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Liquidity Dynamics of Banks in Emerging Market Economies

Abstract: This study examines the liquidity dynamics of banks in emerging market economies. Using annual data of 91 commercial banks from 11 countries, the study established that banks in emerging markets have target liquidity ratios they pursue and partially adjust due to market frictions. Overall, risk aversion and prudence play a significant role in explaining the liquidity dynamics by banks in emerging market economies.

Keywords: bank liquidity, liquidity dynamics, commercial banks, emerging markets, GMM.

JEL Classification: G11, G18, G19, G21, G28.

1. Introduction

Liquidity is of vital importance to banking institutions. On an ongoing basis, a bank has to ensure that it keeps ample cash and a stock of liquid securities to meet its contractual obligations such as cash withdrawals (Subramoniam, 2018, Casu, Girardone and Moluneux, 2006). Three issues are central to bank liquidity. First, the trade-off between liquidity and profitability. Banks keep liquidity buffers to mitigate liquidity risk; however, maintaining high levels of liquidity to mitigate liquidity risk has an opportunity cost in the form of interest income forgone by holding zero or low yield earning liquid assets. Second, banks' balance sheets are fragile by construct which makes them susceptible to failure (Diamond and Dybvig, 1983). Third, bank liquidity problems are contagious due to the interconnectedness of banks and other financial intermediaries. Liquidity problems at an individual bank, especially a systemically important one, can quickly transcend to other banks and the real economy if it is not swiftly addressed (Van

Rixtel and Gasperini, 2013). Therefore, the significance of liquidity falls beyond an individual bank because idiosyncratic liquidity challenges can quickly spill over to other banks and financial institutions as well as the real economy.

Besides, a lack of liquidity can be detrimental even to banks that are highly capitalised as revealed by events that transpired during the 2007/9 global financial crisis. A bank may be well-capitalised and profitable, but a loss of creditors' confidence in the institution's ability to settle obligations upon request may lead to sudden large "en-masse" withdrawals which may bring down an otherwise solvent institution (Bindseil and Fotia, 2021; Elliot, 2014). For instance, the Basel Committee on Banking Supervision (2013) and Le Lesle (2012) observed that although most banks entered the 2007/9 financial crisis with favourable capital ratios, liquidity shortages ignited and catalysed their failure. Accenture (2015) adds that banks did not develop proper liquidity projection models and they over-relied on volatile short term wholesale funding such as Repurchase Agreements (Repos) and Asset-Backed Commercial Paper (ABCP) to finance their activities. At the same time, banks invested heavily in structured products such as Asset-Backed Securities (ABS), which are vulnerable to illiquidity in times of severe financial stress such as the 2007/2009 financial turmoil (Caverzasi, Botta and Capelli, 2019; Kowalik, 2013).

Virtually, all financial transactions and commitments affect a bank's liquidity position. Moreover, a bank's cash inflows and cash outflows are stochastic as they depend on market conditions and other agents' behaviour (Basel Committee on Banking Supervision, 2008). This suggests that liquidity management in banking firms is a complex task: it requires bank managers to develop liquidity optimisation models to optimise their liquid assets holdings. Financial innovation and market dynamics have also brought changes in the ways that banks manage their liquidity. Traditionally, banks relied on retail deposits for funding. However, financial innovation has enabled banks to use short term debt instruments like commercial paper and repurchase agreements to source liquidity from the liability side of their balance sheets (Subhanij, 2010). Nevertheless, events that transpired during the 2007/9 mayhem caused banks to re-examine their liquidity management practices.

This study attempts to shed some insights into the liquidity dynamics of banks in emerging markets given the importance of banks in these markets and the significance of emerging markets in the global economy. Most emerging market economies are bank-based (Tuna and Almahadin, 2021). This emanates from rudimentary and/or less developed capital markets. The study extends literature in the following ways. First, the research explores bank liquidity dynamics from

the asset side of the banks' balance sheet (statement of comprehensive income). This motivation stems from the influence of market liquidity (asset sales) on a banks' overall liquidity profile. Elliot (2014) posits that a bank's liquidity position is significantly influenced by its ability to generate liquidity through asset sales which is dependent on market conditions. Second, as far as could be ascertained, this is the first study to empirically estimate a partial adjustment model for bank liquidity in emerging markets that determines the speed of adjustment. This approach is commonly used in corporate finance and capital management studies. Third, the study proffers insights into the strategic behaviour of liquidity management of banks in emerging markets. Lastly, but not least, the study is premised on commercial banks operating in emerging market economies. This scope is based on the intuition that liquidity management practices of banks are likely to vary between bank-based (emerging economies) and market-based (developed) economies due to differences in market structures and development. Yet, most empirical studies on bank liquidity management are drawn from advanced economies (for example, Banerjee and Mio; 2017; DeYoung and Jang, 2016; Bonner and Eijffinger, 2012). This study seeks to fill this gap. The rest of the study is organised as follows. The succeeding section discusses the variables that influence bank liquidity and formulates hypotheses; the third section attends to methods of the study; the fourth section explores the data (descriptive statistics), while section five presents and discuss the empirical results, with the last section looking at policy implications and recommendations.

2. Literature review: Factors affecting bank liquidity and hypotheses formulation

Past levels of liquidity ($LaR_{ic,\,t-1}$)

Studies by Mashamba and Kwenda (2017), DeYoung and Jang (2016) and Delechat, Arbelaez, Muthoora and Vtyurina (2012) show that banks' liquidity ratios are persistent. Hence, as suggested by Louzis and Vouldis (2015), if the current values of a particular variable are influenced by its past values, the appropriate methodology for regression analysis is a dynamic error component panel model (partial adjustment model) that captures persistence in the dependent variable. For this reason, the study included the lagged dependent variable among the set of the explanatory variable to account for persistence in liquidity ratios and formulates the first hypothesis as follows:

H_1: Adjustment costs may influence banks to maintain liquidity buffers.

