LIQUIDITY REGULATIONS AND BANK BEHAVIOR: AN EMERGING MARKETS PERSPECTIVE

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Abstract

The 2007 to 2009 global financial crisis significantly affected the funding structures of banks, especially internationally active ones (Gambacorta, Schiaffi, & Van Rixtel, 2017). This paper examines the impact of liquidity regulations, in particular, the liquidity coverage ratio (LCR), on funding structures of commercial banks operating in emerging markets over the period 2011 to 2016. Similar to Behn, Daminato, and Salleo (2019) who developed a dynamic partial equilibrium model to examine capital and liquidity adjustments, this paper develops three dynamic error component adjustment models and estimates them using the two-step system generalized method of moments (GMM) estimator to analyze funding adjustments adopted by banks in emerging markets in response to the LCR requirement. The results revealed that banks in emerging markets responded to binding liquidity regulations by increasing deposit, equity as well as long-term funding. In terms of the magnitude of response, deposit funding was found to be more responsive to the LCR rule while the elasticity of equity and long-term funding to the LCR specification was found to be weak. The weak response of equity and long-term funding to liquidity standards was attributed to low levels of capital market development in emerging markets (Bonner, van Lelyveld, & Zymek, 2015). By and large, the results suggest that Basel III liquidity regulations have been effective in persuading banks in emerging market economies to fund their business activities with stable funding instruments. Based on this evidence, the study supports the adoption of Basel III liquidity regulations in emerging markets. Moreover, policymakers in emerging market economies should monitor competition for retail deposits to safeguard the benefits of the LCR rule and pay more attention to developing capital markets.

Keywords: Basel III, Liquidity Coverage Ratio, Funding Structures, Emerging Markets, System GMM

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1. INTRODUCTION

The 2007–2009 global financial crisis had a significant impact on the funding structures of banks, especially internationally active ones (Gambacorta et al., 2017). In the period preceding the crisis, banks experienced difficulties in attracting core deposits (Le Lesle, 2012). Consequently, they supplemented stable retail deposits with volatile short-term wholesale funding instruments, like repos and asset backed commercial paper (ABCP), to satisfy the rising demand for credit during the credit boom (Ratnovski & Huang, 2008). Moreover, changes in banks funding

structures were propelled by financial innovation, in particular, asset securitization and prolific growth in over-the-counter derivatives trading. Financial innovation triggered banks to shift their business models from "originate to hold" to "originate to distribute" structure (Brunnermeier, 2009). These changes triggered banks to increase funding from volatile short-term wholesale funds and invested heavily in mortgage-based securities (MBS) (Kowalik, 2013). However, the growing dependence of banks on wholesale funding resulted in significant vulnerabilities for banks through currency and maturity mismatches leading to greater liquidity risk exposure.

As the global financial turmoil unfolded, funding markets experienced severe stress and market liquidity became very expensive or completely evaporated in some segments (Nagel, 2012). By and large, the global financial crisis was characterized by funding liquidity shortages worldwide and increased mayhem in interbank funding markets. Babihuga and Spaltro (2014) point out that interbank interest rates rose abruptly, interbank lending fell drastically, wholesale funding markets froze, investors shunned bank debt and new debt issues dropped sharply. Yet, banks that depended on stable retail deposits fared better during the crisis than banks that relied on wholesale funding (Vazquez & Frederico, 2012; Ritz & Walther, 2015). Upon this observation, the Basel Committee on Banking Supervision introduced global liquidity regulations in December 2010, in the form of the liquidity coverage ratio (LCR) and net stable funding ratio (NSFR), aimed at strengthening banks funding structures.

Although liquidity regulations are intended to foster the resilience of banking organizations to short-term liquidity shocks by encouraging them to fund their business activities with stable funding sources, banks may not react to regulations as expected by regulators for two reasons. First, if the regulations are not binding enough to induce behavioral change in banks, that is to say, if the penalties/sanctions are not deterrent enough to provoke non-compliant banks to act (Berben, Bierut, van den End, & Kakes, 2010; Calem & Rob, 1999). Second, considering that the goal of bank managers is to maximize value for common stock holders, if regulatory costs far outweigh the benefits of complying with the regulations banks may be complacent to implement the regulatory reforms (Wall & Peterson, 1996). However, if banks respond and provided that liquidity requirements are given as a ratio, banks can improve their liquidity ratios by altering either the numerator and/or the denominator of the metric. Given that the LCR became binding on January 1, 2015, and the NSFR became mandatory from January 1, 2019, this study is interested in examining the influence of the LCR on funding structures of banks in emerging markets.

This paper contributes to ongoing discussions on the impact of the Basel III LCR regulation on funding structures using bank-level data by providing empirical evidence from banks operating in emerging market economies. Extant literature on this discourse includes Kroon, Bonner, van Lelyveld, and Wrampelmeyer (2021) — EU; Banerjee and Mio (2018) — the UK; Roberts, Sarkar, and Shachar (2018) — the USA; Bonner and Eijffinger (2012) — the Netherlands; Schertler (2010) — Germany. This study attempts to provide evidence from emerging market economies based on two reasons. First, the financial systems of emerging markets are bank-oriented because banks are the main providers of long-term funding and play a key role in financial intermediation (Santos-Paulino, 2003; Ito & Park, 2014). Therefore, any disturbances to banks' asset allocation can be detrimental to the real economy; hence, there is a need to investigate whether the LCR regulation has significantly impacted emerging markets banks' funding decisions. Second, for Western economies that over-relied on volatile wholesale funds before the financial crisis, the imposition of liquidity standards to these economies may have merit. However, the relevance of these standards to emerging markets is debatable given that banks in emerging economies already funded their activities with stable sources, that is, retail deposits (Chen & Wu, 2014; Gobat, Yanase, & Maloney, 2014). In the same vein, emerging market economies are presumed to have simpler, perhaps strong, asset and liability management techniques as evidenced by their ability to withstand liquidity disturbances that caused havoc in developed economies (Davis, 2018). Ly (2015) adds that the impact of liquidity regulations may differ between bank-based and market-based economies due to differences in their market structures. Therefore, what remains to be known is the extent to which Basel III liquidity requirements have altered the funding structures of banks operating in emerging market economies. The current study sought to fill this knowledge gap.

Besides, an examination of the behavioral response of banks to harmonized liquidity requirements may matter to bank regulators and policy makers who are the watchdogs of financial sector stability. For instance, if banks are to meet the new binding LCR requirement by garnering more retail deposits, a herd towards retail deposits may create excessive competition for retail deposits which may lead to financial instability (Beng, 2012). On the same note, banks may simply shift liquidity risk from regulated entities to the unregulated or less regulated sectors of the economy via off-balance sheet constructs (Smaghi, 2010). Therefore, an examination of the impact of bank regulation on bank activities is imperative to regulators and economic policy makers to assess whether liquidity standards are producing desired or undesired effects.

The paper is structured as follows: Section 2 attends to literature review followed by a discussion of the research methodology in Section 3. Next, the empirical results are presented and analyzed in Section 4, and lastly the study is concluded in Section 5 with policy implications and reasonable recommendations being offered.

