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Article

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Cogent Business & Management

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Suggested Citation: Yitayaw, Mekonnen Kumlachew (2021) : Firm-specific and macroeconomic determinants of commercial banks liquidity in Ethiopia: Panel data approach, Cogent Business & Management, ISSN 2331-1975, Taylor & Francis, Abingdon, Vol. 8, Iss. 1, pp. 1-18, <https://doi.org/10.1080/23311975.2021.1956065>

This Version is available at:

<https://hdl.handle.net/10419/245097>

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To cite this article: Mekonnen Kumlachew Yitayaw | (2021) Firm-specific and macroeconomic determinants of commercial banks liquidity in Ethiopia: Panel data approach, Cogent Business & Management, 8:1, 1956065, DOI: [10.1080/23311975.2021.1956065](https://doi.org/10.1080/23311975.2021.1956065)

To link to this article: <https://doi.org/10.1080/23311975.2021.1956065>



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Received: 26 November 2020
Accepted: 10 July 2021

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Reviewing editor:
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Stirling, United Kingdom

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BANKING & FINANCE | RESEARCH ARTICLE

Firm-specific and macroeconomic determinants of commercial banks liquidity in Ethiopia: Panel data approach

Mekonnen Kumlachew Yitayaw^{1*}

Abstract: This study investigated the bank-specific and macroeconomic determinants of commercial banks' liquidity in Ethiopia using secondary unbalanced panel data. The empirical analysis is carried out through the use of the generalized method of moments (GMM) estimation of dynamic panel data from 15 commercial banks from 2009–2019. The model result shows that lagged value of liquidity and deposit had a positive and statistically significant effect on commercial banks' liquidity. On the other hand, capital adequacy, bank size, interest rate margin, and gross domestic product had a negative and statistically significant effect on the commercial bank's liquidity. The study suggested that commercial banks in Ethiopia shall be more concerned about deposit mobilization to maintain a sufficient liquidity buffer and improve liquidity performance. Finally, the current study provides useful insights for bankers, analysts, regulators, investors, and other interested parties on the liquidity levels of Ethiopian commercial banks and their determinants and contributes to the scarce empirical evidence.

Subjects: Environmental Economics; Business, Management and Accounting; Industry & Industrial Studies



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PUBLIC INTEREST STATEMENT

The liquidity of banks is considered as a major topic in academic literatures and an essential business practice in the banking industry as it shows “the ability of a bank to fund increases in assets and meet both expected and unexpected cash and collateral obligations at a reasonable cost and without incurring unacceptable losses”. This study investigated the bank-specific and macroeconomic determinants of Ethiopian commercial bank's liquidity from 2009–2019. The results indicated that profitability, deposit, cost of funding, and asset quality are found to have a statistically significant positive effect on commercial bank's liquidity. The result also indicated that loan growth, interest rate margin, and real gross domestic product are found to have a statistically significant negative effect on the commercial bank's liquidity. The added value of this paper is to highlight new facts for enhanced understanding of liquidity and contributes to the scarce empirical evidence.

Keywords: Bank-specific; commercial bank; determinants; bank liquidity; macroeconomic; Ethiopia; panel data approach

1. Introduction

Banks' not only support the economy by providing finance but also plays a vital role by engaging as an intermediary between surplus economic units and deficit economic units (economic agents), other than execution of different valuable activities on both sides of the balance sheet (Shaha et al., 2018; Sambaza, 2016; Horváth et al., 2014). Banks' are playing a pivotal role in channeling funds from depositors to investors constantly (Jenkinson, 2008). Especially in developing countries like Ethiopia, the role of the capital market is nil, and as a result, commercial banks have become the most dominant financial institutions in the financial system (Yimer, 2016).

The liquidity position of banks' as a major issue became apparent in the aftermath of the worldwide financial crunch, which resulted in several commercial banks with serious liquidity issues went bankrupt (Bhati et al., 2015). For banks to effectively discharge their responsibilities, they must be in a healthy condition. Both investors and borrowers are concerned about liquidity (Diamond, et al., 2015). One of the key reasons why banks may not be healthy is their role in transforming maturity and providing insurance to depositors' potential liquidity needs (Yimer, 2016). Moreover, the Basel (2008) on banking supervision emphasized that the stability of a commercial bank depends on its liquidity position and effective liquidity risk management. To guarantee investor's certainty, administrative bodies need to settle some base breaking points of liquidity of banks' (Bagh et al., 2017), as liquidity can be taken as a fundamental concern to the financial strength of financial institutions, particularly in the banking industry (Assfaw, 2019).

According to Bank for International Settlements (2008), liquidity in the context of banking is explained as "the ability of a bank to fund increases in assets and meet both expected and unexpected cash and collateral obligations at a reasonable cost and without incurring unacceptable losses". Liquidity risk had mostly been considered a secondary risk in banking literature before the global financial crisis (Sheefeni & Nyambe, 2016; Matz & Neu, 2006). However, after the global financial turmoil, attention was drawn towards the grave effects of liquidity risk and become one of the main concerns of financial institutions (Al-Homaidi, 2019) as the low solvency of banks' was assumed to be its root cause. Thus, the 2007–08 financial crises raised the issue of better understanding the challenges posed by bank liquidity risk management and highlighted the importance of liquidity for the adequate functioning of the financial markets and the banking sector in particular (Bank for International Settlements, 2010 and 2013).

