ALM BEHAVIOR OF BANKS: DEPOSIT PRICING POSITIONING, MANAGERIAL RISK APPETITE, AND MONEY MARKET

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Abstract

We construct a simple model in which banks use deposit interest rate position to shape for Asset Liability Management (ALM) strategy. Using monthly panel data of 104 banks over the January 2005 - December 2013 period, we empirically test our model. Panel data technique is used to estimate the parameter. We find that the model is well supported. The coefficient of loan growth is positive while reserves inventory is negative. Nevertheless, we find the spread to JIBOR O/N and business index to be negative which contradict our hypotheses. The results are largely unaltered when we account for turbulence period.

Keywords: Banks, Asset Liability Management, Risk Appetite, Deposits, Money Market, Macro Economy

JEL Classification: C23, E41, G21, G32

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1 Introduction

Liquidity is one of major risk in banking industry (Berger et al, 2010; Went and Donohue, 2009). Banks are vulnerable to liquidity shock due to its inherent nature of maturity mismatch. Banks collect short-term deposits and channel them into illiquid and long term instruments such as loans and bonds. Famous models developed by among others: Diamond and Dybvig (1983), Bhattacharya and Gale (1987), Diamond and Rajan (2001) highlight how banks could be easily exposed from runs not only triggered by fundamental factors but also by unfounded rumours. The case is especially important in emerging countries where interbank liquidity market is relatively thin and still underdeveloped (Chang and Velasco, 2001).

Banks manage its liquidity[33] through *asset liability management*/ ALM (Apostolik et al., 2009). Modern practice of ALM is characterized by active management on three policy instruments: financing, lending and inventory. Bank manager adjusts each instrument to prevailing condition and a set of optimization rules. For example banks may opt to reduce loan growth (or even to contract) if the financing is scarce (very high interest rate) and/or inventory is low.

The present paper studies the behavior of banks in Indonesia in managing the liquidity risk especially their ALM practices. Indonesia, like any other emerging market, is banking based economy. Banks account around 60%-70% of corporate funding. On the other hand, the bank funding base is largely traditional with retail deposits hold 70%-80% share of asset financing. Market for deposits is characterized as oligopoly on both sides of demand and supply. The ten largest banks constitutes around 60% of the deposit market demand and around 0.6% depositors account for 50% of total deposit supply. Therefore, a comprehensive investigation on the behaviors of this industry would give a substantial benefit not only for body of knowledge of banking but also policy and practical implications.

Surprisingly, only few studies in this field have been done in the context of emerging markets. Therefore, we consider that our study would provide marginal contribution to existing body of literature.

[33] Liquidity risk is often classified as risk on banking book (liquidity funding risk) and risk on the trading book (liquidity market risk). Risk on the banking book arises from the maturity mismatch which caused banks to be vulnerable to sudden withdrawal. Risk on the trading book on the other hand arises from potential loss of sudden disappearance of market liquidity of the assets it holds most (Went and Denohue, 2010). The definition liquidity risk we assume in this study is the banking book type (liquidity funding risk).

Moreover, our approach to address the research problem is unique. Rather than employing a theoretical modeling to derive a set of prepositions, we start with a practical perspective.

Basically, our study attempts to explore a clear picture of how bank ALM works in Indonesia. To this end, we outline the framework of ALM, postulate possible behavior and design empirical scheme to verify the hypotheses. We have obtained a unique daily deposit interest rate database and monthly financial statements for almost all banks operating in Indonesia during January 2005 – February 2014 period. This data set provides us a necessary and adequate means to address our research objective.

The paper is structured as follows. Section 2 presents literature review of bank liquidity risk management. The model is described in section 3 that subsequently be followed by the empirical methodology in section 4. Section 5 presents the estimation results. In section 6, we conclude the paper and provide policy implications.

2 Bank liquidity risk management: a literature review

Bankers have been aware about the liquidity risk for a very long time. Bank is an inherently unstable since the business involves a substantial maturity mismatch (Freixas and Rochet, 2008; Degryse H. et al, 2009). It mobilizes deposits and invests them long-term loans and by so doing it exposes itself to risk of facing unexpected withdrawal by customers.

In normal situation, cash outflow is generally less than inflow. Hence, bank could maintain a particular balance of deposit (called its core deposits). Nevertheless, there could be times where a sudden and massive withdrawal happens either because of needs of customers or deteriorating of confidence. The latter cause has been the focus of decades of study, one of earliest work could be addressed to Bagehot (1873).

Diamond and Dybvig (1983) is one famous model of liquidity risk in modern banking. They provide a theoretical framework in which bank invests in illiquid and long term asset simultaneously funded by short term customer deposit. There is uncertainty in the timing of customer liquidity need and characteristic of the customer. They show that there could be multiple equilibria in which one is inefficient equilibrium: customer withdraws at the end of banks investing period. There are two reasons for possibility of early withdrawal: (1) when there emerges more attractive alternative instruments compared to deposits (Von Thadden, 1996) and (2) coordination failure among depositors due to lack of confidence to the banks (Freixas and Rochet, 2008).

The coordination failure could happen due to asymmetric information; the nature of withdrawal is giving huge incentives to be the first in line. There could be a situation where some depositors completely fail to retrieve their money. The cause of asymmetric information could be from outside of the bank i.e. sunspots (Anderlini, 1989) and inside of the bankie banks fundamentals (Postlewaite and Vives, 1987).