2. LITERATURE REVIEW

Similar to De Haan and van den End (2013), Kroon et al. (2021) examined the impact of the Dutch LCR, introduced in 2003 and similar to Basel III LCR, on the behavior of Dutch banks and found that the Dutch LCR compelled banks to reduce their reliance on short-term unsecured funding. Behn et al. (2019) developed a dynamic partial equilibrium

model to examine capital and liquidity adjustments of 116 banks under the European Single Supervisory Mechanism during the period 2014Q1 to 2016Q3. Interestingly, they found that EU banks responded very fast to the new liquidity requirements, but heterogeneity in the adjustment strategies is consistent with Schertler (2010). Banks that had high liquidity ratios before the new liquidity policy were not affected by the regulatory changes since they already had large liquidity buffers. The adjustments were noted on both sides of the balance sheet. On the denominator (net cash outflows), banks substituted short-term debt with long-term liabilities to comply with the rule and enhance their funding stability. To improve the numerator (stock of high-quality liquid assets), the banks increased the stock of liquid securities; however, this adjustment also affected their capital ratios. An increase in liquid asset holdings reduced the risk-weighted capital ratio since liquid securities have a positive effect on risk-weighted assets (RWA). Nevertheless, Behn et al. (2019) caution that a switch from loans to liquid securities and the substitution of short-term debt with long-term debt could have a detrimental effect on bank profitability which in turn can have an effect on their capital via a reduction in retained earnings.

Ihrig, Kim, Vojtech, and Weinbach (2019) investigated how US banks adjusted the composition of their high-quality liquid securities to comply with the LCR requirement. They posed a number of interesting questions, among them: Which liquid assets did US banks decide to hold and in what proportion? What motivated the banks to adjust towards certain securities? The study found that US banks met the LCR by securing excess reserves, but after complying with the regulation they modified their liquidity pools by reducing reserve balances and increasing high-quality liquid assets. They attributed the subsequent structural adjustment to the need to prudently manage liquidity and interest rate risk: more risk-averse banks switch their high-grade securities composition towards cash to mitigate the two risks. The study concluded that the bank's risk tolerance towards liquidity and interest rate risk influences its liquidity management strategy.

Again in the USA, Roberts et al. (2018) analyzed the effects of the LCR on liquidity creation of US banks for the period 2009Q1 to 2017Q4. The difference-in-difference estimator was used to exploit the timing of the rule as well as heterogeneity among bank sizes. They found that banks subject to the LCR specification reduced liquidity creation (lending), specifically commercial and residential real estate loans since there was an increased demand for banks subject to the LCR charge to hold more liquid securities and less illiquid securities as compared to non-LCR banks. The asset side adjustments were found to be more prevalent for level 1 assets consistent with the LCR expectations. Moreover, Roberts et al. (2018) established a huge reduction in high run-off LCR items by banks subject to the LCR regulation as compared to non-LCR banks.

Banerjee and Mio (2018) explored how British banks responded to the Individual Liquidity Guidance (ILG) rule, which is designed in the same philosophy as the LCR, using Jordà's (2005) local projection impulse response analysis. The study found that British banks subject to the ILG rule modified both their assets and liabilities items to satisfy the new liquidity requirements. On the asset side, banks responded to the ILG by increasing the pool of high-quality liquid assets to total assets by approximately 12% with the high-quality liquid assets pool being made up of approximately 75% in central bank reserves and about 25% in government securities. The increase in high-quality liquid assets was associated with an almost equal decrease in interbank loans. On the liability side, British banks sourced more funding from stable sources such as retail deposits and decreased their dependence on unstable wholesale funds and non-resident deposits. On the impact of the ILG on bank lending channel, consistent with Bonner and Eijffinger (2012), Banerjee and Mio (2018) could not find evidence to support the claim that banks increased their lending rates to the private sector.

Duijm and Wierts (2016), investigated the impact of the LCR on banks' asset and liabilities structures. Data for the study were sourced from the Dutch liquidity regulatory reports for the period July 2003 to April 2013. Banks' liquidity dynamics, when subjected to liquidity constraints, were analyzed with a vector error correction specification. Model estimate results revealed that when banks move away from their target liquidity level, they adjust their liabilities to revert to their optimal level. Moreover, the study found that in response to a shock in their target liquidity levels, banks on average correct 22% of this disequilibrium within a month. Their results suggest that banks modify their asset and liability structures to satisfy Basel III liquidity standards. Since required liquidity is estimated by weighting liabilities and cash flows, Duijm and Wierts (2016) assert that banks modify their funding mix to a greater extent and portfolio allocation to a lesser extent when their liquidity position shifts.

The European Banking Authority Report (EBA, 2015), made a comprehensive assessment of the effects of the new Basel III liquidity requirements on European banks' business models. The report indicates that liquidity regulations are likely to compel banks to seek more retail deposits, reduce their reliance on wholesale funding, and increase their holding of high-quality liquid assets at the expense of non-eligible high-quality liquid assets. The report further points that liquidity regulations are likely to raise banks' cost of funding, reduce their profitability and alter their funding mix. On the latter point (change in banks' funding mix), the report predicted that banks will potentially move towards equity capital, long-term bonds, and more retail deposits. The report also argues that banks will possibly increase asset securitization by selling illiquid assets to create cash inflows and also move illiquid assets from their balance sheets.

De Haan and van den End (2013) examined the liquidity management practices of Dutch banks subject to the Dutch liquidity balance rule, which structurally resembles Basel's LCR. The sample of the study comprised 62 banks, which hold nearly 99% of total banks' assets, and the period of the study was from 2004 to 2010. Monthly data on banks' balance sheets were sourced for the study from the Dutch National Bank's prudential liquidity

reports. For investigation, the researchers developed three-panel regression models which they estimated with a fixed-effect model. The research findings revealed that banks prefer to stock more liquid assets against expected liquidity outflows compared to what is strictly demanded by the liquidity balance rule. This behavior is consistent with the mismatch reduction strategy. Such behavior was found to be prevalent in smaller banks and foreign subsidiaries. Furthermore, the study established that foreign banks tend to stock lower levels of liquidity because they depend on the parent bank for liquidity support. Safer banks with high capital adequacy ratios and low default probability were also found to hold lower amounts of liquid assets because they have easy access and can obtain cheap funding from debt markets.

Using the Dutch liquidity coverage ratio (DLCR) as a proxy for Basel III LCR, Bonner and Eijffinger (2012) evaluated the impact of binding liquidity standards on the behavior of banks in the interbank market. Data for the study were obtained from the Dutch National Bank's monthly liquidity reports, interbank market transactions data, and individual banks' balance sheets. To analyze the response of banks' interbank borrowing and lending rates, a panel regression specification was developed and estimated using a fixed-effect estimator. The study concluded that the phasing in liquidity rules induced Dutch banks to simultaneously pay and demand a higher rate in the interbank market. These effects were found to be more significant for assets with a tenor exceeding the LCR's 30-day horizon and became more pronounced following the collapse of Lehman Brothers in 2008. Moreover, the study established that during the financial crisis, banks just below or above their prudential liquidity ratio decreased lending.

Making use of regulatory data, Schertler (2010) examined how banks in Germany manage their liquidity when confronted with higher payment obligations specified in the liquidity standards. To achieve this objective, Schertler (2010) makes use of quarterly regulatory data from 2000 to 2008 collected from three types of banks in Germany, namely commercial banks, savings banks, and cooperative banks. The study employs the dynamic panel data estimator, in particular, the system generalized method of moments (GMM) proposed by Blundell and Bond (1998) that recognizes the simultaneity between liquid assets holdings and payment obligations. The study identified heterogeneous strategies among commercial banks, savings banks, and cooperative banks in managing their liquidity when subjected to regulatory pressure. Commercial banks were found to depend more intensively on debt markets for funding, whereas cooperative and savings banks rely on cash flow matching. Besides matching their cash flows, cooperative and savings banks close to the regulatory threshold engage in asset substitution that is reducing illiquid assets, such as loans, and increasing holdings of liquid assets.

3. METHODOLOGY

This study intended to examine all balance sheet items that banks can adjust to meet the LCR rule. However, due to the dearth of granular data on short-term wholesale funding and securitization as well as the inability to get appropriate proxies for these variables, the study was confined to the following funding items: retail deposits, long-term wholesale funding, and equity capital scaled by total liabilities.