Many profitable banks' faced difficulties in managing their funds due to the misunderstanding of liquidity risk (Munteanu, 2012), and some banks' despite having a lot of assets, the sudden withdrawals and the lack of liquid funds lead to a huge loss as a result of taking out emergency loans (Assfaw, 2019). Effective liquidity risk management helps in ensuring a bank's ability to meet its obligations as they become due and reduces the probability of a liquidity crisis, on the fact that a liquidity crisis, in the banking sector can have grave systemic implications in emerging economies, where banks' act as a predominant financial intermediary (Sopan & Dutta, 2018). However, mistakes in liquidity planning and implementation affect bank operations and might exhibit a long-term effect on the economy (Edem, 2017), which may affect a bank's earnings and capital and in extreme circumstances may result in the collapse of an otherwise solvent bank. Liquidity risk not only affects the performance of a bank but also its reputation (Jenkinson, 2008). To avoid such a situation and maintain financial stability, banks' should maintain a sufficient liquid buffer (Arif & Anees, 2012).

According to the National Bank of Ethiopia (NBE) annual report (National Bank of Ethiopia, 2011), Ethiopian banks' were faced with liquidity risk and operational risks more severely than other types of risks. The existence of less efficiency and little and insufficient competition in the country's banking industry is a clear indicator of the relatively poor performance of the sector compared to

the developed world financial institutions (Amdemikael, 2012). If the liquidity risk is not adequately managed it may lead to insolvency or low profitability and ultimately destroy the wealth of shareholders and break down the entire financial institutional framework due to strong integration, dependencies, and contagion effect (Berhanu, 2015). Keeping optimal liquidity for banks in Ethiopia is very important to meet the demand of their present and potential customers.

However, many of the empirical studies carried out on the commercial banking industry of Ethiopia were mainly focused on examinations of factors influencing the profitability of banks, and limited attention was given to consider the bank's liquidity and its determinants. Therefore, it is imperative to investigate the determinants of commercial banks' liquidity in the context of Ethiopia. Thus, this study aimed to contribute to the current literature by providing evidence on the current liquidity position and bank-specific and macroeconomic determinants of commercial banks' liquidity in Ethiopia.

The study is organized in the following manner. Section 2 discussed the relevant literature reviewed. Section 3 presented the data and methodology used in the study. Section 4 indicated the results and discussions and Section 5 comprised the conclusions, recommendations, and directions for future studies.

2. Literatures review

Modern financial theories have long recognized that banks exist because they perform two central activities in the economy: liquidity creation and risk transformation (Berger & Bouwman, 2017). Indeed, banks have a special intermediate role in transforming liquid liabilities (deposits) into illiquid assets (loans) (Dietrich et al., 2014; Bonfim & Kim, 2012). When fund providers deposit cash, a liability is created in a bank's balance sheet and an asset is formed when the bank provides borrowers with funds (Hartlage, 2012). A bank must manage its liability and asset sides to be able to meet the additions to, and withdrawals from, the accounts and keeping optimal liquidity for banks to meet the accidental demands from the depositors.

The liquidity of banks shows the capability of a bank to meet its obligations due at any time, especially to repay customer deposits or to make a payment on the client's order (P. K. Vodová, 2016). Poor liquidity is comparable to a person having a fever; it is a symptom of a fundamental problem. Banks, therefore, are exposed to the risk that they will not have sufficient liquid assets to meet random demands from the depositors (Gatev et al., 2009). As a result, a repeatedly re-financing circle which is a part of the banking business unavoidably exposes banks to liquidity risk (Bonfim & Kim, 2012). Lack of liquidity in extreme situations can lead to the firm's insolvency (Pandey, 2015).

Several studies have been carried out globally on the liquidity risk of banks and determinants of bank liquidity, such as Al-Homaidi et al. (2019) who studied the liquidity determinants of Indian listed commercial banks and indicated that bank size, capital adequacy, deposits, operation efficiency, and return on assets had a significant positive impact on banks' liquidity, whereas assets quality, assets management, return on equity, and net interest margin had a significant negative impact on banks' liquidity. Assfaw (2019) examined the firm-specific and macroeconomic variables, which affect the liquidity position of private commercial banks in Ethiopia. He found that firm-specific factors namely bank size, loan growth, and deposit are found significant determinants of the banks' liquidity, and macroeconomic determinants such as interest rate margin, gross domestic product, national bank bills purchase, and inflation rate had a significant influence on the Ethiopia private commercial banks' liquidity. Khanal (2019) also conducted a study to identify the liquidity determinants of commercial banks of Nepal and he found that profitability has a positive significant impact on bank liquidity, whereas capital adequacy, size, gross domestic product, and inflation had a negative significant impact on bank liquidity.

Sopan and Dutta (2018) explored the bank-specific and macroeconomic determinants of Indian banks' liquidity risk. The result revealed that size, profitability level, funding cost, asset quality, and

GDP growth rate had a significant negative impact on banks' liquidity risk, whereas the rate of deposits, capitalization rate, and inflation rate had a positive effect on banks' liquidity. Zaghdoudi and Hakimi (2017) investigated the bank-specific and macroeconomic factors that influence the liquidity risk of Tunisian banks and found that banks' capital adequacy and economic growth positively affected banks' liquidity risk, while bank size and inflation negatively affected banks' liquidity. Singh and Sharma (2016) conducted a study to identify the factors that affect Indian banks' liquidity and the result showed that bank size, deposits, profitability, capital adequacy, the growth rate of GDP, and inflation had a statistically significant impact on banks' liquidity. Gautam (2016) also examined the determinants of Nepalese commercial banks' liquidity and his finding revealed that capital adequacy has a positive statistically significant impact on banks' liquidity, while non-performing loans and profitability had a negative statistically significant impact on the banks' liquidity.