Bank capital (CAP)

Two competing theories attempt to explain the relationship between bank capital and liquidity, namely financial fragility and risk absorption theory. The risk absorption theory is based on the literature of Repullo (2004), and Von Thadden (2004). Repullo and Von Thadden argue that since capital absorbs losses, it increases the bank's capacity to bear risk which entices it to create more liquidity (by lending); therefore, banks with high levels of capital may target low liquidity. In addition, Bonner and Hilbers (2015) argue that adequately capitalized banks have better access to funding markets, due to their perceived low default risk; hence, they can operate with low levels of liquid assets. On the other hand, the financial fragility theory postulated by Diamond and Rajan (2000) predicts a positive relationship between bank capital and liquidity. Their argument is based on the intuition that bank capital may inhibit liquidity transformation (lending) since it makes a bank's capital structure to be fragile. From this discussion, the relationship between bank capital and liquidity is ambiguous; therefore, the study expects either a positive or negative coefficient term.

H_{2a}: Bank capital positively influences bank liquidity adjustment.

H_{2b}: Bank capital negatively affects bank liquidity dynamics.

Bank Size (SIZE)

The "too big to fail" theory states that regulators are unlikely to permit large banks to fail out of the fear that their closure would trigger the widespread failure of other banks (Anginer, Demirgüç-Kunt, Huizinga and Ma, 2018). Consequently, large banks may target low liquidity on the belief that they will be bailed out. Moreover, large banks are characterised by stable cash flows, better access to capital markets, investment opportunities, and business diversification and their loan portfolios are highly likely to contain liquid assets like syndicated loans (DeYoung and Jang, 2016; Kochubey and Kowalczyk, 2014). In addition, big banks tend to command a large market share and market power (Gautam, 2016). Therefore, large banks have strong incentives to carry low levels of liquid assets. Thus, size is hypothesised to inversely affect bank liquidity.

H_3: Large banks have great incentives to target low levels of liquidity.

Loan growth (LG)

Lending is the principal business activity of commercial banks. As such, the amount of liquid assets maintained by a bank is significantly influenced by loan

demand (Alger and Alger, 1999). If loan demand is weak (strong), banks tend to hold more (less) liquid assets. The study, therefore, predicts that loan growth negatively affects bank liquidity.

H_4: Loan growth negatively affects bank liquidity adjustment.

Asset quality (LLOSS)

Based on the asset quality signalling hypothesis proposed by Lucas and McDonald (1992), asset quality determine bank liquidity adjustment dynamics (Kola, Gjipali and Sula, 2019). Loan loss reserves indicate the perceived riskiness of a bank's loan portfolio. Lucas and McDonald (1992) argue that an increase in loan loss reserves is interpreted as a sign of potential distress by investors, which leads to reduced funding. This means that banks experiencing asset quality deterioration may suffer a significant decrease in external liquidity support. Similarly, Tabak, Li, Vasconcelos and Cajueiro (2013) assert that a rise in loan defaults decreases the amount of liquidity that a bank can generate from loan repayments. Thus, banks expecting high loan losses should maintain high levels of liquidity to ameliorate liquidity risk. *Apriori*, the study expects a positive association between loan loss provisions and banks' liquid assets holdings.

H_5: Loan-loss provisioning positively affects bank liquidity adjustment.

Profitability (ROE)

Profits represent a ready source of liquidity to a bank since huge business profits improve a firm's cash holdings which in turn boost its liquidity (Aspachs, Nier and Tiesset, 2005). This implies that profitable banks may hold significant amounts of liquidity. On the contrary, Bonner and Eijffinger (2012) contend that profitability reduces banks' incentives to maintain large liquidity buffers. They argue that profitable banks can easily fund themselves with debt, due to their ability to service debts, when confronted with liquidity shocks, which makes them be less liquidity constrained. Based on these arguments, the relationship between profitability and banks' liquid assets holdings is ambiguous; hence, the study expects either a positive or negative coefficient term.

H_6: A significant rise in profits enables banks to easily adjust their liquidity levels (H_{6a}: $\beta_6>0$). However, huge profits can create incentives for banks to target lower liquidity due to an increased ability to use capital markets for funding (H_{6b}: $\beta_6<0$).

Deposit-loan synergy (DLS)

Banks offer liquidity services to both depositors and borrowers by offering checking accounts to depositors and loan commitments (credit lines) to borrowers. In the course of providing these services, banks expose themselves to liquidity risk. Banks can hedge this risk by combining transaction/demand deposits and loan demand (Kashyap, Rajan and Stein, 2002). As long as cash demand from depositors is uncorrelated with credit line draw-downs by borrowers, banks can use cash inflows from demand deposits to satisfy loan commitment requests, thereby enabling them to reduce cash holdings while serving both clients (Gatev, Schuermann and Strahan, 2007). This strategy is known as the deposit-loan synergy, and it reduces a bank's impetus to maintain large liquidity buffers for precautionary reasons.

H_7: Deposit-loan synergy reduces banks' incentives to maintain large liquidity buffers.

Transaction deposits (TD)

One of the primary roles of commercial banks in an economy is to offer maturity transformation services to economic agents, that is, to accept short term deposits and issue long term loans. Consequently, the principal source of liquidity to commercial banks tends to be transaction (demand) deposits (Singh and Sharma, 2016). As such, banks with high levels of demand deposits are expected to be highly liquid. Likewise, given that withdrawal of transaction deposits is unpredictable, demand deposits carry a high risk of unexpected withdrawals; hence, as transaction deposits increase, banks should invest more in liquid assets to ameliorate liquidity risk (Chen and Phuong, 2014). The study, therefore, predicts that banks with large transaction deposits target low liquidity.