3.1. Empirical model and variables

The study developed the following empirical model:

$$\Delta Z_{ict} = \rho + \lambda Z_{ic,t-1} + \gamma X_{ict} + \theta REGPRESS + \psi MACFIN_{ct} + \nu_{it} + \varepsilon_{it} \quad (1)$$

where,

- ΔZ_{ict}: change in a given funding item;
- ρ: constant coefficient;
- X_{ict}: vector of bank-specific conditioning variables;
- *REGPRESS*: liquidity regulation;
- *MACFIN*: vector of macroeconomic variables;
- λ, γ, θ, ψ: coefficients to be estimated;
- ν_{it}: unobservable time invariant bank fixed effects;
- ε_{it}: idiosyncratic error term.

3.1.1. Dependent variable (ΔZ_{ict})

The dependent variable is described as a set of balance sheet items that banks can manipulate to meet the LCR specification. The balance sheet items are retail deposits, long-term wholesale funding and equity capital scaled by total liabilities.

3.1.2. Independent variables

Lagged dependent variable

In line with Oura, González-Hermosillo, Chan-Lau, Gudmundsson, and Valckx (2013), the study adds the lagged dependent variable among covariates to account for slow adjustment towards the target (desired) funding structure as well as to address potential endogeneity that may arise from the correlation of explanatory variables and firm fixed effects.

Liquidity regulation (REGPRESS)

Borrowing from previous studies that examined the behavioral response of banks to capital regulations, such as Heid, Porath, and Stolz (2004), Abreu and Gulamhussen (2013), and Tanda (2015), the study measures the impact of liquidity regulations on banks' funding models adjustments by specifying a liquidity regulation dummy variable (*REGPRESS*). The variable *REGPRESS* takes a value

of 1 for banks with an LCR below 100% and 0 for banks with an LCR above 100%. Regulatory pressure is expected to be more pronounced in banks with an LCR shortfall (that is, banks with LCR below 100%) relative to banks with an LCR above 100%. This intuition is based on the fact that LCR deficit banks may be subject to more regulatory scrutiny (Pereira & Saito, 2011); hence, regulation is believed to have a significant influence on banks' funding structure adjustments. In this context, the study expected LCR shortfall banks to have greater incentives to adjust their funding models in fear of regulatory sanctions. Accordingly, liquidity regulation emanating from the LCR (*REGPRESS*) is the key variable of interest.

Conditioning variables

To prevent spurious regression, a set of control variables is incorporated into the regression models. It is worth mentioning that there are few studies, to the researchers' best knowledge, that have explored the behavioral response of banks to binding liquidity requirements; hence, the study assumed that the following variables significantly influence banks' ability to adjust their funding structures: bank size, profitability, income diversification, gross domestic product, financial sector development, and financial sector openness. These variables are described below.

Bank capital (CAR)

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 consistent with 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, the core equity Tier 1 ratio (*CAR*) is included among the regressors in funding (liability items) regression models.

Bank size (SIZE)

Bank size may 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, big banks may have more adjustment options at their disposal, which permits them to easily alter their liability structures.

Profitability (NIM)

Bank profitability may also influence the ability of banks to alter their balance sheet structures based on the two following reasons. First, profitable banks may have easier access to external financing because they can service debts (Deléchat, Henao, Muthoora, & Vtyurina, 2012). Second, retained earnings are counted as capital. This means high-profit banks can plow back more into their businesses, which may make it easier for them to adjust.

Asset quality (NPL)

Asset quality as measured by the ratio of non-performing loans to total loans might also determine banks' ability to alter their balance sheets. Debt funding, deposit sourcing as well as equity issuances are likely to be controlled by the quality of a bank's asset portfolio. Banks with deteriorating asset portfolios may find it difficult to issue debt securities or equity and to attract deposits as they are perceived to be risky (Babihuga & Spaltro, 2014). As such, the study predicts that asset quality may constrain banks to modify their liability items.

Income diversification (ID)

Non-interest income derived from service fees, commission income and trading revenue contribute to higher bank profit, reduces the volatility of bank revenue and profit as well as risk (Senyo, Olivia, Musah, & Nuhu, 2015). This can be attributed to the fact that non-interest revenue is less dependent on traditional income; hence, increased reliance on non-interest income reduces cyclical swings in bank revenue and profit (Stiroh, 2004). Since non-interest income tends to be uncorrelated or weakly correlated with net interest income, income diversification should make a bank's net profit stable. If non-interest income reduces the volatility of bank profits and risk, then the study predicts that banks with broad income streams have great flexibility in modifying their balance sheets.

Bank deposits (DEPOSITS) and liquidity (LIQ)

Traditionally, banks rely on core/retail deposits for funding (DeYoung & Rice, 2004). However, when confronted by deposit supply constraints, banks can alter their funding structure by issuing more debt (Diamond & Rajan, 2001). Therefore, this study hypothesizes that debt or equity issuance is negatively related to changes in bank deposits. A similar relationship is likely to hold for liquidity: deposit-constrained banks may change their funding strategy by issuing more debt securities or equity to alleviate liquidity gaps. Likewise, the study hypothesizes that debt or equity issuance increases as bank liquidity decreases.

Assets growth (AG)

Loans constitute the largest share of a commercial bank's asset portfolio. If loan growth outpaces deposit growth, commercial banks have to borrow to cover this funding gap (Harvey & Spong, 2001). Therefore, as a bank's loan book grows, its funding composition may also change if it uses debt to fund assets growth. Besides, financing constraints create liquidity needs that produce incentives for firms to seek external funding or to make rights issues (Mizen, Tsoukalas, & Tsoukas, 2008). Accordingly, this study predicts that banks issue more debt and equity to fund loan book growth.

Economic conditions (GDP)

Banks' funding structures may fluctuate in response to changes in economic conditions. For instance, before 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 (Basel Committee on Banking Supervision, 2013). Similarly, deposit flows are connected to changes in economic conditions (European Central Bank, 2016). When the economy is doing well, demand for bank savings products and debt instruments tends to increase which leads to considerable changes in banks' funding composition. Consequently, the study expects a positive association between changes in real gross domestic product (*GDP*) growth and changes in banks' funding structures.

Financial sector openness (OPENNESS)

The extent of financial sector openness may determine the extent to which a particular country can tap into foreign markets. 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 financial sector openness and changes in banks' funding structures. Similar to Oura et al. (2013), financial sector openness is measured as the ratio of current account surplus/deficit to *GDP*.

Financial sector development (FSD)

Literature suggests that financial systems in many emerging markets economies are still underdeveloped (Estrada, Park, & Ramayandi, 2010; Griffith-Jones, Karwowski, & Dafe, 2014). Concomitantly, low levels of financial sector development create financial constraints for banks (Bonner et al., 2015). Therefore, banks operating in less developed markets may experience difficulties in adjusting their liabilities since their ability to raise external funding from capital markets might be constrained by shallow and illiquid capital markets. Accordingly, this study hypothesizes that financial sector development adversely affects funding structure adjustments of banks in emerging markets.

Monetary policy (CBR)

Monetary policy may influence banks' funding structures. An easing monetary policy in the form of low policy rates may entice commercial banks to take more risk by increasing leverage/debt issuance (Altunbas, Gambacorta, & Marqués-Ibáñez, 2010; Van Rixtel, González, & Yang, 2016). This study, therefore, predicts that monetary policy easing incentivizes banks to issue more debt.