Concern over possibility of bank run is not the only factor influence the liquidity management. Banks would also like to optimize the level of cash buffer: to stay liquid at the same time to profit from existing lending opportunities. This paradigm necessitates an integrated view between both sides of bank balance sheet: loan expansion and deposit mobilization. Seminal theoretical studies on this approach are among other Ho and Saunders (1981), Prisman et al. (1986) and Kasyap et al. (2002).

Ho and Saunders (1981) build an inventory based model of liquidity risk management. By modeling a bank as a security dealer they argue that banks manage their liquidity through changing the spread of interest margin. The optimal amount of reserves is a function of its cost which composed of opportunity cost of capital (desired target interest margin) and cost of liquidity shortage (central bank penalty rate or interbank rate). Maudos and Guevara (2004) expand the model by adding risk premium and operating cost.

Another influential model of liquidity risk management is the work of Prisman et al. (1986). They refer to the model of industrial organization approach first introduced by Monti-Klein (1971), uncertainty of customer withdrawal and the existence interbank money market. They show that the increase of interbank money market rate would increase the rate of loan and deposits; hence would reduce lending and raise the volume of deposit. The impact of increase of withdrawal uncertainty to loan will depend negatively on the level of desired reserve. High uncertainty coupled with high desired reserves would reduce lending and increase volume of deposit.

Kashyap et al. (2002) explore the possibility of synergies between the two sides of the balance sheet. One of main theoretical result is banks with strong funding basis should expand credit volume more aggressive. The cost of liquid assets inventory is shared between funding and lending activities. Gatev et al. (2007) expand the study of Kashyap et al (2002) by recognizing separated risk in the assets side and liability side and the possibility of a hedging existence.

An interesting recent model of liquidity holdings by bank was developed by Calomiris et al. (2010). With three different set up namely (1) autarkic, (2) coalition of banks and (3) presence of deposit insurance, they show that banks hold cash instruments for three motives: (a) saving on liquidation cost, (b) signaling device due to imperfect monitoring of capital value and (c) improvement to risk management motive. Cash holding is the highest in the presence of deposit insurance in order to prevent moral hazard and ensure proper risk management.

Berger et al. (2014) present the first study that jointly examines how regulatory interventions and capital support affect troubled banks' risk taking and liquidity creation. They obtain regulatory intervention

panel dataset of German banks (2487 banks) with annual frequency on period 1999-2009. Two dependent variables: (a) change in risk weighted assets and (b) change in liquidity production are regressed against regulatory intervention and capital support. They find that regulatory interventions and capital support both succeed in reducing bank risk taking. These two regulatory actions trigger decreases in liquidity creation that could help stabilize the troubled banks.

Gatev et al. (2007) investigate 100 largest publicly-traded domestic US banks in the period of 1990-2002. They construct weekly conditional volatility of stock return as a proxy of risk. This risk measure is then regressed against level of loan commitment and deposit base with variety of bank specific and market control variables. They find that risk measure is higher for banks with greater loan exposure. Nevertheless, this measure could be well compensated by deposit base. In this regards, they conclude that the synergies of lending and deposit funding is in form of hedging.

In an extensive study including 7,000 banks from OECD countries, Bonner et al. (2013) document that in the absence of liquidity regulation, the main motivation of bank cash holding is bank specific (business model, size, profitability and deposit holdings) and country specific (disclosure requirements and industry concentration). In a more regulated environment, disclosure requirements and size remain important factors in managing liquidity risk.

Bonfim and Kim (2010) study the behavior of banks liquidity risk management in times of crises. Using data from 500 commercial banks in 43 countries, they test three liquidity indicators: loan to deposit ratio, interbank ratio and liquidity ratio against a set of explanatory variables: solvency, size, profitability, efficiency and specialization. They also design an empirical scheme that investigates for possible collective action. They find that herding behaviour is present for largest bank that is collective action on liquidity risk management could potentially raise the systemic risk.

Rosen (2007) shows a negative relationship between deposit interest rate and size. Using 14,815 banks in the US, he documents that larger and multi market banks have a competitive advantage in deposit pricing but diminished overtime as industry consolidated. This finding might be due to the fact that large and multi market banks have access to more non-deposit liabilities and diversification effect (banks become less sensitive to shocks to particular market). This may reduce their desire to compete intensively for deposits. His finding confirms earlier studies by Hannan and Prage (2004) and Park and Pennacchi (2005).

Using panel logistic methods with dataset of Croatian Banks, Kraft and Galac (2007) find that high interest rate is a reliable signal of risk taking. They find that banks could steal market from others using interest rate. Nevertheless, in order to benefit from expensive funds obtained the banks are tempted to invest in risky assets which subsequently increase the probability of failure. The reaction of depositors to banks portfolio character is somewhat unresponsive, this might be due to implicit guarantee (from the regulators) perceived by the depositor.

3 The ALM model

In this paper, we construct a practical model of ALM based on the insights derived from studies outlined in previous section. In this model, we focus on the behavior of three ALM response variables; a particular level of liquid assets[34] inventory (henceforth simply called inventory), deposit interest rate and loan expansion.

Banks use these three variables as main ALM responses for several reasons:

1. The role retail funding as major source of financing. The share of retail deposits in a typical Indonesian bank accounts for 70%-80% of assets. Other instrument especially wholesale funding and interbank market are largely underdeveloped.

2. Indonesian banking industry is a highly disproportionate from both perspective of assets and source of funding. Five largest banks in Indonesia accounts for more than 50% of total assets and around 0.6% of depositors control 60% of total deposits supplies. This kind of profile helps establish interest rate as a main competition tool.

