rp1 million, Islamic banks add their marginal LR by Rp0.07 million, everything is held fixed. Finally, if the last period of deposit withdrawals increased by Rp1 million, Islamic banks add their marginal LR by Rp0.17 million.

Finally, equation (25) suggests that marginal return sharing paid by Islamic banks to depositors is determined by both:

- total Islamic bank financings; and
- total amount of deposit withdrawals from depositors.

For example, if the total Islamic bank financings move up Rp1 million in a month, Islamic banks are suggested to increase their marginal return sharing to depositors by Rp0.13 million, everything is held fixed. However, if the total amount of deposit withdrawals in the last period raised Rp1 million, Islamic banks should increase their marginal return sharing to depositors for about Rp0.14 million.

Findings from the models
The model delivers some important messages to be taken into account by Islamic banks, banking regulators and all stakeholders. The first and the most important point to manage deposit withdrawals from depositors is to keep maintaining the robust performance of Islamic banks. It is because depositors will not terminate their deposits in Islamic banks if Islamic banks consistently generate positive return from financing (banking operations).

Even, depositors would increase their deposits in the banks and this will further increase their belief to not withdraw money immediately. Nevertheless, second, Islamic banks should be aware of the unpleasant economic conditions which could both decrease their return (incomes) from financing and cause tight monetary policy (an increase in interest rate). Both factors could potentially lead depositors to withdraw their money from Islamic banks.

Third, Islamic banks have to implement robust financing policies to minimize business losses which could cause depositors to take their money and the banks have to prepare extra LR. Fourth, in the upward trend of total deposits, Islamic banks are suggested to anticipate unnoticed deposit withdrawals, particularly if the last period also indicated an increased deposit withdrawal, by appropriately reserving some liquidity.

Finally, besides reserving some liquidity to mitigate any deposit withdrawal, Islamic banks can prevent deposit termination by:

- increasing their return sharing to depositors when they have an increase trend in financing leading to a potential extra payment of return sharing; and
- increasing their return sharing to depositors when there was an indication of deposit termination in the previous period.
Those are the behavior of depositors in withdrawing money from Islamic banks. Although this is the case of Indonesian Islamic banks, the other Islamic banking industries from different countries might face the same depositors’ behavior in withdrawing money. As such, findings and suggestions found in this paper are believed also relevant to other countries having the same Islamic banking industry. In addition, Islamic banks, banking regulators and all related parties, should take into account five findings and suggestions of this paper to anticipate and mitigate the risk of deposit withdrawals.

**Limitations of the models**

As explained in the earlier part, the models are constructed to mainly analyze the depositors’ withdrawal behavior on the liability side. The comprehensive liquidity management process in Figure 1 which shows a dynamic process involving banking financing policies on the asset side, cost efficiency, entrepreneurs’ business performance, etc. is not fully captured by the static models in this paper. Nevertheless, the models and findings of this paper might support the further research on the other aspects of the whole liquidity management process shown in Figure 1.

**Conclusion**

The problem of deposit withdrawals has to be understood and analyzed to maintain the robust performance of Islamic banking. Taking the case of Indonesian Islamic banking industry, the paper formulates the Islamic liability model to understand the behavior of depositors in withdrawing money from Islamic banks.

Then by using LPM under OLS method with some distributed lag variables, the paper successfully finds factors that lead depositors to take their money from Islamic banks. By knowing that, Islamic banks can anticipate deposit withdrawals by managing LR and can prevent unnoticed deposit withdrawals by adjusting return sharing paid to depositors.

**Notes**

1. It is assumed that most of Islamic banking financing goes to debt-based financing (mostly Murabahah) which produce a fixed, pre-determined and continuous income.
2. About 56.96 per cent of total deposits are short term which also implies consumers’ consumption behavior.
3. As the Sukuk Act was approved in May 2008, government Sukuk is still in the early stage of development.

**References**


**Further reading**

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