Melese and Laximikantham (2015) studied the factors that affect Ethiopian banks' liquidity and the result showed that bank size, capital adequacy, and profitability had a statistically significant impact on bank liquidity. Sudirman (2014) investigated the determinants of Indonesian bank liquidity and indicated that asset quality and profitability had a positive effect on banks' liquidity, whereas capital and cost of funding had a significant negative effect on banks' liquidity. A study by Chagwiza (2014) examined Zimbabwean commercial banks' liquidity and its determinants and he found that total assets, capital adequacy, and the gross domestic product had a significant positive impact on banks' liquidity, while business cycle, adoption of multi-currency, and inflation had a significant negative effect on banks' liquidity. P. Vodová (2013) also scrutinized the determinants of commercial banks' liquidity in Hungary and his study result showed that capital adequacy, lending rate, and profitability had a significant positive impact on banks' liquidity. However, bank size, interest rate on interbank transactions, monetary policy interest rate, and interest rate margin had a significant negative impact on banks' liquidity.

A study by Subedi and Neupane (2013) examined the determinants of banks' liquidity and their impact on financial performance in Nepalese commercial banks. The result showed that capital adequacy and non-performing loans had a significant negative impact on banks' liquidity, whereas bank size has a significant positive impact on banks' liquidity. Laurine (2013) studied the determinants of Zimbabwean commercial banks' liquidity risk after the country adopted the use of multiple currencies exchange rate systems and revealed that capital adequacy and bank size had a negative and significant influence on liquidity risk. Ferrouhi and Lehadiri (2013) also identified the determinants of Moroccan banks' liquidity and found that bank size, external financing, profitability, capital adequacy, foreign direct investment, monetary policy, and the volume of foreign assets positively affect the banks' liquidity, whereas inflation, annual GDP growth, recent financial crisis, and the public deficit had a statistically significant negative impact on banks' liquidity.

Lee et al. (2013) conducted a study to identify the determinants of Malaysia commercial banks' liquidity and identified that asset quality and growth of the local economy had a significant positive effect on bank liquidity, while bank size, the modern financial crisis, and capital adequacy had a significant negative impact on banks' liquidity. Trenca et al. (2012) examined the liquidity determinants in the central and eastern European banking system and found that equity and total assets, lending interest rate, interest rate spread, and inflation had a significant negative effect on banks' liquidity. Munteanu (2012) studied Romania's bank liquidity and its determinants and he established a negative relationship between capital adequacy, asset quality, and interbank funding with banks' liquidity, and a positive relationship between funding cost, credit risk rate, and inflation with banks' liquidity. Bunda and Desquilbet (2008) also examined the determinants of banks' liquidity risk from emerging economies and found that capital adequacy, gross domestic product, and inflation rate had a positive effect on banks' liquidity, whereas bank size, lending interest rate, and financial crisis had a significant negative effect on banks' liquidity.

As empirical studies suggested that, it can be summed up that the liquidity of banks is a function of both bank-specific and macroeconomic factors. Thus, the present study seeks to add value to

the existing evidence by empirically investigating bank-specific determinants such as profitability, capital adequacy, loan growth, deposit, cost of funding, bank size, and asset quality, and macroeconomic determinants such as interest rate margin, real GDP growth rate and an inflation rate that affect the commercial banks' liquidity in Ethiopia.

2.1. Determinants of bank liquidity and the hypothesis

Bank liquidity has been investigated by different studies taking into account bank-specific and macroeconomic variables (Assfaw, 2019; Shaha et al., 2018). The various bank-specific and macroeconomic variables used in this study and their expected effect are explained as follows.

2.1.1. Firm (bank)-specific factors

2.1.1.1. Profitability. Theoretically, profitability and liquidity are two conflicting objectives for banks, where bank shareholders and investors would like to gain profit from their investment which is realized by the role of bank transferring funds gained from lenders to borrowers in the form of credit facilities that affect bank financial solvency when bank have to face withdrawal needs from depositors (Mahmoud Yousef, 2018). The profitability level of a bank influences its liquidity risk parameter and several studies have been found profitability to have a negative relationship with banks' liquidity (Moussa, 2015; Sudirman, 2014; Deléchat et al., 2012; Al-Khour, 2012). However, Al-Homaidi et al. (2019), Singh and Sharma (2016), Melese and Laximikantham (2015), Lartey et al. (2013), and (Lee et al., 2013) found that profitability had a positive effect on banks' liquidity.

H1: Profitability has a significant negative effect on bank liquidity

2.1.1.2. Capital adequacy. According to Moh'd and Fakhris (2013), a bank's capital plays a very important role in maintaining the safety of banks and the security of banking systems in general as it prevents any unexpected loss that banks might face. It has been found that the availability of high capital increases banks' risk-absorbing capacity (Berger & Bouwman, 2017) and liquidity creation capability (Distinguin et al., 2013). Al-Homaidi et al. (2019), Shamas et al. (2018), Singh and Sharma (2016), Melese and Laximikantham (2015), and Vodova (2011) have also found that banks capital has a positive impact on banks' liquidity through its ability to absorb risk. On the other hand, the "financial fragility-crowding out" theory predicts that higher capital reduces liquidity creation and lower capital tends to favor liquidity creation (Diamond & Rajan, 2001). Furthermore, Gorton and Winton (2000) show that a higher capital ratio may reduce liquidity creation through another effect: "the crowding out of deposits". Consequently, higher capital ratios shift investors' funds from relatively liquid deposits to relatively illiquid bank capital. Thus, the higher is the bank's capital ratio; the lower is its liquidity creation. Moussa (2015), Bhati et al. (2015), Lee et al. (2013), Deléchat et al. (2012), and Bhati and DeZoysa (2012) found a significant and negative effect of capital adequacy on banks' liquidity.