3. As stated by Stiglitz and Greenwald (2003), interest rate of loan does not indicate the stance of credit condition due to *credit ration*. The interest rate of loan could be stable even though the attitude of banks toward new credit has been drastically changed. This would be reflected in loan origination standards[35].

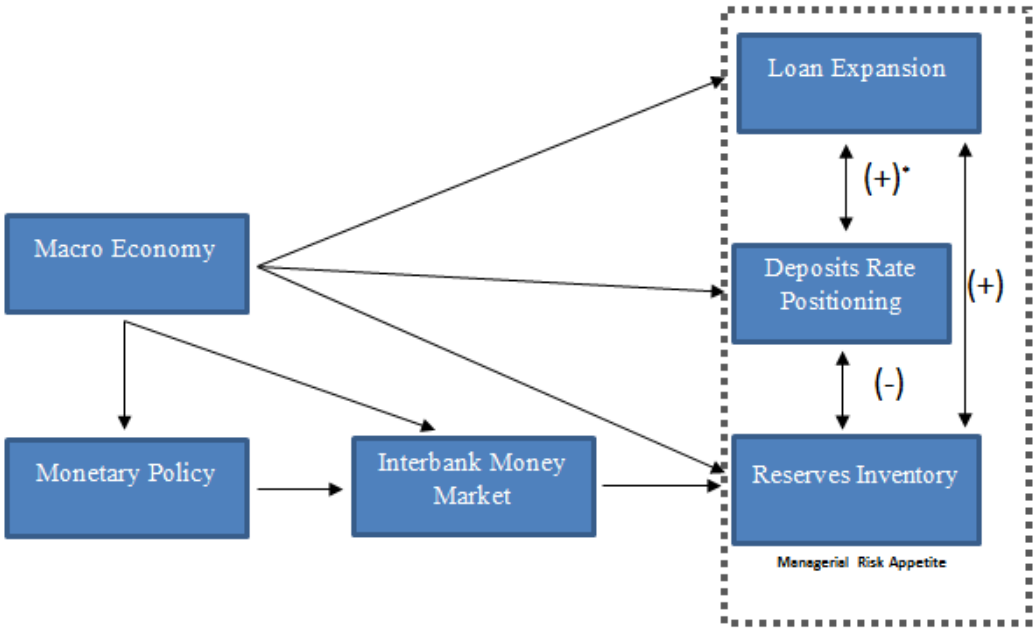
4. These three response instruments allow banks in Indonesia to manage its liquidity actively. Banks could alter the level of inventory, deposit attractiveness and loan expansion that suit best to the prevailing condition or needs.

A bank essentially strives to maintain appropriate (target) inventory for two purposes: (1) regulatory requirement and (2) anticipating cash withdrawal from both funding and lending activities. However, the level of liquid assets could change due to shift in (a) business prospect from cheaper funding cost and/or higher investing yield, (b) macro economy condition and (c) risk appetite.

[34]The regulatory category for liquid assets in Indonesia comprises of cash, placement in the central bank, interbank money market and government securities (Trinugroho et al., 2015). Common liquidity indicators are liquid assets (over regulatory requirement; LA/D) to deposit ratio and loan to deposit ratio (L/D)

[35]The proxy of this variable perhaps is more appropriate to use than loan delta, however we do not have access to this kind of data. Another challenge to use this variable is that it might be very subjective and very difficult to measure properly.

Figure 1. A practical view of Asset Liability Management



Note: *Direction of correlation

The relationship between inventory, deposit interest rate positioning and loan expansion are both simultaneous. On the other hand, the influence of interbank market and macro economy is one way since it is assumed that there is no individual bank could alter these factors. While the reason for macro economy is quite obvious, one way effect of interbank money market is due to its nature as secondary source of liquidity[36] and the domination of central bank (as it is a part of monetary policy transmission)[37].

Bi-causality between deposit interest rate positioning and inventory are in two ways. First, low inventory level could cause bank to behave aggressively for deposit competition. In this regard, bank would offer higher than average interest rate in order to attract more deposit. Second, it could sometimes be a situation in which available funds in deposits market is so abundant, perhaps due to large foreign capital inflow or government expansion, that some banks consider this as an expansion opportunity. Therefore, they still offer higher than average interest rate to tap the funds then channel them to loans. This process may or may not involve higher than desired inventory level, depends on the speed of intermediation. If the loan opportunities are already available, then the hunt of deposits would not involve a persistence higher inventory. On the other hand, if banks have to search for worthy debtor candidates (and perhaps do some screening jobs) then inventory would likely be elevated for sometimes (or even be persistent).

Simultaneous interaction of loan and inventory also forms in two ways. First, low inventory could reduce the appetite of banks to expand further. In this matter, bank would contract the loan expansion. Second, in an expansion phase of economic cycle, risk appetite of banks could be so high that they are willing to lower inventory to take the opportunities to expand. This risk complacency is familiar in crisis literature (see for example Reinhart and Rogoff (2010); Claessens et al. (2013).

External factors such as macro economy condition, monetary policy and internal characteristics which we call managerial risk appetite can affect directly or indirectly to the ALM responses: inventory, deposit interest rate and loan. A famous and recent example is a shock to financial market confidence would cause simultaneously loan contraction, banks have to hoard cash (accumulating inventory) and hence higher drive to attract deposits. The complete set of hypotheses will be given in methodology section.

