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Basel III LCR Requirement and Banks' Deposit Funding: Empirical Evidence from Emerging Markets

Abstract: In December 2010, the Basel Committee on Baking Supervision introduced the liquidity coverage ratio (LCR) standard for banking institutions in response to disturbances that rocked banks during the 2007/08 global financial crisis. The rule is aimed at enhancing banks' resilience to short term liquidity shocks as it requires banks to hold ample stock of high grade securities. This study attempts to evaluate the impact of the LCR specification on the funding structures of banks in emerging markets by answering the question "Did Basel III LCR requirement induced banks in emerging market economies to increase deposit funding more than they would otherwise do?" The study found that the LCR charge has been effective in persuading banks in emerging markets to garner more stable retail deposits. This response may engender banking sector stability if competition for retail deposits is properly regulated.

Key words: Basel III, LCR, commercial banks, emerging market economies

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

1. Introduction

In December 2010, the Basel Committee on Baking Supervision, herein the Basel Committee, introduced the liquidity coverage ratio (LCR) standard, a macroprudential measure, for banking institutions in response to disturbances that rocked banks during the 2007/08 global financial crisis (Vucinic 2016). During the global financial crisis several banks experienced acute liquidity challenges as a result of

sudden evaporation of short term funding in capital markets (Basel Committee on Baking Supervision – BSBS, 2013; Banerjee and Mio 2017). Notwithstanding this, House, Sablik & Walter (2016) pointed out that the implications of the LCR requirement on banks remains a topical issue of debate and economic research. We attempt to make contributions to ongoing discussions and debate on the impact of the LCR charge by examining the behavioral response of banks in emerging markets to the LCR rule. In particular, we seek to address the following question, "Did Basel III LCR requirement induced banks in emerging market economies to increase deposit funding more than they would otherwise do?" Our motivation is drawn from the contribution of banks' funding models to the 2007/08 financial mayhem. Prior to the crisis, banks depended heavily on volatile short term (wholesale) funding instruments like Repos and Asset Backed Commercial Paper (ABCP) to finance their activities (Brunnermeier 2009, Kowalik 2013). However, wholesale funding instruments can quickly evaporate in times of severe crisis as witnessed during the 2007/08 crisis (Kapan & Minoiu 2013, Rosengren 2014). Yet, banks that relied on stable funding instruments like retail deposits exhibited significant resilience to liquidity shocks during the crisis (Bologna 2011, Vazquez & Federico 2012; Berger & Bouwman 2013). It is upon this observation that the Basel Committee introduced the LCR rule in 2010.

The LCR is aimed at enhancing banks' ability to withstand severe financial stress emanating from either the financial system or economy (BSBS, 2013). It requires banks to maintain ample stock of high liquid securities relative to projected short term outflows. The standard allocates weighting factors and run-off rates to assets and liabilities. By implication, the rule encourages banks to substitute funding instruments with high runoff rates, mostly short term debt instruments like Repos and ABCP with low runoff funding instruments, mostly long term and stable like bonds and retail deposits. This study attends to the interaction between Basel III LCR regulation and banks' retail deposits adjustment since banks that depend on retail deposits funding appeared to be sturdy during the global financial crisis (Bologna 2011; Vazquez & Federico 2012; Berger & Bouwman 2013).

The BSBS (2013) and Shijaku (2017) envisage that by increasing retail deposit funding, banks' liquidity profiles are enhanced leading to banking sector stability. Retail deposits are assumed to be stable because customers' deposits and withdrawals are random; therefore, a portion of bank deposits is presumed to be statistically stable (Diamond & Rajan 1983). Besides engendering stability, increasing the share of retail deposits in total funding may increase banks' profitability. In general, retail deposits attract low interest rates (Demirguc & Kunt 1999); hence, banks may boost their profitability through a reduction in overall cost of funding. In addition, a large clientele base allows banks to sell oth-

er products to a large pool of customers and also increase non-interest income through transaction charges and other fees which may increase their profitability (Gassmann, Wackerbeck & Fiedler 2012).

On the contrary, retail deposits are susceptible to runs which may jeopardize banking sector stability. The fragility of bank deposits is one of the main sources of bank failures. Acting rationally or irrationally on the backdrop of negative news about a bank's solvency, depositors can run on an otherwise solvent bank leading to its failure (Elliot 2014). Furthermore, heightened competition for retail deposits among banking firms in the quest to meet the LCR specification may compromise banking sector stability if competition is unregulated (Hartlage 2012). In addition, since the law of demand and supply states that as demand of a commodity increases the price goes up (Whelan & Msefer 1996); high competition for retail deposits may actually push up deposit rates resulting in high funding costs and reduced banks' profitability. Banks may attempt to revert or maintain pre-Basel III profits by charging high rates to borrowers, which may depress loan demand with dire consequences on real economic activity (Svilenova 2011, Mahapatra 2012). Moreover, since banks in emerging market economies are significantly funded by deposits, this funding practice may result in high premium on applying run off rates on deposits and reduce the high quality liquid assets requirement (Basel Consultative Group – BCG, 2014).

Based on this discussion, it is clear that a shift towards retail deposits in pursuit of the LCR charge may not result in expected response from banks since banks tend to evaluate the costs and benefits of adjusting as well as impediments to adjustment (Wall & Peterson 1996). This analysis suggests that besides internal factors, market factors may also constrain banks' behavior. Thus, this investigation is important since it sheds light on the behavioral response of banks to the LCR specification. Moreover, findings of this study may have policy implications which policy makers and bank regulators need to take note of; hence, the study is deemed to be of significant importance to policy makers. For instance, as aforementioned, a herd towards retail deposits may engender heightened competition for retail deposits leading to market distortions and instability. Thus, regulators and policy makers need insights into the behavioral response of banks to the LCR rule to assess the effectiveness or drawbacks of the regulation.