H2: Capital Adequacy has a significant positive effect on bank liquidity

2.1.1.3. Deposit. Deposit highly affecting the position of the banks' liquidity as the demand for liquidity may arrive at an inconvenient time and force the fire sale of illiquid assets in the absence of enough deposit (Assfaw (2019). A study conducted by Mazreku et al. (2019), Al-Homaidi et al. (2019), and Singh and Sharma (2016) revealed that deposits had a positive effect on banks' liquidity; i.e. as demand deposits increase, liquid assets holdings also increase. However, Assfaw (2019), Shaha et al. (2018), and Teshome (2017) indicated that deposit has a significant negative effect on the level of banks' liquidity.

H3: Deposit has a significant positive effect on bank liquidity

2.1.1.4. Loan growth. Loans and advances are the major earning asset of the bank because they are granted to the customer that is considered as illiquid assets and generates higher revenue to banks. Since loans are illiquid assets, an increase in the volume of loans means an increase in illiquid assets in the asset portfolio of a bank that decreases the bank's liquidity (Tibebu, 2019). The studies conducted by Assfaw (2019), Fekadu (2018), Berhanu (2015), and Melese and Laximikantham (2015) found a negative association between loan growth and liquidity of banks.

H4: Loan growth has a significant negative effect on bank liquidity

2.1.1.5. Bank size. Bank size is included to capture the diseconomies of scale and Singh and Sharma (2016) and P. Vodová (2013) observed that liquidity levels were significantly affected by bank size. There are two opposing arguments both theoretically as well as empirically regarding the relationship between bank liquidity and size. The first view is too big to fail which considers the negative relationship between size and liquidity while; the traditional transformation view suggests a positive relationship. Studies conducted by Al-Homaidi et al. (2019), Shaha et al. (2018), Melese and Laximikantham (2015), Chagwiza (2014), and Malik and Rafique (2013) established a positive relationship between the bank size and banks liquidity i.e. larger banks are more liquid than smaller banks. However, Assfaw (2019), Sopan and Dutta (2018), Teshome (2017), Singh and Sharma (2016), Deléchat et al. (2012), and P. Vodová (2013) found a negative relationship between bank size and liquidity.

H5: Bank size has a positive effect on bank liquidity

2.1.2. Macroeconomic factors

2.1.2.1. Interest rate margin. Interest rate margin (spread) is the difference between the gross cost paid by a borrower to a bank and the net return received by a depositor (Assfaw, 2019). A higher interest rate margin will force banks to lend more and reduce their holding of liquid assets. This implies that an increase in interest margin stimulates banks to focus more on lending activity and as a result, the share of liquid assets is decreasing (Al-Homaidi et al., 2019; Tibebu, 2019; Ahokpossi, 2013; Vodova, 2012). Conversely, (Mazreku et al., 2019; Malik & Rafique, 2013) argued, the spread has a positive effect on the liquidity risk of banks.

H6: Interest rate margin has a significant negative effect on bank liquidity

2.1.2.2. Real gross domestic product (GDP). Real gross domestic product is an indicator of the financial health of a country. When the economy is at the boom, banks became optimistic and upsurge their long-term investment and reducing their holding of liquid assets whereas in the period of recession the reverse is true (Assfaw, 2019). But, sometimes banks prefer high liquidity due to lower confidence in reaping profits during an economic downturn, which means a real gross domestic product has a significant positive impact on a bank's liquidity (Mazreku et al., 2019; Zaghdoudi & Hakimi, 2017; Boadi et al., 2016; Chagwiza, 2014; Bunda & Desquilbet, 2008). On the other hand, the theory of bank liquidity and financial fragility stated that when the economy is at the boom, banks became optimistic and upsurge their long-term investment and reducing their holding of liquid assets while in the period of recession the reverse is true. Sopan and Dutta (2018), Singh and Sharma (2016), Sheefeni and Nyambe (2016), Ferrouhi and Lehadiri (2013), and Vodova (2011) and stated that GDP has a significant negative impact on banks' liquidity.

H7: GDP has a significant positive effect on the liquidity of banks.

2.2. Conceptual framework of the study

The conceptual framework helps to clearly show the variables that are used in the study and how they are connected. The conceptual framework portrays both bank-specific and macroeconomic variables used as presented in Figure B1 (see Appendix B).

3. Data and methodology

This study attempted to investigate the determinants that affect the liquidity of commercial banks in Ethiopia. Based on the research objective, the hypotheses developed and the quantitative nature of the data, this study employed a quantitative approach to identify the determinants of commercial banks liquidity. Accordingly, this study adopted an explanatory research design to examine the cause and effect relationships between bank liquidity and determinant variables.

From the total population of 18 commercial banks in Ethiopia, 15 commercial banks that have 9–11 years of audited financial data from 2009 to 2019 (5 banks with 9 years, 4 banks with 10 years, and 6 banks with 11 years of data) have been considered as a sample purposively. The study used secondary data which includes the annual audited financial reports mainly balance sheets and income statements of commercial banks under study. The data were unbalanced panel data as some of the banks do not report over the entire period of the study, which captured both cross-sectional and time-series behaviors simultaneously.