4 Research methodology

The qualitative explanation (concept and literature review) outlined in section 2, could be stated explicitly in form of testable hypotheses. Our ALM concept could be transformed into the following linear model:

[36]Interbank money market still constitutes a small portion of funding. In a typical Indonesian bank, it accounts only 10%-15% of assets financing. Smaller banks are even less reliant to this type source of funding.

[37]The central bank (Bank Indonesia) adopted interest targeting in which its main monetary policy canal: BI rate is used as a gauge to intervene in the money market. Bank Indonesia uses its money market operation whenever the prevailing interbank rate is deviating too much.

$$r^D = \beta_0 + \beta_1 L + \beta_2 I + \beta_3 MRA + \beta_4 IB + \beta_5 Macro \quad (1)$$

Where

r^D : Deposit Pricing Position

L : Level of Loan

I : Liquid Assets(Reserve) Inventory

MRA : a vector of managerial risk appetitevariables

IB : Interbank money market condition

$Macro$: a vector of macro economy and financial market investors sentiment variables

Note here, we should treat the following variables: positioning deposit interest rate, loan and inventory as simultaneously determined (endogenous). We could regard some variables in the vectors of selected managerial risk appetite, macro economy, and interbank money market condition as control. A mixed panel and time series dataset is used to verify the hypotheses. The data comprised of 104 conventional banks with monthly frequency from period of January 2005 to December 2013. The data for macro economy and interbank money market condition are time series

Since we are dealing with long panel data, we use two types of estimation methods as suggested by Cameron and Triverdi (2008). First, we begin with Estimated Generalized Least Squares (EGLS) with Panel Corrected Standard Error (PCSE) that is robust to autocorrelation and heteroscedasticity. The panel data method only considers for cross section effect. Next, we account the endogeneity between deposit price positioning, loan growth and excess reserve by employing the methods of Two Stage Least Squares (2LS) weighted by White variance-covariance matrix. The instruments used are lagged terms of endogenous variables and independent variables.

We use the following proxies for variables:

Table 1. Variables

No.	Variables (Notations)	Definition	Proxies (Notation)	Expected Sign
		Endogenous Variables		
1	Deposit Pricing Position	One of Banks ALM response variables through changing the relative position of own deposit interest rate versus others.	Standardized monthly daily average of deposit maximum interest rate tenor 1 month (Z_MAX)[38]	Dependent variable
2	Loan	One of Banks ALM response variables through changing behavior of loan disbursement.	Log of total Loan (LOAN_L)	Explanatory variable, Positive
3	Liquid Assets (Reserves) Inventory	One of Banks ALM response variables through changing the position of liquid assets inventory.	- The ratio of excess liquid assets (over regulatory requirement) to Non Core Deposits (EXRESS)[39] **or** - The ratio of loan to deposit ratio (LDR)	Explanatory variable, Negative

[38] The formula can be given as follows $Z = \frac{X_i^t - \overline{X}^t}{\sigma_{\overline{X}^t}}$, where X_i^t is the daily average of bank i 1 month maximum deposit interest rate at month t, $\overline{X}^t$ is the average of the industry at month t ie $\overline{X}^t = \frac{\sum_{i=1}^{N} X_i^t}{N}$ and $\sigma_{\overline{X}^t}$ is the standard deviation of X_i^t.

[39] We use definition of Non-Core Deposits as employed by Alamsyah et al. (2009) in which non-core deposits is the sum of 30% of checking account plus 30% of saving accounts and 10% of time deposits.

Table 1. Variables (continued)

Exogenous Variables				
4	Managerial Risk Appetite (MRA)	A vector of variables that describe the overall risk taking characteristic that unique for individual bank: a tendency for conservative or expansive behavior.	- Log of value total assets (Asset_L) - Ratio Net Profit to Equity (Return On Equity, ROE) - Ratio of Operating Cost to Total Income (Cost To Income; CIR) - Average of 6 month yearly loan growth (AVG6YG). - Ratio of Current Account plus Saving Account to Total Deposit (CASA)	Negative Positive Negative Positive Negative
5	Interbank Market Condition (IB)	A variable that describe the tightness of banking system liquidity	- Spread of Overnight Jakarta Interbank Offered Rate to Central Bank Deposit Facility rate (JIBON_S)	Positive
6	Macro Economy (Macro)	A vector of variables that describe the general condition of macro economy and financial market investors' sentiment.	- Business activities index (simple average of retail sales index, industrial product and manufacturing import). (BUSS_IDX) - Financial sentiment index (simple average of indexed (May 2010=100) selected financial indices: Jakarta Composite Index (JCI), inverse of spread of Indonesia Rupiah Sovereign Bond to US Treasury Tenor 10 year and inverse of USD/IDR exchange rate. (FIN_IDX)	Positive Positive

In addition to above basic relationship, we also estimate the impact of turbulence period. We assume the impact to be on level and interaction through loan expansion and excess reserve. We repeat using the similar methods and add the interaction term as instrumental variables. The dating of turbulence period are set by using the Banking Stability Index issued by IDIC for the period of September 2005-March 2006, August 2008-April 2009 and August-November 2013.

5 Estimation results

The estimation results are reported in four subsections. In subsection 5.1, we present the result on pattern of ALM: response of deposit price positioning to loan expansion and reserve inventory. Then, we present the empirical impact estimates of managerial risk appetite to deposit pricing in subsection 5.2 which followed by the results on interbank and macro economy condition. Sub section 5.4 presents the result of cointegration test.