The rest of the paper is structured as follows. Section 2 describes the LCR specification. Section 3 describes methods of study employed to answer the objective of the study. Section 4 presents and discusses empirical findings and the last section, Section 5, concludes the study and offers plausible recommendations.

2. The liquidity coverage ratio (LCR)

The pursuing description of the LCR is extracted from *Basel III document (bcbs238) titled Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools*, issued by the Basel Committee on Banking Supervision in January 2013. The LCR is built on the conventional concept of 'liquidity coverage' techniques that are internally employed by banks to evaluate their exposure to contingent liquidity scenarios. It is made up of two components: the pool of unencumbered high quality liquid assets (HQLA) and total net cash outflows. It is expressed as a ratio of high quality liquid assets to total net cash outflows over a 30-day period as shown in formula (2.1).

$$LCR = \frac{Amount\ of\ High\ Quality\ Liquid\ Assets}{Total\ net\ cash\ outflows\ over\ 30\ day\ period} \geq 100 \qquad (2.1)$$

In the absence of a crisis, banks are expected to maintain the LCR at least 100% on an ongoing basis. However, in the event of a crisis a bank's LCR may be allowed to fall below 100% because it would have drawn down its high quality liquid assets. Furthermore, maintaining the LCR at 100% in periods of crisis can create adverse effects on the bank and other market players (Basel Committee on Banking Supervision 2013).

Description of the numerator: High Quality Liquid Assets

High quality liquid assets are financial securities that are presumed to be very safe and easily liquidated in the markets to meet a bank's obligations. There are two categories of high quality liquid assets: level 1 and level 2 assets. Level 1 comprises cash, central bank reserves and sovereign debt that can qualify for a 0% risk weight under the Basel II standardized approach for credit assets. These assets should make up at least 60% of the total high quality liquid assets and there are no limits to the amount of Level 1 assets that a bank may hold. Level 2 assets are comprised of two categories: Level 2A and Level 2B. Level 2A assets are restricted to the following: claims on securities issued or guaranteed by sovereigns, central banks, public sector enterprises and multilateral development banks; corporate debt securities and covered bonds that meet certain requirements spelt out by the Basel Committee. A 15% haircut is applied to all assets considered under level 2A. Level 2B assets are additional assets that may be considered under level 2 assets at the discretion of national regulators. These assets include: residential mortgage backed securities (subject to a 25% haircut); corporate debt securities (subject to a 50% haircut) and ordinary shares (subject to a 50% haircut). The total

value of level 2 assets is restricted to a maximum of 40% of the total high quality liquid securities stock.

The value of high quality liquid assets is determined by the following formula:

Stock of HQLA = Level 1 + Level 2A + Level 2B –
Adjustment for 15% cap – adjustment for 40% cap (2.2)

Where:

*Adjustment for 15% cap = Max (Adjusted Level 2B -15/85**
*(Adjusted Level 1 + Adjusted Level 2A), Adjusted 2B -15/60*Adjusted Level 1, 0)* (2.3)

Adjustment for 40% cap = Max ((Adjusted Level 2A + Adjusted Level 2B –
*Adjustment for 15% cap)-2/3*Adjusted Level 1 assets, 0)* (2.4)

Characteristics of High Quality Liquid Assets

The Basel Committee stipulates that for an asset to be considered liquid and of high quality it must have the following properties:

a) Fundamental features

- *Low risk*

For an asset to qualify as high quality liquid asset it must be of very low risk because low risk assets are generally liquid (Alger & Alger 1999). Liquid is determined by the creditworthiness of the issuer and the degree of subordination for the asset. The higher the credit worthiness of a borrower, the lower the risk profile of the assets and the more liquid the assets tend to be.

- *Ease and certainty of valuation*

A high quality liquid asset should be ease to value and market participants should generally agree on its valuation. Thus, the formula used to calculate the value of a high quality liquid asset must be easy and should not rely on strong assumptions.

- *Low correlation with risky assets*

Assets that are considered to be of high quality must be lowly correlated with risky assets. The lower the correlation between the high quality liquid asset and the risky assets the more liquid the high quality liquid asset is considered to be.

- *Traded on a developed and recognized market*

For an asset to qualify as a high quality liquid asset it must be listed on a developed and recognized market. In general listing increases an asset's transparency, which enhances its liquidity.

b) Market related features

- *Active and sizable market*

A high quality liquid asset should trade on an active and significantly large market because market breadth and depth are key drivers of an asset's liquidity.

- *Low volatility*

Assets whose prices are fairly stable and less susceptible to sharp price decreases over time carry a low probability of triggering forced sales in a crisis. Therefore, a high grade security should prove to be relatively stable during stressed market conditions.

- *Flight to quality*

Liquid securities should provide investors a safe haven in periods of severe market disturbances. In other words, investors should have confidence in the security to the extent that when crisis hits they should hold such securities for safety reasons.

Description of the denominator: Total net cash outflows

The value of total net cash outflows is given as the sum of anticipated cash outflows less anticipated cash inflows in a stressed market environment for a period 30 days. Mathematically, it can be expressed as follows:

$$\textit{Total net cash outflows} = \textit{Total expected cash outflows} - \textit{Min}\{\textit{Total expected cash inflows; 75\% of total expected cash outflows}\} \quad (2.5)$$

Where:

Total expected cash outflows are determined by multiplying the remaining balances of different categories or types of liabilities and off balance sheet items by the appropriate run off rate.
Total expected cash inflows are determined by multiplying the remaining balance of different categories of contractual receivables by the rates at which they are anticipated to flow in under the scenario up to an aggregate limit of 75% of total anticipated cash inflows.