H_8: Banks with large transaction deposits target low liquidity.

Deposit Insurance (DEP)

Besides bank-specific characteristics discussed above, the study also considered deposit insurance to be a significant factor that explains bank liquidity holdings. The presence of deposit insurance removes incentives for depositors to run on an institution thereby reducing the bank's liquidity risk and ultimately its liquidity buffers (Diamond and Dybvig, 1983). Thus, banks operating in countries with explicit deposit insurance schemes may be less worried about "en masse" withdrawals or bank runs; hence, they may target low liquidity buffers. *Apriori*, the study predicts an inverse relationship between deposit insurance and banks' li-

quidity buffers. Deposit insurance is captured by a dummy variable (DEPINS) that equals one for a country with deposit insurance coverage and zero otherwise. Data on countries' deposit insurance status were obtained from a comprehensive database on deposit insurance schemes created by Demirgüç-Kunt, Kane and Laeven (2014) at the end of 2013.

H_9: The presence of a deposit insurance scheme removes incentives for banks to target large liquidity buffers.

Business Cycles (GDP)

In a world characterised by capital market imperfections, banks' liquidity buffers tend to be countercyclical (Aspachs *et al*., 2005; Delechat et al., 2012). Countercyclicality refers to a scenario whereby banks accumulate liquidity reserves (hoard liquidity) in times of weak economic prospects due to high default risk and weak loan demand and draw down their buffers (lend) in times of economic booms, in response to increased lending opportunities and low default risk. Accordingly, this study hypothesises that business cycles negatively influence banks' liquidity buffers. The study uses annual growth in the real gross domestic product (GDP) as a proxy for business cycles.

H_{10}: Banks react to economic booms by lending aggressively, thereby targeting lower liquidity. (H_{10a}: $\gamma_1 > 0$). Conversely, when the economy moves into a recession banks respond to the economic meltdown by hoarding liquidity (H_{10b}: $\gamma_1 < 0$).

Savings (SR)

In general, corporate and household savings find their way to banks either through direct deposits or investments in banks' debt products (Pati and Shome, 2011). As such, banks operating in countries with a high level of savings should be associated with high levels of bank liquidity (Wadesango, Lora and Charity, 2017). Therefore, the study expects savings to positively influence bank liquidity.

H_{11}: Savings positively influence bank liquidity adjustments.

Monetary Policy (CBR)

In many jurisdictions, central banks attempt to influence economic activity using various tools, especially short term interest rates (the central bank rate or policy rate). Their intervention is likely to affect banks' liquidity adjustments since monetary policy is transmitted via banks (Awdeh, 2019). When the central bank cuts (hike) interest rates, banks tend to respond to this policy change by maintaining

few (large) amounts of liquid securities relative to total assets (Aspachs *et al*., 2005). Stated differently, monetary policy tightening tends to be associated with low liquid assets holdings while monetary policy loosening results in increased liquid assets holdings by commercial banks. Therefore, this study hypothesises that bank liquidity is negatively related to policy rates.

H_{12}: Bank liquidity adversely responds to policy rates.

3. Methodology

3.1. Sample and data

This study is based on a representative sample of commercial banks operating in eleven emerging market economies, namely Hong Kong, India, Mexico, Saudi Arabia, South Africa, Argentina, Indonesia, Korea, Russia, Singapore, and Turkey. The sample is made up of ninety-one (91) banks. The number of banks from each economy is presented in Appendix I. The study period is confined to the period January 2011 to December 2016 which is post the global financial crisis and pre-COVID 19 pandemics. This period was chosen because it eliminates structural breaks that are associated with the global financial crisis and the Covid19 pandemic. The data for individual banks were obtained from Income Statements and Balance Sheets. The data were retrieved from the Bankscope Bureau Van Dijk database. Macroeconomic data for each respective country were obtained from the World Bank databank.

3.2. Empirical model and estimation approach

Liquidity management at banking institutions can be examined in the context of the trade-off theory which is mainly used in corporate finance studies. The theory states that firms target an optimal amount of liquid securities that balance the benefits and costs of maintaining liquid assets (De Haan and Hinloopen, 2003; Kim, 1998). The benefits of holding liquid assets are two-fold: transaction and speculative purposes. The transaction motive suggests that firms maintain liquidity buffers to avoid transaction costs that are related to sourcing external funding and the need to liquidate assets to pay off maturing liabilities. The speculative motive submits that firms keep liquid assets to exploit new investment opportunities that may arise since external funding may not be available as and when needed or costly. On the other hand, the costs associated with liquidity buffers are interest income that is foregone as a result of investing in low yield

earning liquid assets (Kontuš and Mihanović, 2019; Alger and Alger, 1999). This analysis suggests that banks have to optimise their liquidity holdings, that is hold an optimal amount of liquid assets that strikes a balance between liquid assets holdings and profitability. However, liquidity optimisation is affected by capital market imperfections such as transaction costs related to equity issuance. Besides high costs, firms may not be able to obtain funding from capital markets as and when needed. Moreover, in practice, insiders (managers) tend to hold more information than outside investors. This leads to asymmetric information problems between managers and investors which may result in financing constraints for firms because investors may refuse to provide funding at all or provide it at a high cost (He, Chen and Hu, 2019; Myers and Majluf, 1984). Therefore, in an imperfect capital market, firms maintain liquid assets to avoid sourcing funding from external markets when they either face unexpected contingencies or desire to fund new projects.

