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Banking System Adjustment to Shock: The Kenyan Case of Liquidity-Profitability Trade-Offs[1]

By Jared Osoro* and Kiplangat Josea**

Abstract

This paper has the dual objective of establishing whether episodes of market shocks necessarily trigger the choice between more liquidity and more profitability and ascertaining whether the post-shock recovery path is one of liquidity giving way to non-liquid assets growth and, therefore, more profitability that is accompanied by positive economic outcomes. Using annual bank-level data from 2002 to 2020 and a fixed-effects regression model within an unbalanced panel data framework, we establish that: (i) liquidityprofitability trade-offs exist and is amplified during period of shocks. The extent of those trade-offs is sensitive to bank-specific attributes, especially bank size. It is more pronounced among smaller banks than bigger ones (ii) The trade-offs ought to be seen beyond being self-preserving but as a necessary adjustment to assure general market stability and subsequent restoration of the positive finance-growth nexus in a calm environment. As a sufficient condition, the transition process requires a policy environment that is facilitative of real lending rates adjustments corresponding to the attendant risks as opposed to a sticky regime even on the back of expectations of a risk-based pricing mechanism being in place. Without policy disincentivizing the crowding-out, which is prevalent when asset quality is weakening, the transition after the shock to profitability aligned with the positive finance-growth nexus may be prolonged.

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1.0 Introduction

This paper seeks to answer two questions: One, do episodes of market shocks necessarily trigger the choice between more liquidity and more profitability? Two, should the post-shock recovery path necessarily be one of liquidity giving way to non-liquid assets growth and, therefore, more profitability accompanied by positive economic outcomes? We explore these questions in the context of Kenya, acknowledging that whenever there is an economic shock, the banking system adjusts in a manner that allows for general market stability and subsequent restoration of the positive finance-growth nexus in a calm environment. However, depending on the shock's epicentre, especially when a distinction is drawn between one that emanates from the financial sector and one that emanates from the real sector, the nature and magnitude of the costs related to the adjustment have implications on the post-shock recovery journey.

The adjustment of the banking system need not, therefore, be seen as merely self-preserving given that it initially reveals itself in the banks' intertwined roles of managing liquidity risk and liquidity creation. The process of banks creating liquidity to help depositors and companies stay afloat, especially when other forms of financing are difficult while simultaneously managing liquidity risk to ensure that they continue to intermediate, is complex and often comes with trade-offs. The balancing act by the banking system, especially during a shock, stems from the need for balance sheet preservation. The banks' liabilities comprise deposits – some of which can be withdrawn on demand – and equity and are matched with the assets of varying degrees of liquidity. Cognizant that higher liquid assets yield lower returns and therefore come with an opportunity cost for the bank, it is paramount that banks optimize the relationship between liquidity and profitability.

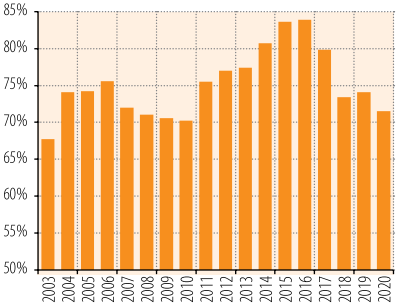
A liquidity–profitability balance in the Kenyan context over the past two decades reveals interesting patterns that motivate the need for a formal assessment of whether there are some underlying trade-offs whose ramifications go beyond

self-preservation. The loan-to-deposit ratio, a proxy for liquidity, was on a declining trend between 2006 – 2010 and 2016 – 2020, reflecting a general increase in overall market liquidity that coincided with declining profitability **(Figure 1a and Figure 1b)**. This pattern that is a pointer to the possibility of a liquidity-profitability trade-off is reinforced by the inverse association between loan-to-deposit ratio and return in assets and equity **(Figure 1c)**.

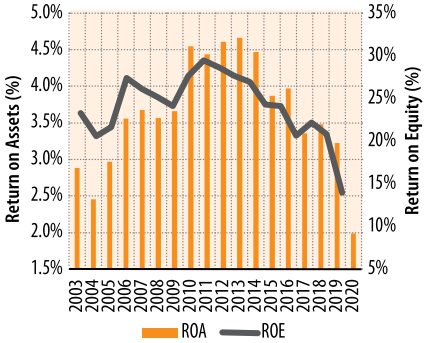
Even as the profitability of the Kenyan banking industry is generally characterized as healthy, and liquidity levels as sufficient, the heterogeneity attribute results in the differing extents of possible trade-offs. The extent to which banks as willing to hold liquidity above regulatory requirements is potentially size-sensitive and a reflection of the segmentation in the inter-bank market that is a binding constraint to liquidity distribution. It is also

Figure 1: Trends of liquidity and profitability in the Kenyan banking sector

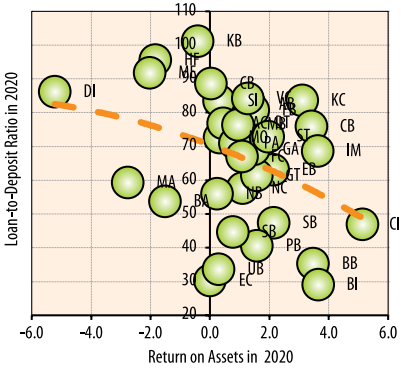
1a. Evolution of Bank Loans-to-Deposits Ratio

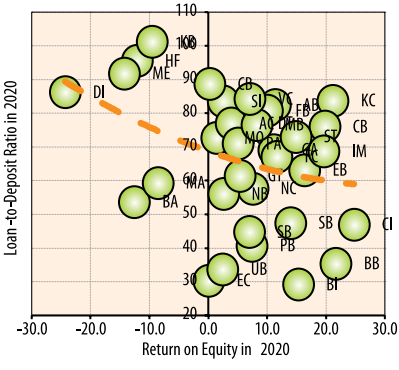


1b. Evolution of Bank Loans-to-Deposits Ratio



1c. Bank liquidity-profitability association





Source: KBA Database

a pointer to differentials in the response function to a shock such as the global financial crisis of 2007 – 2009 and the policy shock of interest rates control of 2016 – 2019 and stands to inform how the banking system as a whole and its various components adjust to the shock of the COVID-19 pandemic whose effects are still evolving.

To answer the above questions, we go beyond the broad trends and examine the market response and adjustments as revealed by bank-level data for the period 2001 – 2020 in terms of portfolio choices and how that fits with policy reactions. It is evident that in the period prior to the COVID-19 pandemic when the banking industry was adjusting to the regime interest rate controls, there was a steady increase in the share of government securities at the expense of loans and advances (**Figure 2a**). Over the period, this trend has been aided by an expansionary fiscal policy and is anticipated to remain countercyclical to address the growth challenges associated with the COVID-19 pandemic.