Objectives of the LCR

The LCR is one of the key reforms taken by the Basel Committee to advance a more buoyant financial sector. The rule is aimed at addressing short term liquidity risk in banks by requiring banks to maintain a buffer of unencumbered high grade assets to meet net liquidity outflows under a stress scenario lasting 30 calendar days. The 30-day calendar period is assumed to provide regulators and a

bank`s management with ample time to resolve the bank's problems in the most prudential manner. The standard ensures that, during periods of idiosyncratic or market wide liquidity stress banks should be able to draw down the pool of high grade securities to meet maturing obligations. The rule is believed to strengthen banks' ability to withstand shocks emanating from either financial or economic crisis, thus reducing the procyclicality effects of banking sector crisis to the real economy.

Liquidity Coverage Ratio implementation

After considering potential impact of the Liquidity Coverage Ratio standard on financial markets, banks' lending activities and economic growth, the Basel Committee decided to go for a phased-in implementation of the metric. The implementation phases of the Liquidity Coverage Ratio are shown in Table 1 below.

Table 1: Phase in implementation of the LCR

Period	1 Jan 2015	1 Jan 2016	1 Jan 2017	1 Jan 2018	1 Jan 2019
Min LCR	60%	70%	80%	90%	100%

Source: Basel Committee on Banking Supervision (2013:8)

Banks started to report the LCR as from 1 January 2015. The minimum ratio that banks were expected to satisfy is 60%, which would rise successively by 10% annually to reach the 100% threshold on 1 January 2019.

3. Econometric specification

In this section, we describe the study's econometric model and justify the estimator of choice. We begin by hypothesizing that banks have a target level of deposits they pursue which optimizes their funding structures. We predict that banks gradually adjust their deposits profile in each given time period because funding structures are generally "sticky" (Oura, Gonzalez-Hermosillo, Chan-Lau, Gudmundsson & Valckx 2013). Besides, we also claim that bank deposits are persistent as current levels of deposits may be influenced by their past values. Based on this setting, we specify our econometric model as follows:

$$\Delta DEP_{ict} = \rho + \lambda Z_{ic,t-1} + \gamma X_{ict} + \psi MACFIN_{ct} + v_{it} + \varepsilon_{it}$$
$$\varepsilon_{ict} \sim \text{IID}\ (0, \sigma_{\varepsilon}^2);\ v_{it} \sim \text{IID}\ (0, \sigma_{v}^2) \qquad (3.1)$$

Where:

ΔDEP_{ict}:	change in deposit funding.
ρ:	constant coefficient.
X_{ict}:	vector of bank specific conditioning variables.
MACFIN:	vector of macroeconomic variables.
$\lambda; \gamma; \psi$:	coefficients to be estimated.
ν_{it}:	unobservable time invariant bank fixed effects.
ε_{it}:	idiosyncratic error term.

Our empirical model suggests that banks have an unobservable internal target level of deposits which is driven by a set of bank specific characteristics as well as macroeconomic fundamentals. Accordingly, we consider the following bank characteristics to be the main drivers of the unobservable internal target deposit funding level:

Bank size (SIZE). Bank size (SIZE) is assumed to significantly influence banks' balance sheet modification. Large banks, due to their balance sheet strength can easily tap funding from capital markets and raise more deposits due to their perceived safety (Alger & Alger 1999). Therefore, large banks may have more adjustment options at their disposal, which permits them to easily alter their liability structures. Bank size is measured as the natural logarithm of total assets.

Profitability (NIM). Bank profitability may also influence the ability of banks to alter their balance sheet structures based on the following two reasons. First, profitable banks may have easier access to external financing because they are able to service debts Bonner, Van Lelyveld & Zymek (2015). Second, retained earnings are counted as capital in banks' financial statements (BSBS 2010). This suggests that high profit banks are able to plough back more into their businesses, which makes it easier for them to adjust their liabilities. In this study bank profitability is measured by the net interest margin ratio (NIM).

Asset quality (NPL). Asset quality as measured by the ratio of non-performing loans to total loans (NPL) might also determine banks' ability to alter their balance sheets since asset quality has a signaling impact (Lucas & McDonald 1992; Asanovic 2017). Lucas & McDonald (1992) sought to examine the impact of asymmetric information about a bank's loan quality on banks' investment and funding decisions and found that asymmetric information affects banks' financing decisions and the market value of their liabilities. As concurred by Babihuga & Spaltro (2014) banks with deteriorating asset portfolio may find it difficult to

issue debt securities or equity and to attract deposits as they are perceived to be risky. As such, the study predicts that asset quality may impede banks to modify their liability items (deposits). We proxy asset quality by the ratio of non-performing loans to total loans (NPL).

Income diversification (ID). As highlighted by Gurbuz, Yanik & Ayturk (2013), banks with diversified income streams tend to have stable cash flows. As such, this study predicts that banks with broad income streams have great flexibility in modifying their liabilities. In this study income diversification was measured as the proportion of non-interest income to total income.

Bank capital (CAP). It may be necessary to include other Basel III requirements as control variables as well because in the process of complying with the LCR, banks also have to simultaneously meet certain capital charges that also rely on LCR items. For instance, risk weighted assets (RWA) value that is used in the determination of capital ratios comprises both liquid and illiquid assets. In addition, since it is difficult to distinguish insolvent banks from illiquid banks, it is prudent to link required capital to liquidity instead of examining the aspects separately. This view is supported by Goodhart (2008) who argues that liquidity and solvency are intertwined facets; an illiquid bank can quickly turn insolvent while a solvent bank can quickly become illiquid. For this reason, core equity Tier 1 ratio (CAP) is included among covariates in funding (liability items) regression models.