After considering all control variables, the complete models for the study can be specified as follows:

$$\Delta\frac{DEPOSITS_{ict}}{TL_{ict}} = \rho + \lambda\left(\frac{DEPOSITS_{ic,t-1}}{TL_{ic,t-1}}\right) + \gamma_1 CAR_{ict} + \gamma_2 SIZE_{ict} + \gamma_3 NIM_{ict} + \gamma_4 NPL_{ict} + \gamma_5 ID_{ict} + \theta REGPRESS + \psi_1 GDP_{ct} + \psi_2 FSD_{ct} + \psi_3 OPENNESS_{ct} + \nu_{it} + \varepsilon_{it} \quad (2)$$

$$\Delta\frac{LTWF_{ict}}{TL_{ict}} = \rho + \lambda\left(\frac{LTWF_{ic,t-1}}{TL_{ic,t-1}}\right) + \gamma_1 CAR_{ict} + \gamma_2 SIZE_{ict} + \gamma_3 NIM_{ict} + \gamma_4 NPL_{ict} + \gamma_5 AG_{ict} + \gamma_6 DEPOSITS_{ict} + \theta REGPRESS + \psi_1 GDP_{ct} + \psi_2 CBR_{ct} + \psi_3 IR_{ct} + \nu_{it} + \varepsilon_{it} \quad (3)$$

$$\Delta\frac{EQ_{ict}}{TL_{ict}} = \rho + \lambda\left(\frac{EQ_{ic,t-1}}{TL_{ic,t-1}}\right) + \gamma_1 SIZE_{ict} + \gamma_2 ROE_{ict} + \gamma_3 NPL_{ict} + \gamma_4 ID_{ict} + \gamma_5 LIQ_{ict} + \gamma_6 DEPOSITS_{ict} + \theta REGPRESS + \psi_1 GDP_{ct} + \nu_{it} + \varepsilon_{it} \quad (4)$$

3.2. Sample selection

The starting point for our sample selection was a population of commercial banks operating in twenty-three (23) emerging market economies derived from the Morgan Stanley Capital Index (MSCI) list of emerging market countries (see Appendix). To ensure that the sample comprised 'pure' commercial banks, the study followed Berger and Bouwman (2009) and Bruno, Onali, and Schaeck (2018) screening procedure. We removed 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). Liquidated, dissolved, and bankrupt banks were also excluded from the sample. The study only considered countries that have fully implemented the LCR rule as of December 31, 2016. To do that, we chose countries that have largely or fully complied with the regulation based on the Basel Committee's Assessment of Basel III LCR Regulations Consistency under its Regulatory Consistency Assessment Programme. As of December 2016, the following 11 emerging 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 resulted in a sample of forty (40) banks from eleven (11) countries.

3.3. Data and data sources

The study obtained bank-specific variables data from individual banks' income statements and balance sheets. This data were retrieved from Bankscope, a databank containing financial statements for banks (Matejašák & Teplý, 2007) and is widely used by academic researchers to obtain bank data, for instance, by Jokipii and Milne (2011) and Ashraf, Arshad, & Hu (2016). The main advantages of the Bankscope database are that it is fairly comprehensive and it presents financial data in standardized formats, that is after adjusting for differences in accounting and reporting standards across jurisdictions (Vazquez & Federico, 2015).

The sampling window for this study covers the period January 2011 to December 2016. The choice of this period was based on the event study concept. Event studies analyze the reaction of firms' share prices to corporate announcements (Kothari & Warner, 2007). As such, the study presumed that banks started to adjust their balance sheets soon after the announcement of Basel III liquidity requirements in December 2010, so that by January 2015 they would have complied with minimum requirements. For this reason, the study period was limited to the period January 2011 to December 2016. Consequently, the study considered a "pure" Basel III period in line with Abreu and Gulamhussen (2013) who examined the influence of risk-based capital requirements on banks centering on a "pure" Basel I period. Furthermore, the sampling window was post the global financial crisis which eliminated issues to do with structural breaks in modeling the data.

3.4. Estimation technique

Equations (2), (3) and (4) can be estimated using pooled ordinary least squares (OLS), random effect, fixed effect models or dynamic models, such as difference GMM proposed by Arellano and Bond (1991) or system GMM developed by Blundell and Bond (1998). Unlike dynamic models, GMM in this case, the static estimators (pooled OLS, random effect, fixed effect) do not permit a distinct analysis of the short and long-term interplay between the independent and dependent variable (Baltagi, 2008). This study is interested in evaluating the short-term impact of liquidity regulations on banks' balance sheet adjustment, hence, the choice of dynamic models (system or difference GMM) over static panel regression estimators.

With regard to the dynamic models, difference GMM suffers from large finite sample bias and poor precision in case that the endogenous variable is highly persistent (Blundell & Bond, 1998). Moreover, Klomp and de Haan (2015) maintain that differencing, in the Arellano and Bond's (1991) estimator, removes long-term cross country information that is in levels of the variables and if the dependent variables are persistent, their lagged values are poor instruments of their differences. In order to address the weak instrument problems in the first difference GMM, Ahn and Schmidt (1995) and Blundell and Bond (1998) suggest the use of additional instruments to the GMM specification to improve the efficiency of the estimator based on the assumption that the first differenced instruments are not correlated with fixed effects. Likewise, Arellano and Bover (1995), argue that additional moment conditions can be established if one assumes that the exogenous variables are uncorrelated with firm fixed effects. In this study, lagged differences of the explanatory variables and dependent variables are regarded as valid instruments for the levels equation. The resulting estimator, system GMM developed by Blundell and Bond (1998), integrates the collection of moment conditions derived from the first difference equation and the additional moment conditions available in levels. Blundell and Bond (1998) show that system GMM is preferred to difference GMM when the explanatory variables are persistent. Accordingly, this study employs the system GMM proposed by Blundell and Bond (1998) for analysis. The strength of system GMM is that it accounts for persistence in dependent variables, weak instrument problem in difference GMM and endogeneity issues in static panel model estimators (pooled OLS, random effect, and fixed effect estimators). System GMM addresses endogeneity, which may arise from a potential correlation of explanatory variables with fixed effects (v_{it}) that are concealed in the error term ($v_{it} + \varepsilon_{it}$) (Wooldridge, 2015), by using all available variables, including lagged and transformed variables, which are uncorrelated with the error term as valid instruments (Green, 2008).

Besides endogeneity, static panel regression models omit dynamics which may lead to dynamic panel bias (Baum, 2006; Bond, 2002). The omission of dynamics might result in misspecified models (Green, 2008). Further, the data were collected from eleven emerging countries for six years. Consequently, there are more panels (*N*) than timeframe (*T*). Roodman (2009) and Baltagi (2008) suggest the use of system GMM for data that have many observations (large *N*) and a small time frame (small *T*).

4. RESULTS ANALYSIS AND DISCUSSION

4.1. Unit root test results

To prevent spurious regression, variables used in this study were checked for unit roots using the Maddala and Wu (1999) unit root test that applies to unbalanced panels. The results of unit root tests reported in Table 1 below show that all variables are stationary at 1% level and integrated of order zero, suggesting that the variables do not contain unit roots. Therefore, it can be concluded that the data used in this study did not contain unit roots which lead to spurious regression coefficients.

Table 1. Unit root test results for the behavioral response of banks to liquidity rules

Variable	*Variable description*	*Chi-square value*	*Order of integration*
HQLATA	High-quality liquid assets/Total assets	193.03***	0
LTWFTL	Long-term wholesale funding/Total liabilities	157.48***	0
EQTL	Tier 1 + Tier 2 capital/Total liabilities	257.46***	0
DEPTL	Retail deposit funding/Total liabilities	253.88***	0
CAR	Total capital/Total assets	186.23***	0
SIZE	Ln(Total assets)	256.13***	0
NIM	$\frac{Interest\ income - Interest\ expenses}{Total\ interest\ earning\ assets}$	305.28***	0
DEPOSITS	Total bank deposits	254.94***	0
GDP	$\frac{Real\ GDP\ in\ current\ year - Real\ GDP\ in\ previous\ year}{Real\ GDP\ in\ previous\ year}$	417.61***	0
IR	Nominal interest rate	136.75***	0
CBR	Central bank rate	277.52***	0

Source: Author's construction based on data obtained from Bankscope.
*Notes: ***, **, * denote 1%, 5% and 10% significance level respectively.*

4.2. Descriptive statistics

Descriptive statistics are displayed in Table 2 below and analyzed in this section. It is interesting to note the positive and negative skewness value for the variables *LTWFTL* and *DEPTL*. The positive skewness for the variable *LTWFTL* suggests that most of the banks in the sample depend less on long-term wholesale funding while the negative skewness value of the variable *DEPTL* conveys that most banks in the sample rely more on deposit funding. This analysis is consistent with extant literature (Bonner et al., 2015). These studies state that due to underdevelopment of capital markets in emerging markets, most banks in these economies tend to rely on traditional retail deposits to finance

their activities. Both variables have positive kurtosis values, meaning that the data have heavier tails than a normal distribution.