Thus, the study assumes that banks have an unobservable internal target liquidity ratio which they consider to be the optimal level of liquidity which balances the benefits and costs of maintaining liquid assets. The internal target liquidity ratio is driven by a set of observable characteristics. Therefore, each bank's desired liquidity ratio (LIQ^*_{ict}) is modelled as a function of the bank's observable characteristics as follows:

$$LIQ^*_{ict} = \beta X_{ict} + \eta_t + \nu_{it} + \varepsilon_{it} \quad (1)$$

Where:

LIQ_{ict}^* : target liquidity ratio (proxied by the liquid asset ratio, LaR) for i at time t in country c, which is perceived to vary across banks and over time.

β : vector of coefficients to be determined.

X_{ict-1} : vector of bank-specific characteristics as well as macroeconomic funda mentals that influence the liquidity ratio setting.

η_t : time effects.

ν_{it} : bank fixed effects.

ε_{it} : idiosyncratic error term.

In the process of pursuing the target ratio, banks face market frictions and adjustment costs which make it costly, if not impossible for banks to instantaneously adjust their balance sheets when confronted with liquidity shocks that move them away from their target ratio (DeYoung and Jang, 2016). Market frictions re-

fer to costs such as asymmetric information, transaction costs, and agency costs that may preclude banks to hold optimal portfolios. This adjustment process is captured by assuming that banks adjust a constant proportion (λ) of the gap between the actual liquidity ratio (LIQ_{ict}) and target liquidity ratio (LIQ_{ict}^{*}) in each period:

$$LIQ_{ict} - LIQ_{ic,t-1} = \lambda(LIQ_{ict}^{*} - LIQ_{ict-1}) + \eta_t + \nu_{it} + \varepsilon_{it} \quad (2)$$

The speed of adjustment (λ) in each period will be high if adjustment costs are low and vice versa. Integrating equation (1) into (2) and slightly rearrange the following equation is obtained:

$$LIQ_{ict} - LIQ_{ic,t-1} = \lambda(\beta X_{ic,t-1} - LIQ_{ict-1}) + \eta_t + \nu_{it} + \varepsilon_{it} \quad (3)$$

Given that it is difficult to estimate λ and β from this non-linear equation, equation (3) is rearranged to yield:

$$LIQ_{ict} = (1-\lambda)LIQ_{ic,t-1} + \lambda\beta X_{ic,t-1} + \eta_t + \nu_{it} + \varepsilon_{it} \quad (4)$$

The complete model for the study can thus be specified as follows:

$$LaR_{ict} = \alpha + \lambda LaR_{ic,t-1} + \beta_1 CAP_{ict} + \beta_2 SIZE_{ict} + \beta_3 LG_{ict} + \beta_4 LLOSS_{ict} + \beta_5 ROE_{ict} + \beta_6 DLS_{ict} + \beta_7 TD_{ict} + \theta DEPINS_{ct} + \gamma_1 GDP_{ct} + \gamma_2 SR_{ct} + \gamma_3 CBR_{ct} + \eta_t + \nu_{it} + \varepsilon_{it} \quad (5)$$

The dynamic nature of Equation 5 calls for the adoption of a dynamic error component model which captures persistence in the dependent variable and addresses heterogeneity and endogeneity. Accordingly, this study adopts the two-step system GMM estimator developed by Blundell and Bond (1998) for estimation. System GMM is also appropriate for panel data that has many panels (large N) and is collected over a short time frame (small T) as in this study (Roodman, 2006).

4. Descriptive Statistics

The results in Table 1 show that liquid asset ratios for sampled banks averaged 34.27% for the period from January 2011 to December 2016. This value means that sampled banks invested about 34% of total assets in liquid assets during the study period. The average liquid asset ratio of 34% suggests that banks in emerging market economies are highly liquid. These results are consistent with earlier findings of Basso, Delgado and Meza (2012). The high ratio of liquid assets to total assets in emerging market economies can be ascribed to regulatory reforms instituted in Asian economies in the wake of the 1997 Asian financial crisis that

triggered banks to revise their liquidity and risk management practices (Packer and Zhu, 2012; Angklomkliew, George and Packer, 2009). In the wake of the 1997 Asian financial crisis, most regulators in emerging market economies instituted regulations that compelled their banks to hold large liquidity buffers. For instance, the Korean bank regulator, Financial Supervisory Service, introduced a minimum won liquidity ratio of 100% that Korean banks had to maintain on an ongoing basis (Kim, 2010).

Bank size which was measured by the natural logarithm of assets had an average value of 19.23 with a standard deviation of 3.51%. Considering that the natural logarithm was employed to limit the variation of maximum and minimum bank size values, descriptive statistics show that bank size dispersion is small. This suggests that banks used in the sample do not have significant differences in their balance sheet sizes. This evidence suggests that the banking systems in sampled economies are concentrated since a concentrated banking system is characterised by a few large banks that control the market with a long tail of small banks. These results concur with Ernst and Young's (2013) finding that the five largest banks in emerging markets hold about 70% of each respective country's total banking system assets.

The 10^{th} percentile for Tier 1 and Tier 2 capital scaled by total risk-weighted assets is 11.78%. This means 10% of banks in the sample had capital adequacy ratios equal to 11.78% or less. Alternatively, 90% of the banks had capital adequacy ratios of 11.78% or more. Since 90% of the banks met the minimum capital requirement prescribed by the Basel Committee on Banking Supervision, these statistics suggest that most banks in the sample are adequately capitalised.