Given the heterogeneous character of the banking industry, the increase in government securities as a share of total assets has been pronounced amongst medium-sized banks, where it has remained well ahead of the industry average (**Figure 2b**). On the back of fairly sticky interest rates where fluctuations are within a narrow band (**Figure 2c** and **Figure 2d**) and the fact that the differential between the real yields of government securities and real lending rates has been narrowing at a time when non-performing loans as a share of total gross loans have been on the

Figure 2: Banking System Portfolio Adjustments

Figure 2a. Disaggregated Bank Asset Structure

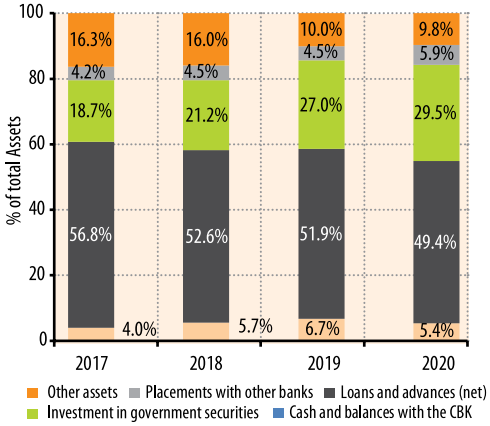


Figure 2b: Banks' Government Securities' Holding (% of total assets)

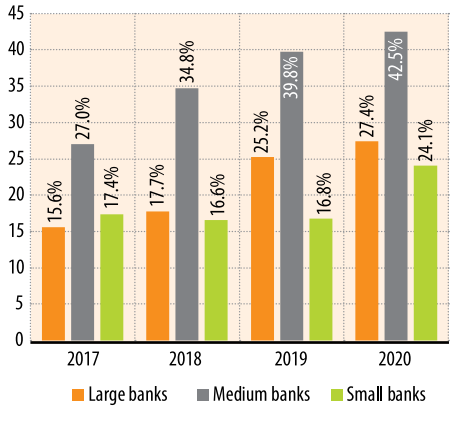


Figure 2c. Real Lending and TB Rates and Asset Quality Evolution (%)

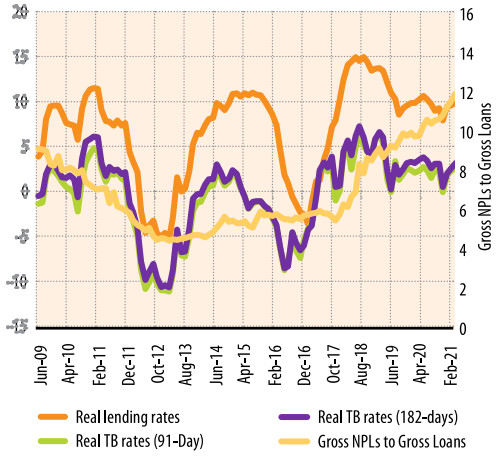


Figure 2d. Interbank Rates, and Government Securities (%)

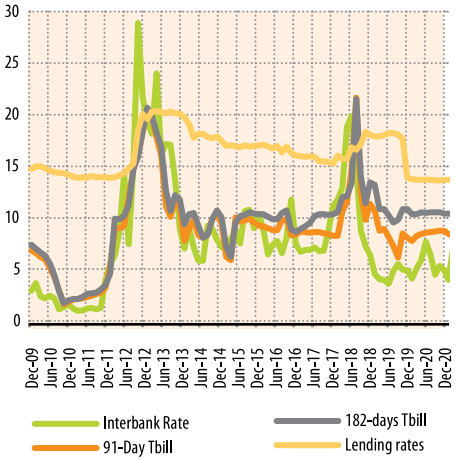


Figure 2e: Banks' sovereign portfolio (% of total assets) and funding gap nexus

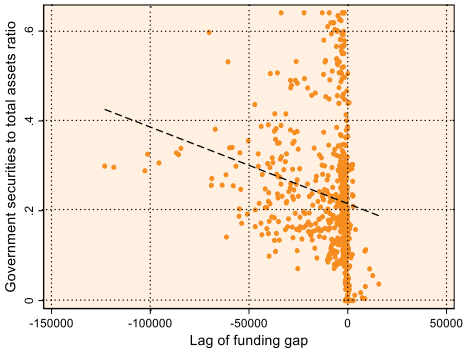
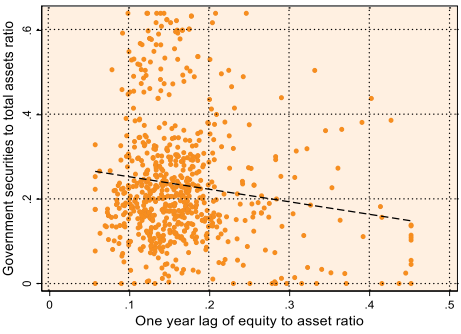


Figure 2f: Banks' sovereign portfolio (% of total assets) and leverage nexus



rise, increased investment in government securities is seen as a *"safe haven"* for banks. The observed interest rates regime, the risk averseness that comes with the deterioration of bank assets over time, and the adjustments on the demand side of the finance equation lend themselves to two broad arguments. The first relates to the tendency of banks to hold government securities for precautionary reasons

during a shock, and this can be inferred from the bivariate assessment of the relationship between the funding gap[2] and government securities. As **Figure 2e** shows, the two have a positive association[3]. The second relates to the argument that banks invest in government securities for capital management purposes. Pursuant to the need to comply with capital adequacy requirements, especially at a time of shock or economic distress, banks could increase capital or decrease risk-weighted assets. While the former is less likely as investors remain apprehensive, a shift in asset composition through a reduction in the share of loans and an increase in the share of government securities considered *"risk-free"* is often an optimal strategy. As **Figure 2f** shows, banks with lower leverage equitytoassets ratio tend to hold higher holdings of government securities in their portfolio.

The empirical assessment of this paper leads to two conclusions. One, during a shock, there are liquidityprofitability trade-offs. The extent of those trade-offs is sensitive to bank-specific attributes, especially bank size, and the trade-offs are more pronounced in smaller banks than bigger ones. The other is that trade-offs ought to be seen beyond being self-preserving but being a necessary adjustment to assure general market stability and subsequent restoration of the positive finance-growth nexus in a calm environment. As a sufficient condition, the transition process requires a policy environment that is facilitative of real lending rates adjustments corresponding to the attendant risks as opposed to a sticky regime even on the back of expectations of a risk-based pricing mechanism being in place.

The rest of the paper is organized as follows: The following section highlights theoretical and empirical literature. This is followed by the methodology, data, econometric estimation and, subsequently, the conclusion.

2 The funding gap is measured by the difference between net loans and deposits.

3 That is, an increase in the banks' funding gap is associated with a rise in investment in government securities.

2.0 Theoretical and Empirical Literature

The examination of the choice of an optimal liquidity position in a portfolio is anchored on three theories. First is the portfolio management theory, developed in the 50's and 60's. According to this theory, risk aversion plays an essential role in explaining the level of liquid assets chosen by a bank, in contrast with other theories that assume banks as being risk neutral. The second is the residual theory. This theory examines liquidity from the credit supply and deposit perspective, on the one hand viewing liquidity as a residual between banks' equity and other liabilities, and the credit portfolio on the other. However, both the portfolio management theory and the residual theory do not explicitly consider the specificities of banks, namely, that they face potentially large, random liquidity shocks due to unpredictable deposit withdrawals or unpaid credits. As should be expected, banks will aim at staying in business by keeping a good reputation regarding their ability to meet liquidity demands. As a result, the buffer theory of liquidity management posits that banks may want to hold liquid assets to meet liquidity shocks. The empirical literature documents the importance of bank characteristics and macroeconomic factors in influencing the bank's liquidity position. Bank-level characteristics that influence liquidity buffers are bank profitability, size, asset quality, efficiency, capital, and opportunity cost. In addition, several other non-bank-level factors, including economic growth and inflation rate, dominate the macroeconomic drivers of a bank's liquidity position. These bank-level and macroeconomic drivers of liquidity are reviewed below.