Economic conditions (GDP). Banks` funding structures may fluctuate in response to changes in economic conditions. For instance, prior to the global financial mayhem, there was a steady flow of wholesale funding but this trend was significantly reversed at the onset and during the crisis (BSBS 2010). Similarly, deposit flows are connected to changes in economic conditions (European Central Bank Economic Bulletin 2016). When the economy is doing well, demand for bank savings products and debt instruments tend to increase which leads to considerable changes in banks funding composition. Consequently, the study expects a positive association between changes in real GDP growth and changes in banks deposit funding.

Financial sector openness (OPENNESS). Another macroeconomic variable considered in this study is the level of financial sector openness. Openness of the financial sector determines the extent to which a particular country can tap into foreign markets (Hermann & Mihaljek 2013; Reinhardt, Ricci & Tressel 2013; Chakraborty & Boasson 2013). Countries with open financial systems can be associated with increased foreign portfolio investments which positively influence

banks' ability to restructure their liabilities. For this reason, the study expects a positive relationship between openness and changes in banks' deposit funding. Similar to Oura et al (2013), the financial sector's openness is measured as the ratio of current account surplus/deficit to GDP.

Financial sector development (FSD). Low levels of financial sector development create financial constraints for banks (Delechat, Arbelaez, Muthoora & Vtyurina 2012). Therefore, banks operating in less developed markets may experience difficulties in adjusting their liabilities since their ability to raise external funding from capital markets tend to be constrained. Accordingly, we hypothesize that low levels of financial sector development motivates banks to seek more deposits as their ability to tap capital markets funding is limited. The ratio of M2 over GDP was included among covariates to evaluate the impact of financial sector development on banks' funding decisions.

LCR regulation (REGPRESS). The LCR may have a direct impact on banks' deposit funding changes. Given the favourable treatment of retail deposits in the LCR calibration banks have strong incentives to up their LCR by increasing deposits funding. To capture the potential effects of the LCR charge on banks' deposit funding dynamics, we include a regulatory dummy variable (REGPRESS) into the baseline model in line with Kleff & Weber (2008), Abreu & Gulamhussen (2013) and Tanda (2015). Similar to Van Roy (2008) and Ashraf, Arshad & Hu (2016), we measure regulatory pressure as the gap between a bank's LCR and Basel minimum threshold of 1 (that is, 1 - LCRict). (REGPRESS) takes the value of 1 for deficit banks (that is, banks with a LCR below 1) and zero for banks with an LCR above 1. This intuition is based on the fact that LCR deficit banks are subject to more regulatory scrutiny (Pereira & Saito 2011), hence, regulators can influence banks funding decisions. Thus, we expect LCR shortfall banks to have greater incentives to adjust their LCR in fear of regulatory sanctions. Moreover, we expect regulatory pressure to be more pronounced in banks with a LCR shortfall (that is, LCR below 100% or 1) relative to banks with a LCR above 100% or 1, the minimum requirement. Therefore, the point estimate of REGPRESS may enable us to examine the extent to which regulatory pressure emanating from the implementation of the LCR rule has influenced banks to alter their deposit funding profiles.

After this exercise, the complete model can be specified as follows:

$$\Delta \frac{DEP_{ict}}{TL_{ict}} = \rho + \lambda(DEP_{ict}/TL_{ic,t-1}) + \gamma_1 \mathrm{CAP}_{ict} + \gamma_2 \mathrm{SIZE}_{ict} + \gamma_3 \mathrm{NIM}_{ict} + \gamma_3 \mathrm{NPL}_{ict} + \gamma_1 \mathrm{ID}_{ict} + \theta REGPRESS + \psi_1 GDP_{ct} + \psi_2 FSD_{ct} + \psi_3 OPENNESS_{ct} + \nu_{it} + \varepsilon_{it} \quad (3.2)$$

Where:

$DEP_{ict}/TL_{ic,t-1}$ = retail deposits to total liabilities; CAP_{ict} = bank capital; $SIZE_{ict}$= bank size; NIM_{ict} = net interest margin; NPL_{ict} = non-performing loans; ID_{ict}= income diversification; REGPRESS = regulatory pressure; GDP_{ct} = real gross domestic product growth; FSD_{ct} = financial sector development; $OPENNESS_{ct}$ = financial sector openness; ν_{it} = bank fixed effects; ε_{it} = idiosyncratic error term.

Our regression equation (Equation 3.2) can be estimated using the pooled Ordinary Least Squares (OLS), Fixed Effect (FE) or Random Effect (RE) estimator. In order to apply the OLS, explanatory variables must not be correlated with both individual effects (ν_{it}) and the idiosyncratic error term (ε_{it}) (Wooldridge 2002). Nevertheless, as pointed out by Wooldridge (2015) most econometric models include unobserved fixed affects to address potential heterogeneity issues which may lead to endogeneity problems because explanatory variables tend to be correlated with fixed effects (ν_{it}) that are concealed in the error term ($\nu_{it} + \varepsilon_{it}$). We suspect that one or more of the explanatory variables in our equations may be correlated with unobserved fixed effects (ν_{it}). For instance, managerial skills may be influenced by bank size whereby large banks due to their financial muscle may be able to attract and retain more experienced and qualified managers relative to smaller banks. Thus, regressing (Equation 3.2) with the OLS estimator may produce biased and inconsistent estimates since one or more regressors may be correlated with the error term due to the inclusion of fixed effects (Baltagi 2008, Larcker & Rusticus 2010).