5.1 The Pattern of Asset Liability Management

First, we report in table 2 the result of the pattern of ALM without accounting for possible endogeneity problem. Here, we can see that all ALM variables have signs as expected which are positive for loan expansion and negative for excess reserve. The coefficients obtained for loan expansion are in the range of 0.099 – 0.164 suggesting 1% loan expansion is associated with approximately 10-50 Z points more aggressive positioning deposit pricing. Loan expansion coefficient is strongly significant (at 1% level) in all specification. The coefficients for excess reserve are in the range of -0.005 - -0.010 with sufficient significance (at 5% level) reached in specification 3.

The significance of estimation is substantially improved if we account for endogeneity. As can be seen in table 3, all excess reserve coefficient dramatically increase while the loan expansion coefficients are somewhat improving. The coefficients of loan expansion are now in the range of 0.113 – 0.288 all with 1% level of significance. On the other hand, the excess reserve coefficient is now in the range of -0.061 - -0.009 with 1% level of significance except specification VIII. This finding suggests that an increase in excess reserve could enable banks to better position it selves in deposit pricing around 0.01 to 0.06 z points.

Table 2. Estimation results: Panel Linear Model

Variables	Z_Max						
	I	II	III	IV	V	VI	VII
C	-0.228	-0.139	-0.452***	-0.249	-1.005***	-0.296	-0.208
	(0.205)	(0.207)	(0.161)	(0.205)	(0.205)	(0.197)	(0.197)
LOAN_L	0.123***	0.164***	0.099***	0.115***	0.154***	0.124***	0.128***
	(0.021)	(0.018)	(0.012)	(0.021)	(0.021)	(0.021)	(0.021)
EXRESS	-0.007		-0.010**	-0.008	-0.005	-0.006	-0.007
	(0.005)		(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
LDR		-0.0006***					
		(0.0002)					
ASSET_L	-0.040	-0.082***		-0.031	-0.054**	-0.035	-0.046*
	(0.026)	(0.024)		(0.026)	(0.026)	(0.026)	(0.025)
ROE	-0.0003***	-0.0003***	-0.0003***		-0.0002***	-0.0003***	-0.0003***
	(0.00008)	(0.00008)	(0.00008)		(0.00008)	(0.00008)	(0.00008)
CASA	-1.275***	-1.286***	-1.275***	-1.274***		-1.299***	-1.253***
	(0.064)	(0.064)	(0.064)	(0.064)		(0.063)	(0.063)
CIR	-0.055	-0.055	-0.050	-0.049	-0.192***		-0.044
	(0.038)	(0.038)	(0.038)	(0.038)	(0.037)		(0.036)
AVG6YG	0.001***	0.001**	0.001**	0.001***	0.0009*	0.001***	
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	
JIBON_S	-0.008**	-0.008**	-0.009**	-0.008**	-0.005	-0.008**	-0.010**
	(0.0041)	(0.0041)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
BUSS_IDX	-0.003***	-0.0029***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
FIN_IDX	-0.036	-0.036	-0.041	-0.039	-0.008	-0.037	-0.034
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.036)	(0.036)
No. Obs	11041	11043	11041	11041	11041	11064	11168
R-squared	0.59	0.59	0.59	0.59	0.57	0.59	0.59
F-Test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FE LR Test (p value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: Panel EGLS Cross Section Weights (PCSE) estimates. The values in parentheses are robust standard error. *,** and ***indicate significance at 10%, 5% and 1% respectively.

Table 4 presents the result when we account for turbulence period. There is a negative impact to positioning of deposit pricing in times of turbulence. Banks tend to reduce the deposits gathering and hence offer a lower interest rate when economic and financial situation is in turbulence. The estimated coefficients are in the order of -0.535 and -0.422 with strong statistical level of significance (at 1%).

The results of panel EGLS PCSE suggest that the sensitivity of positioning of deposit pricing to loan expansion are in the range of 0.094 to 0.167 (all are significant at 1% level) in normal period. This finding is largely unchanged from previous estimation. Nevertheless, when things turn to sour, banks that still pursue loan expansion might have to offer higher interest rate (relative to other). The interaction terms of loan expansion with turbulence are in the range of 0.030 – 0.037 with high level of statistical significance (at 1%) in all specifications. The interaction terms of excess reserve and turbulence are found to be in 0.006-0.012 range however they are not significant by acceptable standards.

When we account for the endogeneity (see table 5) we find again that the level impact coefficient of turbulence period are negative in the range of -0.461 - -0.338. All coefficients are strongly significant at 1% level. The interaction terms of loan expansion and turbulence are all positive and significance at 1% level. The range of the coefficients is slightly lower: 0.026 – 0.033 nevertheless. The interaction terms of loan expansion and excess reserve are again found to be non-significant in the range of -0.023 - -0.009.

All findings presented above lead us to conclude that there is quite robust empirical support to the ALM hypotheses. Loan expansion would lead higher positioning in deposit pricing for banks. The situation is more binding in turbulence period. On the other hand there is also a negative relationship between excess reserves and positioning of deposit pricing, nevertheless this finding is less robust than loan expansion. The situation has not changed significantly if we replace the excess ratio with LDR. Lastly, we find that all else equal turbulence period is exerting negative impact to positioning of banks deposit pricing: they became less aggressive.