2.1 Bank-level drivers of liquidity buffers

- **Profitability effect:** On the empirical front, this paper is related to a small but growing body of literature that investigates liquidity-profitability trade-offs and the literature that examines the drivers of bank profitability, paying particular attention to liquidity. Being highly profitable and high liquid simultaneously is a difficult task for banks; they often trade one for the other. Even then, the effect of profitability on liquidity buffers is

ambiguous. On the one hand, some studies have documented a positive relationship between profitability and liquidity buffers. For instance, In Hungary, Vodova (2013) finds that bank liquidity is positively related to bank profitability. However, on the other hand, studies such as Nishanthini and Meerajancy (2015) established a negative impact of liquidity on profitability in Sri Lanka. In addition, other studies have found a non-linear relationship between profitability and liquidity (Bordeleau and Graham, 2010).

- **Bank size effect.** Whereas the impact of bank size on liquidity buffers is indeterminate, the empirical literature has also shown that the relationship could also be inverse and non-linear[4]. It has also been observed that small and large banks create liquidity differently. For example, large banks create a much higher fraction of their liquidity off the balance sheet (Berger and Bouwman, 2009; Berger and Sedunov, 2017) and they don't actively seek deposits by raising rates (Oliveira et al., 2015). On the contrary, small banks can better collect and act on soft information in lending (Berger et al., 2005). Other studies have shown that liquidity is largely driven by large banks (Zuzana et.al., 2012 and Horváth et al. 2014).

- **Asset quality effect.** The extant literature has examined the effect of asset quality on liquidity buffers using both back-ward looking and forward-looking measures of asset quality, and the empirical evidence also remains mixed. Liquidity is created on both sides of the bank's balance sheets. Banks provide liquidity on demand to depositors on the liability side, while loans to households and businesses are made on the asset side (Diamond and Rajan 2001; Annika Gnann & Sahika 2019). Among the US commercial banks, Cornett et al. (2011) and Berrospide (2012) established their tendency to hoard more liquidity when they have more illiquid assets and unused off-balance sheet loan commitments on their balance sheet. The asset risk also affects funding liquidity in the interbank market in such a way that it leads to an interbank market breakdown with liquidity hoarding (Heider et al., 2009).

- **Efficiency effect:** Banks with higher efficiency levels may have better performance, and they have been associated with higher liquidity creation (Berger & DeYoung, 1997 and Berger et al. 2019). A positive relation has been shown between a bank's cost efficiency and its liquidity creation (Baltas et al. 2017 and Yuejiao et.al., 2020). Since the high-level cost efficiency is associated with good management, the negative effects reinforce that management

4 On account of the "too-big-too-fail" hypothesis that argues that contrary to small size banks, bigger banks tend to hold lower levels of liquidity on account of better access to capital markets as well as to the lender of last resort facilities

inefficiency may have a detrimental impact on a bank's ability to create liquidity (Demirgüç-Kunt et al., 2004), and thus, a reduction in the banks cost burden or an improvement in their profit efficiency levels would result in higher liquidity (Yuejiao et.al., 2020).

- **Capital effect:** The evidence on the impact of capital on liquidity buffers is inconclusive and mixed. On the one hand, capital is related inversely to liquidity buffers and is dominated by the two views. One view is based on the financial fragility view of Diamond and Rajan (2000, 2001), which posits that fragile or relatively low levels of capital are liquidity enhancing. The second view is Gorton and Winston's crowding out of deposits hypothesis (2000). This hypothesis asserts that higher capital has a potential to crowd out deposits and, therefore, a liquidity dampening effect (Lei and Song, 2013; Horváth et al., 2014; Fu, Lin, and Molyneux, 2016; Chaabouni, Zouaoui, and Ellouz, 2018; Casu, di Pietro, and Trujillo-Ponce, 2019; Le, 2019). On the other hand, a strand of literature documenting a positive association between capital and liquidity buffers also exists and is underpinned by the risk-absorption view of Diamond and Dybvig (1983). According to the risk-absorption view, higher capital positions of a bank enable it to absorb more risk, and therefore banks can create more liquidity (Tran et al., 2016; Díaz and Huang, 2017). Furthermore, Berger and Bouwman (2009) show that the relationship is negative for small banks but positive for large banks. However, the introduction of deposit insurance reduces the effect of capital on bank liquidity creation (Fungáčová et al., 2017).

- **Opportunity cost:** Banks are often faced with the opportunity cost of holding liquidity. By considering an intensive margin, liquidity-constrained banks would be expected to quickly adjust their supply by reducing the borrowing limits of their clients or refusing to roll over existing loans. However, in a perfectly competitive world, banks facing excess liquidity would fill this gap by immediately increasing their lending to borrowers who faced constraints at other banks. As a result of financial frictions, even unconstrained banks may decide to hold on to liquid assets, especially in a scenario of increased systemic uncertainty (Acharya et al., 2013; Gale and Yorulmazer, 2013)

2.2 Macroeconomic drivers of liquidity buffers

- ***Economic growth rate:*** The state of the economic condition has significant bearing on liquidity held by banks. Recent studies have shown a positive association (Fidrmuc, Fungáčová, and Weill, 2015; Berger and Sedunov, 2017), and it has emerged that banks create more liquidity when liquidity is high

in stock market (Chatterjee, 2015; Toh, Gan, and Li, 2019), or the economy grows at faster pace (Davydov, Fungáčová, and Weill, 2018). On the flip side, an increase in bank liquidity creation promotes economic growth (Berger and Sedunov 2017) as conditions for the public to access liquid funds get easier (i.e., the cost of borrowing is lower).

- **Inflation rate:** Several papers have analyzed the drivers of bank profitability. Still, empirical analysis of the liquidity-profitability trade-off remains limited, moreso within an emerging market context, yet remains critical both at the policy and institutional level insofar as managing liquidity risks are concerned. From a liquidity point of view, inflation is likely to erode the real value of any outstanding financial claims as opposed to the nominal value of such claims, which may remain unaffected. Thus, an increase in inflation harms the banks by driving down the real rate of return (Huybens and Smith 1998, 1999).

- **Impact of shocks:** Consistent with Bratsiotis and Theodoridis (2022) view that during periods of shocks, banks are reluctant to lend to the real economy because of increased preferences for being liquid rather than being profitable. Bank lending to funding liquidity shocks has been investigated by Diamond and Rajan (2005), and they stress the interaction and reinforcing effects of banks' liquidity shortages and solvency problems. The empirical work reveals that aggregate liquidity shortages can emerge and force banks to prematurely foreclose on loans that otherwise would generate liquidity, which could potentially restrain future lending.