Therefore, to address potential endogeneity issues in pooled OLS estimator we consider an estimating technique that can eliminate the fixed effect element in the disturbance term. This suggests the use of FE estimator; however, the FE estimator produces downward bias estimates in dynamic panel models since the lagged dependent variable ($\Delta Y_{ic,t-1}$) is inversely related with the mean of the error term (ε_{it}), since ($\varepsilon_{i,t-1}$) is incorporated in the transformed error term (Nickell 1981). Similar to the FE estimator, the RE estimator produces inconsistent estimates because in order to use Generalized Least Squares, random effect estimator quasi transformation is conducted which results in endogeneity, that is, correlation of the lagged dependent variable with the error term (Baltagi 2008). This implies that regressing Equation 3.2 with static panel data regression models may lead to heterogeneity and endogeneity problems. Hence, we address the shortcomings of static panel estimators by applying an instrument variable estimator. An instrument variable is a variable that is uncorrelated with the error term but correlated with the exogenous variable we want to remove (Wooldridge 2015). The instrument variable estimator is consistent as long as it meets these two condi-

tions. We resort to asymptotically efficient two-step system Generalized Method of Moments estimation technique suggested by Blundell and Bond (1998). Stata 13 econometrics software was used for analysis.

In terms of specification tests we check for the traditional autocorrelation and instruments validity test using the Arellano & Bond (1991) serial correlation test and Sargan (1958) test. To ensure that the instrument exogeneity test is reliable, we systematically examine whether the number of instruments is less than the number of groups (Giordana & Schumacher 2017). Lastly, we check for stationarity using the Maddala & Wu (1999) test that is applicable for unbalanced panels.

3.1. Data description

This study is based on bank-level data extracted from Bankscope database on a sample of banks operating in emerging market economies. Initially, the study only considers countries that have fully implemented the liquidity coverage ratio rule as of 31 December 2016. To do that, we choose countries that have largely or fully complied with the regulation based on Basel Committee's Assessment of Basel III LCR Regulations consistency under its Regulatory Consistency Assessment Programme. As of December 2016 the following countries have been assessed and found to be compliant or largely compliant with LCR specification: Hong Kong; India; Mexico; Saudi Arabia; South Africa; Argentina; Indonesia; Korea; Russia; Singapore and Turkey. This screening process results in a sample of eleven (11) countries.

The sample population is made up of ninety one (91) banks operating in eleven (11) countries. To ensure that the sample is comprised of 'pure' commercial banks, we follow Berger & Bouwman (2009) and Bruno, Onali & Schaeck (2014) screening procedure. We remove banks with the following features from the sample that were perceived to reflect a non-commercial bank: have zero deposits; have no outstanding loans; do not have commercial real estate or commercial and industrial loans outstanding; have zero or negative equity capital and resemble a building society (with home loans exceeding 50% of gross total loans). This screening procedure leaves us with a sample of forty (40) commercial banks.

The descriptive statistics for variables used in the study are presented in Table 2.

Table 2: Descriptive statistics

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
Deposit funding (DEP/TF)	196	82.48	13.06	34.08	99.43
Bank capital (CAP)	163	10.20	4.42	9.41	45.75
Bank size (SIZE)	197	19.23	3.51	10.36	26.24
Bank profitability (NIM)	197	3.88	2.31	0.7	15.47
Asset quality (NPL)	183	4.36	10.46	0.02	100
Income Diversification (ID)	197	32.70	12.36	5.23	65.90
Economic conditions (GDP)	192	4.20	2.28	-3.77	8.77
Financial sector openness (OPENNESS)	185	-1.42	3.12	-5.87	7.69
Financial sector development (FSD)	185	75.47	61.58	19.56	233.40

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

The estimated mean value of Retail Deposits to Total Funding ratio is 82.48. This value suggests that banks in emerging market economies are largely funded by retail deposits. This finding concurs with Basel Consultative Group finding that deposit funding constitutes about 80% of funding for banks in Malaysia, Philippines and Saudi Arabia.

On average, banks in the sample held a core equity Tier 1 (CET1) ratio of 10.20% over the period January 2011 to December 2016. This suggests that banks in the sample are adequately capitalized since their CET1 ratios exceeds the minimum capital requirement of 4.5% prescribed under Basel III.

Bank profitability was measured by return on equity (NIM). NIM is calculated as the ratio of interest on loans less interest on deposits to total interest earning assets. The average return on equity reported for sampled banks over the period 2011 to 2016 was 3.88%, meaning on average bank executives managed to generate positive returns over the sampling window.

The estimated average ratio of non-performing loans to gross loans is 4.36%. This ratio is within the acceptable international benchmark ratio of at most 5% and demonstrates effective credit risk management. The standard deviation value of 10.46% suggests that there is considerable variation in non-performing loans among banks in emerging market economies.

The estimated average value of the variable income diversification is 32.70%. This value implies that the contribution of non-interest income to banks in emerging

market economies revenue is about 33%. Since non-interest income is made up of bank charges and commission fees, among other incomes, this evidence may suggest two things: high bank charges or well diversified income sources.

The study used real gross domestic product growth (GDP) as a proxy for economic conditions. From Table 2 the variable 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. In addition, 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.

The results in Table 2 show that the ratio averaged about 75% during the sample period, which is very high. This high ratio implies that financial sectors of sampled economies are still underdeveloped. According to Khan & Senhadji (2003) and Hassan, Yu & Sanchez (2011) a high ratio of M2 to GDP connote that money is mostly used as a medium of storing value as a result of limited attractive investment alternatives. Likewise, the standard deviation was estimated to be 61.58%, demonstrating that there is a wide dispersion in the levels of financial sector development among countries used in the sample. This wide dispersion could be due to significant differences in the levels of economic development among the sampled countries. Some of the emerging economies used in our sample such as Brazil and South Africa are a bit advanced in terms of economic development compared to countries like Indonesia[1].

4. Empirical findings

The results of estimating the empirical model (Equation 3.2) with the two-step GMM estimator are presented in Table 3 and discussed herein.