Equity funding scaled by total liabilities has a mean value of 2.57 with a standard deviation of 15.38. On average, for every $100 bank liabilities, $2.57 of the liabilities were funded with equity. The standard deviation value of 15.38 shows that there is great variability in equity funding for banks used in the study. The estimated values of the 10th and 90th percentile respectively are 0.06 and 0.17 and have negligible values. Retail deposits averaged US$0.66 million over the period 2011 to 2016 with a minimum and maximum value of US$0.22 million and US$0.89 million respectively. The mean value of US$0.66 million means that the average value of deposits held by banks in the sample was US$0.66 million during the period of study. The standard deviation value of 14% demonstrates that there is a large variation in the deposits held by sampled banks 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 it 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 economies.

Table 2. Descriptive statistics

Variable	*Variable description*	*Mean*	*Standard deviation*	*10th percentile*	*90th percentile*	*Skewness*	*Kurtosis*
HQLATA	High-quality liquid assets/Total assets	34.14	23.70	6.48	69.14	0.30	1.55
LTWFTL	Long-term wholesale funding/Total liabilities	0.04	0.06	0.00	0.07	5.37	39.43
DEPTL	Retail deposit funding/Total liabilities	82.48	13.06	68.87	95.19	-1.67	6.13
EQTL	Tier 1 + Tier 2 capital/Total liabilities	2.57	15.38	0.06	0.17	6.04	37.47
CAR	Total capital/Total assets	10.20	4.42	5.97	15.79	1.81	7.20
SIZE	Ln(Total assets)	19.23	3.51	15.69	24.49	-0.31	3.12
NIM	Interest income - Interest expenses/Total interest earning assets	3.88	2.31	1.49	6.68	1.44	5.93
NPL	Non-performing loans/Outstanding loans	4.36	10.46	0.33	6.06	8.45	77.42
DEPOSITS	Total deposits	0.66	0.14	0.49	0.82	-0.85	3.55

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

4.3. Correlation matrix

Table 3 below presents pairwise correlations of variables used in the study. Pairwise correlation results in Table 3 highlight that the variable high-quality liquid assets to total assets is positively related to bank capital and profitability. This means that the amount of high-grade securities held by a bank is positively influenced by the bank's level of capital and profitability. These results are consistent with the capital fragility/deposit crowding theory which maintains that an increase in capital removes incentives for banks to effectively monitor their borrowers, resulting in reduced credit supply and consequently high liquid assets holdings (Diamond & Rajan, 2000). Similarly, the positive correlation between net interest margin and high-quality liquid securities may imply that banks use their profits to build liquidity buffers. The correlation between regulatory pressure and high-quality liquid assets is positive as expected, although it is statistically insignificant.

The variable deposit funding to total liabilities is positively correlated with bank size, meaning that deposit funding for banks in emerging economies increases with bank size. This is contrary to the behavior of banks in developed economies where large banks tend to depend more on short-term wholesale funding than deposit funding (De Haan, van den End, & Vermeulen, 2017). Profitability measured by net interest margin is negatively correlated with deposit funding, meaning growth in profitability leads to reduced dependence on deposit funding. This finding implies that banks in emerging economies use part of their profits to finance their business activities, thereby decreasing their reliance on deposit funding. As expected, regulatory pressure is positively correlated with deposit funding.

The correlation between bank size and the ratio of long-term funding to total liabilities is negative and statistically significant which suggests that large banks in the sample rely less on long-term funding. This evidence may be attributed to the underdevelopment of capital markets in emerging economies. The variable long-term funding to total liabilities is also negatively correlated to deposits, regulatory pressure, and real GDP. The correlations are significant at conventional levels. The negative relationship between deposit funding and long-term funding is consistent with the deposit supply constraint theory (Van Rixtel & Gasperini, 2013). The deposit supply constraint theory maintains that banks issue long-term securities to alleviate deposit funding constraints. The positive relationship between long-term funding and real GDP suggests that banks' long-term funding is pro-cyclical, meaning banks tend to increase (or decrease) long-term funding during economic upturns (downturns). A reasonable explanation for these results is that loan demand may rise (decrease) in times of economic booms (recessions) as businesses experience improved (deteriorating) investment prospects, thereby resulting in increased (decreased) long-term funding needs of banks.

Table 3. Correlation matrix

	DEPTL	*LTWFTL*	*EQTL*	*CAR*	*SIZE*	*NIM*	*NPL*	*DEPOSITS*	*REGPRESS*	*GDP*	*CBR*	*IR*
DEPTL	1.0000											
LTWFTL	-	1.0000										
EQTL	-	-	1.0000									
CAR	0.1167	-0.0049	-0.1249*	1.0000								
SIZE	0.2806***	-0.1711*	-0.0548	0.2144***	1.0000							
NIM	-0.1979***	0.034	-0.0588	0.3562***	0.0865	1.0000						
NPL	0.1128	0.2712***	-0.0152	0.2460***	-0.0085	0.0465	1.0000					
DEPOSITS	-	-0.3956***	0.1078	-0.1119	0.1771**	-0.2665*	0.0783	1.0000				
REGPRESS	0.0695	-0.1986*	-0.0584	0.2853	-0.1691	-0.2576***	0.1132	-0.0003	1.0000			
GDP	0.4440***	-0.1864*	-0.1479**	0.1085	0.1746**	-0.1536*	0.1445*	0.5619***	-0.1563**	1.0000		
CBR	-0.2000***	0.1627	-0.0082	0.1214*	0.0462	0.5335***	0.1063	-0.1277	-0.5079***	0.0907	1.0000	
IR	-0.4601	0.3115***	-0.0809	0.0494	0.0075	0.5463*	0.0591	-0.4189	-0.2215***	-0.3157*	0.6887***	1.0000

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

4.4. Results

The empirical findings of the study are displayed in Table 4 and discussed herein.