3.0 Methodology, Data, and Econometric Estimation

In this part, we empirically analyze the liquidity-profitability nexus of the Kenyan banking sector using annual bank-level data from 2002 to 2020, and our equation is of the following function form: -

$$LIQ_{i,t}=\alpha+\beta_0 Profit_{i,t-1}+\beta_1 X_{i,t-1}+\beta_2 Z_{i,t-1}+\mu_t+v_{i,t} \quad (1)$$

Equation (1) is the baseline equation and includes both bank and time effects. The dependent variable is the total liquid assets scaled by a bank's total assets less the minimum regulatory liquidity requirement of 20 percent[5]. Our variable of interest is $Profit_{i,t-1}$ is the return on assets (ROA), and an alternative proxy, the return on equity (ROE) is also adopted. Both theoretical and empirical literature documents the importance of bank characteristics (Delechat, Arbelaez, Muthoora, and Vtyurina, 2012) and macroeconomic factors (cite) in influencing bank's liquidity position. Arising out of the fact that market and financial frictions influence bank's liquidity positions, we control for both bank-level variables $X_{i,t-1}$ and macroeconomic-level variables.

The bank-level control variables included are bank size, expressed as the natural logarithm (ln) of bank assets, efficiency ratio, asset quality, opportunity cost, capital ratio, measured as the total capital to total risk-weighted assets less the minimum regulatory capital of 14.5 percent. According to the literature, bank size matters in the optimal determination of liquidity positions, with smaller banks expected to hold higher liquidity buffers on account of difficulties associated with raising additional capital than bigger banks. Therefore, theoretically, bank size and liquidity buffers are inversely correlated. Similarly, profitability is expected to correlate inversely with liquidity buffers. The more profitable banks likely have easier access to capital and hence would be expected to hold lower liquidity ratios. Other strand studies also show that the effect is non-monotonic and therefore included a squared term of profitability to capture the non-linearity in the relationship. **Table 1** below presents the description, and measurement of the variables as well as the hypothesized relationships.

5. For robustness, robustness, three other liquidity proxies; loan-to-deposit ratio is adopted, and the results are qualitatively similarly.

Table1: Definition and hypothesized signs of variables

Variables	Description and measurement	Source
Dependent variables		
Excess liquidity	Ratio of liquid assets to total assets less the regulatory minimum of 20 percent[6]	KBA Financial Database
Independent Variables		
Profitability proxies[7]		
Return on Assets	Ratio of profit before tax to total assets ratio	KBA Financial Database
Return on Equity	Ratio of shareholder's funds/equity to total assets	KBA Financial Database
Bank-level control variables		
Bank size	Natural logarithm of bank total assets	KBA Financial Database
Efficiency	Ratio of total costs to total income and also referred to as the cost-to-income ratio	KBA Financial Database
Capital adequacy	Ratio of total capital to total risk-weighted assets ratio less 14.5% minimum regulatory capital adequacy ratio	KBA Financial Database
Asset quality	Ratio of total provisions to total loans. It is a forward-looking measure of asset quality	KBA Financial Database
Deposit volatility	Standard deviation of deposits computed over a three-year rollowing window, and expressed in natual logarithm.	KBA Financial Database
Opportunity	Opportunity Cost	KBA Financial Database
Macroeconomic control variables		
GDP growth rate	Annual growth of gross domestic product (GDP)	KNBS Economic Survey
Inflation rate	Annual growth of consumer price index (CPI)	KNBS Economic Survey
COVID-19 shock[8]	A dummy variable taking on the value one if the observation year is 2020 otherwise, zero	Own construction

6. This measures the general liquidity shock absorption capacity of a bank. The higher the share of liquid assets in total assets, the higher the capacity to absorb liquidity shock, given that market liquidity is the same for all banks in the sample. Nonetheless, high value of this ratio may be also interpreted as inefficiency, since liquid assets yield lower income liquidity bears high opportunity costs for the bank. Thus, it is necessary to optimize the relation between liquidity and profitability.
7. Different measures of profitability have been adopted extensively in the empirical literature including return on assets, return on equity, net interest margins, and interest expense to interest income ratio. In this paper, returns on assets is used as a proxy of profitability given that it correlates highly with the other profitability measures.
8. While conceptually the global financial crisis of 2007 – 2009 and the interest rates control regime of 2016 – 2019 could be taken as shocks, the magnitude of their impact in relation to this paper's objective is assumed to be small even if it could have the persistence potential; we therefore do not capture them in the paper's empirical model.

Our sample consists of annual observations on Kenyan banks from 2002 to 2020. The variables are winsorized at the 5st and 95th percentile to minimize the influence of extreme values. Our final sample is made up of an unbalanced panel of 36 banks during the period 2002-2020, making the total number of 695 bank-year observations in our sample. **Table 2** shows descriptive statistics (mean, standard deviation, minimum, and maximum) of the sample of banks. From **Table 2**, a wide variation in across the banking industry is evident, reflecting significant heterogeneities within the market. On average, 17 percent of bank's total assets held in liquid assets in excess of the statutory minimum, but also characterized by sizeable dispersions. Second, 57.8 percent of bank's total assets are loans, and on the higher size 83.0 percent being held in loans and on the lower side 59.6 percent of total assets are held as loans, reflecting the differences in bank's business models. Third, on average, 79.9 percent of deposits are extended as loans with the minimum and maximum being 28.1 percent and 83 percent, respectively. Fourth, bank profitability, proxied by the return on assets for an average bank is 1.8 percent, but with sizeable dispersions among banks as the minimum and maximum return on assets is -0.09 percent, and 4.1 percent respectively. Bank size also exhibits substantial variations, reflecting their different classifications. In terms of asset quality, on average 9.2 percent of total loans are held as provisions, with the highest being 36.7 percent and the least being 5.9 percent, reflecting the differences in bank's portfolio quality, at least from a forward-looking perspective. The cost-to-income ratio, a measure of efficiency shows that for an average bank, 79.5 percent of total income goes into meeting the operating costs. The banking sector is also adequately capitalized, with banks on average holding 8.8 percent of total capital to risk weighted assets in excess of the statutory minimum of 14.5 percent.