[1] Based on 2015 World development indicators published by the World Bank, GDP per capita in Brazil, South Africa and Indonesia stood at $8 757.20; $5 769.80, and $3 336.10, respectively. http://databank.worldbank.org/data/home.aspx

Table 3: Empirical Results

Variable	Variable description	DEP/TL (1)
$(DEP/TL)_{ic, t-1}$	Lagged dependent variable	0.2224*
		(0.1337)
CAP	Bank capital	-0.2371
		(0.2930)
SIZE	Bank size	2.5252
		(2.1325)
NIM	Bank profitability	-1.5589
		(1.1294)
NPL	Asset quality	0.2426***
		(0.0353)
ID	Income diversification	-0.0343
		(0.0992)
REGPRESS	Regulatory pressure	9.4793**
		(4.510)
GDP	Real GDP growth	0.7099
		(0.4718)
FSD	Financial sector development	0.0016
		(0.0653)
OPENNESS	Financial sector openness	-0.6753*
		(0.3881)
Arellano-Bond (2) test		0.3268***
Sargan test		0.3629
Wald test		2928.52

Source: Own construction based on Bankscope data
***, **,* indicates statistical significance at 1%, 5% and 10% respectively.
Standard errors are shown in parenthesis.

Before analysing and discussing empirical results, we report unit root and model specification 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, which employs 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 (not reported for brevity) shows 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. Similarly, the results in Table 3 of the AR (2) test and Sargan test shows that the data does not suffer from serial autocorrelation and overidentified instruments.

(i) Lagged dependent variable (DEP_{t-1})

The regression results show that the coefficient of the lagged dependent variable (DEP_{t-1}) is positive and statistically significant at 10% level. The positive and statistically significant point estimate of the lagged dependent variable DEP_{t-1} means that the use of a dynamic model in this study is justified. This evidence shows that banks in emerging market economies have target deposits level and adjust their level of deposits over time to close deviations from their target. The reason why banks partially adjust could be as a result of financial frictions arising from market imperfections that prevent banks to raise deposits on short notice to meet their liquidity needs. Therefore, if banks have a target deposits level and partially adjust towards the desired level over time, these results are consistent with the trade-off theory widely used in corporate finance. Based on the theory, managers' decision to maintain an optimal deposits level is influenced by marginal costs and marginal benefits of actively managing the target deposits level (Chang & Yang 2016).

The estimated speed of adjustment of roughly 78%, which is 1 minus coefficient of lagged dependent variable (DEP_{t-1}) (that is 1-0.2224), reveals that banks in the sample close about 78% of the gap between current and target deposits in a year. Since the adjustment process depends on the trade-off between costs of being off target and costs of adjusting: if the costs of being off target outweigh costs of adjustment then banks would adjust fast and vice-versa (Drobetz, Schilling & Schroder 2014). The high speed of adjustment suggests that banks in emerging market economies find it more costly to be off target hence they adjust relatively fast to revert to their target deposit levels. This high speed of adjustment could be attributed to the fact that banks in emerging countries are largely funded by retail deposits, which makes it easy for them to increase deposits funding.

(ii) Regulatory Pressure (REGPRESS)

Results in Column 1, Table 3, show that the regulatory pressure dummy variable (REGPRESS) has a positive and significant effect on changes in deposit funding, suggesting that banks in the sample reacted to binding liquidity requirements by increasing funding from core deposits. Therefore, the study found some evidence to support the hypothesis that regulatory pressure has been effective in coercing banks to shift their funding sources towards stable deposit funding. These results compare with Lang (2016) who established that banks in Hungary responded to liquidity regulations by increasing deposit funding from households and non-financial entities. Similarly, Debelle (2012) and Robertson & Rush (2013) observed that competition for retail deposits has intensified among Australian banks as

banks sought more deposits to comply with liquidity charges. Shi & Tripe (2012), also noticed that New Zealand banks are actively pursuing retail funding in reaction to the introduction of liquidity regulations.

The evidence that banks in the sample responded to binding liquidity measures by increasing deposit funding appears to be logical in context of the LCR perspective. The LCR treats retail deposits favourably by applying low run off rates to core deposits; therefore, an increase in retail deposits reduces applicable runoff rates thereby decreasing net cash outflows and improving the LCR. The favourable treatment of retail deposits in the LCR measure is based on their assumed stability. In worst case scenarios, the Basel Committee predicts that a bank can only lose 5% of its core deposits. Han & Melecky (2014) point out that low income depositors (commonly known as retail depositors) have a tendency of maintaining a steady financial behaviour through business cycles. The implication of this behaviour is that at bank level, retail depositors can provide a diversified and reliable funding base that is less susceptible to changes in a bank's financial conditions. Moreover, the stability of retail deposits is enhanced by deposit insurance. Diamond & Rajan (1983) document that insured depositors have a low risk of running on an institution in times of a crisis hence they can provide a stable source of funding. Therefore, from a macroprudential regulation perspective, it can be argued that retail depositors can contribute to the banking sector's stability since they proved to be resilient to funding shocks during the 2007 to 2009 financial crisis (Gatev & Strahan 2006, Ritz & Walther 2015).

However, despite the fact that Basel assumes that retail deposits are stable even in times of extreme crisis, this assumption may not hold for underinsured retail depositors. Underinsured depositors are those depositors with cash balances above the deposit protection coverage limit. Underinsured depositors are highly likely to switch to safer products during a crisis thereby withdrawing their funds from banks. In support of this argument, Grind (2009) observed that underinsured depositors withdrew about $9.4 billion from Washington Mutual over a two-week period in July 2008. Similarly, Flannery (2009) reported that Landsbanki Icesave in Iceland experienced a bank run in September 2008 due to fear by depositors that the country's deposit insurance fund would not be able to meet their claims in the event that the bank collapsed.