3.1. Methods of data analysis

The study used both descriptive statistics and econometric tools to analyze the data. The former one includes simple descriptive methods such as, mean, maximum, minimum, standard deviations, and others that enable to better understand the existing situation and analyze the general trends of the data. The study substantiated the descriptive analysis by manipulating econometric models to examine causation between the explanatory and dependent variables.

Economic relationships which are included in this paper are dynamic and their current behavior depends on their past behavior. Therefore, a dynamic panel model was required. The dynamic nature of the model disallows using standard Ordinary Least Squares (OLS) estimators, which might be biased and inconsistent due to the correlation between the unobserved panel-level effects and the lagged dependent variable (Hasanović & Latić, 2017). Thus, the use of panel data with fixed or random effects does not solve econometric problems inherent in dynamic models. To overcome a problem of endogeneity that makes biased results and unobserved heterogeneity between banks that cannot be accurately measured, Arellano and Bond (1991) proposed a new generalized method of moments (GMM) estimator for dynamic panel model (Difference GMM). They proposed to include additional instruments in the dynamic panel model and to use the different transformations. Later, Arellano and Bover (1995) and Blundell and Bond (1998) proposed an improvement of the Arellano and Bond estimator by imposing additional restrictions to the initial conditions, which allow the introduction of more instruments to improve efficiency. It combines the first difference in equations with equations at the level in which the variables are instrumented by their first differences. It builds a system of two equations (System GMM), the original and transformed one.

Generally speaking GMM controls for endogeneity, unobserved panel heterogeneity, autocorrelation, omitted variable bias, and measurement errors (Ullah et al., 2018). According to Bond (2002), the unit root property makes the Difference GMM estimator biased, while System GMM produces more precise results. The differenced GMM approach corrects endogeneity by transforming all regressors through first differencing and removing fixed effects. However first difference transformation has a weakness because it subtracts the previous observation from the contemporaneous one thereby magnifies gaps in data loss (Ullah et al., 2018). So it affects the estimated result to some extent.

The System GMM approach corrects endogeneity by introducing more instruments for the lagged dependent variable and any other endogenous variable to dramatically improve efficiency, and it

transforms the instruments to make them uncorrelated (exogenous) with fixed effects. System GMM also uses orthogonal deviation instead of, what Differenced-GMM does, subtracting the previous observation from the contemporaneous one; it subtracts the average of all future available variables observation (Roodman, 2009). Thus, this study employed System GMM to examine causation between the explanatory and dependent variables.

3.2. Definition and measurements of variables

3.2.1. Dependent variable

In this study, liquidity has been used as a dependent variable. Bank liquidity is the ability of a bank to meet its obligations due at any time, especially to repay customer deposits or to make a payment on the client's order (P. K. Vodová, 2016). The liquidity ratio is measured as a loan to deposit ratio. It indicates what percentage of the volatile funding of the bank is tied up in illiquid loans. The ratio reflects the proportion of the customers' deposits that have been given out in the form of loans. Therefore, the higher this ratio the less liquid the bank is and interpreted inversely.

$$\text{Liquidity} = \frac{\text{Loans and Advances}}{\text{Customers' Deposit}} \quad (1)$$

3.2.2. Independent variables

Depending on the research hypothesis and literature reviewed, the explanatory variables used to determine the liquidity of commercial banks in Ethiopia including the lagged value of liquidity are profitability, capital adequacy, deposit, loan growth, and bank size which are categorized as bank-specific factors and interest rate margin and real GDP growth rate which are classified as macro-economic factors. Those variables are used with different combinations and reported as significant factors that determine a bank's liquidity by various studies (such as Assfaw, 2019; Singh & Sharma, 2016; Yimer, 2016; Moussa, 2015; Berhanu, 2015). Table A1 presented the summary of variables and their expected effect on commercial bank liquidity (see Appendix A).

To identify the effect of determinant variables on Banks liquidity this study formulated the following econometric model:

$$LIQ_{it} = \alpha + \beta_1(ROA)_{it} + \beta_2(CA)_{it} + \beta_3(DEPO)_{it} + \beta_4(LG)_{it} + \beta_5(Size)_{it} + \beta_6(IRM)_{it} + \beta_7(GDP)_{it} + a_i + v_t + \varepsilon_{it} \dots \dots (1)$$

Where, LIQ is the Liquidity, ROA is the Return on Asset, CA is the Capital Adequacy, DEPO is the Deposit, LG is the Loan Growth, Size is the Bank Size, IRM is the Interest rate Margin and GDP is the Real Gross Domestic Product, i is the i^{th} Banks, t is the time, $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ and β_7 are the coefficients for each explanatory variables in the model, a_i is a bank-specific unobservable effect, v_t is a time-specific factor, and ε_{it} is the error term.

4. Results and discussions

4.1. Descriptive analysis

Liquidity is a ratio of loans and advances to customers' deposits, which measures the volumes of customers' deposits that have been given out in the form of loans. If the higher this ratio, the less liquid the bank is to cover any unforeseen fund requirements and vice versa. As shown in Table A2 (see Appendix A), the average value of banks liquidity is 2.69 (269%), which indicated that the sampled banks on average offered loans to their clients more than twofold of the customers' deposit during the study period, which is higher than the green credit guidelines for loans to deposit ratio (i.e. 75% (CBRC, 2012)). The maximum and minimum values of the liquidity are 55.21 and 0.2425 respectively with a standard deviation of 8.95, which shows the higher disparity of banks liquidity. Thus, it can be concluded that Ethiopian Commercial Banks on average have a higher amount of volatile deposits tied up with illiquid loans, having a ratio that is too high which puts the bank at high liquidity risk.