Table 2: Descriptive Statistics and Stylized Facts of the Kenyan Banking Sector

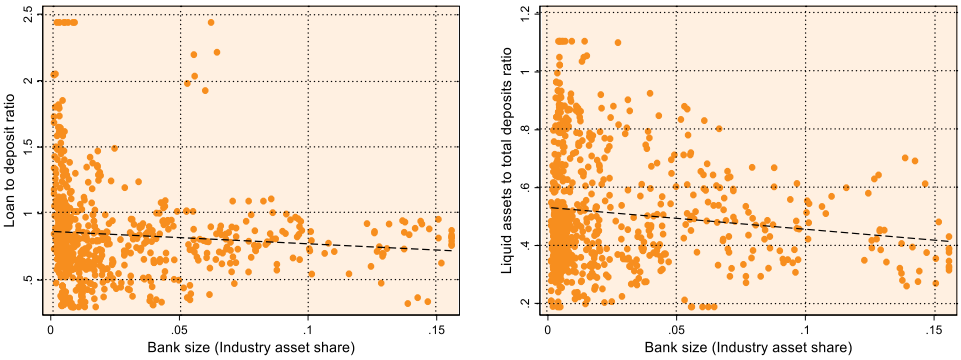
	N	Mean	SD	Min	Median	Max
Excess liquidity	695	0.177	0.135	-0.004	0.146	0.479
Loans-to-Total Assets Ratio (LTA)	695	0.578	0.145	0.281	0.596	0.830
Loans-to-Deposit Ratio (LTR)	695	0.799	0.260	0.359	0.795	1.407
Return on Assets (ROA)	695	0.018	0.013	-0.009	0.018	0.041
Bank size	695	9.934	1.457	7.704	9.703	12.571
Deposit volatility	695	7.573	1.634	2.060	7.662	11.298
Asset quality	695	0.092	0.092	0.014	0.059	0.367
Capital adequacy	695	0.088	0.094	-0.024	0.060	0.311
Efficiency	695	0.795	0.163	0.552	0.778	1.177
Opportunity cost	695	-0.023	0.038	-0.097	-0.023	0.060

	N	Mean	SD	Min	Median	Max
COVID-19 shock	695	0.042	0.200	0.000	0.000	1.000
Bank listing status	695	0.312	0.464	0.000	0.000	1.000
GDP	695	0.047	0.022	-0.006	0.054	0.084
Inflation	695	0.077	0.034	0.020	0.066	0.151

A bivariate assessment of the nexus between liquidity and selected bank characteristics affirms the above descriptive statistics and, together with the correlation matrix given in **Table 3**[9], yields a number of several sytlized facts.

- **One, liquidity and bank size are inversely related.** As **Figure 3** shows, the loan-to-deposit ratio and liquid assets to total deposits ratio, both proxies for liquidity, are inversely related with bank size such that the smaller the bank the higher its liquidity ratio and viceversa. This finding in part could be attributed to the fact that large banks have an access advantage than small banks in the interbank market at short notice as large banks are considered less risky while smaller banks as riskier borrowers in the interbank market.

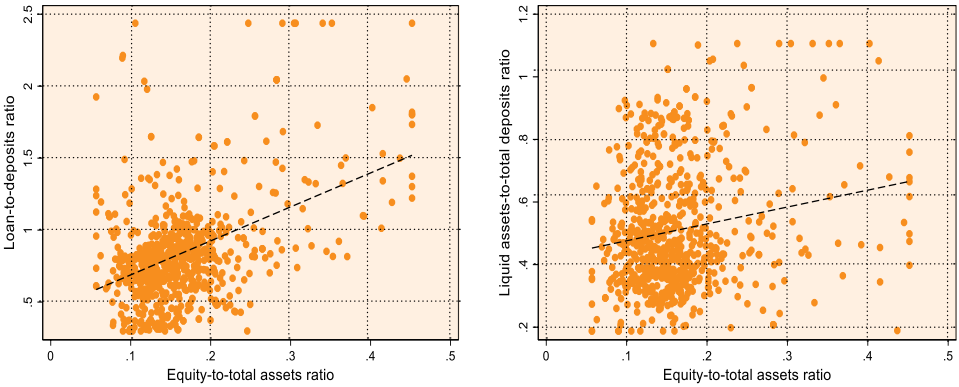
Figure 3: Scatterplot for the relationship between bank liquidity and bank size



9. A common rule of thumb is that if the correlation coefficient, then multicollinearity problems are of concern. In our sample, the only variable size (defined as the natural logarithm of total assets) presents a correlation coefficient higher than 7. This could be due to the fact that liquidity, capital, zscore, and overhead are explanatory variables constructed using the total assets as the reference variable

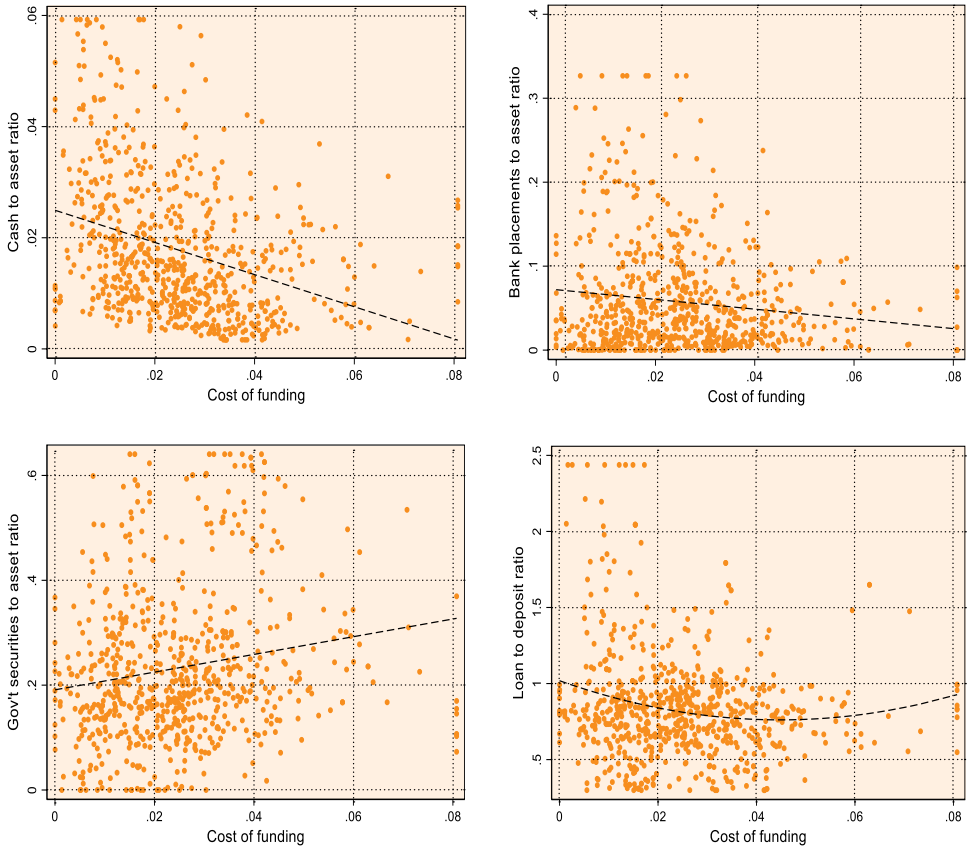
- **Second, liquidity is positively correlated with capital ratio.** As the equity to capital ratio increases, both the loan to deposit ratio and the ratio of liquid assets to total deposits also increases (**Figure 4**). This implies that that banks with higher capital ratio tends to be illiquid than those with lower capital ratios. When capital is high, the probability of distress is relatively low, so any increase in bank capital has little marginal effect in terms of skin-in-the-game type of incentives. Instead, the bank would see less need for liquidity buffers, consequqntly decreasing its liquid asset holdings as the capital ratio rises. At the same time, banks with higher capital have stable liability structure that affords them the ability to have relatively lower liquidity holding. The advantage thereof enables portoflio balancing towards illiquid but high yielding assets, such as loans. This conforms with the observation that big banks tend to be more profitable relative to small and medium sized banks.