(iii) Bank capital (CAP)

The point estimate for bank capital (CAP) in Table 3, Column 3 shows that a standard deviation of 1% increase in equity capital causes bank deposits to drop by about 8%, that is $\frac{4.67^{*} - 0.2371}{13.06}$. This means that changes in equity capital

negatively affect changes in banks' deposits. As suggested by Kochubey & Kowalczyk (2014), the implication of such results is that banks which are funded with stable instruments keep low levels of capital. However, the intuition that banks with stable funding sources maintain low levels of capital could not be supported by empirical results because the coefficient of CAP is statistically insignificant. The possible explanation to these results is that the short period of study could have affected the statistical power of capital on banks' deposits adjustment since capital is slow to adjust (Oura et al 2013).

(iv) Bank Size (SIZE)

The hypothesis that big banks are able to attract large deposits due to their perceived safety could not be supported by empirical results since the coefficient of bank size (SIZE) is statistically insignificant. Research findings may imply that the role of size in influencing bank deposits has changed in the Basel III period. Basel III requires all banks, regardless of their size, to increase deposit funding. This implies that the influence of size on banks' deposit holdings may have been substituted by Basel III liquidity regulations thereby becoming insignificant.

(v) Profitability (NIM)

Regression results report that changes in profitability are negatively associated with adjustments in banks deposits. This evidence suggests that growth in profitability entice banks to decrease their deposits. This behavior could imply that banks use part of their profits (retained earnings) to fund their activities, which reduces their incentives to secure more deposits. However, the explanatory power of profitability is insignificant; suggesting that the impact of profitability has not been large enough to yield a statistically significant influence on changes in deposit funding. Stated differently, the empirical results suggest that profitability has a limited explanatory power on changes in deposit funding.

(vi) Asset quality (NPL)

Asset quality significantly influences changes in deposit funding. According to estimated results, a 24.26% increase in non-performing loans (NPL) causes commercial banks' deposits to increase by 19.43%, which is $\frac{10.46*0.2426}{13.06}$, all else equal. Nevertheless, these findings are counterintuitive. Logically, banks experiencing asset quality deterioration are expected to encounter considerable withdrawals as a result of increased solvency risk. One possible explanation to these findings could be that retail depositors in emerging markets have limited investment options, probably due to the fact that capital markets are still developing

and do not offer attractive returns, therefore, the response of retail deposits to rising asset portfolio risk appears to be inelastic.

(vii) Income Diversification (ID)

The coefficient of Income Diversification (ID) is negative and statistically insignificant; suggesting that changes in bank deposits cannot be explained by changes in noninterest income. The literature of Gurbuz et al (2013) points out that banks with well-diversified income streams tend to have stable operating profits. Since banks can use part of their profits to boost their lending business, the implication of this practice is that banks with well diversified income sources have low impetus to aggressively seek demand deposits. Consequently, a negative relationship between changes in income diversification and bank deposits was anticipated. Results indicate that income diversification negatively influences banks to alter their deposits holdings, consistent with the notion that banks with diversified income sources have low incentives to source deposits. Nevertheless, the coefficient of ID highlights that the impact of income diversification on changes in banks deposits appears to be insignificant. This means that during the period of study noninterest income contribution to changes in bank deposits has been insignificant, probably due to decreases in noninterest revenue for banks in the period succeeding the global financial crisis.

(viii) Business Cycles (GDP)

The point estimate of real gross domestic growth (GDP) suggests that changes in deposit funding are positively influenced by changes in gross domestic product. As argued by Ahlswede & Schildbach (2012), growth in GDP causes disposable income to raise thereby increasing bank deposits. Nonetheless, the study could not find evidence to prove that deposits growth is significantly driven by changes in gross domestic product because the coefficient of GDP is statistically insignificant. These findings suggest that economic output had an impact on bank deposits, but the effect may not have been large enough to yield a statistically significant influence.

(ix) Financial sector development (FSD)

Literature suggests that financial development measured by financial inclusion promotes savings mobilization which in turn boosts bank deposits (Sahay, Cihak, N'Diaye and Barajas, 2015). As a result, a positive relationship between financial sector development and bank deposits was expected. Although the coefficient of financial sector development (FSD) is positive as expected, it is small and also statistically insignificant. Consistent with Prasad (2010), this evidence offers that

financial inclusion appears to be relatively low in emerging market economies. Makina, Chiwunze & Ndari (2014) attributes low levels of financial inclusion in emerging countries to, among other factors, high bank charges, stringent regulatory requirements such as Know Your Customer requirements and lack of confidence in banks as a result of high incidences of bank failures.

(x) Financial sector openness (OPENNESS)

The variable OPENNESS was included in the regression analysis to examine whether countries with open financial systems are able to attract foreign deposits. The results in Column 1, Table 3 indicate that financial sector openness has a negative and significant effect on changes in bank deposits. Although these results are contrary to expectations, they appear to be logical given capital requirements under Basel III. The main providers of foreign deposits to emerging market economies are major international banks who provide these deposits in the form of loans to foreign banks. Considering that Basel III capital requirements encourage large international banks to adopt the Internal Ratings Based approach to credit risk management, the Internal Ratings Based approach could have created perverse effects on the lending activities of international banks to emerging markets. The Internal Ratings Based approach requires banks to set aside more capital when lending to lower rated borrowers. This implies that international banks have to set aside more capital when lending to emerging market economies which may have low ratings compared to developed economies. As a result, international banks might have been decided to reduce lending to banks in emerging market markets. This analysis is in line with the findings of Ghosh, Sugawara & Zalduendo (2011). Through simulation analysis Ghosh et al (2011) concluded that emerging market economies could experience a 3% reduction in bank flows as a result of Basel III standards.