Table 4. Empirical results

Variable description	*Variable*	*DEPTL (1)*	*LTWFTL (2)*	*EQTL (3)*
Lagged dependent variable	*Lagged dependent variable*	0.2224* (0.1337)	0.3128*** (0.0871)	0.9990*** (0.0014)
Bank capital	*CAR*	-0.2371 (0.2930)	-0.0030*** (0.0006)	.
Bank size	*SIZE*	2.5252 (2.1325)	0.0014 (0.0015)	0.0011*** (0.0004)
Bank profitability	*NIM*	-1.5589 (1.1294)	0.0106*** (0.0015)	-0.0012** (0.0006)
Asset quality	*NPL*	0.2426*** (0.0353)	0.0014*** (0.0006)	-0.0198*** (0.0016)
Income diversification	*ID*	-0.0343 (0.0992)	-	0.7377*** (0.1494)
Asset growth	*AG*	-	0.0002*** (0.00001)	-
Bank liquidity	*LIQ*	-	-	-0.1977*** (0.1494)
Bank deposits	*DEPOSITS*	-	-0.0690*** (0.0153)	0.7377*** (0.1494)
Liquidity regulation	*REGPRESS*	9.4793** (4.510)	0.0119*** (0.0022)	0.0945* (0.0493)
Real GDP growth	*GDP*	0.7099 (0.4718)	-0.0024*** (0.0006)	-0.0043 (0.0083)
Financial sector development	*FSD*	0.0016 (0.0653)	-	-
Financial sector openness	*OPENNESS*	-0.6753* (0.3881)	-	-
Monetary policy	*CBR*	-	0.0025*** (0.0006)	-
Interest rate	*IR*	-	0.0003 (0.0002)	-
	Arellano-Bond (2) test Sargan test Wald test	0.3268*** 0.3629 2928.52	0.5126*** 0.2673 9157.51	0.3154*** 0.0672 6.38e+07

Source: Author's construction based on Bankscope data.
*Notes: ***, **,* indicates statistical significance at 1%, 5% and 10% respectively. Standard errors are shown in parenthesis (brackets).*

The results[1] presented in Table 4 above show that all models passed both the Arellano-Bond autocorrelation test and Sargan test, implying that the models did not suffer from autocorrelation and over-identified instruments.

4.4.1. Deposit funding scaled by total liabilities

Lagged dependent variable ($DEP_{ic,t-1}$)

Dynamic panel regression results show that the coefficient of the lagged dependent variable ($DEP_{ic,t-1}$) is positive and statistically significant at 10% level. The positive and statistically significant point estimate of the lagged dependent variable $DEP_{ic,t-1}$ means that the adoption of a dynamic model in this study is justified. This evidence suggests that banks in emerging economies have target deposit levels and adjust their level of deposits over time to close deviations from their target. The reason why banks partially adjust could be financial frictions arising from market imperfections that prevent banks from raising deposits on short notice to meet their liquidity needs. These results are consistent with the trade-off theory widely used in corporate finance. The trade-off theory states that there are marginal costs and benefits of maintaining liquid assets. Based on the trade-off theory, the managers'

[1] To save space, only statistically significant variables were analyzed and discussed.

decision to maintain an optimal deposit 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 the lagged dependent variable ($DEP_{ic,t-1}$) (1 - 0.224), 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; therefore, if costs of being off-target outweigh the 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 economies find it costlier to be off-target hence they quickly adjust 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 with retail deposits which makes it easy for them to increase deposits funding.

Liquidity regulation (REGPRESS)

Empirical results displayed in column 1 of Table 4 show that the liquidity regulation dummy variable (*REGPRESS*) has a positive and significant effect on changes in deposit funding. The results suggest that banks in emerging markets reacted to binding liquidity requirements by increasing funding from core deposits. Therefore, the study found some evidence to support the hypothesis that regulatory pressure stemming from LCR requirements has been effective in coercing banks to shift their funding sources towards stable deposit funding. These results may be compared with those of Lang (2017) who established that banks in Hungary responded to Basel III liquidity regulations by increasing deposit funding from households and non-financial entities. Similarly, Debelle (2012) and Robertson and Rush (2013) observed that competition for retail deposits has intensified among Australian banks as banks sought more deposits to comply with liquidity charges. Shi and 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 the context of the LCR perspective. The LCR treats retail deposits favorably 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 favorable treatment of retail deposits in the LCR measure is based on their assumed stability. In worst-case scenarios, Basel predicts that a bank can only lose 5% of its core deposits. Han and Melecky (2014) point out that low-income depositors (commonly known as retail depositors) tend to maintain a steady financial behavior through business cycles. This behavior implies that, at the 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 and Dybvig (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 to banks. Thus, 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 (Ritz & Walther, 2015).

Asset quality (NPL)

Asset quality significantly influences changes in deposit funding. According to estimated results, a 24.26% increase in non-performing loans causes commercial banks' deposits to increase by 19.43%[2], 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. A plausible explanation for these findings could be that retail depositors in emerging markets have limited investment options, probably because 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.

Financial openness (OPENNESS)

The variable *OPENNESS* was included in the regression analysis to examine whether countries with open financial systems can attract foreign deposits. Results in column 1 of Table 4 show that financial sector openness has a negative and significant effect on changes in bank deposits[3]. Although these results are contrary to expectations, they appear to be logical when one considers capital requirements under Basel III. The main providers of foreign deposits to emerging economies are major international banks that provide these deposits in the form of loans to foreign banks. Notwithstanding this, since Basel III capital requirements encourage large international banks to adopt the internal ratings based (IRB) approach to credit risk management, the IRB approach could have created perverse effects on the lending activities of international banks to emerging markets because it requires banks to set aside more capital when lending to lower-rated borrowers, like borrowers from emerging markets. This implies that international banks have to set aside more capital when lending to emerging market economies as they may have low ratings. As a result, international banks might have decided to reduce lending to banks in emerging markets. This analysis is in line with the findings of Ghosh, Sugawara, and Zalduendo (2011). Through simulation analysis, the study of Ghosh et al. (2011) concluded that emerging economies could experience a 3% reduction in bank flows as a result of Basel III capital standards.

[2] $Economic\ impact = \frac{SD_{EXPLANATORY\ VAR} \times Regression\ Coefficient}{SD_{DEPENDENT\ VAR}}$

[3] The study did not split foreign and local deposits due to the dearth of granular deposits data.

4.4.2. Long-term wholesale funding scaled by total liabilities

Lagged dependent variable ($LTWF_{t-1}$)

Model estimates in column 2 of Table 4 indicates that the point estimate of the lagged dependent variable ($LTWF_{t-1}$) is positive and statistically significant at 1% significance level. Hence, the adoption of a partial adjustment model adopted in this study is validated. The study found evidence to substantiate the claim that adjustment costs prevent banks to quickly adjust their long-term funding structures. Adjustment costs arising from asymmetric information and rigidities in funding markets may make it difficult for banks in emerging markets to source long-term funding on short notice. Furthermore, these findings highlight that banks long-term funding structures are persistent over time. This means the value of long-term debt held by a bank in a given period is dependent on the amount of long-term funding in the previous period.

Liquidity regulation (REGPRESS)

The coefficient of *REGPRESS* is positive, indicating that liquidity regulation influences banks to shift their funding sources towards long-term wholesale funding consistent with Kroon et al. (2021). Nevertheless, the study found that the influence of regulatory pressure on banks' long-term debt adjustment is very weak; the coefficient is about 1%. These findings may lend support to the intuition that capital markets in emerging economies are less developed which impedes banks' ability to issue long-term bonds. This evidence is consistent with Prasad's (2010) finding that bond markets in emerging countries are inadequately developed and high-grade corporate bonds that meet minimum standards specified by the LCR are available in limited quantities. For this reason, emerging economies could have faced difficulties to float long-term bonds to meet LCR requirements. Moreover, the empirical results could be supporting the argument that emerging economies largely depend on deposit funding, hence, the response of long-term wholesale funding to liquidity requirements tends to be weak. This analysis concurs with the findings of the Basel Committee on Banking Supervision (2014). The Basel Consultative Group documented that banks in emerging countries like Malaysia, the Philippines and Saudi Arabia have very high levels of deposits, comprising up to 80% of total funding. Such funding patterns could have inhibited the ability of banks in emerging economies to shift their funding sources towards long-term instruments.