The loan books of banks operating in emerging market economies grew by approximately 13% on average over the period January 2011 to December 2016, implying that bank lending in emerging market economies has been on an upward trend in the period succeeding the global financial crisis. The International Monetary Fund (2009), observed that bank lending in emerging markets, although it fell during the crisis, has been growing at 10% largely because of the financial strength of banks in emerging markets. The International Monetary Fund ascribed sound financial positions of banks operating in emerging market economies to a legacy of lessons they learned from the 1997 crisis which provoked them to prudently manage their capital. Nevertheless, there is a large dispersion in loan book growth. This is signified by a standard deviation of 25.63%. The minimum and maximum values of -29.53% and 196.35% respectively, entailing that some banks significantly cut back lending while others aggressively lent during the study period.

Table 1: Descriptive Statistics

Variable name	Mean	Standard deviation	10th Percentile	90th Percentile	Minimum	Maximum
Liquid asset ratio (LAR)	34.27	23.71	6.48	69.14	2.43	76.34
Bank size (SIZE)	19.23	3.51	15.69	24.49	10.36	26.24
Bank capital (CAP)	16.11	4.67	11.78	18.9	9.41	45.75
Loan Growth (LG)	13.4	25.63	-7.83	28.64	-29.53	196.35
Asset quality (LLOSS)	2.33	2.10	0.45	5.87	0.08	18.56
Profitability (ROE)	9.81	13.08	2.27	20.38	-86.75	32.58
Deposit-loan synergy (DLS)	49.76	27.39	13.61	93.89	0.00	113.08
Transaction Deposits (TD)	7.37	1.57	5.39	9.81	4.01	10.47
Deposit insurance coverage (DEPINS)	0.90	0.30	-	-	0.00	1.00
Business cycle (GDP)	4.20	2.28	1.63	6.64	-3.77	8.77
Savings ratio (SR)	27.76	6.96	18.34	34.81	14.10	35.55
Monetary Policy (CBR)	5.65	2.93	0.5	8	0.50	12.75

Source: Own construction based on data obtained from Bankscope
***, **, * denotes 1%, 5% and 10% significance level respectively.

Loan loss reserves as a proportion of gross loans were used to measure the riskiness of banks' loan portfolios. The variable has an average value of 2.33 with a standard deviation of 2.1. This means, on average, banks set aside an amount equivalent to 2.33% of gross loans to cater for bad and doubtful debts. This behaviour demonstrates conservative loan loss provisioning standards which can be attributed to robust risk management and cautious loan loss provisioning adopted by Asian banks[1] used in the study in response to the 1997 Asian financial crisis (Angklomkliew *et al*., 2009). The standard deviation of 2.1% highlights that there is a small dispersion in the amounts set aside by banks to cater for bad and doubtful debts.

Bank profitability was measured by return on equity (ROE). The average return on equity reported for sampled banks over the period 2011 to 2016 was 9.81%, meaning on average bank executives managed to generate a positive return for their shareholders. Analysing the minimum and maximum values (-86.75% and 32.58%, respectively) it seems some banks in the sample made significant losses while some reported healthy profits over the sample period. Concomitantly, the standard deviation for ROE is 13.08%, indicating that profit variation among the selected banks for January 2011 to December 2016 was large.

[1] Asian banks constitute 50% of the final sample; therefore, their behaviour was assumed to have a significant influence on study findings.

Transaction deposits averaged US$7.37 million for the selected banks over the study period. The 90th percentile was US$9.81 million. It can be inferred that 90% of commercial banks in the study had transaction deposits of US$9.81 million or less. Stated differently, 10% of the banks had demand deposits of US$9.81 million or more on their balance sheets during the period of study. The low standard deviation value of 1.57 suggests that deposit funding in emerging market economies is fairly homogenous across banks, lending support to the assertion that banks in emerging market economies are widely funded by deposits (Bonner and Hilbers, 2015).

The variable deposit loan synergy reported an average value of $US49.76 with a standard deviation of roughly 27%. This value highlights that there is a large variation in deposit loan synergy practice over the sampling window. This evidence is supported by the minimum and maximum values of 0.00 and 113.08, respectively, indicating that some banks did not employ this strategy at all while some of the banks employed it.

The study used real gross domestic product growth (GDP) as a proxy for business cycles. Table 1 shows that the GDP has a mean value of 4.2 with a standard deviation of 2.28 and a minimum and maximum value of -3.77 and 8.77, respectively. The average GDP is positive showing that countries used in the sample reported positive economic growth over the period 2011 to 2016. Moreover, the magnitude of GDP dispersion is relatively low (2.28%) suggesting that economic growth among emerging market economies for the period 2011 to 2016 is not widely dispersed. Notwithstanding this, the minimum value of (-3.77) suggests that some of the countries used in the sample experienced negative growth in economic output during the period under investigation.

Savings ratio measured as gross national savings to the gross domestic product was another variable employed to assess the impact of macroeconomic fundamentals on banks' liquidity adjustments. The variable averaged 27.76% with a minimum value of 14.1% and a maximum of 35.55%. The mean value of 27.76% demonstrates that the rate of household savings for countries used in this study is quite high. Furthermore, the high value of domestic savings in emerging market economies could imply that households and individuals place a significant part of their savings in time deposits at banks. The standard deviation value of roughly 7% means that there is a small variation in the level of savings among the sampled countries.

5. Results

5.1. Unit root test results

In order to avoid spurious regression, data were first checked for the presence of unit roots using the Maddala and Wu unit root test, in particular, the Fisher type unit root test based on Augmented Dickey-Fuller tests. The null hypothesis predicts that all panels contain unit roots whereas the alternative maintains that at least one panel is stationary. The results for unit root tests (not presented for brevity) revealed that all variables are stationary at 1% level and integrated in levels which means that data used in this study did not contain unit roots; hence, the alternative hypothesis which states that at least one panel is stationary is upheld.