Regarding the explanatory variables, the average value of profitability (ROA) is 0.02, which shows that 2 cents were generated from one birr investment on assets of banks with -0.01 minimum and 0.05 maximum values. The average value of capital adequacy (CA) is 0.14, which shows that 14 cents of one birr asset were financed by shareholders equity with a minimum value and maximum value of 0.03 and 0.99 respectively. The average value of the deposit (DEP) is 0.70, which shows that on average the customers' deposit represents 70 percent of the bank asset with a minimum value of 0.01(1 percent) and a maximum value of 0.92(92 percent). The loan growth (LG) has an average value of 2.33, which shows that the loan and advances given to the customers grown by 233 percent with a minimum value of 0.12 and maximum values of 11.91, and a standard deviation of 0.96 which shows a great variation among banks loan growth. The average asset (Size) of Ethiopian commercial banks is 9.99(9.9 Billion) which ranges from 8.07(118 Million) to 11.74(54.9 Billion). The mean value of NIM is 0.0053(0.5 percent) which is a very low margin ranging from -2.55 to 1.29. Likewise, the average value of the real gross domestic product (GDP) is 0.09, which shows that on average the real gross domestic product growth rate between 2009–2019 was 9 percent which varies from 7 percent to 11 percent.

4.2. Scatter sketches of explanatory variables

The study sketched scatter plots to show the relationship between explanatory variables with emphasis on statistically significant variables. Figure B2 presented the scatter sketch between explanatory variables from 2009 to 2019 (see Appendix B).

4.3. Test for multicollinearity

An implicit assumption that is made when using the panel least square estimation method is that the independent variables are not correlated with one another. To do so, the study test for multicollinearity using Variance Inflation Factor (VIF), and the result indicated a VIF of 1.79 means that there is no multicollinearity problem see Table A3 in Appendix A.

4.4. The two-step system GMM estimation result

Table A4 (see Appendix A) presented the model results to identify the determinants of commercial banks' liquidity in Ethiopia. Based on the analysis, The F-test statistics indicated the goodness of fit of the model, the Hansen statistics result shows that the instrumental variables are valid, the Sargan test for the validity of the over-identifying restrictions in the GMM estimation is accepted for all specifications, and the second-order autocorrelation is rejected by the test for AR (2) which shows there is no second-order autocorrelation.

The significant coefficient of lagged dependent variable proves the dynamic model. The lagged value of liquidity has a positive impact on the current level of liquidity and would appear to be a suitable instrument for liquidity. It is consistent with the expectations as it is assumed that banks tend to maintain higher levels of liquidity from the past into the forthcoming period.

The model result showed that **capital adequacy** has a negative and statistically significant effect on the liquidity of banks (-2.4156), which indicated that a percentage change in capital adequacy is associated with a 2.416% decrease in bank liquidity in the short run at 1% significance level, on average ceteris paribus. It has been found that the availability of high capital increases banks' risk-absorbing capacity and liquidity creation capability. The result shows the opposite influence of capital adequacy on bank liquidity which is against the prior expectation. It seems that banks with lower capital adequacy pay more attention to liquidity risk management and hold a sufficient buffer of liquid assets which is consistent with the findings of Moussa (2015), Bhati et al. (2015), Lee et al. (2013), Deléchat et al. (2012), and Bhati and DeZoya (2012) found a significant and negative effect of capital adequacy on banks' liquidity. However, the result is against the findings of Al-Homaidi et al. (2019), Shamas et al. (2018), Singh and Sharma (2016), and Melese and Laximikantham (2015) have found that banks capital has a positive impact on banks' liquidity through its ability to absorb risk.

Banks are dependent on deposits for their liquidity needs; unless they are forced to sell their illiquid assets in the absence of enough deposit (Assfaw, 2019). The **deposit** has a positive and statistically significant effect on the liquidity of banks (0.1011), which shows that a percentage change in deposit leads to a 0.1011% increase in bank liquidity in the short run at a 5% significance level, on average *ceteris paribus*. The result is in line with the prior expectation and the findings of Al-Homaidi et al. (2019), Mazreku et al. (2019), Sopan and Dutta (2018), and Singh and Sharma (2016) who revealed that deposit had a positive effect on bank liquidity; i.e. as demand deposits increase, liquid asset holdings also increased. However, this result is against the findings of Assfaw (2019), Shaha et al. (2018), and Teshome (2017) who found that deposit has a significant negative effect on the banks' liquidity.

Bank size has a negative and statistically significant effect on banks' liquidity (−0.2338), which indicated that a percentage change in bank size is associated with a 0.234% decrease in bank liquidity in the short run at a 1% significance level, on average *ceteris paribus*. Regarding the size of the banking institution, its effects on the overall liquidity are mixed (Roman & Sargu, 2015). Thus, a large bank will tend to attract additional clients through the crowding-in effect, therefore increasing the overall liquidity of the bank. Still, in prolonged boom periods, larger banking institutions will tend to provide more average products (higher interest rates for loans and lower interest rates for deposits), thus determining a part of their clientele to relocate toward smaller banking institutions that are more customer-friendly, in this case, the overall liquidity of the smaller banks being increased (Roman & Sargu, 2015). The result is not in line with the prior expectation but consistent with findings of Khanal (2019), Assfaw (2019), Sopan and Dutta (2018), Teshome (2017), Zaghdoudi and Hakimi (2017), Singh and Sharma (2016), Deléchat et al. (2012), and P. Vodová (2013) who found that bank size has a significant negative effect on banks' liquidity i.e. as the bank size increases, the liquid buffer of the bank decreases. However, the result was against the findings of Al-Homaidi et al. (2019), Shaha et al. (2018), Melese and Laximikantham (2015), Chagwiza (2014), and Malik and Rafique (2013) who revealed that bank size has a positive effect on banks' liquidity i.e. larger banks are more liquid than smaller banks.