Capitalization (CAR)

The variable *CAR* has a positive coefficient sign, suggesting that well-capitalized banks face little difficulties in adjusting their funding structures towards long-term instruments. This finding is consistent with the risk absorption theory proposed by Berger and Bouwman (2009). The theory maintains that higher capital enhances a firm's risk absorption capacity; therefore, highly capitalized banks enjoy cheaper and large access to debt markets. Moreover, these findings might be supporting the notion that a large capital base minimizes financial constraints thereby enabling commercial banks to issue more debt securities (Van Rixtel et al., 2016). The empirical results concur with Kosmidou's (2008) assertion that debt funding is enhanced as capital grows because capital minimizes bank risk and can be used as a buffer to absorb losses. Although capital positively contributes to the issuance of long-term securities like bonds, the contribution of the variable seems to be of little effect given that the coefficient on the variable *CAR* is only 0.3%. The limited elasticity of capital could be attributed to the fact that banks' funding structures are relatively "sticky" hence banks take time to adjust or the adjustment tends to be slow (Oura et al., 2013).

Profitability (NIM)

The point estimate of the variable *NIM* in column 2 of Table 4 shows that bank profitability positively influences changes in long-term wholesale funding. This association is statistically significant at 1% level. In terms of economic significance, 1 standard deviation increase in bank profits contributes to 0.4081%, that is

$$\frac{2.31 * 0.0106}{0.06}$$

an increase in long-term funding scaled by total liabilities. This practice is in line with the tax benefit and bankruptcy costs view, which states that profitable firms issue more debt in their capital structure because they have a low probability of distress (low costs of bankruptcy) and can significantly benefit from tax shields associated with debt (Gropp & Heider, 2010).

Asset quality (NPL)

The variable *NPL* was used to measure the riskiness of a bank's asset portfolio. In general, an increase in non-performing loans increases a firm's financial distress thereby reducing the firm's creditworthiness. For this reason, *NPL* is expected to have a negative effect on changes in long-term debt issuance. Contrary to expectations, the coefficient of *NPL* is positive and statistically significant at 1% level, which indicates that non-performing loans positively influence changes in banks long-term funding. This counterintuitive evidence could be explained by the fact that banks in emerging economies did not experience significant loan defaults compared to their counterparts in developed economies because the global financial meltdown which caused significant write-offs in developed economies was not as severe in emerging economies. As a result, even though growth in non-performing loans was expected to negatively affect debt issuance, its impact was less severe in emerging economies as demonstrated by the small positive coefficient of *NPL*.

Assets growth (AG)

The study found a strong and statistically significant relationship between asset growth and changes in long-term debt funding. The estimated coefficient of asset growth is 0.0002 and it is statistically

significant at 1% significance level. This suggests that asset growth is an important factor in explaining changes in long-term debt funding. This relationship is plausible in that commercial banks are mainly funded with deposits and debt (DeYoung & Rice, 2004). Hence, as loan demand surges, banks have strong incentives to approach capital markets for additional funding since deposits take time to gather. This evidence concurs with the findings of Binici and Köksal (2012) who established a positive and significant relationship between asset growth and leverage growth for banks operating in Turkey.

Bank deposits (DEPOSITS)

The study found a negative and significant influence of deposits on long-term debt funding consistent with the deposit supply constraint theory (Diamond & Rajan 2001), and empirical findings of Van Rixtel et al. (2016). The deposit supply constraint hypothesis states that banks issue more debt securities to alleviate deposit funding constraints. This means that when banks face difficulties to source retail deposits to fund their lending activities, they resort to debt issuance. This practice was prevalent in the period preceding the global financial turmoil. Kowalik (2013) highlights that due to deposit funding constraints, banks resorted to wholesale funding, primarily short-term funding, by issuing securities such repos and ABCP. Besides using deposits to alleviate funding constraints, banks may be enticed to reduce the amount of debt in their capital structure as their level of deposits grows to maximize profits since deposits are relatively cheaper than debt (Allen, Carletti, & Marquez, 2015).

Business cycles (GDP)

Regression results in column 2 of Table 4 indicate that a negative and significant association exists between business cycles and banks long-term debt funding. This means banks tend to increase (decrease) debt funding during economic downturns (booms). These findings imply that debt funding for banks in emerging markets is countercyclical. Banks appear to be increasing long-term borrowing in times of economic crisis and vice-versa. However, banks are expected to lend more in times of crisis to alleviate recessions. These results emphasize the need for regulators to reinforce the countercyclical capital buffer enunciated under Basel III. The countercyclical capital buffer encourages banks to build up capital buffers in good times thereby enabling them to continuously lend in times of crisis. The buffer would also reduce banks' need for long-term funding in periods of crisis, which would enable them to support businesses instead of themselves seeking external funding.

Monetary policy (CBR)

The study found that the point estimate of the central bank rate, a proxy for monetary policy, has a positive and significant impact on changes in long-term debt. Its coefficient is 0.0025 and it is statistically significant at 1% level. This evidence corresponds to the intuition that an accommodating monetary policy characterized by low central bank policy rates provides some incentives to banks to increase debt funding by issuing more bonds (Borio & Zhu, 2012).

4.4.3. Equity funding scaled by total liabilities

Lagged dependent variable (EQ_{t-1})

The estimated coefficient of the lagged dependent variable (EQ_{t-1}) is highly positive and statistically significant. This evidence is consistent with the hypothesis that adjustment costs prevent banks from completely adjusting their capital ratios in each period and therefore motivates banks to maintain large capital buffers. Besides adjustment costs, equity issues have a signaling effect which may create incentives for banks to maintain large capital buffers. Myers and Majluf (1984) document that equity issues in the presence of asymmetric information may send negative information to the market about a bank's economic value thereby persuading banks to hold capital above minimum regulatory requirements. The estimated speed of adjustment is 0.1%, which is 1 minus coefficient of lagged dependent variable (that is 1 - 0.999), meaning that commercial banks in the sample close about 0.1% of their capital gap each year. This indicates that banks in emerging markets slowly adjusted their capital ratios to reach their target rate during the period under study. These results suggest that there could be less appetite for bank stocks in the Basel III era which hinders banks' ability to issue new equity. Using event study methodology Bruno et al. (2018) found that bank shareholders responded negatively to the announcement of Basel III liquidity measures. They also established that European Union bank shareholders suffered large cumulative wealth losses of about 233 million euros due to decreases in bank share prices following the announcement of Basel III liquidity rules. The authors attributed the investors' negative reaction to the general belief that the Basel III liquidity standards would be detrimental to banks' future earnings.

Liquidity regulation (REGPRESS)

The estimated parameter of *REGPRESS* is positive as expected and statistically significant. Its coefficient is 0.0945, and it is statistically significant at 10% level. This evidence suggests that the new liquidity regulations are binding and effective. Stated differently, research findings offer that commercial banks in emerging economies responded to liquidity regulations by increasing equity funding consistent with the treatment of equity capital in LCR calibration. Equity capital is considered to be perpetual, that is, it has no fixed maturity date; hence, it falls outside the 30-day LCR net cash outflow window. Therefore, banks have strong incentives to increase their funding using equity. Higher equity capital ratios are beneficial from a financial stability point of view although higher equity may impose some costs on banks. Equity capital acts as a buffer that absorbs losses thereby minimizing the likelihood of bank failure. Notwithstanding this, equity issuance may convey negative information to the market about a bank's

financial status (Myers & Majluf, 1984). Investors view equity issues as a reflection of management's insights into the firm's prospects and value. In general, investors treat equity issuance as a sign that the firm's share price is overvalued or management does not have positive net present value projects to invest in. This negative information disincentives equity issuance, hence bank managers prefer internal funding to external sources, all else equal.