Table 3. Estimation results: Panel Instrumental Variables

Variables	Z_Max						
	I	II	III	IV	V	VI	VII
C	0.159	-0.150	-0.353	0.160	-0.817***	-0.076	-0.195
	(0.203)	(0.207)	(0.220)	(0.202)	(0.233)	(0.188)	(0.232)
LOAN_L	0.192***	0.288***	0.113***	0.192***	0.229***	0.184***	0.133***
	(0.039)	(0.029)	(0.016)	(0.039)	(0.037)	(0.037)	(0.025)
EXRESS	-0.048***		-0.061***	-0.048***	-0.040***	-0.051***	-0.009
	(0.016)		(0.014)	(0.016)	(0.011)	(0.015)	(0.006)
LDR		-0.0007***					
		(0.0003)					
ASSET_L	-0.110***	-0.189***		-0.110***	-0.123***	-0.088**	-0.052*
	(0.037)	(0.030)		(0.038)	(0.037)	(0.036)	(0.031)
ROE	-0.0004**	-0.0004**	0.0004**		-0.0004**	-0.0004**	-0.0003**
	(0.0002)	(0.0002)	(0.0002)		(0.0002)	(0.0002)	(0.0001)
CASA	-1.391***	-1.338***	-1.386***	-1.391***		-1.412***	-1.250***
	(0.093)	(0.064)	(0.088)	(0.095)		(0.078)	(0.057)
CIR	-0.063	-0.057	-0.053	-0.056	-0.180*		-0.049
	(0.059)	(0.060)	(0.055)	(0.058)	(0.100)		(0.053)
AVG6YG	-0.197***	-0.070***	-0.168***	-0.201***	-0.161***	-0.160***	
	(0.052)	(0.020)	(0.047)	(0.053)	(0.045)	(0.043)	
JIBON_S	-0.013**	-0.010*	-0.013**	-0.013**	-0.008	-0.012**	-0.010*
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)
BUSS_IDX	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***	-0.003***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0006)	(0.0005)	(0.0004)
FIN_IDX	-0.044	-0.041	-0.061	-0.045	-0.015	-0.051	-0.032
	(0.041)	(0.040)	(0.040)	(0.041)	(0.039)	(0.040)	(0.036)
No. Obs	11040	11039	11040	11040	11040	11040	11152
R-squared	0.51	0.55	0.52	0.51	0.51	0.51	0.59
F-Test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OIR: (p-value)	0.171	0.117	0.122	0.177	0.519	0.221	0.125

Panel 2SLS Cross Section Weights (White) estimates. The values in parentheses are robust standard error. *,** and ***indicate significance at 10%, 5% and 1% respectively.

Table 4. Estimation results: Panel Linear Model Accounting for Turbulence Period

Variables	Z_Max						
	I	II	III	IV	V	VI	VII
C	-0.120	-0.031	-0.410	-0.138	-0.876	-0.189	-0.88
	(0.207)	(0.210)	(0.161)	(0.207)	(0.208)	(0.200)	(0.202)
LOAN_L	0.126***	0.167***	0.094***	0.117***	0.156***	0.126***	0.130***
	(0.021)	(0.019)	(0.012)	(0.021)	(0.021)	(0.021)	(0.021)
EXRESS	-0.006		-0.010	-0.007	-0.006	-0.006	-0.007
	(0.005)		(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
LDR		-0.0006					
		(0.0002)					
ASSET_L	-0.051**	-0.093***		-0.042*	-0.065**	-0.047*	-0.058**
	(0.026)	(0.025)		(0.026)	(0.026)	(0.026)	(0.025)
ROE	-0.0003***	-0.0003***	-0.0002***		-0.0003***	-0.0003***	-0.0003***
	(0.00008)	(0.00008)	(0.00008)		(0.00008)	(0.00008)	(0.00008)
CASA	-1.266***	-1.276***	-1.265***	-1.264***		-1.289***	-1.244***
	(0.064)	(0.064)	(0.064)	(0.064)		(0.063)	(0.063)
CIR	-0.057	-0.058	-0.050	-0.052	-0.192***		-0.044
	(0.038)	(0.038)	(0.038)	(0.038)	(0.036)		(0.036)

Table 4. Estimation results: Panel Linear Model Accounting for Turbulence Period (continued)

Variables	Z_Max						
	I	II	III	IV	V	VI	VII
AVG6YG	0.001*** (0.0005)	0.001** (0.0005)	0.0001** (0.0005)	0.001*** (0.0005)	0.0009* (0.0005)	0.001*** (0.0005)	
JIBON_S	-0.007* (0.004)	-0.007* (0.004)	-0.008* (0.004)	-0.007* (0.004)	-0.005 (0.004)	-0.007* (0.004)	-0.009** (0.004)
BUSS_IDX	-0.003*** (0.0003)	-0.003*** (0.0003)	-0.003*** (0.0003)	-0.003*** (0.0004)	-0.003*** (0.0004)	-0.003*** (0.0003)	-0.003*** (0.0003)
TURBL	-0.443*** (0.106)	-0.446*** (0.105)	-0.422*** (0.105)	-0.445*** (0.106)	-0.535*** (0.109)	-0.446*** (0.106)	-0.428*** (0.105)
TURBL*LOAN_L	0.031*** (0.007)	0.032*** (0.007)	0.030*** (0.007)	0.031*** (0.007)	0.037*** (0.007)	0.031*** (0.007)	0.030*** (0.007)
TURBL*EXRESS	0.008 (0.009)	0.006 (0.008)	0.007 (0.009)	0.008 (0.009)	0.012 (0.009)	0.008 (0.009)	0.008 (0.009)
No. Obs	11041	11041	11041	11041	11041	11064	11168
R-squared	0.59	0.59	0.59	0.59	0.57	0.59	0.59
F-Test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
FE LR Test (p value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Panel EGLS Cross Section Weights (PCSE) estimates. The values in parentheses are robust standard error. *,** and ***indicate significance at 10%, 5% and 1% respectively.