Figure 4: Scatterplot for the relationship between bank liquidity and capital



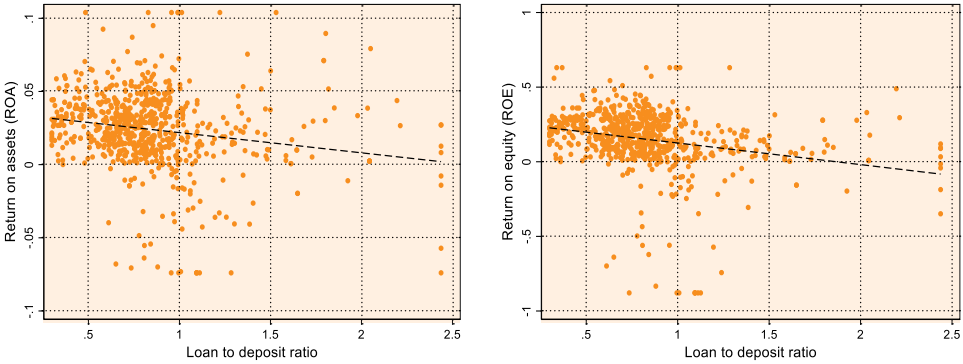
- **Third, the relationship between liquidity and cost of funding is mixed.** A higher cost of funding is inversely related with cash to asset ratio and bank placements to asset ratio, but positively related with government to asset ratio, and loans to deposits ratio, albeit first decreasing up until a certain point before increasing (**Figure 5**). The negative correlation implies that as the cost of refinancing increases, banks tend to invest in illiquid assets, thus lowering the ratio of cash to total asset ratio, bank placements and increase their investments in government securities and loans.

Figure 5: Scatterplot for the relationship between liquidity and cost of funding



- **Fourth, liquidity is inversely related with profitability. Figure 6** illustrates the inverse relationship between liquidity and profitability, proxied by both the return on assets and return on equity. This affirms the hypothesis of the existence of a liquidity-profitability trade-off, albeit in a univariate context.

Figure 6: Scatterplot for the relationship between bank liquidity and profitability



- In addition to the above analysis, cost of funding is also inversely related with cash-to-total asset ratio, cash and balances at CBK to total assets ratio, bank placements-to-total assets ratio, and profitability, but positively related with government securities-to-total assets ratio. The opportunity cost as measured by the difference between return on loans and on securities decreases as the loan to deposit ratio increases. Similarly, banks' asset quality increases as the loan to deposit ratio increases but declines as the government securities to asset ratio increases, and this phenomenon is expected as these investment instruments are considered "*risk-free*". Moreover, asset quality is inversely related with bank profitability, suggesting that a deterioration of a bank's loan portfolio is associated with a squeeze in its profitability position. We also establish that banks with lower asset quality, tend to hold highly liquid assets, especially cash and cash and balances at the CBK.

Further, in addition to the bivariate analysis conducted above, we also conduct unit root tests to avoid the problems of spurious regression estimates. To that end, therefore, employ the Im–Pesaran–Shin (IPS) panel unit-root tests underpinned by the fact we are dealing with an unbalanced panel data for which other panel unit-root tests such as the ADF-Fisher, Phillips-Perron (PP), Hadri, and Breitung panel-unit roots tests are only amenable to balance panel data. The IPS panel unit root assumes non-stationarity (i.e., presence of a unit root process) under its null hypothesis. As presented in Table 4 below, the results confirm that some variables used in the analysis are integrated of order zero (i.e., they are stationary at level), and some of the variables are integrated of order one (i.e., they become stationary after first-differencing).

Table 3: Panel unit root tests

Variables	At Level	At First Difference	Comments
Bank size (total assets)	0.6757 (0.7504)	-8.1668 (0.000)	Stationary after 1st differencing
Provisions to total loans ratio	1.2156 (0.8879)	-11.8524 (0.000)	Stationary after 1st differencing
Loans-to-Deposit Ratio	-2.5049 (0.0061)		Stationary at level
Total Capital to Trwa	-3.5240 (0.0002		Stationary at level
Cost to Income Ratio	1.9386 (0.0263)		Stationary at level
Opportunity cost	-6.7563 (0.0000)		Stationary at level
Return on Assets	-2.7223(0.00320		Stationary at level
GDP	-6.4420		Stationary at level
Inflation	0.7246 (0.7657)	-20.5056(0.000)	Stationary after 1st differencing
CBR	-2.891 (0.0019)		Stationary at level

Notes: Null: Unit root (assumes common unit root process) The IPS test were estimated using constant and trend variables in the model; The lag length is selected using the Akaike Information Criterion (AIC). *** Parameters are significant at the 5% and thus indicates the rejection of the null hypothesis of a unit root.

Table 4: Pearson's correlation matrix of variables

	Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1)	Liquid Assets to Total Assets Ratio (LAR)	1.000													
(2)	Loans-to-Total Assets Ratio (LTA)	-0.902	1.000												
(3)	Loans-to-Deposit Ratio (LTR)	-0.771	0.862	1.000											
(4)	Return on Assets (ROA)	0.209	-0.238	-0.196	1.000										
(5)	Bank size	-0.041	-0.030	-0.093	0.253	1.000									
(6)	Deposit volatility	-0.034	-0.061	-0.121	0.315	0.896	1.000								
(7)	Asset quality	-0.139	0.328	0.411	-0.269	-0.337	-0.363	1.000							
(8)	Capital adequacy	0.435	-0.339	-0.091	0.184	-0.424	-0.396	0.107	1.000						
(9)	Efficiency	-0.357	0.424	0.360	-0.824	-0.323	-0.361	0.436	-0.157	1.000					
(10)	Opportunity cost	0.109	-0.028	0.023	-0.059	0.126	0.061	0.216	0.039	-0.049	1.000				
(11)	COVID-19 shock	0.067	-0.038	-0.041	-0.129	0.173	0.117	-0.002	-0.044	0.102	0.120	1.000			
(12)	Bank listing status	-0.226	0.205	0.131	0.255	0.611	0.569	-0.028	-0.317	-0.231	0.040	0.015	1.000		
(13)	GDP	0.007	0.008	-0.010	0.137	0.117	0.154	-0.189	-0.067	-0.155	-0.118	-0.494	-0.007	1.000	
(14)	Inflation	-0.020	0.022	0.008	0.047	-0.077	-0.026	-0.071	0.000	-0.026	-0.138	-0.135	-0.009	-0.146	1.000

4.0 Results and Discussion of Findings

We empirically test the liquidity-profitability trade-offs hypothesis. The analysis is undertaken at three different levels. At the first level, we run a regression with only the constant term, and the time-invariant bank and year fixed effects. The results of the different regressions estimated are presented in **Table 5**. In column 1 we present regression with only the year fixed effects, and in column 2, results of bank fixed effects are reported, while in column 3, both the year and bank fixed effects are reported. The results show, the regression with only year fixed effects has an adjusted r-squared of 0.022, that with only bank fixed effects has an adjusted r-squared of 0.670, and while that with both year and bank fixed effects included has an adjusted r-squared of 0.685. These results show that variations in excess liquidity held by banks is explained by both time-invariant bank characteristics and the additional time fixed effects only additional improve the statistically fit of the model. this implies therefore that excess liquidity is driven more by the bank characteristics.