Likewise, the **interest rate margin** was found to have a negative and statistically significant effect on the liquidity of banks (−0.1052), which indicated that a percentage change in an interest rate margin is associated with a 0.105% decrease in bank liquidity in the short run at 1% significance level, on average *ceteris paribus*. The result suggested that an increase in interest margin stimulates banks to focus more on lending activity and as a result, the share of liquid assets is decreasing. The result was consistent with the prior expectation and the finding of Al-Homaidi et al. (2019), Assfaw (2019), Berhanu (2015), P. Vodová (2013), and Trenca et al. (2012) who found that interest rate margin has a significant negative effect on the banks' liquidity. However, the result was against the findings of Vodova (2012) and Tibebe (2019) who revealed that interest rate margin has a positive effect on banks' liquidity.

Finally, the **real GDP growth rate** has a negative and statistically significant effect on the bank's liquidity (−1.5192), which indicated that a percentage change in real GDP growth is associated with a 1.519% decrease in bank liquidity in the short run at 5% significance level, on average *ceteris paribus*. The theory of bank liquidity and financial fragility stated that when the economy is at the boom, banks became optimistic and upsurge their long-term investment and reducing their holding of liquid assets while in the period of recession the reverse is true. The model result is consistent with the theory and the findings of Sopan and Dutta (2018), Singh and Sharma (2016), Sheefeni and Nyambe (2016), Ferrouhi and Lehadiri (2013), and Vodova (2011) who indicated that GDP has a negative significant impact on banks' liquidity. However, it is against the findings of Mazreku et al. (2019), Zaghdoudi and Hakimi (2017), Boadi et al. (2016), Chagwiza (2014), and Bunda and Desquilbet (2008) who revealed that GDP has a positive impact on a banks' liquidity.

5. Conclusions, recommendations, and directions for further studies

The main objective of the study was to identify the bank-specific and macro-economic factors that affect Ethiopian commercial banks' liquidity between the 2008–9 financial crises and COVID-19 that will serve as a stepping stone for studies conducted on the same area in the future in Ethiopia.

Based on the findings from the descriptive analysis, the average value of banks liquidity is 2.69, which is too high and puts the bank at high risk during the study period and it can be concluded that Ethiopian Commercial Banks on average has a higher amount of volatile deposits tied up with illiquid loans.

The study finding demonstrated that; the lagged value of liquidity and deposit have a positive and statistically significant effect on the liquidity of commercial banks. On the other hand, capital adequacy, bank size, interest rate margin, and real GDP growth rate have a negative and statistically significant effect on the liquidity of commercial banks in Ethiopia.

Based on the findings, the following operational and policy recommendations are forwarded.

Based on the study findings, the bank's liquidity was mainly affected by internal factors. Since the management of the banks has control over the bank-specific (internal) factors, it is possible to improve the bank's liquidity by giving more attention to the identified factors.

Commercial banks should have a liquidity management policy, should practice effective liquidity risk management, and should identify their optimal level of liquid asset holdings by weighting the marginal costs and benefits of holding them to ensure a bank's ability to meet its obligations as they become due and reduces the probability of a liquidity crisis.

The national bank of Ethiopia should consider and consistently revise their policies that affect banks' liquidity and encourage banks to maintain the central bank and international liquidity requirements to improve the viability in the sector.

The study is also recommended for further study: As this study identifies only limited bank-specific and macroeconomic variables, there have to be further researches that include more bank-specific variables, macroeconomic variables, and regulatory factors that affect the liquidity of Ethiopian commercial banks. A study can be also carried out using other liquidity measurement ratios such as liquid asset to deposit and short-term borrowing ratio and a liquid asset to total asset ratio which are not considered in this study.

Acknowledgements

I am gratefully indebted to all those who have contributed to the success of this study. First and foremost I recognize and praise the name of Almighty Lord whose power has made me come this far. I would like to express my deepest sense of gratitude to Yohannes Kefale for his insightful advice and support in the course of preparing this paper. My love Abeba and my son Leul I love you and thank you for your love and support. You will always remain treasured in my heart.

Funding

The author received no financial support for the research, authorship, and/or publication of this article.

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Declaration of conflicting interests

The author declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

Citation information

Cite this article as: Firm-specific and macroeconomic determinants of commercial banks liquidity in Ethiopia: Panel data approach, Mekonnen Kumlachew Yitayaw, *Cogent Business & Management* (2021), 8: 1956065.