Table 5. Estimation results: Panel Instrumental Variables Accounting for Turbulence Period

Variables	Z_Max						
	I	II	III	IV	V	VI	VII
C	0.265 (0.219)	-0.035 (0.224)	-0.306 (0.237)	0.266 (0.218)	-0.695 (0.243)	0.170 (0.201)	-0.070 (0.243)
LOAN_L	0.194*** (0.039)	0.288*** (0.029)	0.108*** (0.018)	0.194*** (0.039)	0.230*** (0.038)	0.195*** (0.038)	0.136*** (0.025)
EXRESS	-0.046*** (0.016)		-0.060*** (0.015)	-0.046*** (0.016)	-0.039*** (0.012)	-0.045*** (0.015)	-0.009 (0.006)
LDR		-0.0008*** (0.0003)					
ASSET_L	-0.120*** (0.036)	-0.198*** (0.030)		-0.120*** (0.037)	-0.132*** (0.035)	-0.114*** (0.036)	-0.064** (0.031)
ROE	-0.0004** (0.0002)	-0.0004** (0.0002)	-0.0004** (0.0002)		-0.0003** (0.0002)	-0.0004** (0.0002)	-0.0003** (0.0001)
CASA	-1.390*** (0.094)	-1.332*** (0.065)	-1.383*** (0.088)	-1.391*** (0.095)		-1.422*** (0.090)	-1.241*** (0.057)
CIR	-0.065 (0.059)	-0.061 (0.061)	-0.054 (0.055)	-0.058 (0.059)	-0.182* (0.101)		-0.047 (0.052)
AVG6YG	-0.203*** (0.053)	-0.074*** (0.021)	-0.172*** (0.047)	-0.208*** (0.054)	-0.167*** (0.046)	-0.206*** (0.053)	
JIBON_S	-0.011* (0.006)	-0.009 (0.006)	-0.010* (0.006)	-0.011* (0.006)	-0.007 (0.005)	-0.011* (0.006)	-0.009* (0.005)
BUSS_IDX	-0.004*** (0.0005)	-0.004*** (0.0005)	-0.004*** (0.0005)	-0.004*** (0.0005)	-0.004*** (0.0006)	-0.004*** (0.0004)	-0.003*** (0.0003)
TURBL	-0.354** (0.144)	-0.413*** (0.131)	-0.338** (0.141)	-0.355** (0.145)	-0.461*** (0.175)	-0.355** (0.145)	-0.439*** (0.119)
TURBL*LOAN_L	0.027*** (0.009)	0.030*** (0.008)	0.026*** (0.009)	0.027*** (0.009)	0.033*** (0.011)	0.027*** (0.009)	0.031*** (0.008)
TURBL*EXRESS	-0.022 (0.024)	-0.009 (0.010)	-0.018 (0.021)	-0.023 (0.024)	-0.018 (0.023)	-0.022 (0.024)	0.010* (0.005)

Table 5. Estimation results: Panel Instrumental Variables Accounting for Turbulence Period (continued)

Variables	Z_Max						
	I	II	III	IV	V	VI	VII
No. Obs	11040	11037	11040	11040	11040	11062	11152
R-squared	0.51	0.54	0.52	0.51	0.51	0.51	0.59
F-Test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
OIR: (p-value)	0.194	0.118	0.133	0.201	0.567	0.209	0.114

Panel 2SLS Cross Section Weights (White) estimates. The values in parentheses are robust standard error. *,** and ***indicate significance at 10%, 5% and 1% respectively.

5.2 The Impact of Managerial Risk Appetite

Of five bank characteristics variables we use, we find that CASA, ROE, Asset and AVG6YG as the most important. We find efficiency as largely statistically unimportant except in few specifications.

Banks with more transactional characteristics (higher CASA ratio) will position themselves much better than other banks. The range of estimates obtained using EGLS PCSE methods are -1.299 - -1.253 with 1% level of significance in all specification (including or not including turbulence period). The estimates are somewhat increased when we use 2SLS White methods to -1.412 - -1.250 with high level of significance (1%). This result is largely are unaltered when we include turbulence period. Arguably this is the most robust finding in our study.

Although numerically small, the estimation results of profit target are highly significant. It seems in order to meet the shareholders requirement; banks choose to manage the funding conservatively. They are not tempted to pursue aggressive deposits gathering to fund lending. In essence banking Indonesia is about margin business not quantity business.

Specifically we find that the estimates of profit target in the order of -0.0003 - -0.0002 in EGLS PCSE method (with and without accounting for turbulence period) and slightly lower in the range of -0.0004 - -0.0003 in 2SLS White Method. Estimation using EGLS PCSE methods is at 1% level of significance while using 2SLS White Method is at 5% level of significance.

We also find that size generally contributes positively ie. improves banks position in deposit pricing. Coefficient estimates from EGLS PCSE method (with and without accounting for turbulence period) are in the range of -0.093 - -0.031. Ten out of twelve specifications shows acceptable level of significance (at least 10%). The estimates are considerably lower (ie. more negative) when using 2SLS White method. With this method we find the estimates to be in the range of -0.189 - -0.052. Here all estimates are statistically significant at least at 10% level (mostly at 1%).