Table 5: Preliminary Analysis of the liquidity-profitability trade-offs

	(1)	(2)	(3)
	Excess Liquidity	Excess Liquidity	Excess Liquidity
Constant	0.170***	0.082***	0.074***
	(0.023)	(0.017)	(0.021)
Observations	695	695	695
Adjusted R^2	0.022	0.670	0.685
FE Bank	NO	YES	YES
FE Year	YES	NO	YES

Standard errors in parentheses. + $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. A regression with the excess liquidity buffers, expressed as the ratio of liquid assets to total assets less the statutory regulatory minimum capital ratio of 20% and a constant together with the year and bank fixed effects included.

At the second level, we investigate the impact of micro-level, that is we estimate regression with only time variant and invariant bank-level characteristics, and the results are reported in **Table 6**. In column 1, we present the regression results of without both the bank and year fixed effects, while in column 2, year fixed effects are included, and in Column 3, both the bank and year fixed effects are also included in the regression. The highlights of the findings are as follows:

- Banks' liquidity and profitability are inversely and statistically related. In most of the regressions, higher profitability, proxied by return on assets is related inversely with excess liquidity suggesting that profitable banks opt for optimality in their balance sheet structure by shifting their asset allocation towards high yielding assets, and in turn achieving higher profitability. To better understand what adjustments banks, make to reduce their extent of liquidity, we look at the relationship between profitability and the loan-to-deposit ratio which is considered a proxy for bank illiquidity. We find that higher profitability is often associated with higher illiquidity, as evident from the positive effect of profitability on loan-to-deposit ratio. Overall, this results therefore suggests that there is a trade-off between bank profitability and liquidity. More importantly, the adjustments and the manner of the trade-offs are on the asset side, as higher profitability can only be attained by higher loans, and as the share of loans increases for a given level of deposit, illiquidity increases. The more banks lean towards liquid assets as could be occasioned by market or broader economic shocks, the less profitable they are. This affirms our hypothesized view that in the Kenyan banking system, liquidity-profitability trade-offs exist. With banks seeking to remain on the optimal profitability path even under shocks that underpin the trade-offs, the resort to near liquid but safe investments is evident from the finding that the bigger the opportunity cost - the margin between interest on loans and advances and interest on investments in government securities - the lower the liquidity ratio; even the opportunity cost is statistically insignificant, it is an acknowledgement that liquidity provides a sense of safety but at the expense of profitability that non-liquid assets promise.

- Other bank characteristics are also important factors explaining the variations in excess liquidity. First, the size of the bank is positively related with excess liquidity, albeit only significant when only year effects are included. Second, the effect of deposit volatility is however an insignificant predictor of excess liquidity holding by banks. Third, Asset quality, proxied by the ratio of provisions to total loans ratio is mostly negative but generally weak as shown in column 1 and 2, but the relationship becomes positive and significant when considering both year and bank fixed effects suggesting that all else equal, banks with lower asset quality

(i.e., higher ratio of provisions to total loans) accumulates excess liquidity, possibly for precautionary motives. Third, we also observe that lower asset quality, proxied by a forward-looking measure, is positively correlated with higher loans-to-deposit ratio suggesting that as the asset quality deteriorate, more loans are also being granted for a given level of bank deposits. This is consistent with the view by Diamond and Dybvig (1983) who postulates that credit risk and liquidity risk are positively correlated.

- Fourth, capital buffers are associated with an increase in excess liquidity holding increases when bank and year fixed effects are considered in isolation but induce less holdings of excess liquidity when both year and bank-level fixed effects are considered. This implies that a bank's capital more than the minimum statutory requirement, a binding constraint for banks, is attained an additional holding of capital is associated with lower holdings of liquidity buffers, perhaps underpinned by the fact that higher capital ratio is associated with a stable liability structure and therefore lower need liquidity holdings more than the statutory minimum of 20 percent. Similarly, as the excess capital is accumulated, this does not affect the extent of illiquidity as proxied by the loan-to-deposit ratio. Overall, this finding is intuitive and consistent with the literature that argues that better capitalized banks tend to hold higher liquidity buffers if higher capitalization is indicative of a prudent business model. Fifth, inefficiency, captured by the cost-to-income ratio is positively correlated with holdings of excess liquidity. Sixth, the higher the opportunity cost the higher is the holding of excess liquidity. Seventh, the covid-19 is shown to have triggered a slight decline in bank's excess holdings albeit the relationship being generally weak.

- Lastly, a bank's listing status is also an important predictor of excess liquidity holdings with listed banks tending to hold less liquidity buffers, than non-listed banks, but the relationship is weak. This finding is intuitive as being listed confers banks with better access to capital markets and therefore the incentive of holding excess liquidity is less pronounced compared to non-listed banks. In addition, being listed related negatively with loan-to-deposit ratio, albeit the relationship is weak.

Table 6: Micro-level regressions of the liquidity-profitability trade-offs

	(1)	(2)	(3)	(4)	(5)
	Excess Liquidity	Excess Liquidity	Excess Liquidity	Loans-to-Deposit Ratio	Loans-to-Deposit Ratio
Return on Assets	-3.378***	-2.474***	1.677***	2.670***	2.670***
	(0.633)	(0.605)	(0.504)	(0.965)	(0.965)
Bank size	0.003	0.049***	0.004	0.038**	0.038**
	(0.007)	(0.009)	(0.010)	(0.019)	(0.019)
Deposit volatility	0.000	-0.004	-0.006	-0.005	-0.005
	(0.006)	(0.006)	(0.005)	(0.009)	(0.009)
Provisions-to-Loans Ratio	-0.105	-0.110+	0.203***	0.749***	0.749***
	(0.064)	(0.065)	(0.057)	(0.109)	(0.109)
Capital efficiency	0.648***	0.679***	-0.371***	0.039	0.039
	(0.058)	(0.058)	(0.053)	(0.102)	(0.102)
Cost-to-Income Ratio	-0.419***	-0.353***	0.188***	0.219**	0.219**
	(0.054)	(0.054)	(0.048)	(0.091)	(0.091)
Opportunity Cost	0.251+	-0.054	0.565***	0.773***	0.773***
	(0.129)	(0.132)	(0.104)	(0.199)	(0.199)
Covid_19 shock		-0.039	-0.001	-0.036	-0.036
		(0.032)	(0.028)	(0.055)	(0.055)
Listed banks		-0.123***	0.037	-0.021	-0.021
		(0.014)	(0.034)	(0.065)	(0.065)
Constant	0.499***	0.085	0.377***	0.065	0.065
	(0.070)	(0.090)	(0.096)	(0.185)	(0.185)
Observations	613	613	613	613	613
Number of banks	36	36	36	36	36
Adjusted R^2	0.320	0.410	0.410	0.698	0.698
FE Bank	NO	NO	YES	YES	YES
FE Year	NO	YES	YES	YES	YES

Standard errors in parentheses. + $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ Excess liquidity is the ratio of liquid assets to total assets ratio less the statutory regulatory minimum capital ratio of 20%