5.2. Empirical findings

The appropriateness of system GMM procedure depends on the validity of instruments used and the absence of autocorrelation in differenced errors. The Sargan test of instruments validity and Arellano and Bond test for zero autocorrelation in differenced errors were employed to check for the existence of these two conditions. The results in Table 2 show that the instruments used are not over-identified and the residuals exhibit only first-order autocorrelation hence the estimation procedure employed in the study is substantiated. Moreover, these results confirm the consistency of the GMM estimator. The Wald test of joint significance reported a statistically significant p-value, demonstrating that the empirical model is properly fitted. To control for time fixed effects Equation 5 was re-estimated after incorporating time dummies into the regression equation. The results displayed in Model 1 relate to regression estimates without time dummies whereas the results presented in Model 2 reports empirical estimates controlled for time fixed effects. Their expected influence on banks' liquidity dynamics is discussed herein. Moreover, the study also reports economic significance calculated at the sample mean by dividing the product of the standard deviation of the explanatory variable and regression coefficient by the standard deviation of the dependent variable. Economic significance coefficients enable one to examine the economic impact of changes in the independent variable on the dependent variable.

Table 2: Results of banks liquidity management practices

Variable	Model 1		Model 2	
	Coefficient Sign (1)	Economic impact (2)	Coefficient Sign (3)	Economic impact (4)
$LAR_{ic,t-1}$	0.5467*** (0.1508)	-	0.6681*** (0.1212)	-
SIZE	5.8783** (2.9607)	0.8702	2.0368 (2.6470)	0.3015
CAP	-0.0917 (0.2373)	-0.0181	-0.2147 (0.2667)	-0.0423
LG	0.0513*** (0.0148)	0.0555	0.0899*** (0.0168)	0.0971
LLOSS	-2.283*** (0.5783)	-0.2022	-1.8096*** (0.5237)	-0.1603
ROE	-0.1947*** (0.0286)	-0.1074	-0.1382*** (0.0294)	-0.0762
DLS	-0.2321*** (0.0390)	-0.2681	-0.2014*** (0.0435)	-0.2327
TD	11.9923** (5.6294)	0.7941	12.7741* (7.7582)	0.8459
DEPINS	63.4001 (97.4963)	0.8022	9.9682 (96.7466)	0.1261
GDP	1.8842** (0.8626)	0.1812	1.4419 (0.9295)	0.1387
SR	-1.3611*** (0.4114)	-0.3995	-1.7993*** (0.5144)	-0.3400
CBR	-0.4843 (0.5559)	0.0598	-0.8904 (0.5925)	-0.1100
Time fixed effects	No	No	Yes	Yes
Arellano-Bond (2) test	0.6190		0.6273	
Sargan test	0.5911		0.4704	
Wald test	914.68***		2516.42***	

Source: Own construction based on data from Bankscope.
***, **, * denotes 1%, 5% and 10% significance level respectively.
Standard errors in the parenthesis (brackets).

Lagged liquidity ratio (LaR_{t-1})

The coefficient of the lagged dependent variable is positive and statistically significant at 1% significance level. Therefore, the adoption of a dynamic panel model in this study is substantiated. The positive and significant coefficient of the lagged dependent variable suggests that banks in emerging market economies have target liquidity levels and they partially adjust their liquidity to reach their desired

liquidity level consistent with the trade-off theory. Moreover, this evidence suggests that liquidity ratios banks in emerging market economies are persistent and banks in emerging markets actively managed their liquidity over the period of study. This finding is consistent with Delechat et al. (2012) finding that liquidity ratios of banks in Central America are persistent. Without time dummies, the speed at which banks adjust their liquidity to revert to their target level is estimated to be 0.4533 (1-0.5467). These results imply that banks close about 45% of deviation from their desired liquidity level within a year. At this speed of adjustment, it would take roughly 2.21 years $\left(\frac{1}{0.4533}\right)$ to reach their target. After controlling for time fixed effects, the speed at which banks in emerging market economies adjust their liquidity decreases to 0.3319 (i.e. 1-0.6681). The speed at which banks in emerging market economies adjust their liquidity is slow. This slow adjustment speed is consistent with the proposition that adjustment costs preclude banks to immediately revert to their target liquidity level, thereby confirming the hypothesis that adjustment costs create incentives for banks to maintain liquidity buffers (H_1). As discussed earlier some of the factors that influence adjustment costs are market frictions such as asymmetric information, transaction costs, and agency costs. These market frictions create strong incentives for banks to minimize adjustment costs by holding higher levels of liquidity.

This evidence concurs with Drobetz, Schilling and Schroder (2014) finding that adjustment costs tend to be high in bank-based (emerging) economies relative to market-based (developed) economies because advanced economies have well-developed and vibrant capital markets which make it relatively easy for banks to adjust their liquidity. As evidence, Ernst and Young (2013) reports that stock market capitalization as a proportion of GDP is about four times higher in advanced economies compared to emerging markets economies. Ernst and Young went on to add that developed economies bond market size is almost 2.5 times greater than established emerging market economics like Malaysia and South Africa.

Furthermore, a comparative analysis of adjustment speeds of banks in bank-based economies and market-based economies may offer additional evidence to this analysis. In the United States of America, De Young and Jang (2016) found that banks in the United States of America adjust their liquidity by approximately 27.15% per annum, meaning that they close 27% of the gap between their target and desired liquidity in a year. Their results demonstrate that banks in the United States of America target and actively manage their liquidity. The findings of De Young and Jang and the present study's empirical results support the proposition that adjustment costs are higher in bank-based economies relative to market-

based economies. Consequently, difficulties in assessing external funding may explain why banks in emerging market economies hold excess liquidity.