With EGLS PCSE method (with and without accounting for turbulence period) we find the estimates of AVG6YG to be in the range of 0.0001 – 0.001 nevertheless all estimates are statistically significant at least at 10% level. Situation changes dramatically when we use 2SLS White method which account endogeneity. Not only the estimates change sign but the numerical value and level of significance also rise substantially. We find the estimates to be in the range of -0.208 - -0.070 with strong level of statistical significance (1%). The first findings are in line with the hypothesis while the second part contradicts.

Lastly we find that efficiency estimates are mostly fail to reach acceptable significance. Using EGLS PCSE method the estimates are in the range of -0.192 - -0.044, only two specifications out of twelve reach level of significance of 10%. The condition could not be improved by using 2SLS White method. The estimates range are -0.180 - -0.047, here again only two specifications out of twelve reach level of significance of 10%.

5.3 Interbank and Macro Economy Condition

We find that interbank condition negatively related with banks deposit pricing position, which contradict our hypotheses. The estimates find with EGLS PCSE method are in the range of -0.010 - -0.005. Twelve specifications out of fourteen reach acceptable level of significance of (at least) 10%.

The estimates somewhat improve in terms of numerical value and statistical significance when we use 2SLS White method. Here we find the estimates to be in the range of -0.013 - -0.007. Twelve specifications out of fourteen reach acceptable level of significance of (at least) 10%.

Business condition looks also to affect banks deposit pricing position negatively. The estimates obtained with EGLS PCSE are -0.003 (a remarkable similarity) with strong level of statistical significance (at 1%). Situation changes slightly when we use 2SLS White method. The estimates slightly decline to around -0.004 and again the level of significance is high (at 1%).

We exclude financial index variable in the panel estimation that account for turbulence since it is indicated that the two might have collinearity. In first set of panel (not including turbulence classification) we obtain the estimates to be in the range of -0.041 - -0.008 however none reach acceptable level of

significance. The situation does not change when we switch to 2SLS white method.

5.4 Cointegration Test

Given we employ a long panel dataset; it is natural if we proceed to cointegration test for further confirmation. We employ Pedroni (2004) and Dumitrescu Hurlin (2012) Panel Causality test to establish the possibility of cointegration observed in the data.

First, we exercise with excess reserve ratio. Using this proxy, we find that a null hypothesis of no cointegration is rejected by all statistics (V, rho, Phillips-Perron and ADF). Furthermore, Dumitrescu-Hurlin test also confirms of possible bi-causality (ie. endogeneity) between deposit pricing positioning, loan expansion and excess reserve. Nevertheless, it seems also there is slight tendency of both loan expansion and excess reserve to homogenously cause deposit pricing positioning than on the other way around.

We replace the excess reserve ratio with LDR and find a similar conclusion. Again the null hypothesis of no cointegration is convincingly rejected by all statistics (V, rho, Phillips-Perron and ADF). Dumitrescu-Hurlin test also confirms of possible bi-causality (ie. endogeneity) between deposit pricing positioning, loan expansion and excess reserve. However the case for deposit pricing positioning and reserve ratio is somewhat weaker than previous finding (using excess ratio). Perhaps one way causality would also fit the data.

6 Conclusions and Policy Implications

We have model a simple asset liability management framework of a bank in which interest rate of deposits; reserve inventory and loan are determined simultaneously as a response to bank specific variables, interbank money market and macro economy condition. More specifically using monthly panel data of 104 banks operating during January 2005 - December 2013, we empirically test this conjecture.

The empirical ALM pattern is largely consistent with the hypotheses. The coefficients of loan expansion are in the range of 0.113 – 0.288 all with 1% level of significance. On the other hand the excess reserve coefficient are in the range of -0.061 - -0.009 with mostly 1% level of significance. This pattern shows that loan expansion is generally associated with more competitive positioning of deposit pricing which could be compensated by higher reserve holdings. All else equal turbulence period is exerting negative impact to positioning of banks deposit pricing: they became less aggressive.

We find that size and CASA composition give banks a competitive advantage in deposit pricing. Larger banks and more CASA share in deposit structure could improve bank deposit pricing positioning. Although numerically small however the estimation results of profit target are highly significant. This finding highlight the fact that banking in Indonesia is about margin business not quantity business.

Finally, we find that interbank and business condition negatively related with banks deposit pricing position, which contradict our hypotheses. These empirical results perhaps are caused by signaling and money multiplier effect. A rise in spread of interbank money market (to central bank deposit facility) indicates a tight liquidity in the system hence banks reduce its expansion and the need to finance it (by deposits). On the other hand the increase in business condition will raise the deposit growth through money multiplier effect that might offset the initial rise in money demand.

The above empirical findings have several policy implications that should be well noted by regulators. First, as we find that loan and reserve are indeed an integrated part of ALM measures then it opens a way to better management of monetary policy. Monetary policy efficacy could be improved by "below the line" measures such as loan growth target and adjusting required reserve. Second, we find that size and CASA share improve banks deposit pricing positioning toward their customers; hence consolidation might improve the stability of the system. Third, since banks are found to be alert on signaling effect of interbank money market rate and counter effect of business condition, it highlight the importance of managing the volatility of financial market and economy. Less volatile market and economy have proven to be beneficial for banks ALM.

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