At the third level, we carry regression with both micro-level as well as macro-level predictor variables and the results are reported in **Table 7**. For the micro-level variables, the results remain qualitatively similar with reported in Table 2 above but for a few exceptions. The highlights of the findings are as follows: First, the higher the deposit volatility of a bank, the higher the excess holding with the relationship being significant at 10 percent, as shown in Column 2. Second, it becomes evident that the COVID-19 shock induced significant holdings of liquidity buffers among banks, as captured in Column 2. Third, listed banks tend to hold less liquidity buffers relative to non-listed banks. Fourth, the higher the opportunity cost, the higher is the excess liquidity holdings by banks. Fourth, excess liquidity is pro-cyclical along business cycles, albeit with a positive but weak statistical relationship. In terms of the loan-to-deposit ratio, a measure of illiquidity, excess liquidity holding, and business cycles are counter-cyclical, indicated by a significant negative relationship between growth in gross domestic product and excess liquidity buffers. The procyclicality of liquidity buffers is therefore supportive of monetary policy implementation and transmission as liquidity injections to stimulate the economy during contractionary periods would be useful in supporting aggregate credit. In terms of inflation, the effect is however insignificant.

Table 7: Micro-Macro level regressions of the liquidity-profitability trade-offs

	(1)	(2)	(3)	(4)
	Excess Liquidity	Excess Liquidity	Loans-to-Deposit Ratio	Loans-to-Deposit Ratio
Return on Assets	-2.474***	-1.092**	3.720***	2.668***
	(0.604)	(0.469)	(1.186)	(0.964)
Bank size	0.051***	-0.014	-0.099***	0.036+
	(0.009)	(0.009)	(0.018)	(0.019)
Deposit volatility	-0.005	0.007+	0.009	-0.003
	(0.006)	(0.004)	(0.012)	(0.009)
Provisions-to-Loans Ratio	-0.108+	0.061	1.065***	0.747***
	(0.065)	(0.053)	(0.127)	(0.109)
Capital adequacy	0.681***	0.428***	-0.400***	0.032
	(0.058)	(0.049)	(0.114)	(0.102)
Cost-to-Income Ratio	-0.353***	-0.106**	0.477***	0.216**
	(0.054)	(0.044)	(0.106)	(0.091)
Opportunity Cost	-0.063	-0.359***	0.504+	0.786***
	(0.131)	(0.097)	(0.258)	(0.198)

	(1)	(2)	(3)	(4)
	Excess Liquidity	Excess Liquidity	Loans-to-Deposit Ratio	Loans-to-Deposit Ratio
covid_19=1	-0.034	0.089***	0.247***	-0.056
	(0.038)	(0.030)	(0.074)	(0.061)
Listed banks	-0.123***	-0.067**	0.235***	-0.024
	(0.014)	(0.032)	(0.027)	(0.065)
Annual Growth of GDP	1.784**	1.770***	-2.087	-2.145+
	(0.886)	(0.579)	(1.738)	(1.189)
Annual Growth of CPI	0.339	0.220	-0.227	0.002
	(0.642)	(0.421)	(1.259)	(0.865)
Constant	0.062	0.302***	0.926***	0.088
	(0.091)	(0.090)	(0.178)	(0.186)
Observations	613	613	613	613
Number of Banks	36	36	36	36
R^2	0.439	0.776	0.384	0.730
FE Bank	NO	YES	NO	YES
FE Year	YES	YES	YES	YES

Standard errors in parentheses. + $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

These findings provide one possible explanation for how banks adjust to shocks. They increase their liquidity positions, and as established that there exists a liquidity-profitability trade-off, are willing to accommodate low profitability positions. The results on the macroeconomic variables are aligned with the general liquidity profitability trade offs in at least three ways.

- Firstly, underneath the weak alignment between liquidity and business cycle is the fact that sometimes – and especially during the shocks – the policy levers meant to promote growth end up steering banks way from illiquid assets and more towards government securities. In essence, countercyclical fiscal policy is growth promoting but also liquidity promoting.
- Secondly, inflation is key to determining the real returns to both government securities and illiquid bank assets. If the real return differential is narrowing over time on the back of deteriorating asset quality, the shift to government securities is expected and will have implications on the overall liquidity position of the banking system. At the core of this as earlier observed is the sticky lending rates which, if allowed to fluctuate in line with risks, could widen the differential and incentivize a shift towards illiquid assets.

- Thirdly, economic shocks feed into banks' expectations of market liquidity conditions and therefore inform relatively more conservative liquidity management strategies.
- Consistent with Bratsiotis and Theodoridis (2022) view that during periods of shocks, banks are reluctant to lend to the real economy because of increased preferences for being liquid rather than being profitable.

This paper's empirical results provide insights into understanding the banking system's adjustment to shocks as manifested in the confirmed liquidity–profitability trade-offs. The trade-offs ought to be seen beyond being self-preserving, but as a necessary adjustment to assure general market stability and subsequent restoration of the positive finance-growth nexus in a calm environment. The transition process requires, as a sufficient condition, a policy environment that is facilitative of real lending rates adjustments corresponding to the attendant risks as opposed to a sticky regime even on back of expectations of a risk-based pricing mechanism in place. Without policy disincentivizing the crowding-out which is prevalent when asset quality is weaking, the transition after the shock to a profitability that is aligned with the positive finance-growth nexus may be prolonged.

5.0 Conclusions

Whenever there is an economic shock, the banking system adjusts in manner that allows for general market stability and subsequent restoration of the positive finance-growth nexus in a clam environment. The adjustments are on the back of the system's intertwined roles of managing liquidity risk and liquidity creation. The process of banks creating liquidity to help depositors and companies stay afloat especially when other forms of financing are difficult while simultaneously managing liquidity risk to ensure that they continue to intermediate is complex and often comes with trade-offs.

This paper has the dual objective of: one, establishing whether episodes of market shocks necessarily trigger the choice between more liquidity than more profitability; and two, acertaining whether post-shock recovery path necessarily be one of liquidity giving way to non-liquid assets growth and therefore more profitability that is accompanied by positive economic outcomes. Using annual bank level data from 2002 to 2020, and a fixed effects regression model within an unbalance panel data framework we establish that:

- During a shock there is are liquidityprofitability trade-offs. The extent of those trade-offs are senstrive to bank specific attruibutes, especially bank sized, being more pronounced in smaller banks than bigger ones.

- The trade-offs ought to be seen beyond being self-preserving, being a necessary adjustment to assure general market stability and subsequent restoration of the positive finance-growth nexus in a clam environment. The transition process requires, as a sufficient condition, a policy environment that is facilitative of real lending rates adjustments corresponding to the attendant risks as opposed to a sticky regime even on back of expectations of a risk-based pricing mechanism to be in place. Without policy disincentivizing the crowding-out which is prevalent when asset quality is weaking, the transition after the shock to a profitability that is aligned with the positive finance-growth nexus may be prolonged.

This paper provides a platform for further studies that will support the understanding the liquidityprofitability trade-offs as a basis for market positioning and regulatory policy. One extension of the study will be the examination of the liquidity thresholds and bank size thresholds beyond which the trade-offs are minimized.

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