4.1. Robustness check

Following previous literature, Fu, Lee, Xu & Zurbrugg (2011) and others who used alternative estimators for robustness check, the study employed Difference GMM proposed by Arellano and Bond (1991) for robustness check. Unlike system GMM, difference GMM make use of existing lagged dependent variable levels as instruments for the first differenced lag. The estimator transforms the covariates through first differencing and then employs generalized method of moments to fit the model. The results of re-estimating Equations 3.2 using difference GMM are presented in Appendix 1. From the results, it can be noticed that most of the estimates concur with previous findings. Nevertheless, there are

some variations in sign and statistical significance of some covariates, notably the variables NIM (profitability measure) and FSD (financial sector development proxy). In the baseline model, NIM had a negative and statistically significant point estimate but in the reestimated model the variable NIM has a positive sign and is statistically significant. These results (robustness test results) suggest that growth in profitability enhances the inflow of bank deposits. Since retained earnings are counted as part of a bank's core capital under Basel capital requirements these results may imply that depositors presume profitable banks to be relatively stable hence they may make more deposits at profitable banks. Turning to the variable FSD, in the baseline model it had positive and insignificant impact on changes in bank deposits; however, in the difference GMM output, the variable FSD negatively and significantly influences changes in bank deposits. These results confirm the proposition that financial sector development diminishes bank incentives to increase deposit funding. In other words, it seems that financial sector development enhances banks' ability to source funds from capital markets, thereby reducing their incentives to garner deposits. However, the pattern of influence of liquidity regulations, as indicated by the coefficient and significance of the variable REGPRESS, is consistent in both models. Therefore, robustness test suggests that empirical estimates are fairly robust to dynamic re-specification.

5. Conclusion and Recommendations

The study established that banks in emerging markets reacted to mandatory liquidity requirements by increasing the share of retail deposits in total funding. From a macroprudential regulation perspective, this behaviour can engender financial sector stability because retail deposits are resilient to funding shocks (Gatev and Strahan 2006, Ritz and Walther 2015). From a micro perspective, growth in retail deposits particularly demand deposits that earn below market interest may boost banks profitability via reduction in overall cost of funding. In addition to this, a large clientele base allows banks to sell other products and increase non-interest income through transaction charges which effectively increase their revenue. Therefore, banks in emerging markets are advised to design strategies that enable them to attract significant retail deposits. Banks can mobilize retail deposits through acquisitions, expanding branch network, instituting competitive deposit rates, offering non-financial benefits to depositors such as automatic entry into periodic promotions for new depositors that offer attractive prizes, product differentiation and creative marketing (Gassmann, Fielder & Wackerbeck, 2012).

Besides using retail deposits to fulfil liquidity measures, there are some advantages of increasing retail deposits in banks. First, since retail deposits, particularly demand deposits, generally earn below market interest especially in emerging market economies (Borio, Gambacorta & Hofmann 2017); increasing core deposits may enhance banks' profits by reducing overall funding costs. This argument may be substantiated by empirical findings of Duraj & Moci (2015) which revealed deposits positively influence profitability of banks in Albania. Likewise, pooling new depositors may also give banks a wide platform to sell their products thereby boosting their revenue.

Furthermore, although a switch towards retail deposits can to foster banking sector stability due to the resilience of core deposits, this behaviour may also compromise systemic stability if competition for high valued retail deposits grows excessively. This line of argument is consistent with presentations made by Hartlage (2012). Drawing a comparison between the LCR and FSS105 liquidity rule introduced in Korea, which is similar to Basel LCR, Hartlage (2012) highlighted that the introduction of FSS105 liquidity rule in Korea increased competition for time deposits (which were needed to satisfy the rule) resulting in large market distortions, thereby undermining the stability of the Korean financial sector. Eventually, Korean regulators were forced to relax the regulations. Therefore, this study argues that systemic stability may be jeopardized if banks compete excessively for retail deposits in response to the new liquidity rules. We advise bank regulators to strictly monitor competition for retail deposits so that it does not erode benefits of banking sector stability achieved by increased deposit funding.

Moreover, Ahlswede & Schildbach (2012) argue that cluster risk may develop due to concentrated funding in retail deposits that may not be adequately covered by deposit insurance. In order to minimize this risk, regulators may have to increase deposit insurance premium so that most of the deposits are insured. But, a rise in deposit insurance premium may lead to increased insurance costs for commercial banks that may reduce their profits. Ahlswede & Schildbach (2012), also contend that the predominance of retail deposits as the main form of investment for households may reduce the flow of funds to capital markets which may inhibit the development and growth of capital markets in emerging market economies. Policy makers in emerging markets should encourage households to invest in capital markets. This may be done by increasing public awareness of the products offered in capital markets as well as the benefits of capital market investments.

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Appendix 1: Robustness test results

Variable	Coefficient
Lagged dependent variable ($DEP_{ic, t-1}$)	0.2333**
	(0.0958)
Bank size (SIZE)	15.0693***
	(4.1341)
Bank capital (CAP)	-0.0123
	(0.2878)
Asset quality (NPL)	0.2791***
	(0.0219)
Profitability (NIM)	2.4571**
	(1.1693)
Regulatory pressure (REGPRESS)	12.0808***
	(1.3789)
Real GDP growth (GDP)	-0.2498
	(0.6986)
Financial Sector Development (FSD)	-0.2342***
	(0.0660)
Financial Sector Openness (OPENNESS)	-1.1581***
	(0.6426)
Arellano-Bond (2) test	0.1735
Sargan test	0.2893
Wald test	19 068.79***

Source: Own construction based on data obtained from Bankscope
***, **, * indicate significant levels at 1%, 5% and 10%, respectively.
Standard errors are in parenthesis.