Bank size (SIZE)

System GMM regression results indicate that bank size has a negative and significant effect on bank capital. This interpretation is based on the estimated point estimate of 0.0011. These results imply that large banks in emerging markets operate with low levels of capital possibly because they have easy access to capital markets compared to small banks. Similar results were found by previous researchers. For instance, Pereira and Saito (2011) studied the capital management practices of banks in Brazil and established that size negatively affects bank capital. Another interpretation of these findings is that large banks may feel less pressurized to operate with high levels of capital because of the "too big to fail" phenomenon and the view that small banks face difficulties accessing capital from financial markets (Jokipii & Milne, 2011). The "too big to fail" theory maintains that big banks tend to operate with low levels of capital because they have a high probability of being bailed out in times of distress as a result of their systemic importance (Fonseca & González, 2010). These findings emphasize the need for different rules for systemically important institutions if the regulator's goal of systemic stability is to be achieved. Moreover, these findings may lend support to the notion that big banks enjoy economies of scale compared to their counterparts due to their greater ability to screen and monitor borrowers, which reduces their incentives to maintain large capital buffers (Alkadamani, 2015). Moreover, the negative coefficient of the variable *SIZE* could be indicating that smaller banks are less diversified which in turn motivates them to maintain large capital ratios (Pereira & Saito, 2011).

Profitability (ROE)

In this study, *ROE* was used to examine the effects of charter value on banks' capital. The charter value theory predicts that profitable banks tend to hold high capital ratios to protect their charter/franchise value (Demsetz, Saidenberg, & Strahan, 1996). As expected, return on equity (*ROE*) has a statistically significant positive effect on banks' capital changes. This evidence supports the claim that banks with higher charter values are motivated to set aside more capital from their earnings to preserve their franchise value as argued by Gropp and Heider (2010). Another interpretation of these results could be that commercial banks in the sample seem to use retained earnings to increase their equity capital rather than issuing new equity. These results are consistent with the findings of Alkadamani (2015) who examined the behavioral response of 46 commercial banks in four emerging economies, namely Saudi Arabia, Jordan, Kuwait and the United Arab Emirates, and found that profitable banks in these economies increased their capital ratios by retaining earnings instead of issuing new equity. From these results, it can be inferred that sampled banks in emerging economies find it costly to raise additional equity from equity markets hence they prefer to elevate their capital ratios by using funds generated internally. This analysis is consistent with the principal argument of the study that capital markets in emerging countries are underdeveloped; therefore, banks' ability to source new capital through equity issuance is limited. Moreover, this practice appears to be consistent with the pecking order theory in corporate finance. The pecking order theory states that, in the presence of asymmetric information, firms prefer to finance their businesses, firstly, with internal sources of finance (retained earnings), followed by debt and lastly new equity (Myers & Majluf, 1984). However, the impact of *ROE* on capital is not very high given that return on equity contribution to changes in bank capital is only 0.1%. This may imply that banks in emerging markets do not sorely depend on retained earnings to build their capital bases but may be using other debt instruments like subordinated debt, preference shares, and debentures to boost their capital base.

Asset quality (NPL)

The variable *NPL* was included in the model to examine the effects of asset quality on bank capital dynamics. A higher level of *NPL* implies greater asset portfolio risk; hence, banks with high *NPL* ratios are expected to hold more capital for risk management reasons. Contrary to expectations, regression results show that the variable *NPL* has a negative and significant effect on bank capital changes. These results could be explained by the fact that current loan losses weigh down the amount of RWA used in the determination of equity capital ratio, which in turn reduces the ratio of RWA to total assets leading to a negative association between non-performing loans and bank capital (Heid et al., 2004).

Liquidity (LIQ)

The negative and statistically significant parameter estimate on *LIQ* shows that liquidity negatively affects bank capital dynamics. Consistent with Jokipii and Milne (2011), these results demonstrate that banks with significant investments in cash and marketable securities tend to maintain low levels of capital. This behavior is in line with the intuition that liquid banks are deemed to be less risky, which in turn creates incentives for them to target low capital ratios (Aggarwal & Jacques 2001). Indeed, Diamond and Rajan (2000) point out that bankruptcy costs decrease as the amount of liquid assets grows; therefore, banks with large liquidity buffers tend to operate with low levels of capital. Since empirical findings have demonstrated that banks with high levels of liquidity tend to target low capital levels, the study offers that there is a need for joint implementation of capital and liquidity regulations to ensure that banks maintain adequate levels of both capital and liquidity.

Deposits (DEPOSITS)

The coefficient of the variable *DEPOSITS* is positive and statistically significant (0.7377). As expected, banks in emerging economies heavily depend on deposits to finance their business activities. This evidence is in line with the intuition that banks in emerging markets have limited access to capital markets hence they depend more on deposits for funding (Oura et al., 2013). This practice can be attributed to the underdevelopment of capital markets in most emerging economies that inhibit banks' ability to diversify their funding structures.

5. CONCLUSION

This study contributes to the extant literature by examining the behavioral response of banks in emerging economies to binding LCR specifications. The study results revealed that banks in emerging markets reacted to mandatory liquidity requirements by increasing the share of retail deposits, equity, and long-term funding in total funding. This finding may have some policy implications. From a macroprudential regulation perspective, this behavior can engender financial sector stability because retail deposits are resilient to funding shocks (Gatev & Strahan, 2006). Likewise, from a micro perspective, growth in retail deposits, particularly demand deposits that usually earn below-market interest rates, boosts banks' profitability by reducing the overall cost of funding. Furthermore, a large clientele base allows banks to sell other products and increase non-interest income through transaction charges which effectively increase their revenue (Hartlage, 2012). Therefore, banks are advised to design strategies that enable them to attract significant retail deposits. Banks can mobilize retail deposits through acquisitions, expanding branch networks, 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, Wackerbeck, & Fiedler, 2012).

The shortcoming of increased deposit funding is a possible surge in competition for high-valued retail deposits because of their favorable treatment in the calibration of the LCR. Hartlage (2012) maintains that heightened competition for retail deposits may undermine financial sector stability. As such, bank regulators are recommended to monitor competition for retail deposits so that it does not "get out of hand" to the extent that it erodes benefits of stability achieved by increased deposit funding. Moreover, Ahlswede and Schildbach (2012) argue that cluster risk may develop due to concentrated funding in retail deposits that may not be adequately covered by deposit insurance. To minimize this risk, regulators may have to increase deposit insurance premiums so that most of the deposits are insured. But, a rise in deposit insurance premium may lead to increased insurance costs and reduced profits for commercial banks. Ahlswede and 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. This may inhibit the development and growth of capital markets in emerging economies.

Similarly, a shift towards equity capital provides incentives for better risk management. This can be attributed to the fact that asymmetric information makes it difficult for creditors to correctly price bank risk hence banks with a limited liability tend to assume excessive risk (Dagher, Dell'Ariccia, Laeven, Ratnovski, & Tong, 2016). Equity capital can minimize this moral hazard problem by internalizing bankruptcy costs resulting in enhanced risk management. Likewise, a switch towards long-term debt instruments minimizes asset and liability mismatches thereby fostering financial sector stability. Notwithstanding this, the weak impact of regulatory pressure on changes in equity and long-term wholesale funding suggests that banks in emerging markets face difficulties in adjusting their balance sheets towards these funding instruments. Thus, policymakers in emerging market economies need to pay more attention to developing capital markets.

The research encountered data challenges largely because significant banks in emerging markets do not have rich databanks. The study was thus restricted to an unbalanced panel of only forty banks from eleven economies which may affect the analysis.

Future researchers can examine the efficacy of liquidity regulations in different jurisdictions. Other scholars can examine the implications of the upcoming IFRS 9 standards on banks' liquidity dynamics. Another interesting inquiry would be a granular analysis of components that the banks are adjusting as well as the factors that motivate such behavior.

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APPENDIX

Table A.1. MSCI Emerging Markets Index

America	*Europe, Middle East & Africa*	*Asia*
Brazil	Czech Republic	China
Chile	Egypt	India
Colombia	Greece	Indonesia
Mexico	Hungary	Korea
Peru	Poland	Malaysia
	Qatar	The Philippines
	Russia	Taiwan
	South Africa	Thailand
	Turkey	
	The United Arab Emirates	

Source: MSCI (2021).