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Appendices

Appendix A

Table A1. Summary of variables and their expected relationship

Variables	Measurement/proxies	Notation	Expected Effect
Liquidity	Loans and Advances/Customers' Deposit	LIQ	NA
Independent Variables (bank-specific Factors)			
Profitability	Net Income/Total Asset	ROA	-
Capital Adequacy	Total Equity/Total Asset	CA	+
Deposit	Deposit/Total Asset	DEPO	+
Loan Growth	Loans and Advances growth rate	LG	-
Bank Size	Natural Logarithm of Total Asset	Size	+
Independent Variables (Macroeconomic Factors)			
Interest rate Margin	[Interest income from loan and advances/Total loans and advances]—[Interest paid out on deposit /Total deposits]	IRM	-
The real GDP growth rate	The annual real Growth rate of gross domestic product	GDP	+

Source: Developed based on the literature

Table A2. Descriptive statistics for the variables

Variable	Mean	Std. Dev.	Min	Max
LIQ	2.6969	8.9539	0.2425	55.2191
ROA	0.0237	0.0103	-0.0198	0.0575
CA	0.1465	0.0861	0.0372	0.9945
DEPO	0.705	0.1903	0.0096	0.9276
LG	2.3314	0.9618	0.1201	11.9111
Size	9.9957	0.6462	8.0721	11.7453
IRM	0.0053	0.4343	-2.5449	1.2933
GDP	0.0959	0.0113	0.077	0.114

Source: Own computation, 2020

Table A3. Multi-collinearity test for LIQ

Variable	VIF	1/VIF
Size	2.77	0.361408
CA	2.55	0.392322
IRM	1.64	0.609639
DMO1	1.61	0.620360
ROA	1.50	0.667139
LEN3	1.25	0.801681
GDP	1.23	0.814812
Mean VIF	1.79	

Source: Owns computation 2020

Table A4. Two-step system GMM estimation result

Explanatory Variables	Coefficient	Std. Err.	t-value
Lag of LIQ	0.4343*	0.2119	2.05
ROA	−0.2325	2.3704	−0.10
CA	−2.4156***	0.7900	−3.06
DEPO	0.1011**	0.0424	2.38
Size	−0.2338***	0.0291	−8.04
LG	0.0206	0.0670	0.31
IRM	−0.1052***	0.0282	−3.73
GDP	−1.5192**	0.6730	−2.26
_cons	2.7665***	0.3830	7.22
Number of Observations	136	AR(2) test	0.889
Number of Instruments/ Groups	15/15	Sargan test	0.463
F statistics	3305.95	Hansen test	0.780
Prob > F	0.000		

*** p < 0.01, ** p < 0.05, * p < 0.1 implies statistically significant at 1%, 5%, and 10% level respectively. P-value reported for AR(2) and Sargan and Hansen test statistics.

Source: Own computation, 2021

Appendix B

Figure B1. Theoretical model on determinants of bank liquidity.

Source: Developed based on literature

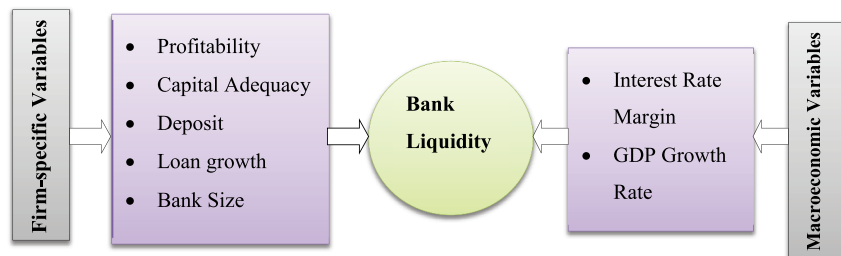
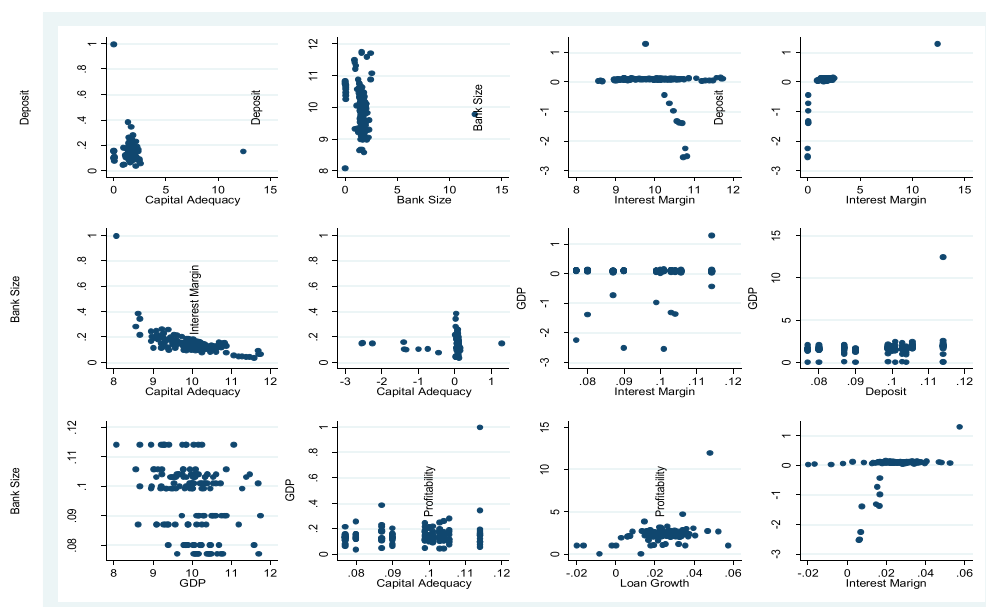


Figure B2. Scatter sketch between explanatory variables.

Source: Owns computation 2020



Since the explanatory variables are large in number, it is very difficult to plot the relationship between each variable. Thus, the study gives priority and presented the association between statistically significant variables.



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