Bank capital (CAP)

The coefficient of parameter is statistically insignificant in both models; thus, H_2 could not be verified by empirical results. These findings imply that capital has no significant impact on the size of the liquidity buffer maintained by banks in emerging market economies. One plausible explanation to these findings could be that although capital creates incentives for banks to keep low liquidity, its impact could have been affected by Basel III capital requirements. Basel III package requires banks to maintain both large liquidity and capital ratios. The joint management of liquidity and capital requirements might have reduced the influence of capital on banks' liquidity adjustments.

Bank Size (SIZE)

The point estimate is positive and very significantly different from zero (5.8783) in Model 1. In terms of economic impact, the coefficient elasticity evaluated at the sample mean is 0.8702. This means a one standard deviation change in bank size contributes to 87% changes in bank liquid assets holdings, indicating that size significantly explains the size of liquidity buffers maintained by banks. This evidence refutes the hypothesis that big banks maintain low levels of liquidity (H_3) and lend support to the conjecture that small banks depend more on themselves in liquidity management by keeping large liquidity buffers probably because they have limited access to external funding. These results concur with the findings of (Lastuvkova, 2014) who examined liquidity management strategies of banks in the Czech Republic and found that small banks invest more in liquid assets compared to large banks, for precautionary reasons as they have limited external financing.

Loan growth (LG)

Empirical results show that the relationship between bank liquidity and loan growth is positive and statistically significant in both models. In terms of economic significance, a one standard deviation change in loan growth leads to about a 6% increase in bank liquidity (Model 1 results, Column 2, Table 2). Contrary to empirical evidence from developed markets, for example, Kochubey and Kowalczyk (2014); the study could not find evidence at conventional levels to support the conjecture that banks in emerging markets experiencing high loan growth maintain low liquidity.

Asset quality (LLOSS)

Contrary to expectations, the point estimate of loan loss reserves to gross loans is negative with a coefficient of -2.283 and it is statistically significant at 1% significance level in the absence of time dummies. Hence, the study could not find evidence to support the claim that banks in emerging markets respond to asset quality deterioration by increasing their liquid asset holdings in anticipation of reduced external funding. This evidence lends supports to the principal argument of this study that banks in emerging markets depend less on capital markets for funding or banks in emerging economies rely more on themselves (deposits) for funding.

Profitability (ROE)

The coefficient of ROE is negative and significantly different from zero (-0.1947) at 1% level. The elasticity of bank profitability computed at the sample mean is -0.1074 (Table 2, Model 1, Column 1,). A 19.47% increase in bank profits triggers banks in emerging markets to reduce their liquid assets holdings by roughly 11%, all things constant. It appears profitable banks in emerging market economies are less financially constrained, implying that they can easily raise external funding when the need arises. This decreases their need to maintain large liquidity reserves. Stated differently, empirical results suggest that profitable banks tend to maintain low liquidity because they experience less financial constraints when borrowing from funding markets, possibly because they can service debts. This finding concurs with Delechat et al. (2012) finding that profitable banks in Central America tend to keep low liquidity because they can easily obtain external funding from capital markets when they face liquidity shocks. Moreover, these results are consistent with empirical evidence from advanced economies. For example, Bonner and Eijffinger's (2012) study found that profitable banks in the Netherlands operate with low levels of liquidity because they can easily access funding from capital markets as they have ample cash to service their debts.

Deposit – Loan Synergy (DLS)

The point estimate of the variable DLS has a negative sign -0.2321(Column 1, Table 2) and is statistically significant at 1% level in the baseline model. In terms of economic significance, a one standard deviation increase in deposit-loan synergy practice triggers banks in emerging markets to reduce liquid assets holdings by roughly 27%, *ceteris paribus*. The empirical results substantiate the proposition that commercial banks hedge liquidity risk through deposit-loan synergies (H_7)

consistent with evidence from advanced economies Kashyap et al. (2002) and Gatev et al. (2007).

Transaction Deposits (TD)

The point estimate of the variable transaction deposits is positive and statistically significant (11.9923) at 5% level in the baseline model (model without time dummies). Its elasticity computed at sample mean in the baseline model is 0.7941 (Table 2, Column 2). When transaction deposits increase by about 12 units banks' investments in liquid securities grow by about 0.79 units, all else equal. These findings suggest that bank deposits and liquidity increase (decrease) jointly in emerging markets, supporting the claim that banks with large demand deposits tend to pursue large liquidity buffers (H_8). This evidence is consistent with empirical findings from developed economies (for instance, De Haan and Van den End, 2013).

Deposit insurance (DEPINS)

Contrary to expectations, empirical results show that the point estimate of deposit insurance on banks' liquidity is positive, but not significantly different from zero (the p-value is 0.516[2] in Model 1). Therefore, the hypothesis that deposit insurance coverage incentivises banks in emerging market economies to keep low levels of liquidity is not confirmed.

Business cycles (GDP)

The coefficient of real GDP growth is positive and statistically significant at 1% significance level. The estimated coefficient of 1.8842 in the model without time dummies corresponds to a sensitivity value of 0.1812 (Column 2, Table 2). A one-unit increase in real GDP growth contributes to a 0.1812 unit increase in bank liquidity, all things constant. The positive association between business cycles and bank liquidity implies that bank liquidity in emerging market economies is procyclical (Kozarić and Žunić Dželihodžić, 2020). This evidence conveys that banks in emerging market economies build up their liquidity holdings when the economy is doing well and run down their buffers when the economy enters into a recession. Therefore, the study found evidence to confirm H_{10}.

[2] Not reported for brevity.

Savings level (SR)

Surprisingly, empirical results indicate that savings negatively affect bank liquidity. A 1.36 unit increase in savings motivates banks to decrease investments in liquid assets by about 0.40 units, all else equal. Consequently, (H_{11}) could not be supported. These results could imply that banks in emerging market economies invest less national savings in liquid securities, however, it seems they channel most of the savings towards productive investments aimed at spurring economic growth and job creation. This evidence may render support to the notion that firms in emerging market economies mainly rely on banks for long term funding since banks appear to be investing most of their savings deposits in loans. This view is in line with the Financial Stability Board's (2011) assertion that emerging markets are characterised by concentrated and less complex financial systems and banks play a large role in financial intermediation because capital markets and other financial institutions are still underdeveloped.

Monetary policy (CBR)

The estimated coefficient of the central bank rate is negative in both models but statistically insignificant. Consistent with the International Monetary Fund (2009), the study could not find enough statistical evidence at conventional levels to support the hypothesis that monetary policy affects banks' liquidity adjustments in emerging markets. The International Monetary Fund suggests that the ineffectiveness of monetary policy in emerging markets may be attributed to global financial crisis strains that might have buckled monetary policy transmission in emerging market economies. Furthermore, the insignificant interplay between monetary policy and banks' liquidity buffers could be attributed to high liquidity reserves maintained by banks in emerging markets that makes monetary policy ineffective.

6. Policy Implications and Recommendations

This study was interested in providing insights into liquidity adjustment dynamics and management techniques pursued by banks in emerging markets economies. Research findings revealed that banks in emerging market economies have target/optimal liquidity levels and they partially adjust to maintain their desired liquidity level. The speed of adjustment was found to be slow suggesting that banks in emerging economies face high adjustment costs. In light of these findings, it can be inferred that adjustment costs create incentives for banks in emerging markets to maintain liquidity buffers.

Furthermore, the study established that bank-specific characteristics influence liquidity adjustment decisions of banks in emerging markets. The finding that bank size positively influences banks' liquidity adjustment implies that banks in emerging market economies depend more on liquid assets and less on wholesale funding for liquidity management. From this evidence, the study can conclude that banks in emerging markets are risk-averse. In terms of policy implications, this behaviour engenders banking sector stability; hence, policymakers should reinforce it through strict monitoring of banks' compliance with the liquidity coverage ratio (LCR) regulation.

Moreover, the study established that banks in emerging markets increase liquid assets holdings as their lending business grows. Since maturity transformation exposes banks to liquidity risk, empirical results suggest that banks in emerging markets are risk-averse as they increase holdings of liquid assets in response to the growth in loans (illiquid assets). Moreover, this behaviour demonstrates prudent liquid management. From these results, it can be inferred that banks in emerging markets conservatively and prudently manage their liquidity. Regulators in emerging markets ought to reinforce this good practice by monitoring the compliance of banks to the liquidity coverage ratio (LCR) rule which encourages banks to maintain liquid assets that correspond to their expected net cash outflows over 30 days.

Research findings also revealed that banks in emerging markets with large volumes of transaction deposits maintain large liquidity buffers, suggesting that banks in emerging markets react to growing transaction deposits by increasing investments in liquid assets. This practice demonstrates sound liquid management; hence, regulators should strengthen this good behaviour through strict supervision of the LCR standard.

Another interesting finding worth mentioning is the negative impact of loan loss reserves ratio on banks' liquid assets adjustment. This finding suggests that banks in emerging market economies poorly manage credit risk and this has some implications for both bank managers and supervisors. Loan loss provisions are important because they play a significant role in determining the stability and soundness of banking institutions. Inadequate loan loss provisioning may result in capital erosion which jeopardises the banking sector's stability. As such, banks' loan loss provision estimates are a vital tool for microprudential regulation that regulators use to monitor the quality of banks' loan portfolios. Based on these empirical findings, bank managers in emerging markets should adopt forward-looking loan loss management practices. Such practices are consistent with IFRS 9 impairment rules. Likewise, due to asymmetric information between regula-

tors and banks, bank regulators need to obtain timely information on banks' loan loss provisions since loan losses are reported on an accrual basis. Delays in obtaining such information in time would paint a good picture of banks' solvency which may not be true. This evidence reinforces the introduction of IFRS 9 in banking institutions.

The study also contributes to the analysis of the relationship between macroeconomic conditions and banks' liquidity holdings. The positive association between real GDP growth and banks' liquidity buffers suggests that bank liquidity is procyclical, meaning that banks in emerging markets accumulate (drawdown) liquidity buffers when the economy is performing well (badly). This behaviour is consistent with the aims of the LCR. The LCR encourages banks to build up liquidity buffers in good times and draw them down in terms of crisis. As such, the study advocates policymakers to reinforce this interplay through tight supervision of liquidity requirements.

Monetary policy in emerging market economies was found to be ineffective in altering overall banking sector liquidity in emerging markets. This implies that central banks' efforts to stimulate economic activity by reducing short term interest rates are defeated in emerging markets probably because aggregate bank liquidity is very high. This calls for regulators to look at other tools of stimulating economic activity by manipulating bank liquidity. One such tool is statutory reserve requirements. This analysis possibly explains why statutory reserve requirements are very high in emerging markets. Overall, the study established that risk aversion and prudence play a significant role in explaining the level of liquid assets maintained by banks in emerging market economies.

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Appendix I: List of countries and banks

Country	Number of banks
Argentina	8
Hong Kong	10
India	9
Indonesia	6
Mexico	9
Saudi Arabia	8
South Africa	5
Singapore	11
South Korea	13
Russia	9
Turkey	3
Total	91